

Name: _____ ()

Class: Sec 4 / ()



南 华 中 学
NAN HUA HIGH SCHOOL
2017 PRELIMINARY EXAMINATION

Subject : Biology

Paper : 5158 / 1

Level : Secondary Four Express

Date : 20 September 2017

Duration : 1 hour

INSTRUCTIONS TO CANDIDATES

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, class and index number on the OTAS in the spaces provided.

There are **forty** questions in this test. Answer **all** questions. For each question, there are four possible answers, **A, B, C** and **D**.

Choose the one you consider correct and record your choice in **soft pencil** on the OTAS.

INFORMATION FOR CANDIDATES

Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this booklet.

This paper consists of 21 printed pages.

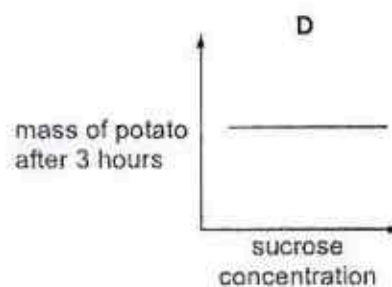
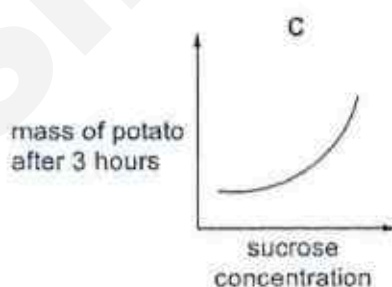
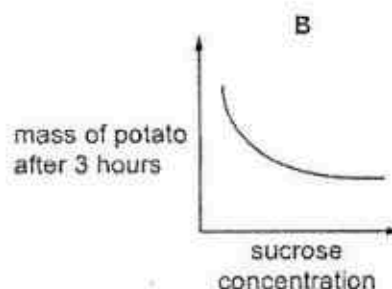
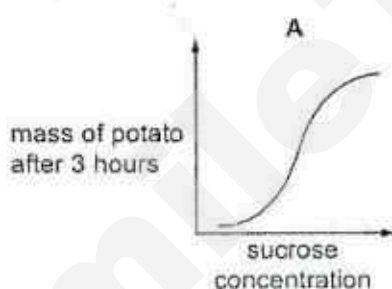
- 1 Which processes produce a continuous space for the flow of water in xylem vessels?

	break down of the cell walls between adjacent cells	removal of the cytoplasm in each cell
A	no	no
B	no	yes
C	yes	no
D	yes	yes

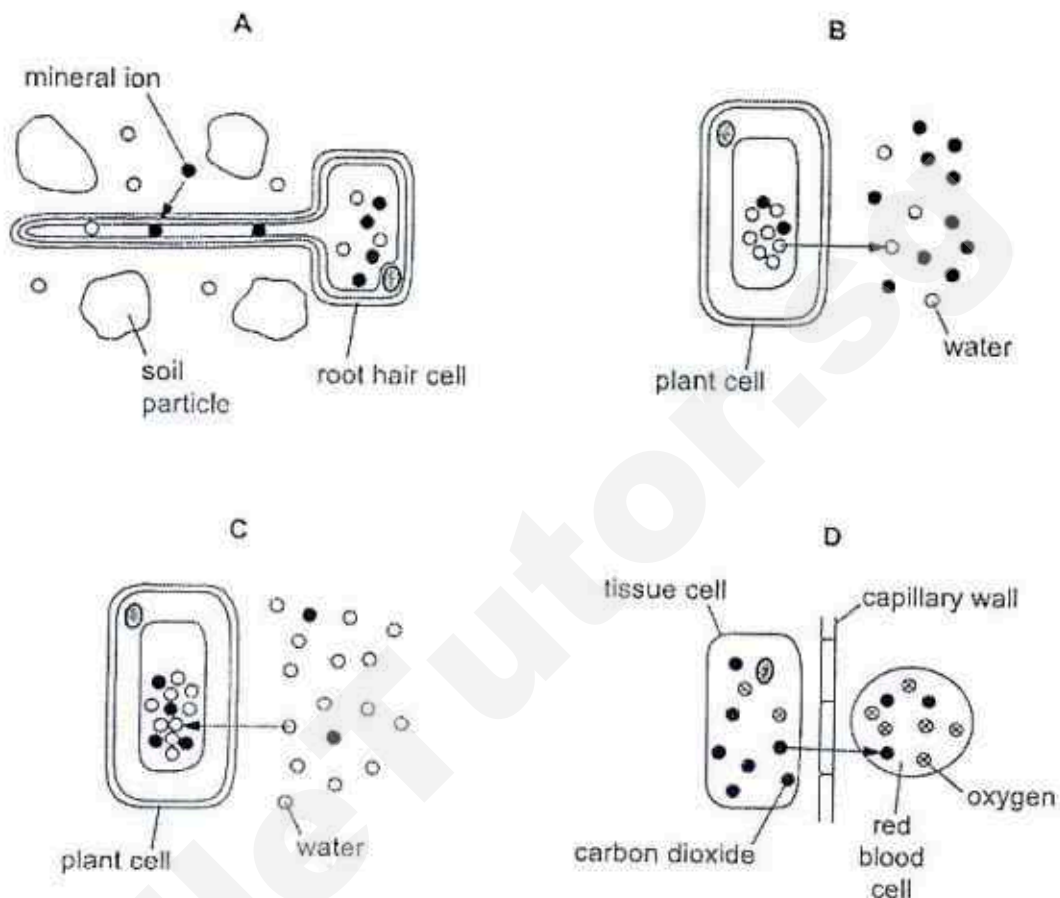
- 2 Which characteristics are correct for both osmosis and diffusion?

	require a partially permeable membrane	require a concentration gradient	require energy
A	✓	✓	×
B	✓	×	✓
C	×	✓	×
D	×	×	✓

- 3 Potatoes of the same shape and size are placed in sucrose solutions of different concentrations. After three hours, the mass of each potato piece is measured. Which graph shows the results of this experiment?



- 4 Which diagram below illustrates the process of active transport?



- 5 Two samples of food are tested. The results are shown in the table below. What do these results show?

	Test		
	Iodine test	Benedict's test	Biuret test
Sample 1	brown	orange-red	blue
Sample 2	blue-black	blue	violet

- A Sample 1 contains starch only while sample 2 contains proteins only.
 B Sample 1 contains starch and reducing sugars only while sample 2 contains starch only.
 C Sample 1 contains reducing sugars only while sample 2 contains starch and proteins only.
 D Sample 1 contains reducing sugars and proteins only while sample 2 contains starch only.

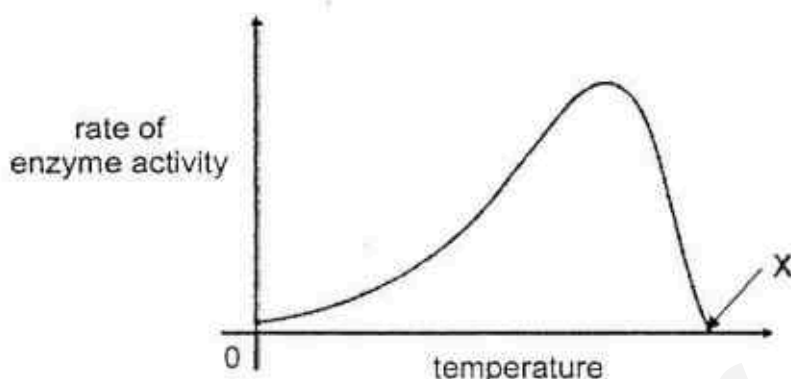
- 6 Which of the following fluids from a healthy man would produce a positive result with the Biuret Test?
- (i) Bile
 - (ii) Blood plasma
 - (iii) Pancreatic juice
 - (iv) Sweat
 - (v) Urine
- A (i) and (ii) only
B (ii) and (iii) only
C (ii), (iii) and (iv) only
D (ii), (iii) and (v) only
- 7 The diagram below represents the digestion of maltose to glucose by maltase.



Which of the following correctly identifies glucose, maltase and maltose?

	glucose	maltase	maltose
A	X	Y	Z
B	X	Z	Y
C	Y	X	Z
D	Z	Y	X

- 8 The graph below shows the rate of enzyme activity against temperature.



Which of the following explains the rate of enzyme activity observed at point X?

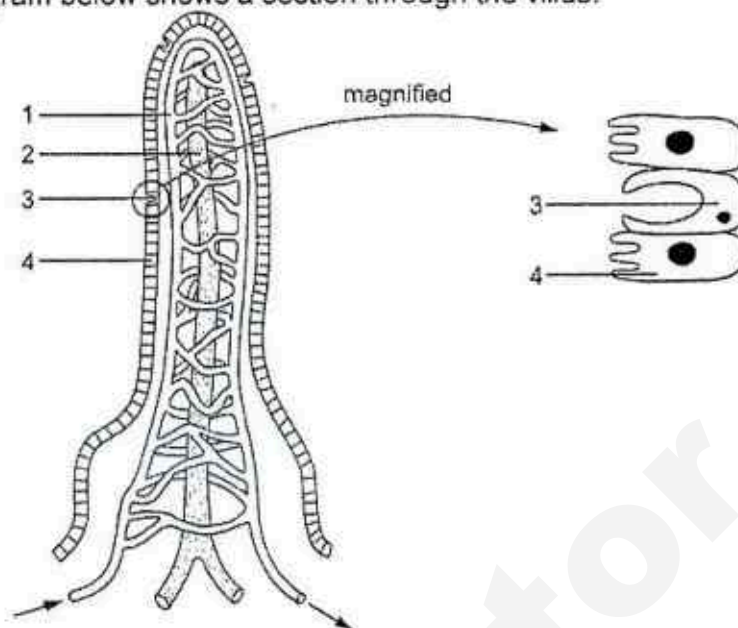
- (i) Concentration of enzyme and substrate are too low.
 - (ii) Enzymes are inactive.
 - (iii) Enzymes do not have enough kinetic energy.
 - (iv) Shape of substrate is not complementary to enzyme's active site.
- A (i) and (ii) only
B (ii) and (iii) only
C (ii) and (iv) only
D (iv) only
- 9 Test tubes 1, 2, 3 and 4 contain equal volume of oil suspension. Other substances were also added into each test tube as shown in the table below. The test tubes were left for eight hours and Ethanol Emulsion Test was conducted.

Test tube	Content
1	pancreatic lipase + sodium hydrogen carbonate
2	pancreatic lipase + alkaline condition
3	pancreatic lipase + hydrochloric acid
4	pancreatic lipase + alkaline condition + bile

Which test tube(s) would produce a negative result for Ethanol Emulsion Test?

- A 1, 2 and 4 only
B 2 and 3 only
C 2 and 4 only
D 3 only

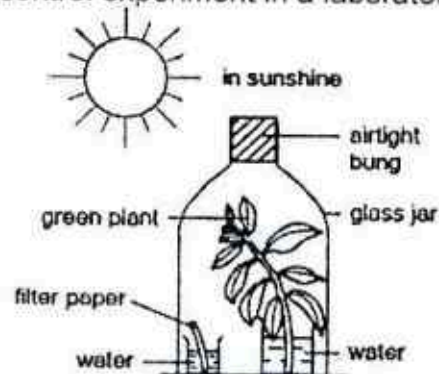
10 The diagram below shows a section through the villus.



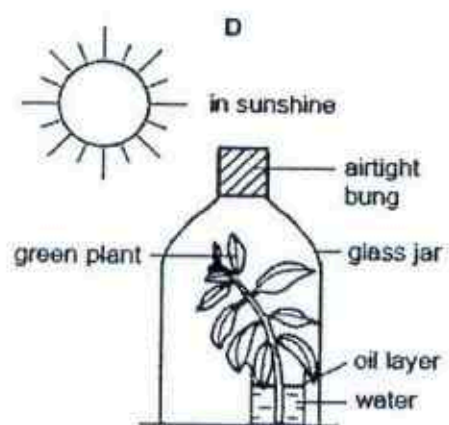
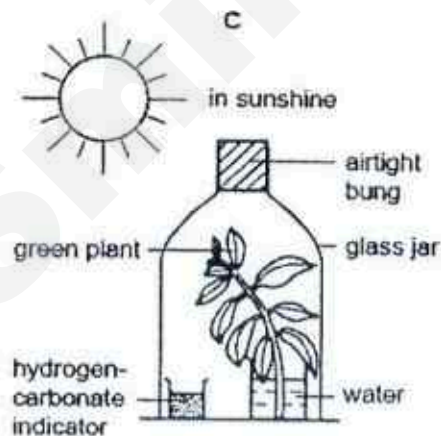
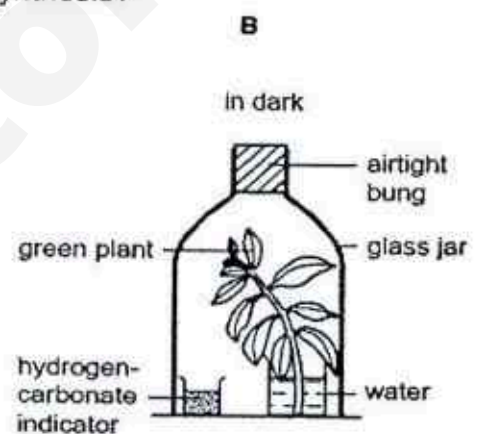
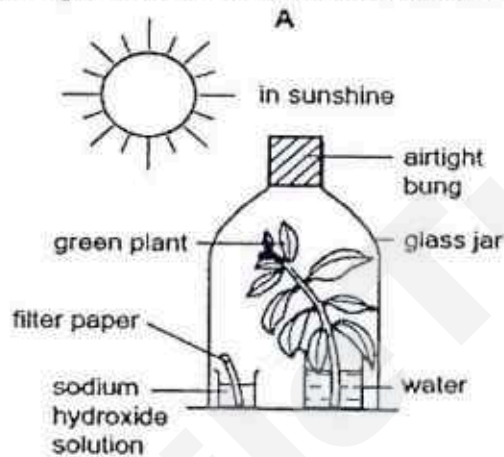
Which sequence correctly describes the functions of the numbered parts?

	1	2	3	4
A	absorbs digested food	transports glucose	transports digested fats	produces mucus
B	absorbs digested food	transports digested fats	produces mucus	transports glucose
C	transports glucose	transports digested fats	absorbs digested food	produces mucus
D	transports glucose	transports digested fats	produces mucus	absorbs digested food

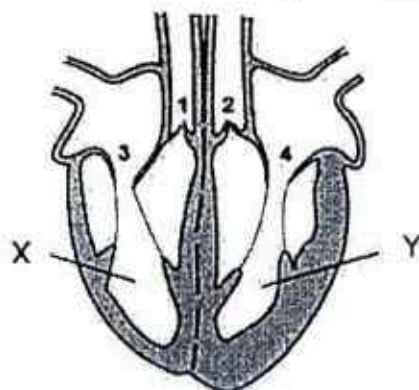
- 11 The diagram below shows a green shoot photosynthesising under a glass jar. This was used as a control experiment in a laboratory investigation.



Which diagram below shows the other experiment that should be done to investigate the need for carbon dioxide in photosynthesis?



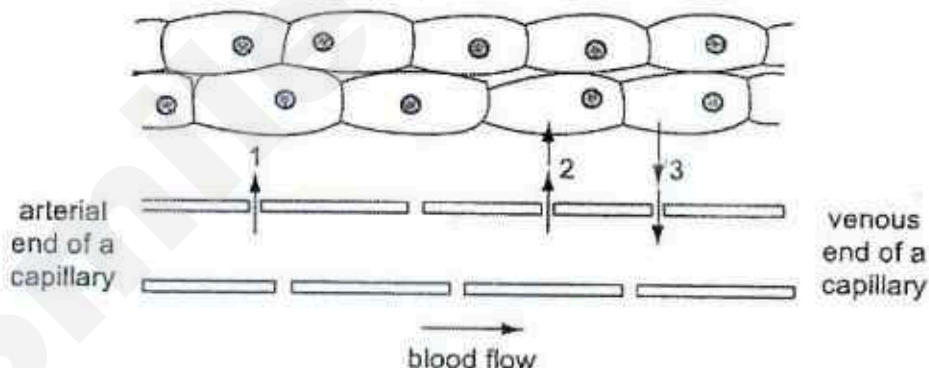
- 12 The diagram below shows a section through the heart.



Which of the following shows the correct state of the valves when blood is flowing out of chambers X and Y?

	valves 1 and 2	valves 3 and 4
A	closed	closed
B	closed	open
C	open	closed
D	open	open

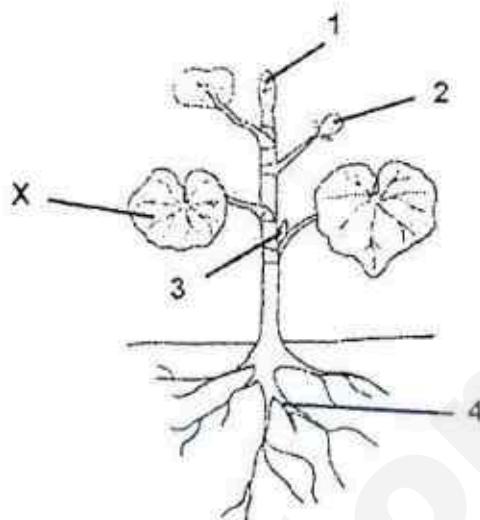
- 13 The diagram below represents a tissue with an adjacent capillary.



Which substances can 1, 2 and 3 represent?

	1	2	3
A	glucose	tissue fluid	carbon dioxide
B	oxygen	carbon dioxide	glucose
C	tissue fluid	glucose	oxygen
D	tissue fluid	oxygen	carbon dioxide

- 14 The diagram below shows a green plant on a sunny day.



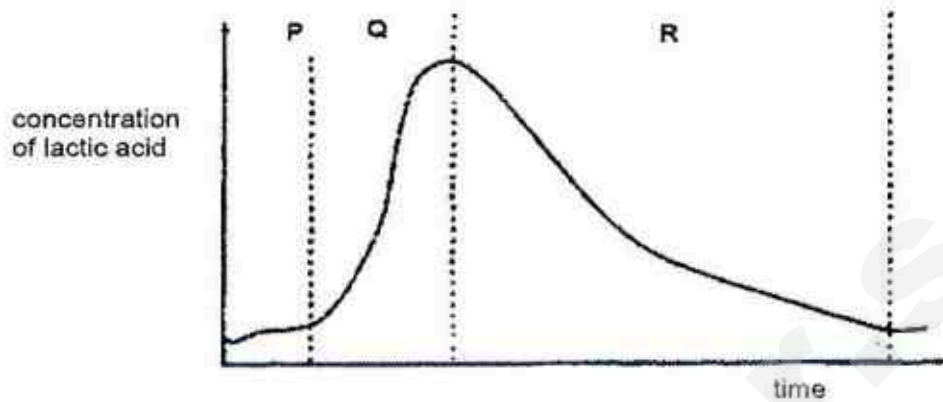
Where can the products, made by leaf X, be found after translocation?

- A 1 and 2 only
B 1, 2, 3 and 4
C 3 and 4 only
D 4 only
- 15 The table below shows movements involved in breathing.
Which describes the movements involved in breathing out?

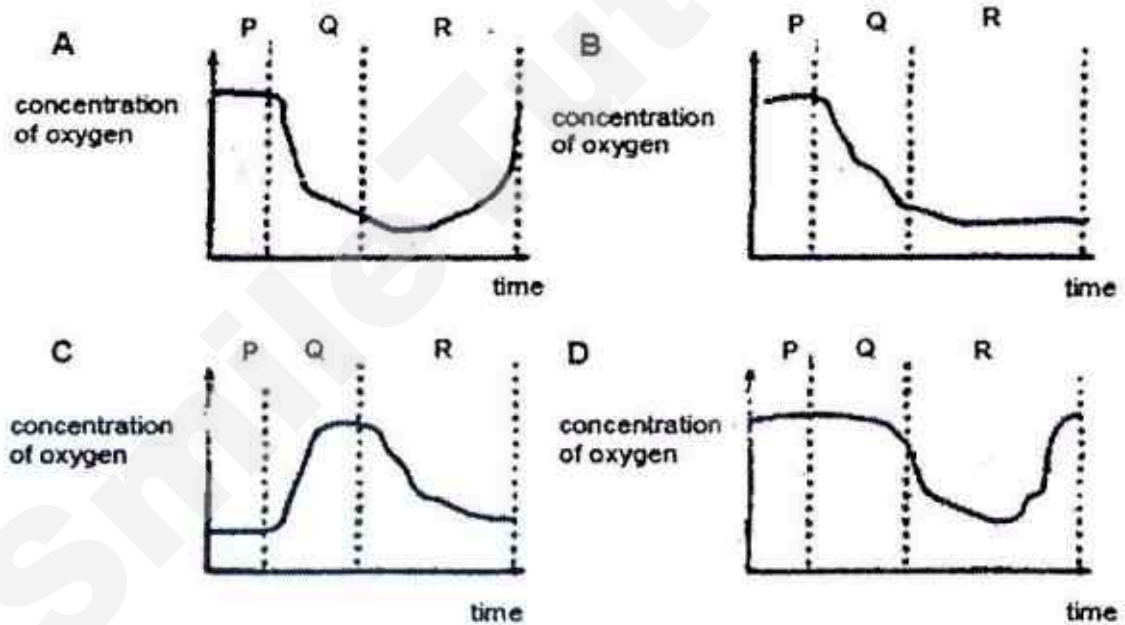
	movement of ribs	movement of diaphragm
A	downwards and inwards	downwards
B	downwards and inwards	upwards
C	upwards and outwards	downwards
D	upwards and outwards	upwards

- 16 Which feature of alveoli decreases the diffusion distance of oxygen and carbon dioxide molecules?
- A Each alveolus has a large blood supply.
B Each alveolus is only 0.1-0.2 mm in diameter.
C There are approximately 150 million alveoli in each lung.
D The walls of the alveoli are only one-cell thick.

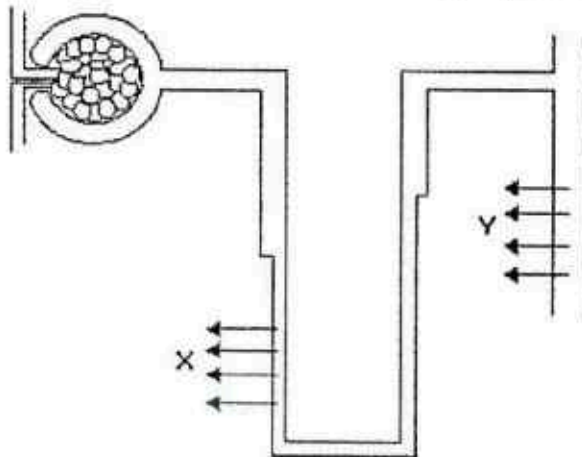
- 17 The graph below shows the concentration of lactic acid in the blood of an athlete.



Which of the following graphs correctly shows the level of oxygen content in his blood?

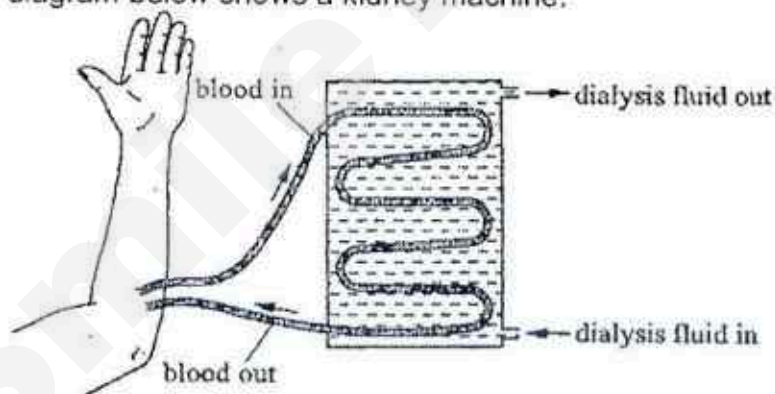


- 18 The diagram below shows a kidney nephron from a person.



An increased movement of water would occur in the direction of _____.

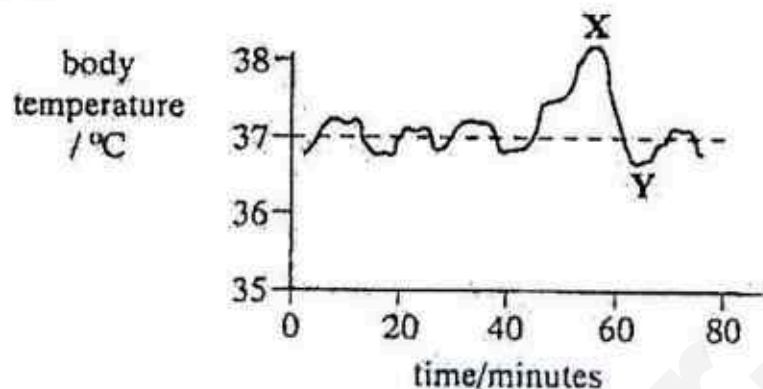
- A X if the person drinks large amount of water
 - B X if the person eats a salty meal
 - C Y if the person is in a cold room for 5 hours
 - D Y if more anti-diuretic hormone is released
- 19 The diagram below shows a kidney machine.



Which of the following substances need to be at the same concentration in the dialysis fluid and the blood?

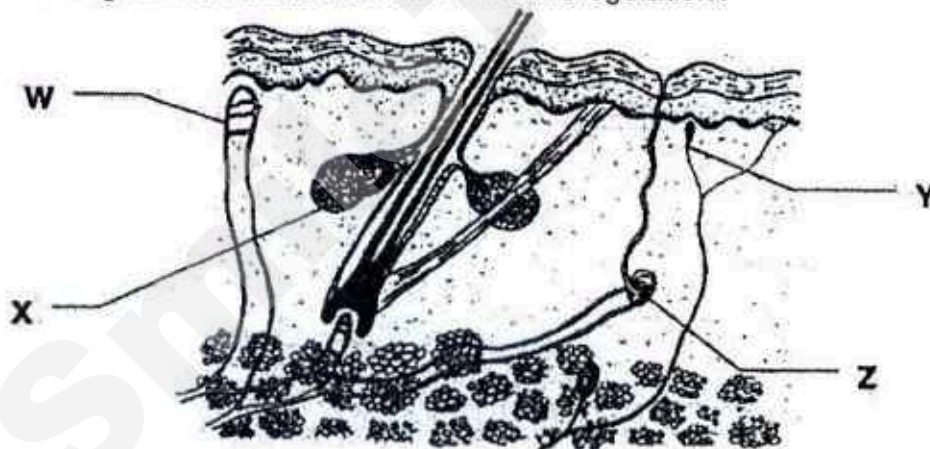
- A glucose
- B nitrogenous waste
- C salts
- D water

- 20 The graph below shows changes in a person's body temperature plotted against time.



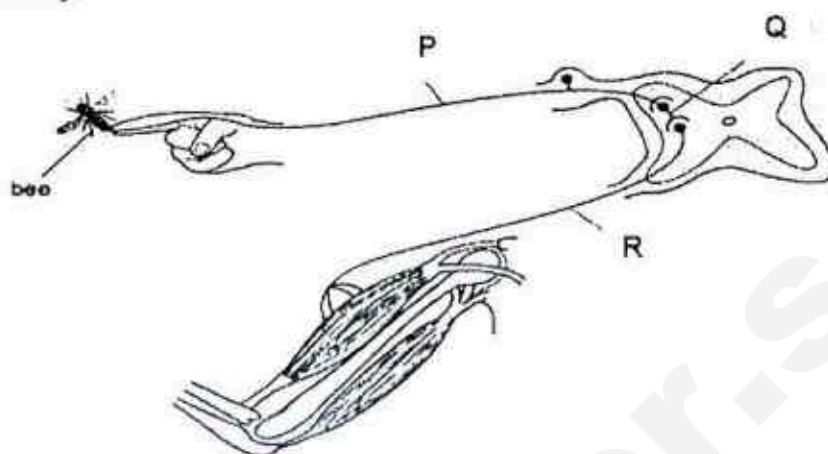
What causes the change in temperature between X and Y?

- A Increased air temperature
 - B Increased production of sweat
 - C Reduced blood flow through skin capillaries
 - D Shivering
- 21 The diagram below shows a section through the human skin. Which of the following structures are involved in thermoregulation?



- A W and X
- B W, Y and Z
- C X, Y and Z
- D Y and Z

- 22 The diagram below shows a reflex arc in which a bee sting causes the arm to move quickly.



Which of the following options correctly describe the response if the nerve impulse is blocked at Q?

	pain felt	arm moved
A	no	no
B	no	yes
C	yes	no
D	yes	yes

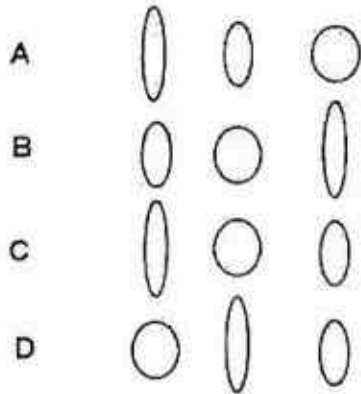
- 23 The trigeminal nerve in humans connects the brain with both the teeth and the skin of the face. When the dentist administers a local anaesthetic by injection, you can no longer feel pain and you cannot smile properly.

This allows you to conclude that _____.

- A the trigeminal nerve contains both motor and sensory neurons
- B the trigeminal nerve contains only sensory neurons
- C the trigeminal nerve contains only motor neurons
- D the trigeminal nerve contains only relay neurons

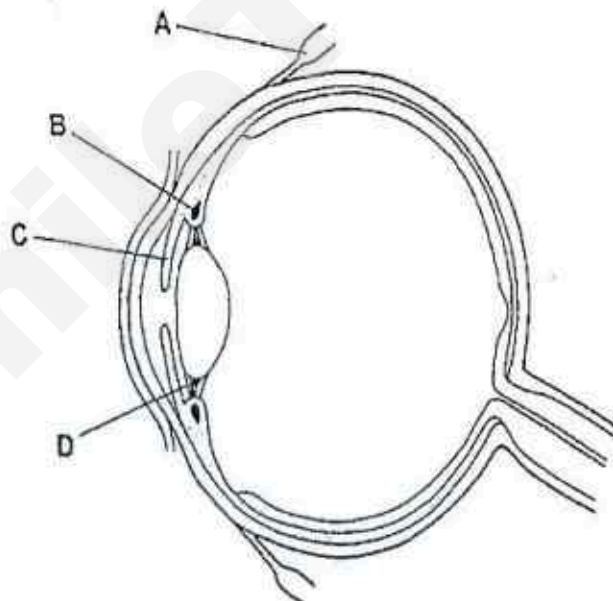
- 24 John sees his bus approaching from a distance, looks at his watch and checks it with the digital clock at the bus interchange.

Which of the following shows the sequence of changes taking place in the shape of the lens in his eyes?

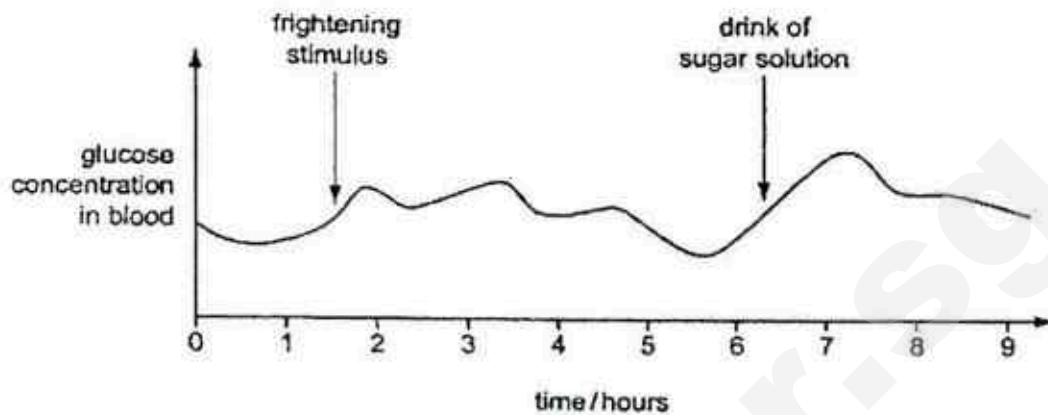


- 25 The diagram below shows a section through the eye.

Which structure is mainly responsible for movement of the eyeball so that light falls on the fovea?



- 26 The graph below shows the blood glucose concentration over a period of time.



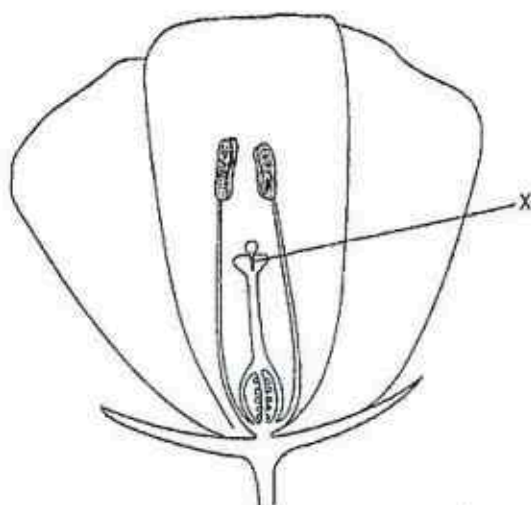
- Which statement is consistent with the blood glucose concentration at 6.5 hours?
- A Adrenaline secretion is high.
B Glucagon secretion is high.
C Insulin secretion is low.
D The brain detects the low blood glucose concentration.
- 27 Adrenaline is secreted quickly when a person is frightened. How does this affect the heart beat and the liver?

	heart beat	liver converts
A	decreases	glycogen to glucose
B	decreases	glucose to glycogen
C	increases	glycogen to glucose
D	increases	glucose to glycogen

- 28 What would be found in an insect-pollinated flower?

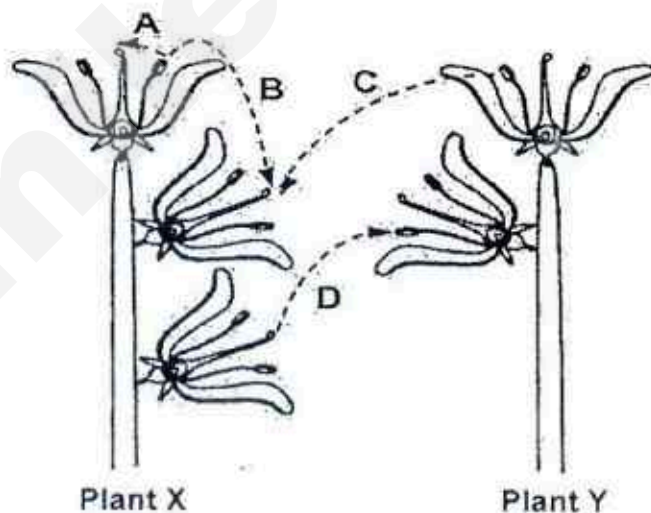
- A a large, feathery stigma
B long, pendulous stamens
C petals reduced or absent
D sticky pollen grains

- 29 The diagram below shows a section through a flower.
Which of the following travels down tube X?

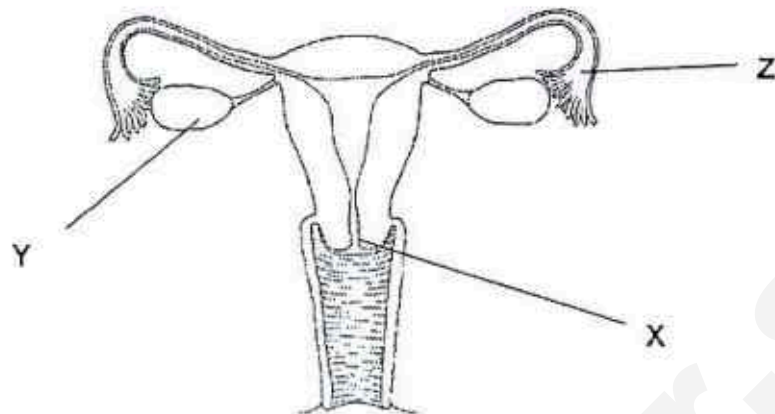


- A female gamete
- B male gamete
- C nectar
- D pollen grain

- 30 The diagram below shows two plants X and Y that are of the same species.
Which arrow represents cross-pollination?



- 31 The diagram below shows the female reproductive system.



Which of the following options correctly matches the labelled parts X, Y and Z?

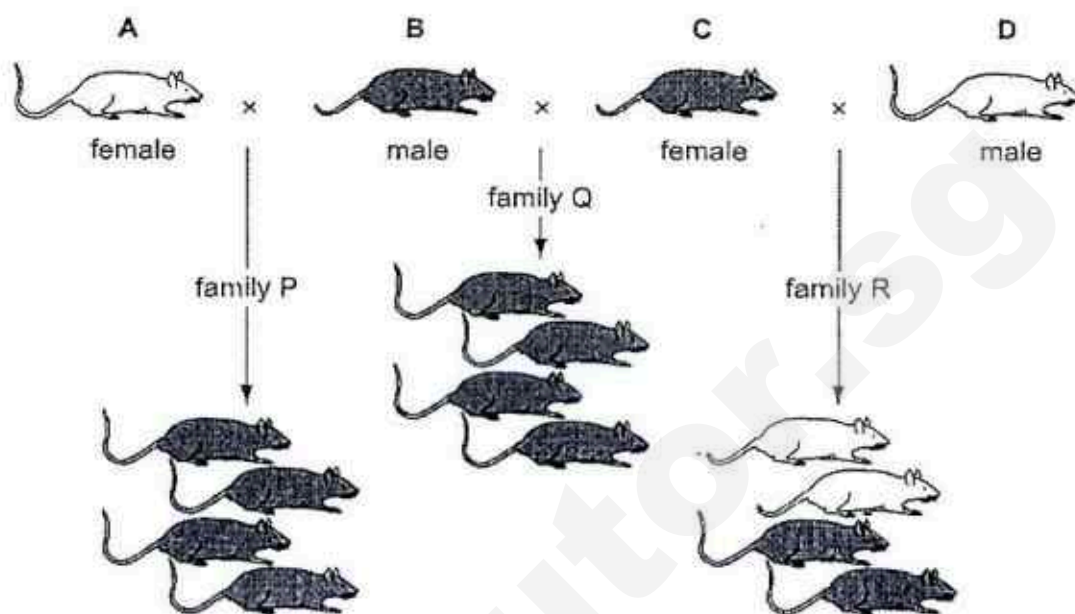
	X	Y	Z
A	Cervix	Ovary	Fallopian tube
B	Cervix	Ovum	Oviduct
C	Vagina	Ovary	Fallopian tube
D	Vagina	Ovum	Oviduct

- 32 Which of the following are valid measures to limit the spread of HIV virus?

- 1 Abstinence
- 2 Antibiotics
- 3 Condoms
- 4 Oral contraceptives

- A 1, 3
- B 1, 3, 4
- C 2, 3, 4
- D 3, 4

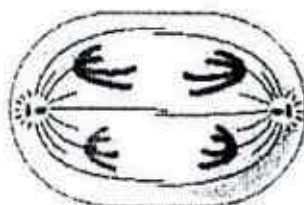
- 33 The diagram below shows the inheritance of coat colour in mice. Which mouse is heterozygous for coat colour?



- 34 Black-furred chinchillas produce gray-furred chinchillas when mated with white-furred chinchillas. What is the ratio of phenotypes in offspring produced if two gray-furred chinchillas are mated?

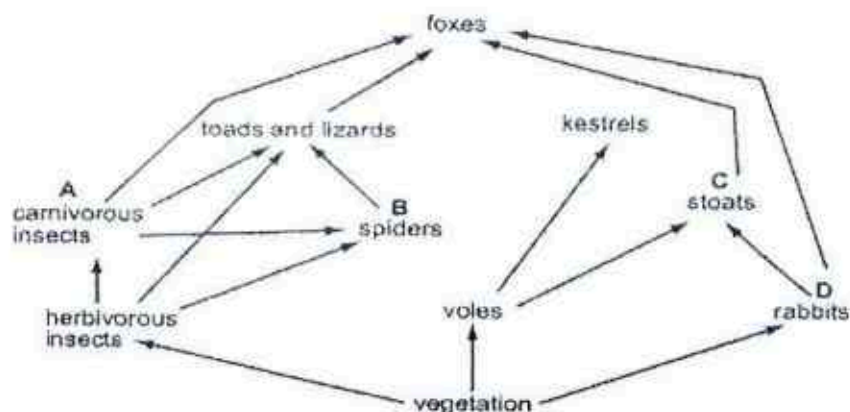
	Black	Gray	White
A	1	0	1
B	1	1	1
C	1	2	1
D	0	1	0

- 35 The diagram below shows a stage in cell division.



Which option below correctly identifies the stage shown?

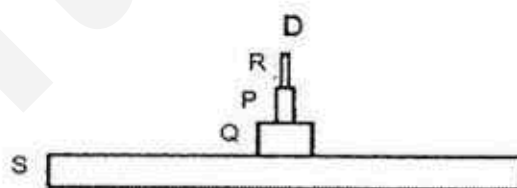
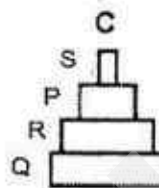
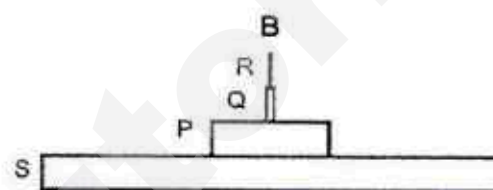
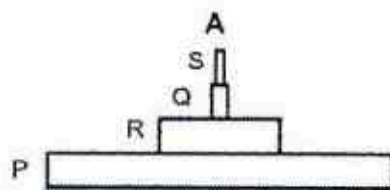
- | | <u>Cell division</u> | <u>Stage</u> | <u>Diploid number</u> |
|---|----------------------|--------------|-----------------------|
| A | Meiosis | Anaphase I | 4 |
| B | Meiosis | Prophase I | 2 |
| C | Mitosis | Prophase | 4 |
| D | Mitosis | Anaphase | 2 |
- 36 Which process below **does not** result in genetic variation?
- A arrangement of chromosomes at equator during metaphase I
B exchange of alleles during prophase I between chromosomes
C random fusion of nuclei of male and female gametes during sexual reproduction
D separation of sister chromatids at the centromere during anaphase II
- 37 A human cell contains all of the following. Which of the following is the smallest in size?
- A deoxyribonucleic acid
B gene
C nucleus
D Y chromosome
- 38 The diagram below shows a food web in a forest. Which labelled organisms in the food web are both secondary and tertiary consumers?



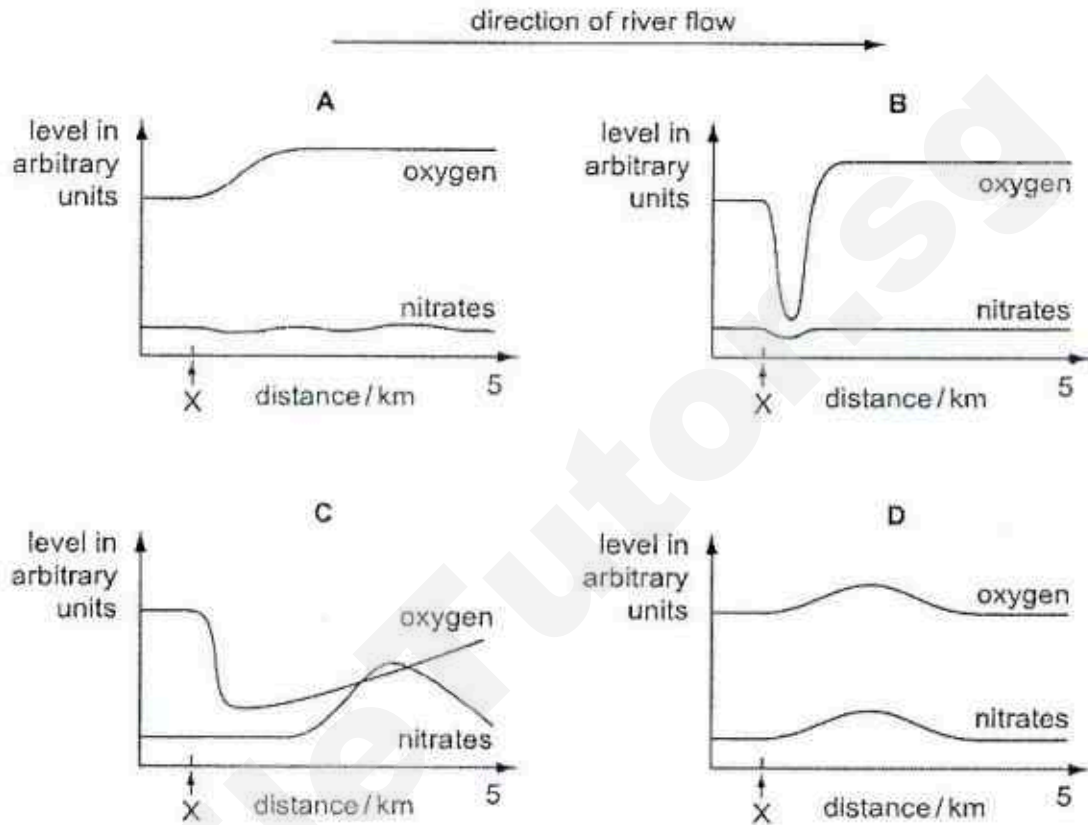
- 39 The table below shows the results of a field study of four species in a food chain in an area of a woodland.

species	number of individuals	biomass of one individual / arbitrary units	energy value per unit mass / arbitrary units
P	10,000	0.100	1.0
Q	5	10.000	2.0
R	500	0.002	1.8
S	3	300,000,000	0.5

Which of the following represents the correct pyramid of energy from the given data?



- 40 The graphs below show how the levels of dissolved oxygen and nitrates change along the length of a river. Which graph shows the effect of sewage entering the river at the point marked X?



.....End of paper.....

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1	D	11	A	21	B	31	A
2	C	12	C	22	C	32	A
3	B	13	D	23	A	33	C
4	A	14	B	24	C	34	C
5	C	15	B	25	A	35	A
6	B	16	D	26	C	36	D
7	D	17	A	27	C	37	B
8	D	18	D	28	D	38	B
9	A	19	A	29	B	39	B
10	D	20	B	30	C	40	C

Name: _____ ()

Class: Sec 4 / ()



南 华 中 学
NAN HUA HIGH SCHOOL

PRELIMINARY EXAMINATION 2017

Subject : Biology
Paper : 5158/02
Level : Secondary Four Express
Date : 12 September 2017
Duration : 1 hour 45 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, class and index number in the spaces provided at the top of this page.

Write in dark blue or black pen.

You may use a pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, highlighters, glue or correction fluid.

SECTION A – 50 MARKS

Answer all questions.

Write your answers in the spaces provided on the Question Paper.

SECTION B – 30 MARKS

Answer all the questions.

Write your answers in the spaces provided on the Question Paper.

Write an E (for Either) or an O (for Or) next to Question 9 in the grid below to indicate which question you have answered.

INFORMATION FOR CANDIDATES

You are advised to spend no longer than one hour on Section A and no longer than forty-five minutes on Section B.

The number of marks is given in brackets [] at the end of each question or part question.

The total number of marks for this paper is 80.

For Examiner's Use	
Section A	
Section B	
7	
8	
9	
Total	

This paper consists of 19 printed pages.

Page 1 of 19

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Section A [50 marks]

Answer all questions.
Write your answers in the spaces provided.

- 1 A study of fresh fruits extracts on the formation of a gel from gelatin is conducted. The process is known as gelation. Gelatin is a protein obtained from the partial hydrolysis of collagen, a structural protein found in tough, fibrous tissues such as animal hooves. Extracts of fresh fruits contain enzymes. Some enzymes prevent the hardening of gelatin.

In the investigation shown in Fig.1.1, a toothpick is inserted into the hardened gelatin and the toothpick remains upright. After 20 minutes of adding 3 different fruit extracts to the gelatin, the results are shown below:



Fig.1.1

- (a) (i) Name the type of enzymes investigated.
.....[1]
- (ii) Explain the action of enzymes on gelation.
.....[1]
- (iii) Predict and explain what will happen if the pineapple extract for Gel Z is boiled before it is added to the well.
.....
.....[1]

Fig.1.2 shows some parts of the human alimentary canal and associated organs.

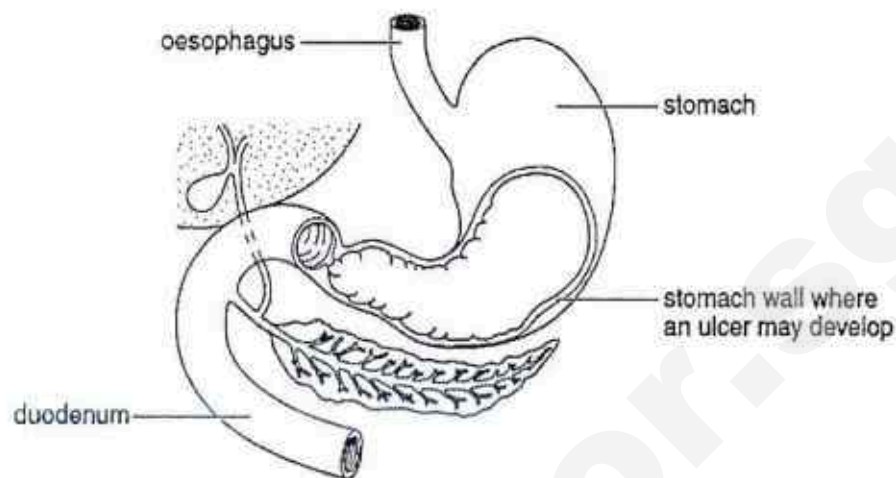


Fig.1.2

- (b) Name and describe the process that moves food down the oesophagus to the stomach.

name of process[1]

description of process

.....

.....

.....[1]

- (c) A sore can develop on the wall of the stomach and is called an ulcer, which can cause a person pain. The pain may be relieved by taking a drug that reduces the amount of acid produced by the cells in the stomach wall.

Suggest and explain how the processes taking place in the stomach may be affected in a person taking this drug.

.....

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.....

.....

.....[2]

[Total:7]

- 2 Fig.2.1 shows a sample of human blood seen using a microscope.

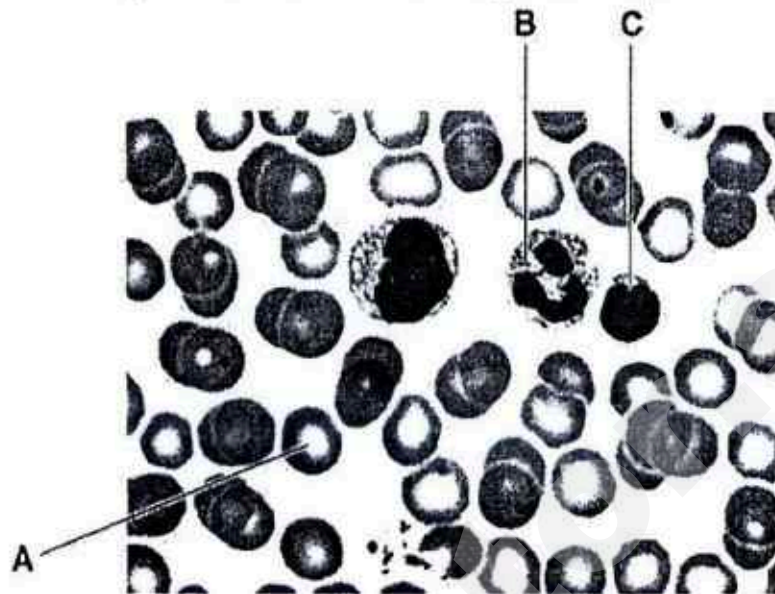


Fig.2.1

- (a) (i) Use your knowledge of the structure of cell A seen in Fig.2.1 and explain why it appears to be more lightly coloured at its centre than at its edge.

.....
.....[1]

- (ii) Some diseases can cause a person to have fewer cells B and C in the blood. State and explain the consequences of this on the person's health.

.....
.....
.....
.....
.....[3]

- (b) Table 2.2 shows the results of different blood groups taken from persons P, Q and R when mixed together.

		Donor's antigen in blood		
		A	B	AB
Recipient	P	-	+	+
	Q	+	-	+
	R	+	+	+

Key
'+' Agglutination
'-' No agglutination

Table 2.2

Based on the results shown above, state the blood group of persons P, Q and R. Give reasons to support your answers.

[3]

Person	Blood group	Reason
P		
Q		
R		

Fig.2.3 below shows the blood groups of the members in a family.

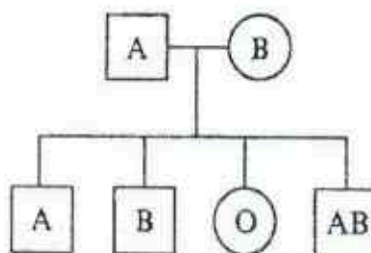


Fig.2.3

- (c) (i) Explain how parents of blood group A and blood group B can have children of blood group O.

.....

.....

.....

.....

[3]

- (ii) State and explain the type of variation shown by blood group.

.....

.....

.....

.....[2]

[Total: 12]

- 3 Fig.3.1 shows a model that a student made to represent the human breathing system.

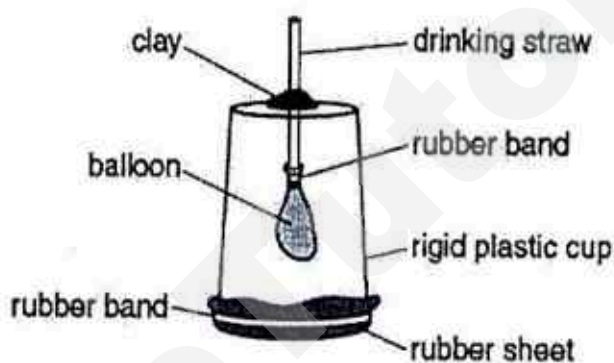


Fig.3.1

- (a) State the part of the model shown in Fig.3.1 that represents each of the following structures.

trachea

diaphragm[1]

- (b) Describe **two** ways in which this model does **not** accurately represent the human breathing system.

.....

.....

.....

.....[2]

- (c) The model becomes damaged by a hole made in the side of the rigid plastic cup.

Describe and explain how this damage will change what the student would observe as the model is used to demonstrate the action of breathing in.

.....

.....

.....

.....

.....

[2]

[Total:5]

- 4 Fig.4.1 shows a potometer.

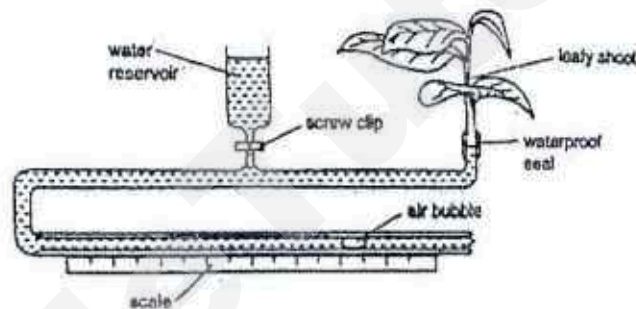


Fig.4.1

- (a) Describe how the potometer can be used to measure the rate of water loss from the leafy shoot.

.....

.....

.....

.....

.....

.....

[3]

Four experiments were carried out to investigate the distribution of stomata on the upper and lower surfaces of the leaf of a leafy shoot.

Each set-up was left in a windy place and weighed at 4-hour intervals for 24 hours.

Fig.4.2 shows the set-up of the experiment.

Fig.4.3 records the treatment of the plants and the changes in the weight of each set-up over 24 hours.

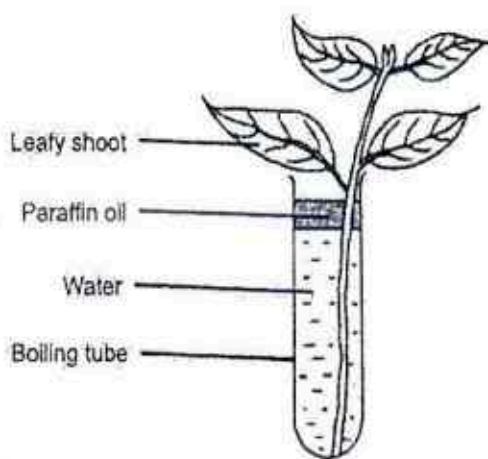


Fig.4.2

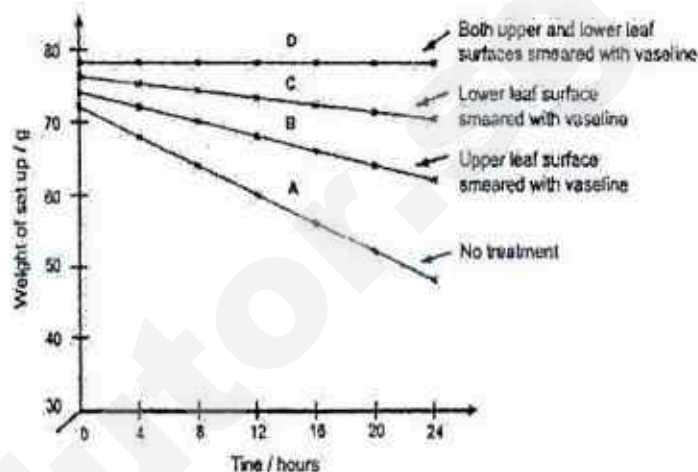


Fig.4.3

- (b) (i) Define transpiration.

.....
.....[1]

- (ii) With reference to Fig.4.3, describe the differences in set-ups B and C and draw a conclusion for the experiment.

.....
.....
.....
.....
.....[2]

- (iii) Suggest and explain how the graph for set-up C will change if the set-up was placed under a bell jar.

.....

.....

.....

.....

.....

.....[3]

Fig.4.4 shows part of the carbon cycle.
The numbers represent the changes in the flow of carbon in gigatons of carbon per year between parts of the cycle.

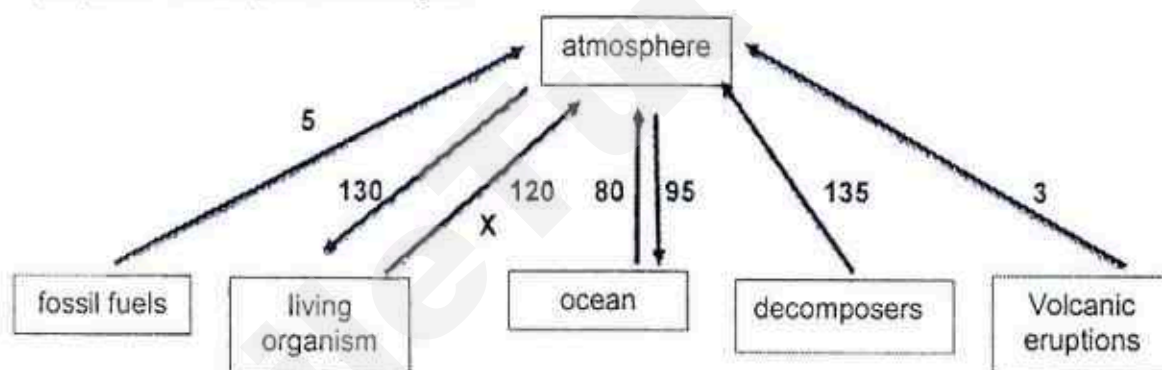


Fig.4.4

- (c) (i) Name process X.

.....[1]

- (ii) Calculate the total amount of carbon dioxide released each year.

[1]

- (iii) State what is meant by the term carbon sink.

.....
.....
.....[1]

- (iv) Suggest **two** reasons why the forest gives out less carbon than it takes in.

.....
.....
.....
.....[2]
[Total:14]

- 5 Fig.5.1 shows a kidney tubule and Table 5.2 shows the concentration of glucose, in structures X and Y, in a normal healthy female adult.

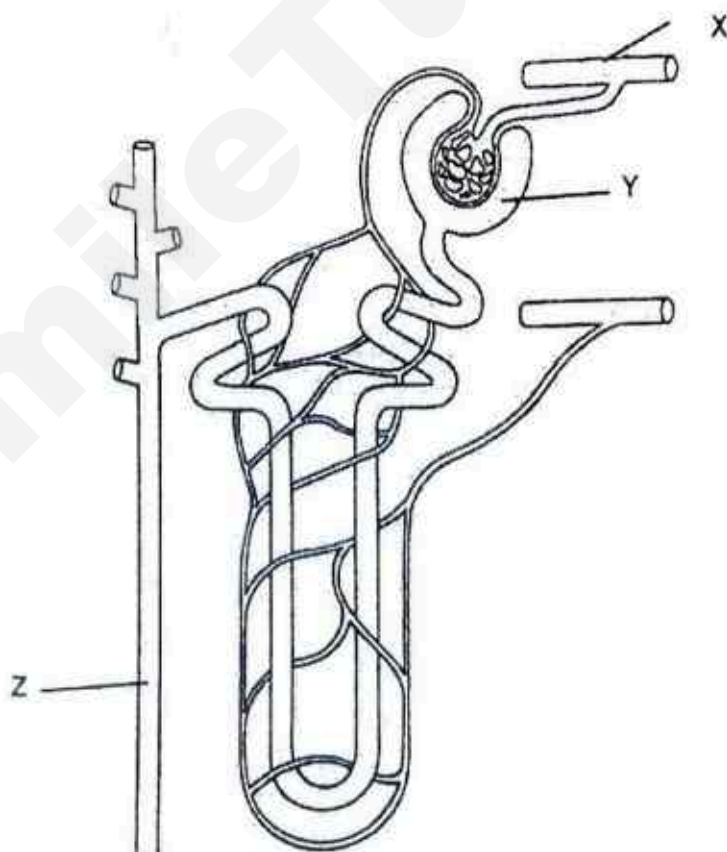


Fig.5.1

structure	glucose concentration (g/100cm ³)
X	0.1
Y	0.1
Z	

Table 5.2

- (a) (i) Complete Table 5.2 to show the glucose concentration in structure Z. [1]

- (ii) Explain the difference in glucose concentration between structures Y and Z.

.....

[1]

- (b) Anti-diuretic hormone (ADH) can stimulate the reabsorption of water in the kidney tubule.

- (i) Which of the structure X, Y or Z does ADH act on?

.....[1]

- (ii) Explain the effect of increased body temperature on ADH.

.....

[4]

[Total: 7]

- 6 (a) A boy is making a move on the chess board.
How is this action different from a reflex action?

.....

.....

.....

.....

.....

.....[3]

- (b) A man's head was injured in a car accident. When doctor shone a bright light into each of his eyes, the pupil of his right eye did not constrict. Suggest an explanation for the failure of his right pupil to constrict.

.....

.....

.....

.....

.....[2]

[Total: 5]

-----End of Section A-----

Section B [30 marks]

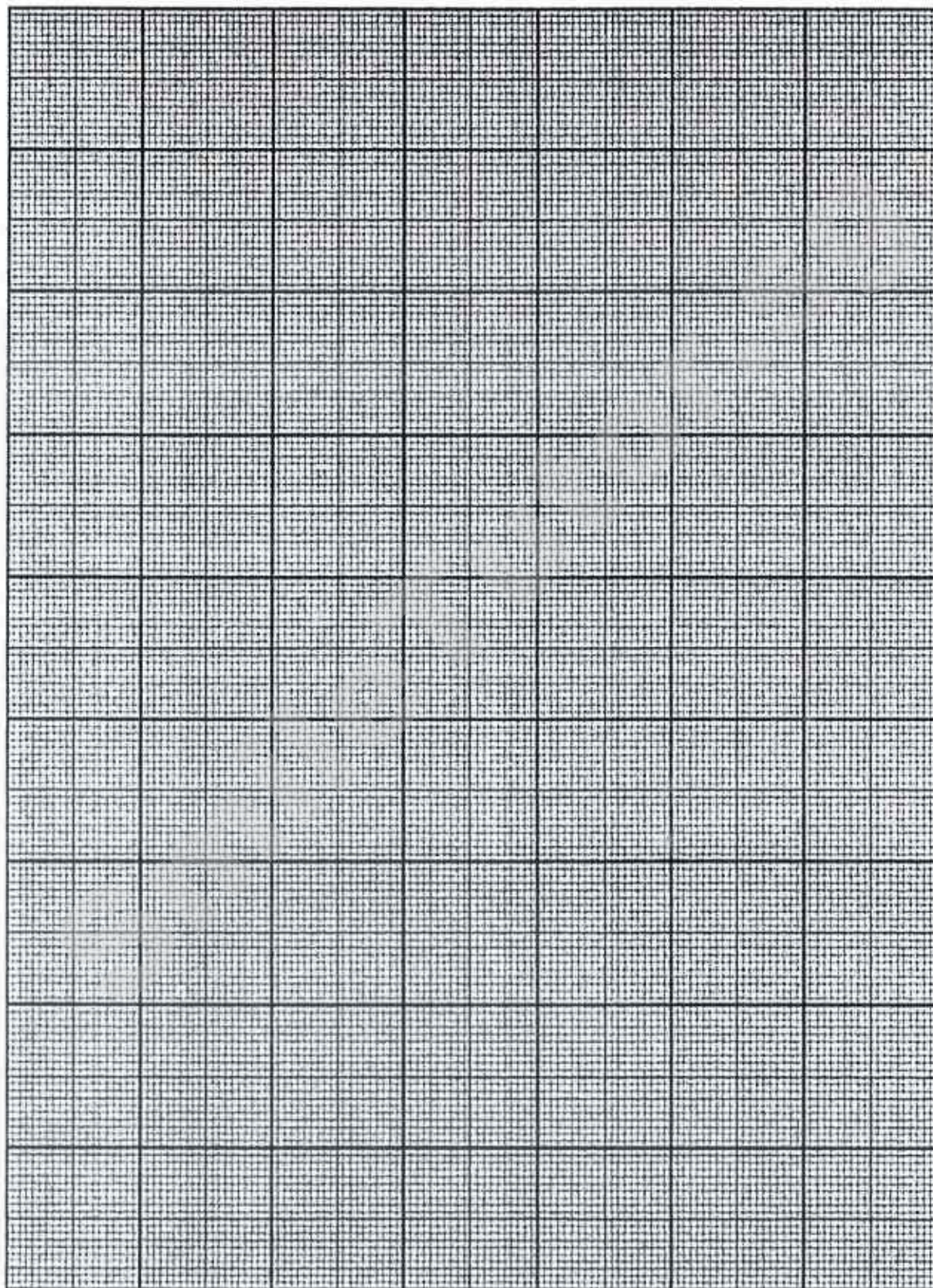
Answer all questions.
Write your answers in the spaces provided.

- 7 Table 7.1 below shows the relationship between blood alcohol content and the percentage risk of accident.

Blood alcohol content/ g per 100cm ³	Percentage risk of accident/ %
0.000	0.0
0.025	0.5
0.050	1.0
0.100	9.0
0.125	16.5
0.150	26.0

Table 7.1

- (a) (i) Plot the data given in Table 7.1 on the grid provided. [4]



- (ii) Use the graph to predict the percentage risk of a road accident if a driver had blood alcohol content of $0.075 \text{ g per } 100 \text{ cm}^3$.

.....[1]

- (iii) Describe and explain the relationship shown by the data in Table 7.1 between blood alcohol content and the percentage risk of accident.

.....[3]

- (b) Unlike most food nutrients, alcohol does not need to be digested. Instead, it is readily absorbed into the blood from the stomach. Alcohol can also be inhaled into the lungs as a vapour. It is then absorbed into the bloodstream.

Describe how inhalation of alcohol vapour into the lungs can lead to a faster increase in concentration of alcohol in the brain as compared to drinking it.

.....[2]

[Total: 10]

- [6]

- [4]

Page 16 of 19

9 (a) Describe the concurrent changes to the uterus of a woman during the menstrual cycle with reference to the effects of oestrogen and progesterone if the woman does not become pregnant.

[4]

- [2]

- [4]

[Total: 10]

9 (a) Describe the role of the placenta during the development of the fetus.

[4]

(b) Explain how the development of the fetus of a mother who smokes might be affected.

[2]

(c) "Genetic engineering only benefits the human population." Discuss the validity of this statement.

[4]

[Total: 10]

-----End of paper-----

Nan Hua High School
Preliminary Examination 2017
Biology Marking Scheme

1	(ai)	protease [1]												
	(aii)	enzyme/protease digest gelatin/protein to polypeptides [1]												
	(aiii)	Boiling denature protease in the pineapple, making it unable to digest proteins, making gelatin remain hard/toothpick remain upright . [1]												
	(b)	name of process: peristalsis [1] description of process: circular and longitudinal muscles contract and relax alternately to produce a rhythmic wave-like contractions . [1]												
	(c)	Less protein digestion [1] Pepsin required acidic medium to function/ hydrochloric acid provide pepsin with an acidic condition to function. [1]												
2	(ai)	biconcave in shape/more haemoglobin at edges than at centre/ absence of nucleus. [1]												
	(aii)	problem: reduced immunity/immune response/ less able to fight infection [1] explanation: phagocytes engulf and ingest foreign particles by phagocytosis , lymphocytes produces antibodies to neutralise toxin (1 function of antibodies) [1]												
	(b)	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Person</th><th style="text-align: center;">Blood group</th><th style="text-align: center;">Reason</th></tr> </thead> <tbody> <tr> <td style="text-align: center;">P</td><td style="text-align: center;">A</td><td>Presence of antibodies b in plasma that cause agglutination in B/ AB/ No agglutination in A</td></tr> <tr> <td style="text-align: center;">Q</td><td style="text-align: center;">B</td><td>Presence of antibodies a in plasma to cause agglutination in A and AB/ No agglutination in B</td></tr> <tr> <td style="text-align: center;">R</td><td style="text-align: center;">O</td><td>a and b antibodies present in plasma , thus agglutination in A, B and AB</td></tr> </tbody> </table> <p>If all the blood groups are correct, award 1 mark. If all the blood groups are correct plus one correct reason, award 2 marks.</p>	Person	Blood group	Reason	P	A	Presence of antibodies b in plasma that cause agglutination in B/ AB/ No agglutination in A	Q	B	Presence of antibodies a in plasma to cause agglutination in A and AB/ No agglutination in B	R	O	a and b antibodies present in plasma , thus agglutination in A, B and AB
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Q	B	Presence of antibodies a in plasma to cause agglutination in A and AB/ No agglutination in B												
R	O	a and b antibodies present in plasma , thus agglutination in A, B and AB												
	(ci)	I^A and I^B alleles are dominant to I^O allele [1] Blood group O children are homozygous recessive with $I^O I^O$ [1] can inherit one I^O allele from each parent/ each parent pass down/ contribute one I^O allele who are $I^A I^O$ and $I^B I^O$ [1] Penalise 1 mark for wrong notation of I^O												
	(cii)	Discontinuous variation [1] There are no intermediates for blood group/ do not show additive effects/ distinct phenotypes/ only affected by genetic factor/gene/ not affected by environmental factor [1]												
3	(a)	trachea-drinking straw diaphragm-rubber sheet [1]												
	(b)	-model:1 balloon; human: 2 balloons -model:ribs not represented; human: ribs present -model:intercostal muscles not represented; human: intercostal muscles present												

		-model:rigid plastic cup does not move; human: ribs move upwards/downwards -model:bronchus/bronchioles not represented; human: bronchus/bronchioles present -model: rubber sheet not dome at rest/does not move independently; human: diaphragm arches up/dome shape at rest; move independently. [any 2] [2]
	(c)	Balloon no longer inflate/ expand[1] ,air is able to pass through the hole and pressure in cup not reduced and less air flowing through the straw . [1]
4	(a)	It is assumed that the rate of absorption of water by the plant is equal/proportional to the rate of water loss from the plant . [1] As the water moves into the plant, the air bubble moves to the left/towards shoot . [1] By measuring the distance moved by the air bubble per unit time , we can measure the rate of water loss from the leafy shoot. [1]
	(bi)	Transpiration is the loss of water vapour from the aerial parts of the plant through the stomata of the leaves [1]
	(bii)	Rate of drop in weight or drop in weight of set-up B is greater than that of C from 74g to 62g in set up B, as compared from 76g to 70g in set up C/ a drop of difference of 12g vs 6 g [1] This shows that the lower leaf surface has more stomata than upper surface [1]
	(biii)	Graph C will have a gentler slope/less steep [1] Higher humidity/ No wind to remove the water vapour/ concentration of water vapour increases in bell jar, lowers/ decreases water vapour concentration gradient between intercellular air space and atmosphere [1] Reduces rate of transpiration / rate of water loss [1], therefore less weight loss / weight of set ups will be higher
	(ci)	Respiration [1]
	(cii)	$5+120+80+135+3=343$ gigatons [1]
	(ciii)	A carbon sink stores more carbon than it releases for long periods of time such as forests/oceans [1]
	(civ)	More carbon dioxide is taken up by plants for photosynthesis than given out during respiration [1] Carbon dioxide is converted to organic substances , which enters into food chain when animals eat plants [1]; The organic substances will form part of skeleton [1] and become coal after long periods of time.
5	(ai)	0.0 [1]
	(aii)	All the glucose molecules , which are forced out of the glomerular blood capillaries into the Bowman's capsule, will be selectively reabsorbed at the proximal convoluted tubule . [1]
	(bi)	Z [1]
	(bii)	Increased body temperature results in more sweat being produced [1]. Increased water loss decreases the water potential in the blood plasma . [1] Hypothalamus in the brain is stimulated to produce more ADH [1] and stimulates pituitary gland to release more ADH into the bloodstream [1], increasing its concentration.
6	(a)	Voluntary action involves conscious control . Reflex action DOES NOT involve conscious control . OR Voluntary vs involuntary action [1]

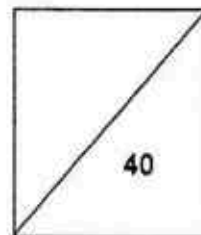
		<p>Voluntary action MAY NOT have an immediate response. Reflex action has a Immediate response. [1]</p> <p>Voluntary action DOES NOT need a stimulus. Reflex action occurs in response to a stimulus. [1]</p> <p>sensory vs no sensory neurone involved [1]</p> <p>initiated in the brain vs initiated in the receptor [1]</p>
	(b)	<p>sensory neurone / optic nerve/ relay / motor neurone in the brain is damaged / cut [1]</p> <p>When head is damaged, nerve impulses cannot be transmitted to the effector circular and radial muscles in the iris. [1]</p>
7	(ai)	S [1] L [1] A [1] P [1]
	(aii)	3.5%
	(aiii)	<p>As blood alcohol content of blood increases, the percentage risk of accidents increases. [1]</p> <p>comparative use of figures from both axes [1]</p> <p>explanation [1]</p> <ul style="list-style-type: none"> • slows down reaction / response/ reflexes/ increases time/ blurred / impaired vision/ poor judgment (of distances)/ poor / lack of co-ordination
	(b)	<p>Alcohol enters the lung and diffuse into the bloodstream in the alveolus [1] which brings it to the left side of the heart and directly to the brain. [1]</p> <p>OR</p> <p>absorption in the stomach will transport to liver via hepatic portal vein for alcohol detoxification / breakdown [1]</p> <p>reduced alcohol concentration in blood transported to brain [1]</p>
8	(a)	<p>Carbon dioxide diffuse into the leaf through the stomata [1] into the intercellular air spaces and dissolves in the film of moisture around the mesophyll cells [1] dissolved carbon dioxide diffuses into the chloroplasts of the mesophyll cells [1] carbon dioxide together with water molecules [1] form glucose during photosynthesis [1] excess glucose is converted to starch and stored in the leaf [1]</p> <p>OR</p> <p>during photosynthesis, photolysis of water molecule into oxygen gas and hydrogen atoms/ ions [1] which is then used to reduce CO₂ into glucose [1]</p>
	(b)	<p>Structural similarities: long, narrow protrusions to provide large surface area for faster absorption [1] OR</p> <p>Both have abundant mito for release E for active transport of substances</p> <p>Functional similarities: for absorption of mineral salts/ digested food substances by active transport and diffusion [1] OR</p> <p>both maintain a concentration gradient for diffusion / absorption of substances</p> <p>Structural differences:</p> <p>root hair part of one cell but villi has many cells OR</p> <p>blood vessels and lacteals are found in villi but not in root hair cell OR</p> <p>villi is made up by a layer of epithelial cells but not root hair</p>

		<p>Functional differences: Root hair absorb mineral salts and water from the soil but villi absorb digested nutrients / amino acids, glucose and lipids from the alimentary canal [1]</p>																		
9E	(a)	<p>During menstruation from day 0 to 5, levels of oestrogen and progesterone are low causing the uterine lining to break down. [1] During days 6-13, oestrogen level start to increase as follicles develop to form Graafian follicle, causing the growth and repair of the uterine lining, thicken and spongy with blood vessels. [1] During day 14, ovulation occurs and the Graafian follicle forms a corpus luteum. Level of oestrogen begins to drop and level of progesterone increases. Uterine lining is thicken further and is richly supplied with blood capillaries. [1] Day 15 to 28, the egg is not fertilised and disintegrate. The corpus luteum in the ovary breaks down and the progesterone level decreases, causing the uterine lining to break down and the cycle repeats. [1]</p>																		
	(b)	<table border="1"> <tr> <td>Basis of comparison</td><td>Fetus</td><td>Newborn baby</td></tr> <tr> <td>Source of nutrients</td><td>Maternal</td><td>External</td></tr> <tr> <td>Route taken by nutrients</td><td>Via umbilical vein</td><td>Alimentary canal</td></tr> <tr> <td>Form in which nutrients are received</td><td>Simplest form</td><td>Requires digestion/ relies on enzymes</td></tr> <tr> <td>Gaseous exchange</td><td>Diffusion from placenta</td><td>Relies on lungs/ breathing</td></tr> <tr> <td>Requirement for gaseous exchange</td><td>Difference in concentration gradient</td><td>Difference in pressure</td></tr> </table> <p>Any 2 comparisons</p>	Basis of comparison	Fetus	Newborn baby	Source of nutrients	Maternal	External	Route taken by nutrients	Via umbilical vein	Alimentary canal	Form in which nutrients are received	Simplest form	Requires digestion/ relies on enzymes	Gaseous exchange	Diffusion from placenta	Relies on lungs/ breathing	Requirement for gaseous exchange	Difference in concentration gradient	Difference in pressure
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Gaseous exchange	Diffusion from placenta	Relies on lungs/ breathing																		
Requirement for gaseous exchange	Difference in concentration gradient	Difference in pressure																		
	(c)	<p>Gene that codes for progesterone is isolated from a human cell and cut using restriction enzyme. [1] Same restriction enzyme is used to cut a bacterial plasmid isolated from a bacterial cell to produce complementary sticky ends. [1] Mix progesterone gene with bacterial plasmid and joined together with DNA ligase. [1] Temporary heat or electric shock is applied to open up the pores of the bacteria to allow the recombinant plasmid to enter. Transgenic bacteria produce progesterone and is cultured in large-scale fermenters for mass production. [1]</p>																		
90	(a)	<p>Placenta allows dissolved substances like glucose, amino acids and oxygen to diffuse from the mother's blood into fetus's blood. [1] Placenta allows metabolic waste products like urea and carbon dioxide to diffuse from the fetus's blood into the mother's blood to be excreted. [1] Placenta allows antibodies present in the mother's blood to diffuse into the fetus's blood to provide defence diseases. [1] Placenta produces progesterone which maintains the thickness of the uterine lining. [1]</p>																		
	(b)	<p>Presence of nicotine cause the mother's arteries supplying blood to the placenta to narrow, reducing the supply of oxygen and glucose to the developing fetus, hence affecting fetal brain development. [1] Carbon monoxide from cigarette smoke reduces the red blood cells oxygen carrying capacity thus reducing</p>																		

		the oxygen supply to the developing fetus. Growth of feuts reduced as rate of respiration decreases.[1]
	(c)	Invalid. Any 4 points Antibiotic resistance genes used in genetic engineering may be accidentally incorporated into disease causing bacteria , making antibiotics ineffective in treating certain diseases [1] New proteins in GM food may cause allergies in humans [1]Possible long-term negative effects of GM organisms on health eg; toxic or carcinogenic substances [1]



NORTH VISTA SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2017



NAME: _____ ()

CLASS: _____

SUBJECT: BIOLOGY (PAPER 1)

DATE: 28 AUGUST 2017

LEVEL / STREAM: SECONDARY 4 EXPRESS

TIME: 1 HOUR

CODE : 5158/01

INSTRUCTIONS TO CANDIDATES

Write in soft pencil.

Do not use staples, paper clips, glue or correction tape/fluid.

Write your full name, register number and class on the cover page of the question paper and OTAS sheet provided.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate OTAS sheet.

Read the instructions on the OTAS sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

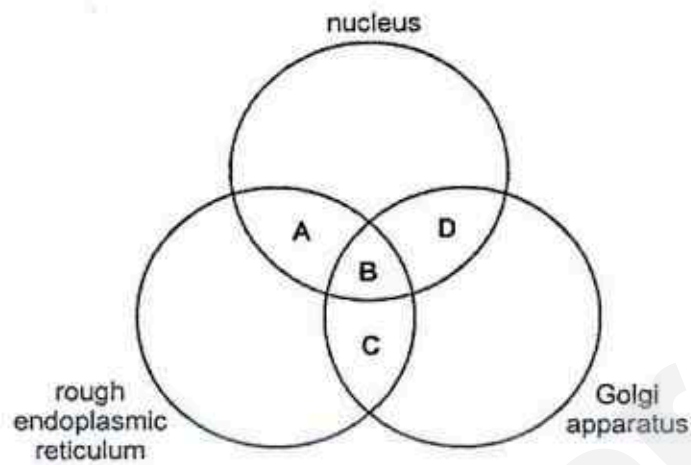
Any rough working should be done in this question paper.

The use of an approved scientific calculator is expected, where appropriate.

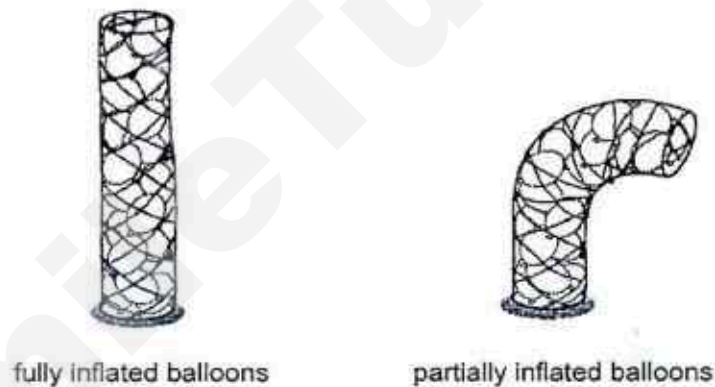
This question paper consists of 18 printed pages.

[Turn over

- 1 Which organelles are required for the formation of vesicles containing insulin in the pancreas?



- 2 The diagrams show a cylindrical net packed with rubber balloons filled with air. It is used to explain wilting in plants.



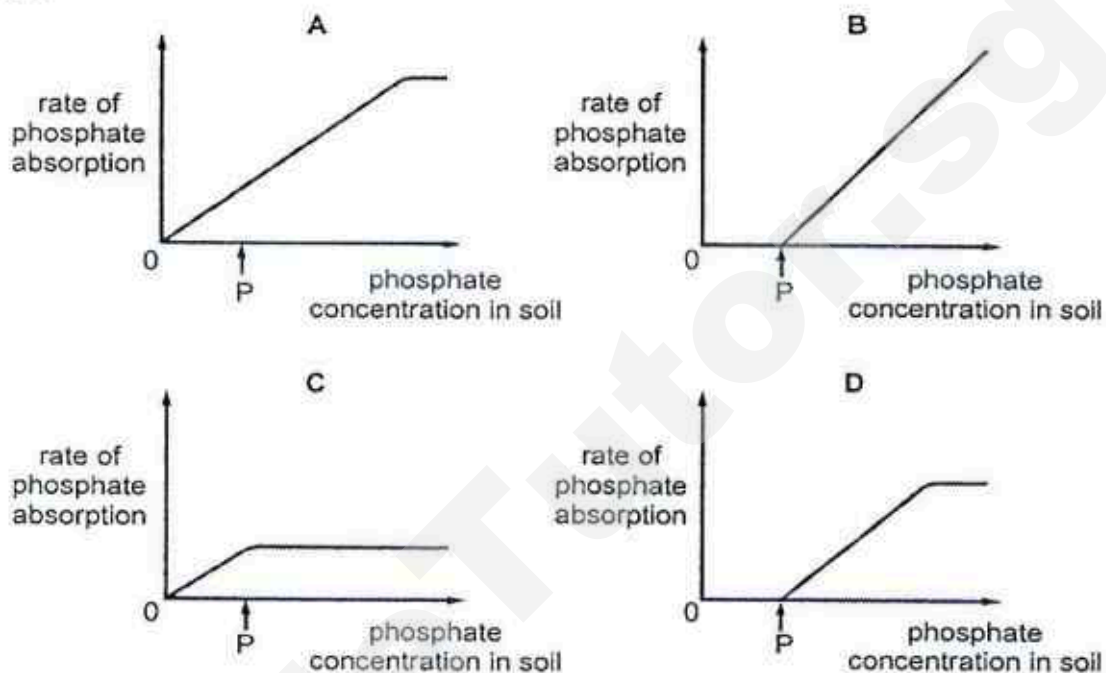
Which part of a plant is represented by the parts of the structure shown?

	balloons	net	air
A	cells	epidermis	cell sap
B	cell sap	cell walls	cells
C	cell walls	cells	epidermis
D	epidermis	cell sap	cell wall

- 3 The rate of phosphate ion absorption by the roots of a plant was measured at different soil phosphate concentrations. Plants are able to absorb phosphates by diffusion and active transport.

At P, the concentration of phosphates in the soil is the same as in the cell.

Which graph shows how the rate of absorption varies with phosphate concentration in the soil?



- 4 The diagram represents an enzymes molecule.



What could be the substrate(s) for this enzyme?



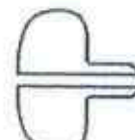
P



Q



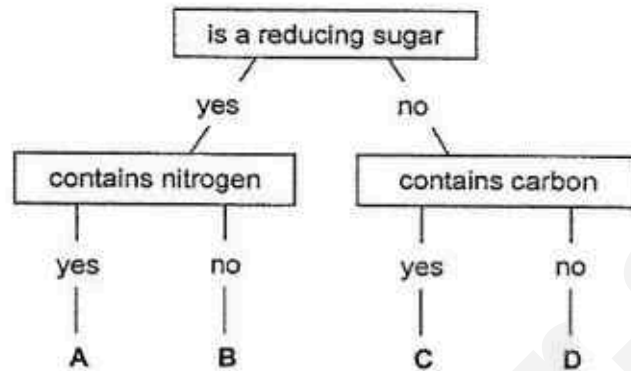
R



S

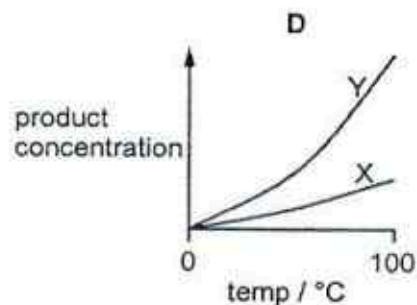
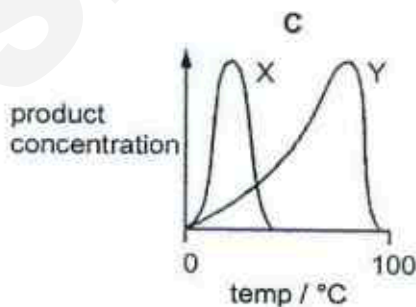
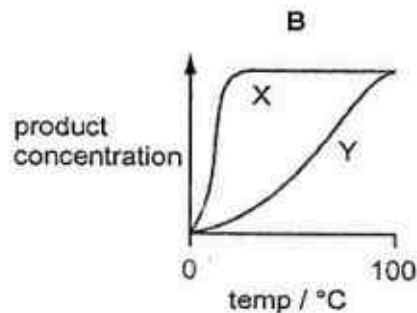
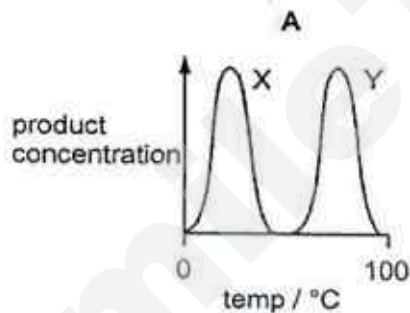
- A P and R
B R only
C Q only
D Q and S

- 5 Which molecule in the key is sucrose?



- 6 Two enzymes, X and Y were used in an experiment. The concentration of product produced by each enzyme at temperatures between 0°C and 100°C was measured. Enzyme X was from bacteria that live in rivers at temperatures from 3°C to 19°C . Enzyme Y was from bacteria that live in hot springs at temperatures from 45°C to 85°C .

Which graph shows the results?



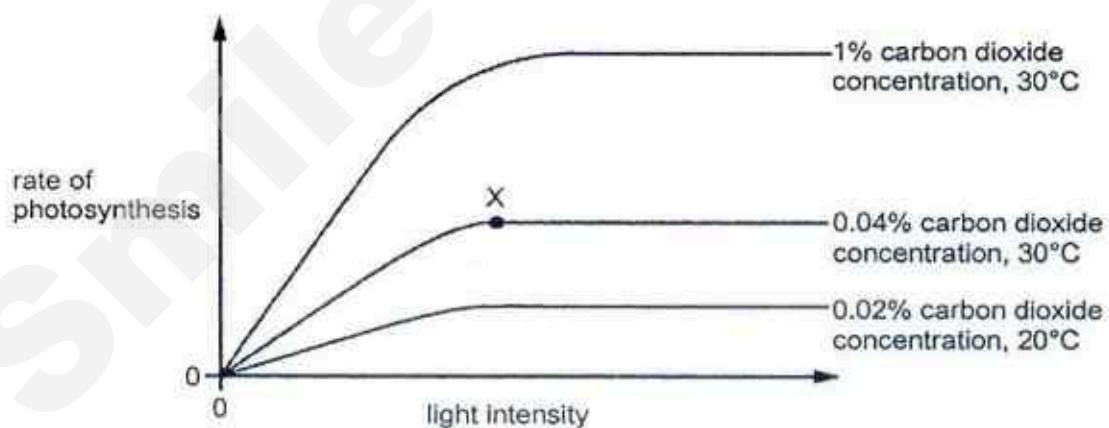
- 7 What are the effects on the body of drinking a large amount of alcohol?

	reaction time	effect on brain
A	decreases	depressed
B	decreases	stimulated
C	increases	depressed
D	increases	stimulated

- 8 Some organisms live in the dark at the bottom of the seas. They use energy from chemicals from the hot water that comes out of volcanoes to synthesise glucose.

Which statement describes these organisms?

- A Their enzymes have a low optimal temperature.
 B They are primary consumers.
 C They do not need to be green.
 D They use mitochondria to synthesise food.
- 9 The graph shows how the rate of photosynthesis varies with different environmental factors.



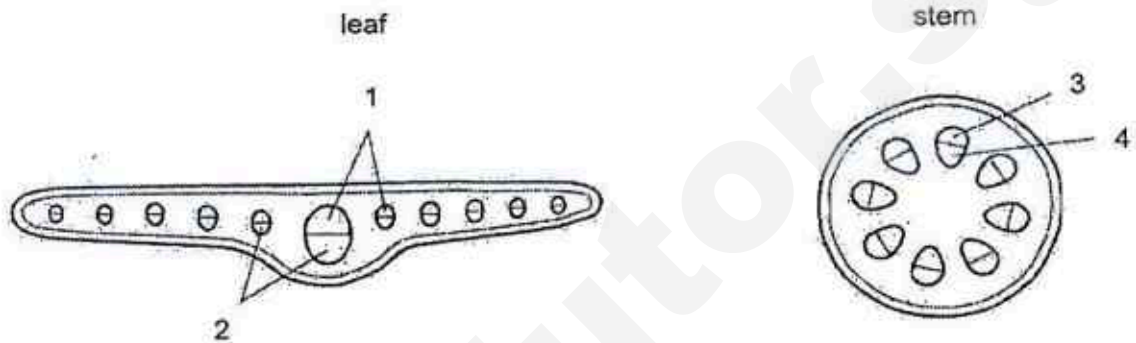
Which factor is limiting the rate of photosynthesis at point X?

- A availability of water
 B carbon dioxide concentration
 C light intensity
 D temperature

10 What is the main cause of water moving up to the leaves in xylem vessels?

- A active transport of substances into the roots
- B evaporation of water from the epidermis of the leaf
- C evaporation of water from mesophyll cells
- D use of water in leaves for photosynthesis

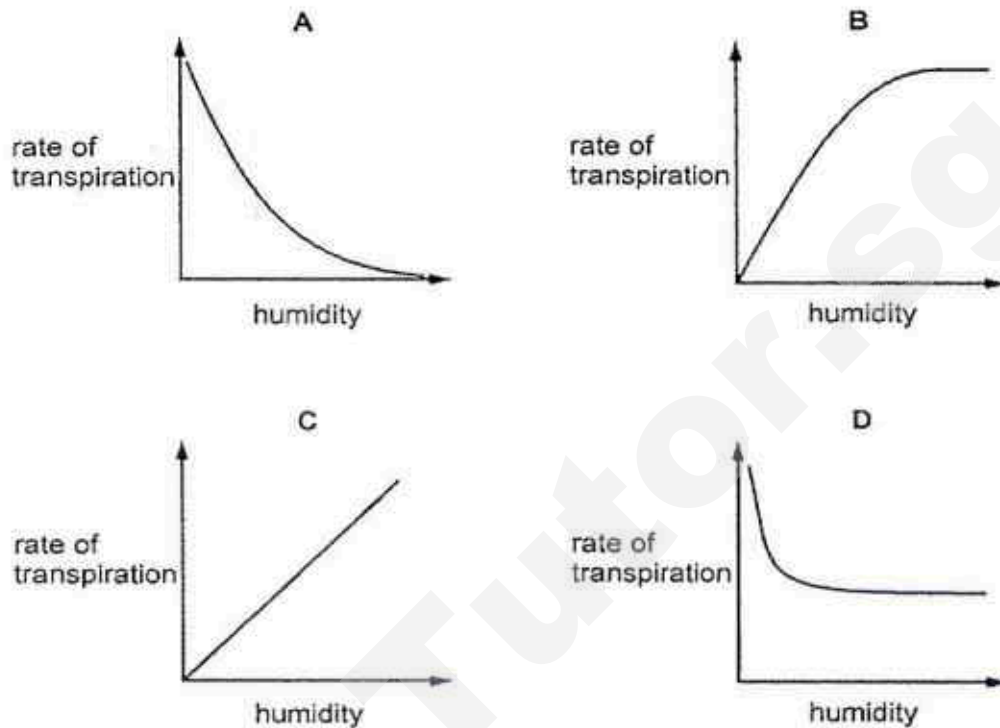
11 The diagrams show cross sections of the leaf and stem of a plant.



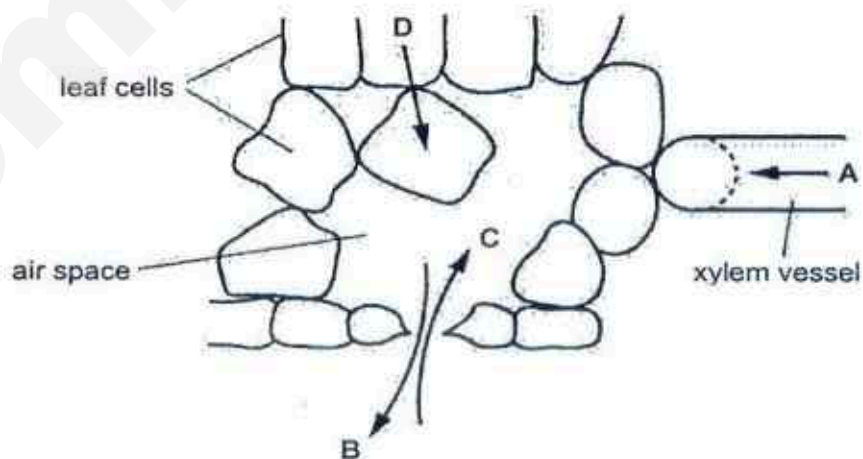
Which tissues transport most mineral ions?

	1	2	3	4	
A	✓	✗	✓	✗	key ✓ = yes ✗ = no
B	✓	✗	✗	✓	
C	✗	✓	✓	✗	
D	✗	✓	✗	✓	

- 12 Which diagram represents the effect of atmospheric humidity on the rate of transpiration?

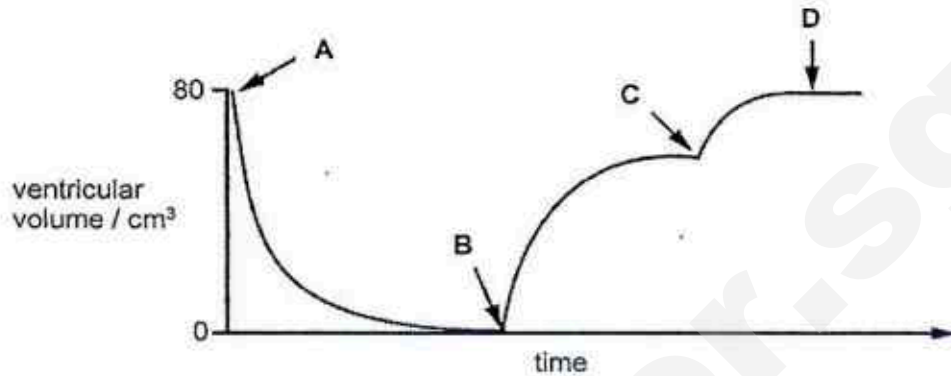


- 13 The diagram shows part of a cross section through a leaf. Which arrow shows the movement of water by osmosis?

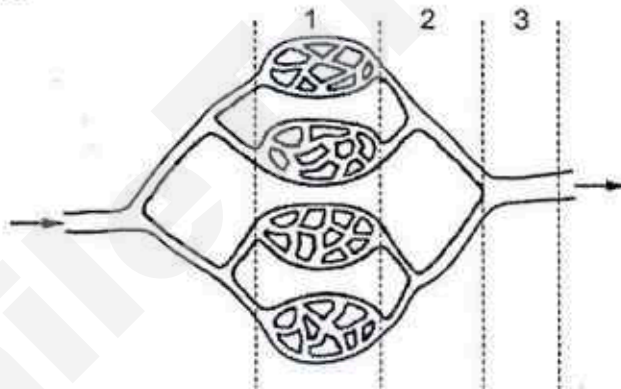


- 14 The graph shows the changes that take place in the volume of the left ventricle during one cardiac cycle.

Which point on the graph represents the start of atrial systole?



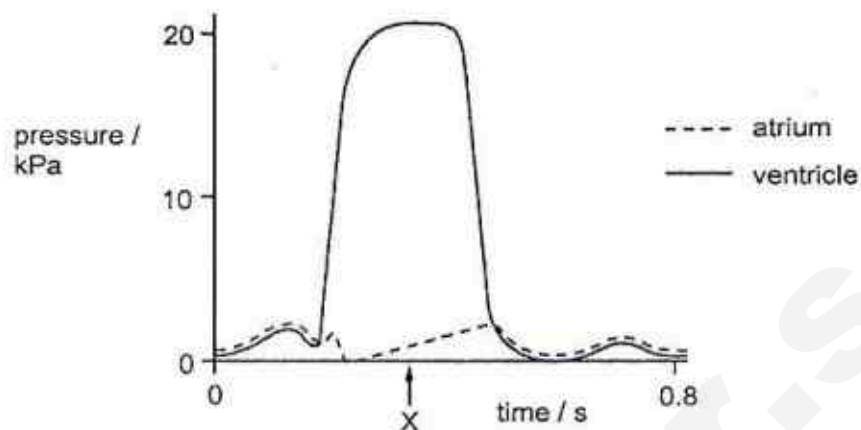
- 15 The diagram shows various blood vessels in the human body. The direction of blood flow is shown by the arrows.



Which areas have the lowest blood pressure and speed of blood flow?

	lowest blood pressure	lowest speed of blood flow
A	1	1
B	1	3
C	2	3
D	3	1

- 16 The graph shows pressure changes in the left side of the heart.



What happens to the heart valves at time X?

	bicuspid valve	aortic valve
A	closed	closed
B	closed	open
C	open	closed
D	open	open

- 17 Some reactions that take place in the blood are listed below.

- 1 carbon dioxide + haemoglobin \rightarrow carboxyhaemoglobin
- 2 carbon dioxide + water \rightarrow carbonic acid
- 3 hydrogencarbonate ions + hydrogen ions \rightarrow carbon dioxide + water

Which reaction(s) take(s) place at a higher rate in a blood capillary in an alveolus than in a blood capillary in active muscles?

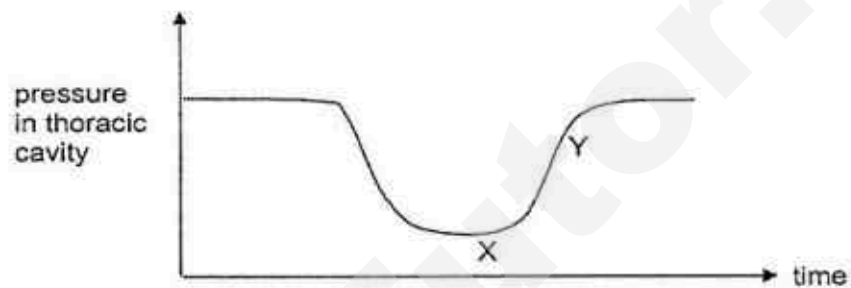
- A 1 and 2
- B 1 and 3
- C 2 only
- D 3 only

- 18 An oxygen molecule diffuses from the air in an alveolus through cells to haemoglobin in a red blood cell.

What is the minimum number of cell surface membranes through which this molecule must pass?

- A 2
- B 3
- C 4
- D 5

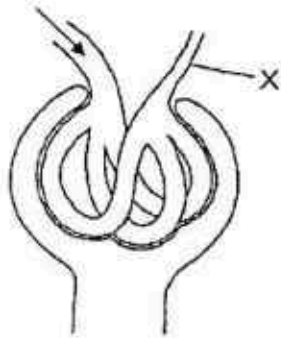
- 19 The diagram below shows changes in air pressure in the thoracic cavity during breathing.



Which muscles contracts or relaxes between X and Y?

	muscle contraction	muscle relaxation
A	diaphragm	external intercostal muscle
B	diaphragm	internal intercostal muscle
C	external intercostal muscles	diaphragm
D	internal intercostal muscles	diaphragm

- 20 The diagram shows part of a human nephron. The movement of blood is indicated by the arrow.



What will happen if the diameter of the blood vessel becomes smaller at X?

- A less urine produced
 - B less anti-diuretic hormone secreted
 - C more glomerular filtrate forms
 - D water reabsorption increases
- 21 What provides the force for ultrafiltration in the kidney tubule?
- A anti-diuretic hormone
 - B ventricular systole
 - C mitochondria in the glomerulus and Bowman's capsule
 - D water potential difference
- 22 When the body temperature increases, which part of the skin dilates as part of the homeostatic process?

	blood capillaries	arterioles	shunt vessel
A	✓	✓	✗
B	✓	✓	✓
C	✗	✓	✗
D	✗	✗	✗

key

✓ = dilates

✗ = does not dilate

23 What is meant by a negative feedback mechanism?

- A A change away from a set point causes a change towards the set point.
- B A change away from a set point causes further changes from the set point.
- C A change towards a set point causes a change away from a set point.
- D A change is prevented from a set point.

24 Nerve impulses can travel

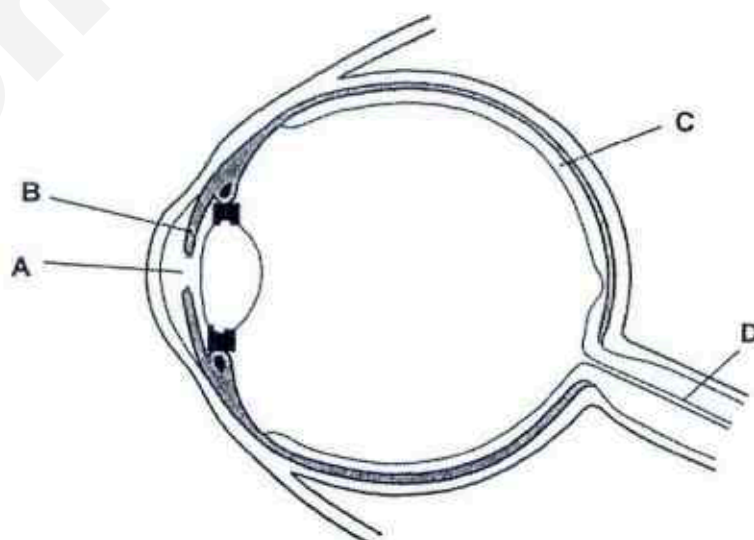
- 1 away from central nervous system
- 2 towards the central nervous system
- 3 within the central nervous system

In which direction do nerve impulses in sensory and relay neurones travel?

	sensory neurones	relay neurones
A	1	1
B	1	2
C	2	3
D	2	1

25 The diagram shows a section through an eye.

Which structure controls how much light enters the pupil?



26 Some potentially life-threatening situations are listed below.

- 1 low blood glucose concentration
- 2 low blood pressure
- 3 low blood water potential

In which condition(s) would giving a person an adrenaline injection be useful?

- A 1 only
B 1 and 2
C 2 only
D 2 and 3

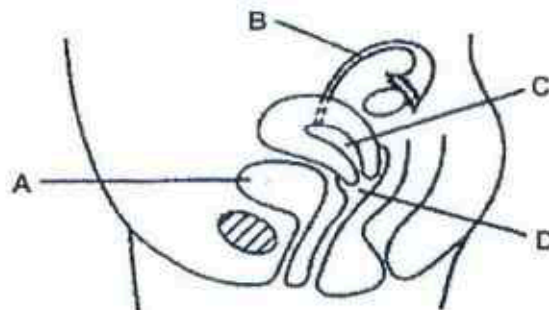
27 A small piece of tissue was taken from the roots of a plant and placed in a nutrient medium. The tissue grows into a mass and is transferred into another medium which induces the formation of new plants.

Which type of reproduction is this and how do the genotype of the new plants compare with that of the plant?

	type of reproduction	genotype
A	asexual	different
B	asexual	identical
C	sexual	different
D	sexual	identical

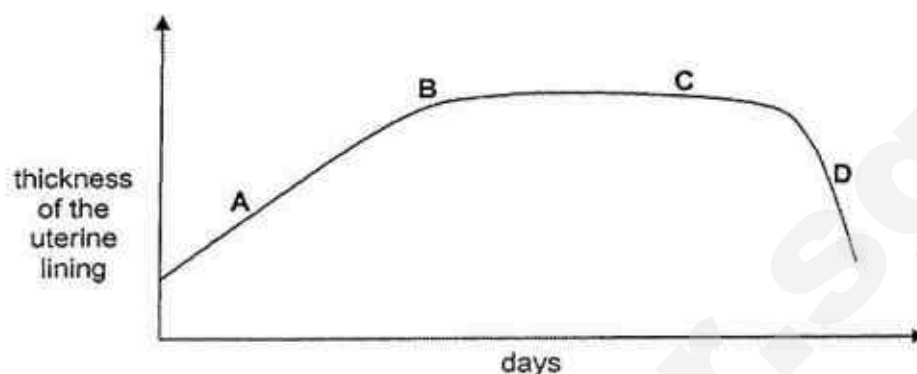
28 The diagram shows part of the female reproductive system.

Where are sperms deposited during intercourse?



- 29 The diagram shows the thickness of the uterine lining during the menstrual cycle.

At which part of the cycle is the woman most fertile?



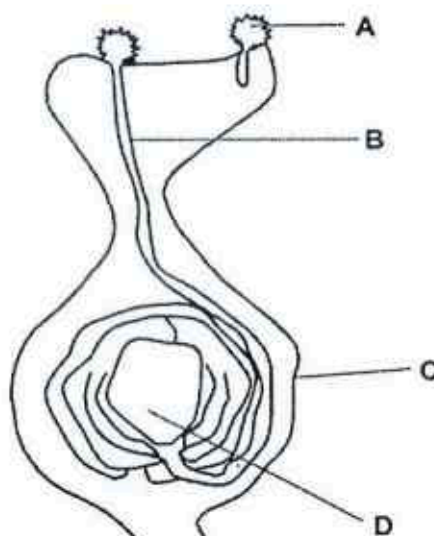
- 30 A group of chemicals used to treat cancer prevents the formation of spindle during cell division.

Which phase of mitosis is the first to be affected?

- A anaphase
- B metaphase
- C prophase
- D telophase

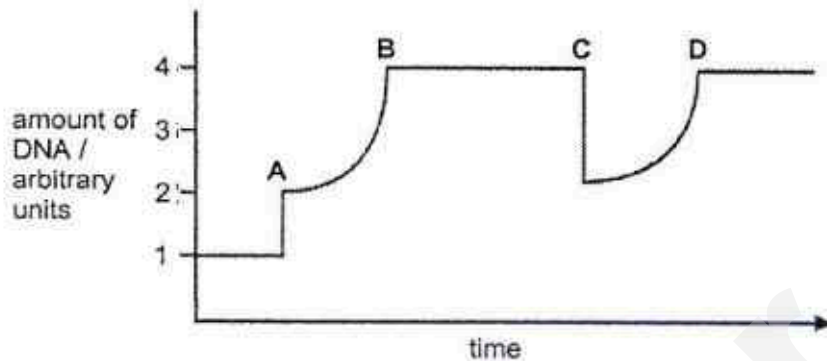
- 31 The diagram shows the cross section of part of a flower.

Which structure is haploid?



- 32 The graph represents the changes in the quantity of DNA in a nucleus of a gamete to formation of an embryo.

At which point on the graph did fertilisation take place?



- 33 A short piece of DNA 19 base pairs long was analysed to find the number of nucleotide bases in each of the polynucleotide strands. Some of the results are shown below.

	number of nucleotide bases			
	adenine	cytosine	guanine	thymine
strand 1		4		7
strand 2		5		

How many nucleotides containing thymine were present in strand 2?

- A 3
- B 5
- C 7
- D 8

- 34 A student wrote some statements about the production of human insulin in laboratories.

- 1 The human insulin gene can only be obtained from human pancreatic cells.
- 2 The insulin gene is inserted into bacterial DNA.
- 3 The cultured bacteria are used in injections for diabetics.

Which statement(s) is/are correct?

- A 1 and 2
- B 2 only
- C 2 and 3
- D 3 only

- 35 Which row describes an allele?

	copied during cell division	part of a DNA molecule	
A	✓	×	key ✓ = yes × = no
B	✓	✓	
C	×	✓	
D	×	×	

- 36 Two heterozygous individuals are crossed. Some of the offspring show the recessive characteristic.

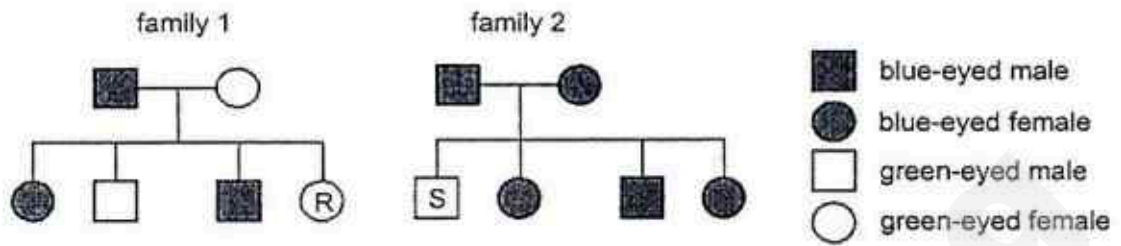
What is the probability that one of these offspring that shows the recessive characteristic is homozygous?

- A 0.00
B 0.25
C 0.50
D 1.00
- 37 Black individuals of an insect camouflages on the soot covered tree trunks. Occasionally, pale coloured individuals of this insect occur. When pollution is reduced, the pale coloured individuals become more common.

Which process causes this?

- A conservation
B genetic engineering
C natural selection
D selective breeding

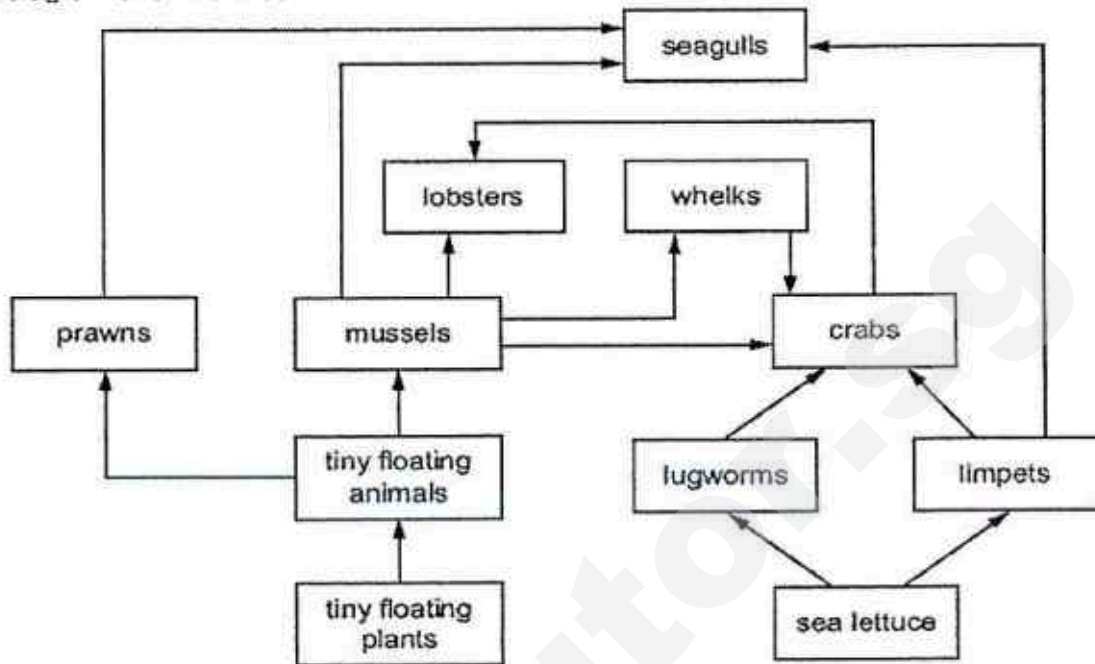
38 The diagram shows the pattern of inheritance of iris colour in two families.



If individuals R and S have children together, what prediction can be made about the iris colour of these children?

- A All the children will have blue eyes.
- B All the children will have green eyes.
- C Half the children will have blue eyes.
- D Three-quarters of the children will have blue eyes.

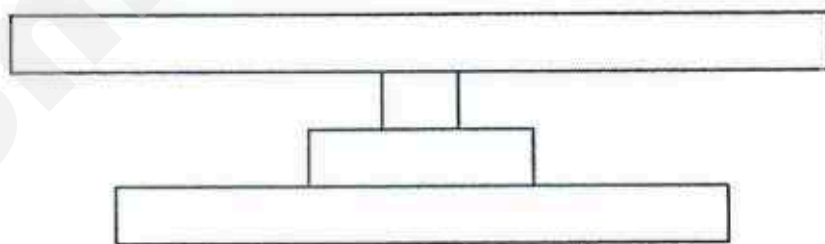
39 The diagram shows a food web.



What is the maximum number of trophic levels in this food web?

- A 4
- B 5
- C 6
- D 7

40 The diagram shows a pyramid of numbers.



Which food chain is represented by this pyramid of numbers?

- A bush → caterpillar → bird → parasitic fly
- B grass → deer → lion → flea
- C papaya tree → fruit fly larvae → beetle → spiders
- D microscopic plants → microscopic animals → fish → dolphin

Biology (SPA) 5158 2017 Preliminary Exam Answers
Paper 1

1	2	3	4	5	6	7	8	9	10
B	A	A	D	C	C	C	C	B	C
11	12	13	14	15	16	17	18	19	20
B	A	D	C	D	B	D	D	D	C
21	22	23	24	25	26	27	28	29	30
B	C	A	C	B	B	B	D	B	C
31	32	33	34	35	36	37	38	39	40
A	A	A	B	B	D	C	B	C	B

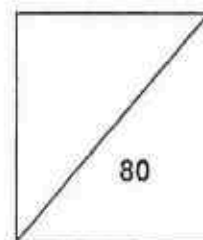
- Qs 1 Insulin is a protein. Synthesis of protein starts at nucleus (transcription), which then continues at rough endoplasmic reticulum (translation and protein modification) and finally Golgi apparatus (packaging of proteins into vesicles).
- Qs 2 The net is the outermost portion of the structure which corresponds to the epidermis which is the outermost portion of plants. The individual balloons represent the individual cells in the plant. The air that fills up the entire balloons represents the cell sap found in the large vacuoles of plants.
- Qs 3 Phosphate ions are minerals taken up by roots. Uptake of minerals involve diffusion and active transport. When the mineral ion concentration is higher in the soil (before P), diffusion occurs. When mineral ion concentration is lower in the soil (after P), active transport occurs.
- Qs 4 Substrate Q can fit into the enzyme, enzyme likely to break down the substrate to form products. Substrates S when combined together can fit into the enzyme, enzyme is likely to bind both substrates together into products.
- Qs 5 Sucrose is not a reducing sugar and contains carbon element.
- Qs 6 X should have a lower optimal temperature than Y. All enzymes will be inactive at low temperature and denature at very high temperature.
- Qs 7 Alcohol cause a person to react more slowly (reaction time – time taken to react thus increases) and depresses brain functions.
- Qs 8 Cell L is the xylem which contains water and minerals. Starch and protein are absent in the xylem. Cell M is the phloem which contains amino acids and sucrose. Large molecules such as starch and proteins are absent in the phloem.
- Qs 9 At X, graph has plateaued so light intensity is no longer the limiting factor. When carbon dioxide concentration increases (graph above), the rate of photosynthesis increases at the same time point. Hence carbon dioxide is the limiting factor.
- Qs 10 Water vapour exits the stomata during transpiration, which lowers the humidity of the air spaces in the leaves. More water on the surfaces of mesophyll cells then evaporates into the air spaces. Water potential of mesophyll cells thus decreases and water is absorbed into the mesophyll cells from the xylem in leaves. This causes the entire water column in the xylem in the stem to be pulled upwards into the leaves.
- Qs 11 Mineral ions are transported by xylem. Tissues 1 and 4 represent xylem.

- Qs 12 When atmospheric humidity increases, the water vapour concentration gradient between the air outside the leaf and inside the leaf becomes less steep. The rate of diffusion of water vapour out of the leaf (rate of transpiration) thus decreases as humidity increases. When the water vapour concentration outside and inside the leaf are the same, there will be no diffusion of water vapour.
- Qs 13 Water movement in the xylem is by transpiration pull, from cell to cell is by osmosis and from the air inside the leaf to outside the stomata (vice versa) is by diffusion.
- Qs 14 When ventricular volume decreases, the ventricle is contracting while atria relaxes. The ventricle then relaxes and fills up with blood when the atria is also relaxing at the same time (passive flow of blood). The atria then contracts (atrial systole) to force more blood into the ventricles.
- Qs 15 Capillaries have the lowest speed of blood flow as the total cross sectional area is the largest and also for exchange of substances between blood and cells. Veins have the lowest blood pressure as blood from the small blood capillaries enter the larger veins.
- Qs 16 At X, the ventricle is at the highest pressure. Hence pressure in ventricle will be higher than aorta and atrium. The bicuspid valve will be forced close to prevent backflow of blood into atrium while aortic valve will be forced open to push blood into aorta.
- Qs 17 Carboxyhaemoglobin only forms in the presence of carbon monoxide. In the alveolus, carbon dioxide is removed from the blood into the lungs, hence there will be greater formation of carbon dioxide at the lungs than muscles.
- Qs 18 The oxygen molecule will enter the alveolar cells, exit the alveolar cells, enter the blood capillary cells, exit the blood capillary cell then enter the red blood cell.
- Qs 19 The pressure in the thoracic cavity increases which indicates that the volume decreases. Exhalation is occurring. Diaphragm will relax and arch upwards while internal intercostal muscles contract.
- Qs 20 When the efferent arteriole (X) becomes smaller, the blood pressure at the afferent arteriole increases. A higher pressure leads to greater filtration of small molecules at glomerulus, hence the volume of glomerular filtrate increases.
- Qs 21 Ultrafiltration is dependent on having a high hydrostatic pressure. This is mainly provided by the contraction of the muscles of the left ventricle.
- Qs 22 Only the arterioles which contain muscles in the walls undergo vasodilation.
- Qs 23 Negative feedback involves mechanisms to return back to the normal condition.
- Qs 24 Sensory neurone transmit nerve impulses from the receptor to the relay neurones found in the nervous system. Relay neurones are found within the central nervous system and transmit nerve impulses within the brain and spinal cord.
- Qs 25 The iris controls the amount of light entering the eye.
- Qs 26 Adrenaline increases the heart rate, leading to higher blood pressure, and stimulates the conversion of glycogen to glucose in the body, leading to higher blood glucose level.
- Qs 27 Reproduction that does not involve gametes is known as asexual reproduction and the offspring will be genetically identical to the parent plant.

- Qs 28 Sperms are deposited in the vagina as indicated by D.
- Qs 29 The woman is most fertile when the lining is thick and at the time of ovulation. After ovulation, the egg will die if it is not fertilised within 24-36 hours. Once the thickness of the lining decreases, this indicates menstruation.
- Qs 30 Spindle fibres first form during prophase in the mitotic cycle.
- Qs 31 The pollen grain contains the male gamete that is haploid.
- Qs 32 At 1 unit, this represented haploid egg. At 2 units, the egg has fused with the sperm which indicates fertilisation. At 4 units, the fertilised egg has undergone interphase to double its DNA for mitosis to occur. A reduction of 4 to 2 units indicate mitosis and formation of 2 daughter cells, each containing 2 units of DNA.
- Qs 33 Strand 1 would have 5 guanine bases as they pair with 5 cytosine bases in strand 2. Since the DNA is 19 base pairs long, there are 3 adenine bases in strand 1. This means that there are 3 thymine bases in strand 2.
- Qs 34 The human insulin gene can be obtained from any cell in the body with a nucleus. The insulin gene is inserted in a plasmid which is bacterial DNA. The bacteria is not injected into humans. Insulin produced by the bacteria has to be purified first.
- Qs 35 An allele is part of a DNA molecule and during Interphase of cell division, it is copied into a new strand of DNA.
- Qs 36 For offspring to show the recessive characteristic, the genotype must be homozygous. Hence the probability is 1 (100%).
- Qs 37 Pollution causes soot deposition on the tree. With a reduction in soot production, pale coloured insects now have a competitive edge and more will be able to survive to reproduce. This is natural selection.
- Qs 38 From family 2, green eye is a recessive trait as it an allele found in both parents but not shown. Offspring S inherits a green eye allele from each parent and expresses the green-eyed trait. Hence, R and S are both recessive homozygous for green eye and all their offspring can only inherit green eye trait.
- Qs 39 tiny floating plants → tiny floating animals → muscles → whelks → crabs → lobsters
6 trophic levels is the maximum that can be found in this food web.
- Qs 40 The top of the pyramid is the largest, this would indicate the top organism is parasitic. The bottom of the pyramid is large, this would indicate the organism is smaller and much greater in number compared to the next trophic level.



NORTH VISTA SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2017



NAME: _____ ()

CLASS: _____

SUBJECT: BIOLOGY (PAPER 2)

DATE: 23 AUGUST 2017

LEVEL / STREAM: SECONDARY 4 EXPRESS

TIME: 1 HOUR 45 MINUTES

CODE : 5158/02

INSTRUCTIONS TO CANDIDATES

Write your full name, register number and class on all the work you hand in.

Write in dark blue or black pen.

You may use a pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, glue or correction tape/fluid.

Section A

Answer all questions.

Write your answers in the spaces provided on the Question Paper.

Section B

Answer all the questions.

Write your answers in the spaces provided on the Question Paper.

Electronic calculators may be used.

You are advised to spend no longer than one hour on Section A and no longer than 45 minutes on Section B.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

This question paper consists of 17 printed pages.

[Turn over

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Section A

Answer all questions.

Write your answer in the spaces provided.

- 1 Fig 1.1 shows part of the flowering head of a small tree that grows in tropical climates. The flowers of the plant are pink in colour.

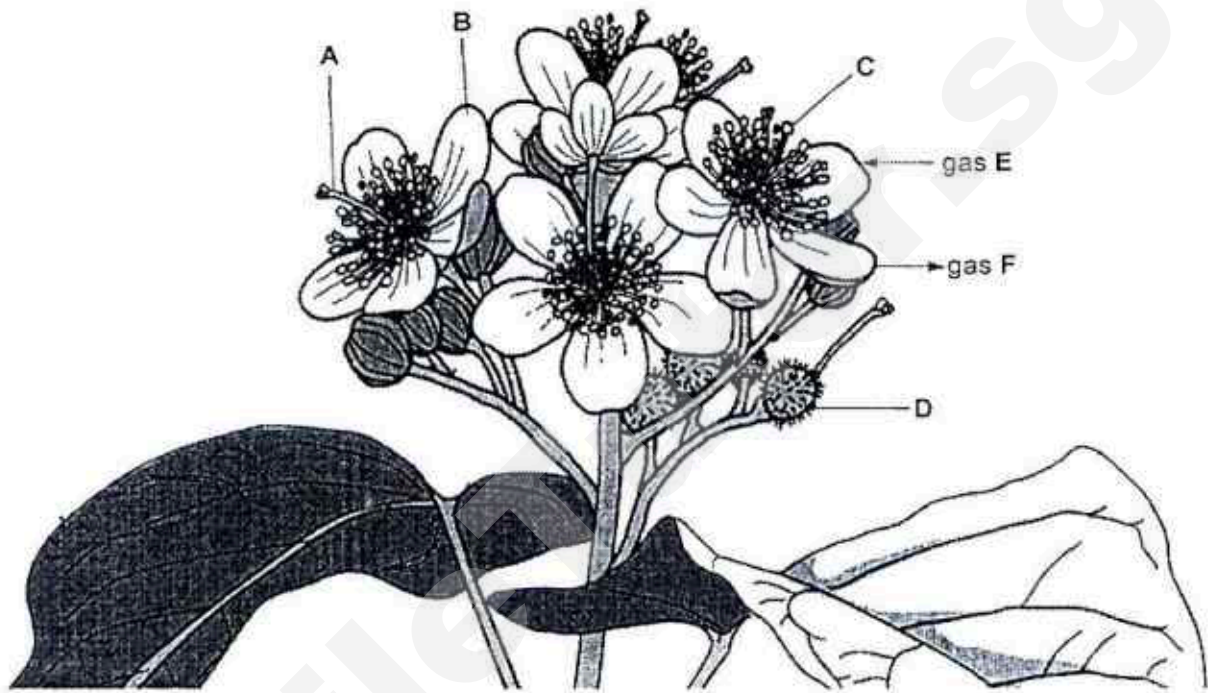


Fig. 1.1

- (a) Identify the structures labelled A, B, C and D.

A
 B
 C
 D [4]

- (b) Structure B contains stomata similar to those found in the leaves. E and F represent gases that pass into and out of structure B during daylight hours.

Suggest the identity of gases E and F and state a reason for your answer.

E

F

reason [3]

- (c) Fig. 1.2 shows pollen grains, G and H, produced by flowers of 2 different plant species.



magnification x800

pollen grain G



magnification x250

pollen grain H

Fig. 1.2

Suggest which type of pollen grain, G or H, will be produced by the flower shown in Fig. 1.1 and explain your answer.

.....

.....

..... [2]

[Total: 9]

- 2 Fig. 2.1 shows a particular white blood cell in a human body synthesising enzymes used to destroy bacteria within the cell.

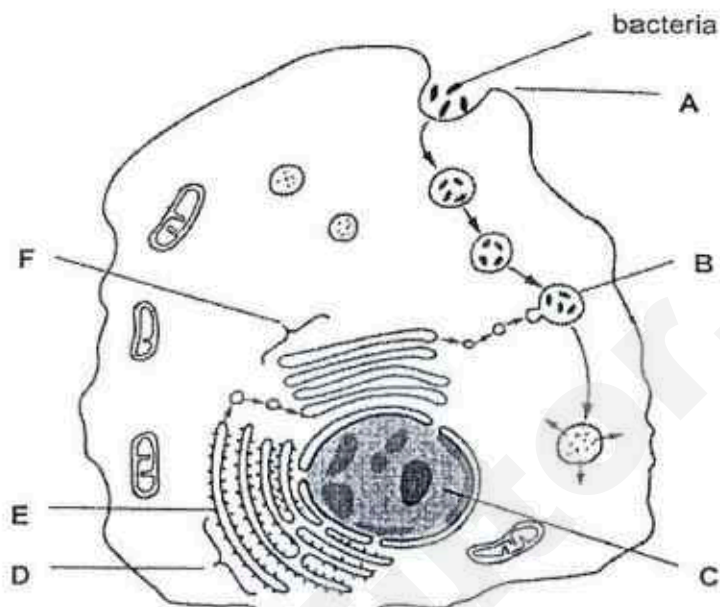


Fig. 2.1

- (a) Name the process at A.

..... [1]

- (b) Name the stages of enzyme synthesis that occur at C and at D.

C

D [2]

- (c) Name the structures E and F.

E

F [2]

- (d) Describe what happens to the enzymes from structures E to F before it can be fully functional in B.

.....

 [2]

[Total: 7]

3 *Rhabdostyla* is a single-celled organism that has no cell wall.

- (a) Gases are exchanged across the cell membrane of this organism.

Name the process of removal of gases from the organism.

.....[1]

- (b) *Rhabdostyla* lives in freshwater habitats where the water has a very low concentration of solutes.

The organism has a contractile vacuole that fills with water and empties at intervals as shown in Fig. 3.1. The contractile vacuole removes excess water from the organism.

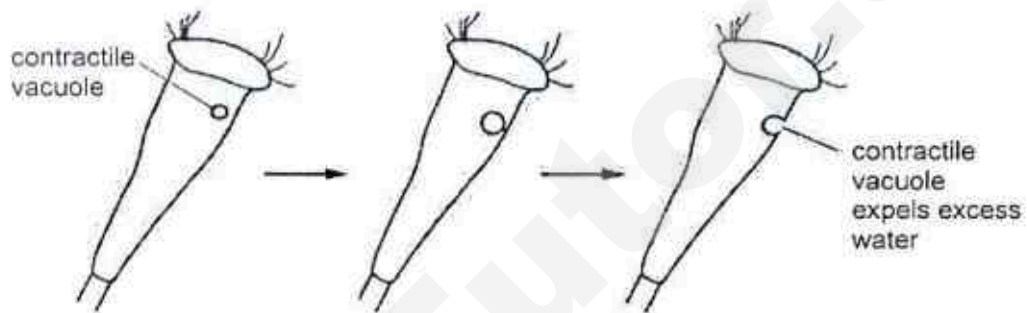


Fig. 3.1

Explain, using the term water potential, why *Rhabdostyla* needs to remove excess water.

.....

[3]

- (c) In an investigation, individual *Rhabdostyla* were placed into different concentrations of sea water.

In Fig. 3.2, draw a straight line to predict the rate of water removed by the contractile vacuole of the organism at increasing seawater concentration.

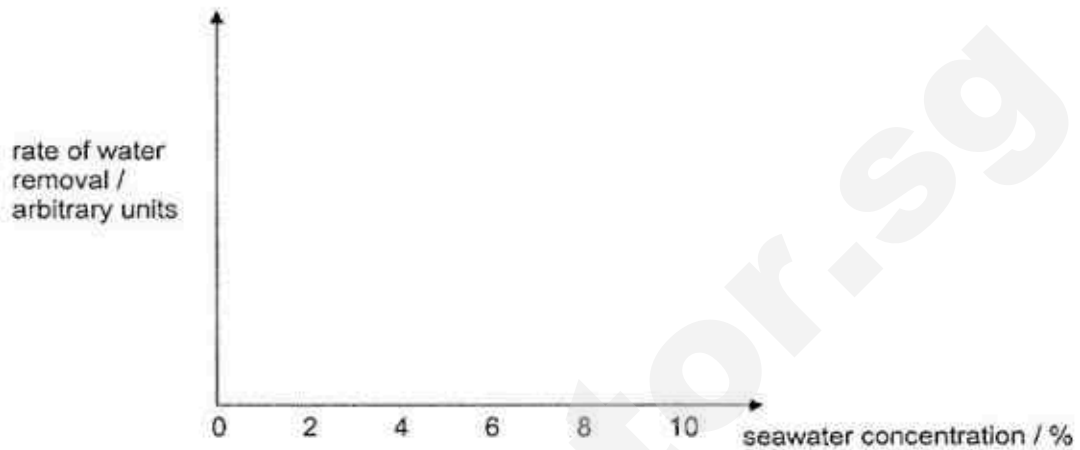


Fig. 3.2

[1]

- (d) Suggest why single-celled plant organisms do not have contractile vacuoles.

.....

.....

.....[2]

[Total: 7]

- 4 Fig. 4.1 shows a foetus developing inside its mother.

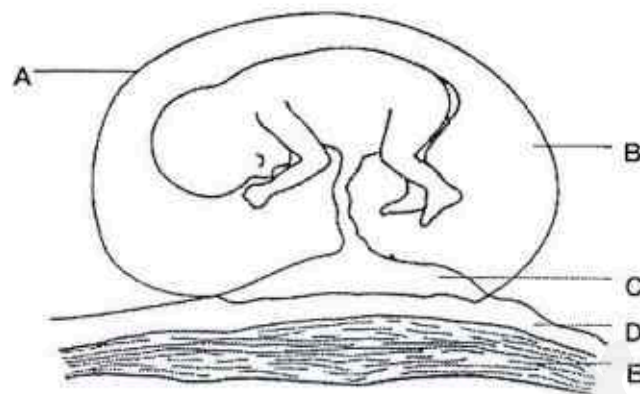


Fig. 4.1

- (a) Complete Table 4.1, using letters from Fig. 4.1, to identify each of the following:

Table 4.1

		letter
(i)	a region that contains cells which could be used for determining the sex of the foetus.	.....
(ii)	a structure that is used to expel the foetus at birth	.....
(iii)	a temporary structure that is expelled during menstruation if pregnancy had not occurred	.....

[3]

- (b) Some pregnant women take substances such as drugs that may cause their babies to suffer from severe withdrawal symptoms when they are born.

- (i) Name a drug which the mother may have taken during pregnancy that might cause these withdrawal symptoms.

..... [1]

- (ii) Suggest how the drug taken by the mother is able to reach the foetus.

.....

.....

.....

..... [3]

[Total: 7]

- 5 A study was conducted to investigate the density of stomata on the leaves of two different species of freshwater plants in a pond.

Table 5.1 shows the results.

Table 5.1

species	location of leaves	mean stomatal density/number per mm ²	
		upper epidermis	lower epidermis
Brazilian waterweed	submerged in the water	0	0
water lily	floating on the surface of the water	420	0

- (a) Name the cells that control the size of the stomata.

..... [1]

- (b) Suggest a reason for the distribution of stomata for the two plant species.

Brazilian waterweed

.....

water lily

..... [2]

(c) Fig. 5.1 shows a cross section through the leaf of a water lily.

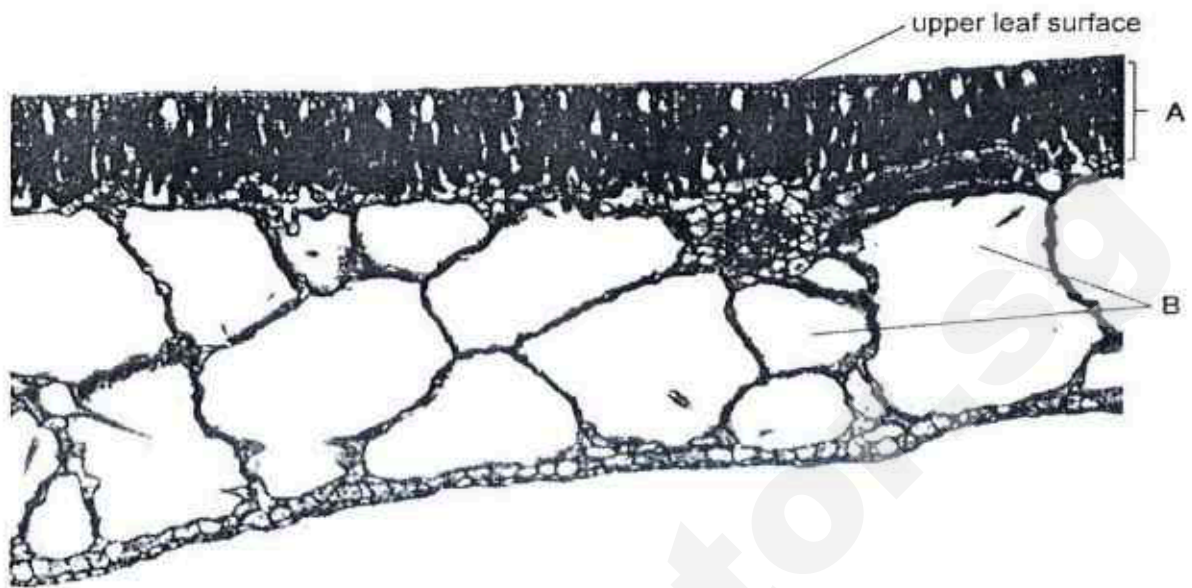


Fig. 5.1

(i) Identify the tissue labelled A.

.....
 [1]

(ii) Suggest how the feature labelled B helps the water lily leaf adapt to photosynthesis.

.....

 [3]

[Total: 7]

6 Fig. 6.1 shows some plant cells undergoing mitosis.

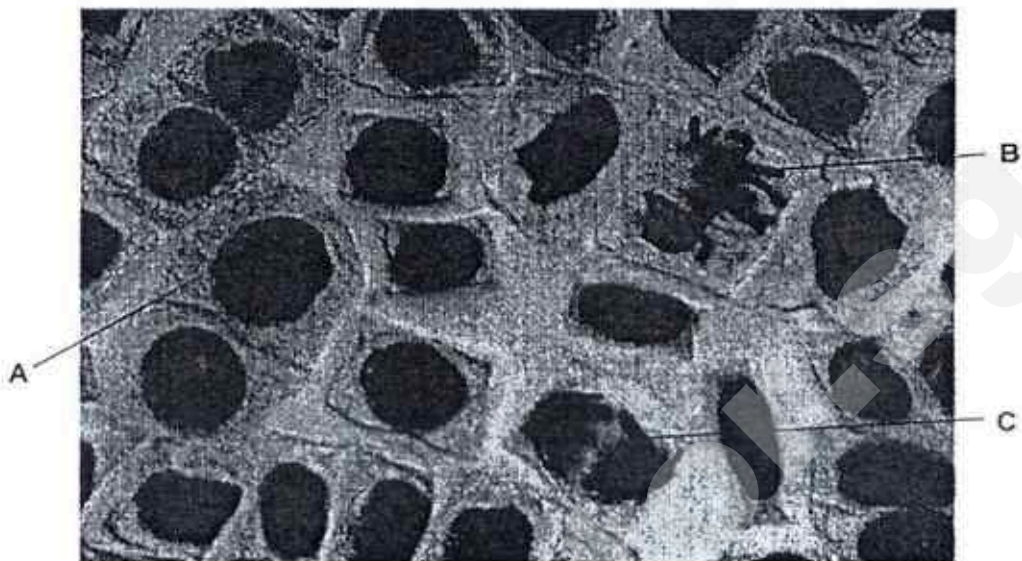


Fig. 6.1

(a) Name the stages of mitosis occurring in the cells labelled A, B and C.

- A
 B
 C [3]

(b) State what occurs so that chromosomes become visible in the cell.

- [1]

- (c) Fig. 6.2 shows an animal cell at a certain stage of mitosis.

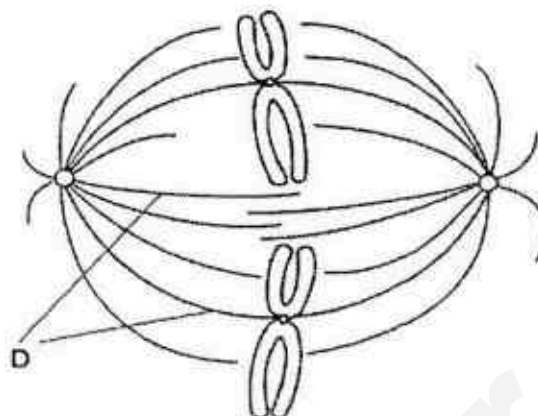


Fig. 6.2

- (i) State the diploid number of this cell.
[1]
- (ii) Describe the function of D.

[1]
- (iii) State a difference in the cell of a plant and an animal in the stage of mitosis shown in Fig. 6.2.
[1]

[Total: 7]

- 7 A group of athletes who trained at sea level moved to high altitude for further training. Blood samples were taken from the athletes to measure any changes in the concentration of haemoglobin in the blood and changes in the haematocrit.

Haematocrit is the volume of red blood cells expressed as a percentage of the total volume of a sample of blood.

The results are shown in Table 7.1.

Table 7.1

blood measurements	at sea level	after 3 weeks at high altitude	percentage change
mean concentration of haemoglobin in the blood / g 100 cm ⁻³	13.1	14.9	.....
mean haematocrit	41.0	42.5	+ 3.7

- (a) Complete Table 7.1 by calculating the percentage change in haemoglobin concentration. [1]

- (b) State the environmental factor that caused a change in the blood measurements when the athletes trained at high altitude.

..... [1]

- (c) Explain how the changes in blood measurements could help the athletes when they compete at sea level.

.....

 [4]

[Total: 6]

Section B

Answer three questions.

Question 10 is in the form of an Either/Or question. Only one part should be answered.

- 8 An investigation was conducted to compare the reaction time of males and females across different ages. Participants of the investigation had to raise their hand when they heard a specific word.

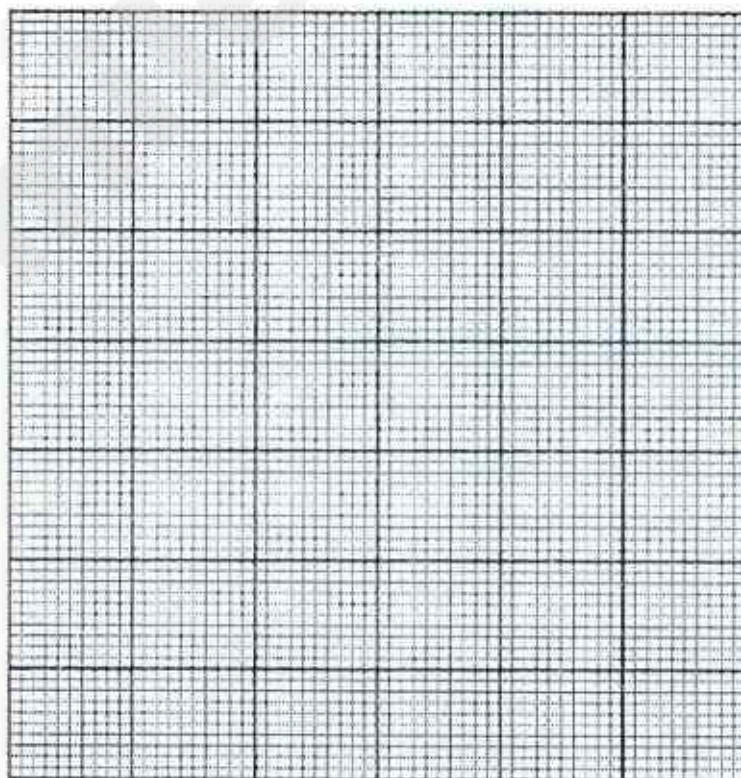
Table 8.1 shows the results of the investigation.

Table 8.1

age / years	average reaction time / ms	
	male	female
5	300	295
15	180	170
25	170	195
35	180	200
45	200	220
55	230	235

- (a) Plot these data on the grid below.

[4]



- (b) Describe the differences in the reaction time of males and females.

.....

.....

.....

.....[2]

- (c) A person raises his hand when he accidentally touches a hot object.

Compare the differences in the nervous pathway of the reaction of a person who has touched a hot object compared to the investigation where participants raise their hands when they hear a specific word.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....[4]

[Total: 10]

- 9 (a) Describe how the use of excess fertilisers in farms can cause the death of fish in nearby rivers and lakes.

10

- (b) In a study, researchers collected water samples from a river and detected the presence of an insecticide used to control mosquitoes and other insects. It was concluded that the chemicals in the insecticide had drastically decrease the population of predatory birds living in the area such as eagles and falcons over the years.

Explain how the chemicals in the insecticide could cause the drastic decrease in the population of predatory birds.

[5]

[Total: 10]

10 Either

- (a) Describe the similarities and differences between the absorption of ions in plants and the uptake of glucose in humans.

[6]

- (b) Explain why humans absorb amino acids but plants do not.

[4]

[Total: 10]

AutoCAD

Explain how the amount of water lost through the skin and urine will be affected on a cold day.

[4]

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Biology (SPA) 5158 2017 Preliminary Exam Answers
Paper 2

- 1(a) A – style;
B – petal;
C – anther;
D – ovary / fruit;

- 1(b) E – oxygen;
F – carbon dioxide / water vapour;

respiration occurs;
accept transpiration if water vapour given for F;

- 1(c) flower is insect-pollinated as it has brightly coloured flowers/many flowers grown in clusters/large petals/short stamens;
produce pollen with rough surface to attach onto insects' body / pollen grains produced by insect-pollinated flowers tend to be large like H;

- 2(a) A – phagocytosis;

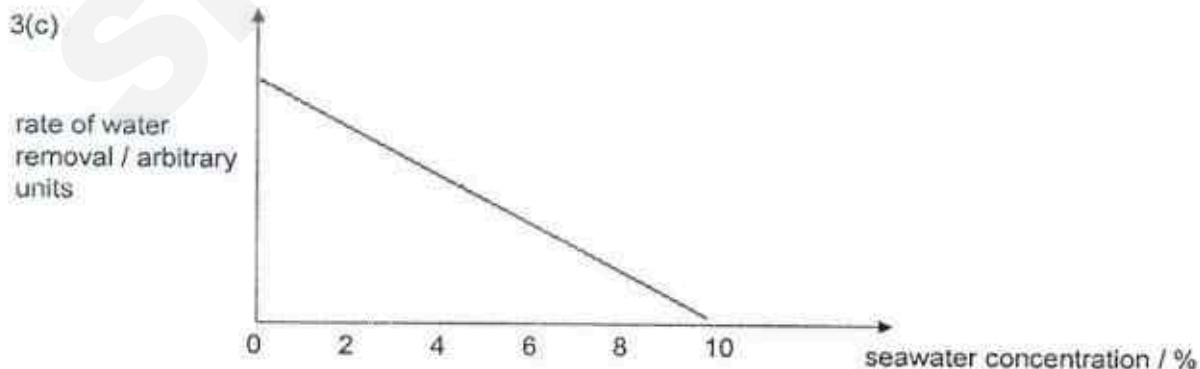
- 2(b) C – Transcription;
D – Translation;

- 2(c) E – ribosome / rough endoplasmic reticulum;
F – golgi apparatus;

- 2(d) any 2 of
amino acids link up to form polypeptide/protein at E;
E transport protein to F;
F modifies protein;

- 3(a) diffusion; accept excretion

- 3(b) organism is placed in environment of higher water potential than itself;
there is net movement of water molecules from the surrounding into the organism by osmosis;
need to remove water to prevent bursting;



- 3(d) plant cell contain cell wall;
which prevents cell from absorbing excess water / prevents cell from bursting;

- 4(a) i – B/C;
ii – E;
iii – D;

4(b)(i) alcohol / nicotine / heroin / named addictive drug;

4(b)(ii) any 3 of
substance enters mothers' blood;
diffuses across placenta;
enters foetus' blood;
travels through umbilical cord/umbilical vein;

5(a) guard cells;

5(b) Brazilian waterweed – plant absorbs dissolved gases / plant has no access to atmosphere
water lily – only top surface of the leaf exposed to atmosphere

5(c)(i) palisade mesophyll tissue;

5(c)(ii) numerous large air spaces in the leaves for buoyancy;

max 2 for any of the following
leaves are closer to the light / leaves can absorb more light;
for more photosynthesis;
to exchange gases with the air/atmosphere;

6(a) A – prophase
B – metaphase
C – anaphase

6(b) chromatin coils / condenses / undergoes condensation / becomes shorter and thicker;

6(c)(i) 2

6(c)(ii) shortens to separate/move sister chromatids to opposite ends/poles of cell;

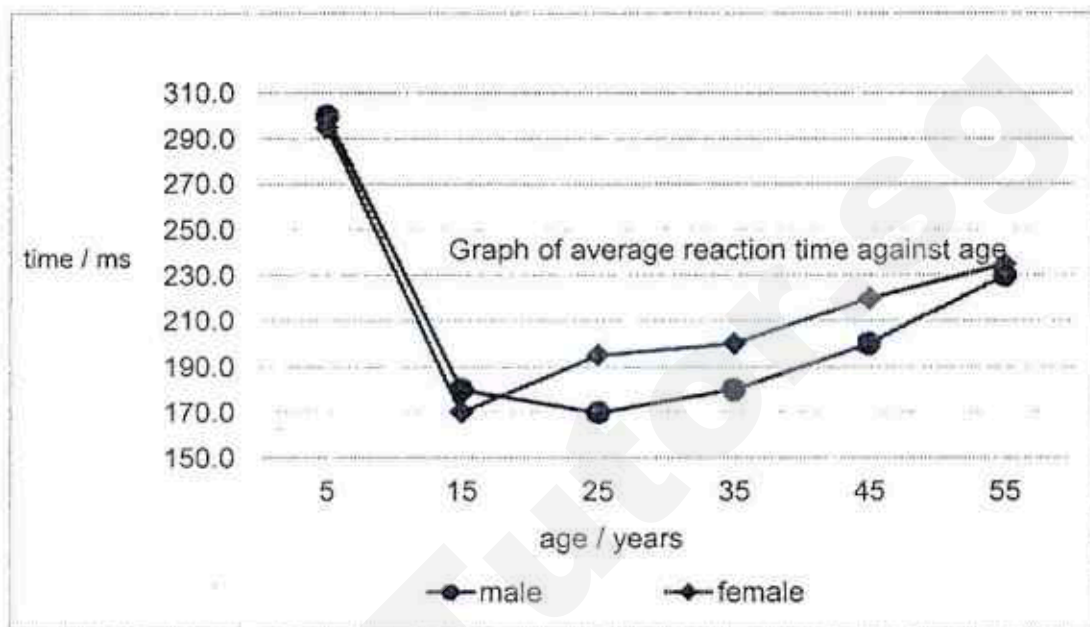
6(c)(iii) centrioles/spindle fibres not formed;

7(a) + 13.7

7(b) less oxygen;

7(c) any 4 of
more haemoglobin in blood;
can bind to / transport more oxygen in blood;
more aerobic respiration;
release more energy for muscle contraction;
can help increase stamina;

- 8(a) y and x-axis labels and intervals;
plots for male;
plots for female;
smooth curve line drawn, both graphs labels;



- 8(b) males at 5 to 15 years have slower reaction time than females;
males at 25 to 55 years have faster reaction time than females;
8(c) any 4 comparisons:

response to hot object	response to sound
reflex action	voluntary action;
faster response	slower response;
stimulus is heat / receptor at skin	stimulus is sound / receptor at ear;
nerve impulse bypass conscious part of brain	nerve impulse received by brain which then sends another nerve impulse;
nerve impulse transferred to relay neurone in spinal cord and then to motor neurone;	nerve impulse transferred to relay neurone in brain;

- 9(a) fertilisers wash into rivers during rain, causes excess growth of algae / eutrophication;
algae prevents sunlight from reaching submerged plants;
submerged plants unable to photosynthesize and dies;
algae eventually dies due to insufficient nutrients/fertilisers;
cause increase in bacteria in rivers during decomposition, which decreases oxygen levels in water leading to death of fish;

- 9(b) the chemicals/insecticide absorbed by water plants/producers;
non-biodegradable, stored in fatty tissues;
fish feeds on water plants, chemicals accumulate in fish / bioaccumulation occurs;
chemical passed along the food chain to predatory birds and bioamplification occurs;
predatory birds at top of food chain suffer toxic effects of chemicals due to high
concentration of chemicals;

Either

- 10(a) any 6 of

similarities –

- 1 large surface area / both elongated structures;
- 2 both involve diffusion of substances;
- 3 both involve active transport / require energy / against concentration gradient;
- 4 both in solution;
- 5 both require membrane;

differences (linked points) –

- 6 plant uptake through root hairs
- 7 while humans through villi/microvilli;
- 8 ions absorbed from the soil while
- 9 glucose absorbed from / in the intestines / digestive system;

- 10(b) any 4 of

- 1 plants use nitrates;
- 2 which combine with carbohydrates / glucose;
- 3 to make own amino acids;
- 4 humans ingest / eat / consume proteins from other organisms;
- 5 have to be digested to amino acids;

Or

- 10(a) any 6 of

- blood glucose concentration falls below norm, pancreas release more glucagon into blood;
glucagon stimulates liver to convert glycogen to glucose;
blood glucose increases back to norm;
negative feedback to reduce glucagon secretion;
blood glucose concentration rises above norm, pancreas release more insulin into blood;
insulin stimulate liver to convert excess glucose to glycogen, stored in liver;
blood glucose decreases back to norm;
negative feedback to reduce insulin secretion;

- 10(b) sweat glands less active, less sweat produced;
higher blood pressure / hydrostatic pressure at afferent arterioles;
more filtrate forms at nephron;
higher volume of urine produced;



Paya Lebar Methodist Girls' School (Secondary)
Preliminary Examination 2017
Secondary 4 Express

CANDIDATE NAME		CLASS		CLASS INDEX NUMBER	
CENTRE NUMBER				INDEX NUMBER	

BIOLOGY (SPA)

5158/01

Paper 1 Multiple Choice

22 August 2017

Additional Materials: Multiple Choice Answer Sheet

1 hour

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name and index number on all the work you hand in.

There are **forty** multiple-choice questions on this paper. Answer **all** questions. For each question, there are four possible answers **A, B, C** and **D**.

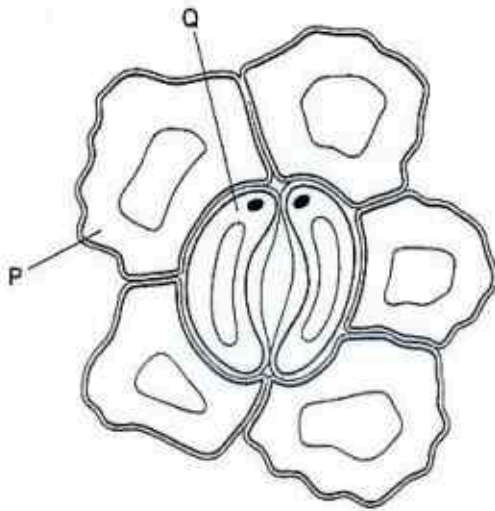
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

This document consists of **21** pages including this cover page.

- 1 The diagram shows cells in the epidermis of a leaf.



To complete the diagram, which structural features should be added to the cells P and Q?

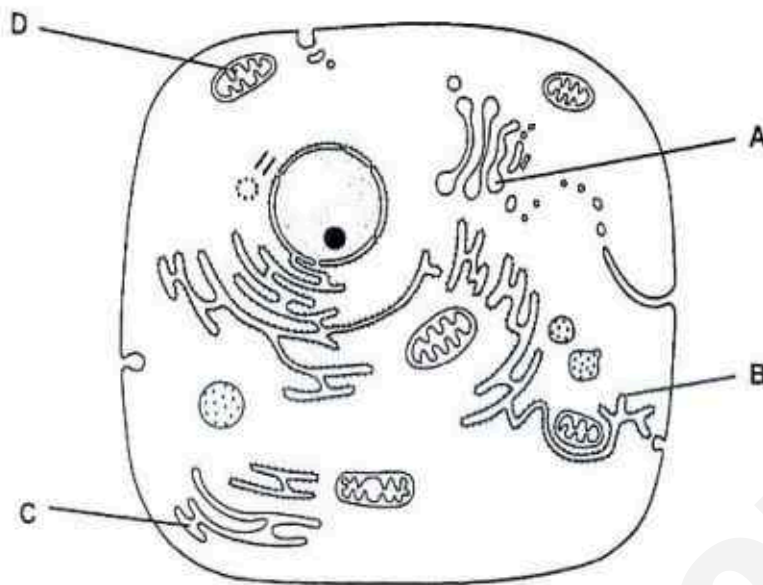
	P		Q	
	chloroplasts	nucleus	chloroplasts	nucleus
A	✓	✓	x	x
B	✓	x	✓	✓
C	x	✓	✓	x
D	x	x	x	✓

- 2 What are the levels of organisation of the retina and of the eye?

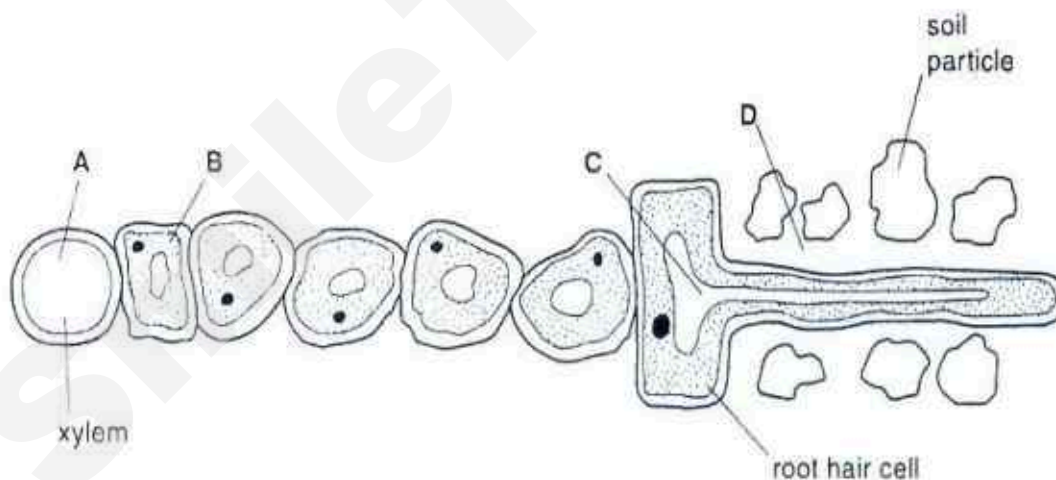
	retina	eye
A	cell	organ
B	cell	organ system
C	tissue	organ
D	tissue	organ system

- 3 The diagram shows the ultrastructure of a typical animal cell.

Which structure synthesises and transports lipids and steroids?



- 4 The diagram shows part of a plant root in the soil. The root is absorbing water. At which labelled point is the water potential highest?



- 5 Some organisms live at the bottom of the seas where it is very dark. To synthesise glucose, they use energy from chemicals in very hot water that comes out of volcanoes.

What is a distinguishing feature of these organisms?

- A Their enzymes are easily denatured by heat.
- B They do not need carbon dioxide.
- C They do not need to be green.
- D They obtain energy only as carnivores.

6 Which group of compounds ensures that metabolic reactions take place effectively?

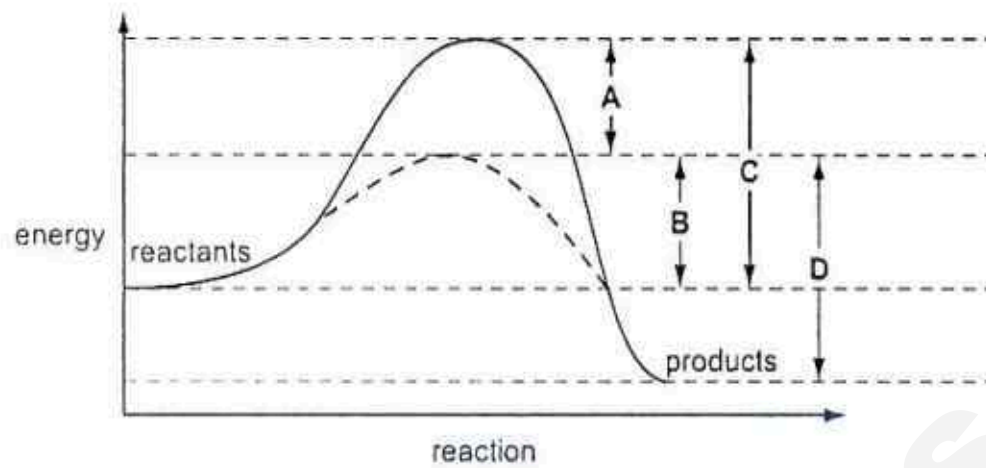
- A carbohydrates
- B enzymes
- C fatty acids
- D hormones

7 Which combination of procedures would not be used in a food test?

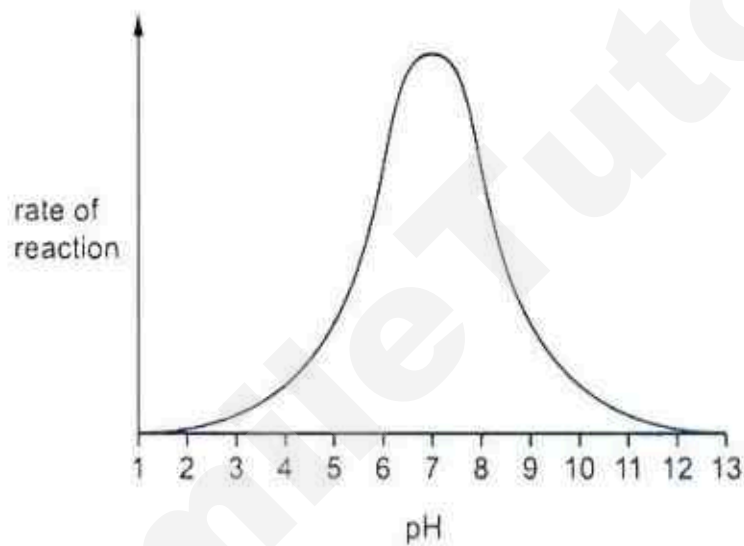
	use heat	use biuret reagent	use Benedict's reagent	boil with dilute acid
A	✓		✓	
B	✓	✓		
C	✓		✓	✓
D		✓		

8 The graph shows the activation energy of an enzyme-catalysed reaction and the same reaction without a catalyst.

Which arrow shows the activation energy of the uncatalysed reaction?



- 9 The graph shows the effect of pH on a particular enzyme-controlled reaction.



When is the enzyme not active?

- A at pH 1 and pH 13
- B at pH 3 and pH 11
- C at pH 5 and pH 9
- D at pH 7

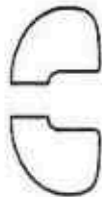
- 10 The diagram represents an enzyme molecule.



What could be substrates for this enzyme?



W



X



Y



Z

- A W only B W or X C Y only D Y or Z

11 What is an example of assimilation?

- A absorption of glycerol into lacteals
- B breakdown of alcohol in the liver
- C building of proteins from amino acids
- D release of a hormone from a gland

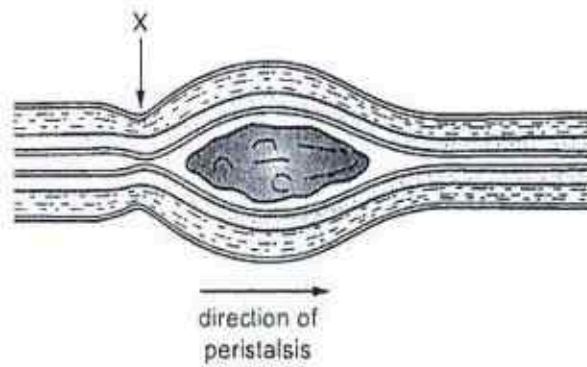
12 The small intestines of cows are similar in general structure and function to the small intestines of humans.

A disease in cows reduces the number of villi in their small intestines. The cows lose weight and become weak.

What explains this?

- A less amylase produced
- B less peristalsis
- C less absorption of nutrients
- D slower digestion of proteins

13 The diagram shows a piece of small intestine during peristalsis.



What is happening at X?

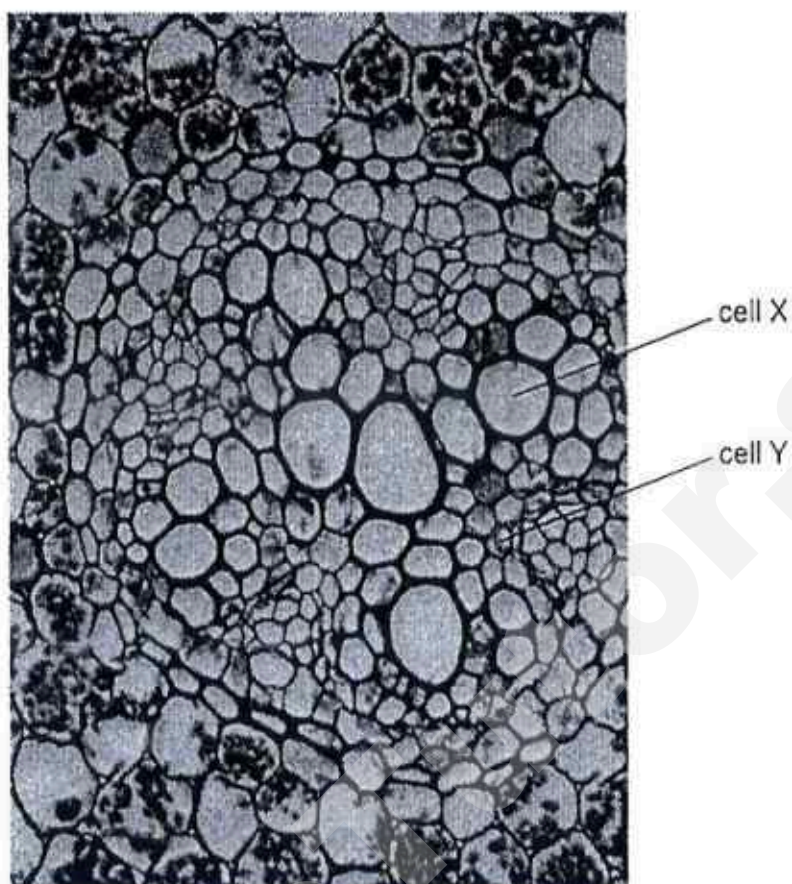
	circular muscles	longitudinal muscles
A	contracted	contracted
B	contracted	relaxed
C	relaxed	contracted
D	relaxed	relaxed

- 14 The graph shows how the rate of photosynthesis varies with light intensity and temperatures. Other variables are kept the same.

In which sections of the graph is light intensity limiting the rate of photosynthesis?

- A P and R
- B Q and S
- C R and Q
- D S and P

15 The photomicrograph shows part of a section through a root.



The contents of cell X and the contents of cell Y are each tested with Benedict's solution and with iodine solution.

Which results are expected?

	cell X		cell Y	
	Benedict's solution	iodine solution	Benedict's solution	iodine solution
A	+	+	-	-
B	+	-	+	+
C	-	+	-	+
D	-	-	+	-

key

+ = positive result

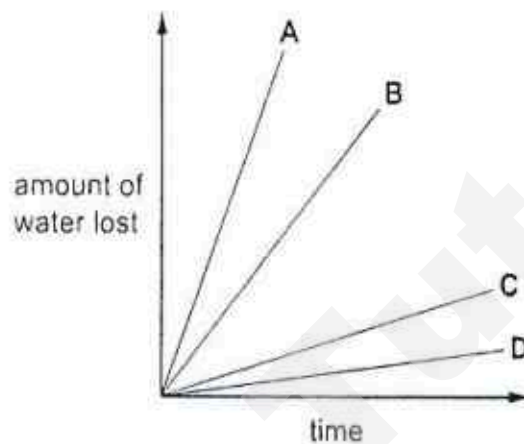
- = negative result

16 In an experiment to investigate transpiration, the leaves of four identical shoots are treated as follows.

- 1 upper surfaces covered with waterproof jelly
- 2 lower surfaces covered with waterproof jelly
- 3 upper and lower surfaces covered with waterproof jelly
- 4 untreated

The graph shows the water lost by the four shoots.

Which line shows the result for shoot 4?



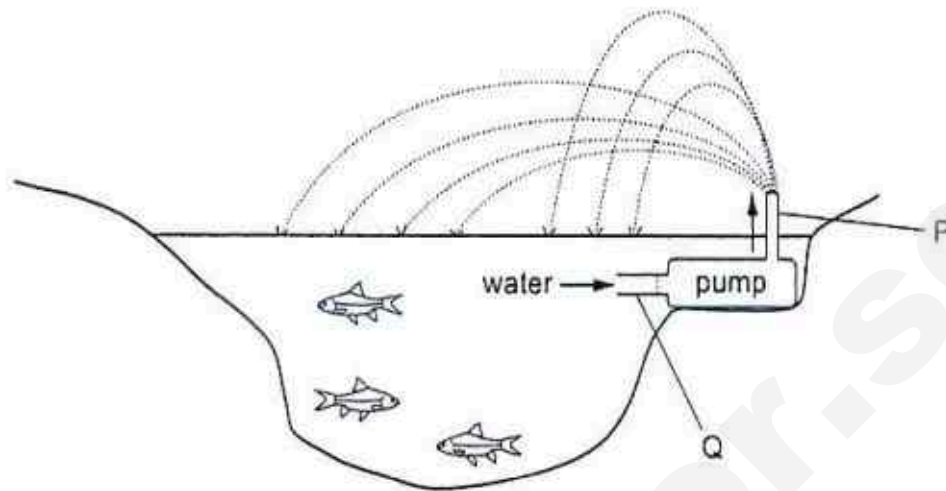
17 The list shows four metabolic processes.

- 1 carbon dioxide + water \rightarrow glucose + oxygen
- 2 glucose \rightarrow alcohol + carbon dioxide
- 3 glucose \rightarrow lactic acid
- 4 glucose + oxygen \rightarrow carbon dioxide + water

Which of these processes occur in muscles?

- A 1 and 2
- B 2 and 3
- C 3 and 4
- D 4 and 1

- 18 The diagram shows a garden pond with a fountain worked by a pump. The fountain brings oxygen from the air to the fish in the pond.

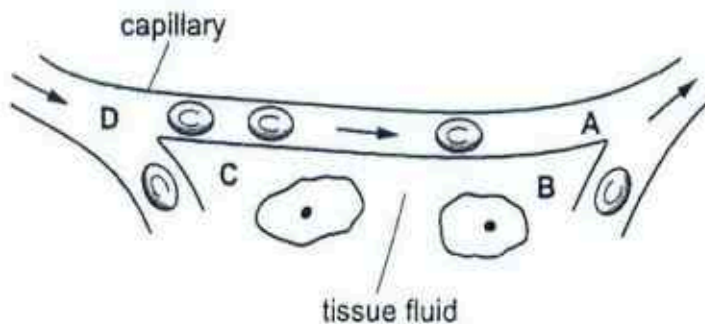


The system can be compared with part of the human circulatory system. The pump is compared with the heart.

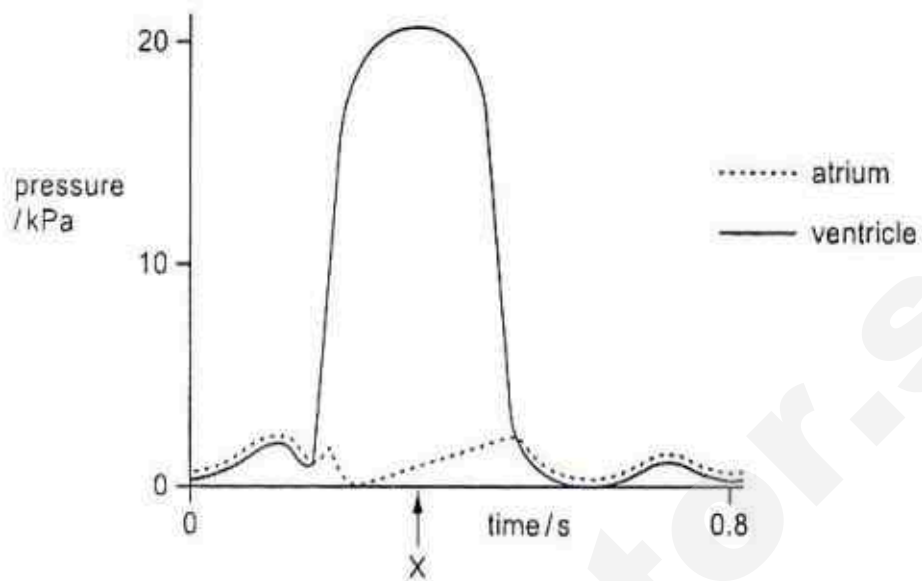
What are P and Q compared with?

	P	Q
A	aorta	pulmonary artery
B	pulmonary artery	vena cava
C	pulmonary vein	vena cava
D	vena cava	aorta

- 19 The diagram shows the movement of blood through a tissue.
At which labelled point is the pressure highest?



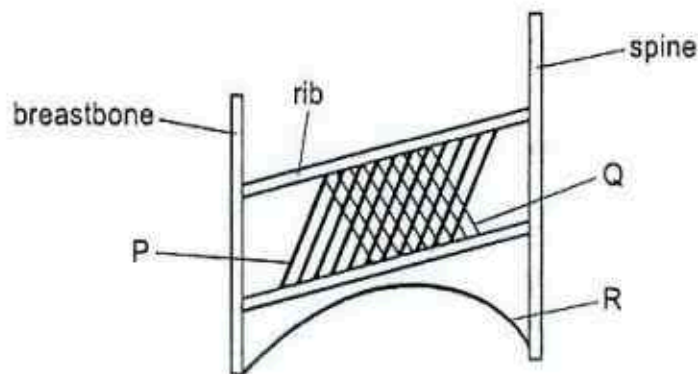
- 20 The graph shows pressure changes in the left atrium and in the left ventricle during one heartbeat.



What is the state of the valves in the heart at time X?

	left atrio-ventricular valve (bicuspid)	semi-lunar valve (in aorta)
A	closed	closed
B	closed	open
C	open	closed
D	open	open

21 The diagram represents some of the muscles involved with breathing.



Which muscles are contracting during breathing in?

- A P and Q
 - B Q and R
 - C P and R
 - D P, Q and R
- 22 A woman has been smoking heavily for many years. Which statement could not be correct?
- A Her arteries are blocked with tar.
 - B She is addicted to nicotine.
 - C The cilia in the trachea have been destroyed.
 - D The surface area of the lungs is reduced.
- 23 Why is glucose found in the urine of diabetics?
- A increased uptake and use of glucose by the body cells
 - B not enough glucose in the blood is converted to glycogen
 - C stored fats in the body are being oxidized
 - D too much glucose is absorbed by the kidney cells

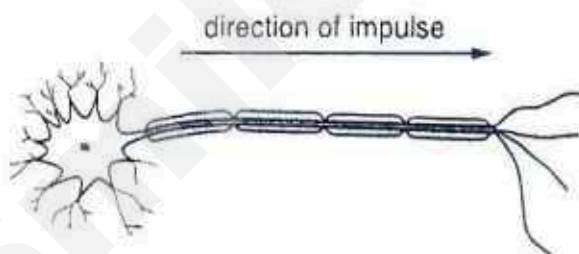
- 24 What would be the pupil size and lens shape of a person reading a mobile phone text message in a brightly-lit room?

	pupil size	lens shape
A	large	fat
B	large	thin
C	small	fat
D	small	thin

- 25 Which of the following can be an effector in a reflex arc?

- A a gland
- B a light receptor
- C the brain
- D the spinal cord

- 26 The diagram shows a neurone carrying an impulse.



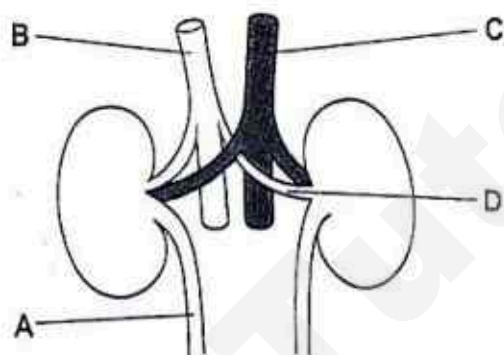
Which row describes the type of neurone and the direction of impulse?

	type of neurone	direction of impulse
A	motor	towards the spinal cord
B	motor	away from the spinal cord
C	sensory	towards the spinal cord
D	sensory	away from the spinal cord

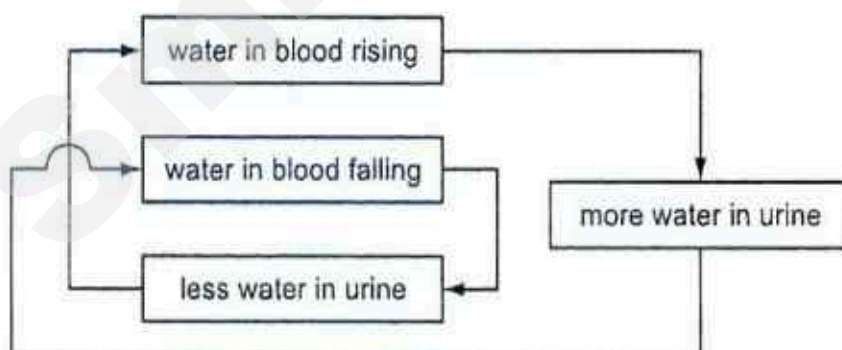
27 The table shows the composition of a liquid found in the human body.

component	concentration / arbitrary units
amino acids	0.00
glucose	0.00
proteins	0.00
salts	1.50
urea	2.00

In a healthy person, which structure contains this liquid?



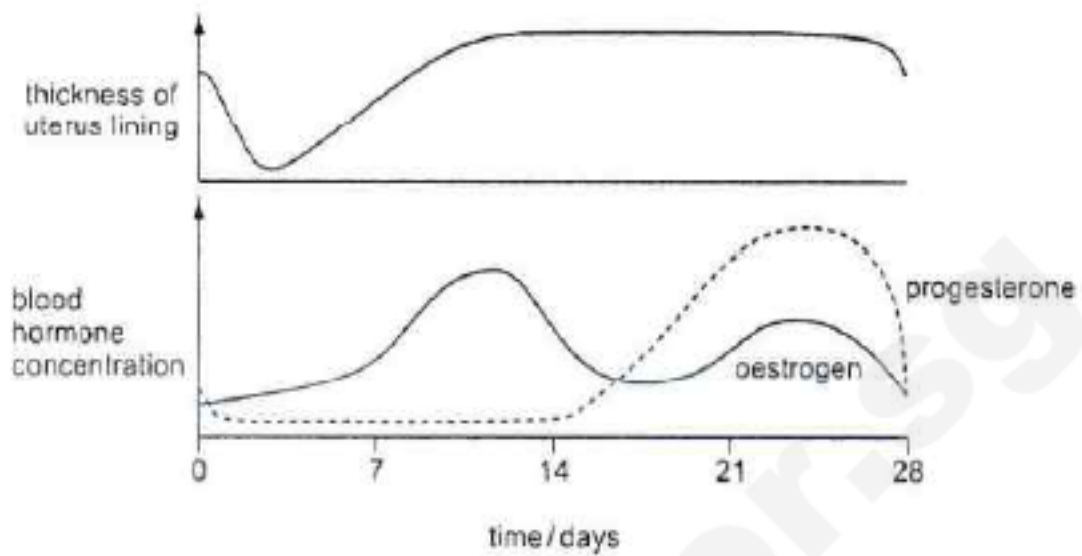
28 The diagram refers to the control of water concentration in the blood.



Why is this a negative feedback system?

- A It decreases the amount of water in the blood.
- B It increases any change in the amount of water in the blood.
- C It increases the amount of water in the blood.
- D It reverses any change in the amount of water in the blood.

29 The graphs show changes that occur in a woman during the menstrual cycle.



Which statement is supported by evidence in the graphs?

- A A large increase in progesterone concentration always results in thickening of the uterus lining.
 - B At ovulation, the uterus lining is at its thickest.
 - C Each time the oestrogen concentration rises, the uterus lining becomes thicker.
 - D Within 5 days of ovulation, the uterus lining gets thinner.
- 30 Which statement correctly describes advantages or disadvantages of self-pollination to a plant?
- A It needs a lot of pollen but can happen when a plant is on its own.
 - B It needs little pollen but there is a high chance of pollination.
 - C It needs no agent to transfer pollen but pollination is unlikely.
 - D It needs two plants of the same species but there is little variation in the offspring.

31 A male gamete leaves the pollen tube immediately after the pollen tube has entered which structure?

- A ovary
- B ovule
- C stigma
- D style

32 Which feature of sexual reproduction helps a species to evolve?

- A Fewer offspring are produced than in asexual reproduction.
- B Offspring are the result of the fusion of the nuclei of dissimilar gametes.
- C Offspring always inherit advantageous characteristics.
- D Offspring produced will always be in a suitable environment.

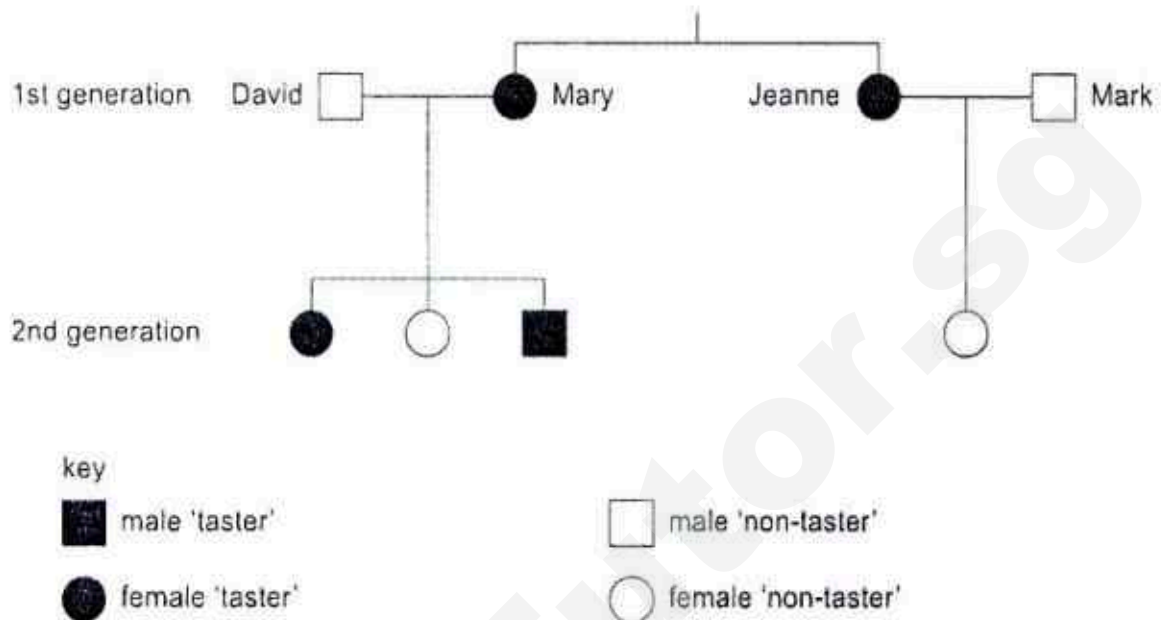
33 Two heterozygous individuals are crossed. Some of the offspring show the recessive characteristic.

What is the probability that one of these offspring that shows the recessive characteristic is homozygous?

- A 0.00
- B 0.25
- C 0.50
- D 1.00

34 The diagram shows a family tree and the inheritance of the ability to taste a certain substance.

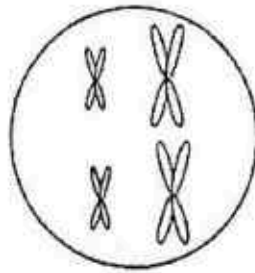
The allele for the ability to taste this substance is dominant.



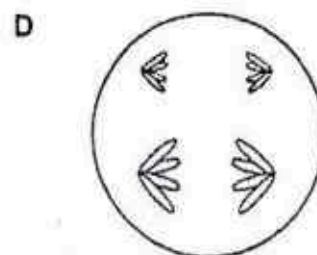
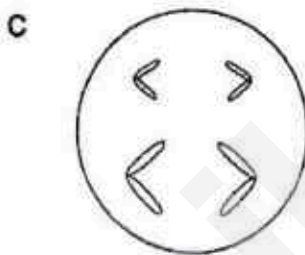
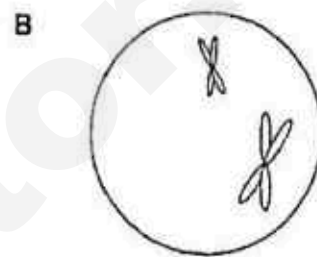
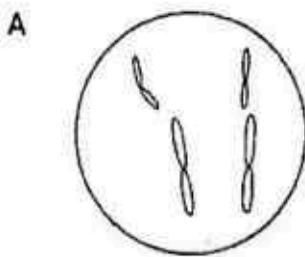
Which statement about the genotypes of the sisters Mary and Jeanne is correct?

- A Mary is heterozygous and Jeanne is homozygous.
- B Mary is homozygous and Jeanne is heterozygous.
- C They are both heterozygous.
- D They are both homozygous.

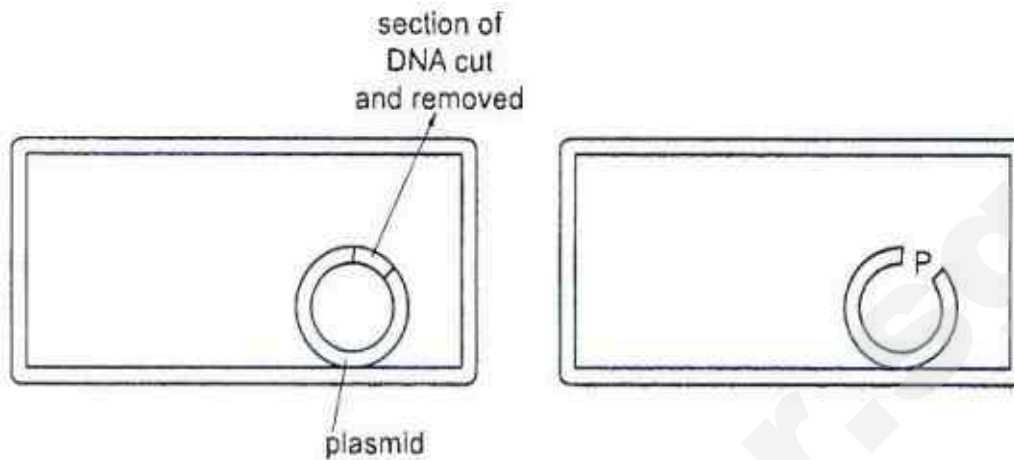
35 The diagram represents the nucleus of a cell $2n=4$ in late prophase of meiosis.



Which diagram represents a cell of the same species in anaphase II of meiosis?



- 36 The diagram shows a bacterium whose plasmid is being used during genetic engineering to produce human insulin.



What is inserted at P so that the bacterium can produce human insulin, and which enzyme is used to catalyse the insertion?

- A a section of human DNA, using DNA ligase
- B a section of human DNA, using restriction enzymes
- C a section of human mRNA, using DNA ligase
- D a section of human mRNA, using restriction enzymes

37 Bacteria can be genetically engineered to produce human insulin.

Before this method was developed, the only insulin available was that from cattle or pigs.
It was obtained from extracts of animal pancreas.

Which statements about the two methods are correct?

W Large numbers of bacteria can be cultured in a small space.

X Bacteria reproduce very quickly and make insulin quickly.

Y People sometimes develop diseases from insulin taken from cows or pigs.

Z The insulin produced in bacteria is not the same as that produced in the human pancreas.

A W, X and Y

B W, X and Z

C W, Y and Z

D X, Y and Z

38 In the DNA sequence for sickle cell anaemia, adenine replaces thymine in a CTT triplet, forming the triplet CAT. During synthesis of the sickle cell haemoglobin molecule, the amino acid valine is incorporated instead of glutamic acid.

What is the anticodon in the transfer RNA molecule carrying this valine?

A CAT

B CAU

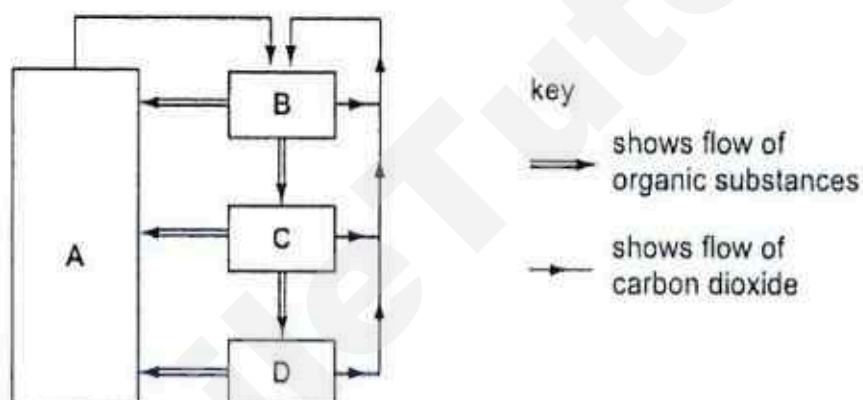
C GTA

D GUA

39 Which processes result in organisms gaining carbon compounds, and in the addition of carbon dioxide to the atmosphere?

	organisms gaining carbon compounds	addition of carbon dioxide to the atmosphere
A	photosynthesis and combustion	respiration by animals
B	photosynthesis and combustion	respiration by plants
C	photosynthesis and feeding	dead organisms changing to fossil fuels
D	photosynthesis and feeding	respiration by plants

40 The diagram represents the flow of substances within a balanced ecosystem. The boxes are various trophic levels. Which box represents producers?



S4 Prelim exam P1 2017

Qn	1	2	3	4	5	6	7	8	9	10
Ans	C	C	C	D	C	B	B	C	A	D
Qn	11	12	13	14	15	16	17	18	19	20
Ans	C	C	B	B	D	A	C	B	D	B
Qn	21	22	23	24	25	26	27	28	29	30
Ans	C	A	B	C	A	B	A	D	B	B
Qn	31	32	33	34	35	36	37	38	39	40
Ans	B	B	D	C	C	A	A	B	D	B

Section A

[50 marks]

Answer all questions in this section.

Write your answers in the spaces provided.

- 1 Fig. 1.1 shows a villus from the small intestine of a mammal and an enlarged view of a cell from region A.

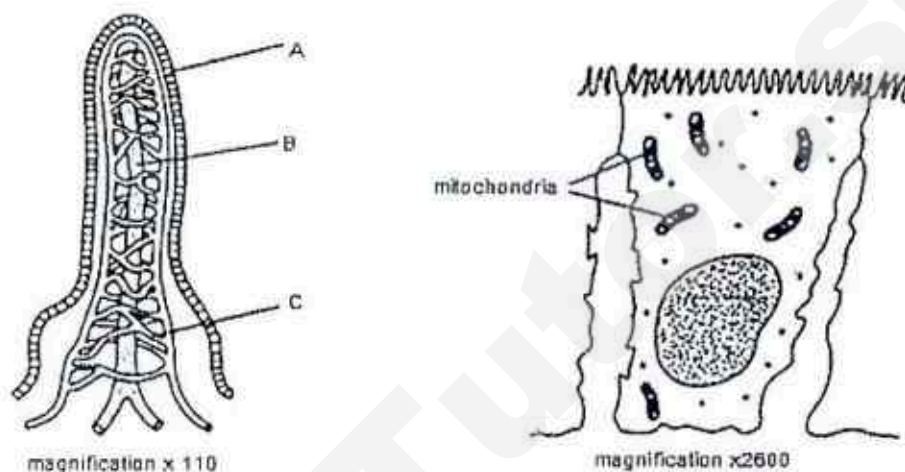


Fig.1.1

- (a) Identify regions A, B and C. [3]

A
B
C

- (b) Explain how the cell from region A is adapted for its function.

.....
.....
.....
.....
.....
.....
.....
.....[3]

[Total: 6m]

- 2 Fig 2.1 shows part of the alimentary canal that lies in the upper part of the human body.

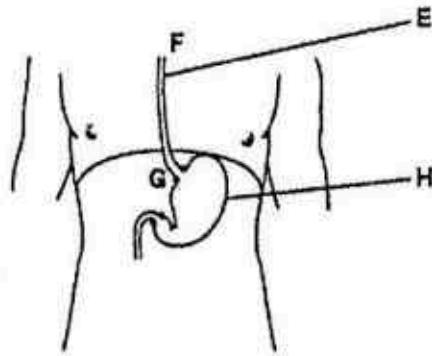


Fig. 2.1

- (a) Suggest why the walls of part H are normally coated with mucus.

.....

.....

.....

.....

.....

.....

.....

.....

.....

[4]

- (b) A person who lies down after a heavy meal can suffer from a condition known as heartburn.

- (i) Suggest which part of the Fig 2.1 shown above is affected by heartburn and why heartburn is not a biologically accurate name for the condition.

.....

.....

.....

.....

[2]

- (ii) Explain why medication used to treat the condition are often alkaline in nature.

.....

.....

.....

.....

[2]

(iii) Suggest the possible side effects the medication might have on the person.

.....

.....

.....

.....[2]

[Total: 10m]

- 3 Fig 3.1 shows a section through a heart that is connected to a LV Assist Device. The LV Assist Device aids the heart in systemic circulation.

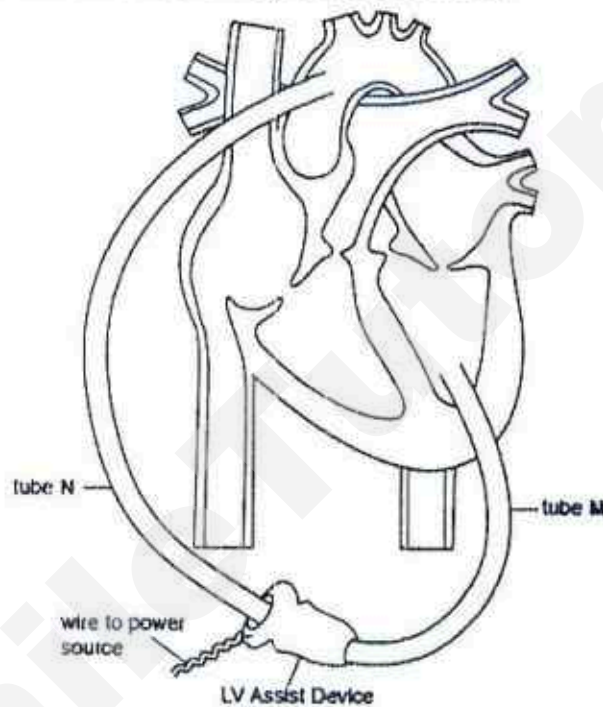


Fig. 3.1

- (a) Based on Fig 3.1, describe and explain why the device is known as the LV Assist Device.

.....

.....

.....

.....[2]

- (b) Name the tissue and blood vessel through which tubes M and N pass through respectively.

M:[1]

N:[1]

(c) Draw on Fig 3.1 to show the direction of blood flow through the LV Assist Device. [1]

(d) Name the valve that is bypassed by the blood passing through the LV Assist Device.

.....
..... [1]

(e) Sometimes the pulmonary circulation requires artificial assistance. Describe and explain where an Assist Device would be fitted in this situation.

.....
.....
.....
..... [2]

(f) Suggest whether a person with fitted LV Assist Device should be doing strenuous exercise. Explain your answer.

.....
.....
.....
..... [2]

[Total: 10m]

- 4 Fig. 4.1 shows a plant growing in an area that has well-watered soil.

The plant was held by the stem and pulled from the ground before being replanted in another area of well-watered soil.

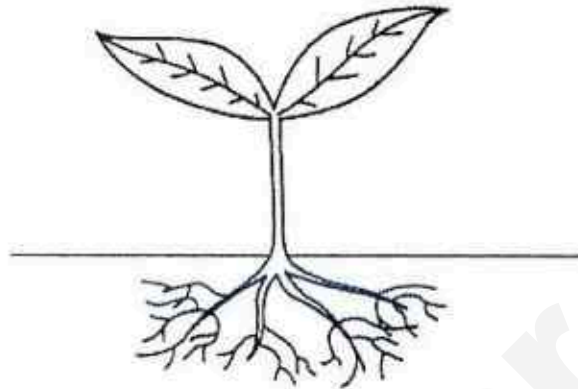


Fig. 4.1

- (a) Explain why the plant wilted for the first several days after being replanted and then recovered its original appearance.

.....
.....
.....
..... [2]

- (b) Fig 4.2 shows the uptake and the loss of oxygen by a leaf during a 24 hour period.

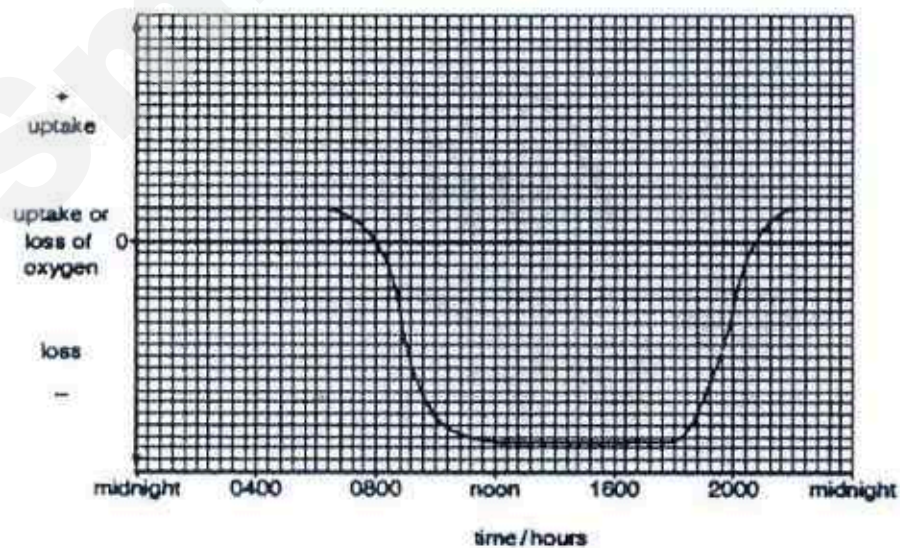


Fig 4.2

- (i) Describe and explain the shape of the graph in Fig 4.2.

[4]

- (ii) A micropipette was inserted into the phloem of the plant at the stem at regular intervals to measure the rate of photosynthesis as shown in Fig 4.3.

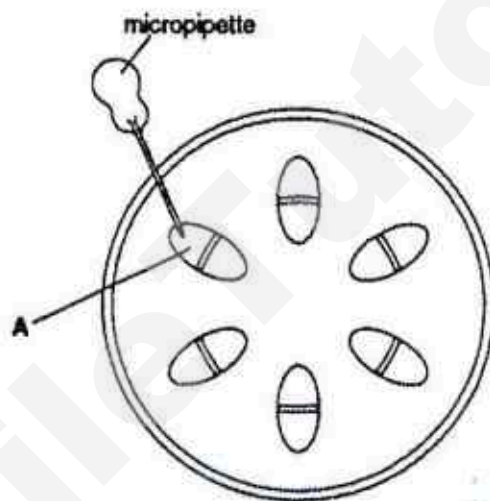


Fig. 4.3

Describe how the results would be affected based on Fig 4.2.

[3]

[Total: 9m]

- 5 Fig. 5.1 shows the flowering head of wheat and the individual flowers before and after the flowers open.

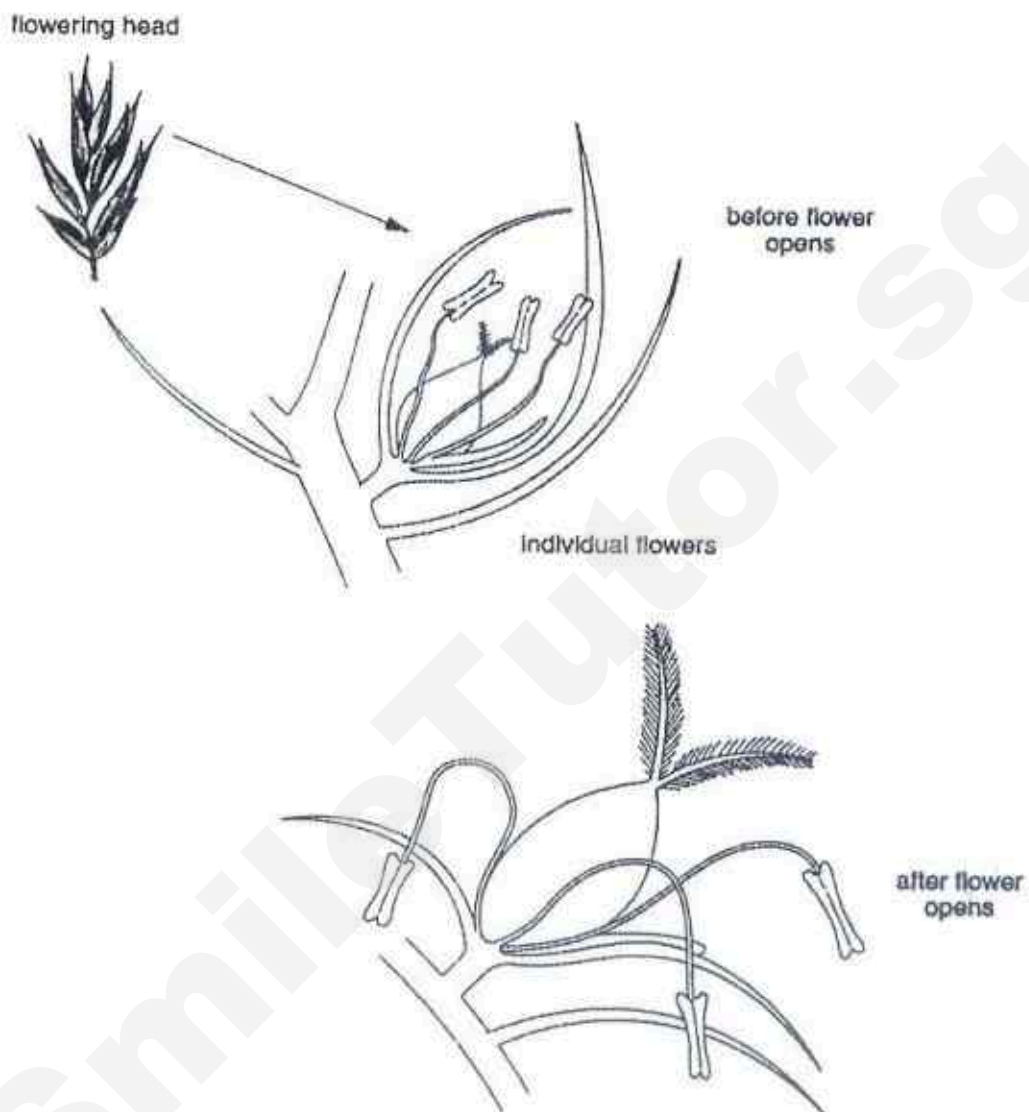


Fig 5.1

The anthers release most of their pollen before the flower opens. The rest is released after the flower opens.

Fig 5.2 shows pollen grains from the flowers of different species, labelled with letters K to Q.

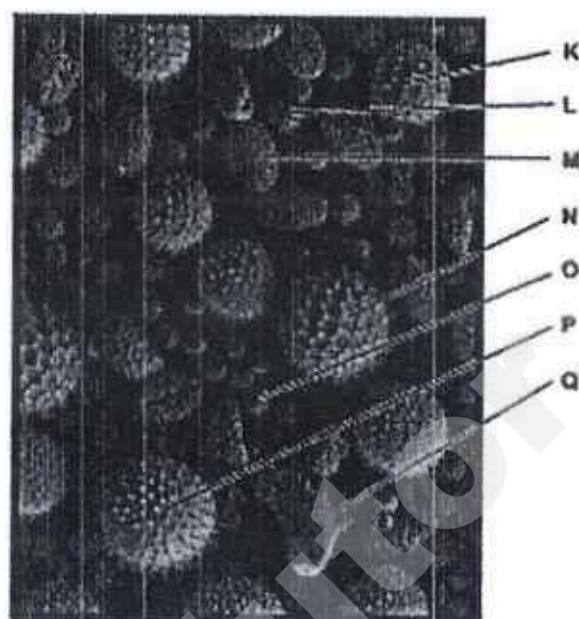


Fig. 5.2

- (a) Based on Fig 5.2, describe and explain which pollen grain (K-Q) is most likely to be the pollen grain from the flower shown in Fig 5.1.

.....

.....

.....

.....

..... [3]

- (b) Wheat pollen is only released for a few hours after the flowers open. What are the disadvantages?

.....

.....

.....

..... [2]

[Total: 5m]

- 6 An investigation was carried out to study the effect of diet on the production of urine. Three students took 1.5 dm^3 of a different drink, A, B and C each. Fig 6.1 shows the volume of urine released by each student over the next two and a half hours.

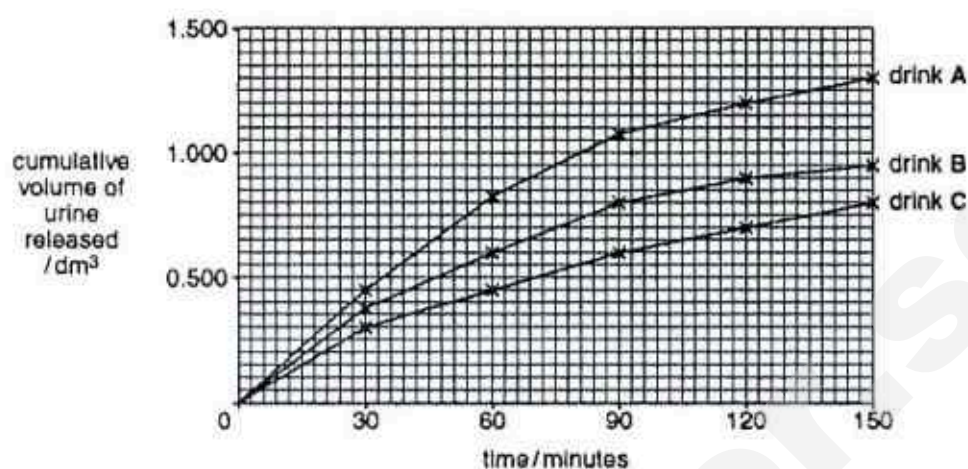


Fig 6.1

- (a) Describe and explain how the concentration of the urine of a person can be affected after a meal high in protein and low in water.

.....
.....
.....
..... [2]

- (b) Which drink should a person avoid on a hot day? Explain your answer.

.....
.....
.....
.....
..... [3]

-

Describe and explain how the concentration of glucose will change for a diabetic patient in the structures B, C and D after a heavy meal.

[3]

- [2]

End of Section A

DETACH THIS SECTION AND SUBMIT SEPARATELY
Preliminary Examination 2017
Secondary 4 Express

CANDIDATE NAME		CLASS		CLASS INDEX NUMBER	
CENTRE NUMBER	<div style="display: flex; justify-content: space-between; width: 100%;"> <div style="border: 1px solid black; width: 25px; height: 25px;"></div> <div style="border: 1px solid black; width: 25px; height: 25px;"></div> <div style="border: 1px solid black; width: 25px; height: 25px;"></div> <div style="border: 1px solid black; width: 25px; height: 25px;"></div> </div>	INDEX NUMBER	<div style="display: flex; justify-content: space-between; width: 100%;"> <div style="border: 1px solid black; width: 25px; height: 25px;"></div> <div style="border: 1px solid black; width: 25px; height: 25px;"></div> <div style="border: 1px solid black; width: 25px; height: 25px;"></div> <div style="border: 1px solid black; width: 25px; height: 25px;"></div> </div>		

Section B

[30 marks]

Answer **three** questions.

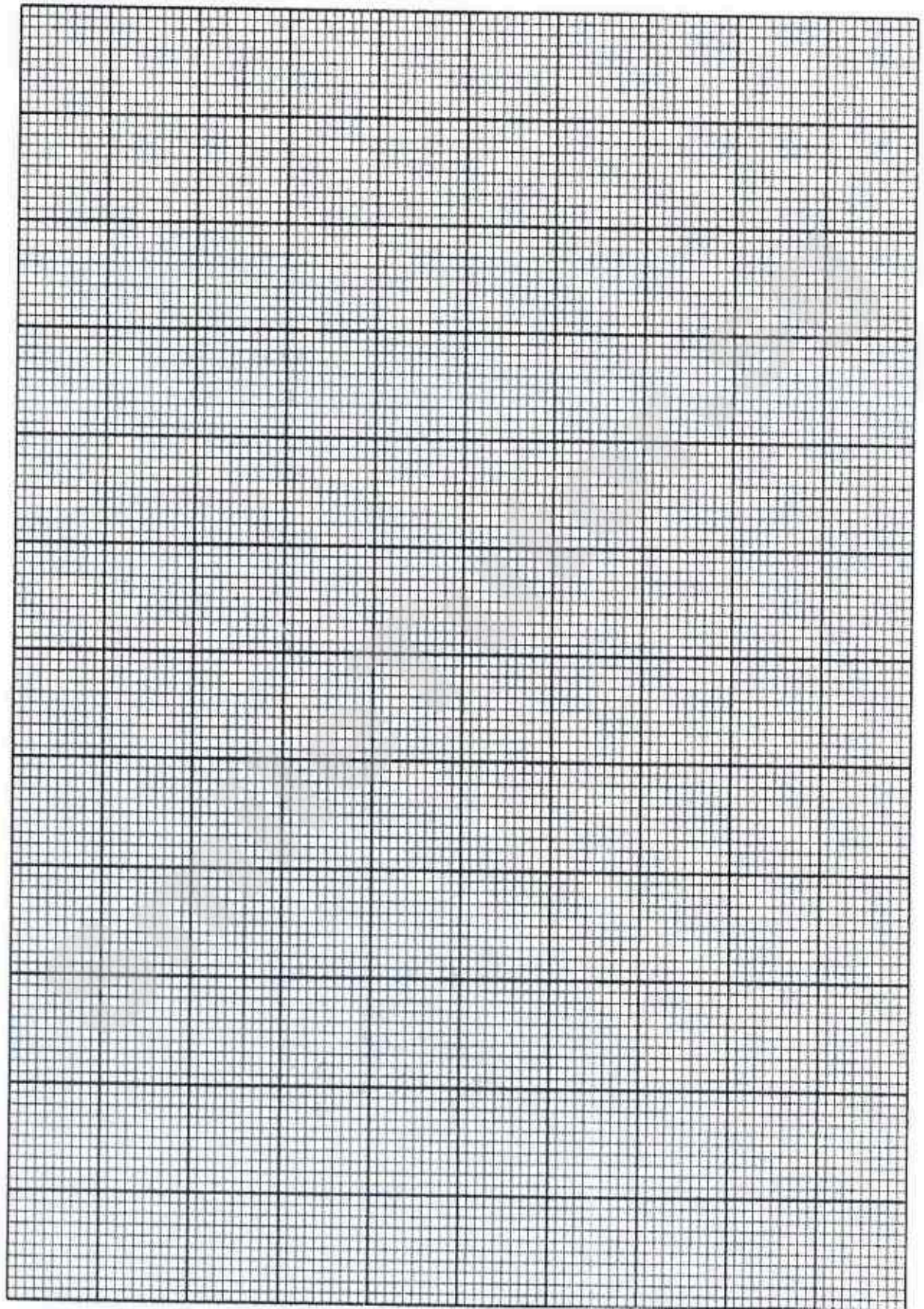
Question 9 is in the form of an **Either / Or** question. Only one part should be answered.

- 7 Table 7.1 shows the number of people in a population with different blood types.

Table 7.1

Blood type	Percentage of population with each blood types
A	42
B	10
AB	4
O	44

- (a) Draw a suitable graph in the space on page 14 to show the percentage of the population with each blood type. [3]



- (b) Suggest and explain the type of variation shown in the graph drawn on page 14.

.....

.....

.....

.....

.....[2]

- (c) Table 7.2 shows the distribution of blood types in the populations of four countries.

Table 7.2

Country	Percentage of population with each blood type			
	A	B	AB	O
S	23	38	10	29
T	42	10	4	44
U	24	19	5	52
V	36	3	4	47

Suggest why the percentage of population with blood types B and AB in Country V is so different from that of Countries S, T and U.

.....

.....[1]

- (d) Draw a genetic diagram below to show how it is possible for parents to have children with totally different blood type from them.

[4]

[Total: 10m]

- 8 Fig. 8.1 below shows a sloth which is a mammal that can be found in the South American rainforests.

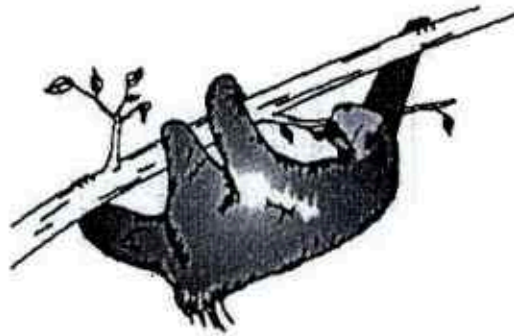


Fig 8.1

Sloths have the following features:

- They are slow moving.
- They climb down the tree to deposit their faeces in a hole they dig near the foot of the tree.
- They lose a quarter of their body weight when they defecate which is every 6 to 8 days.
- They feed on leaves from trees.
- Their fur is often green as it contains a single-celled plant-like organism algae.
- Their fur also contains blood-sucking mosquitoes and many small animals such as adult moths that feed on the algae on the hair of the sloth.
- Moths lay their eggs in the faeces of the sloth on which the moth larvae feed.
- The major predators of the sloth are the jungle cats and the harpy eagles.

- (a) The structure and features of the alimentary canal of the sloth are similar to human. One structure of their alimentary canal is much larger than the same part found in humans. Identify the structure and explain your answer.

.....
.....
.....
..... [2]

- (b) Suggest why the sloth have algae on its body.

.....
.....
.....
..... [2]

- (c) Draw a pyramid of energy to show the trophic level of the organisms that interact with the sloth. Label all the trophic level. [1]

- (d) Based on the information given on the sloth, suggest why the sloth has a relatively thick layer of fur even though it lives in the rainforest which is hot and humid.

.....

.....

.....

..... [2]

- (e) Fig. 8.2 shows a diagram of a nearby town and a factory nearby.

Fig. 8.2

Factory R has been disposing traces of heavy metal into the river which flows into the town and provides fish for the people living in the town. Explain why there are reports of people in the town who suffer from poisoning of heavy metals.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 10m]

9 EITHER

- (a) Some farmers keep animals that they will sell for people to eat. Suggest why these farmers may restrict the activity of these animals and keep the surrounding temperature close to the body temperature of the animals.

[4]

- (b) Compare genetic engineering versus selective breeding.

[6]

[Total: 10m]

9 OR

- (a) As a person gets older, the lens of the eyes may lose their elasticity. Describe and explain how the light rays from a near object may pass through eyes but not form a clear image on the retina of an old person.

[4]

- (b) Person A smoked for twenty years and Person B is a non-smoker. Describe and explain why Person A might feel fatigue and shortness of breath more easily than Person B after they both had performed vigorous exercise.

[6]

[Total: 10m]

END OF PAPER

Sec 4 Exp Bio Preliminary Exam 2017

Marking Scheme

Paper 2

Mark schemes will use these abbreviations:

;	separates marking points
/	alternatives
()	contents of brackets are not required but should be implied
R	reject
A	accept (for answers correctly cued by the question, or guidance for examiners)
AW	alternative wording (where responses vary more than usual)
AVP	alternative valid point (where a greater than usual variety of responses is expected)
ORA	or reverse argument
<u>underline</u>	actual word underlined must be used by candidate (grammatical variants excepted)
max	indicates the maximum number of marks that can be given
+	statements on both sides of the + are needed for that mark

Sec A

No.	Expected Answer	Mark	Remarks
1a	A epithelium / epithelial lining; B lacteal; C capillary / blood vessel;	3	
B	A has <i>microvilli</i> that increases / large surface area for faster absorption and faster rate of diffusion / active transport (into villus) <i>numerous mitochondria</i> is present so that (for) respiration can occur to release energy for active uptake / transport;	1 1 1 1	
		6 marks	
2a	ref. protection / barrier / prevents damage / breakdown / digestion of walls ; acid / HCl ; ref. protease ; walls are made of protein ; ref. lubrication ;	Max 4	
bi	Heartburn occurs at the <i>oesophagus</i> . As the heart not involved and there is no	1 1	

	connection between E and the heart, heartburn is the wrong term to use.		
Bii	Hydrochloric acid (from stomach) ; (acid) damages the cells / walls ; (acid) neutralised (by the medication) ;	1 1	
Biii	Acid will be neutralised by the medication enzymes need acid to be activated Denatured/not in optimum pH reduce digestion of protein	1 1	
	Total	10	
3(a)	It is connected from the left ventricle to the aorta and helps blood flow from left ventricle to aorta with the help of power source instead of left ventricular contraction.	1 1	
(b)	Muscle Aorta	2	
(c)	arrow right to left through LV Assist Device / in tube M / N	1	
(d)	aortic / semi-lunar ;	1	
(e)	The device would be fitted from the right ventricle; to the pulmonary artery so that blood can be pumped to the lungs.	1 1	
(f)	No. During strenuous exercise, more oxygen is needed by the muscles to release energy from respiration. Left ventricle pump blood to rest of body to deliver oxygen. Hence, a person with LV device might be unable to meet the demands of the oxygen needed and the person might feel faint/fatigue easily/stress for the heart and LV device.	1 1	
	Total	10	
3a	In the process, root hairs removed / roots damaged and stem / xylem damaged and less water absorbed/ Furthermore, the plant loses water / transpires; cells lose water / cells become flaccid; As the plant is replanted, it will recover as root (hairs) regrow, (more) water absorbed ; cells gain water again / become turgid ;	1 1	
Bi	From 0600 to 1200, increased light level Photosynthesis increase, and more O ₂ produced Lost through stomata From 1200 to 1800, rate of photosynthesis is the highest as highest light intensity. Highest amount of O ₂ produced. Between 1800 to 2200, reduced light levels ;	1 1 1	

	photosynthesis slowing down ;less O ₂ produced / lost AW ; stomata closing / closed AW ; after 2200 to 0600, lowest light intensity, photosynthesis stops ;O ₂ used / absorbed / gained / uptake AW ;(for) respiration ;	1	
bii	Amount of sucrose recorded would be dependent on rate of photosynthesis. Glucose produced would be converted to sucrose and transported to other parts of the plant sucrose transported (to underground stems) through phloem/ translocation ; Amount of sucrose recorded between 1200 to 1800 would be the highest because photosynthesis is occurring at highest rate and lowest after 1800 from midnight till 0600 because rate of photosynthesis is decreasing	1 1 1	
	Total	9marks	
5a	L/O Flower in Fig 5.1 is wind pollinated. Pollen grain is small and light so that can be carried by wind.	1 1 1	
5b	wind can't carry / can't be carried far / reduced dispersal ; too much dependence on self-pollination / lack of (genetic) variation AW ;	1 1	
	Total	5	
6(a)	More protein - correct ref. amino acids / ORA ; broken down in / converted by liver / deamination, more urea in (urine) / ORA ; less water - (urine) more concentrated	1 1	
B	drink A ; on a hot day, to reduce body temperature / keep cool / AW for thermoregulation , water already being lost in sweat when sweating occurs more than usual ; Drink A increases volume of / more water in urine / produces most / lot of / more urine and causes danger of dehydration / increases thirst / AW ;	1 1 1	
c	B would contain some / more / high (glucose) / C would contain more / high (glucose) / D would contain more / high (glucose) ; lack of Insulin for diabetic glucose would not be converted into glycogen ; kidney unable to/doesn't reabsorb all glucose ;	1 1 1	

8a	rectum / colon / large intestine ; stores faeces / infrequent defaecation AW ; OR stomach ; storing food and slower digestion (ref. defaecation every 6-8 days) ; OR ileum / small intestine ; slower digestion ;	2	
B	camouflage / less easily seen ; so not eaten / escape predators (or named) AW ; slow moving / cannot escape quickly ;	2	
8c		Correct organization Height equal for each level	
8d	They do not move around much. Low metabolic rate. Less heat produced. Hence, they need thick fur to maintain body heat/ less sweat produced, able to have thick fur and have no problem with sweat evaporation for thermoregulation.	1 1 1	
8e	Heavy metal is taken in by the fish/organisms/ plants found in the river. Heavy metal is non-biodegradable and cannot be excreted and is stored in tissues of fish Fish eats the plants/ other fish Passed down via food chains The concentration of heavy metal increases as we move along the trophic level. Results in the bioaccumulation of heavy metal in people who are the top consumers and hence they suffer from heavy metal poisoning as the concentration is high	1 1 1 1 Max 3	
		Total 10 M	
9 either a	less energy required ; to raise body temperature / keep body warm / thermoregulation ; ref. movement ;	1 1	

	<p>ref. less muscle activity/use ;</p> <p>ref. respiration ;</p> <p>more energy available + increase biomass/grow ;</p> <p>(farmer) increased productivity / profit / lower feeding costs /</p> <p>(consumer) lower cost to buy ;</p>	<p>1</p> <p>1</p>	
9b	<p>Advantages of selective breeding is that farmers can afford it more than GE where the modified plants/animals are more expensive and not affordable for the poorer farmers.</p> <p>Another advantage of selective breeding is that there is lesser risk of having genes that code for antibiotic resistance being accidentally incorporated into bacteria that cause human diseases which may occur in GE organism.</p> <p>One disadvantage of selective breeding is that there is a possibility that defective genes will be transmitted to offspring whereas in GE, selection of desired gene before transfer eliminates the risk of transferring a defective gene.</p> <p>Selective / artificial breeding can also result in inbreeding, and an accumulation of recessive alleles in the population. The recessive alleles are not expressed in the heterozygous parents. They are more likely to be passed down to the offspring. If the recessive alleles code for a genetic disease, the homozygous offspring will suffer from the disease</p> <p>Selective breeding is also a much slower process where several generations are involved. GE is a faster process which uses individual cells that reproduce rapidly in small container in a laboratory.</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>	

	Selective breeding is also less efficient as organisms grown more slowly and require more food as compared to GE where the organism grow faster and may require less food.	1	
	Selective breeding requires a larger space as it involve breeding several generations whereas GE is a process which uses individual cells that reproduce rapidly in a small container in a laboratory.	1	
	<i>Total</i>	10 points	
9 Or A	light / rays are bent / refracted / converged ; such that the light / rays can be focused on the retina to form clear image. (lens has) less ability to change shape AW / accommodate (therefore lens unable to be fully convex ; (lens) cannot refract sufficiently / decrease focal length sufficiently AW ; (cannot focus on the) retina / fovea / yellow spot ;	1 1 1 1 1	Max 4
9b	Vigorous exercise – need to take in more oxygen for increased respiration to release more energy Smoker – suffer from emphysema and chronic bronchitis. Emphysema – lungs no longer elastic. Walls of alveoli broken down, reduced surface area for exchange of gases. Breathing is no longer passive. Hence, shortness of breath to exchange gases more quickly Fatigue – insufficient oxygen delivered to muscle cells. Insufficient energy from respiration	1 1 1 1 1 1 1	Max 6
	<i>Total</i>	10	



ST. MARGARET'S SECONDARY SCHOOL
Preliminary Examinations 2017

CANDIDATE NAME

CLASS

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REGISTER NUMBER

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BIOLOGY

5158/01

Paper 1 Multiple Choice

29 August 2017

Secondary 4 Express

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, class and register number on the cover page and on the Answer Sheet in the spaces provided.

There are **forty** questions on this paper. Answer **all** questions. For each question, there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

This document consists of 15 printed pages.

X Which row correctly shows the structures found in a red blood cell?

	cell membrane	mitochondria	nucleus
A	absent	absent	absent
B	present	absent	absent
C	present	present	absent
D	present	present	present

2 When stained with different dyes, a tissue sample showed the presence of the following:

- 1 cellulose
- 2 fat granules
- 3 lignified cell walls
- 4 starch granules

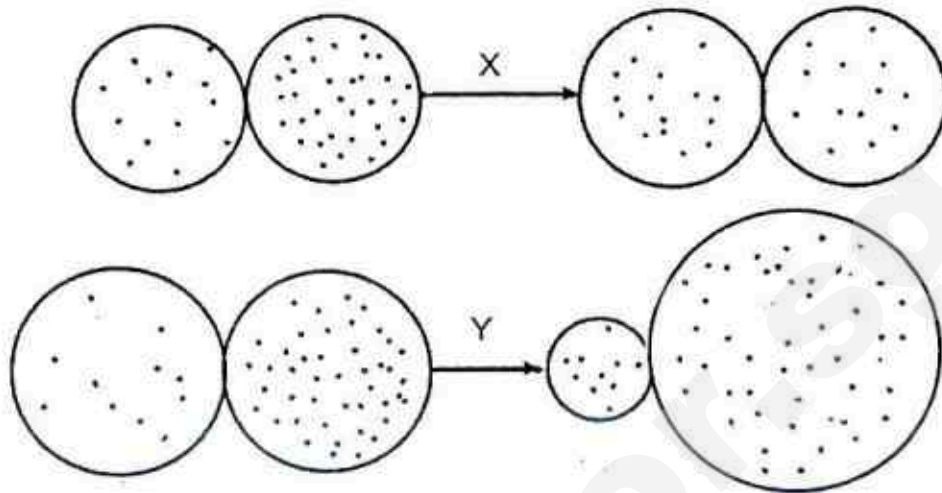
Which result does **not** help to conclude that the tissue sample is of plant origin?

- A** 1
- B** 2
- C** 3
- D** 4

3 A fresh potato cylinder was weighed before it was placed in a concentrated sucrose solution. After an hour, the cylinder was dried and weighed again. Which row shows the correct change in the weight of cylinder and the process that caused the change?

	change in weight	process
A	decrease	crenation
B	decrease	plasmolysis
C	increase	crenation
D	increase	plasmolysis

- 4 The diagrams show two processes, X and Y, occurring between two living cells.



Which of the following correctly identify the processes?

	X	Y
A	diffusion	diffusion
B	diffusion	osmosis
C	osmosis	diffusion
D	osmosis	osmosis

- 5 A sample of food was tested for its contents using two methods. The results are shown in the table.

test	results
Benedict's test	brick-red precipitate
biuret test	violet colouration observed

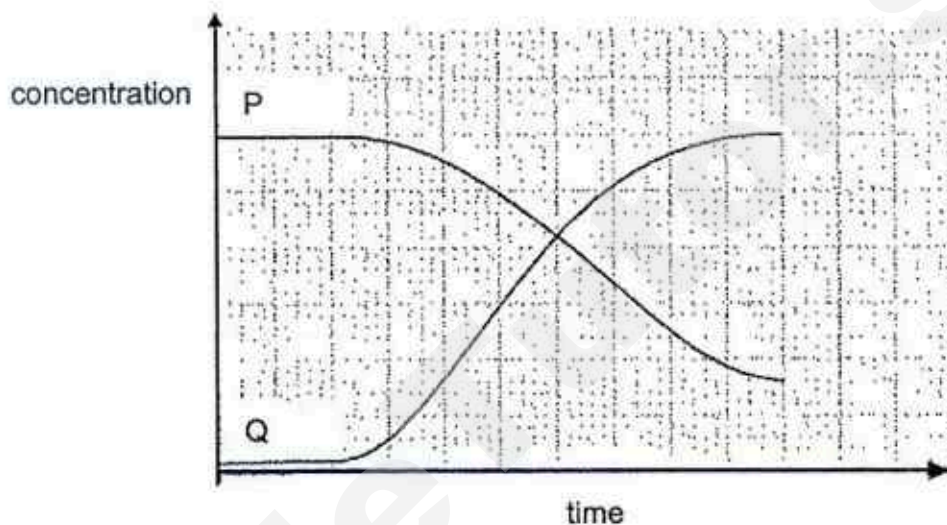
Which nutrients does the sample contain?

- A fat and protein
- B fat and reducing sugars
- C protein and reducing sugars
- D protein and starch

6 Which of the following does **not** contain the element nitrogen?

- A amino acids
- B glycogen
- C pepsin
- D urea

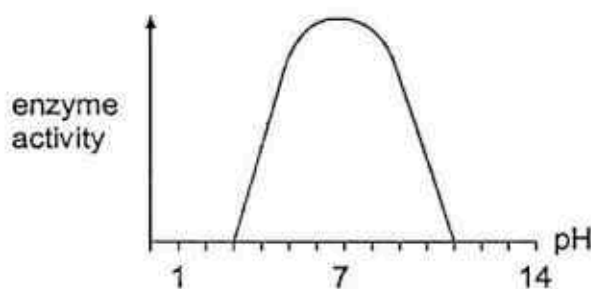
7 The graph shows how the concentration of substances involved in an enzymatic reaction changes over time.



What do the curves P and Q represent?

	P	Q
A	enzyme	product
B	product	substrate
C	substrate	enzyme
D	substrate	product

- 8 The graph shows the activity of an enzyme over a range of pH.



What does the graph show about the activity of this enzyme?

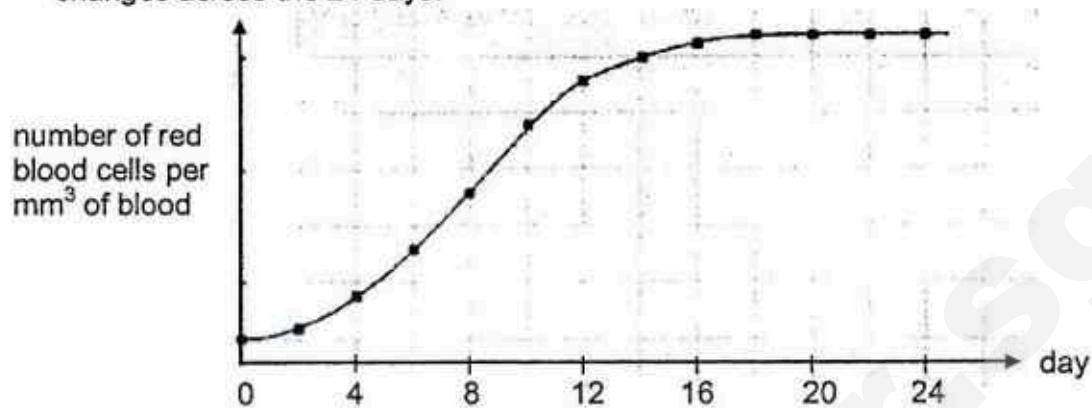
- A It is denatured at high temperatures.
 B It is inactive in acidic conditions.
 C It is the most active at pH 7.
 D Its optimum pH is 11.
- 9 The oesophagus, small intestine and large intestine are organs found in the digestive system. Which statement about these organs is true?
- A All have villi along their inner walls.
 B All food substances can be absorbed through their walls into the bloodstream.
 C All move the food inside them using peristaltic movements.
 D All secrete enzymes for digestion to occur.
- 10 Under which conditions does pepsin act on proteins most quickly?

	pH	temperature
A	2	40°C
B	2	60°C
C	9	40°C
D	9	60°C

- 11 Which row correctly describes the difference between plasma and tissue fluid?

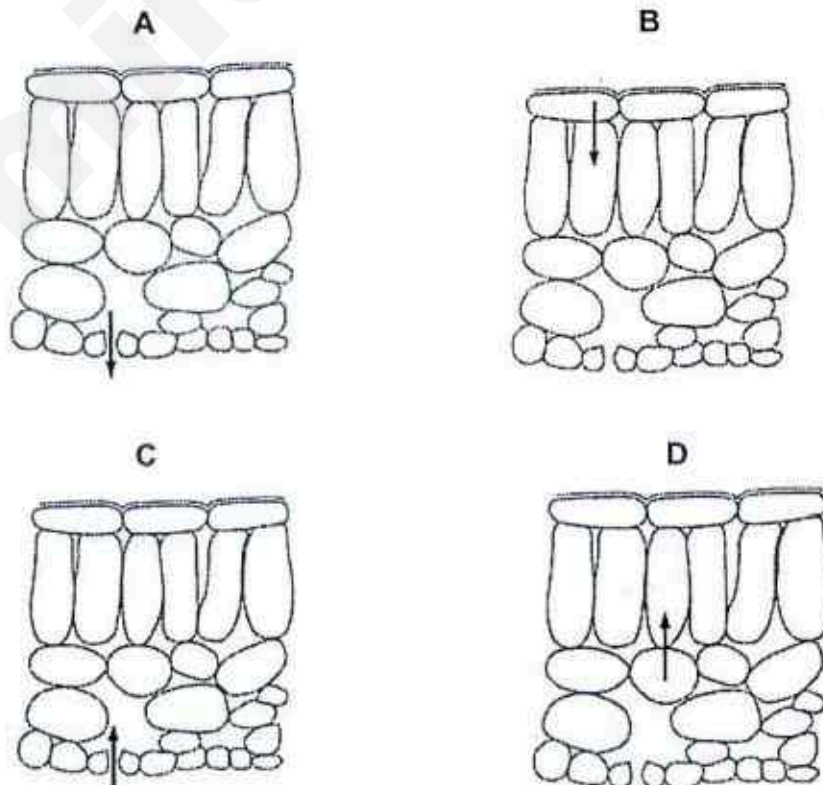
	plasma	tissue fluid
A	less glucose	more glucose
B	more platelets	fewer platelets
C	plasma proteins present	plasma proteins absent
D	white blood cells present	white blood cells absent

- 12 A man moves from sea level on Day 0 to the mountains and stays there for 24 days. The graphs shows how the number of red blood cells per unit volume of blood changes across the 24 days.

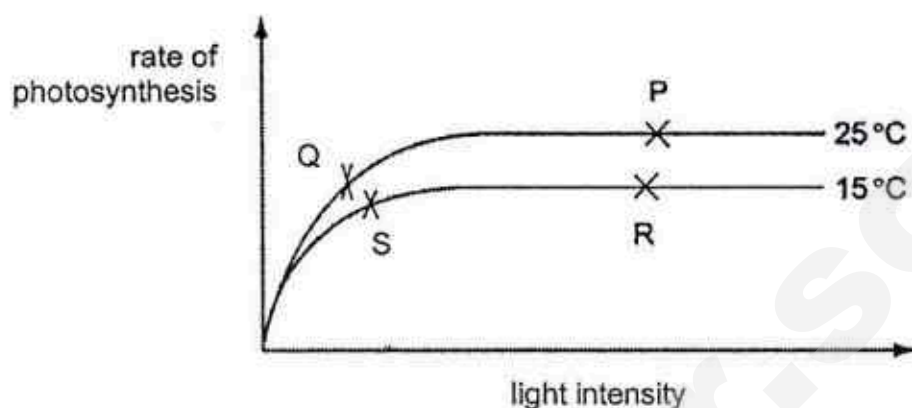


Based on the graph, which deduction **cannot** be made?

- A A person who has just arrived on the mountains will feel breathless.
 - B Exercising in the mountains helps a person develop stronger lungs.
 - C It takes about 18 days to get used to the high altitude of the mountains.
 - D Oxygen is transported faster to body cells when one is on the mountains.
- 13 The diagrams show the arrangement of cells in a section of a green leaf. Which arrow represents the diffusion of most oxygen during photosynthesis?

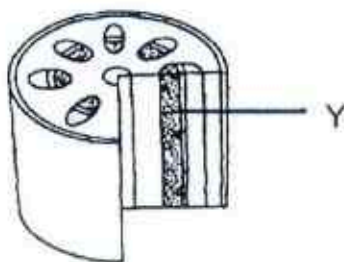


- 14 The graph shows how the rate of photosynthesis varies with light intensity at two different temperatures. Other variables are kept constant.



At which points of the graph is carbon dioxide concentration limiting the rate of photosynthesis?

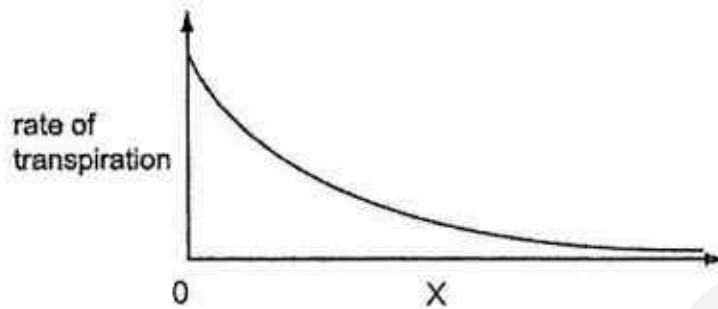
- A P and R
 - B P and S
 - C Q and R
 - D Q and S
- 15 The diagram shows a section through a stem.



What is the main transport function of Y?

	substance transported	carried from	carried towards
A	sugar	leaves	roots
B	sugar	roots	leaves
C	water	leaves	roots
D	water	roots	leaves

- 16 The graph shows how transpiration rate is affected by factor X.



What could factor X be?

- A humidity
 - B light intensity
 - C temperature
 - D wind speed
- 17 What causes an oxygen debt to develop?
- A increase in carbon dioxide concentration in blood
 - B increase in pulse rate
 - C oxygen demand being greater than oxygen supply
 - D rapid breathing
- 18 If a blood clot were to form in a coronary artery, it can cause a heart attack. Which substance in the blood of a smoker would increase the risk of clot formation?
- A carbon monoxide
 - B irritants
 - C nicotine
 - D tar
- 19 Which of the following would **not** take place in a dialysis machine?
- A diffusion of solutes into surrounding dialysis fluid
 - B flow of blood along a tube with partially permeable walls
 - C prevention of blood cells from leaving the tubing
 - D selective reabsorption of salts

20 What happens when a person drinks a large volume of water?

	amount of ADH secreted	reabsorption of water at kidney	volume of urine produced
A	less	less	more
B	less	more	less
C	more	less	more
D	more	more	less

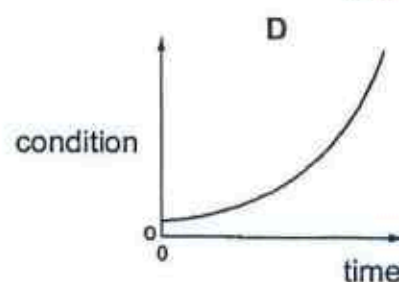
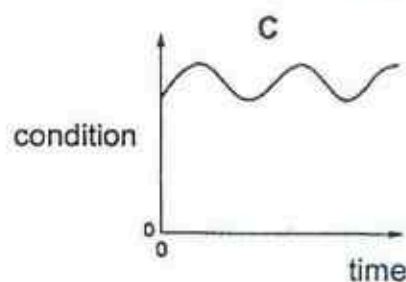
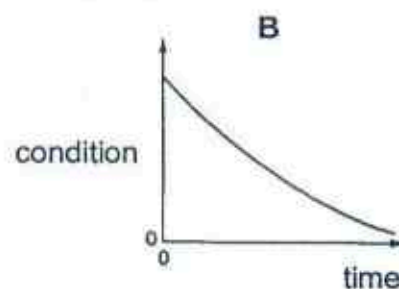
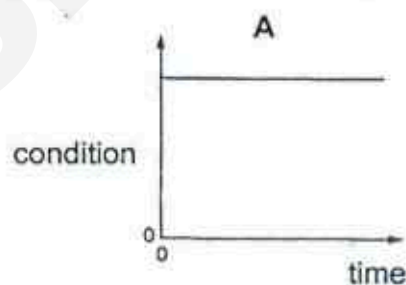
21 Which body response is **not** an example of homeostasis?

- A increased blood sugar due to secretion of adrenaline
- B increased insulin secretion after a heavy meal
- C more blood flows to skin surface in hot weather
- D more concentrated urine excreted after profuse sweating

22 Which of the following shows the ways in which the skin responds when a person is exposed to very cold air?

	state of arterioles	position of hair
A	constricted	erect
B	constricted	flat
C	dilated	erect
D	dilated	flat

23 The graphs show how four different conditions in the body may change with time. In which graph is the condition being controlled by negative feedback?



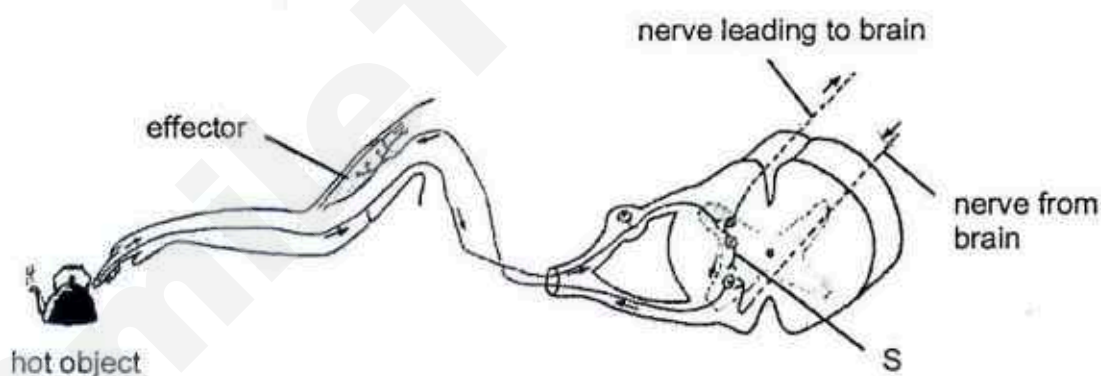
24 When a person is threatened by a fierce dog, which changes occur in the body?

	increase in	decrease in
A	adrenaline secretion	breathing rate
B	adrenaline secretion	rate of peristalsis
C	insulin secretion	breathing rate
D	insulin secretion	rate of peristalsis

25 Which structure causes the greatest refraction of light that enters the eye?

- A conjunctiva
- B cornea
- C lens
- D iris

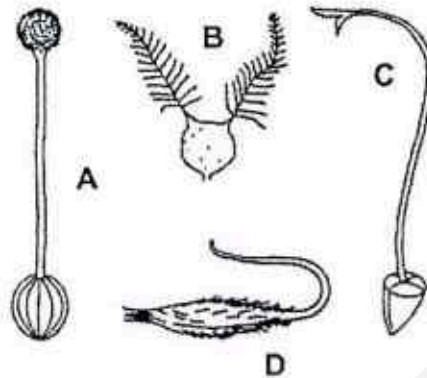
26 The diagram shows the nervous pathway of a reflex action when a person's finger touches a hot object.



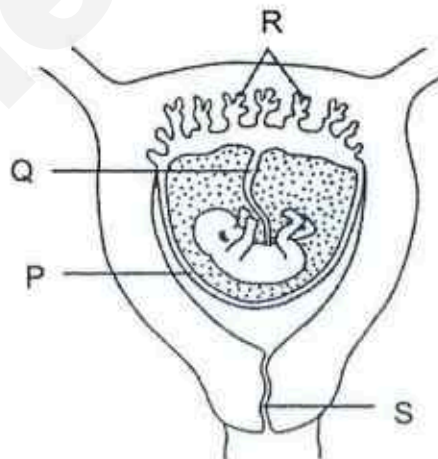
Which of the following nervous pathways will remain or be lost if S is cut?

	sensation of pain	voluntary action	reflex action
A	lost	lost	remain
B	lost	remain	remain
C	remain	lost	lost
D	remain	remain	lost

- 27 The diagrams show carpels from four different flowers. Which carpel is associated with wind pollination?



- 28 Which statement about pollen grains is correct?
- A An embryo is formed when a pollen grain fuses with the female gamete.
 - B Pollen grains are the male gametes of a plant.
 - C Pollen grains can only germinate if they land on the stigma of another flower.
 - D The sugary fluid of a stigma stimulates pollen grains to germinate.
- 29 The diagram shows a foetus developing in a uterus.



Which structures remove excretory products from the foetus?

- A P and Q
- B P and S
- C Q and R
- D R and S

- 30 Which part of the male reproductive system helps to maintain a lower temperature in the testes?
- A Cowper's gland
 - B prostate gland
 - C scrotum
 - D sperm duct
- 31 What is the basic unit of DNA?
- A base
 - B deoxyribose sugar
 - C gene
 - D nucleotide
- 32 Some stages involved in producing a transgenic plant are listed.
- 1 Cut out the gene using enzymes.
 - 2 Identify the gene in the donor species.
 - 3 Infect the crop plant with the bacteria.
 - 4 Insert the gene into the bacteria using plasmids.
 - 5 Let the bacteria reproduce.

In which order are these stages carried out?

- A 1 → 2 → 3 → 4 → 5
 - B 2 → 1 → 4 → 5 → 3
 - C 3 → 5 → 4 → 1 → 2
 - D 4 → 1 → 5 → 2 → 3
- 33 A married couple has three sons and the wife is pregnant with their fourth child. What is the chance that the fourth child will be a girl?
- A 6.25%
 - B 25%
 - C 50%
 - D 75%

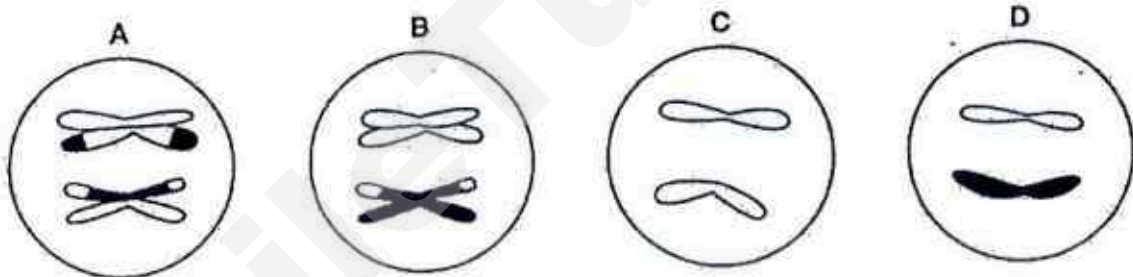
34 Which of the following could be a result of natural selection?

- A dogs that are friendly to humans
- B grapes that do not develop seeds
- C mosquitoes that are resistant to insecticides
- D onion crops with a pleasant taste to humans

35 The diagram shows a cell at anaphase I of meiosis.



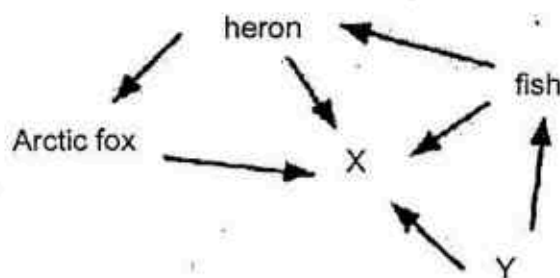
Which diagram shows a normal gamete that can be produced from this cell?



36 *Drosophila melanogaster* is a type of fruit fly with a diploid number of chromosomes. Cell division occurs in the *Drosophila melanogaster* in a similar way to humans. Each somatic cell has 8 chromosomes. Which statement about this type of fruit fly is correct?

- A After fertilisation, the zygote has 8 chromosomes.
- B After mitosis, the daughter cells produced have 4 chromosomes each.
- C It can produce gametes with 4 different genetic combinations.
- D It can produce gametes with 8 chromosomes.

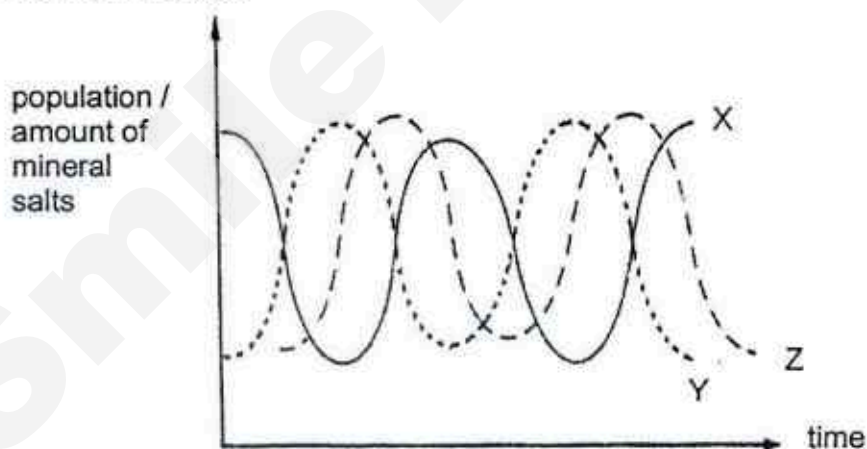
- 37 The diagram shows a food web on an Arctic island.



What are the possible identities of X and Y?

	X	Y
A	algae	man
B	bacteria	algae
C	bacteria	man
D	man	bacteria

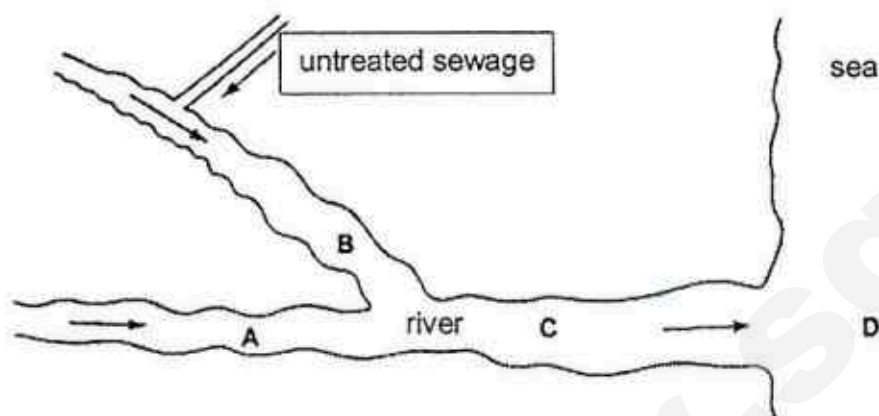
- 38 In a pond, variations in the population of producers, the population of consumers and the amount of dissolved mineral salts were measured over a period of 2-years. The graph shows the results.



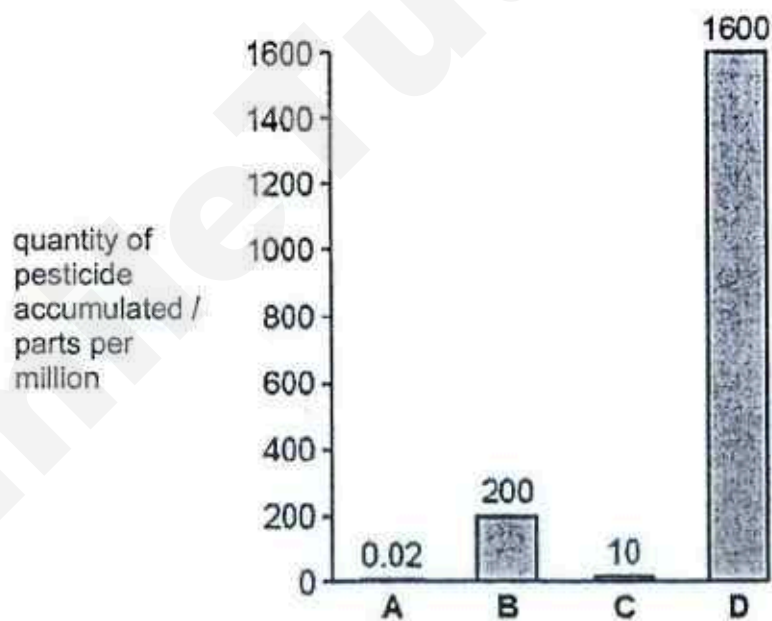
What does each line represent?

	dissolved mineral salts	producer population	consumer population
A	X	Y	Z
B	Y	Z	X
C	Z	X	Y
D	Z	Y	X

- 39 The diagram shows a river flowing into the sea. The river is polluted by untreated sewage. At which point (A, B, C or D) will the oxygen level be the lowest?



- 40 The graph shows the quantities of pesticides that accumulate in four populations (A, B, C and D) at different trophic levels in a food chain. Which population is likely to be herbivores?



Sec 4E Biology (5158)
Marking Scheme

Paper 1

1	-	11	C	21	A	31	D
2	B	12	B	22	A	32	B
3	B	13	A	23	C	33	C
4	B	14	A	24	B	34	C
5	C	15	D	25	B	35	D
6	B	16	A	26	D	36	A
7	D	17	C	27	B	37	B
8	C	18	C	28	D	38	A
9	C	19	D	29	C	39	B
10	A	20	A	30	C	40	C



ST. MARGARET'S SECONDARY SCHOOL

Preliminary Examinations 2017

CANDIDATE NAME

CLASS

REGISTER NUMBER

BIOLOGY

5158/02

Paper 2

22 August 2017

Secondary 4 Express

1 hour 45 minutes

Additional Materials: NIL; candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A

Answer **all** questions.

Write your answers in the spaces provided on the Question Paper.

Section B

Answer **all** the questions.

Write your answers in the spaces provided on the Question Paper.

Electronic calculators may be used.

You are advised to spend no longer than one hour on Section A and no longer than 45 minutes on Section B.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

For Examiner's Use	
Paper 1	40
Paper 2: Section A	50
Paper 2: Section B	30
Total	120
Parents' Signature	

This document consists of 14 printed pages.

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Section A

Answer all questions.

For
Examiners'
Use

Write your answer in the spaces provided.

- 1 Fig. 1.1 shows an experiment that was conducted to investigate the effect of a sugar solution of different concentrations on potato tissue. The distance moved by the air bubble was measured after 30 minutes.

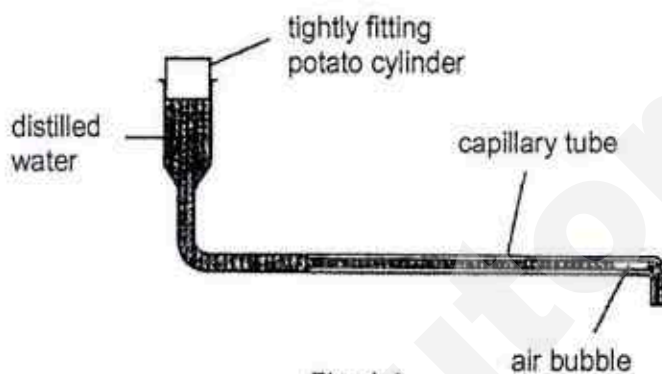


Fig. 1.1

- (a) Explain why the air bubble moved towards the left.

.....

.....

.....

.....

[3]

- (b) The experiment was repeated several times, each time with a fresh potato cylinder and a sugar solution of increasing concentration. At a particular concentration, the air bubble did not move even after 30 minutes. Explain this observation.

.....

.....

.....

[2]

- (c) The experiment was then repeated, but using a boiled potato cylinder. The air bubble moved towards the right. Explain the observation.

.....

.....

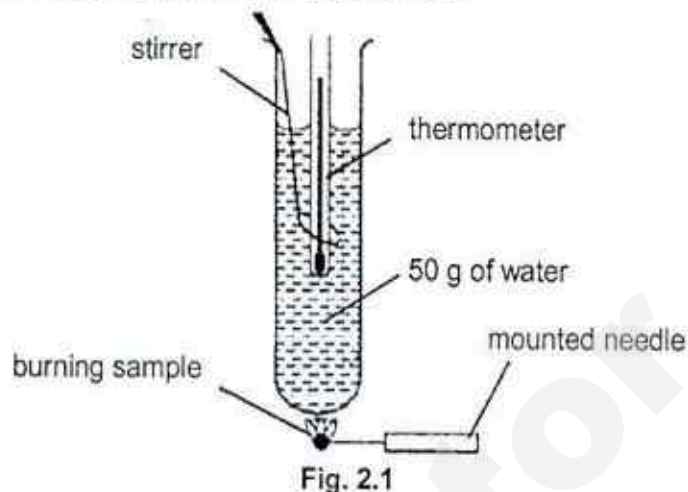
.....

[2]

[Total: 7]

- 2 The apparatus shown in Fig 2.1 can be used to measure the energy content of a food sample which contains mainly proteins. The food sample is fixed onto a mounted needle, set alight and held under a boiling tube of water, until it finishes burning. The temperature of the water is taken before and after burning the food.

For
Examiners' Use



- (a) Suggest a reason for stirring the water before the temperature is read.

[1]

- (b) It takes 4.2 J to raise the temperature of 1 g of water by 1 °C. In the experiment shown in Fig 2.1, the temperature of the water rose from 20 °C to 30 °C. Calculate the energy content of the food sample used.

[1]

- (c) The experiment was repeated using the same mass of food sample that contains mainly fats instead. Would the rise in temperature be higher, lower or the same as that in (b)?

[1]

- (d) The actual energy content of the food sample used in (b) and (c) are found to be higher than what was calculated from the experiment. Suggest a reason for this difference.

[1]

[Total: 4]

- 3 Fig. 3.1 shows a potted plant with a ring of bark removed at point X. Leaf B was enclosed within a transparent bottle containing air with radioactive carbon dioxide. The soil was watered with a solution containing radioactive phosphate ions. The entire plant was exposed to sunlight for six hours. The plant did not wilt at the end of six hours.

For
Examiners' Use

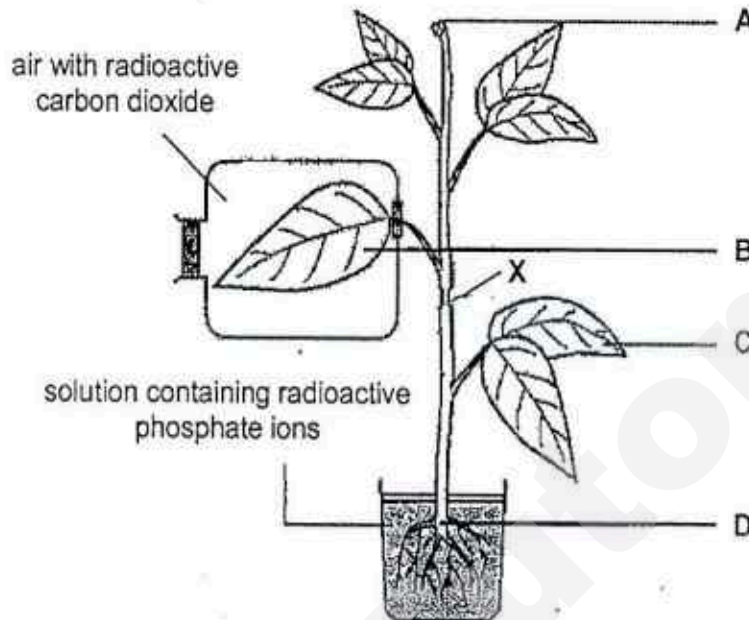


Fig. 3.1

- (a) Which tissue is removed when the ring of bark was removed at X?

[1]

- (b) (i) Which labelled part(s) A, B, C or D will be tested positive for radioactive carbon?

[1]

- (ii) Explain your answer.

[2]

- (c) (i) Which labelled part(s) A, B, C or D will be tested positive for radioactive phosphate ions?

[1]

- (ii) Explain your answer.

[1]

- (d) The bottle that enclosed leaf B was removed and the plant is left in darkness for two hours. The air surrounding leaf B was tested positive for radioactivity.

For
Examiners'
Use

(i) Which radioactive substance was detected?

..... [1]

(ii) Explain your answer.

..... [1]

[Total: 8]

- 4 Fig. 4.1 shows an experimental set-up using potato strips in hydrogen peroxide solution at room temperature. Potato cells contain an enzyme known as catalase, which breaks down hydrogen peroxide to release oxygen. The number of bubbles released per minute is counted to calculate the rate of catalase activity.

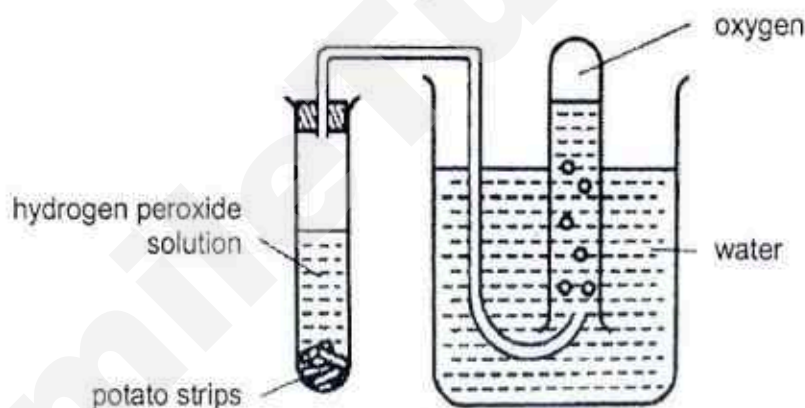


Fig 4.1

- (a) The potato strips were kept in the refrigerator before the experiment. Explain why there were no bubbles released initially when the strips were added to hydrogen peroxide.

..... [2]

- (b) Suggest and explain a change that can be made to the potato strips in this experiment so that the number of bubbles released per minute can be increased.

..... [2]

- (c) Lipases are also enzymes. However, when lipase solution was used in place of potato strips, no bubbles were released. Explain this observation.

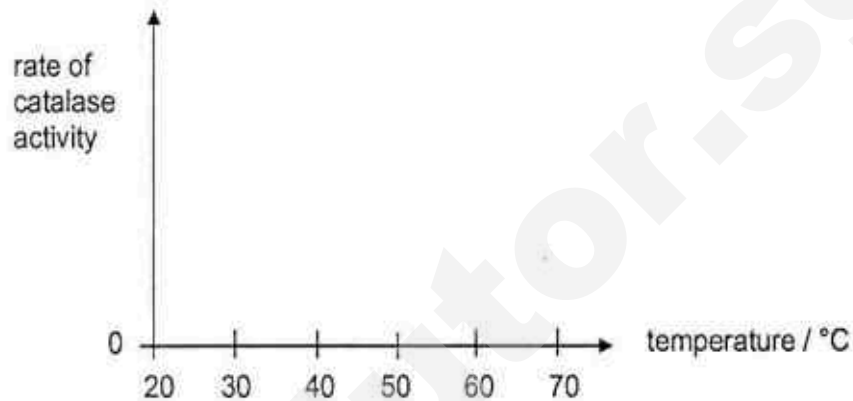
For
Examiners'
Use

.....

.....

..... [2]

- (d) In the axes below, sketch the graph of rate of catalase activity against temperature.



[2]

[Total: 8]

- 5 Mango plants can reproduced using seeds or a stem cutting. Stem cutting is done by cutting off a portion of the stem containing a growing shoot from the parent plant and growing it in soil directly.

- (a) State whether the reproduction method by seeds or stem cutting is asexual or sexual reproduction.

seeds

stem cutting

.....

.....

[1]

- (b) Given that mango plants are easily destroyed by infection of a certain fungus, explain which reproduction method is preferred by farmers to ensure successful reproduction.

.....

.....

.....

..... [3]

[Total: 4]

- 6 Fig. 6.1 shows a pair of homologous chromosomes.

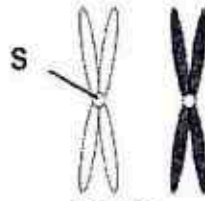


Fig. 6.1

For
Examiners'
Use

- (a) Name structure S.

[1]

- (b) "Homologous chromosomes carry the same genes but they may not be genetically identical." Do you agree with the statement? Explain why.

[1]

- (c) During meiosis, crossing over between homologous chromosomes occurs.

- (i) Describe what is meant by the term *crossing over*.

[3]

- (ii) In which stage of meiosis does crossing over occur?

[1]

- (d) A sample of tissue taken from the small intestine of an animal was analysed. Some of the cells had 10.8 units of DNA while others had only 5.4 units.

- (i) Suggest a stage of the cell cycle for the cells with 10.8 units of DNA and 5.4 units of DNA.

cells with 10.8 units of DNA

cells with 5.4 units of DNA

[2]

- (ii) How many units of DNA would be present in a gamete formed in this animal?

[1]

[Total: 9]

- 7 Fig. 7.1 shows the pedigree of a family who suffers from Leber's Congenital Amaurosis (LCA). Individuals with LCA have reduced vision at birth and can be blind from infancy.

For
Examiners' Use

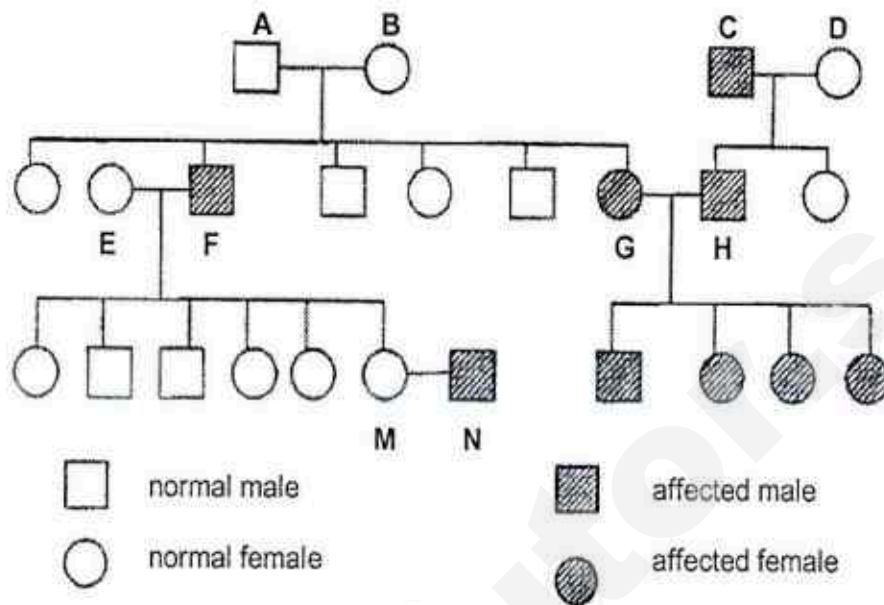


Fig. 7.1

- (a) LCA is a disorder caused by a recessive allele.

(i) Describe what is meant by the term *recessive*.

[2]

(ii) With reference to Fig. 7.1, explain how you can tell that LCA is caused by a recessive allele.

[2]

- (b) Describe the genotype of M.

[1]

- (c) What is the chance of M and N having a baby boy who suffers from LCA?

[1]

[Total: 6]

- 8 Fig. 8.1 shows the flow of energy through part of a food chain.

For
Examiners'
Use

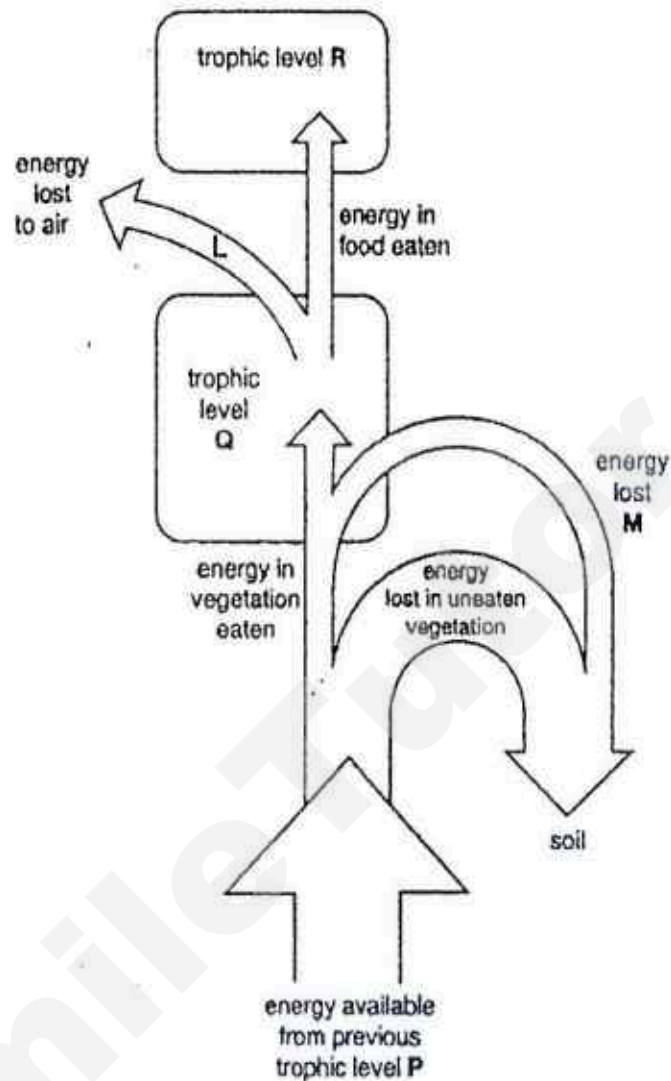


Fig. 8.1

- (a) What processes are likely to be responsible for the losses of energy at L and M?

L
M

[2]

- (b) Describe briefly how energy enters food chain at trophic level P.

.....
.....

[2]

[Total: 4]

Section B

Answer three questions.

For
Examiners' Use

Question 11 is in the form of an **Either/Or** question. Only one part should be answered.

- 9 Insulin injection is a treatment for Type 1 diabetic patients. Recently, a nasal spray containing insulin has been developed as an alternative treatment. Patients can inhale the spray to take in insulin directly through the lungs. In an experiment, Type 1 diabetic patients are divided into two groups and each received a different type of treatment. Fig. 9.1 shows the changes in insulin concentration in the blood plasma for both groups of patients.

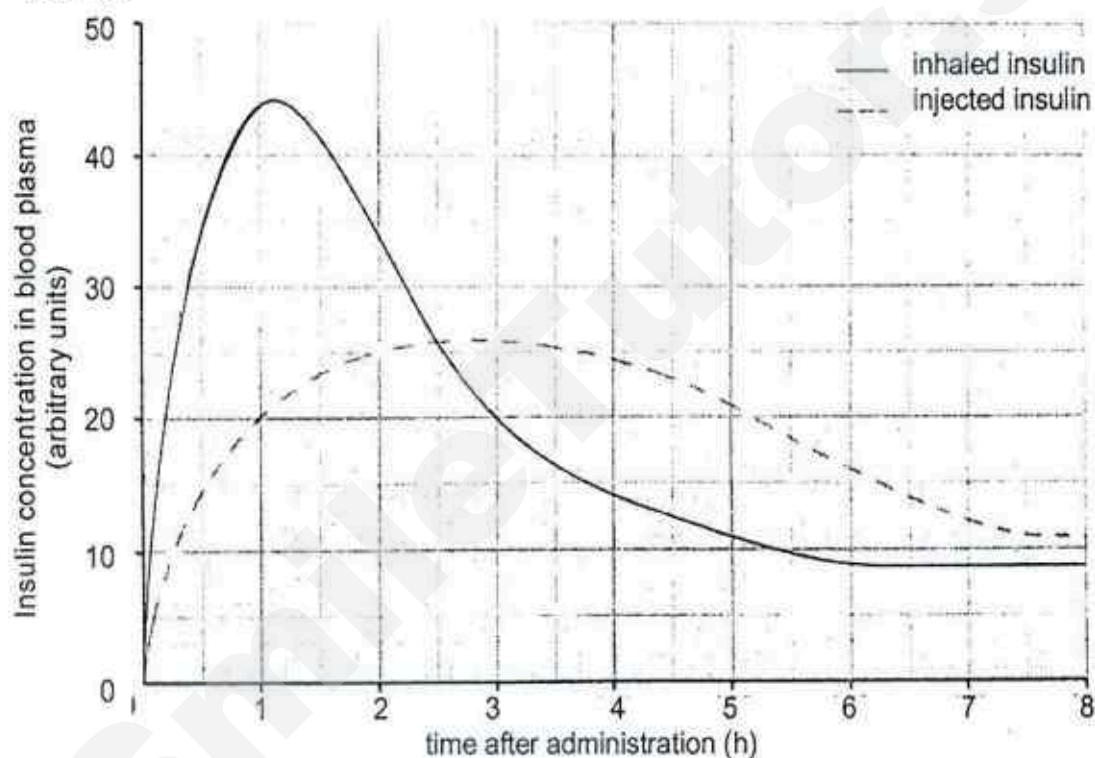


Fig. 9.1

- (a) With reference to Fig. 9.1, compare the blood insulin concentration in the patients receiving inhaled insulin and injected insulin.

.....

.....

.....

.....

.....

.....

[3]

Table 9.2 shows changes in the glucose concentration in blood plasma for patients receiving inhaled and injected insulin.

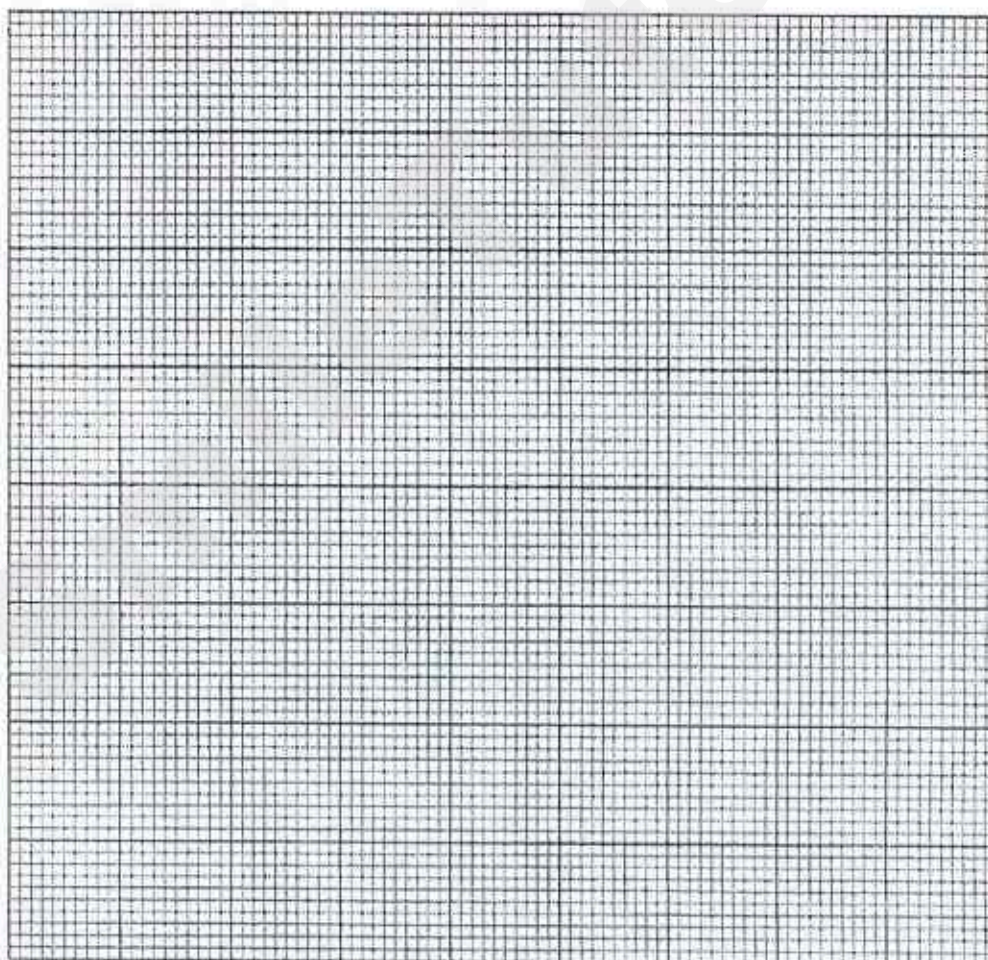
For
Examiners' Use

Table 9.2

time after administration (h)	0	1	2	3	4	5	6	7
glucose concentration in blood plasma of those with inhaled insulin (arbitrary units)	35	15	8	6	7	14	16	20
glucose concentration in blood plasma of those with injected insulin (arbitrary units)	35	24	20	13	6	8	10	11

(b) Plot these data on the grid below.

[4]



(c) Briefly explain how insulin leads to the drop in blood glucose concentration in the first few hours.

[1]

- (d) State two conclusions that can be made by comparing the effectiveness of inhaled insulin and injected insulin.

For
Examiners'
Use

[2]

[Total: 10]

- 10 (a) Describe how substances found in cigarette smoke can lead to difficulties in breathing through chronic bronchitis.

[5]

- (b) Outline the mechanism of exhalation.

[5]

[Total: 10]

11 EITHER

(a) Explain the differences in composition of blood in the renal vein compared to the renal artery.

[4]

(b) Explain why a person would usually urinate less often when he is exercising under the hot sun for a long period of time.

[6]

[Total: 10]

11 OR

For
Examiners'
Use

(a) Describe the structural differences of an artery and capillary.

[4]

(b) The average speed of blood in a human artery is 50 cm/s, but the average speed of blood in a human blood capillary is 0.05 cm/s. Account for this difference and explain its significance.

[6]

[Total: 10]

Sec 4E Biology (5158)
Marking Scheme

Paper 1

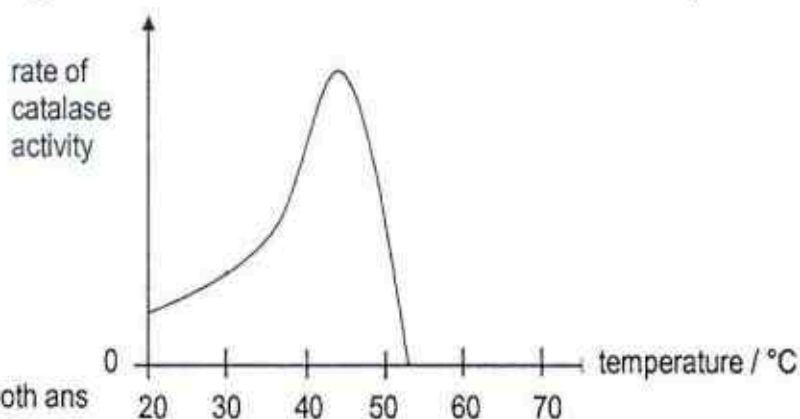
1	—	11	C	21	A	31	D
2	B	12	B	22	A	32	B
3	B	13	A	23	C	33	C
4	B	14	A	24	B	34	C
5	C	15	D	25	B	35	D
6	B	16	A	26	D	36	A
7	D	17	C	27	B	37	B
8	C	18	C	28	D	38	A
9	C	19	D	29	C	39	B
10	A	20	A	30	C	40	C

Paper 2
Section A

- 1
 - (a) Water has a higher water potential than potato cells [1].
Water molecules move into the cells via osmosis [1] through the partially permeable cell membrane [1].
 - (b) The water potential / concentration of the sugar solution is the same as that of the potato cells [1].
There is no net movement of water molecules [1] in or out of the cells.
(R: "No osmosis" & "Water molecules did not move through membrane.")
 - (c) Boiling destroyed the cell surface membrane of the cells [1].
Cell contents leaked out / diffused out of the cells [1].
- 2
 - (a) To ensure temperature is uniform in the boiling tube [1].
(R: "Temperature is constant" as it suggests uniformity in terms of time)
 - (b) $4.2 \times 50 \times 10 = 2100 \text{ J}$ [1] (R: no units)
 - (c) Higher [1].
 - (d) (any one) [1]
There was heat loss to the environment.
Not all the food sample was burned completely.
Some energy was converted to light energy and lost.
The layer of soot formed around the boiling tube lowers heat transfer to the water.
The flame was not placed under the tube promptly after the food caught fire.
- 3
 - (a) Phloem [1].

- (b) (i) A and B [1].
- (ii) **(R: carbon dioxide is required/ absorbed for photosynthesis.)**
Carbon dioxide is a substrate of photosynthesis / Carbon dioxide is incorporated into the glucose made during photosynthesis [1]. The radioactive sugars formed in leaf B can be translocated through the phloem up to A [1].
(R: "Phloem was still intact, hence food was still translocated to A" as the role of phloem in translocation is not explicit)
- (c) (i) A, B, C and D [1].
- (ii) Phosphate ions are transported up through the xylem [1], which is unaffected by the ringing at X.
(R: "Xylem was still intact, hence minerals was still transported" as the role of xylem in mineral transport is not explicit)
- (d) (i) Carbon dioxide [1].
- (ii) **Max: [1]**
The cells respire and break down / oxidise radioactive sugars / glucose [1].
The cells respire and release carbon dioxide [1].

- 4 (a) At low temperatures, kinetic energy of enzymes is low [1]. The rate of effective collisions between enzymes and substrates is low / rate of formation of enzyme-substrate complex is low [1], resulting in low rate of reaction.
- (b) **(R: "Increase temperature to optimum" & "Increase number of potato strips" as the change should be made to existing potato strips)**
Cut the potato strips into smaller pieces [1]. This increases surface area to volume ratio to release catalase from potato to break down hydrogen peroxide [1].
- (c) Lipase molecules have active sites that are not complementary to hydrogen peroxide molecule / hydrogen peroxide molecule is unable to fit into the active site of lipase [1].
Hydrogen peroxide cannot be broken down [1].
(R: Descriptions on fats not containing hydrogen peroxide)
- (d) [1]: Curve increased, from a non-zero value on vertical axis, then decreased.
[1]: Curve peaked $\leq 50^{\circ}\text{C}$ and declines to a zero. Decrease is steeper than increase.



- 5 (a) [1m if both ans

seeds: sexual reproduction.
stem cutting: asexual reproduction.

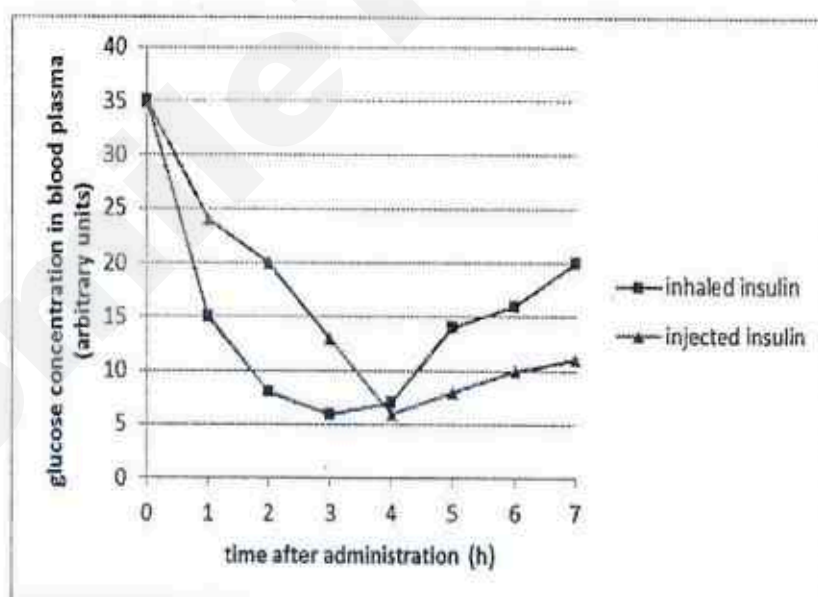
- (b) Seeds. Growing the plants from seeds will ensure genetic variation [1]. (*R: Comparison with parents only*) This makes the species more adaptable to changes in the environment [1]. When the fungus infects the plants, not all the plants will be susceptible to the infection [1]. (*Note: Not to assume that parent plants are resistant to infection*)
- 6 (a) Centromere [1].
- (b) Yes. They can carry different alleles / different forms of the same gene [1].
- (c) (i) Chromatids of homologous chromosomes cross / twist [1], to form chiasma(ta) [1]
Parts of the chromosomes break and exchange parts [1].
- (ii) Prophase I [1].
- (d) (i) 10.8 units: interphase / prophase / metaphase / anaphase [1].
5.4 units: telophase / cytokinesis [1].
- (ii) 2.7 units [1].
- 7 (a) (i) A recessive allele does not express itself in the heterozygous condition [1]
but only in the homozygous condition [1].
- (ii) A and B are normal, but they have children F and G who are affected [1].
They must have a recessive allele / heterozygous and passed on one recessive allele each to F / G [1].
- (b) Heterozygous [1].
- (d) 25% [1].
- 8 (a) L: respiration [1].
M: death / decomposition [1].
- (b) Light energy is converted into chemical energy [1] through photosynthesis [1].

Section B

- 9 (a) [2m for similarities + 1m for difference OR 1m for similarity + 2m for differences]
 Similarities [1m each. Max 2m]
- Insulin concentration increased before decreasing in both types of patients.
 - Insulin concentration reached a constant of about 10 units in both patients from about 7.5h after administration.

Differences [1m each. Max 2m]

- Insulin concentration peaked about 2h earlier in the patients who received inhaled insulin (or quote values of ≈ 1 h and 3h for both groups of patients).
 - Insulin concentration peaked at about 25 units higher in the patients who received inhaled insulin (or quote values of ≈ 44 and 26 units in both groups of patients).
 - Insulin concentration took about 1h more to fall back to normal range from the maximum insulin concentration in patients who received injected insulin (or quote values of ≈ 4 h for patients with injected insulin and ≈ 5 h for patients with inhaled insulin).
- (b) Horizontal (x) axis labelled as "time after administration" and vertical (y) axis labelled as "glucose concentration in blood plasma" [1].
 Size of graph is at least half the grid + good scale [1].
 All points plotted correctly for both groups of patients ([1] x 2).
 -0.5m if points are not joined point to point.
 -0.5m if graphs are not labelled.



- (c) Insulin stimulates conversion of excess glucose to glycogen [1] in liver and muscles. / increase cell permeability to glucose to increase uptake of glucose into cells [1].
- (d) Inhaled insulin has a faster response time than injected insulin [1].
 The effect of injected insulin is longer lasting than inhaled insulin [1].

- 10 (a) Tar and irritants found in cigarette smoke can lead to chronic bronchitis [1].

(R: carbon monoxide – not directly linked to chronic bronchitis)
Epithelium lining of airways is inflamed [1].
Excessive mucus is secreted [1].
Cilia lining the airways are paralysed [1].
Mucus and dust particles are not removed [1]. (A: dust-trapped mucus)
 Breathing difficulties occur due to blocked airways.

- (b) Diaphragm relaxes and arches upwards [1].
External intercostal muscles relax while internal intercostal muscles contract [1].
 Ribs move downwards and inwards [1].
 These processes decrease volume of thoracic cavity [1].
 Pressure of thoracic cavity increases until it is higher than that of atmospheric pressure [1]. (R if no comparison with atmospheric pressure)
 Air is forced out of the lungs.
 (R: description of pressure change as the driving force behind rib and diaphragm movement)

11 Either

- (a) (any two pairs)

Difference between renal vein and artery [1]	Explanation [1]
Blood in the renal vein contains less oxygen.	Oxygen is used up for <u>respiration</u> in kidney cells.
Blood in the renal vein contains more carbon dioxide.	Carbon dioxide is produced during <u>respiration</u> in kidney cells.
Blood in the renal vein contains less / almost no urea but blood in the renal artery does. (A: nitrogenous waste products) (R: excretory / metabolic waste products)	Urea is excreted / removed by kidneys.
Blood in the renal vein has lower concentration of mineral salts.	<u>Excess mineral salts</u> are removed by kidneys.
Blood in the renal vein has lower water potential. (R: water concentration / water level)	<u>Excess water</u> is removed by kidneys.

- (b) Exercising under the hot sun causes sweat production to increase [1].
 More water is lost through sweating, reducing blood water potential [1].
 The hypothalamus detects the change/decrease/drop in the blood water potential [1].
 More anti-diuretic hormone (ADH) is released by the pituitary gland [1].
 Permeability of collecting duct is increased [1], resulting in more water (re)absorption [1].

11 Or

- (a) [1m for each pair]

artery	capillary
Wall is made up of muscles	Wall is made up of cells
Wall is thick	Wall is one-cell thick
Wall is elastic, able to stretch and recoil	Wall is non-elastic
Lumen is relatively big	Lumen is relatively small
Larger in size	Microscopic in size

- (b) Average speed of blood in the artery is higher [1].

The artery leads blood away from the heart [1], and the heart creates the high pressure when its muscles contract [1], resulting in the high speed of blood.
This allows blood to be pumped to body cells quickly [1].
Capillaries are highly branched/has a large cross-sectional area, resulting in low pressure [1], and consequently the low speed of blood.
This allows time for exchange of substances to occur [1].

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CHIJ St. Nicholas Girls' School
2017 Secondary 4 (O Level) Biology Prelim
Marking Scheme and Markers' Report

General Comments

Generally, candidates who attempted the **Either** question performed better than the other option. Many candidates did not read the questions thoroughly before attempting them, leading to loss of time in answering, especially in the Essay section. Candidates need to manage their time well and not spend too much time on Section A.

Paper 1 (40 marks)

Question	1	2	3	4	5	6	7	8	9	10
Answer	C/D	C	A	C	C	C	C	D	D	A

Question	11	12	13	14	15	16	17	18	19	20
Answer	C	C	D	B	D	C	B	C	B	C

Question	21	22	23	24	25	26	27	28	29	30
Answer	C	B	D	B	C	C	B	A	D	B

Question	31	32	33	34	35	36	37	38	39	40
Answer	B	C	C	A	A	D	B	C	A	D

Comments on MCQ

Question 5

Many chose distractor D instead. Being incompressible allows blood to be pushed forward, hence this statement is correct with regards to water being suitable to be used in the blood transport system.

Question 10

Many chose distractor C. statement 4 is wrong because if less digestion occurs, the patient should not have high blood glucose concentration (hyperglycemia).

Question 11

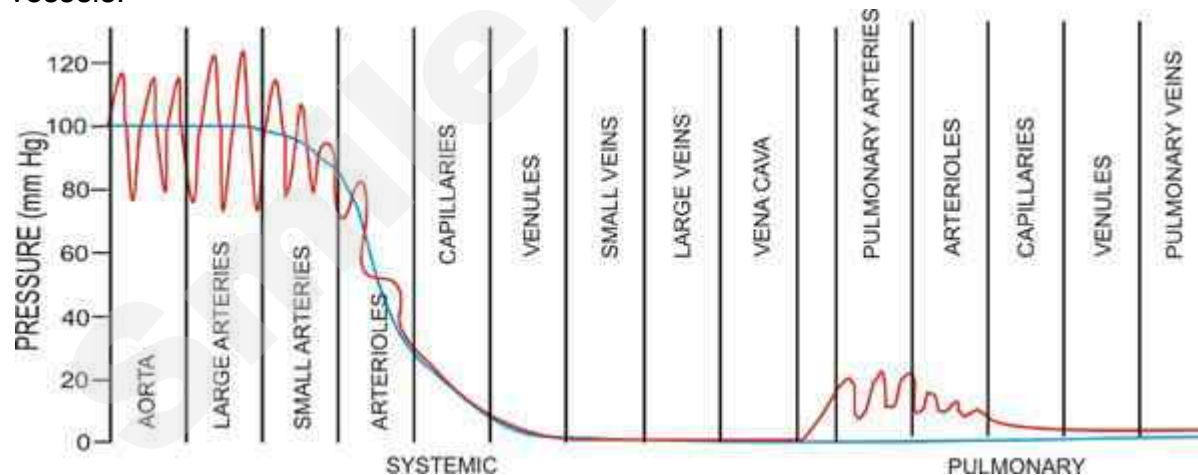
Many chose distractor B. Students need to revise and familiarise themselves with the concept of limiting factor. At point B light intensity is still the limiting factor.

Question 17

Many chose distractor A. The exit of glucose and amino acids at the arterial end as well as along the capillary network. But the presence of plasma proteins in the blood capillaries maintain the blood osmotic/water potential and draws water molecules to themselves, hence resulting in the difference in water potential and points X and Y.

Question 18

Many chose distractor D. vena cava (Q) has the lowest blood pressure just before it reaches into the right atrium of the heart. Pulmonary artery (R) would have higher blood pressure than pulmonary vein (S). Refer to textbook page 160 for diagrammatic representation of bp in vessels.



Question 21

Many chose distractor A. Carbon dioxide should increase as blood flows from P→Q as the cells are respiring as well.

Question 22

Many chose distractor A or D. Children in general do not have low metabolic rates; but their surface area: volume ratio is larger, hence resulting in faster heat loss. Similarly, smaller animals like rats lose heat faster to surroundings as compared to larger animals like elephants.

Question 31

Many chose distractor A. L is the rectum, metabolic waste products are produced by cells, but L contains egested waste materials.

Question 37

Many chose distractor A. Statement 2 is also correct because there are 3 types of fur pattern (spotted, rosette and marbled) hence showing discontinuous variation. But between cat 1 and 2, there is different degrees of spots, but no clear cut phenotype, hence showing continuous variation as well.

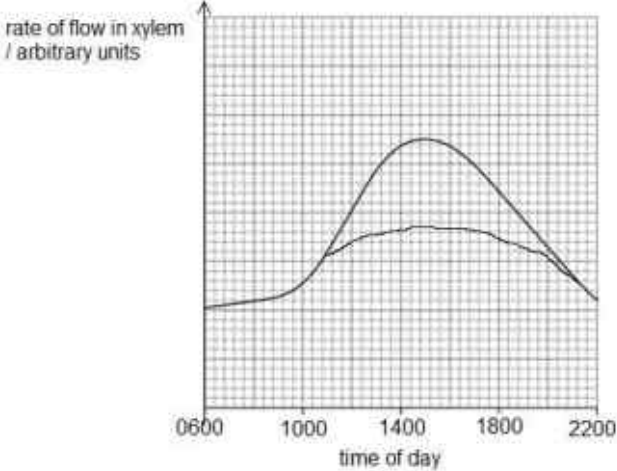
Question 40

Many chose distractor B. Although all living thing die and decay and the carbon is released as carbon dioxide and methane, there is only one single process that is able to convert the carbon dioxide in the atmosphere into other forms (carbs, fats, proteins etc) – photosynthesis.

Paper 2
Section A (80 marks)

Qn	Answer	Marks	Markers' Report										
1a	Microvilli; Increase surface area for volume ratio for absorption;	0.5m each [1]	Some students mistaken microvillus for villus. Please read question – microvilli is the folding of the intestinal epithelial cell membrane.										
1b	Trypsin/protease; Catalyse; Breakdown of protein to polypeptides/peptones; Erepsin/peptidase; Breakdown of polypeptides to amino acids; Alkaline/pH 8-9 environment;	0.5m each [3]	Some students again, did not read question, and talked about digestion of fats and carbohydrates as well. Some were confused about the enzymes and their functions.										
1c	<table><tr><th>organelle</th><td></td></tr><tr><td>E</td><td>Rough endoplasmic reticulum</td></tr><tr><td>F</td><td>Golgi apparatus/body</td></tr><tr><td>G</td><td>Mitochondrion</td></tr><tr><td>H</td><td>nucleus</td></tr></table> <p>Spelling must be correct and singular</p>	organelle		E	Rough endoplasmic reticulum	F	Golgi apparatus/body	G	Mitochondrion	H	nucleus	0.5m each [2]	Generally well done, except some who mistook H for vacuole. Animal cells do not have large central vacuoles.
organelle													
E	Rough endoplasmic reticulum												
F	Golgi apparatus/body												
G	Mitochondrion												
H	nucleus												

Qn	Answer	Marks	Markers' Report
2(ai)	<p>Between 1000-1400, <u>light intensity increases</u>/ highest level of sunlight; Guard cells photosynthesize more and <u>stomata opens wider/ widely</u>;</p> <p><u>Steeper water vapour concentration gradient</u> between <u>intercellular air spaces and atmosphere</u>; More water vapour diffuses out of stomata/more water lost via transpiration /more water loss due to high transpiration rate; Need to replenish <u>thin film of moisture</u>; so more water is <u>drawn from xylem into mesophyll cells</u>/ greater <u>transpiration pull to replace loss of water/ osmosis occurs to cause water to enter cells with lower water potential</u>, resulting in increase flow rate</p> <p>OR</p> <p>Between 1000-1400, temperature increases; More <u>evaporation of water from thin film of moisture</u>;</p> <p><u>Steeper water vapour concentration gradient</u> between <u>intercellular air spaces and atmosphere</u>; More water vapour diffuses out of stomata/more water lost via transpiration /more water loss due to high transpiration rate; Need to replenish <u>thin film of moisture</u>; so more water is <u>drawn from xylem into mesophyll cells</u>/ greater <u>transpiration pull to replace loss of water/ osmosis occurs to cause water to enter cells with lower water potential</u>, resulting in increase flow rate</p>	0.5m each [3]	<p>Evaporation of water vapour through stomata -0m</p> <p>instead of <u>loss of water vapour through stomata</u> (or <u>diffusion of water vapour</u>- which is already in gaseous state. Water evaporates to form water vapour and water vapour diffuses out)</p> <p>Water needed for photosynthesis - 0m (does not explain transpiration rate)</p>

Qn	Answer	Marks	Markers' Report
2(aii)	<p>Lower curve, difference starts from 1100 onwards</p>  <p>rate of flow in xylem / arbitrary units</p> <p>0600 1000 1400 1800 2200</p> <p>time of day</p>	[1]	<p>Common errors:</p> <p>Lower curve not drawn starting from 11 am or slightly after 11 am (allowance upto ~12 noon)</p> <p>Drawing of straight line, not curve – at the hottest time of the day and after (the shape of the curve should follow the original curve but lower).</p> <p>Extending line out of the original curve (showing higher transpiration at the end of the day than would be normal)</p> <p>Each mistake -0.5 deduction</p>
2(b)	<p>Swellings <u>above and below the debarked area</u>;</p> <p>Manufactured <u>food materials/sugars and amino acids / sucrose</u> cannot be transported;</p> <p><u>Up and down past the debarked area</u>/ transport was <u>bi-directional</u>;</p> <p><u>Phloem absent</u> / removed</p>	0.5m each [2]	<p>Student failed to state the swellings were <u>above and below the debarked area</u>. Wrongly assumed that swelling was near leaves only.</p> <p>Common omission – transport is bidirectional (only one direction mentioned).</p> <p>Misconceptions:</p> <ul style="list-style-type: none"> • Glucose or starch/ both glucose and sucrose transported in phloem - 0m • As xylem was exposed, water

Qn	Answer	Marks	Markers' Report
			loss caused wilting (disregarded issue of swelling)
3(a)	<p>O₂ concentration: Seals have a higher rate of oxygen consumption than Man;(0.5) Which allows for <u>higher rate of aerobic respiration</u>; for (0.5) which releases <u>more energy for muscular contractions</u> / <u>releases more heat</u> ; (0.5)</p> <p>OR Seals have a higher oxygen concentration in blood than Man;(0.5) Enable cells to <u>carry out aerobic respiration longer</u> (0.5) to <u>releases large amount of energy for longer time/ can dive longer</u> before anaerobic respiration begins/ lactic acid buildup; (0.5)</p> <p>Body fat: Seals have a thicker layer of fat under the skin than Man;(0.5) To act as <u>an insulating layer</u> ;(0.5) Serves to <u>reduce heat loss to the icy water/ environment</u>; (0.5)</p>	0.5m each [3]	<p>Comparison that levels were <u>higher</u> for oxygen and fat in the seal must be stated (some careless omissions)</p> <p>More heat <u>produced</u>-0m (heat is released)</p> <p>Increased oxygen concentration enables increased metabolic rate - 0m (<u>aerobic respiration/ tissue respiration must be stated</u> as this has to do with oxygen level)</p>
3(b)	<p>Body temperature is lower nearer the skin surface /<u>higher further away closer to internal organs</u>; (0.5) <u>Vasoconstriction of arterioles</u> near skin surface (0.5); Little heat loss from skin surface via <u>conduction, convection and radiation</u>; (0.5) <u>More blood</u> circulates around the <u>internal organs/ vital organs</u>; (0.5)</p> <p>OR the <u>temperature difference between the skin and water is small to reduce significant heat loss to environment</u> /<u>temperature gradient</u> between skin and water is <u>not steep</u> so that core body temperature/ inner organs remain warmer during diving (0.5)</p>	0.5m each [2m max]	<p>Concept of blood transporting heat and vasoconstriction results in more blood being channelled to internal organs is weak. If values are quoted correctly based on graph with correct unit – ½ m Latent heat lost -0m (no evaporation of water from skin under water)</p> <p>Higher % of fat near skin surface to increase insulation-0m as this does</p>

Qn	Answer	Marks	Markers' Report
	(Max 2m)		NOT explain the low temperature at the skin surface.
3(c)	<p>Arteriole X <u>vasoconstricts</u>/ shunt in vessel X constricts (0.5);</p> <p>Arteriole Y <u>vasodilates</u> (0.5);</p> <p>More blood flows through the <u>capillaries</u> closer/<u>nearer</u> to skin surface (0.5) ;</p> <p>So more heat lost from skin by <u>conduction, convection and radiation</u>; (0.5)</p> <p>Spelling errors seen – ‘vasodialation’</p>	0.5m each [2]	<p>Students to identify type of vessels.(deduction if at least one arteriole is not identified)</p> <p>Some difficulty identifying X and Y as arterioles, failure to mention capillaries have increased blood flow.</p> <p><u>Common error</u>:</p> <p>Capillaries vasodilate -0m</p> <p>Capillaries do not constrict/ dilate but arterioles. Blood vessels also do NOT move closer/ further from skin surface.</p> <p>Latent heat lost through conduction, convection and radiation – incorrect as latent heat is lost when there is a change of state/ evaporation of water.</p>
3(d)	<p><u>Evaporation of water in sweat</u> which removes heat from skin (0.5);</p> <p><u>As latent heat of vapourisation (0.5) ;</u></p> <p>Or</p> <p>Panting removes heat;</p> <p>due to evaporation of water from saliva as latent heat/ convection to air;</p> <p>OR</p> <p>Fur lies flat on skin reducing air trapped;</p> <p><u>Reduces insulating layer</u> of air <u>more heat can be lost</u>;</p> <p>OR</p>	0.5m each [1]	Sweating= perspiring (osmoregulation –vague, 0m)

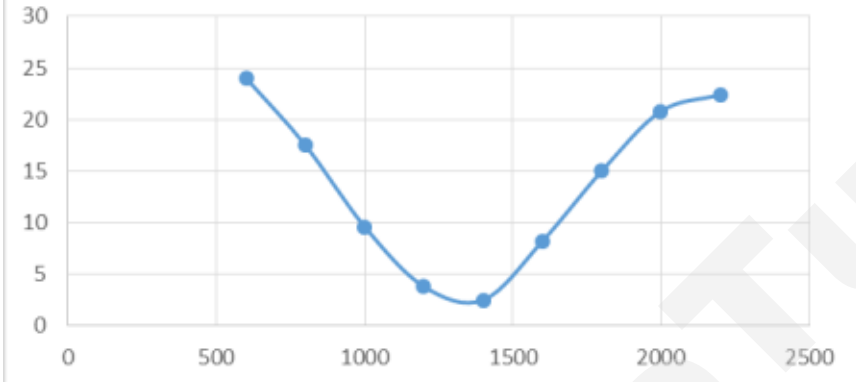
Qn	Answer	Marks	Markers' Report
	Slowing down of metabolic rate; To <u>reduce heat released</u> and <u>decrease temperature</u>		
4(a)	Figure 4.1: Cortex (0.5) Reason: presence of Bowman's capsule/ glomeruli seen/ renal capsules (0.5) Figure 4.2 : Medulla (0.5) Reason: Sections of kidney tubules/ collecting ducts/ sections of loop of Henle / collecting ducts seen (0.5)	0.5m each [2]	Mostly identified the photos as parts of kidney nephron instead of parts of the kidney.
4(b)	Active sweating results in decrease in blood water potential; Hypothalamus produces/secreted more <u>Anti-diuretic hormone</u> ; <u>pituitary gland releases</u> more ADH; <u>DCT and CT:</u> More permeable to water; More <u>reabsorption</u> of water back into surrounding blood capillaries; To increase blood water potential to norm	0.5m each [3m max]	As long as mentioned Anti Diuretic Hormone once – 0.5m awarded
5(a)	Platelets and <u>damaged blood vessels/tissues</u> ; Release thrombokinase; Which <u>catalyse (award once)</u> ; conversion of prothrombin → thrombin (Ca^{2+} needed here); Which catalyse conversion of (soluble) fibrinogen → (insoluble) fibrin threads; form mesh to trap blood cells to form blood clot	0.5m each [3]	Students have to be careful of their phrasing: 'Damaged platelets....' → × 'platelets and tissues form thrombokinase' → × 'thrombin to prothrombin' → × 'fibrin to fibrinogen' → ×
5(bi)	<u>Both enzymes and substrates</u> gained/increase kinetic energy; Move faster and frequency of <u>effective</u> collisions increase; More <u>enzyme-substrate complexes</u> form; Blood clot takes shorter time to form	0.5m each [2]	Many students still missing the link that both enzymes and substrates (reactants) gain KE; as well as keywords required for enzyme related questions

Qn	Answer			Marks	Markers' Report
5(bii)	Hydrogen bonds in enzyme/substrate broken; Due to vigorous vibrations in molecule; Enzyme denature/destroyed; Less enzyme-substrate complexes form/ substrate cannot fit into active site; Longer time for blood clot to form			0.5m each [2 max]	Generally well done.
6(a)		X: umbilical arteries [0.5] Must be plural, spelling correct	Y: umbilical vein [0.5]	1m each [3]	Some could not spell or identify the vessels correctly. Also confused with the materials carried by each type of vessel. The umbilical vessels originate from the fetus, hence umbilical arteries carry blood away from fetus; umbilical vein carries blood to fetus.
	materials transported (List 2 of each vessel)	Urea, carbon dioxide, nitrogenous waste products [1.5 for both]: every mistake made -0.5m ECF applies if vessels named wrongly	Amino acids, glucose, antibodies, oxygen, vitamins		
	direction of blood flow	Fetus → placenta/mother [0.5]			
6(bi)	Rh allele is dominant ; Both parents heterozygous genotype; Each contribute one recessive (Rh-) allele; Child is homozygous recessive			0.5m each [2]	Generally students understand the inheritance, but are unable to articulate. Heterozygous already means different alleles present, and it refers to genotypes. Reference to alleles instead of

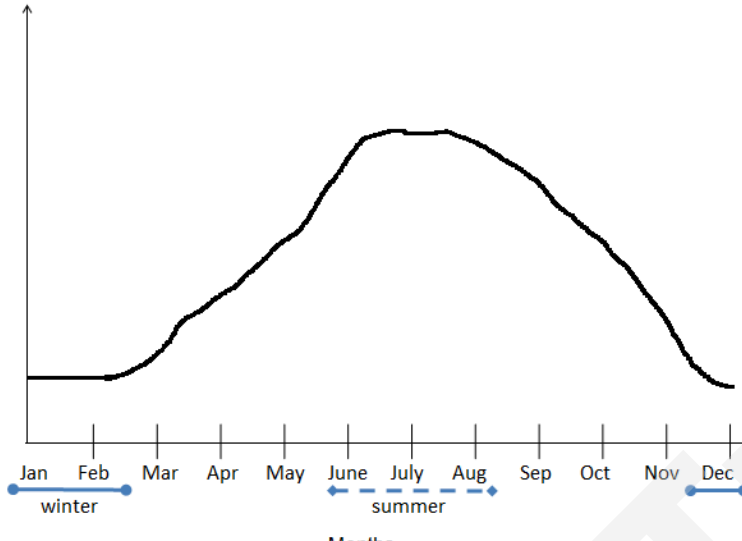
Qn	Answer	Marks	Markers' Report
			antigens should be made instead. And no need to give probability.
6(bii)	<p>Punnett Square [1m] woman: r and r gametes + man: R and r gametes circled; offspring genotypes correct</p> <p>→ Sex-linked Punnett square drawn: 0m → Gametes not circled –½ m → Different letters (not caps/small) used –½ m → Offspring genotype not diploid/missing –½ m</p> <p>Working [0.5m]: $P(\text{female and Rh}+) = 0.5 \times 0.5$ Answer: 0.25 [0.5]</p>	[2]	<p>Generally well done; for those students who understood concept of inheritance. Please be careful and remember to circle gametes.</p> <p>Calculation of probability some forgot about gender (50/50 chance) and 'autosomal' means not sex-chromosome.</p>
7(ai)	<p>Genetically identical to parent plant. One single parent. Form of asexual reproduction/ no fertilisation/ no pollination occurs/ no fusion of gametes.</p>	Any 1 [1]	Clones are genetically identical, not similar.
7(aii)	<p>Exposed to different amounts of sunlight/nutrients/water; Growth rate is different</p> <p>Reject: environment factor</p>	[1]	Some students mistaken this question to talk about natural selection.
7(bi)	<p>Triploid: 36 Diploid: 24 Haploid: 12 Offspring: 36</p>	0.5m each [2]	

Qn	Answer	Marks	Markers' Report
8(a)	(i) CGT TAC CAA (ii) X: CGU Y: UAC Z: CAA each mistake -½m	1m each	Some students still cannot remember that RNA does not contain thymine (T).
8(b)	Substitution of a single base may not result in change in polypeptide sequence/amino acid added/ same polypeptide produced/ More than one codon codes for the same amino acid; Amino acid produced/formed/made → -½m tRNA codes for amino acid → -½m	[1m]	Generally students able to understand that one amino acid is CODED by more than one codon, so the protein produced remains unchanged.
8(ci)	Milk is only/sole food source for infants; As they grow they are able to obtain energy from other food sources - or in their own words/meaning same- Infants drink more milk than adults → ½m ; no reference to adults → 0m	[1m]	
8(cii)	Random mutations cause lactase gene to be permanently switched on/ not switched off/cause some to continue producing lactase as adults; Introduction of dairy products in diet (selection pressure); Those able to digest lactose in milk can obtain more nutrients are at selective advantage; Survive and reproduce; Pass on this trait to their offsprings; Over many generations, population carrying the LP trait increased	0.5m each [3]	Students who understood context of question and followed the natural selection template would do well. Some were lost and thought the cattle developed LP instead. (Why?)

Section B (30 marks)

Qn	Answer	Marks	Markers' Report
9(a)	<p>distance of filamentous algae from lake's surface / cm</p>  <p>Scale- 1m (origin must be labelled correctly; takes up min. 50% of grid; x-axis should not be odd-scale of 10sq= 3hr) Line – 1m (smooth curve or best fit curve) Axes- 1m (written in full with units) Points -1m (allow for 1 mistake in plotting)</p>	[4m]	<p>Some students still have problems with graph plotting. Please study the values before deciding on the scale. Refrain from using odd scales like 10sq = 3hr; 10 sq = 30 which will result in inaccurate values plotted.</p> <p>Some students plotted bar graph instead. But time is not discrete or categorical variable. If student wants to attempt a curve/line of best fit, ensure that number of points above/below are equal and near the line/curve.</p>

9b	<p>At 1400 the distance of algae to surface is nearest/smallest while it is furthest at 2000;</p> <p>light intensity is the <u>strongest</u> at 1400; Rate of photosynthesis in algae high and <u>a lot of oxygen is released</u>; Algae becomes <u>more buoyant/ less dense</u> and floats up nearer to surface of lake;</p> <p>Night time/ <u>no light</u> at 2000; Algae <u>only respire</u>s /rate of respiration higher than photosynthesis; Sinks further down</p>	0.5m each [3m max]	<p>Many students misread question, thinking it is from 1400 to 2000 → question asking at 2 timings: 1400 <u>AND</u> 2000.</p> <p>Many students also fail to understand that photosynthesis is not a choice, and plants/algae do not decide whether they float or sink to get more light to photosynthesize. They fail to link photosynthesis with oxygen production and talked about transpiration/gaseous exchange instead.</p>
9ci	<p>Dry the algae; until its mass stays constant/</p>	0.5m each [1]	<p>Many fail to explain the concept of how to obtain accurate dry mass – all water is evaporated when the mass of algae no longer decreases.</p>

9cii	<p>Biomass of algae / kg</p>  <p>Months</p>	<p>[1] Highest during summer; lowest during winter</p>	<p>Students could understand that photosynthetic rate is linked to sunlight availability; during summer months productivity and biomass of algae should increase, and should decrease and remain low during the winter months.</p>
9ciii	<p>Fertilisers wash off the farm into the lake; Result in increased algae growth/algae population increase/ algae bloom/eutrophication; Cover lake surface and result in <u>less sunlight reaching</u> underwater; Submerged aquatic plants cannot/less photosynthesis; Aquatic plants die and decomposers use up dissolved oxygen; Dissolved oxygen concentration decreases; Other aquatic animals suffocate and die</p>	<p>0.5m each [3m max]</p>	<p>Generally well answered; except for some who failed to differentiate the effects of fertilisers from pesticides and talked about bioamplification/bioaccumulation instead. Fertilisers do not contain DDT (pesticide) nor microbes.</p>

10	<p><u>Carbon dioxide</u> diffuses through stomata of leaves; into intercellular air spaces; <u>Dissolve in thin film of moisture</u> surrounding mesophyll cells; Diffuse <u>into mesophyll cells/chloroplasts</u>; To produce <u>glucose in photosynthesis</u>; Transported as <u>sucrose in phloem</u> /via translocation; To other parts of the plant; for <u>storage as starch</u>; [max 4m]</p> <p>-----</p> <p>Transferred to rabbit during <u>feeding</u>; Digested into maltose by amylases; Then into glucose by maltase; <u>Absorbed into the blood</u> at small intestines/ileum/villi;</p> <table><tr><td>Carried in blood plasma; to the liver via hepatic portal vein; Leaves liver via hepatic vein; Enter vena cava; Into <u>right</u> atrium and ventricle/<u>right</u> side of heart; Leaves heart via <u>pulmonary arteries</u> to the lungs; <u>Diffuses out of blood capillary into alveolar epithelial cell</u></td><td>Diffuse into tissue cells; Oxidised in aerobic respiration to release energy; Carbon dioxide produced diffused out of tissue cells into red blood cells; Combine with water to form carbonic acid; Catalysed by carbonic anhydrase; Dissociate into hydrogencarbonate ions and diffuse out of red blood cells; Carried to lungs by pulmonary arteries; <u>Diffuse out of blood capillary into alveolar epithelial cell</u></td></tr></table> <p>[max 4m]</p>	Carried in blood plasma; to the liver via hepatic portal vein; Leaves liver via hepatic vein; Enter vena cava; Into <u>right</u> atrium and ventricle/ <u>right</u> side of heart; Leaves heart via <u>pulmonary arteries</u> to the lungs; <u>Diffuses out of blood capillary into alveolar epithelial cell</u>	Diffuse into tissue cells; Oxidised in aerobic respiration to release energy; Carbon dioxide produced diffused out of tissue cells into red blood cells; Combine with water to form carbonic acid; Catalysed by carbonic anhydrase; Dissociate into hydrogencarbonate ions and diffuse out of red blood cells; Carried to lungs by pulmonary arteries; <u>Diffuse out of blood capillary into alveolar epithelial cell</u>	0.5m each [8m Max]	Poorly done. Mostly able to describe movement of CO ₂ into leaf only. Many were confused and mentioned about carbon dioxide inhaled being brought to the lungs for gaseous exchange. Also many mentioned about rabbit taking in O ₂ released by plant during photosynthesis.
Carried in blood plasma; to the liver via hepatic portal vein; Leaves liver via hepatic vein; Enter vena cava; Into <u>right</u> atrium and ventricle/ <u>right</u> side of heart; Leaves heart via <u>pulmonary arteries</u> to the lungs; <u>Diffuses out of blood capillary into alveolar epithelial cell</u>	Diffuse into tissue cells; Oxidised in aerobic respiration to release energy; Carbon dioxide produced diffused out of tissue cells into red blood cells; Combine with water to form carbonic acid; Catalysed by carbonic anhydrase; Dissociate into hydrogencarbonate ions and diffuse out of red blood cells; Carried to lungs by pulmonary arteries; <u>Diffuse out of blood capillary into alveolar epithelial cell</u>				

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<p>Either 11(a)</p>	<p>The athlete's <u>diaphragm muscles contracts faster</u> and <u>diaphragm flattens</u>; <u>external intercostal muscles contract quicker</u>; while his <u>internal intercostal muscles relax faster</u>; His <u>ribs move upwards and outwards</u> more rapidly; The <u>volume of thoracic cavity increases</u>; The <u>air pressure in the lungs becomes lower than the external atmospheric pressure</u>, so air is forced into the lungs; <u>to increase ventilation rate /depth of ventilation</u> (take in larger volume of air); To provide <u>more oxygen for rapid aerobic respiration/ tissue respiration for release of large amount of energy</u></p>	<p>0.5m each [4m]</p>	<p>Many students failed to state 'diaphragm muscles' and that intercostal muscle movements were <u>faster</u>. <u>'Increased ventilation rate /depth of ventilation'</u> , 'air is <u>forced into</u> lungs' due to difference in pressure was also commonly missed out.</p>
<p>11(b)</p>	<p>Cigarette smoke <u>contains nicotine/ nicotine releases adrenaline</u>; adrenaline <u>increases his heartrate/ increases blood pressure/ increases clotting of blood</u>; It also <u>contains carbon monoxide</u>; which <u>combines with haemoglobin to form carboxyhaemoglobin</u>; This <u>reduces the efficiency of oxygen transport</u>; Hence he has to <u>breathe at a faster rate to take in more oxygen</u>; Caffeine <u>increases breathing rate /heart rate</u>; <u>Very rapid beating of heart and breathing rate due to combined effects/ maximum breathing and ventilation rate reached/ rapid rise of blood pressure/ increased production of adrenaline</u>; To provide <u>more glucose and oxygen</u> to muscles; During <u>aerobic respiration to release high amount of energy required</u>; OR <u>insufficient oxygen results in anaerobic respiration</u>;</p>	<p>0.5m each [6m max]</p>	<p>Students needed to <u>identify short term effects of cigarette smoke and caffeine</u> on the heart and breathing. Many students failed to read the question and simply discussed the long term effects of smoking such as tar/ excess mucus production/ cilia being paralysed or the effect of CO increasing atherosclerosis due to fatty deposits on rough inner surfaces of arteries– all of which are long term effects of exposure NOT the <u>immediate impact of smoking on the runner</u> during the race. CO – to be written out in full as 'carbon monoxide'.</p>

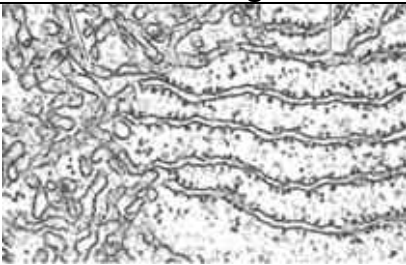

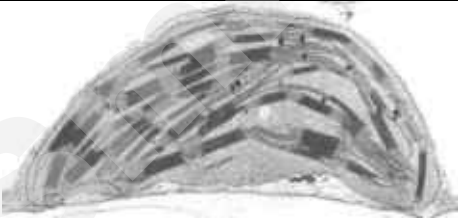

	<p>buildup of lactic acid and muscle fatigue/ lactic acid causes angina/ chest pain; (max 5m)</p> <p><u>irregular rapid heartbeat/ overworking of heart muscles/coronary arteries are blocked due to thrombus/blood clot in coronary arteries; result in decreased blood supply and oxygen for heart/brain or other vital organs</u> causing collapse/ heart attack / heart muscle death or SCD; (1m)</p>		<p>Some also assumed runner was habitual smoker and had emphysema and thus coughed all the way– 0m (not stated in question)</p> <p>Note: Adrenaline causes clotting and heightens the effect of already pre-existing clots in blocking coronary arteries during heavy exercise such as a marathon.</p>
Or 11(a)	<p>OPP is <u>non-biodegradable/fat soluble/water insoluble</u>; <u>Stored in fatty tissue</u> of organism and not excreted out; <u>Absorbed by plants</u> when used in farms/absorbed by plants <u>through contaminated water source</u>; Person <u>accumulates increasing concentrations</u> of OPP from his food/ <u>eating vegetables and fruit with time</u> (bioaccumulation); Until toxic levels reached and OPP poisoning occurs. OPP is also passed along food chain in increasing concentrations (bioamplification)/ when primary consumer like a cow eats vegetables and then the meat is consumed by man, man would have increasing concentration of OPP as man is at the highest trophic level in the food chain (bioamplification);</p>	0.5m each [3 m]	<p>Terms ‘bioaccumulation’ and ‘bioamplification’ were not explained clearly, some confusion seen and mixing up of terms.</p>
Or 11(b)	<p>The skin in his hand contains <u>receptors (nerve endings)</u> [0.5] ; <u>receive the stimulus (heat)</u> [0.5]; <u>nervous impulse transmitted through the sensory neurone</u> more slowly [0.5]; -The impulses <u>pass along</u> more slowly <u>across a synapse</u> [0.5] ; to a <u>relay neurone</u>[0.5] ; <u>in spinal cord</u> [0.5] ; the impulses pass/pass slower through another synapse[0.5] ;</p>	0.5m each [7m max]	<p>Not very well answered – some students had difficulty recalling the reflex pathway and could not apply information on the impact of OPP in triggering <u>repeated contractions at synapses</u>. Most students mentioned impulses were slowed down due to damage</p>

	<p>to a <u>motor neurone</u> [0.5] ; which <u>transmits nervous impulses to the biceps muscle (effector) to cause contraction</u> [0.5];</p> <p>OPP <u>prevents muscle from relaxing after contracting/muscle stays locked/ causes uncontrollable muscle contractions/</u> reflex action cannot occur due to <u>repeated muscle contractions</u> [0.5]; Thus person will not flex the elbow/ <u>not move hand away quickly away from hot object</u> in reflex [0.5];</p> <p><u>another relay neurone carries the impulses to the brain</u> [0.5]; person is able to <u>feel the pain /heat slowly;</u> [0.5] <u>may not be able to move hand away / move hand voluntarily</u> resulting in <u>greater tissue damage</u> due to hand remaining on hot pan longer ; [0.5]</p>	<p>to neurones. Quite a few students merely copied statements from the question such as 'OPP causes sensory and motor nerve damage' or replicated chunks on Ach which was not required.</p> <p>Students had misconceptions that the sensory neurone received stimuli/ detected heat. Some students did not discuss the reflex pathway and mentioned only voluntary action briefly.</p> <p>Many students omitted the explanation on how the brain senses the pain after the reflex occurs.</p> <p>Note: Ach is released at terminals of all motor neurones, synapses in CNS, terminals of neurones and without it being broken down contractions can occur repeatedly /uncontrollably.</p>
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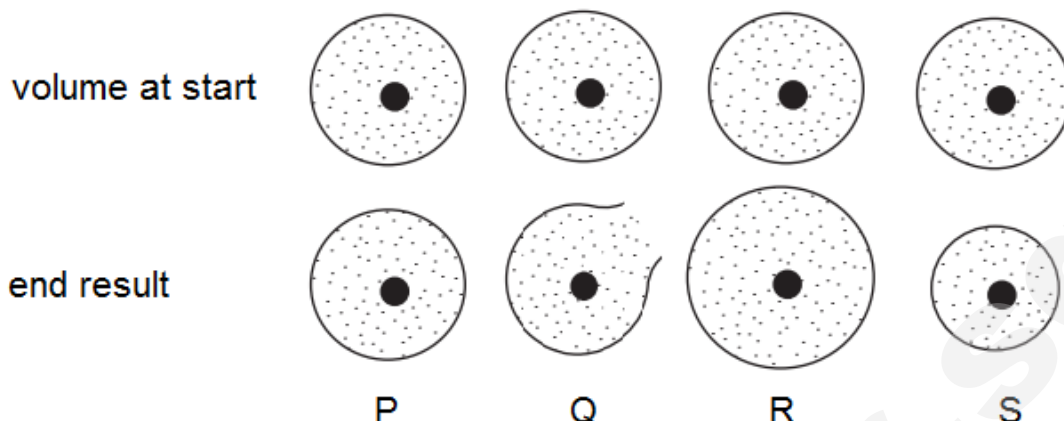
1. Which of the following correctly shows the different levels of cell organisation?

	cell	tissue	organ
A	haemoglobin	heart	spleen
B	phloem	sieve tube element	leaf
C	lymphocyte	blood	lung
D	sperm	muscle	sweat gland

2. Four electron photomicrographs of cell organelles are shown below.
 Which of the following is **not** a correct match of the cell organelle to its function?

	cell organelle	function
A		site of polypeptide synthesis and transport
B		modification and repackaging of synthesised protein
C		oxidation of glucose
D		formation of spindle fibers during mitosis

3. Identical animal cells were placed in salt solutions of different concentrations. The diagram shows the volume of the cells at the start and end of the experiment.



Arrange the salt solutions in ascending concentration.

- A** Q, R, P, S
B R, P, S, Q
C S, R, P, Q
D S, P, Q, R
4. The table shows the results of an investigation on the uptake of nitrate ions by a plant.

time from the start of experiment (mins)	units of nitrate ions taken up by plant tissue under the following conditions		
	sugar absent, oxygen present	sugar present, oxygen absent	sugar and oxygen present
0	0	0	0
30	0	30	100
60	0	50	150
90	0	70	180
120	0	70	200

Which statement is a valid conclusion of the investigation?

- A** Uptake of nitrate ions is via diffusion only.
B Uptake of nitrate ions occurs during aerobic respiration only.
C Uptake of nitrate ions is by diffusion and active transport.
D Uptake of nitrate ions stops in the absence of oxygen.
5. Three statements about water are shown below.

- It has a high specific heat capacity.
- It is incompressible.
- It is an excellent solvent.

Which statement(s) make water suitable to use in a blood transport system?

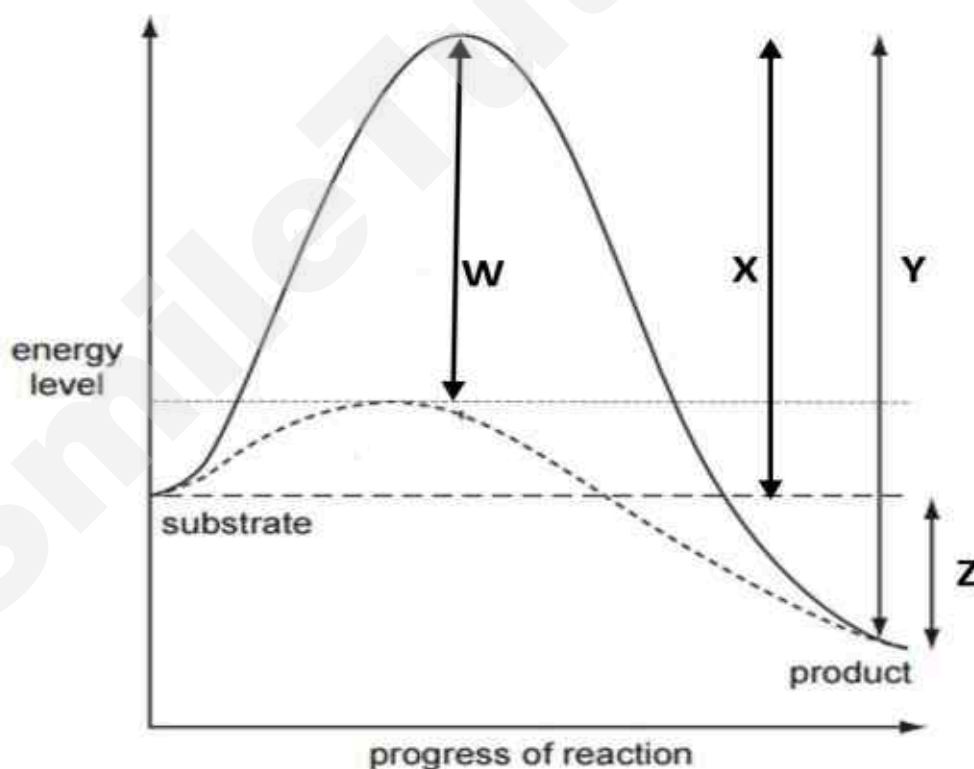
- A** 1, 2 only
B 1, 2 and 3
C 2, 3 only
D 3 only

6. A student was asked to carry out a series of food tests on the compounds in each of the three test tubes. The table shows the results of the student's tests.

test tube	reagent added to test tube			
	sodium hydroxide + copper (II) sulfate	Benedict's solution	iodine solution	ethanol + water
X	violet	orange	brown	clear
Y	blue	blue	blue-black	cloudy
Z	violet	brick-red	brown	cloudy

Which conclusion is consistent with the results?

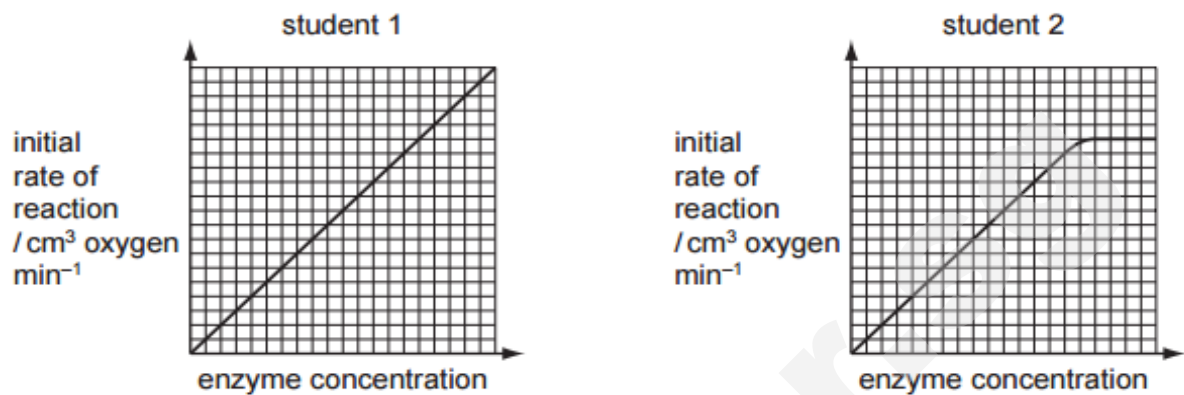
- A** A mixture of egg white and starch only was placed in test tube X.
B A mixture of sucrose and starch only was placed in test tube Y.
C If contents in test tube Y were first boiled with hydrochloric acid before the addition of Benedict's solution, the mixture will turn brick-red.
D Test tube Z contained less maltose than test tube X.
7. The graph shows the energy changes during a reaction, with and without the presence of an enzyme.



Which of the following represents the activation energy of the reaction in the presence of the enzyme?

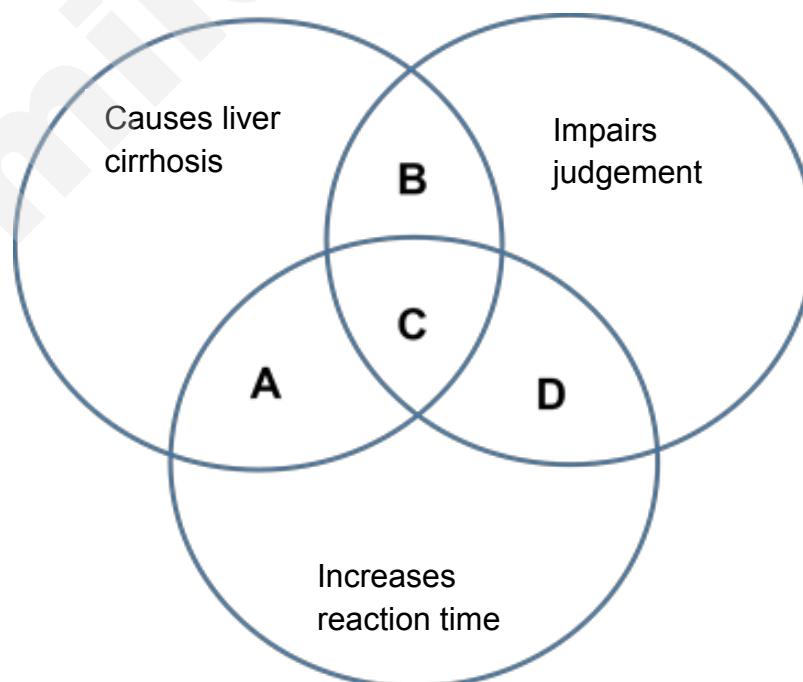
- A** W
B Y
C X - W
D Y - Z

8. Catalase catalyses the breakdown of hydrogen peroxide to water and oxygen. Two students investigated the effect of enzyme concentration on the rate of reaction. They predicted that their results would be the same. The graphs below show the results obtained by each student.



Which statement explains the different trend shown by student 2?

- A** Student 2 added an inhibitor to the investigation.
 - B** Student 2 performed the experiment at a higher temperature.
 - C** Student 2 performed the experiment at pH 5 instead of pH 8.
 - D** Student 2 used a lower concentration of hydrogen peroxide in the experiment.
9. Which of the following represents the short-term effects of alcohol consumption?

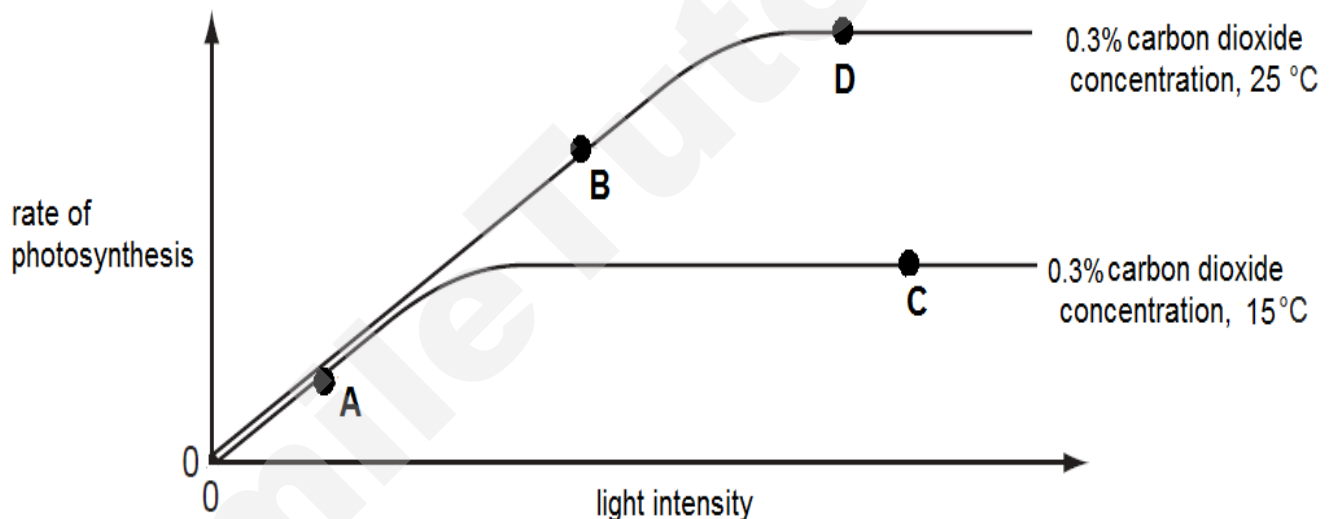


10. In patients with cystic fibrosis, thick mucus blocks the pancreatic duct. Which of the following are possible effects of this?

1. Patient egests oily stools.
2. Patient experiences weight gain.
3. Patient suffers from malnourishment.
4. Patient suffers from hyperglycemia.

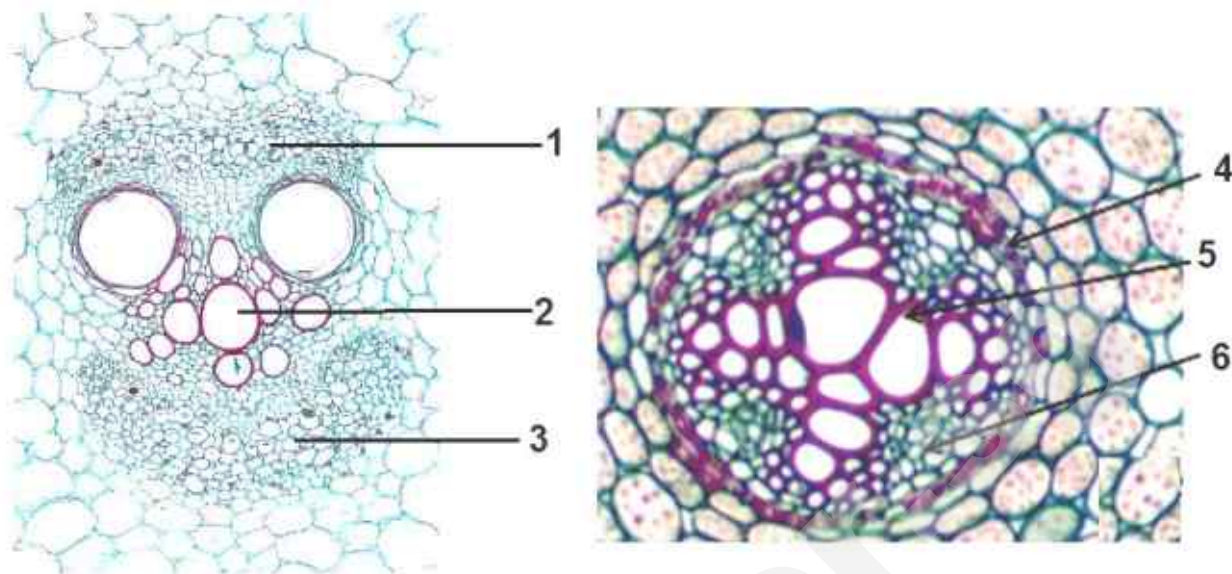
- A** 1 and 3 only
B 1, 2 and 4 only
C 1, 3 and 4 only
D 2 and 3 only

11. A student carried out an investigation to find out the rate of photosynthesis in a pea plant at different light intensities and carbon dioxide concentrations. The graph shows her results.



At which point is temperature a limiting factor?

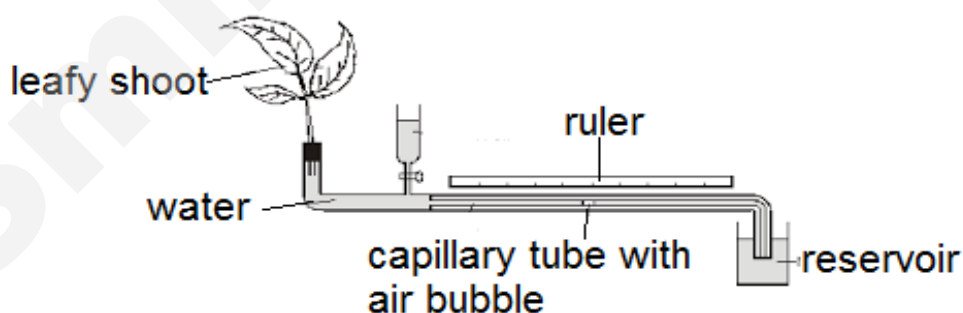
12. The vascular tissues of a dicotyledonous stem and root are shown.



Which of the following correctly matches the tissues to their function?

	transport of mineral salts	transport of food substances
A	1 and 5	2 and 3
B	1 and 6	3 and 4
C	2 and 5	1 and 6
D	3 and 4	5 and 6

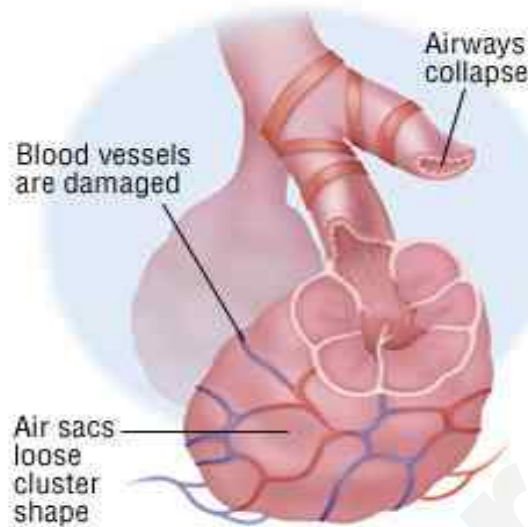
13. A potometer was set up below.



Under which environment will the air bubble travel the longest distance?

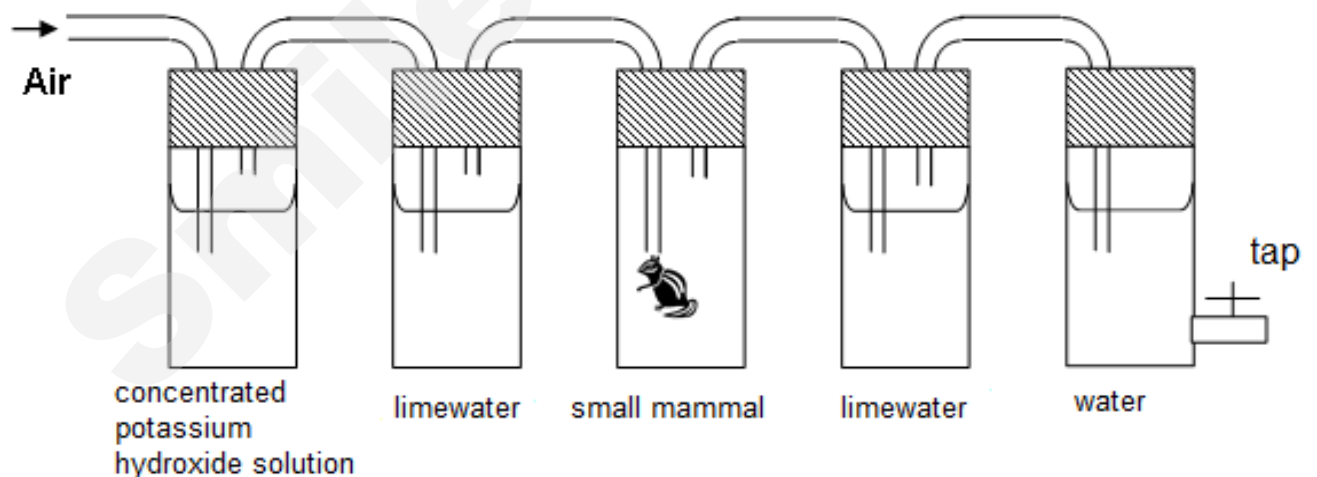
- A** dim and cold
- B** dim and windy
- C** sunny and humid
- D** sunny and windy

14. The diagram shows part of the alveoli of a patient diagnosed with a respiratory condition.



What causes the signs and symptoms of this condition?

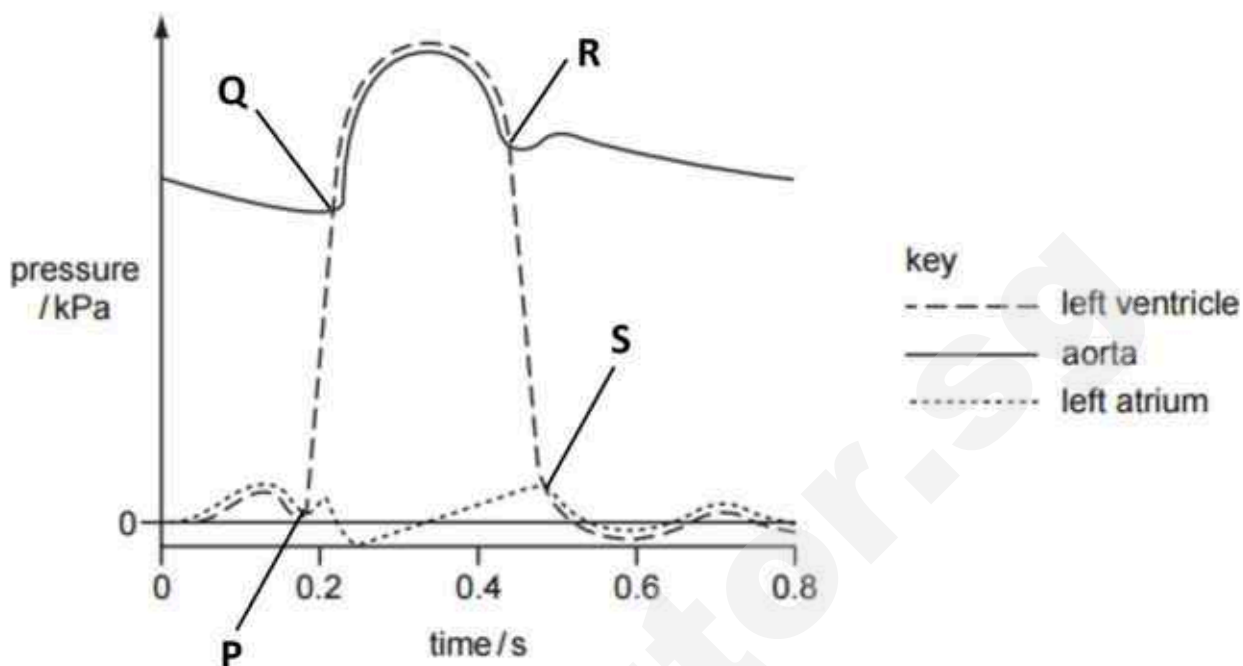
- A** blockage of pulmonary artery
 - B** breaking down of alveolar walls
 - C** inflammation of bronchus
 - D** presence of tar in alveoli
15. The diagram shows an experimental setup.



What is the primary aim of this experiment?

- A** To demonstrate that carbon dioxide is present in the atmosphere.
- B** To demonstrate that oxygen is absorbed to support the metabolic activities of the small mammal.
- C** To demonstrate that the small mammal releases energy in the form of heat.
- D** To demonstrate that the small mammal releases carbon dioxide during respiration.

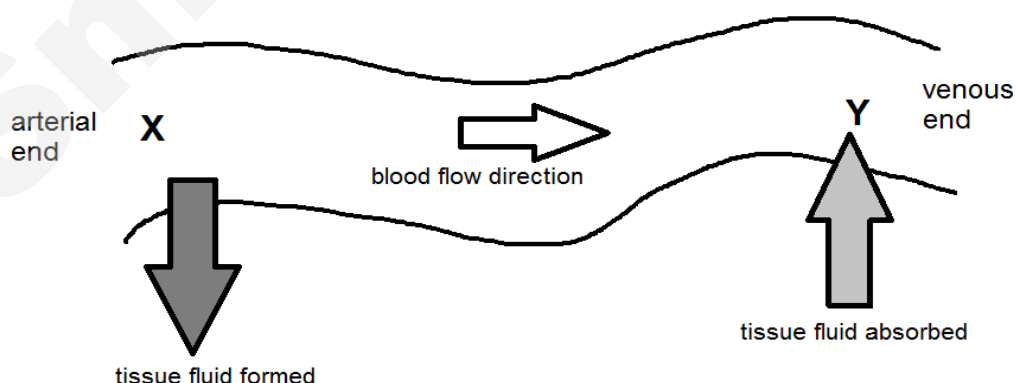
16. The pressure changes in the left side of the heart is shown below.



Which of the following correctly identifies the states of the valves?

	atrio-ventricular open	semi-lunar close
A	between P and S	between P and Q
B	between P and Q	between Q and R
C	before P and after S	between R and S
D	between Q and R	before P and after S

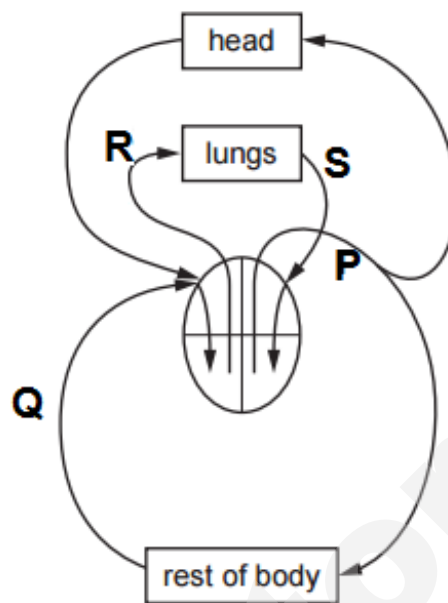
17. The diagram shows the movement of substances in and out of a capillary.



What is the cause of the change in water potential between points X and Y?

- A Glucose and amino acids exit the capillary at point X.
- B Presence of plasma proteins in the capillary.
- C Red blood cells remain in the capillary.
- D The blood pressure at point X is higher than at Y.

18. The diagram represents the human circulatory system.

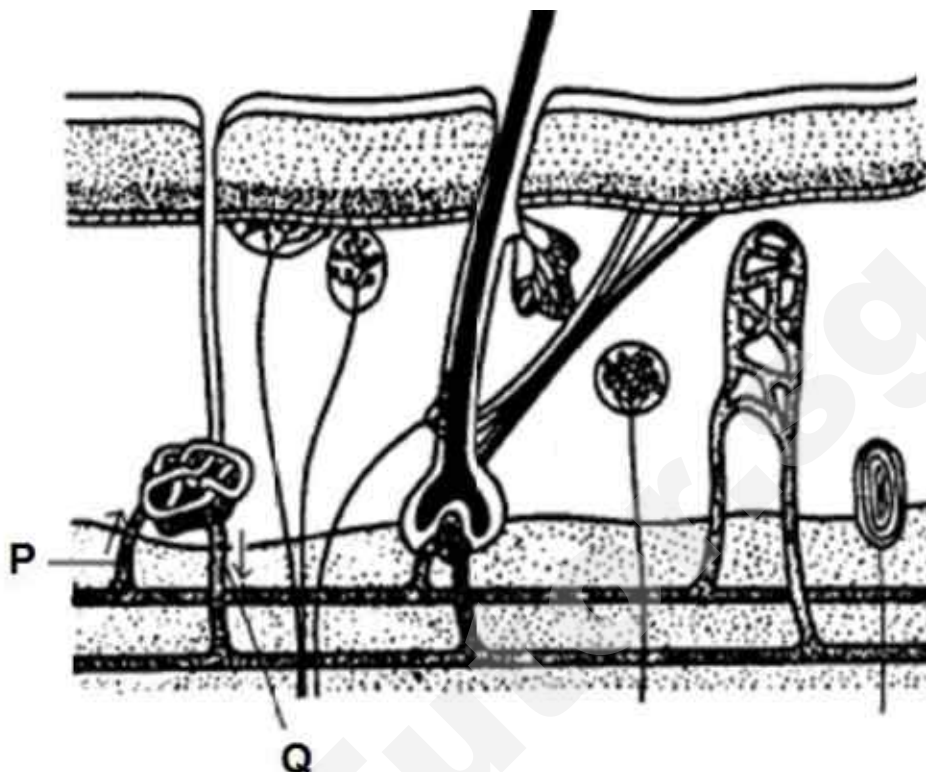


What are the possible blood pressures (in kPa) in vessels P to S shown?

	P	Q	R	S
A	1	4	2	16
B	4	16	2	1
C	16	1	4	2
D	16	4	1	2

19. Which of the following does not occur in the mammalian kidney?
- A** regulation of blood pH
 - B** removal of bile pigments from the body
 - C** removal of excess salts in the body
 - D** removal of urea from the body
20. A drug has been found to inhibit the effects of ADH. What would be the consequence of giving this drug to a healthy person?
- A** A smaller volume of urine will be produced.
 - B** More proteins will be present in the urine.
 - C** The person will become dehydrated.
 - D** The urine produced will be more concentrated.

21. The diagram below shows a section through the human skin.



Which of the following corresponds to the changes in concentrations of carbon dioxide, urea and salt as blood passes from **P** to **Q**?

	carbon dioxide	urea	salt
A	decreases	decreases	decreases
B	decreases	increases	decreases
C	increases	decreases	decreases
D	increases	increases	increases

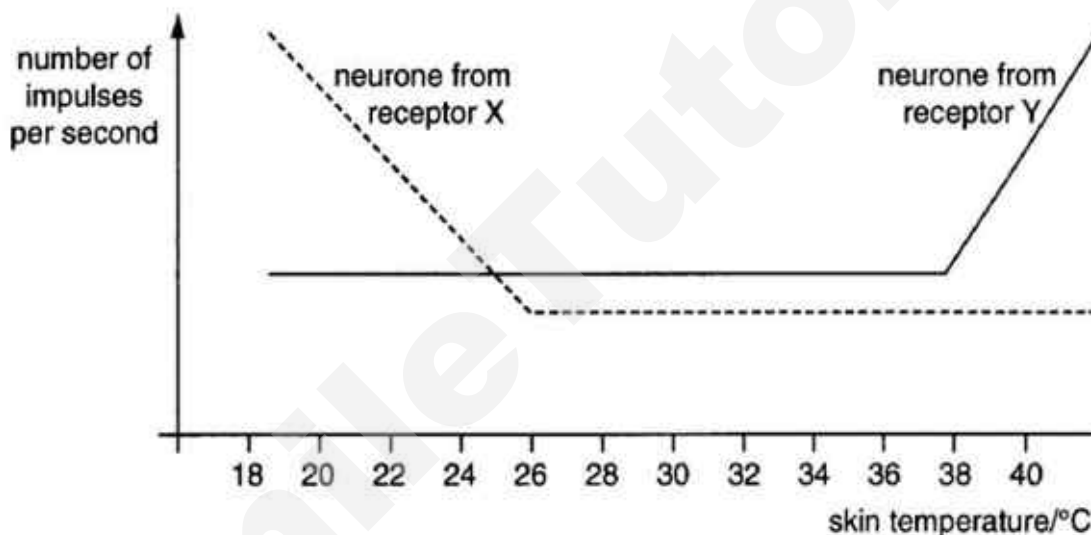
22. Young children often have problems with hypothermia and may even die if they are exposed to very cold weather. What is this partly due to?
- A** an excessive flow of blood to the skin
 - B** their large surface area to volume ratio
 - C** their less hairy skin
 - D** their low metabolic rate
23. Two boys were in a physical fight and were chasing each other. Which of the following is a result from the increased secretion of the hormone involved in the fight-or-flight mechanism?
- A** decreased breathing rate
 - B** decreased heart rate
 - C** increased blood supply to the kidneys
 - D** increased breakdown of glycogen by the liver

24. The table gives information about a few hormones and their respective glands of production, target site and their eventual fate.

Which of the following is correct?

	hormone	gland	target site	fate after use
A	anti-diuretic hormone	hypothalamus	urinary bladder	destroyed by the kidneys
B	glucagon	pancreas	liver	excreted in urine
C	insulin	liver	muscles	egested in faeces
D	oestrogen	pituitary	uterus	excreted in urine

25. The graph shows the number of nerve impulses per second travelling along two sensory neurones from the skin of a person's arm to the brain. The skin receptors X and Y, are exposed to different temperatures.



Which of the following statements best illustrates the graph?

- A** Receptor X responds most strongly to temperatures above 22°C.
B Receptor Y responds most strongly to temperatures below 38°C.
C Receptors X and Y respond most strongly outside the range of 26°C to 38°C.
D Receptors X and Y respond most strongly at temperatures between 26°C and 38°C.
26. A student was playing a video game where she had to press a buzzer as quickly as possible whenever she saw an animated character run across the screen.

What was the pathway taken by nerve impulses from the student's eyes to the muscles of her hand?

- A** optic nerve → retina → spinal cord → brain → spinal nerve
B optic nerve → retina → spinal cord → spinal nerve → brain
C retina → optic nerve → brain → spinal cord → spinal nerve
D retina → optic nerve → spinal nerve → brain → spinal cord

27. A lady was walking in bright sunlight. Which changes take place in her eyes when she moves from bright sunlight into a theatre which is pitch dark and then later stands on a brightly lit stage?



reaction I



reaction II

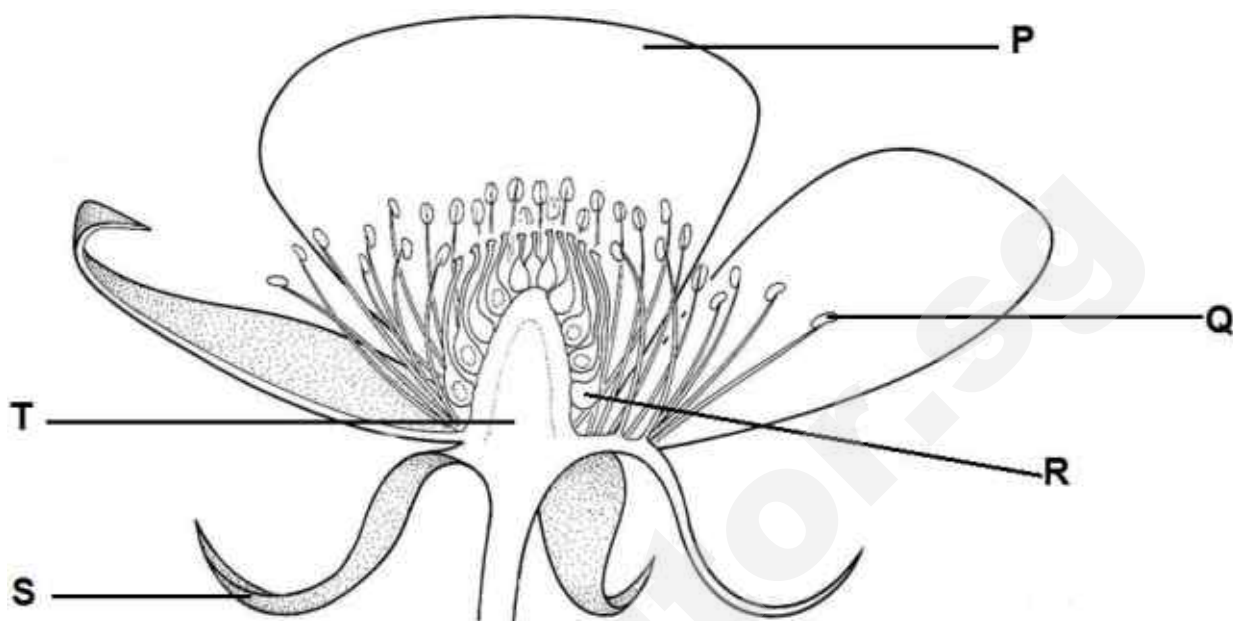
	In sunlight	→	In dark theatre	→	On bright stage
A	I	→	I	→	I
B	I	→	II	→	I
C	II	→	I	→	II
D	II	→	II	→	I

28. A girl stands 15 metres away from a signboard and sees it clearly. She walks towards the signboard and stops 0.25 metres from it.

Which row correctly shows the changes occurring in her eyes so that the signboard is still in focus?

	ciliary muscles	suspensory ligaments	lens becomes	result: how are light rays refracted?
A	contract	slacken	thicker	more
B	contract	tighten	thinner	less
C	relax	slacken	thinner	less
D	relax	tighten	thicker	more

The diagram shows the longitudinal section through a blackberry flower. Use the diagram below to answer questions 29 and 30.



29. Which of the following correctly describes parts **P** to **T**?

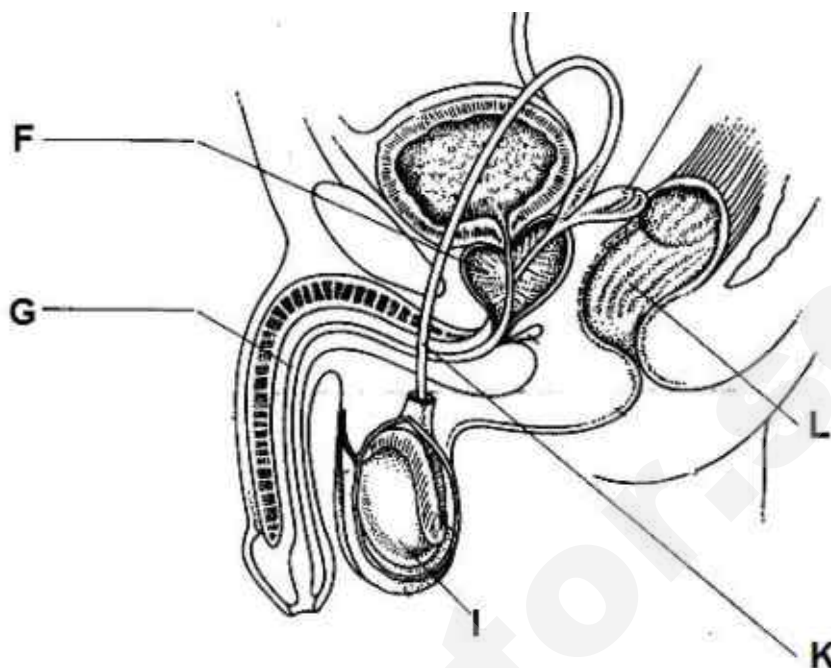
	P	Q	R	S	T
A	attracts pollinators	produces pollen grains	develops into seed	protects the flower before it blooms	develops into fruit
B	attracts pollinators	shakes during a breeze to release gametes	develops into seed	landing platform for pollinators	develops into fruit
C	protects the flower before it blooms	shakes during a breeze to release gametes	develops into fruit	attracts pollinators	site where flower parts grow from
D	landing platform for pollinators	produces pollen grains	develops into fruit	protects the flower before it blooms	site where flower parts grow from

30. Which of the following statements about the blackberry flower are correct?

1. The flower is wind-pollinated.
2. Self-pollination can occur within the flower.
3. Eleven fruits can be produced from this flower.
4. Only eleven pollen grains can land on the stigma of the flower.

- A** 1 and 3 only
B 2 and 3 only
C 2 and 4 only
D 2, 3 and 4 only

31. The cross section of the male urino-reproduction system is shown.



Paul made a few statements about the male urino-reproduction system.

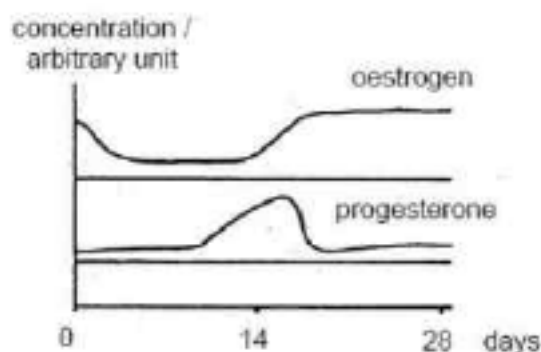
1. In vasectomy, K is cut and tied.
2. Metabolic waste products exit the body via L.
3. Fluid from F contains nutrients to nourish sperms.
4. G is able to conduct both urine and semen out simultaneously.
5. I is both an exocrine and endocrine gland.

Which of his statements are true?

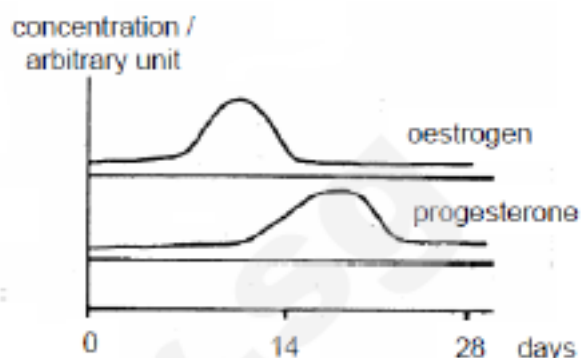
- A** 1, 2 and 3 only
- B** 1, 3 and 5 only
- C** 2, 4 and 5 only
- D** 3, 4 and 5 only

32. Which of the following shows the correct changes in the concentrations of ovarian hormones in a woman who was successful in conception?
(Assume that menstruation occurred on Day 0.)

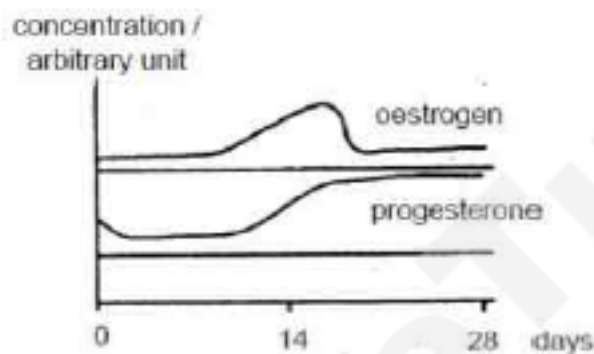
A



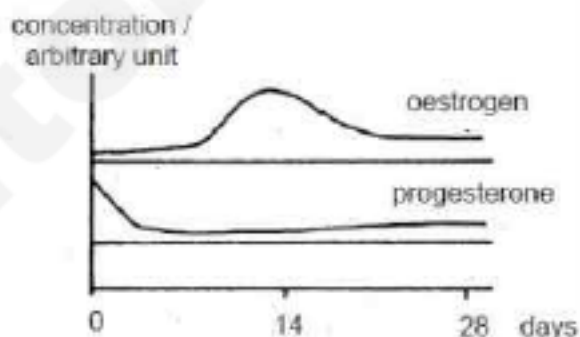
B



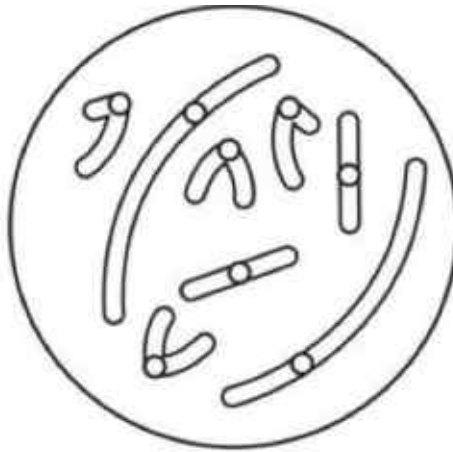
C



D

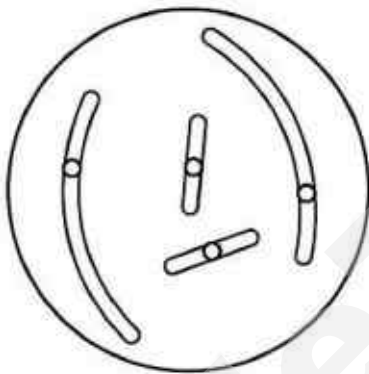


33. The diagram shows the nucleus of a body cell of an organism.

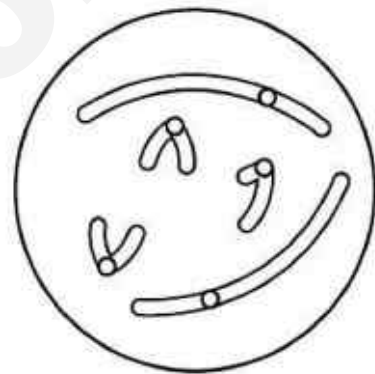


Which diagram represents a possible gamete nucleus produced by the organism?

A



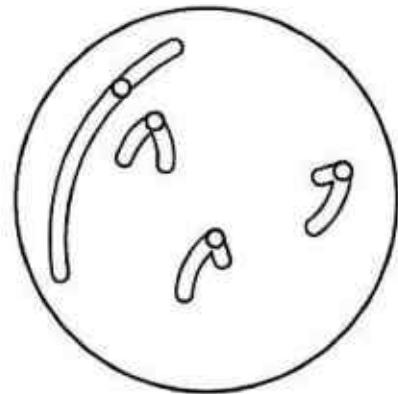
B



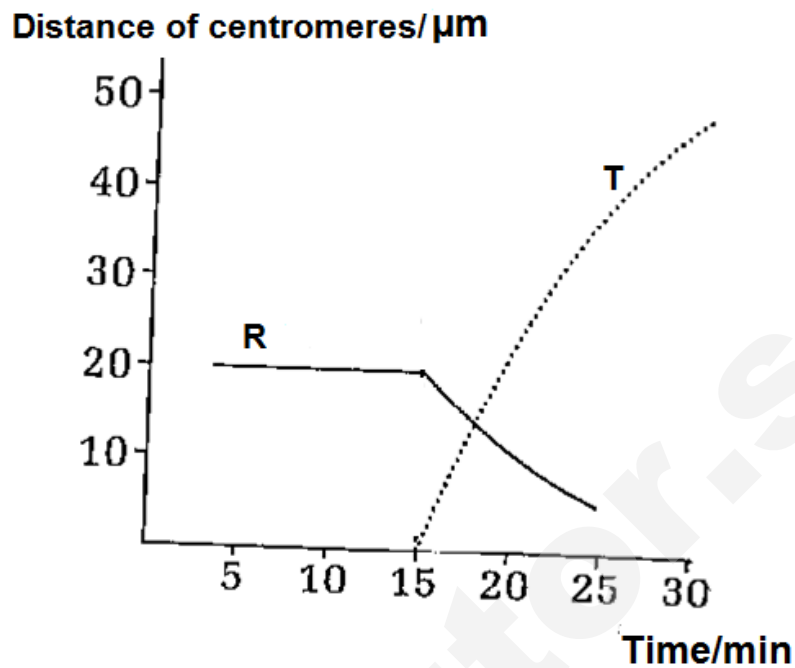
C



D



34. The graph below illustrates the behaviour of chromosomes during one mitotic division.

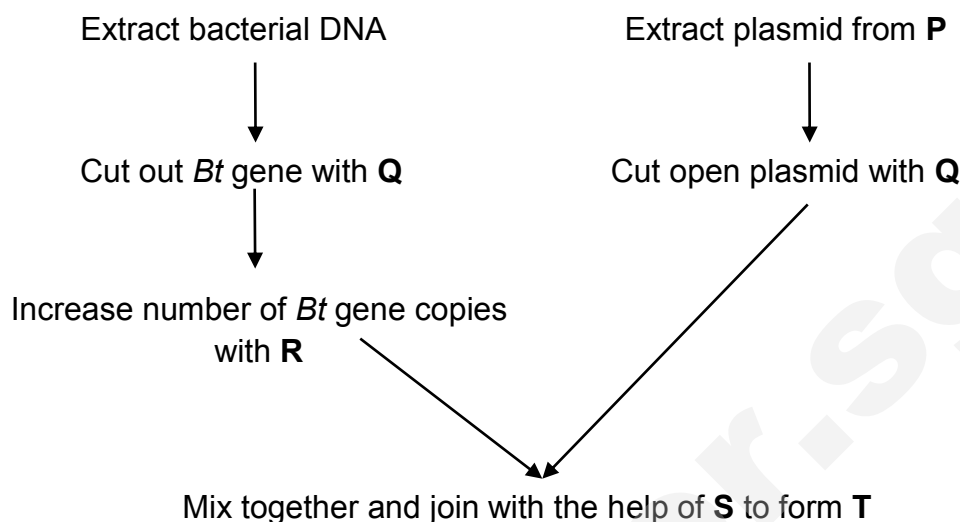


Which of the following statements are correct?

1. Anaphase occurs from the 15th minute onwards.
2. Line R represents the distance between the centromere and the spindle pole.
3. The radius of the cell is approximately 40μm.
4. Line T represents the distance between the centromeres of homologous chromosomes.

- A** 1 and 2 only
B 1 and 3 only
C 1, 3 and 4 only
D 2 and 4 only

35. The diagram outlines part of the process to produce a GM cotton plant that is pest resistant.



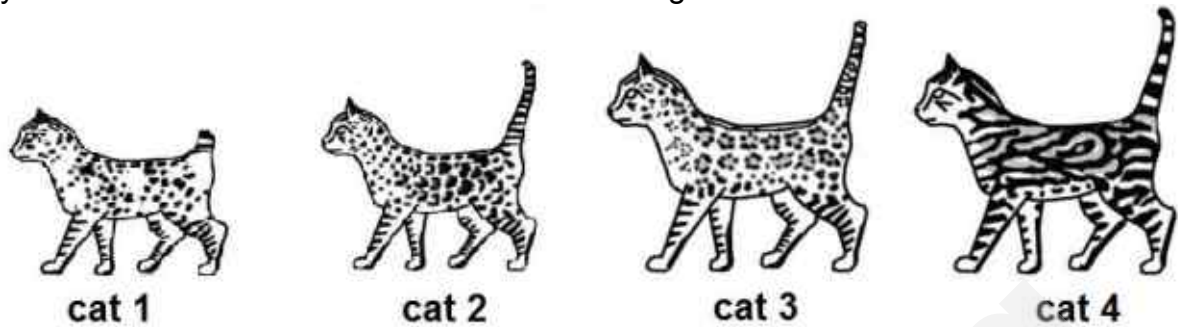
Which row correctly identifies **P** to **T** in each step?

	P	Q	R	S	T
A	<i>Agrobacteria</i>	restriction enzyme	polymerase	ligase	recombinant plasmid
B	<i>Agrobacteria</i>	ligase	restriction enzyme	lipase	recombinant bacteria
C	<i>E. coli</i>	polymerase	ligase	lipase	recombinant bacteria
D	<i>E. coli</i>	restriction enzyme	polymerase	ligase	recombinant plasmid

36. Which of the following features of DNA enable it to meet the requirements as a molecule of inheritance?

	requirements as molecule of inheritance			
	ability to remain stable	ability to contain information	ability to transfer information	ability to replicate
A	complementary base pairing	formation of mRNA for translation	sequence of nucleotides	sugar-phosphate backbone
B	formation of mRNA for translation	complementary base pairing	sugar-phosphate backbone	sequence of nucleotides
C	sequence of nucleotides	sugar-phosphate backbone	complementary base pairing	formation of mRNA for translation
D	sugar-phosphate backbone	sequence of nucleotides	formation of mRNA for translation	complementary base pairing

37. Sherlyn noted down some observations of her 4 Bengal cats.



	cat 1	cat 2	cat 3	cat 4
fur pattern	spotted	spotted	rosetted	marbled
blood group	A	AB	A	B
tail length / cm	10	30	24	26

Which of the following statement(s) about the cats is/are correct?

1. Blood type in cats displays codominance.
2. Fur pattern shows both continuous and discontinuous variation.
3. The length of the cats' tails is controlled by a single gene.
4. The size of the cats are determined only by their genes.

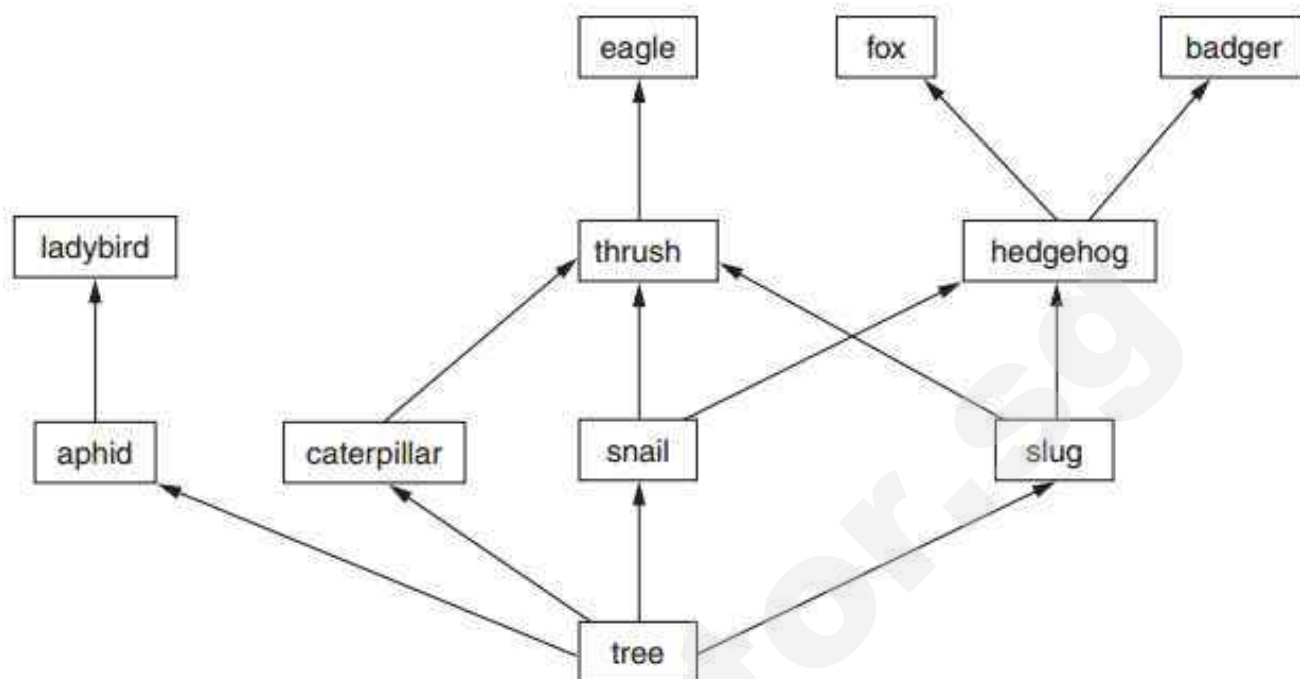
- A** 1 only
B 1 and 2 only
C 1, 2 and 4 only
D 3 and 4 only

38. Lethal alleles are alleles that cause death of the organism that carries them, either prenatally or shortly after birth. Brachydactyly is a genetic condition which the fingers are unusually short in carriers; and fatal in homozygous recessive individuals due to major skeletal defects.

Which of the following crosses would result in the phenotypic ratio of 1 normal : 2 brachydactyly in the offspring?

- A** BB x BB
B BB x Bb
C Bb x Bb
D Bb x bb

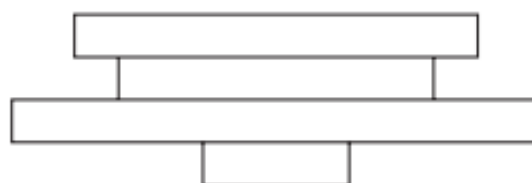
39. The diagram shows part of a food web.



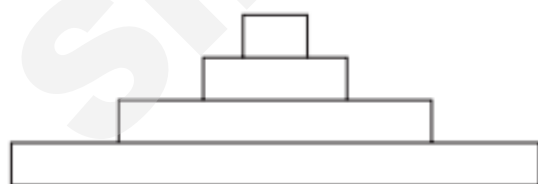
Which is a pyramid of numbers based on this food web?



A



B

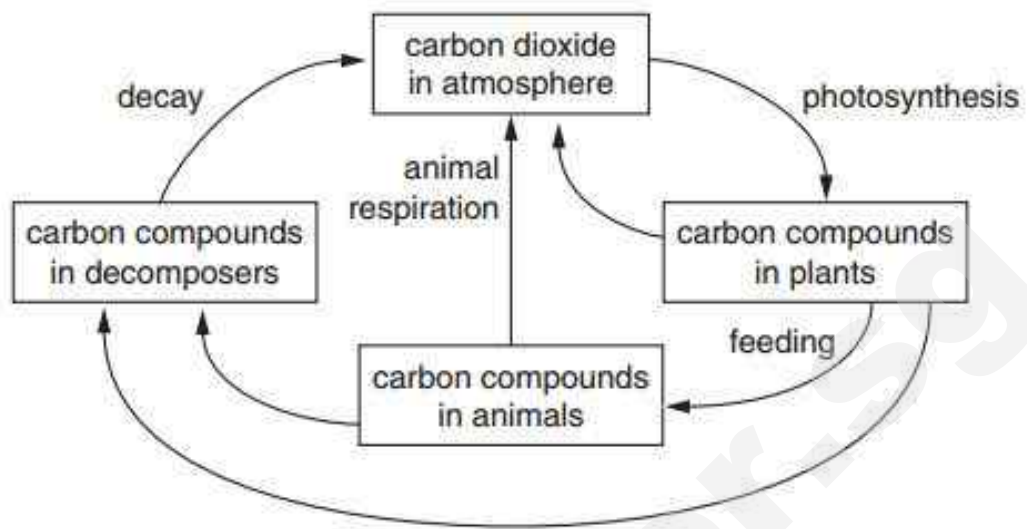


C



D

40. The diagram shows the cycling of carbon in the environment.



Which process converts most carbon from one form to another?

- A animal respiration
- B decay
- C feeding
- D photosynthesis

The End

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Section A

Answer **all** questions.

Write your answer in the spaces provided.

- 1 Figure 1.1 shows the lining of the human small intestine (**A**) as well as an electron micrograph of one type of cell found in lining **A**.

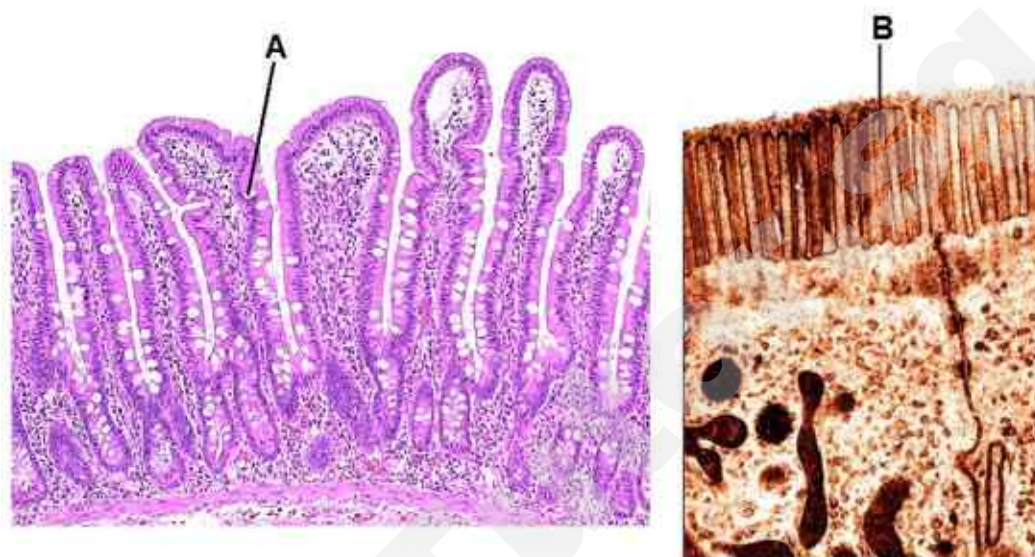


Figure 1.1

- (a) Name structure **B** and state its function. [1]

Structure **B**

Function:
.....

- (b) The small intestine is involved in both digestion and absorption.

Describe how proteins are digested within the small intestine. Include the names of enzymes involved and conditions required. [3]

.....
.....
.....
.....
.....
.....
.....
.....
.....

- (c) Lining **A** also contains mucus-secreting cells. Mucin is a protein and a component of mucus. Figure 1.2 shows the organelles in the cell involved in mucin production.

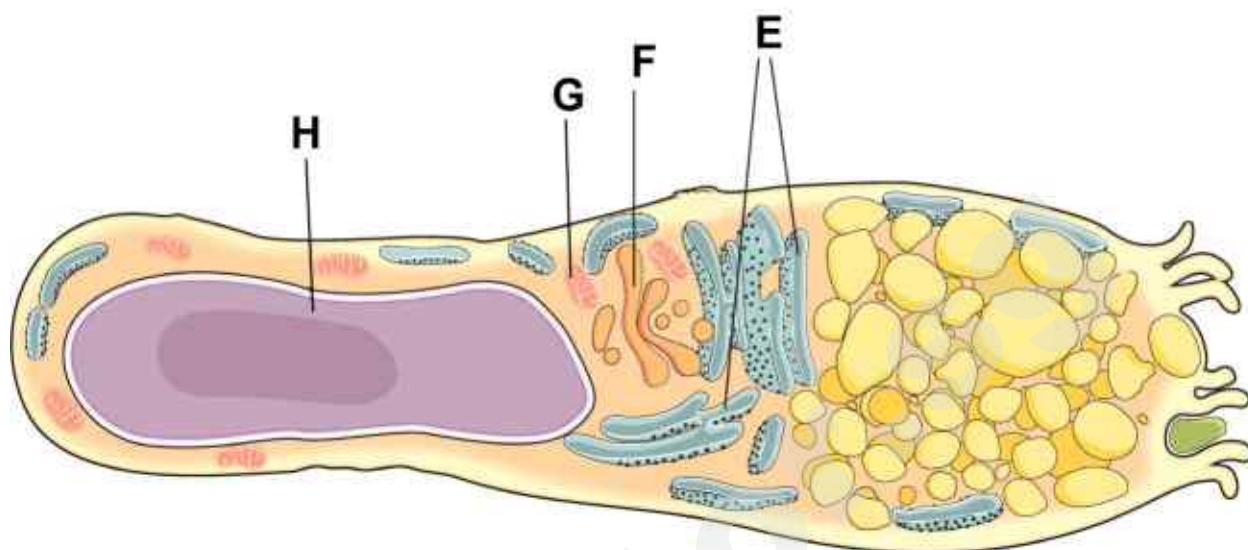


Figure 1.2

Identify organelles **E – H**.

[2]

E	
F	
G	
H	

[Total: 6 marks]

- 2 Figure 2.1 shows the rate of flow in the xylem in the trunk of a mango tree throughout the day.

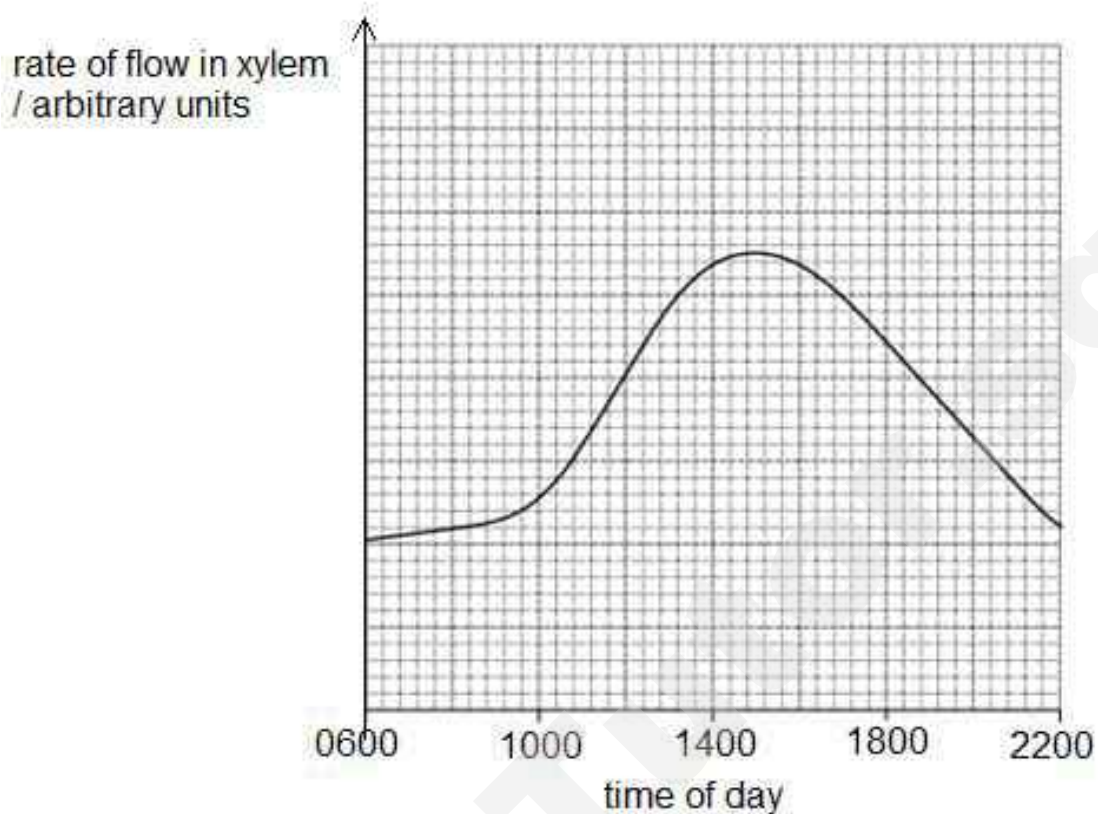


Figure 2.1

- (a) (i) Explain the increase in the rate of flow between 1000 and 1400 hours. [3]

.....

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- (ii) Phenylmercuric acetate (PMA) was administered to the mango tree at 1100. [1]
PMA is known to cause stomatal closure.

Sketch on Figure 2.1 to show how the rate of flow in the xylem will be affected by PMA.

- (b) Marcotting is a vegetative propagation method that farmers use to cultivate mango trees. It involves wounding a part of a plant first, then wrapping the segment in plastic and rooting medium to induce root formation.

Figure 2.2 shows portion of the branch of the mango tree that was wounded (its bark removed) in preparation for marcotting. Only the xylem is left intact.

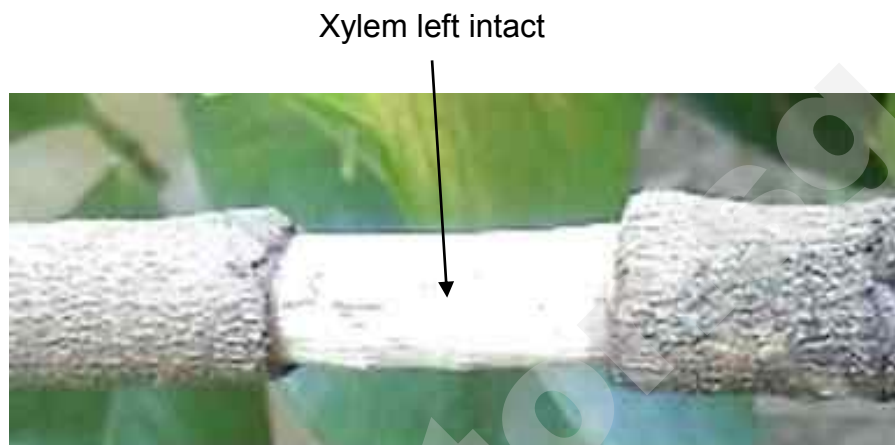


Figure 2.2

State **and** explain what the farmer would observe if he left the debarked branch [2]
exposed and unwrapped for a few days.

.....

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.....

.....

[Total: 6 marks]

- 3 Data was collected on the characteristics of Weddell seals, which live in the extremely cold Antarctic seas, and compared with equivalent data from humans during diving experiments using implanted blood flowing meter devices.

The data from diving experiments is given in Table 3.1.

Table 3.1

feature	human	Weddell seal
mass (kg)	70	70
resting average body temperature ($^{\circ}\text{C}$)	37	37
O_2 concentration in blood at sea level (ml / kg)	15	60
body fat (%)	22	55

- (a) From Table 3.1, explain how differences in oxygen concentration in blood and body fat help Weddell seals be better adapted to survive in Antarctic than humans. [3]

Oxygen concentration in blood :

.....

.....

Body fat:

.....

.....

Temperature readings were taken at a number of locations at the surface and inside the body of a Weddell seal in water at 0°C. The data is summarized graphically in Figure 3.2.

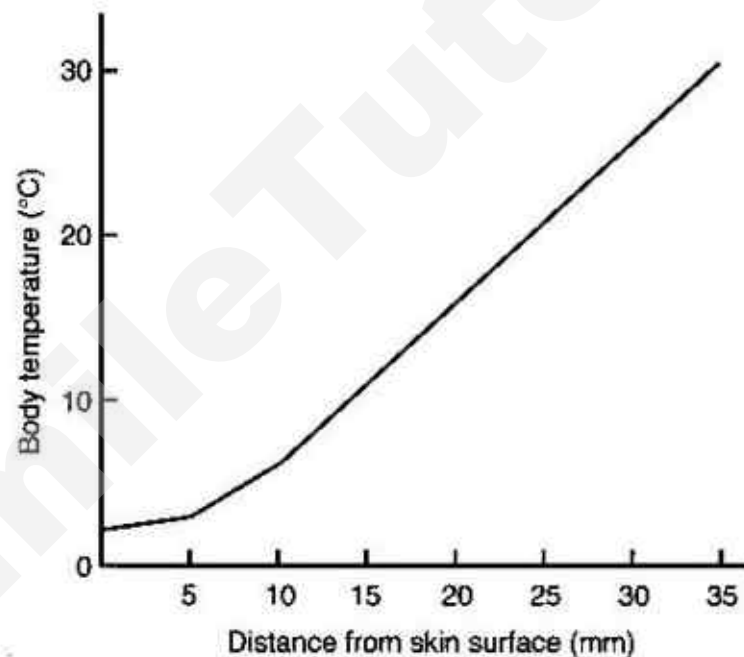


Figure 3.2

- (b) Based on Figure 3.2, describe the relationship between the distance from the skin surface and body temperature. Explain how this is advantageous to the seal diving in freezing waters. [2]

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Cape fur seals spend part of their time lying in the sun. In this situation, the seal may face a potential problem of overheating.

Figure 3.3 shows the arrangement of blood vessels in the body of a Cape fur seal.

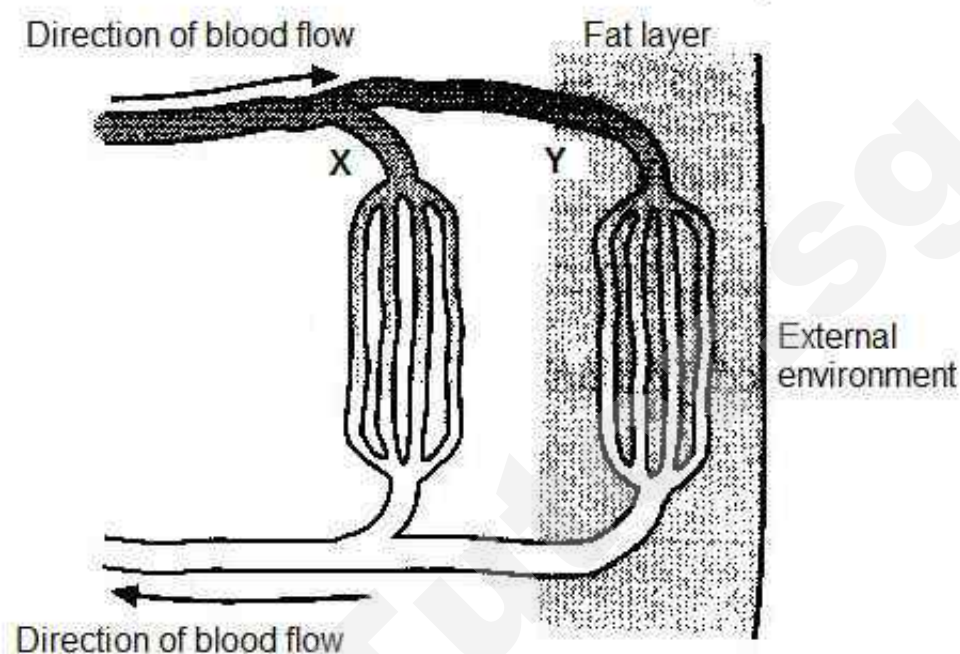


Figure 3.3

- (c) Based on Figure 3.3, describe and explain how a seal lying in the sun prevents overheating. [2]

.....

.....

.....

.....

- (d) Suggest another mechanism that occurs so that the seal can lose excess heat on a hot day. [1]

.....

.....

[Total: 8 marks]

- 4 Figures 4.1 and 4.2 are photomicrographs taken from 2 different regions of a mammalian kidney containing parts of the kidney nephron.

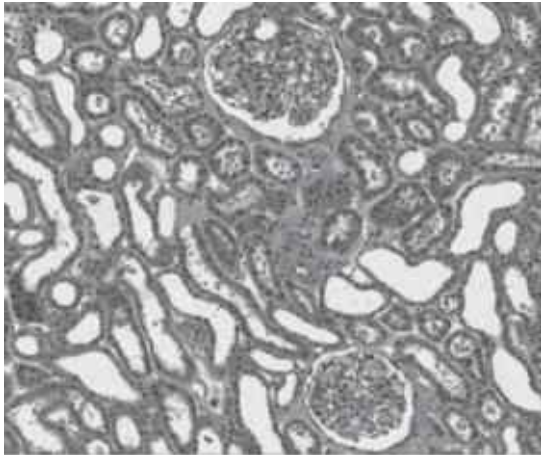


Figure 4.1

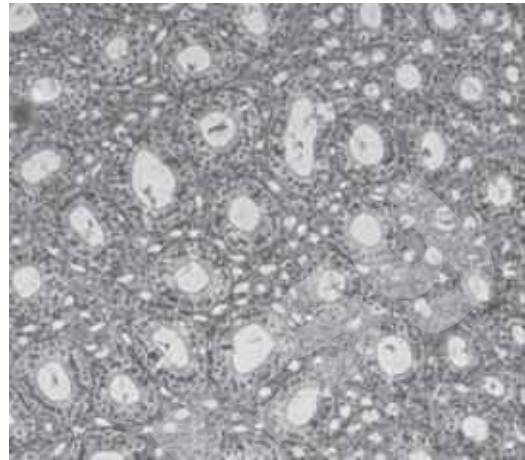


Figure 4.2

- (a) Name the region of the kidney from where tissues in Figure 4.1 and Figure 4.2 [2]
come from, stating your reason from the photomicrographs shown above.

Figure 4.1:

Reason:
.....

Figure 4.2:

Reason:
.....

- (b) Explain how cells in Figure 4.2 are influenced by a hormone in osmoregulation on [3]
a hot day when active sweating occurs. You should identify the hormone and the
nephron region(s) in your answer.

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[Total: 5 marks]

- 5 Figure 5.1 shows one common blood coagulation test - Ivy method of bleeding time. A sterilised area of the forearm is selected and pierced with a sterilised scapel at three points. Blood is blotted from the three points on a piece of filter paper every 30 seconds until the bleeding stops.



Figure 5.1

- (a) Describe the events occurring at the three cut sites which caused the bleeding to stop. [3]

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- (b) Another series of experiments using the Ivy method of bleeding time were carried out on a volunteer at different temperatures.

The results are shown in Table 5.2.

Table 5.2

temperature of skin / °C	time taken for bleeding to stop / min
25.0	15.0
28.0	13.0
31.0	10.5
34.0	8.0
37.0	6.0
40.0	20.0
43.0	33.0

Assuming that the normal temperature of skin is 37.0 °C, explain the results

- (i) when temperature increased from 25.0 °C to 34.0 °C; [2]

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- (ii) at 43.0 °C [2]

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[Total: 7 marks]

- 6 Figure 6.1 shows the cross section of the human umbilical cord under light microscope.

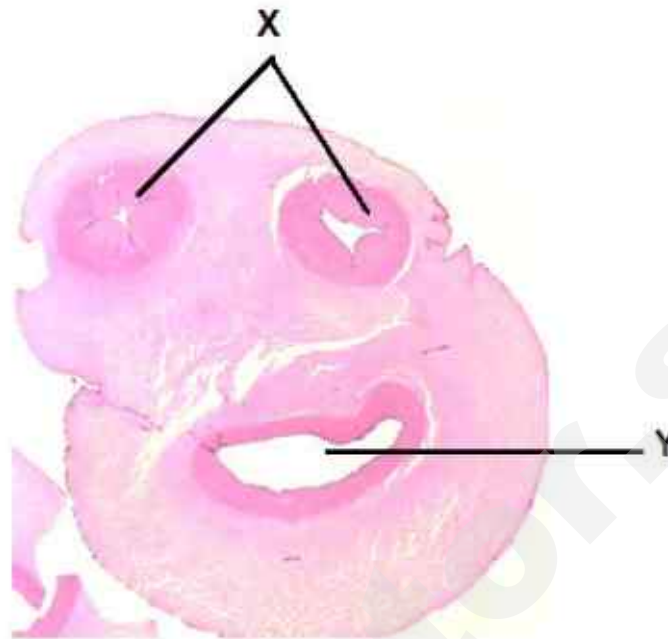


Figure 6.1

- (a) Identify vessels **X** and **Y** and complete the table to compare the blood carried by both types of vessels. [3]

name of vessel	X:	Y:
list 2 materials transported in each vessel		
direction of blood flow		

- (b) The Rhesus factor (Rh) is an antigen found on human red blood cells; people who have the rhesus antigen are considered Rh positive.

- (i) Explain how two Rh positive parents can have a child who is Rh negative. [2]

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- (ii) The rhesus gene is found on an autosomal chromosome. Using the Punnett square for rhesus factor, calculate the probability of a Rh negative woman and a heterozygous Rh positive man having a child who is female **and** Rh positive. Show your working. [2]

Man \ Woman		

[Total: 7 marks]

- 7 It is difficult to get rid of dandelions from gardens because small pieces of the roots are able to grow into new plants if left behind in the soil, as shown in Figure 7.1.

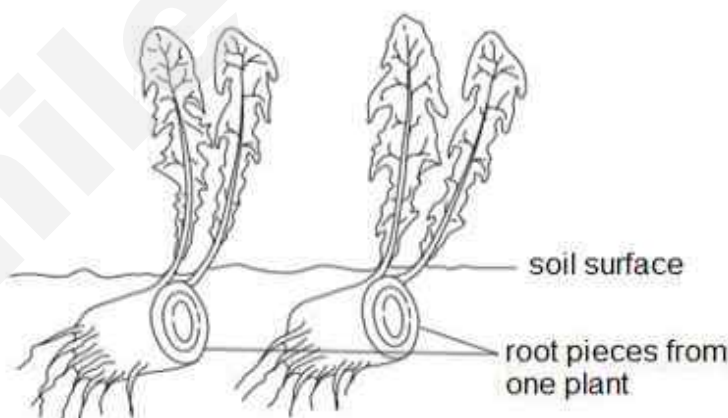


Figure 7.1

- (a) (i) Explain why the dandelion plants produced this way form clones. [1]

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- (ii) Suggest a reason why the cloned dandelion plants may not be identical in appearance. [1]

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- (b) Dandelions that produce seeds without fertilisation are triploid in nature. Triploid dandelions are produced through the process known as triploid-diploid reproduction, as summarised in Figure 7.2.

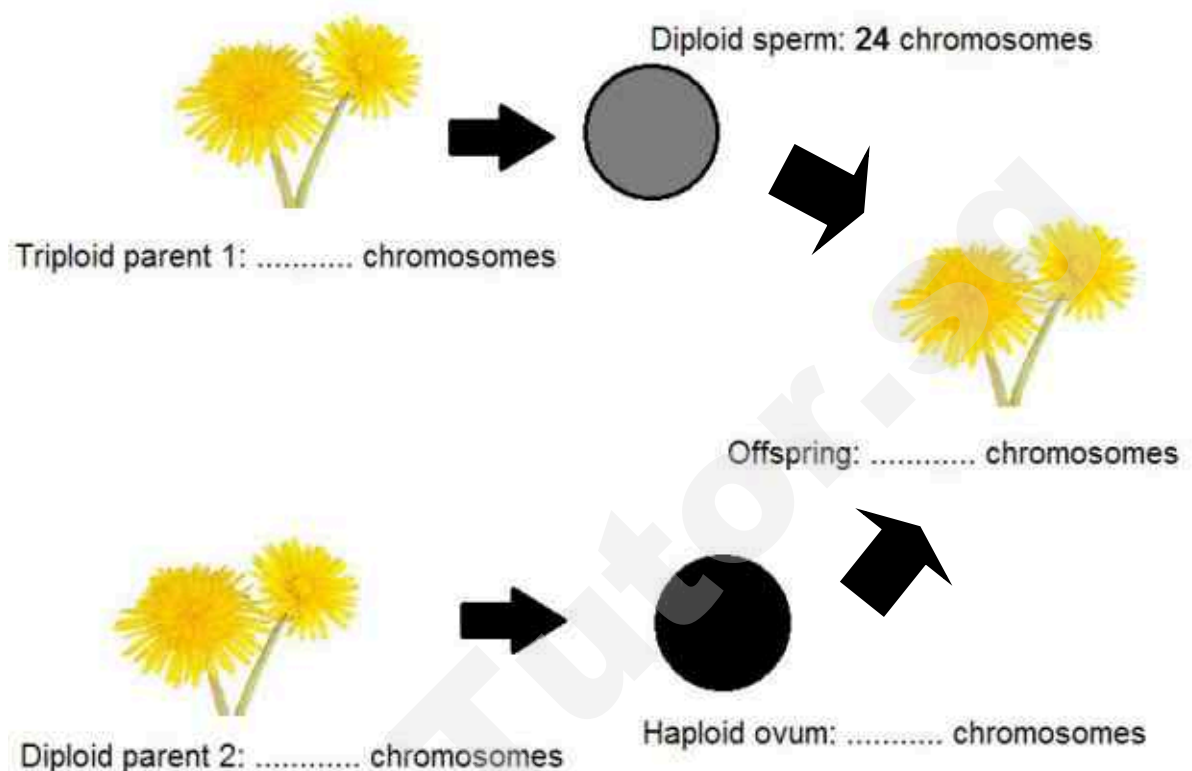


Figure 7.2

Complete Figure 7.2 to show the number of chromosomes present at each stage of reproduction. [2]

[Total: 4 marks]

8 Figure 8.1 illustrates the process of protein synthesis in animal cells.

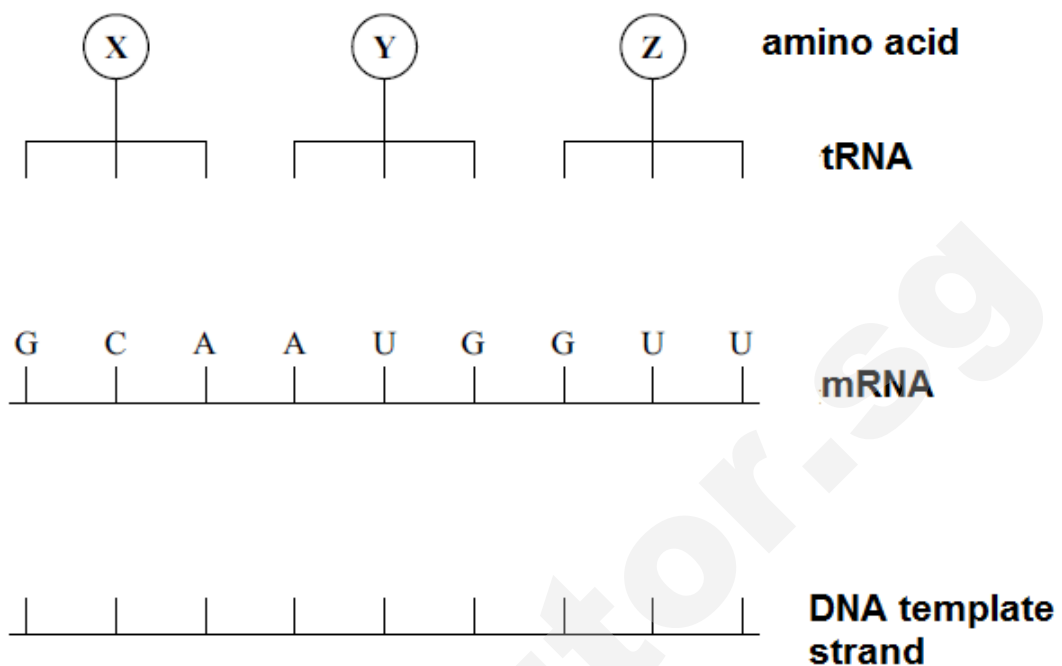


Figure 8.1

- (a) Complete Figure 8.1 to show
- (i) the bases on the DNA template strand; [1]
 - (ii) the anticodons on the tRNAs; [1]
- (b) Suggest why sometimes a mutation involving the substitution of a single base in DNA may **not** be harmful to the organism. [1]
-
-
- (c) In mammals, the lactase gene is active in infants, but as they mature and drink less milk, the gene is 'switched off'. Some humans, however, continue to produce lactase throughout adulthood, a trait known as lactase persistence (LP). Studies have shown that the LP trait expression co-evolved with the spread of domestic cattle and dairying into Europe.
- (i) Suggest a reason why the lactase gene is mainly active **only** in infants [1] and not adults.
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- (ii) Using your understanding of natural selection, suggest an explanation on [3]
how lactase persistence (LP) came about in Europe.

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[Total: 7 marks]

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Section B

Answer **three** questions. Question **11** is in the form of an **Either /Or** question. Only one part should be answered.

- 9 A student conducting an investigation at a lake observed a peculiar phenomenon – during the day he could see mats of filamentous algae floating on the lake's surface (Figure 9.1); during the night the filamentous algae disappeared.



Mats of filamentous algae

Figure 9.1

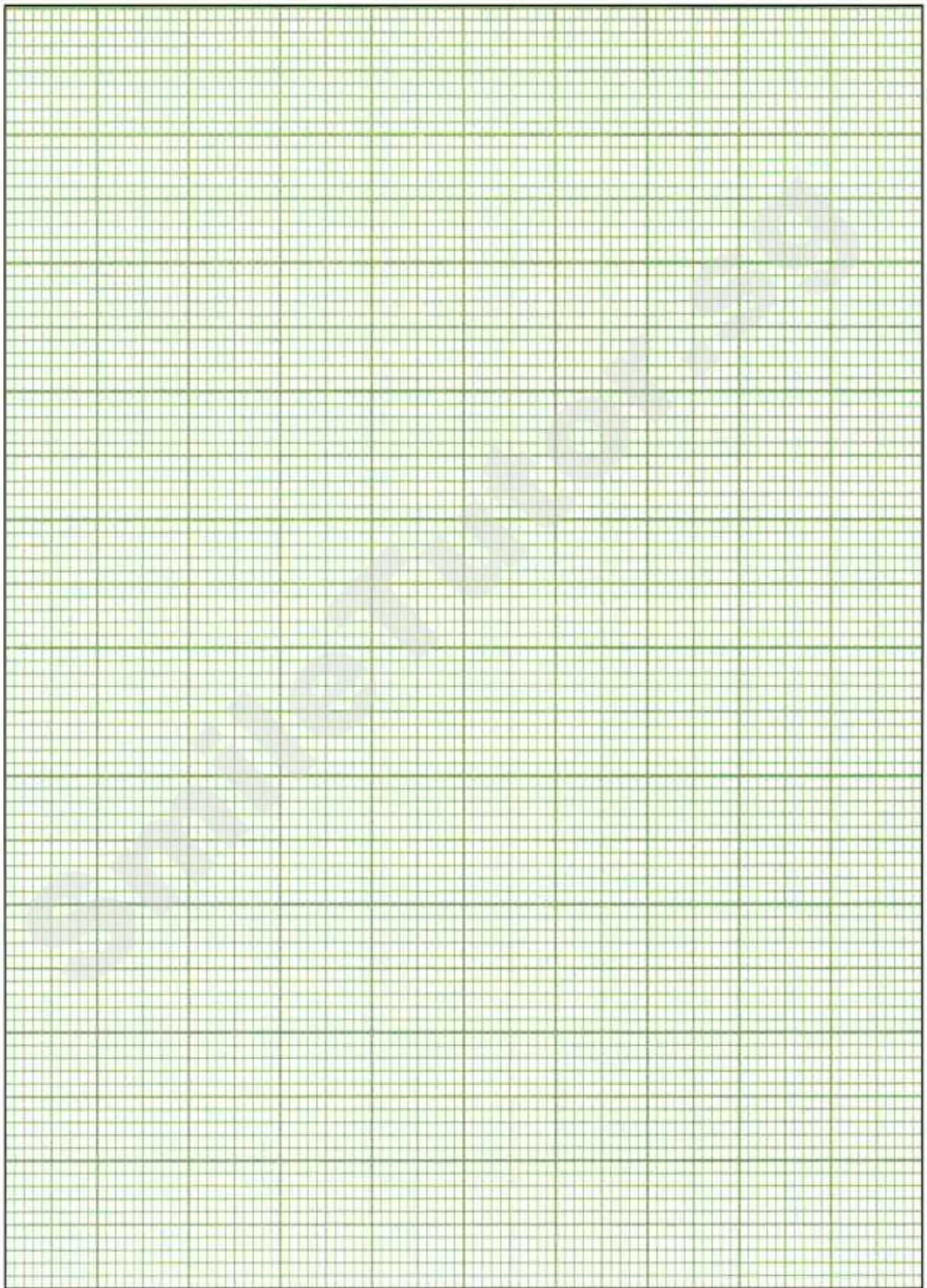
He tracked the changes in the distance of the filamentous algae from the lake's surface throughout the day and recorded his results in Table 9.2.

Table 9.2

time	distance of filamentous algae from lake's surface / cm
0600	24.0
0800	17.5
1000	9.6
1200	3.8
1400	2.5
1600	8.2
1800	15.0
2000	20.8
2200	22.4

(a) Plot the data in the grid provided below.

[4]



- (b) Explain the difference in the distance of the filamentous algae from the lake's surface at 1400 and 2000. [3]

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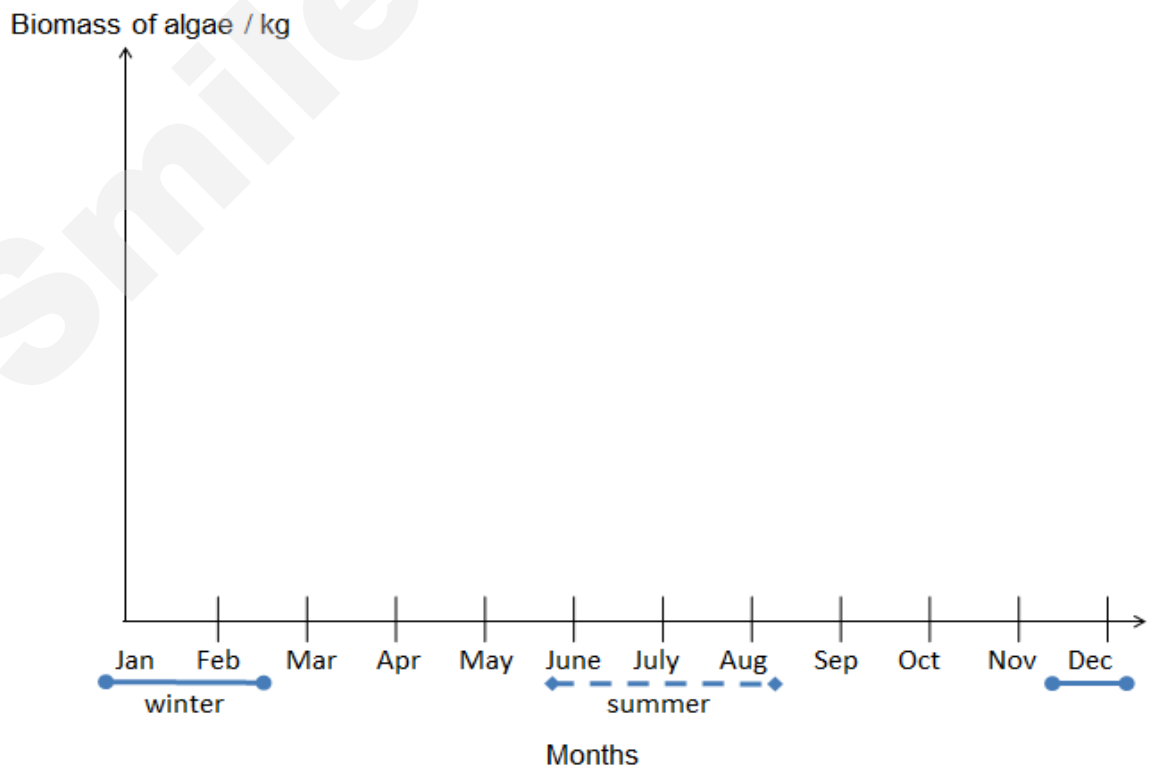
.....

- (c) (i) As part of his ecological investigation, he had to collect samples of algae and measured its biomass. Suggest how he could obtain accurate biomass readings of the algae. [1]

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.....

- (ii) Sketch, in the axes below, the estimated change in the biomass of algae over the course of the year. [1]



- [illegible]

10 Outline the processes **and** route undertaken by carbon from the time it enters a [8]
leaf to the time it reaches the alveolar epithelial cell of a rabbit. Your answer
should include **all** forms that the carbon is converted to.

[illegible]

rePrange202127

Either

11 A man decided to participate in the Sundown marathon.

- (a) Describe the roles of his various respiratory structures **during inhalation** [4]
that enable him to increase his running speed.

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- (b) The man collapsed while running the marathon and was found to have [6]
suffered from SCD (Sudden Cardiac Death). He smoked two packets of
cigarettes and had strong coffee just before the marathon. Coffee contains a
stimulant called caffeine.

Describe **and** explain how the man's actions before the marathon could
have affected his heart and breathing during the marathon to cause SCD.

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[Total: 10 marks]

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Or
11

Organophosphate pesticides (OPPs) are still widely used in agriculture on vegetables and fruits for pest control despite their negative health effects.

- (a) Describe how a person living in an urban environment, with no direct contact [3] with OPP, can suffer from OPP poisoning.

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The neurotransmitter Ach is released at the synapse to generate new nerve impulses in the next neuron. At the motor-end plate, Ach triggers muscle contraction and must be broken down afterward for the muscle to relax rather than remain locked in its tense state.

Figure 11.1 shows a synapse releasing Ach.

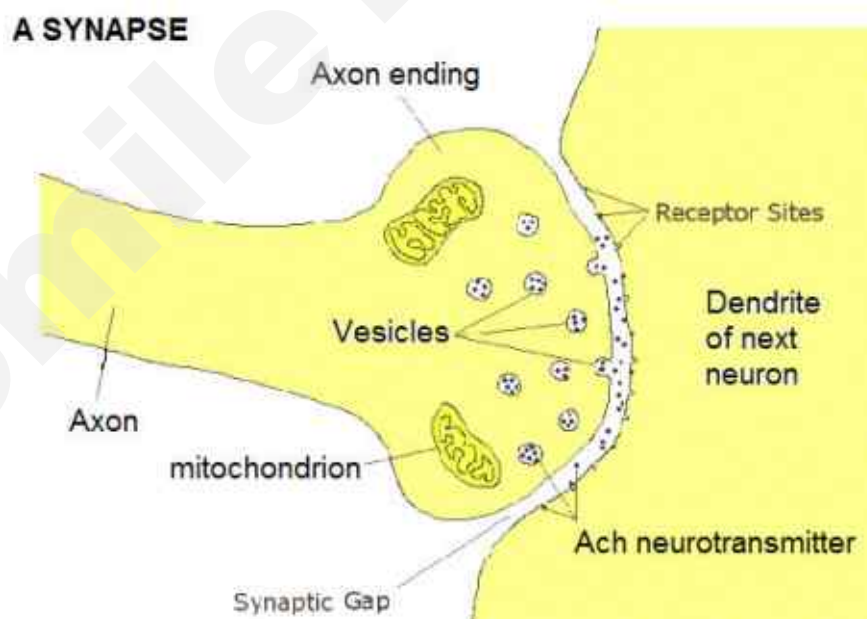


Figure 11.1

OPP causes peripheral (sensory and motor) nerve damage as it inhibits cholinesterase, the enzyme that breaks down Ach at the synapse.

- Let's Tutor

The end



TANJONG KATONG GIRLS' SCHOOL
PRELIMINARY EXAMINATION 2017
SECONDARY FOUR

5158

BIOLOGY

Paper 1

Friday

15 September 2017

1 h

Additional Materials: OMR Answer Sheet

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.

Write your name, class and register number on the OMR Answer sheet.

Answer all questions. Choose the most suitable answer, A, B, C or D, and record your choice with a soft pencil on the OMR Answer Sheet provided. Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

The use of an approved scientific calculator is expected, where appropriate.

The total marks for this paper is 40.

This question paper consists of 15 printed pages.

Answer ALL the questions on the OMR Answer sheet provided.

- 1 Which of the following does not list the structures from the simplest to the most complex?

- A epithelial cell, epithelium, large intestine, digestive system
- B muscle cell, cardiac muscle, heart, circulatory system
- C nerve, spinal cord, relay neurone, nervous system
- D root hair cell, epidermis, root, vascular system

- 2 Four different agar cubes contain a green chemical that will change from green to pink when exposed to dilute hydrochloric acid. Each agar cube was soaked in a beaker of hydrochloric acid and timed to see how long it will take to completely change colour. Which agar will take the shortest time to completely change its colour from green to pink?

agar	dimensions in cm			total surface area / cm ²
	length	breadth	height	
A	0.5	0.5	0.5	1.5
B	0.5	0.5	1.0	2.5
C	0.5	1.0	1.0	4.0
D	1.0	1.0	1.0	6.0

- 3 Which cell would need the most energy to take in nitrate molecules by active transport?

A

cytoplasm cell exterior

cell membrane

B

cytoplasm cell exterior

cell membrane

Key: nitrate molecule

C

cytoplasm cell exterior

cell membrane

D

cytoplasm cell exterior

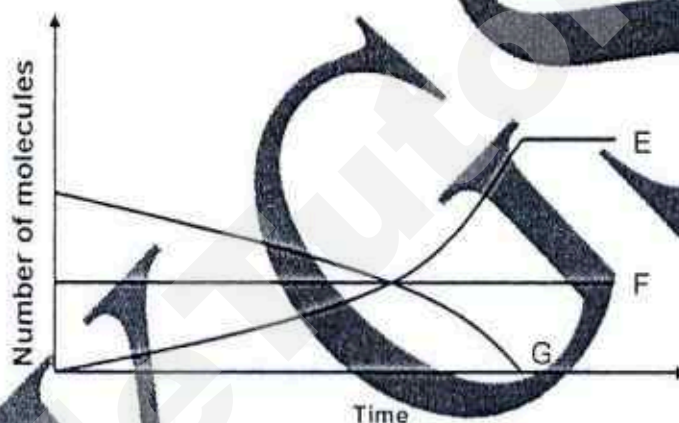
cell membrane

- 4 A 2% solution of starch and a 2% solution of amylase were mixed together separately and placed in a warm water bath of 30°C. After one hour, samples of the mixture were tested with three reagents.

Which result would be expected?

	biuret solution test	Benedict's solution test	iodine solution test
A	blue	brick-red	yellow
B	blue	blue	blue-black
C	violet	blue	blue-black
D	violet	brick-red	yellow

- 5 The following graph represents data collected for a chemical reaction aided by the action of the enzyme catalase.



What do the three lines indicated by E, F and G represent?

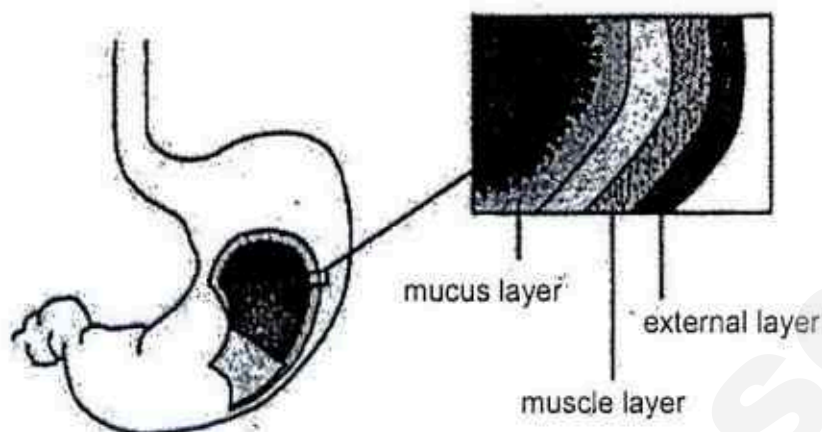
	E	F	G
A	catalase	oxygen and water	hydrogen peroxide
B	oxygen and water	catalase	hydrogen peroxide
C	oxygen and water	hydrogen peroxide	catalase
D	hydrogen peroxide	oxygen and water	catalase

- 6 A patient is diagnosed with liver disease which affects many functions of the body. Which of the following functions is **not** affected?

1. alcohol absorption
2. bile production
3. pepsin secretion
4. prothrombin production

- A 1 and 2 only
 B 1 and 3 only
 C 2 and 3 only
 D 3 and 4 only

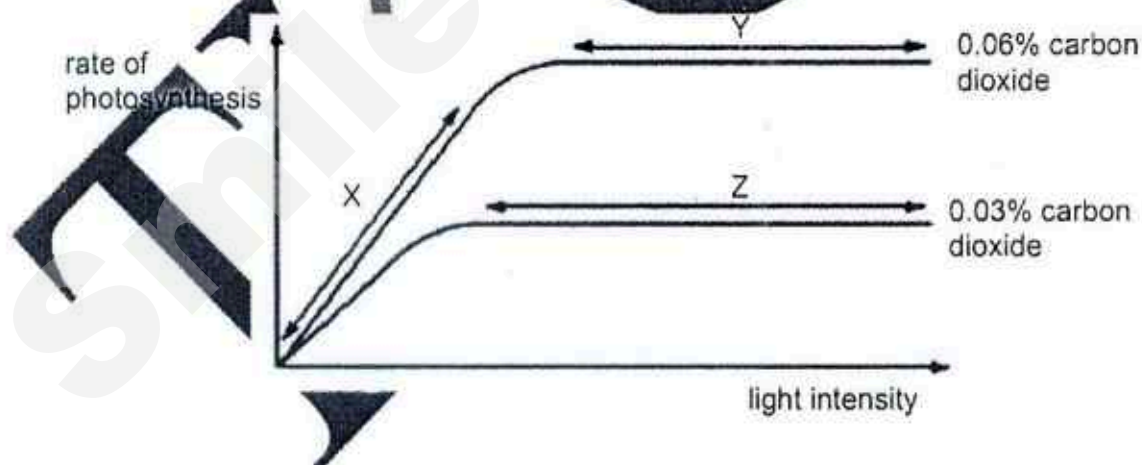
- 7 The diagram shows the different layers of a stomach wall.



A patient suffers from a disease which results in the inability to produce the innermost mucus layer of the stomach. Mucus is a slippery substance which is secreted by glands found in the stomach lining. Which of the following is a likely consequence of this disease?

- A destruction of the stomach wall
- B decreased rate of pepsin action
- C increase movement of chyme moving into duodenum
- D increase production of gastric juice

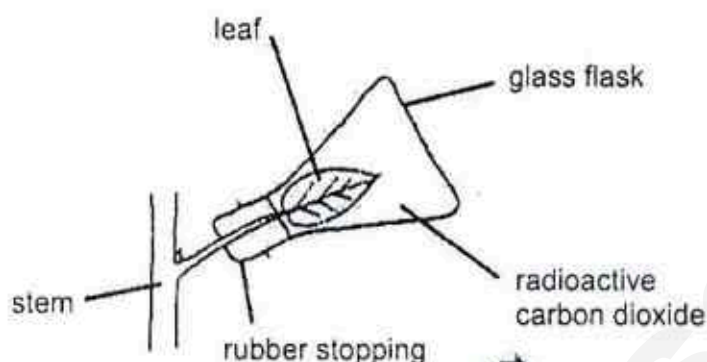
- 8 The graph shows the rate of photosynthesis of a plant subjected to increasing light intensity at two carbon dioxide concentrations. The temperature is kept constant.



What could be limiting the rate of photosynthesis at points X, Y and Z?

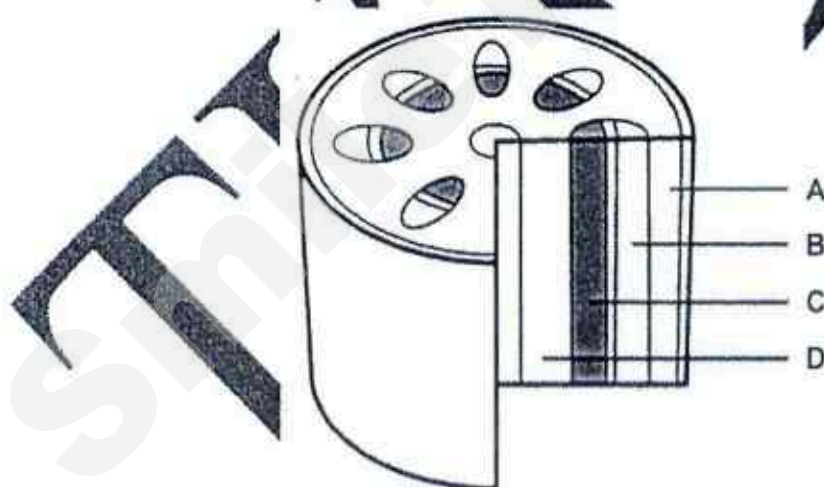
	X	Y	Z
A	carbon dioxide	light intensity	light intensity
B	carbon dioxide	light intensity	carbon dioxide
C	light intensity	carbon dioxide	light intensity
D	light intensity	carbon dioxide	carbon dioxide

- 9 The diagram shows an experiment where a leaf was exposed to radioactive carbon dioxide.



Which of the following parts of the leaf will **not** test positive for radioactivity after some time?

- A guard cell
B palisade mesophyll cell
C phloem
D xylem
- 10 The diagram shows a labelled section of a plant stem. Which labelled part transports mineral salts that are absorbed from the soil?



- 11 Which of the following environmental conditions would cause the most rapid transpiration?

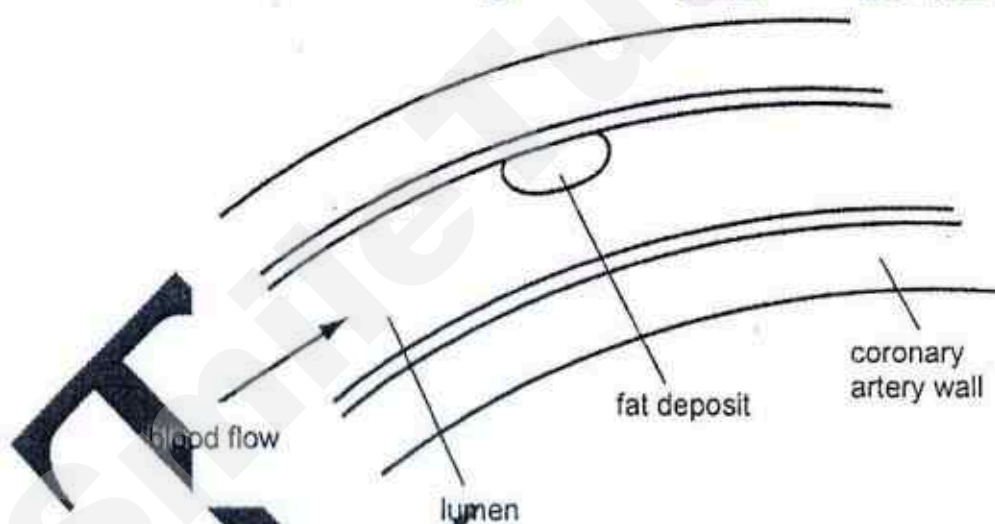
	water vapour in air / %	light intensity / lux	temperature / °C
A	50	10	20
B	50	5	20
C	20	10	45
D	20	5	45

- 12 The table shows the changes in blood pressure in the left atrium, the left ventricle and the aorta at different times during a sequence of contraction and relaxation of the heart.

time in s	blood pressure in kPa		
	left atrium	left ventricle	aorta
0.0	0.5	0.4	10.6
0.1	1.2	0.7	10.6
0.2	0.3	6.7	10.6
0.3	0.4	17.3	16.0
0.4	0.8	8.0	12.0

Which of the following statements is incorrect?

- A aortic valve is closed at $t = 0.4\text{s}$
 B bicuspid valve is closed from $t = 0.2$ to $t = 0.4\text{s}$
 C increase in ventricular pressure from $t = 0.0\text{s}$ to $t = 0.1\text{s}$ is due to atrial systole
 D ventricular systole started at $t = 0.3\text{s}$
- 13 The diagram shows a damaged section of the coronary artery that may lead to a heart attack.



What best describes the events that could lead to a heart attack?

- A further fat deposits followed by platelet and red blood cells destruction
 B further fat deposits followed by platelets forming a fibrin mesh
 C hardening of the artery wall to prevent diffusion
 D restriction of the lumen of the artery leading to decrease blood oxygen level

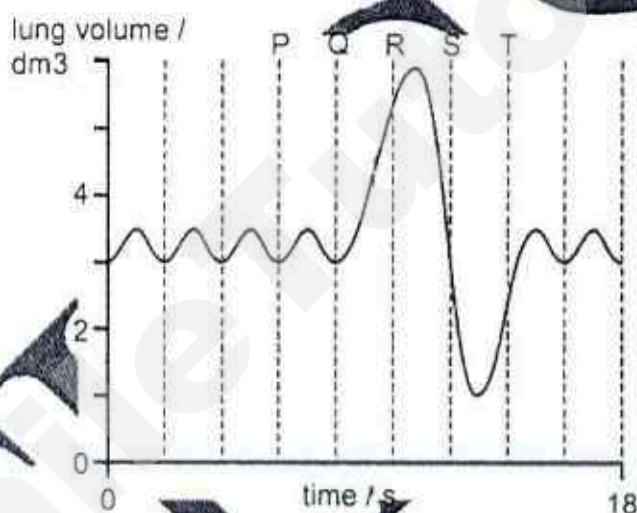
- 14 An athlete ran a 100-metre race. The following changes takes place in the athlete's body during the race.

1. increase in availability of oxygen to muscles
2. increase in breathing rate
3. increase in carbon dioxide concentration in the blood
4. increase in production of carbon dioxide by muscles

Which of the following shows the correct sequence of events taking place in the athlete's body?

- A 2 → 1 → 4 → 3
 B 3 → 4 → 2 → 1
 C 4 → 2 → 3 → 1
 D 4 → 3 → 2 → 1

- 15 The graph shows the changes in the lung volume over a period of 18 seconds.



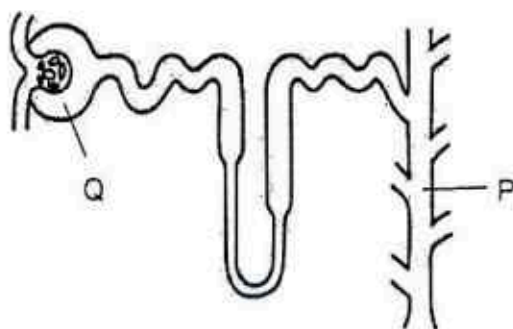
Which of the following time periods shows the fastest rate of breathing?

- A P to Q
 B Q to R
 C R to S
 D S to T

- 16 Which row correctly identifies the effects of carbon monoxide, nicotine and tar?

	effect		
	increase blood pressure	increase gene mutation	decrease oxygen in blood
A	carbon monoxide	nicotine	tar
B	nicotine	nicotine	carbon monoxide
C	nicotine	tar	carbon monoxide
D	tar	carbon monoxide	nicotine

Instructions: For Questions 17 to 18, refer to the diagram below which shows a nephron.



17 Which of the following activities results in P becoming less permeable to water?

1. cycling up a slope
2. drinking a lot of water
3. eating a pack of salted peanuts
4. sitting on a couch and reading a book

- A 1 and 2 only
 B 1 and 3 only
 C 2 and 3 only
 D 2 and 4 only

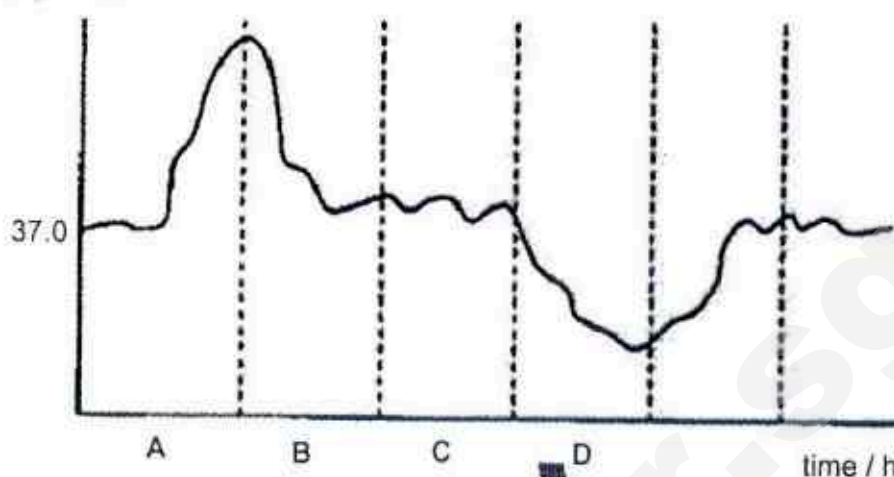
18 Which substance is found in Q?

- A glucose
 B hormones
 C platelets
 D prothrombin

19 Which of the following descriptions of the features in a dialysis machine maximises the rate of removal of nitrogenous wastes in the blood of a patient undergoing dialysis?

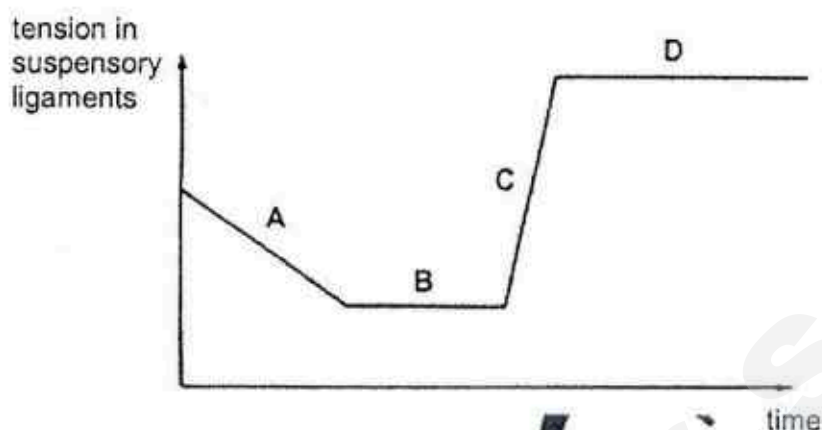
- A fresh dialysis fluid has zero concentration of nitrogenous waste
 B long and coiled dialysis tubule
 C partially permeability of dialysis tubule
 D the flow of blood in the dialysis tubule is always flowing in the opposite direction to the dialysis fluid

- 20 The graph shows the changes in a person's internal temperature over a period of time.
- temperature / °C



- Which period would arterioles supplying blood to the capillaries under the skin become constricted?
- 21 In a frog, the movement of the leg away from a pin prick is known to be a reflex action. Which one of the following will **not** inhibit this reflex?
- A cutting the dorsal root of the spinal nerve
 - B cutting the ventral root of the spinal nerve
 - C removing the brain
 - D removing the neurones in the grey matter of the spinal cord
- 22 A woman smells a flower and smiles because she feels that the scent is fragrant. Which of the following shows the correct sequence of the structures involved?
- 1. receptor
 - 2. motor neurone
 - 3. sensory neurone
 - 4. brain
- A 1 → 3 → 4
 - B 3 → 4 → 2
 - C 1 → 3 → 4 → 2
 - D 1 → 2 → 4 → 3

- 23 The graph below which shows the changes in the tension of the suspensory ligaments in the eyes of a man who looked at various objects over a period of time.



Which part of the graph **best** represents the time when he saw a vehicle moving towards him?

- 24 In a poorly-lit room, colours are often difficult to distinguish. Which of the following is the correct explanation for this?

- A Cone cells are unable to function properly under dim conditions.
- B Light is not properly refracted in the eye.
- C Light is unable to be focussed properly on the fovea.
- D Rod cells are unable to function properly under dim conditions.

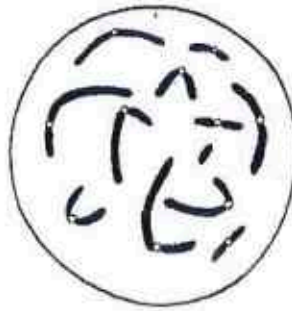
- 25 Which of the following statements show the correct changes occurring when a person is terrified?

	Increase	decrease
A	conversion of glycogen to glucose	diameter of pupil in the eye
B	diameter of pupil in the eye	diameter of skin arterioles
C	diameter of skin arterioles	ventilation rate
D	ventilation rate	conversion of glycogen to glucose

- 26 A student decides to measure the amount of DNA in a cell when it is undergoing meiosis. If the cell started off with 10 picograms of DNA in prophase I, what is the amount of DNA in each daughter nucleus at the end of the first meiotic division and the second meiotic division?

	End of	
	first meiotic division / picogram	second meiotic division / picogram
A	5.0	5.0
B	5.0	2.5
C	10.0	5.0
D	10.0	10.0

- 27 The diagram shows the chromosomes in the nucleus of a cell during telophase II of meiosis.



Which of the following statements is not true?

- A The haploid number of chromosomes for this cell is 12.
 - B The stage directly before this involved the separation of sister chromatids.
 - C There are 12 pairs of homologous chromosomes in the parent cell.
 - D When the next cell cycle begins, the chromosomes will undergo DNA replication.
- 28 The diagram shows a spider plant, *Chlorophytum* spp. with plantlets that are produced asexually from the main plant.



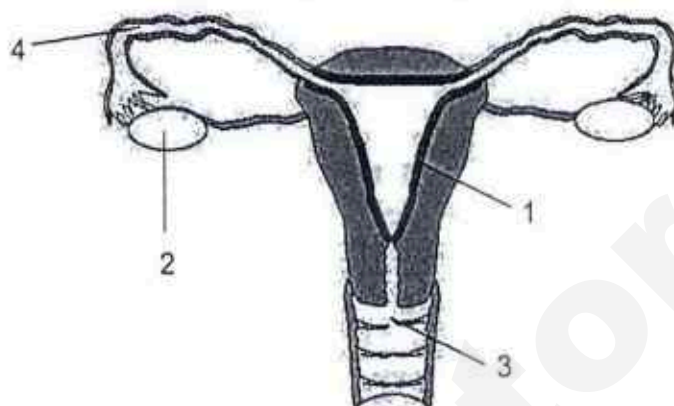
Which of the following is not an advantage of this type of reproduction?

- A The plantlets are able to grow rapidly.
- B The plantlets do not need external agents for this type of reproduction.
- C The plantlets will be able to inherit desirable traits from the main plant.
- D The plantlets will be well adapted to changing environments.

29 Which structural adaption of a flower is **not** needed in wind pollination?

- A feathery stigma
- B nectar guides
- C pendulous filament
- D small pollen grains

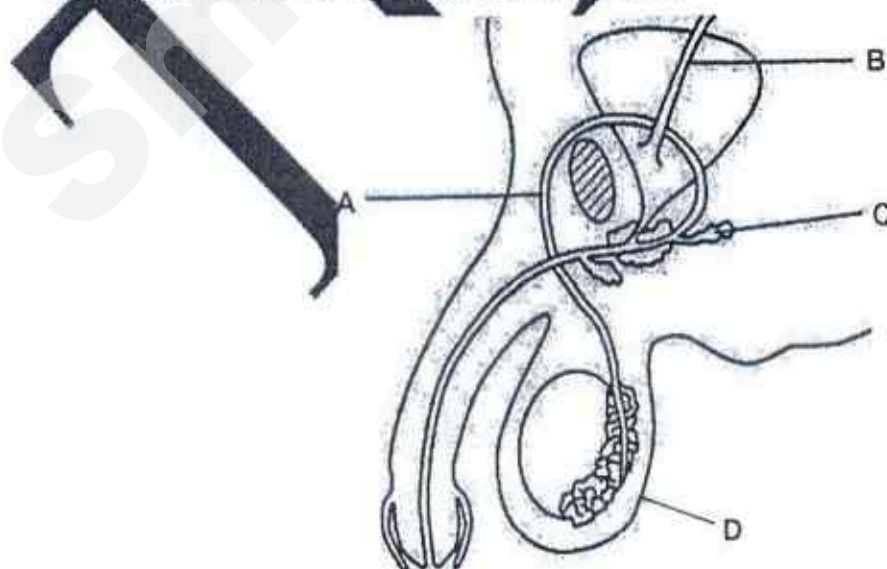
30 The diagram shows the female reproductive system.



At different times of the reproductive cycle of a healthy female, the following structures can be found. Which of the following is correct?

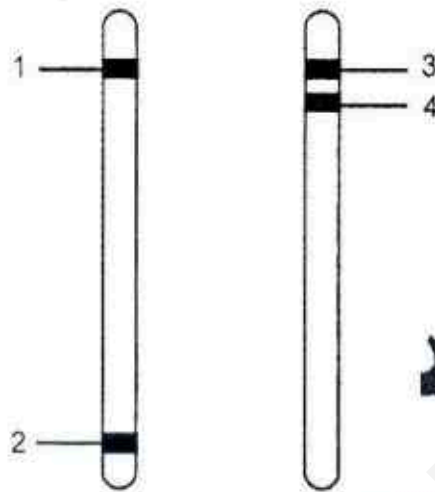
	developing ovum	zygote	sperm	embryo
A	2	4	1	3
B	2	4	3	1
C	4	1	3	2
D	4	2	1	3

31 The diagram shows the male reproductive system.



Which part is involved in the temporary storage of gametes?

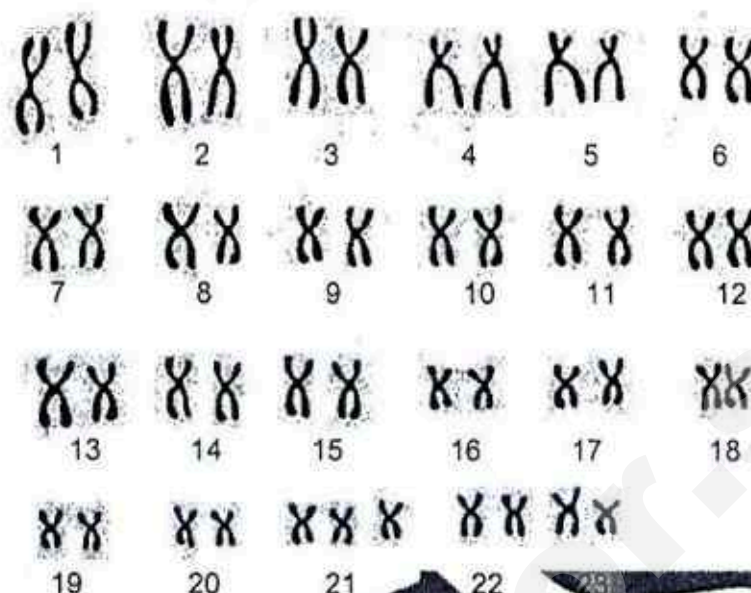
- 32 The diagram represents a pair of homologous chromosomes showing four sites where genes are located (gene loci).



Which pair of genes are alleles?

- A 1 and 2 only
B 1 and 3 only
C 2 and 4 only
D 3 and 4 only
- 33 Tay-Sachs disease is a rare inherited disorder that affects nerve tissues in the brain. Affected individuals who are homozygous recessive rarely survive beyond childhood. Heterozygotes are carriers with no obvious disease symptoms.
- If two heterozygotes are crossed, what will be the probability that a surviving offspring of the next generation is heterozygous?
- A 0.25
B 0.33
C 0.67
D 0.75
- 34 A student breeding black-eyed fruit flies for 10 generations discovered 6 fruit flies with white eyes. What could be a possible explanation for this observation?
- A a mutation has occurred
B artificial selection has occurred
C natural selection has occurred
D the gene for white eye is recessive

- 35 The diagram shows the karyotype of a human.



Which of the following are the possible phenotypes?

1. female
2. male
3. Down's syndrome
4. sickle-cell anaemia

- A 1 and 3 only
 B 1 and 4 only
 C 2 and 3 only
 D 2 and 4 only

- 36 Which of the following shows the correct information during the process of coding for a polypeptide from DNA?

	in the nucleus	in the cytoplasm
A	transcription	translation
B	transcription	replication
C	translation	transcription
D	translation	condensation

- 37 The use of restriction enzymes in genetic engineering is to

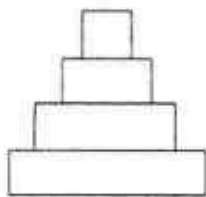
- A create new DNA.
 B join the sticky ends of the desired gene and plasmid together.
 C identify the bases on the DNA for replication.
 D recognise and cut certain sequence of DNA bases.

38 Which of the following is **not** an implication of genetic engineering?

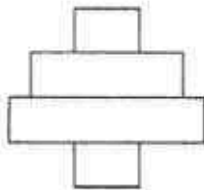
- A decrease in unhealthy nutrients in food products
- B decrease in the time spent on producing insulin
- C increase in crops that can thrive in harsh conditions
- D increase in the cost of producing insulin

39 Which pyramid of numbers matches the food chain below?

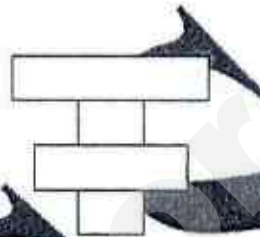
papaya tree → caterpillar → mynah → tick



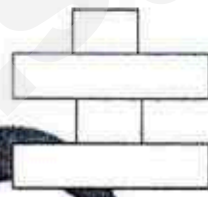
A



B



C



D

40 The rate of absorption of light energy measured in a field is $6300 \text{ kJ m}^{-2} \text{ day}^{-1}$. Only 1% of this energy is converted into new plant production. 10% of the net plant production at one trophic level is transferred to the next trophic level. How much energy is entering the primary consumer?

- A $0.063 \text{ kJ m}^{-2} \text{ day}^{-1}$
- B $0.630 \text{ kJ m}^{-2} \text{ day}^{-1}$
- C $6.300 \text{ kJ m}^{-2} \text{ day}^{-1}$
- D $66.000 \text{ kJ m}^{-2} \text{ day}^{-1}$

END OF PAPER

2017 Sec 4 Biology Prelim - Answer Key

Paper 1

1	2	3	4	5	6	7	8	9	10
C	A	D	D	B	B	A	D	D	C

11	12	13	14	15	16	17	18	19	20
C	D	B	D	A	C	D	A	D	D

21	22	23	24	25	26	27	28	29	30
C	C	A	A	B	B	D	D	B	B

31	32	33	34	35	36	37	38	39	40
C	B	C	A	C	A	D	D	C	C

Candidate Name

Class	Register No.
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TANJONG KATONG GIRLS' SCHOOL
PRELIMINARY EXAMINATION 2017
SECONDARY FOUR

5158

BIOLOGY

Paper 2

Wednesday

13 September 2017

1 h 45 min

No Additional Materials are required.

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.

Write your name, class and register number on page 1.

SECTION A [50 marks]

Answer all questions. Write your answers in the spaces provided on the question paper.

SECTION B [30 marks]

Answer all questions. Write your answers in the spaces provided on the question paper.

Electronic calculators may be used.

You are advised to spend no longer than one hour on Section A and no longer than 45 minutes for Section B.

The intended marks for questions and part questions are given in the brackets [].

FOR EXAMINER'S USE		
Section A		
Section B	8	
	9	
	10 E/O	
Total		80

The total marks for this paper is 80.

This question paper consists of **16** printed pages.

Section A [50 marks]

Answer ALL the questions on the space provided.

For
Examiner's
Use

- 1 Fig. 1.1 shows two slices of potato strips (strips A and B) bonded together using a waterproof adhesive. Subsequently, a layer of waterproof paint is applied onto the exposed surface of strip B.



Fig. 1.1

The bonded strips are immersed in concentrated salt solution for 20 minutes.

- (a) Explain the appearance of the bonded strips after 20 minutes.

Handwritten answer for (a):

The strips will become limp and wilted. This is because the strips are immersed in a concentrated salt solution, which is a hypertonic solution. Water will move out of the potato cells by osmosis, causing them to lose turgor pressure and become flaccid.

[4]

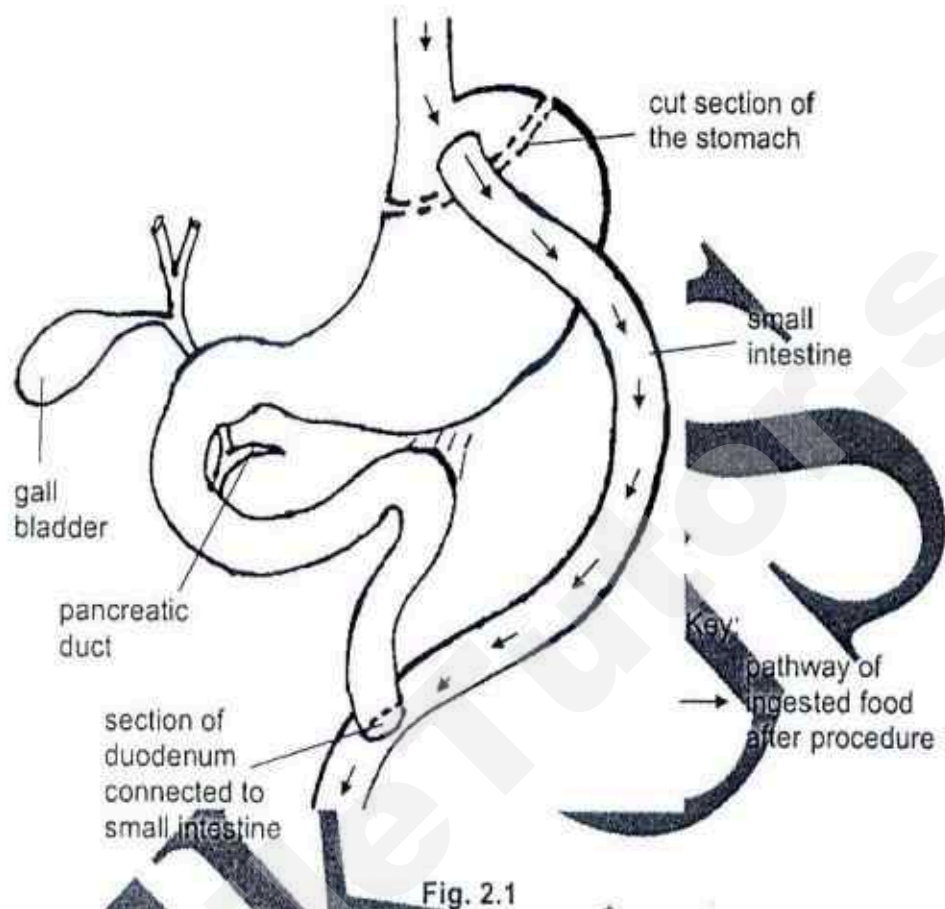
- (b) Draw the appearance of a cell extracted from strip A after 20 minutes.



[2]

[total:6m]

- 2 Fig. 2.1 shows a surgical procedure known as a bariatric surgery. This type of surgery is performed on patients who have health problems related with obesity.



- (a) (i) State the substance found in the gall bladder.

[1]

- (ii) Explain how this substance helps in digestion.

[2]

- (b) The patient consumes a meal of fried chicken. How will the digestive process be affected due to the result of this surgical procedure?

[3]
[total:6m]

- 3 Fig. 3.1 shows the rates of water absorbed and water transpired by a plant within a 12-hour period.

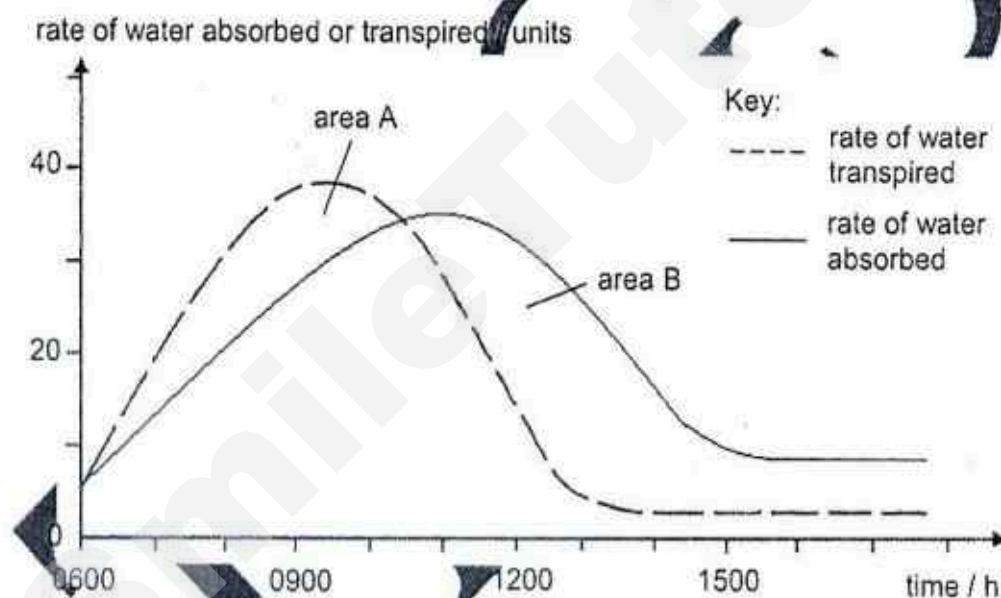


Fig. 3.1

- (a) What do areas A and B represent?

Area A : _____

Area B : _____

[2]

- (b) With reference to Fig. 3.1, explain if the plant is actively growing.

[3]

- (c) Suggest why there is a difference in the timings for maximum rate of water absorbed and water transpired.

[2]

[total:7m]

- 4 An experiment was carried out to determine the effect of temperature on the rate of oxygen consumption for a species of lizard (Lizard A) when it is at rest and when it is running. Lizards are reptiles that depend on external temperatures to help them regulate their internal temperatures.

Several lizards (Lizard A) were fitted with masks, with each mask covering the entire head of the lizard. Air was supplied into each mask through one tube, and collected through another. Oxygen consumption, which is the difference in oxygen concentration in the air supplied and the air exhaled was collected at different temperatures. Table 4.1 shows the results of this experiment.

temperature (°C)	oxygen consumption (units)	
	at rest	running
15	0.01	0.16
20	0.03	0.22
25	0.04	0.29
30	0.07	0.35
35	0.09	0.43
40	0.12	0.57

Table 4.1

- (a) Describe the effect of temperature on the rate of oxygen consumption in Lizard A when at rest.

[1]

- (b) Account for the difference in the rates of oxygen consumption in Lizard A when it is at rest and running.

[3]

- (c) The mask used in the first experiment can also measure the build-up of oxygen debt of the lizards during running. Fig. 4.2 shows the oxygen debt of Lizard A and Lizard B, another species of lizard, during running at various temperatures.

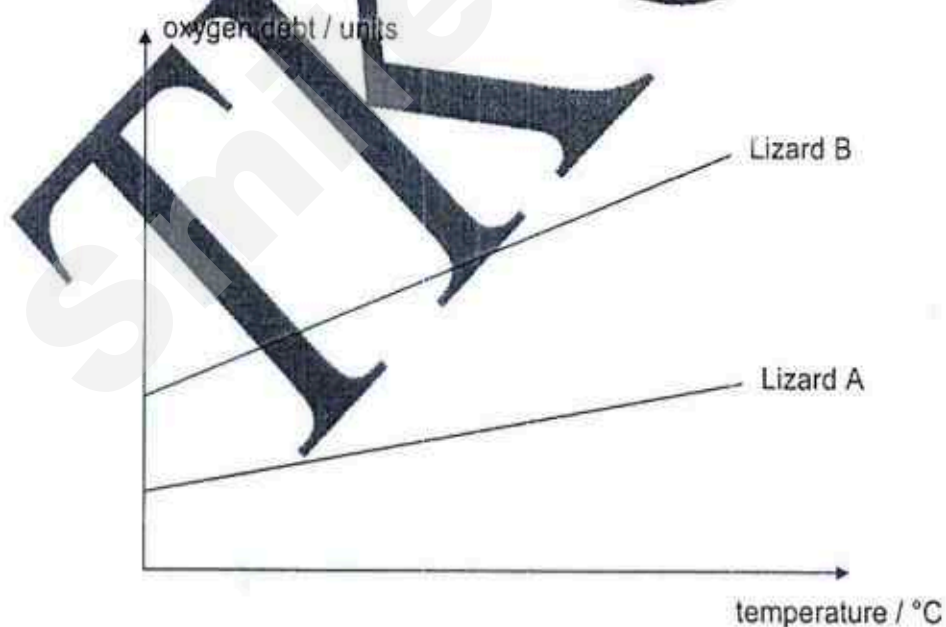


Fig. 4.2

Lizard A is a fast-moving insectivore, whereas Lizard B is a slow-moving herbivore. With reference to Fig. 4.2, explain how Lizard A is well-adapted for its mode of life.

[3]
[total:7m]

- 5 (a) Fig. 5.1 shows a cell at interphase before it undergoes mitosis.

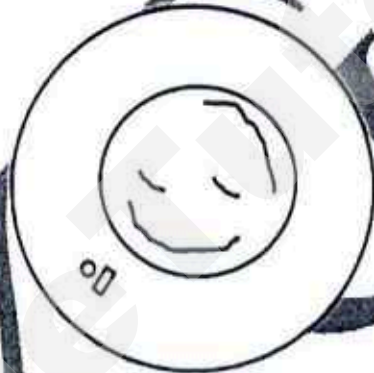


Fig. 5.1

- (i) In the diagram below, draw the appearance of the cell at metaphase.



[2]

- (ii) Explain why it is important for the cell to appear that way during metaphase.

[2]

- (b) (i) Describe how metaphase in (a)(i) is different from metaphase I.

[1]

- (ii) State two differences between the daughter cells produced during mitosis and meiosis.

[2]

[total:7m]

- 6 Fig. 6.1 shows a pair of nucleotides in a DNA molecule.

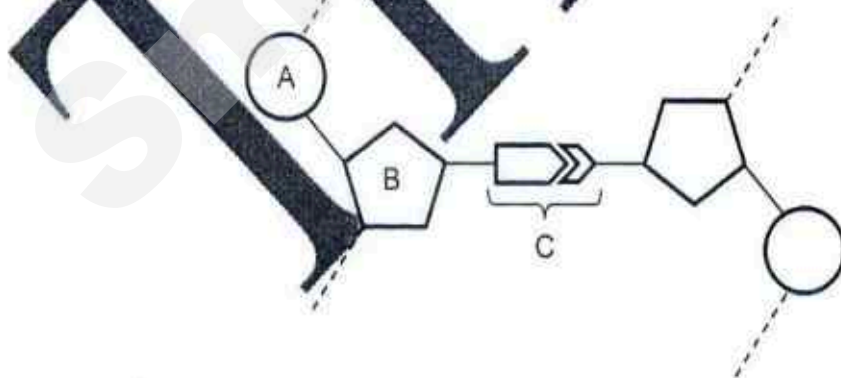


Fig. 6.1

- (a) Identify structures A and B.

A : _____

B : _____

[2]

- (b) State the possible base pairings of C to ensure stability in the DNA structure.

_____ [2]

- (c) Discuss how the significance of C in (b) contributes to the process of forming recombinant plasmids in bacteria transformation.

_____ [3]

- (d) One modern application of bacterial transformation is the manufacture of insulin for diabetic patients. Explain the role of insulin in people with diabetes.

_____ [3]

[total:10m]

- 7 A study was conducted on four different species of organisms in a forest ecosystem. The total number of individuals in each population and the average mass of each individual (in arbitrary units) were obtained, and the results recorded in Table 7.1.

Organism	Number of individuals	Average biomass of each individual/ arbitrary units	Total biomass/ arbitrary units
W	80	4500	
X	37	12 750	
Y	195	37	
Z	3800	15	

Table 7.1

- (a) Calculate the total biomass of each population in the space provided in Table 7.1.

[1]

- (b) Based on the data in Table 7.1,

- (i) draw a food chain to show the relationships between the organisms in the ecosystem.

[1]

- (ii) sketch and label a pyramid of biomass to show the relationships between the organisms in the ecosystem.

[2]

- (c) Food chains rarely go beyond four trophic levels. Explain why this is so.

[3]

[total:7m]

END OF SECTION A

Section B [30 marks]

Answer ALL the questions on the space provided.

For
Examiner's
Use

- 8 A group of naturalists conducted an experimental study on a species of finches (*Geospiza fortis*) commonly found in the Galapagos islands.

The lengths of the beaks of 175 *Geospiza fortis*, all of which are the same age, were measured as shown in Fig. 8.1.

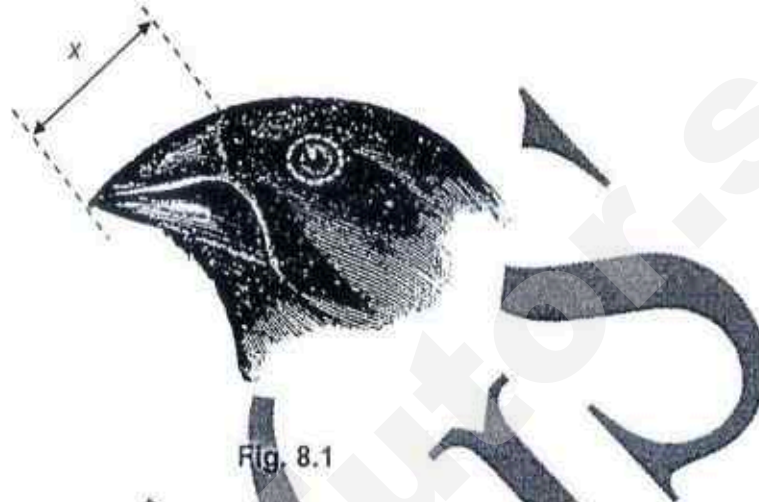
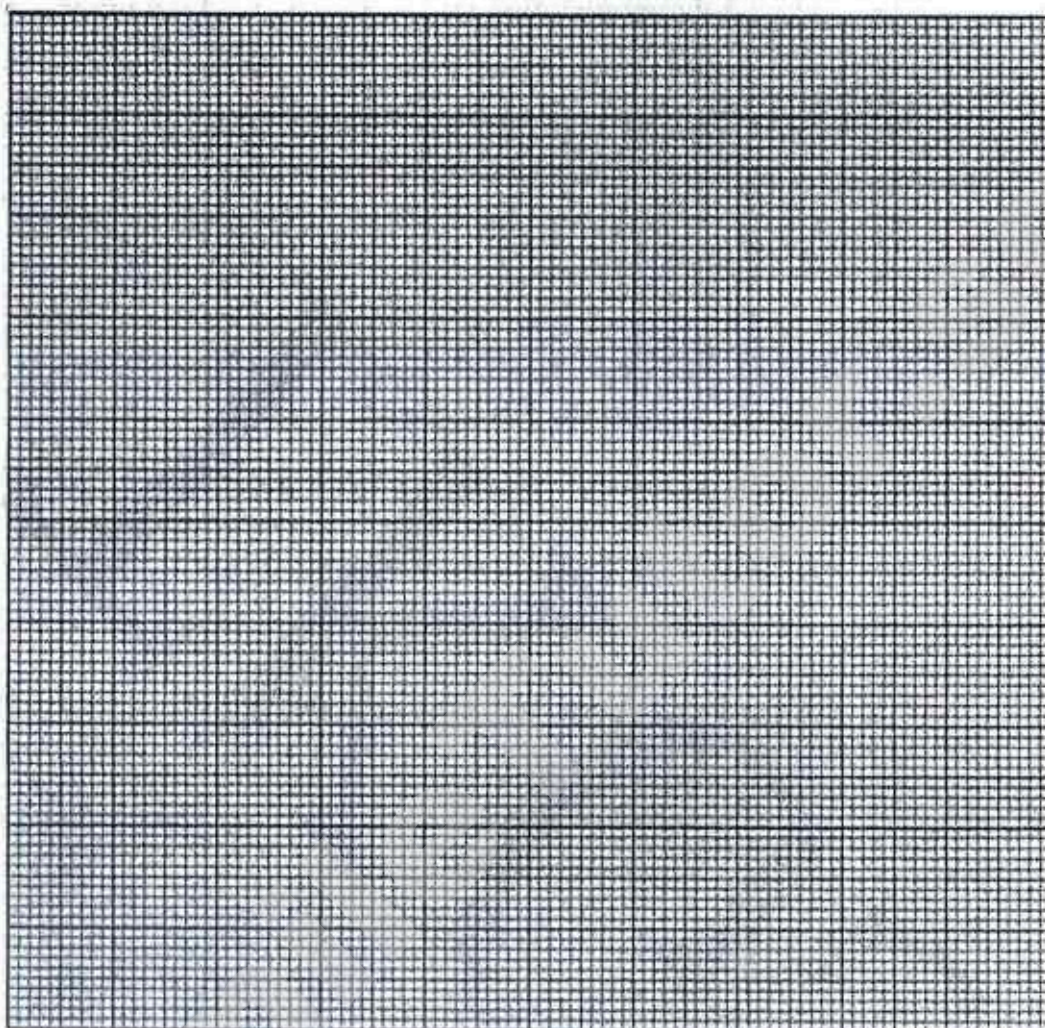


Table 8.2 shows the data collected.

x / cm	No. of <i>Geospiza fortis</i>
$0.5 \leq x < 1.0$	2
$1.0 \leq x < 1.5$	13
$1.5 \leq x < 2.0$	20
$2.0 \leq x < 2.5$	32
$2.5 \leq x < 3.0$	45
$3.0 \leq x < 3.5$	38
$3.5 \leq x < 4.0$	25

Table 8.2

- (a) Based on the information in Table 8.2, construct a histogram to illustrate the results.



[3]

- (b) (i) State the type of variation shown in the beak lengths of *Geospiza fortis*.

[1]

- (ii) Suggest two reasons in the difference of beak lengths of *Geospiza fortis*.

[2]

- (c) While conducting the study on *Geospiza fortis*, the group of naturalists came across *Geospiza olivacea*, a species of finches which are closely related with *Geospiza fortis*. The appearance of the beak of *Geospiza olivacea* is different to that of *Geospiza fortis*, which is possibly due to the difference in their diets. *Geospiza fortis* feeds mainly on seeds, whereas *Geospiza olivacea* feeds mainly on insects.

Fig. 8.3 shows the appearance of the beak of *Geospiza olivacea*.

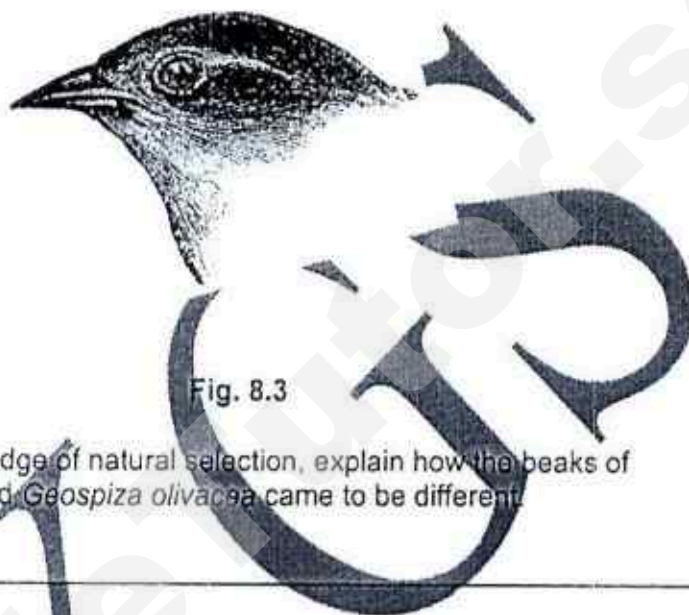


Fig. 8.3

Using your knowledge of natural selection, explain how the beaks of *Geospiza fortis* and *Geospiza olivacea* came to be different.

[4]

[total:10m]

[5]

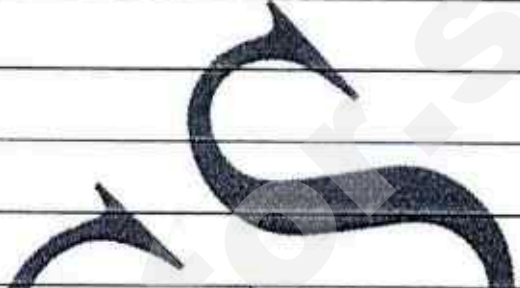
- (b) Explain why it is suitable for a person with blood type A to receive blood transfusion from blood type O, but not suitable from blood type B.

[5]

[total:10m]

10 EITHER

(a) Explain why oceans are able to take in more carbon than they can give out.



[4]

(b) Explain the effects on bodies of water when polluted by

- fertilisers; and
- pesticides.

TK

[6]

[total:10m]

10 OR

- (a) Explain why negative feedback is essential in homeostasis.

[4]

- (b) Explain how the mechanisms for controlling body temperature are coordinated.

[2]

- (c) Explain why it is not advisable to stay in a humid enclosed room at 40 °C for more than 20 minutes.

[4]

[total:10m]

END OF SECTION B

END OF PAPER

2017 Sec 4 Biology Prelim - Answer Key

Paper 1

1	2	3	4	5	6	7	8	9	10
C	A	D	D	B	B	A	D	D	C
11	12	13	14	15	16	17	18	19	20
C	D	B	D	A	C	D	A	D	D
21	22	23	24	25	26	27	28	29	30
C	C	A	A	B	B	D	D	B	B
31	32	33	34	35	36	37	38	39	40
C	B	C	A	C	A	D	D	C	C

Paper 2

Answers		
1	a	Strip A curves more than Strip B (OWTTE); Higher water potential in cell sap than solution (or opposite); Water molecules move out of cell into solution + osmosis; Waterproof paint prevents water molecules enter Strip B;
	b	(cell membrane partially/fully detached from cell wall); (Cell wall, nucleus and vacuole must be shown in their correct positions);
2	a	i Bile;
	ii	Emulsify fats + physically break fat globules into smaller fat globules; Increase surface area to volume ratio + increase lipase digestion into fatty acids + glycerol;
	b	Fat and protein digestion decreases; (I: carbohydrates) (R: no digestion) Less digestion of protein by pepsin/protease in stomach OR less/no formation of chyme + no increase in surface area to volume ratio for enzyme digestion; Late introduction of intestinal and pancreatic protease and bile + insufficient time for complete digestion;
3	a	A – amount of water loss B – amount of water used
	b	Total area of B is greater than A; Net water gained by plant OR more water is used by the plant than lost through transpiration; For photosynthesis, medium for chemical reaction e.g. respiration, medium for transport, maintain turgidity of cells;

		(any one function of water in plants)
	c	Water loss through transpiration occurs earlier than water absorbed into the plant; Water is drawn into the plant by transpiration stream/pull;
4	a	As temperature increases from _____ to _____, rate of oxygen consumption increases from _____ to _____;
	b	Oxygen consumption + respiration rate is higher during running than resting; Muscles contract more during running than resting; More oxygen is needed as a respiratory substrate; More energy is required for muscle contraction; (capped at 2m)
	c	Lizard A uses more aerobic respiration + less oxygen debt compared to B; To release more energy for running; Less anaerobic respiration + less lactic acid is produced;
5	a	i (4 chromosomes with sister chromatids lined at the equator + 2 big and 2 small chromosomes); (spindle fibres attached to centromere of each chromosome);
		ii During anaphase + sister chromatids pulled apart to the opposite ends of the cell; Equal distribution of chromosomes;
	b	i Chromosomes arranged in a single line at the equator in metaphase, but in metaphase I homologous chromosomes are arranged in pairs on the equator;
		ii Diploid / same chromosome number as parent vs haploid / half chromosome number as parent; Genetically identical vs not genetically identical; 2 daughter cells vs 4 daughter cells; (any two, but must compare properly)
6	a	A – phosphate group; B – sugar / deoxyribose
	b	Cytosine and guanine; adenine and thymine;
	c	Desired gene + plasmid is cut using same restriction enzyme to create sticky ends; DNA ligase is used to join desired gene to plasmid; Bases of the sticky end of desired gene are complementary to the bases of the sticky end of the plasmid;
	d	Insulin injected/absorbed into patients' blood + stimulates liver; convert excess glucose into glycogen + stored in liver and muscle cells; blood glucose level decreases to normal;
7	a	W – 360000

		X – 471750 Y – 7215 Z – 57000
	b	i X → W → Z → Y
		ii (upright pyramid); (trophic levels labelled);
	c	Energy transfer decreases along the trophic levels in the food chain; 90% is lost + (1 example); 10% is successfully transferred for growth of cells / repair of tissues;
8	a	(axes); (scale); (height of histogram);
	b	i Continuous;
		ii Different sexes / diets / genes / health (any two)
	c	<u>Mutation causes variation in phenotype of beak shape;</u> <u>Adapt to changing environment by changing diets;</u> <u>Grow to maturity and reproduce;</u> <u>Pass the genes to next generation;</u>
9	a	Bicuspid & tricuspid valve (or atrio-ventricular valves) between left and right atrium and ventricle respectively; Closes when ventricles contract to prevent blood from re-entering the atrium + pump blood into the pulmonary artery and aorta; Semi lunar valves in pulmonary artery + aorta; Closes when ventricles relax to prevent blood from re-entering ventricles from the pulmonary artery and aorta; Septum prevent oxygenated and deoxygenated blood from mixing;
	b	Blood type A has antigen A and antibodies b; Blood type O has no antigens; Hence antibodies b will not react with RBC from blood type O; Blood type B has antigens B; Antibodies b will react with antigen B of RBC to cause RBC to clump/agglutinate;
10 E	a	Carbon dioxide is soluble + dissolve into oceans; Phytoplankton, algae and plants absorbed carbon dioxide for photosynthesis; Carbon is transferred from one trophic level to another in the ocean foodweb; Carbon is stored in the tissues of organisms in the ocean as food molecules; Carbon compounds stored as fossil fuels in ocean seabeds; (capped at 4m)
	b	i Nitrates and phosphates in fertilisers causes algal blooms; Blocks sunlight from penetrating water body + decrease photosynthesis from submerged plants;

		Competition for oxygen in water increases by organisms in the water body leads to depletion of oxygen; Organisms die and increase decomposition; (capped at 3m)
	ii	Non-biodegradable substances absorbed and accumulated in the bodies of organisms; Unable to be broken down and excreted; Bioamplification/biomagnification of these substances as the trophic levels in the food chain/web increases;
10 O	a	Homeostasis is the maintenance of a constant internal environment; A negative feedback is a process where the body carries out a corrective mechanism in response to a stimulus to bring about the reverse effect of a stimulus; which on restoring the normal conditions causes a feedback to the receptor to stop the corrective mechanism;
	b	Changes in blood temperature is detected by the hypothalamus in the brain; Brain sends out nerve impulses to effectors in body to carry out responses to bring temperature back to normal;
	c	Body gains heat from surrounding temperatures; Sweat on the skin surface unable to evaporate; No heat loss through latent heat of vaporisation; Cells cannot perform metabolic functions + temperature higher than optimum;



ANDERSON SECONDARY SCHOOL
Preliminary Examination 2017
Secondary Four Express & Five Normal
Academic



CANDIDATE NAME:

CLASS:

INDEX NUMBER:

BIOLOGY (SPA)

5158/01

Paper 1

18 August 2017

1 Hour

1130 – 1230h

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, Class and Index number on the Answer Sheet in the spaces provided unless this has been done for you.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

This document consists of 15 printed pages

SECTION A

Answer all the questions in the Multiple Choice Answer Sheet.

1 Which of the following are correct descriptions for a plant cell?

- (i) The nucleus contains genetic material.
- (ii) Photosynthesis occurs inside the chlorophyll.
- (iii) The cell wall is freely permeable to dissolved substances.

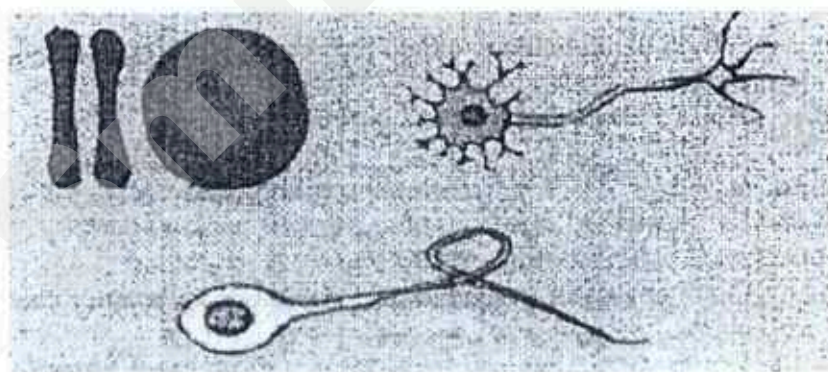
- | | | | |
|---|--------------------|---|---------------------|
| A | (i) and (ii) only | B | (ii) and (iii) only |
| C | (i) and (iii) only | D | (i), (ii) and (iii) |

2 Which of the following cells of a green leaf have chloroplasts?

- (i) guard cells
- (ii) mesophyll cells
- (iii) epidermal cells

- | | | | |
|---|---------------------|---|---------------------|
| A | (i) and (ii) only | B | (ii) only |
| C | (ii) and (iii) only | D | (i), (ii) and (iii) |

3 The diagram below shows three kinds of human cells:



All these cells _____.

- (i) carry out respiration
- (ii) contain genetic material
- (iii) can grow in size
- (iv) can undergo cell division

- | | | | |
|---|---------------------|---|--------------------------|
| A | (i) only | B | (i) and (ii) only |
| C | (ii) and (iii) only | D | (i), (iii) and (iv) only |

- 4 Which of the following structure can be found in a mesophyll cell, a root epidermal cell and a xylem vessel?

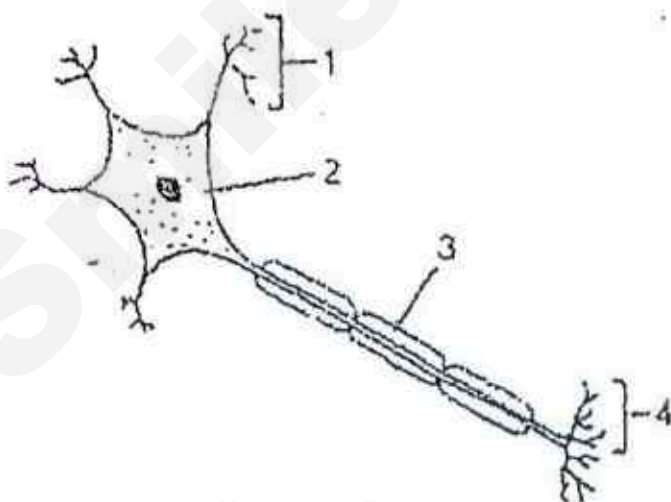
A nucleus
B cell membrane
C cell wall
D chloroplast

- 5 A sample of food mixed with water was tested to find out its contents. The results are shown in the table below:

test	results
Benedict's test	brick red precipitate formed
Iodine test	iodine solution remained brown
Ethanol emulsion test	white emulsion formed
Biuret test	violet solution formed

What were present in the food sample?

- A amino acids, fats and reducing sugars
B amino acids, fats and starch
C reducing sugars, fats and proteins
D starch, fats and proteins
- 6 The diagram below shows a neurone.



Which correctly identifies part 2 and the functions of parts 1 and 3?

	2	function of 1	function of 3
A	axon	transmits impulses	speeds up transmission
B	cell body	insulation	receives impulses
C	cell body	receives impulses	insulation
D	dendron	receives impulses	speeds up transmission


- 7 Four groups of potato strips have been immersed separately in different solutions (I to IV) for one hour. The following table shows the percentage change in mass of the potato strips:

solution	Percentage change in mass / %
I	+8
II	-6
III	-3
IV	0

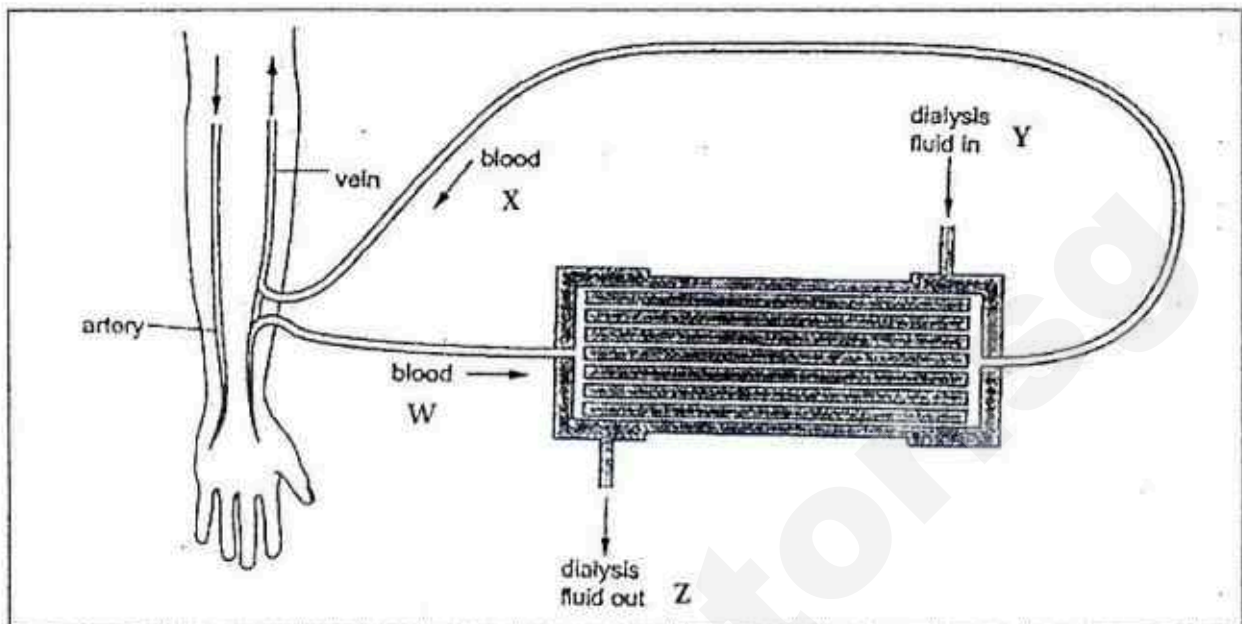
What conclusion can you draw from the results of this experiment?

- A Solution I has the highest water potential.
 B Solution II has a higher water potential than solution III.
 C Solution III has the highest water potential.
 D Solution IV is distilled water.
- 8 Which of the following processes is carried out by osmosis?
- A The formation of tissue fluid in the capillary network.
 B The absorption of water in the small intestine.
 C The upward transport of water in the xylem.
 D The formation of glomerular filtrate.
- 9 When the external temperature drops, the following changes may take place in the human body:
- (i) body temperature falls
 (ii) body temperature rises
 (iii) brain detects cooler blood
 (iv) shivering begins

In which order do they occur?

	first  last			
A	(i)	(iii)	(iv)	(ii)
B	(i)	(iv)	(iii)	(ii)
C	(iii)	(ii)	(iv)	(i)
D	(iii)	(iv)	(ii)	(i)

10 The diagram shows the flow of blood and dialysis fluid through a dialysis machine.



Where would the concentration of urea be the lowest or absent?

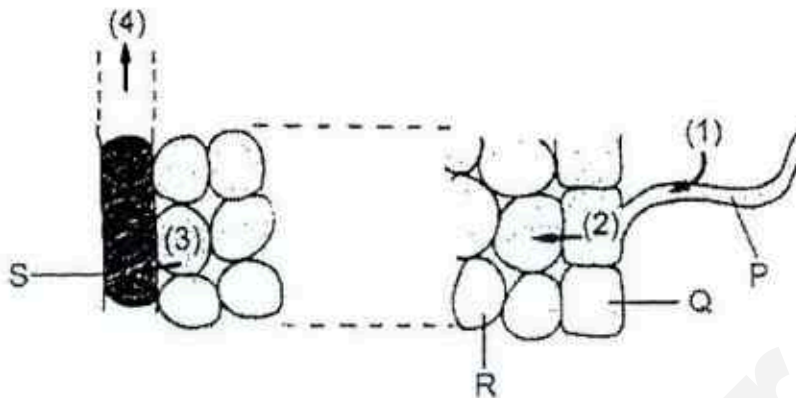
- A W and X
- B X and Y
- C W and Z
- D Y and Z

11 Which of the following processes in the human body **does not** require enzymes?

- (i) The formation of urea in the liver.
- (ii) The emulsification of oil in the duodenum.
- (iii) The neutralization of gastric juice by the pancreatic juice.

- A (i) only
- B (ii) only
- C (i) and (ii) only
- D (ii) and (iii) only

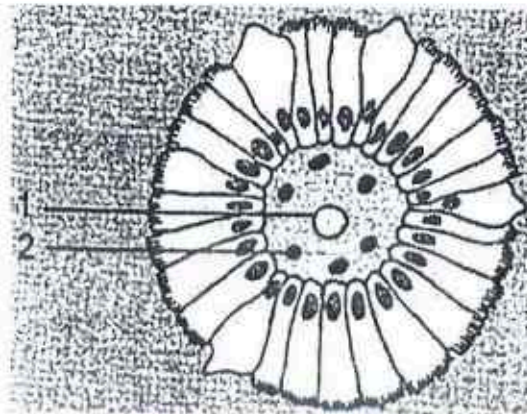
- 12 The diagram below shows the pathway of water movement from the soil into the root of a plant:



Osmosis occurs in _____.

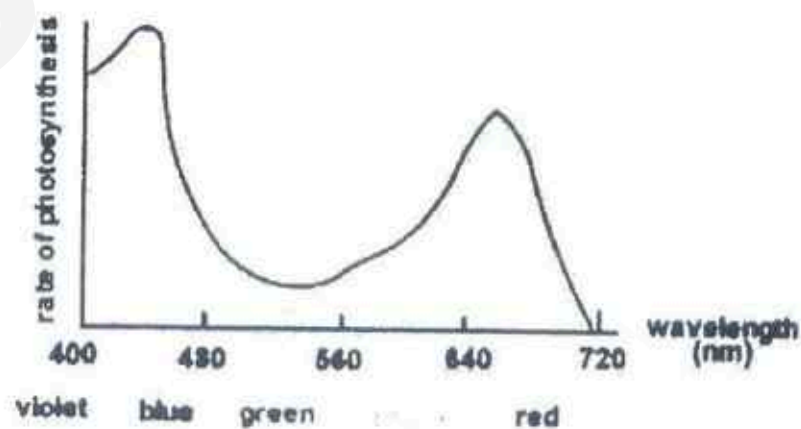
- A (1) and (2) only
 - B (1), (2) and (3) only
 - C (2), (3) and (4) only
 - D (1), (2), (3) and (4)
- 13 A patient has a large part of his colon removed in an operation. As a result, the patient could not _____.
- A eat solid food
 - B eat fatty food
 - C absorb amino acids efficiently
 - D produce solid faeces
- 14 When bile juice is added to a sample of oil, it breaks down the oil to fat droplets. This is due to the effect of _____.
- A bile pigments
 - B bile salts
 - C lipase
 - D water

Questions 15 and 16 refer to the diagram below, which shows the transverse section of a villus in the small intestine:



- 15 The food substances absorbed into structure 1 are mainly _____.
- | | | | |
|---|---------------|---|----------|
| A | fatty acids | B | vitamins |
| C | simple sugars | D | fats |
- 16 Food substances absorbed into structure 2 will first reach the _____.
- | | | | |
|---|-------|---|----------|
| A | liver | B | heart |
| C | lungs | D | pancreas |

Questions 17 and 18 refer to the graph below, which shows the rate of photosynthesis of a green plant when it is illuminated by lights of different colour:



17 What colours of light are most effective for photosynthesis?

- | | | | |
|---|------------------|---|-----------------|
| A | yellow and green | B | yellow and blue |
| C | red and green | D | red and blue |

18 During photosynthesis, light energy is used to _____.

- A join glucose molecules into starch
- B break down water molecules
- C form glucose molecules
- D combine hydrogen and carbon dioxide

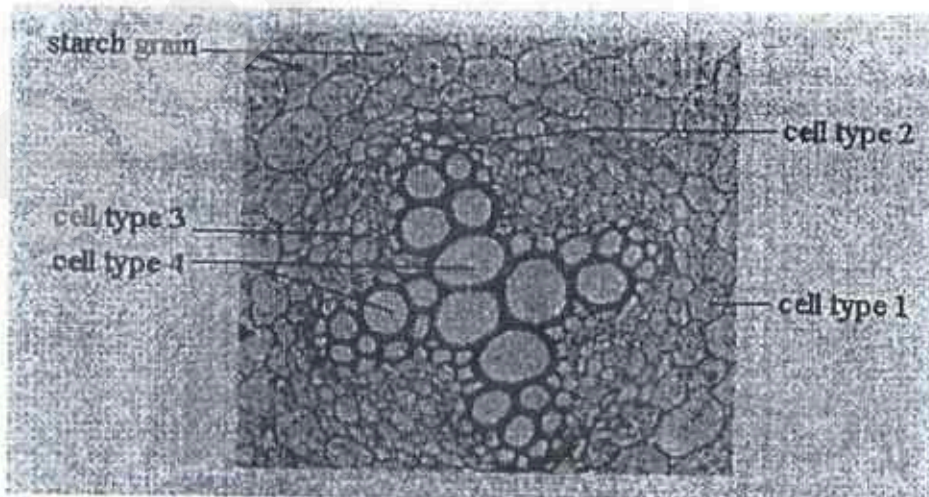
19 The statements are about how the liver deals with excess glucose:

- (i) It is converted to amino acids.
- (ii) It is converted to fats.
- (iii) It is deaminated to produce urea.
- (iv) It is stored as glycogen.

Which statements are correct?

- A (i) and (ii) only
- B (i), (ii) and (iii)
- C (ii) and (iv)
- D (iv) only

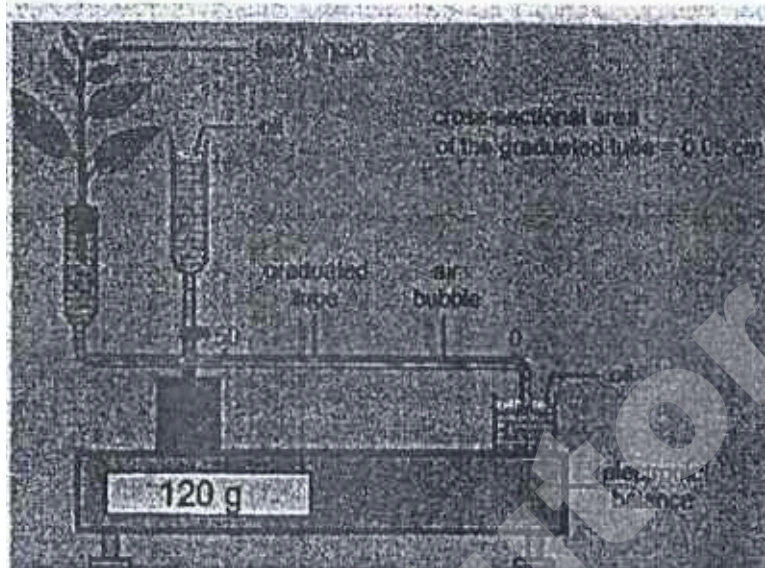
20 Refer to the photomicrograph of a section of a young root below:



Which type of cells show the lowest rate of respiration?

- | | | | |
|---|-------------|---|-------------|
| A | cell type 1 | B | cell type 2 |
| C | cell type 3 | D | cell type 4 |

Questions 21 and 22 refer to the diagram below which shows a set-up used to measure the rate of water absorption and transpiration of a leafy shoot:



	Initial reading	Reading after 30 min
Position of air bubble (cm)	2	12
Weight of set-up (g)	120.5	120.2

Note: 1 cm³ water has a mass of 1 g.

21 What is the transpiration rate of the leafy shoot?

- A 0.3 g per hour
- B 0.4 g per hour
- C 0.5 g per hour
- D 0.6 g per hour

22 How much water is retained by the shoot in 30 minutes?

- A 0.2 g
- B 0.3 g
- C 0.4 g
- D 0.5 g

23 Urea is produced as an excretory substance in the human body in the _____.

- A urinary bladder
- B liver
- C kidney
- D rectum

- 24 Which of the following reactions occur in the skeletal muscle when a person is performing vigorous exercise?

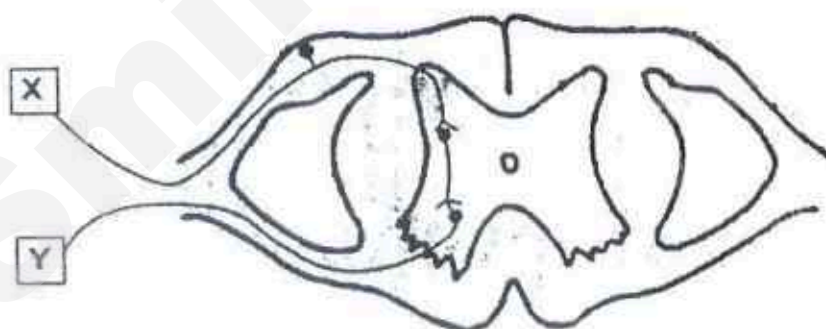
- (i) glucose \rightarrow lactic acid
 (ii) glucose \rightarrow carbon dioxide
 (iii) glucose + oxygen \rightarrow carbon dioxide + water

- A (i) only
 B (iii) only
 C (i) and (iii) only
 D (i), (ii) and (iii)

- 25 When a person tries to focus on a distant object, which of the following changes occurs?

- | | <u>suspensory ligament</u> | <u>lens</u> |
|---|----------------------------|-------------|
| A | slacken | more convex |
| B | slacken | less convex |
| C | become taut | more convex |
| D | become taut | less convex |

- 26 The diagram below shows a nervous pathway in the human body:



Structures X and Y could be:

- | | <u>X</u> | <u>Y</u> |
|---|----------------|----------------|
| A | leg muscle | skin of finger |
| B | pancreas | liver |
| C | retina | iris muscle |
| D | skin of finger | arm muscle |

27 Which of the following descriptions of insulin is **not** correct?

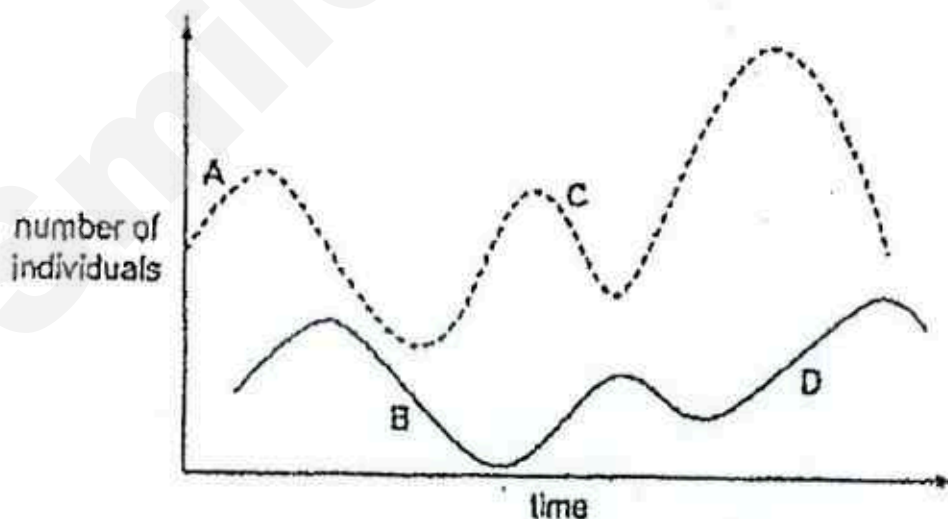
- A It is a protein.
- B It is secreted by an endocrine gland.
- C It is carried by the blood to the target organs.
- D It catalyses the conversion of glucose to glycogen.

28 Rice is a type of grass that has been grown by humans for about 5000 years. Over hundreds of years, farmers have improved the yield of rice crops. They kept grains from the highest yielding stalks to grow the next crop.

What is this farming practice?

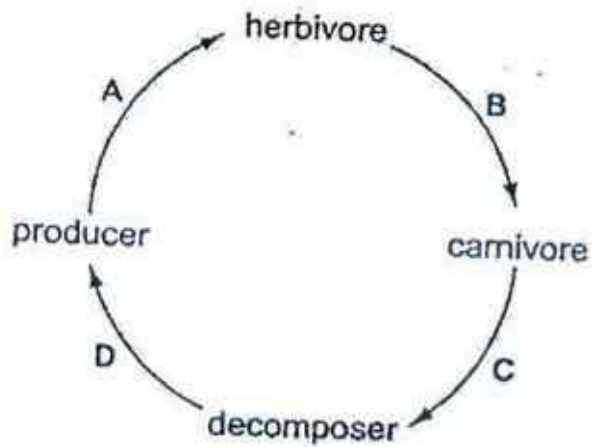
- A genetic engineering
- B natural selection
- C out breeding
- D selective breeding

29 The graphs show the changes in the populations of predator and prey over a period of time.



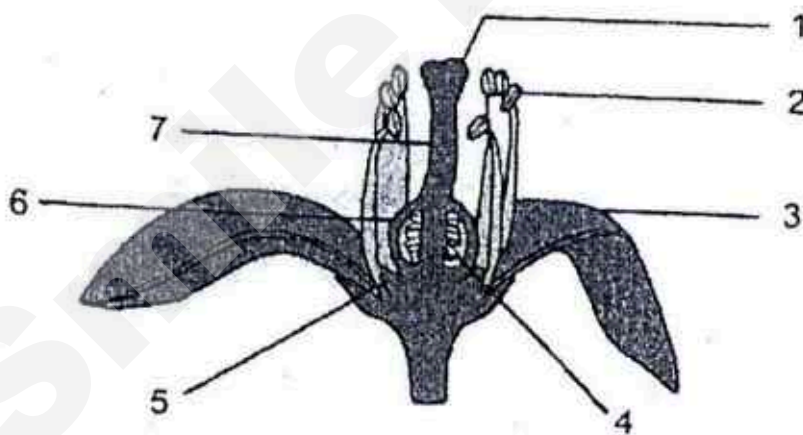
Which point on the graph shows a decrease in predator population?

30 The diagram shows how carbon circulates in nature.



Through which stage does most energy flow?

Questions 31 and 32 refer to the diagram below, which shows the longitudinal section of a flower:



31 Meiosis occurs in _____.

- A 1 and 4
- B 1 and 6
- C 2 and 4
- D 2 and 6

32 In a wind-pollinated flower, what structures would be very small or absent?

- | | | | |
|---|---------|---|---------|
| A | 1 and 2 | B | 1 and 3 |
| C | 2 and 5 | D | 3 and 5 |

33 A function of the mammalian placenta is _____.

- A expel the foetus during childbirth
- B prevent the foetus from dehydration
- C allow the mother's blood to pass into the foetal circulation
- D allow metabolic wastes to pass from the foetal blood to the mother's blood

34 What are the functions of the amniotic fluid in humans?

- (i) It acts as a shock absorber.
- (ii) It provides nutrients for the embryo.
- (iii) It allows the foetus some degree of movement.

- A (i) and (ii) only
- B (i) and (iii) only
- C (ii) and (iii) only
- D (i), (ii) and (iii)

Questions 35 and 36 refer to the table below which shows some features of a pair of twins, named June and Jane:

	June	Jane
body height /cm	165	168
blood group	A	O
eye colour	blue	blue
IQ	96	110

35 Which characteristic can best help you find out if June and Jane are identical twins or not?

- | | | | |
|---|-------------|---|-------------|
| A | body height | B | blood group |
| C | eye colour | D | IQ |

36 If both of their parents have brown eyes, which of the following can be deduced?

- (i) Both parents are heterozygous for eye colour.
- (ii) Brown eye is dominant to blue eye.
- (iii) Both June and Jane are homozygous for eye colour.

- A (i) and (ii) only
- B (i) and (iii) only
- C (ii) and (iii) only
- D (i), (ii) and (iii)

37 In humans, a sperm differs from an ovum in that _____.

- A it contains less cytoplasm
- B it has a smaller nucleus
- C it has no sex chromosome
- D it contains a smaller number of chromosomes

38 In the human body, active cell division occurs in the following except the _____.

- | | |
|---------------|-------------|
| A bone marrow | B brain |
| C testis | D epidermis |

39 All cells in our body are derived from the fertilized egg by cell division. Which of the following cells contain the same genetic material as the fertilized egg?

- (i) skin cells
- (ii) brain cells
- (iii) red blood cells

- A (i) and (ii) only
- B (i) and (iii) only
- C (ii) and (iii) only
- D (i), (ii) and (iii)

40 A kind of cell division in the human body has the following main stages:

- (i) chromosomes separate
- (ii) chromosomes arrange in pairs
- (iii) DNA replicate

Which of the following is a correct sequence of the different stages?

- A (i), (ii), and (iii)
- B (i), (iii) and (ii)
- C (ii), (iii) and (i)
- D (iii), (ii) and (i)

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Biology 5158 Mark Scheme

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
C	A	A	C	C	C	A	B	A	B
A11	A12	A13	A14	A15	A16	A17	A18	A19	A20
D	B	D	B	D	A	D	B	C	D
A21	A22	A23	A24	A25	A26	A27	A28	A29	A30
D	A	B	C	D	D	D	D	B	A
A31	A32	A33	A34	A35	A36	A37	A38	A39	A40
C	D	D	B	B	D	A	B	A	D



ANDERSON SECONDARY SCHOOL
Preliminary Examination 2017
Secondary Four Express & Five Normal
Academic



CANDIDATE NAME:

CLASS:

INDEX NUMBER:

BIOLOGY (SPA)

5158/02

Paper 2

24 August 2017

1 h 45 minutes

1040 – 1225h

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your index number and name on all work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams, graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A

Answer **all** questions.

Write your answers in the spaces provided on the Question Paper

Section B

Answer **all** questions

Write your answers in the spaces provided on the Question Paper

The number of marks is given in brackets [] at the end of each question or part question.

This document consists of 20 printed pages

SECTION A

Answer all the questions

Write your answers in the spaces provided.

- 1 The table shows the pressure changes in the left side of the heart during one cardiac cycle.

time /s	blood pressure / kPA	
	left atrium	left ventricle
0.0	0.7	0.3
0.1	1.0	2.0
0.2	0.1	12.5
0.3	0.2	15.3
0.4	1.0	4.5
0.5	0.5	1.0
0.6	0.6	0.3
0.7	0.7	0.3

- (a) When is the valve between the atrium and the ventricle closed?
Explain your answer.

Between:s tos.

Explanation:

.....

[2]

- (b) The maximum pressure in the ventricle is much higher than that in the atrium.
State what causes this.

.....

[2]

(c) Use the information in the table to calculate the heart rate in beats per minute.

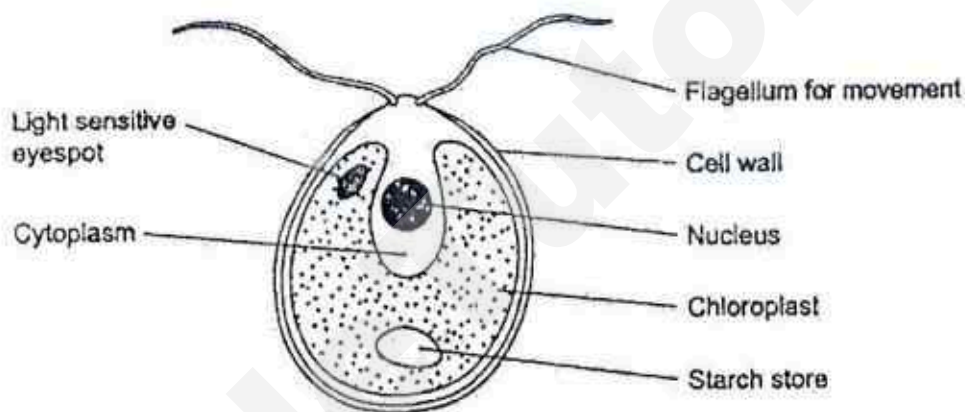
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.....

.....[1]

[Total: 5]

2 The diagram shows a unicellular organism called *Chlamydomonas*.



(a) Name two structures shown in the diagram that are present in plant cells but are not present in animal cells.

.....

.....[2]

(b) *Chlamydomonas* lives in freshwater ponds. Use your knowledge of osmosis to suggest an advantage of using starch as a carbohydrate store.

.....

.....

.....

.....[1]

- (c) *Chlamydomonas* has adaptations that help it to maintain a high rate of photosynthesis. Use information in the diagram to explain what these adaptations are.

.....

.....

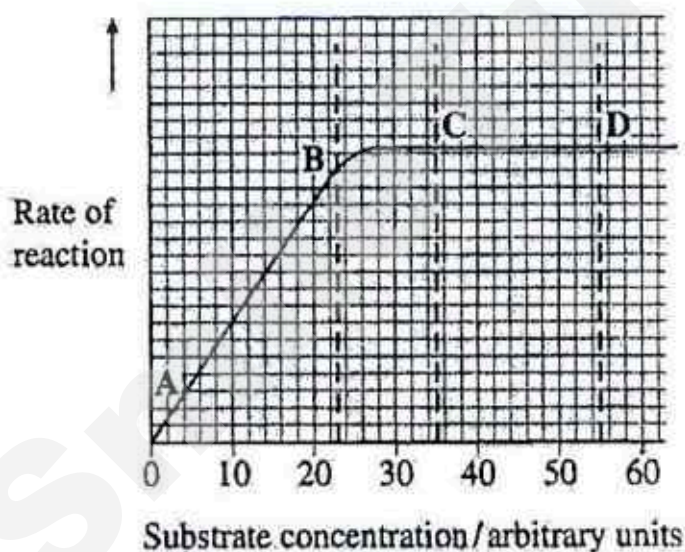
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.....[2]

[Total: 5]

- 3 The graph shows the effect of substrate concentration on the rate of an enzyme-controlled reaction.



- (a) Using information from the graph, describe the effect of substrate concentration on the rate of this enzyme-controlled reaction.

.....

.....

.....

.....

.....[2]

- (b) Explain with evidence from the graph what limits the rate of reaction between points A and B?

.....

[1]

- (c) Suggest a reason for the shape of the curve between points C and D.

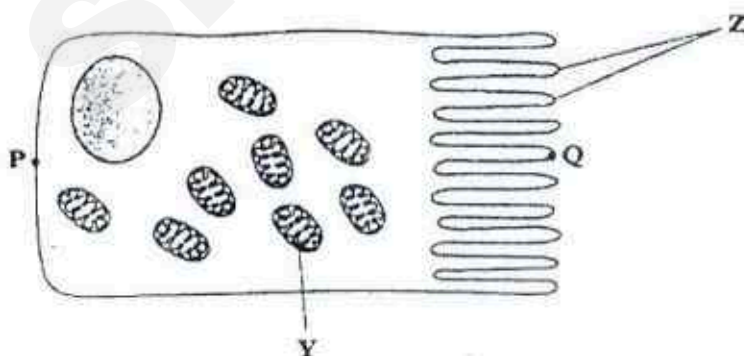
.....

[1]

- (d) Sketch a curve on the graph to show the rate of this reaction when the temperature is increased to optimum temperature. [1]

[Total: 5]

- 4 The diagram shows an epithelial cell from the small intestine which is involved in the absorption of nutrients after digestion:



- (a) Name the organelle Y.

Y:[1]

(b) There are large numbers of organelle Y in this cell. Explain the reason for this.

.....

.....

.....

.....[2]

(c) Celiac disease is a disease of the human digestive system which results in less of the structures Z. Although people with celiac disease can digest proteins, they have low concentrations of amino acids in their blood. Identify Z and explain why they have low concentrations of amino acids in their blood.

.....

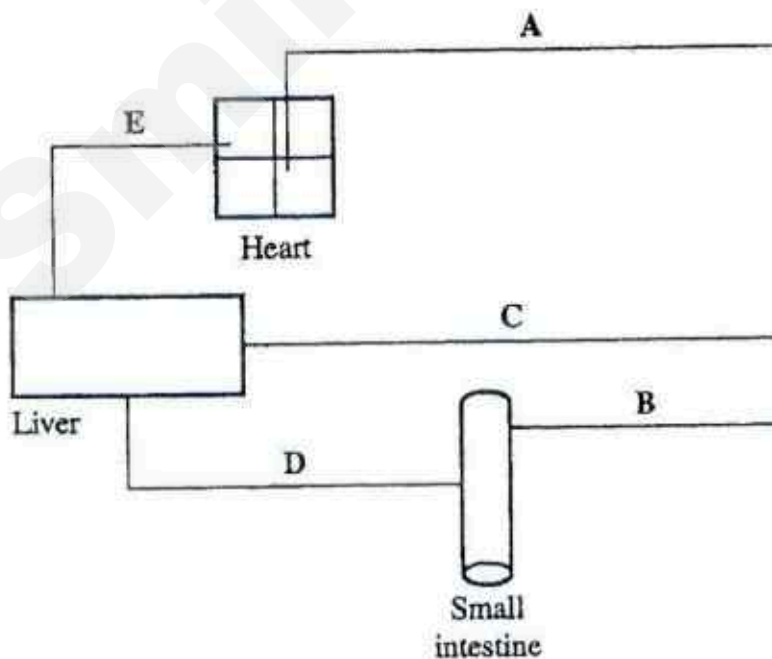
.....

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.....[2]

[Total: 5]

5 The diagram shows some of the large blood vessels in a mammal:



(a) Add arrows to the diagram to show the direction of blood flow in each of the blood vessels A to E.

[1]

(b) Which of the blood vessels A to E is the hepatic portal vein?

.....[1]

(c) Which of the blood vessels A to E contains blood at the lowest pressure?

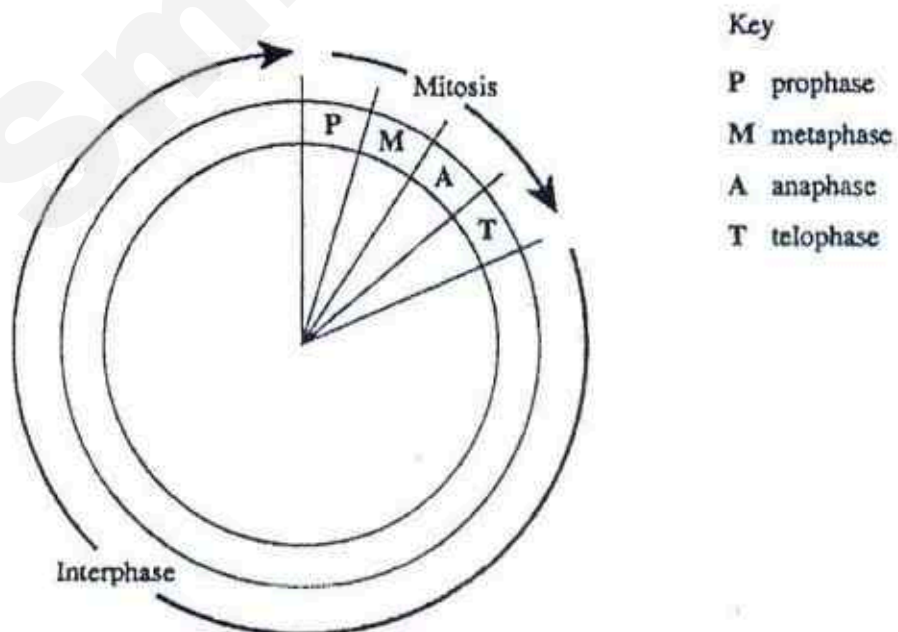
.....[1]

(d) Complete the table to show two differences between the structure of vessel C and the structure of vessel E. [2]

structural feature	vessel C	vessel E

[Total: 5]

6 The diagram shows mitosis in a cell cycle:



- (a) The table shows the number of chromosomes and the mass of DNA in different nuclei. All nuclei come from the same animal. Complete this table. [2]

nucleus	number of chromosomes	mass of DNA / arbitrary units
at prophase of mitosis	26	60
at telophase of mitosis		
from a sperm cell		

- (b) A protein called p53 stops the cell cycle. Uncontrolled cell division can cause cancer to develop. Suggest how mutation can cause cancer.

.....

.....

.....

.....

.....

.....[2]

- (c) New drugs are developed to treat cancer. At what phase in the cell cycle would each of the following drugs act?

(i) A drug that prevents DNA replication.

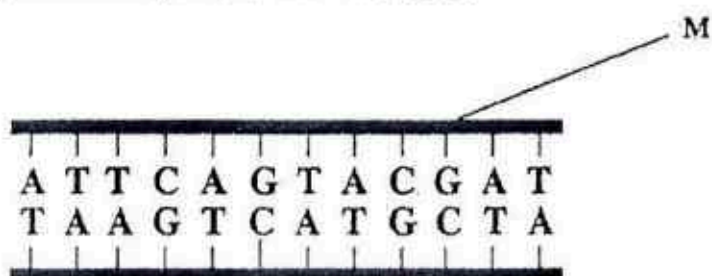
.....[1]

(ii) A drug that prevents spindle fibres shortening.

.....[1]

[Total: 6]

7 The diagram shows part of a DNA molecule.



(a) Name the two components of the part of the DNA molecule labeled M.

.....[2]

(b) Scientists calculated the percentage of different bases in the DNA from a species of bacterium. They found that 14% of the bases were guanine. What percentage of the bases in this species of bacterium was adenine? Explain your answer.

.....

[2]

[Total: 4]

8 A breeder crossed a black male cat with a black female cat. The female cat produced 8 black kittens and 4 white kittens.

(a) Explain using the observation why the allele for white fur is most likely recessive.

.....

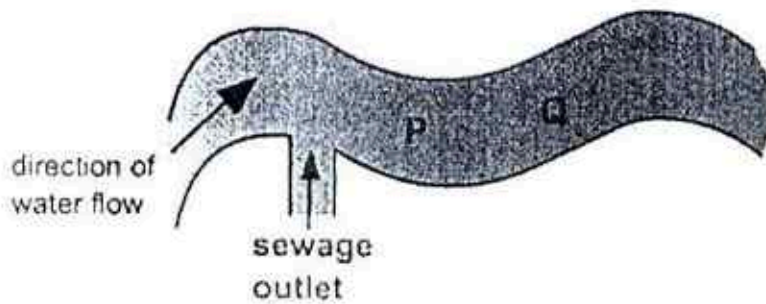
[1]

- (b) Draw a genetic diagram and predict the likely ratio of colours of kittens born to a cross between this black male and a white female. [5]

Ratio of black fur : white fur is[1]

[Total: 7]

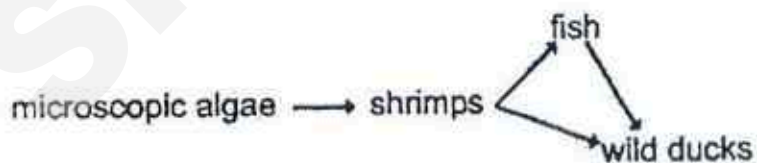
9 The diagram below shows a sewage outlet to a river.



- (a) Follow the direction of water flow from the sewage outlet to site P and Q.
Explain how this would affect the oxygen concentration at P and further downstream at Q in the river.

[3]

- (b) The following diagram shows a food web in a lake:



- (i) If the shrimp population decreases, how would this affect the wild duck population?

[illegible]

- (ii) If the lake water contains a trace amount of DDT, explain which organism may have the highest concentration of DDT in its body?

.....

.....

.....

.....

.....

..... [3]

[Total: 8]

Name: _____ () Class: _____

SECTION B

Answer three questions.

Question 12 is in the form of an Either/Or
Only one part should be answered.

Write your answers in the spaces provided.

- 10 Students investigated the effect of different concentrations of sodium chloride solution on discs cut from an apple. They weighed each disc and then put one disc into each of a range of sodium chloride solutions of different concentrations. They left the discs in the solutions for 24 hours and then weighed them again. Their results are shown in the table:

concentration of sodium chloride solution / mol dm ⁻³	mass of disc at start / g	mass of disc at end / g	ratio of mass at start to mass at end
0.00	16.1	17.2	0.94
0.15	19.1	20.2	0.95
0.30	24.3	23.2	1.05
0.45	20.2	18.7	1.08
0.60	23.7	21.9	
0.75	14.9	13.7	1.09

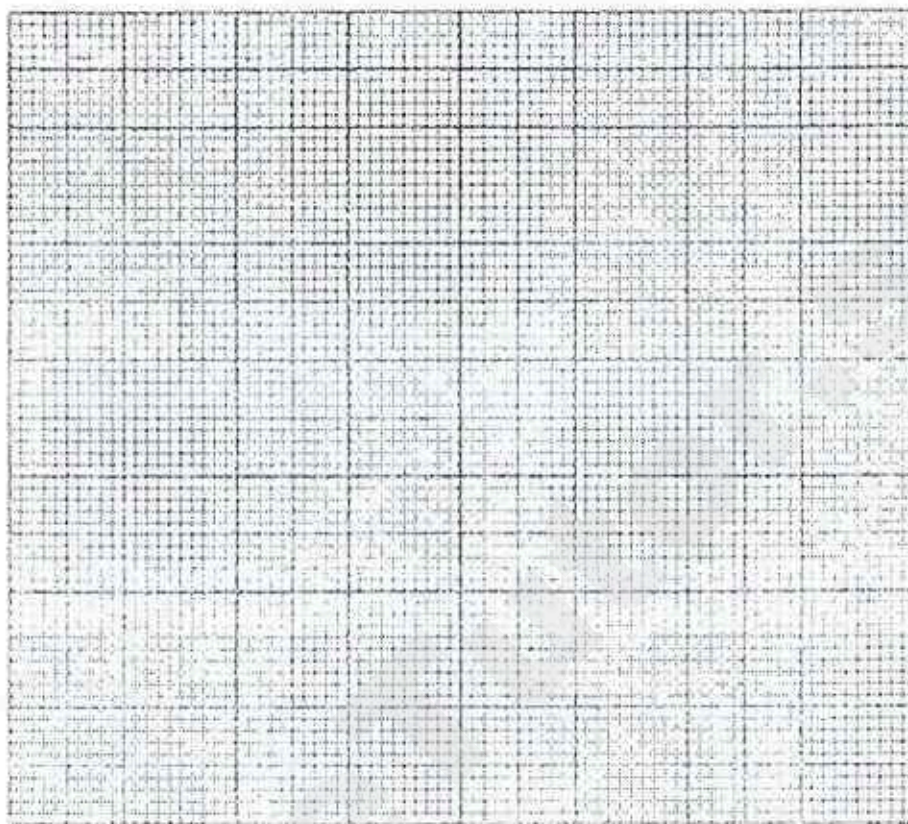
- (a) Calculate the ratio of the mass at the start to the mass at the end for the disc placed in the 0.60 mol dm⁻³ sodium chloride solution and fill in the table. [1]

- (b) The students gave their results as a ratio. List 2 advantages of giving the results as a ratio?

1.

2. [2]

- (c) Plot this data on the grid provided with concentration of sodium chloride solution on the x-axis and ratio of mass at start to mass at end on the y-axis. [4]



- (d) The students were advised that they could improve the reliability of their results by taking additional readings at the same concentrations of sodium chloride. List 2 advantages of doing so.

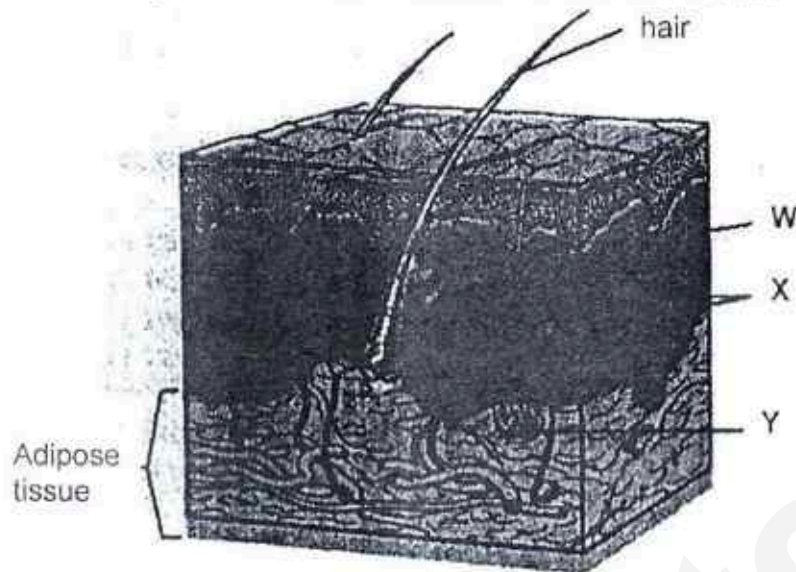
1.
2. [2]

- (e) From the graph plotted, find the concentration of the sodium chloride solution that has the same water potential as the apple tissue.

..... [1]

[Total: 10]

11 The diagram below shows a section of the human skin:



(a) Identify W, X and Y.

[2]

(b) When a person is doing strenuous exercises, a lot of heat is released through respiration which increases the body temperature. Explain how our body regulates this increase in body temperature.

[4]

- (c) Explain why after drinking a lot of salty soup, a healthy person will produce a large volume of concentrated urine.

.....

.....

.....

.....

.....

.....

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.....[2]

- (d) A person has not eaten food for 12 hours. Explain how the body regulates the blood glucose level in his body.

.....

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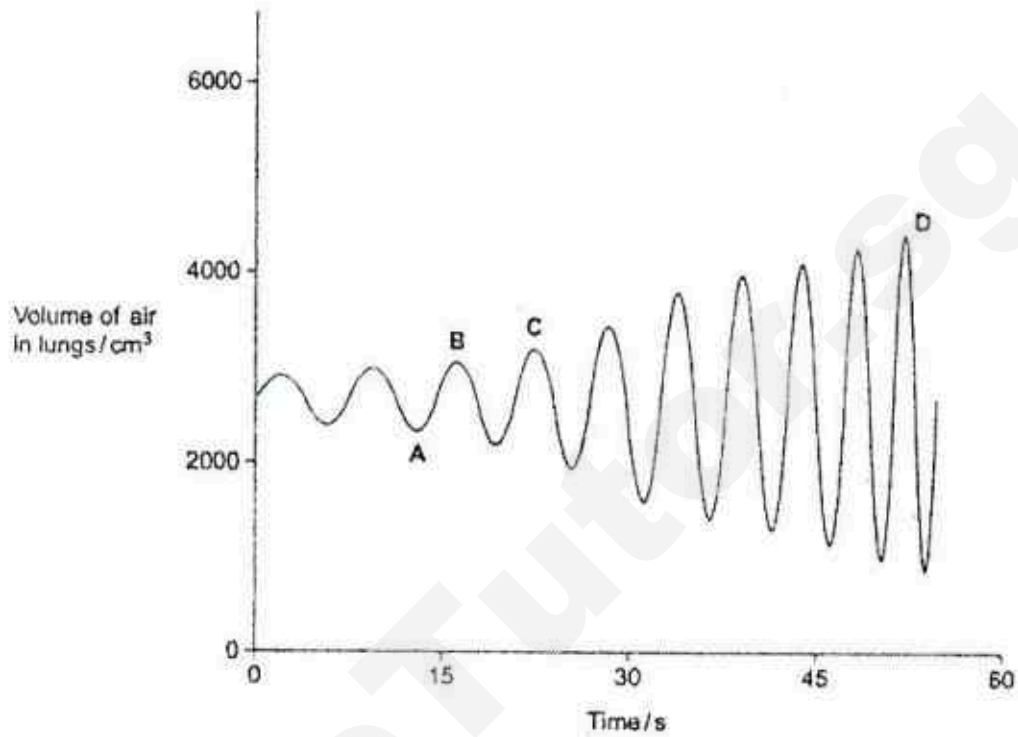
.....

.....[2]

[Total: 10]

12 Either

The graph shows changes in the volume of air in a person's lungs during breathing:



The person was breathing in between times A and B on the graph.

- (a) Explain how the graph shows that the person was breathing in between times A and B and describe what happens to the diaphragm between times A and B.

[2]

[3]

[4]

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(a) Trace the path of a molecule of urea as it enters the renal artery till it is discharged out of the body.

5

(b) Why does the ingestion of alcohol increase the volume of urine?

.....

.....

.....

.....

.....

.....[2]

(c) How are excretory products removed from the blood during kidney dialysis without removing glucose?

.....

.....

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.....

.....

.....

.....[3]

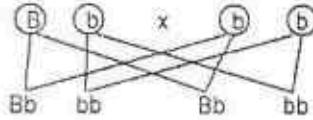
[Total: 10]

Anderson Secondary School
2017 Secondary 4 Express Prelim
Biology 5158 Mark Scheme

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
C	A	A	C	C	C	A	B	A	B
A11	A12	A13	A14	A15	A16	A17	A18	A19	A20
D	B	D	B	D	A	D	B	C	D
A21	A22	A23	A24	A25	A26	A27	A28	A29	A30
D	A	B	C	D	D	D	D	B	A
A31	A32	A33	A34	A35	A36	A37	A38	A39	A40
C	D	D	B	B	D	A	B	A	D

Question	Solution	Marks	Comments
1 (a)	0.1s and 0.5s [1] Pressure in ventricle higher than pressure in atrium [1]	[2]	
(b)	Ventricle has thicker wall / is much muscular than atrium [1] So ventricle <u>contractions</u> are stronger / harder / create higher pressure [1]	[2]	R: never say ventricle contract to generate higher pressure
(c)	$60 / 0.7 = 85.7 = 86$ heart beats per min [1] [R: decimal places]	[1]	R: decimals since cannot have fraction of heartbeat
2 (a)	Any 2: Cell wall / starch store / chloroplast [2]	[2]	
(b)	Starch is <u>insoluble</u> + Starch does not affect <u>water potential</u> and affect water entry by osmosis	[1]	R: starch lower water potential or increase water potential
(c)	Any 2: Light sensitive eyespot detects light [1] Flagellum enables movement towards light [1] Has one large cup-shaped chloroplast contains <u>chlorophyll</u> absorbs light for photosynthesis [1]	[2]	R: statement not complete, does not show purpose. R: many chloroplasts R: no mention of chlorophyll
3 (a)	When the substrate concentration increases from 0 to <u>27 / 28 arbitrary units</u> , the rate of reaction increases [1]. The rate of reaction plateaus / become constant at beyond substrate concentration of 27 / 28 units [1]	[2]	R: no mention of values R: rate of reaction increases linearly / proportionally from 0 to 26 arbitrary units of substrate concentration
(b)	Substrate concentration is limiting because when substrate concentration increases from	[1]	

Question	Solution	Marks	Comments																					
	0 to 23 arbitrary units, rate of reaction also increases [1]																							
(c)	All active sites are occupied / saturated with substrates/ maximum number of enzyme-substrate complexes formed [1]	[1]	R: enzymes used up																					
(d)	Curve is steeper and plateaus at a lower substrate concentration (it must also start at zero).	[1]	R: curve plateaus lower than original																					
4 (a)	mitochondrion	[1]																						
(b)	Mitochondrion is the site of aerobic <u>respiration</u> [1], to <u>release energy</u> to help to absorb the <u>glucose / amino acids / fatty acids & glycerol</u> (must list any 2 nutrients) against concentration gradient by <u>active transport from the small intestine into the bloodstream</u> . [1]	[2]	R: produce energy																					
(c)	Z are <u>villi</u> [1] R:villus When villi are destroyed there will be <u>reduced surface area</u> for absorption, reducing the amount of amino acids absorbed from the small intestine [1]	[2]	R: no absorption																					
5 (a)	Arrow for A away from heart; arrows for C and B towards the organs; arrow for D towards the liver; arrow for E towards the heart [1]	[1]																						
(b)	D	[1]																						
(c)	E	[1]																						
(d)	<table><tr><th>structural feature</th><th>vessel C</th><th>vessel E</th></tr><tr><td>Any 2:</td><td></td><td></td></tr><tr><td>valves</td><td>absent</td><td>present</td></tr><tr><td>Thickness of walls</td><td>thicker</td><td>thinner</td></tr><tr><td>muscle</td><td>more</td><td>less</td></tr><tr><td>Elastic fibers/tissue</td><td>more</td><td>less</td></tr><tr><td>lumen</td><td>narrow</td><td>wide</td></tr></table>	structural feature	vessel C	vessel E	Any 2:			valves	absent	present	Thickness of walls	thicker	thinner	muscle	more	less	Elastic fibers/tissue	more	less	lumen	narrow	wide	[2]	R: vessel C – thick, vessel E - thin
structural feature	vessel C	vessel E																						
Any 2:																								
valves	absent	present																						
Thickness of walls	thicker	thinner																						
muscle	more	less																						
Elastic fibers/tissue	more	less																						
lumen	narrow	wide																						
6 (a)	For telophase: 26, 30 [1] For sperm cell: 13, 15 [1]	[2]																						
(b)	Mutation cause a change in the DNA code that produces p53 [1] Protein p53 is not made [1]	[2]																						
(c) (i)	interphase	[1]																						
(c) (ii)	anaphase	[1]																						
7 (a)	Phosphate, deoxyribose	[2]																						
(b)	36% of the bases is A [1] 14% of bases is G, so 14% of bases is C since there are <u>complementary base pairs</u> C-G, so 78% of the bases are for the A-G base pairs [1]	[2]																						
8 (a)	Since both parents are black yet they can	[1]																						

Question	Solution	Marks	Comments
	produce white kittens, it means the parents are <u>heterozygous black</u> , and have the recessive white allele. Since the white allele is not expressed in the parent, it is recessive.		
(b)	<p>Let B represent dominant allele for black fur. Let b represent recessive allele for white fur. [1] Parental phenotype: black male x white female Parental genotype: Bb x bb [1]</p> <p>Gametes:  [1]</p> <p>F1 generation genotype = 2 Bb : 2 bb [1] F1 generation phenotype = 2 black fur : 2 white fur [1]</p> <p>Ratio of black fur : white fur is 1:1 [1]</p>	[6]	R: no proper labels
9 (a)	<p>The <u>organic wastes</u> in sewage are a good <u>source of food for bacteria</u>. [1] Bacteria grow and multiply rapidly, using up the oxygen in the water so oxygen concentration at P is low / lower [1] Further downstream, at Q is far from the pollution point, there is <u>less organic matter</u>, <u>less bacteria</u> so the oxygen concentration is <u>higher</u> than at P. [1]</p>	[3]	<p>R: eutrophication, growth of algae (no marks given if mention algae since it is organic waste) R: decomposition uses oxygen (should be bacterial respiration)</p>
(b) (i)	Shrimp population decrease will cause wild duck population to decrease since shrimp is a food source for wild duck [1]. As wild duck also feed on fish, the wild duck population is also indirectly caused to reduce by the reduction in the fish population which is caused by the reduction on the shrimp population [1]	[2]	
(b) (ii)	<p>DDT is <u>non-biodegradable</u> and when consumed is <u>not excreted</u> [1] It is stored in the <u>fatty tissues</u> of the shrimp and fishes [1] As it goes up the food chain it will build up as the higher level consumers consume more and it reaches highest concentration in the <u>wild ducks</u> due to <u>bioaccumulation</u> [1].</p>	[3]	R: bioaccumulation occurs from one trophic level to the next; should be bioamplification. Top predator is bioaccumulation.
10 (a)	1.08	[1]	
(b)	<p>Allows comparison / shows proportional change [1] Allows discs with different starting masses [1] Easily determine if there has been a gain or loss in mass [1]</p>	[2]	R: Easier to observe trend
(c)	<p>Both axes labelled correctly with units [1] Appropriate scale that allows > 50% of graph paper used for both axes [1] Points accurately plotted, allow 1 error [1] Best fit graph drawn [1]</p>	[4]	R: Ratio of mass

Question	Solution	Marks	Comments
(d)	Allows anomalies to be identified / allows effect of anomalies to be reduced / effect of drastic variation in data to be minimised [1] A more reliable average/mean can be calculated <u>without the anomalous data</u> [1]	[2]	R: accurate (should be reliable)
(e)	Reading where ratio = 1, so concentration of sodium chloride solution is 0.24 mol dm^{-3} (take from student's graph)	[1]	
11 (a)	W: erector muscle X: blood capillaries [R: blood capillary] Y: sweat gland	[2]	3 correct = 2 marks 2 correct = 1 mark 1 correct = no mark
(b)	- Rise in body temperature is the stimulus and trigger the <u>hypothalamus</u> (is the receptor) [1] - Hypothalamus is stimulated and sends nerve impulses to relevant body parts. <u>Skin arterioles vasodilate</u> and <u>shunt vessels constrict</u> [1] - More blood flows to capillaries in skin, greater heat loss via radiation, conduction & convection [1] [A: radiation only] - <u>Sweat glands</u> become <u>more active</u> and secrete more sweat. Heat loss via latent heat of vaporization when sweat evaporates [1]	[4]	R: lost of latent heat of vaporisation
(c)	- <u>Blood water potential rises</u> and trigger the hypothalamus to cause the pituitary gland to release <u>less Anti-diuretic hormone (ADH)</u> . <u>Less water reabsorbed</u> at the <u>collecting duct</u> as it is less permeable to water, so more water lost resulting in large volume of urine [1] - excess salts also excreted from the kidneys resulting in more concentrated urine/less selective reabsorption of mineral salts [1]	[2]	
(d)	Blood glucose level <u>drops below set point</u> . Stimulate the <u>Islets of Langerhans</u> to release <u>more glucagon</u> which is transported by blood to liver and muscles. Glucagon converts the stored glycogen to glucose [1]. Blood glucose level rises until set point. When blood glucose concentration returns to set point it	[2]	

Question	Solution	Marks	Comments
	serves as a feedback for the Islets of Langerhans to release normal amounts of glucagon [1]		
12 Either	(a) Volume of air in the lungs increased indicating that he is breathing in [1]. Diaphragm contracts [1] And flattens / moves down [1]	[3]	IB: describe about intercostal muscles which is not asked for in question
	(b) Breathing rate increases / more breaths per min between C and D [1] Volume of air inhaled per breath increases / deeper breaths [1] One cause – could be started running / exercising/increased adrenaline level in blood [1]	[2] [1]	
	(c) - alveoli are spherical in shape and present in large quantities, providing a <u>huge surface area</u> for <u>faster diffusion of oxygen</u> into the blood [1] -The walls of the alveoli are <u>one-cell thick</u> , resulting in a small distance for diffusion for <u>faster rate of diffusion</u> of gases through it [1] - inner alveolar surface are covered with a thin film of moisture/water allowing the <u>dissolving of oxygen</u> and the subsequent <u>rapid diffusion</u> in solution [1] - alveoli are well-supplied with blood capillaries which transport away diffused oxygen so as to maintain a steep concentration gradient for diffusion of oxygen into the blood [1]	[4]	R: alveoli is one cell thick
12 Or	(a) -Urea molecule travels to a branch of the renal artery and reaches the <u>glomerulus</u> [1] - <u>high hydrostatic pressure</u> created by <u>the afferent arteriole</u> having a wider lumen than the <u>efferent arteriole</u> [1] forces the urea molecule through the partially permeable basement membrane into the <u>renal capsule / Bowman's capsule</u> by <u>ultrafiltration</u> [1] -travels to the proximal convoluted tubule, Loop of Henle distal convoluted tubule [1] and collecting duct without being selectively reabsorbed [1] - reaches the <u>renal pelvis</u> and into the <u>ureter</u> [1] - stored in the <u>urinary bladder</u> and travels out of the body via the <u>urethra</u> during urination [1]	[5 max.]	
	(b) Alcohol inhibits the secretion of anti-diuretic hormone / less ADH by the pituitary gland [1] Less ADH leads to less water being reabsorbed at the <u>collecting duct</u> so more urine produced [1]	[2]	
	(c) -Dialysis fluid <u>does not contain</u> metabolic waste products so a concentration <u>gradient</u> exists for urea, uric acid and creatinine, excess water and mineral salts to diffuse out of the tubing into the dialysis fluid [compulsory,1] -Dialysis fluid contains the <u>same concentration of glucose</u> as the blood so that glucose do not	[3]	

Question	Solution	Marks	Comments
	<p>diffuse out of the patient's blood into the dialysis fluid. [compulsory,1]</p> <p>Any 1:</p> <ul style="list-style-type: none"> -The direction of blood flow is opposite to the flow of the dialysis fluid. This maintains the concentration gradient for the removal of waste products [1] -The partially permeable tubing is narrow, long and coiled to increase the surface area to volume ratio. This speeds up the rate of diffusion of waste substances from the blood into the dialysis fluid [1] 		

Name of Candidate: _____ ()

Class: _____



BUKIT PANJANG GOVERNMENT HIGH SCHOOL

Preliminary Examination 2017

SECONDARY 4 Express

BIOLOGY

Paper 1

5158/01

Date: 18 August, 2017

Duration: 1h

Time: 0745 – 0845 h

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, class and register number on this question paper and the Optical Answer Sheet (OAS).

There are forty questions in this paper.

Answer **all** questions.

For each question there are four possible answers A, B, C and D.

Choose the **one** you consider correct and record your choice in **soft pencil** on the OAS.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this question paper.

For Examiner's Use

Total

/40

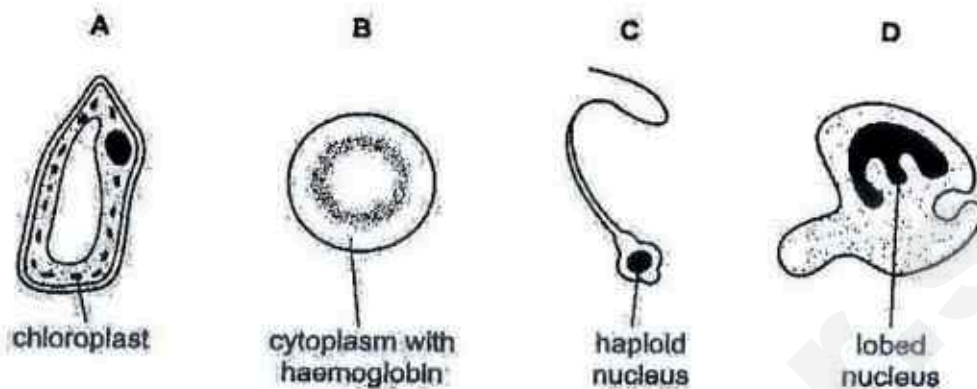
[Turn over

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- 1 The diagrams show four types of cells found in organisms.

Which cell moves around inside an organism but is **not** capable of locomotion?



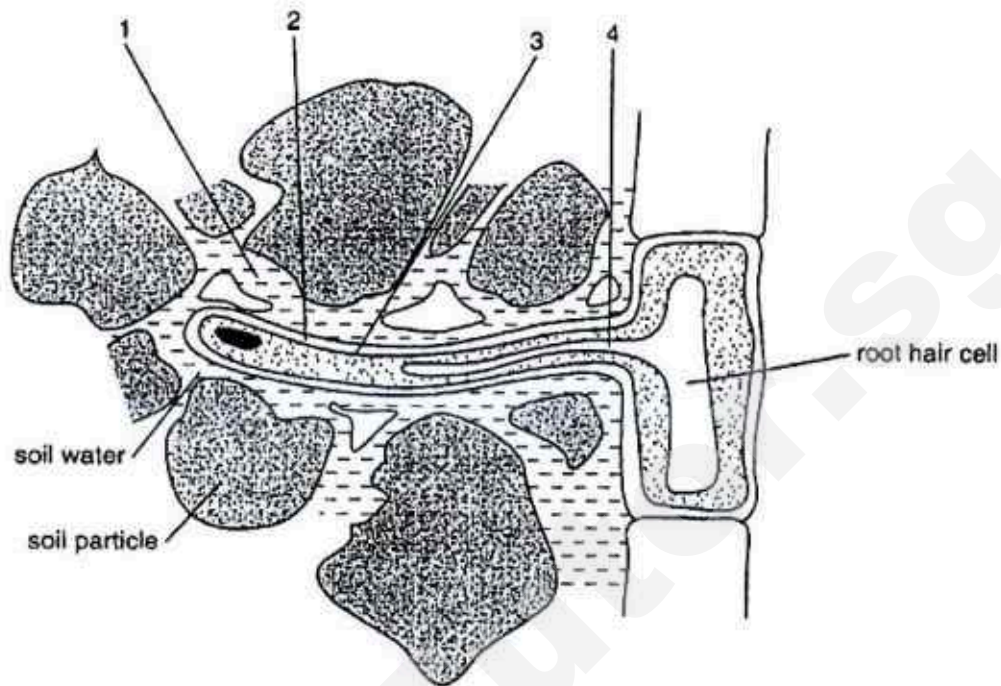
- 2 The diagram shows an electron micrograph of a plant cell.



What do structures X, Y and Z contain?

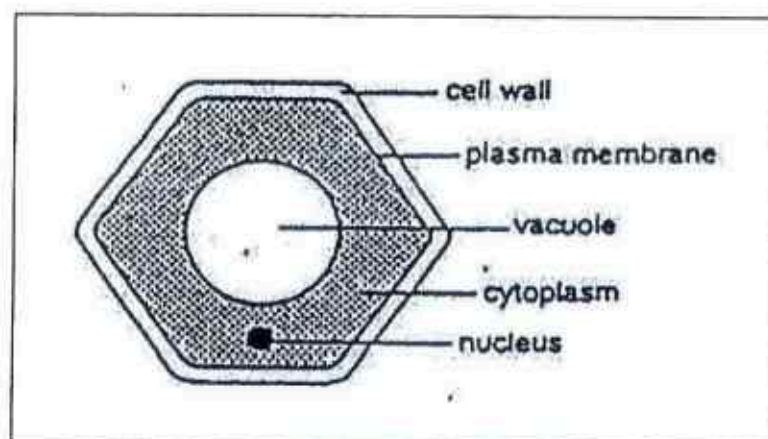
	X	Y	Z
A	mineral ions	starch	DNA and RNA
B	cell sap	mineral ions	proteins
C	cell sap	starch	DNA and RNA
D	starch	mineral ions	proteins

- 3 The diagram below shows a root hair cell and surrounding soil particles.

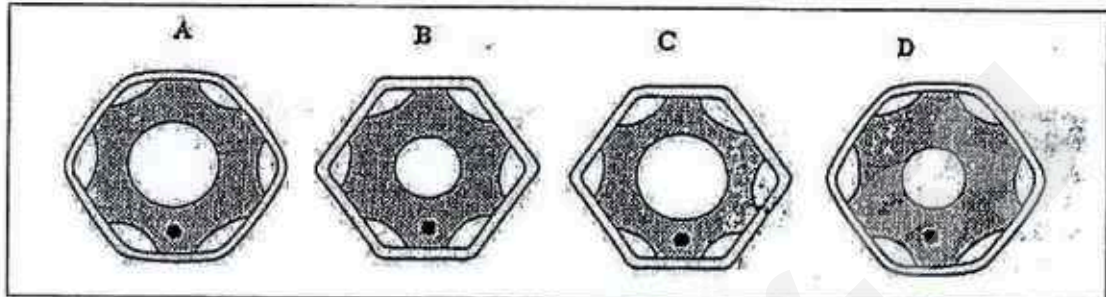


	higher concentration of water molecules	partially permeable membrane	lower concentration of water molecules
A	1	2	4
B	1	3	4
C	4	2	1
D	4	3	1

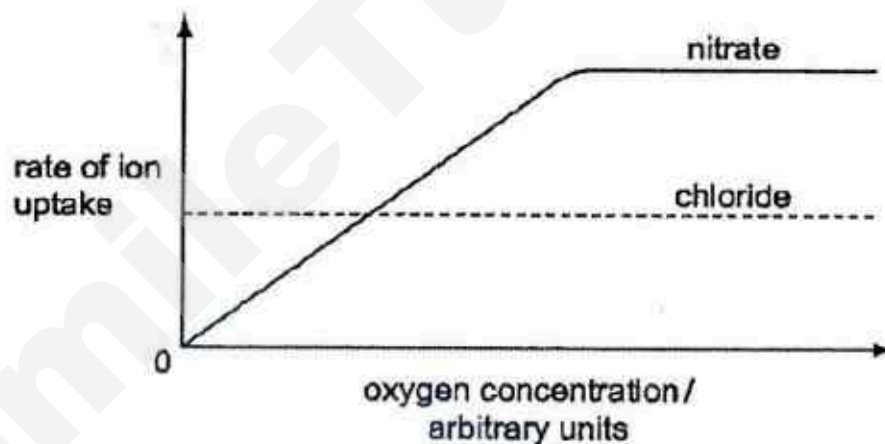
- 4 The diagram shows the appearance of a plant cell immersed in a solution which the same water potential as the cell's sap.



Which of the diagrams shown below most accurately represents the appearance of this cell after immersion in a solution of low water potential?



- 5 The roots of a plant are placed in a hypotonic solution containing chloride and nitrate ions. The graph shows how the rate of uptake of chloride and nitrate ions by the roots of the plant varies with oxygen concentration.



What can be concluded about how chloride and nitrate ions enter the roots?

	chloride	nitrate
A	active transport	active transport
B	active transport	diffusion
C	diffusion	active transport
D	diffusion	diffusion

- 6 The table shows two properties of four different chemicals.

Which chemical is an enzyme found in the human body?

chemical	molecular structure includes nitrogen	denatured by temperatures above 65°C
A	✓	✓
B	✓	x
C	x	✓
D	x	x

Key
✓ = true
x = false

Questions 7 and 8 refer to the table below, which shows the composition of 150g each of four kinds of food.

food	protein (g)	carbohydrate (g)	fat (g)	calcium (mg)	iron (mg)	vitamin A (mg)	vitamin C (mg)
W	40	30	30	324	18	0.03	4.3
X	50	10	40	974	6	0.01	1.9
Y	30	10	60	226	3	0.09	1.5
Z	20	60	20	181	1	0.16	0.2

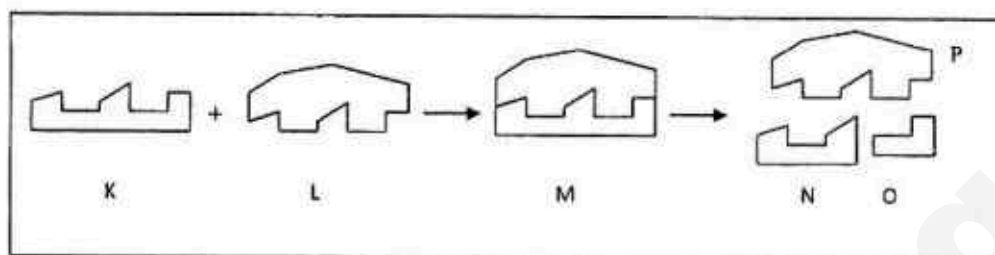
- 7 Which food has the highest energy value?

A W
B X
C Y
D Z

- 8 Which food would you recommend to a female undergoing menstruation?

A W
B X
C Y
D Z

- 9 Study the reaction represented by the following diagrams.



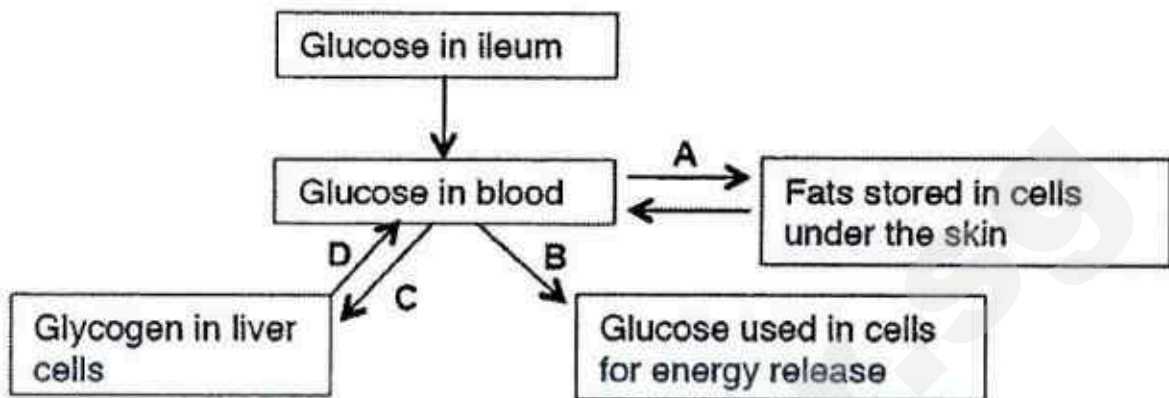
Which of the following statements are true?

- i: It is an anabolic reaction.
- ii: K and L are sensitive to temperature and pH.
- iii: M is the product.
- iv: N and O may not be formed all the time in this reaction.
- v: P is the enzyme-substrate complex.

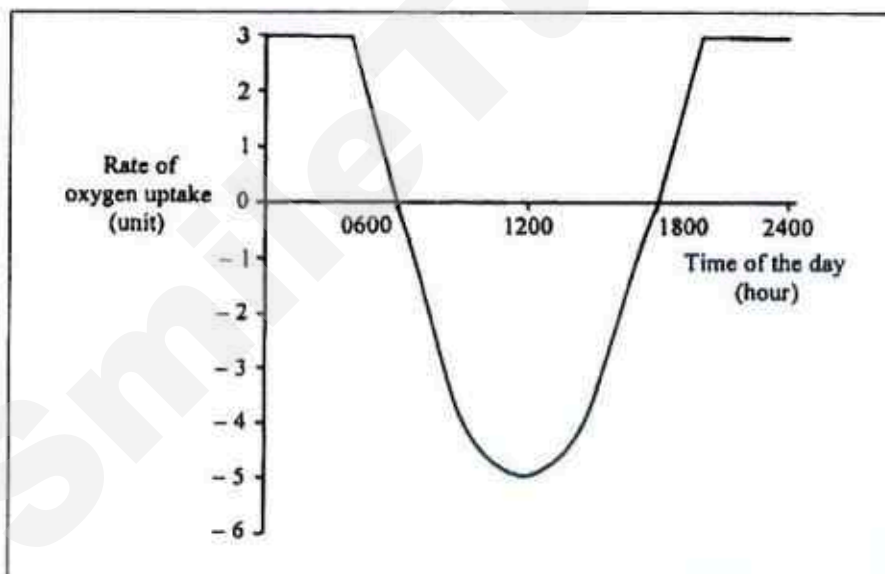
- A i and ii only
 B i, ii and iii
 C i, ii, iv and v
 D None of the above
- 10 Which of the following pairs of events occur during peristalsis in the oesophagus?

	state of circular muscles	diameter of oesophagus
A	contracted behind the bolus	narrower round the bolus
B	contracted behind the bolus	wider round the bolus
C	relaxed behind the bolus	narrower round the bolus
D	relaxed behind the bolus	wider round the bolus

- 11 The diagram below shows what can happen to glucose in a human body. Which change represents assimilation?



Questions 12 and 13 refer to the graph below, which shows the rate of oxygen uptake of a plant in 24 hours.



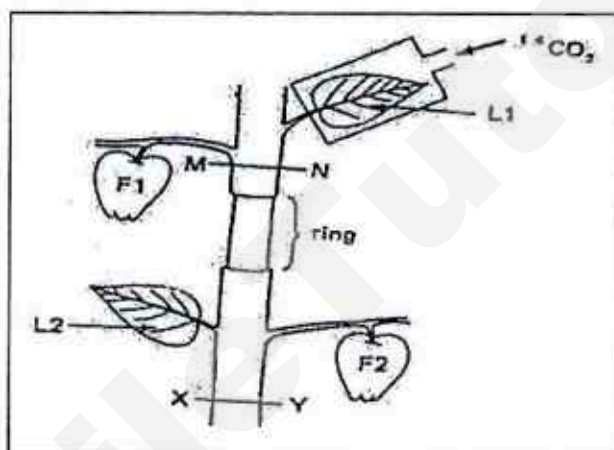
- 12 Which of the following correctly describes the plant at 1200 hour?
- A It carried out photosynthesis, but not respiration.
 - B It carried out photosynthesis at the maximum rate.
 - C The rate of photosynthesis was equal to the rate of respiration.
 - D The rate of photosynthesis was lower than the rate of respiration.

- 13 Based on the graph, we may conclude that at 1800 hour the rate of photosynthesis was 3 units.

What assumption has to be made in order to arrive at this conclusion?

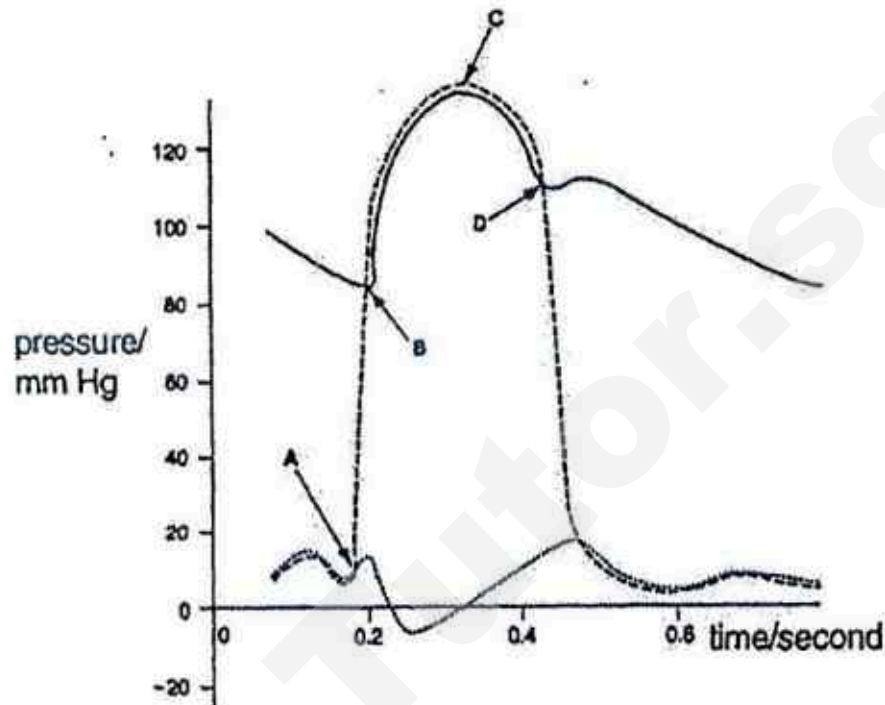
- A The plant did not carry out respiration at 1800 hour.
- B The rate of photosynthesis of the plant varied at different times of the day.
- C The rate of respiration of the plant was constant throughout the 24 hour period.
- D The rate of respiration of the plant was equal to the rate of photosynthesis at 1800 hour.

For questions 14 and 15, refer to the diagram below, which shows that a ring of bark was removed from a leafy branch. Assume that there are more leaves at the top of the plant.



- 14 What would be the difference in the development of the fruits labelled F1 and F2 several days after the ring had been cut?
- A F2 became smaller than F1 because no more water was transported to it.
 - B F1 became bigger than F2 because it could receive more food from leaves.
 - C F2 became bigger than F1 because it was nearer to the root region so that more water was transported to it.
 - D There is no difference in the size between F1 and F2.
- 15 At the end of the experiment, which of the following parts contain radioactive carbon ^{14}C ?
- A F1 and F2 only
 - B F1 and L1 only
 - C F2 and L2 only
 - D L1 and L2 only

- 16 The diagram below gives information about blood pressures in various parts of the circulatory system during the cardiac cycle.



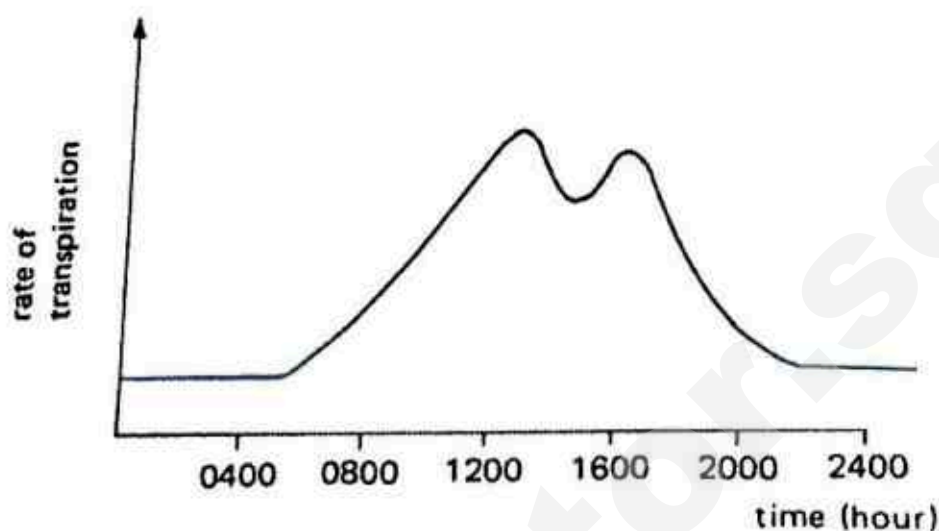
At which point does the bicuspid valve close?

- 17 The table shows the blood type antibody conditions in the blood plasma of four patients and the type of blood each received in a transfusion.

Which patient, A, B, C or D is safe from agglutination?

	blood type antibody	blood received in transfusion
A	a	A
B	b	B
C	a & b	A
D	none	AB

For questions 18 & 19, refer to the graph below, which shows the changes in transpiration rate of a plant during a hot, dry and sunny day.



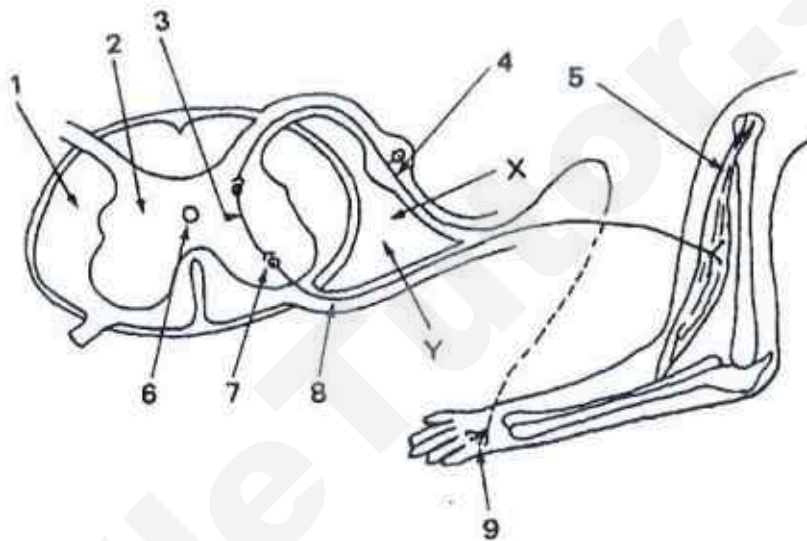
- 18 The sudden change of the transpiration rate at 0600 hour is mainly due to
- A decrease in relative humidity of air
 - B increase in water supply
 - C increase in light intensity
 - D decrease in the speed of wind
- 19 The sudden drop of the transpiration rate at 1300 hour is mainly due to
- A the cloudy condition in the sky
 - B the decrease in carbon dioxide concentration in air
 - C the decrease in the amount of starch in the guard cells
 - D the temporary closure of the stomata
- 20 During osmoregulation, which of the following correctly describes the sequence of homeostatic response to loss of water through profuse sweating?

	organ stimulated	hormone secreted	kidney tubule action	water absorption
A	hypothalamus	adrenaline	absorb	less
B	hypothalamus	ADH	reabsorb	more
C	kidney	ADH	reabsorb	less
D	kidney	adrenaline	absorb	more

21 What happens when the core temperature of the body increases?

	diameter of surface (peripheral) blood vessels	urine production
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

For questions 22 and 23, refer to the diagram below.



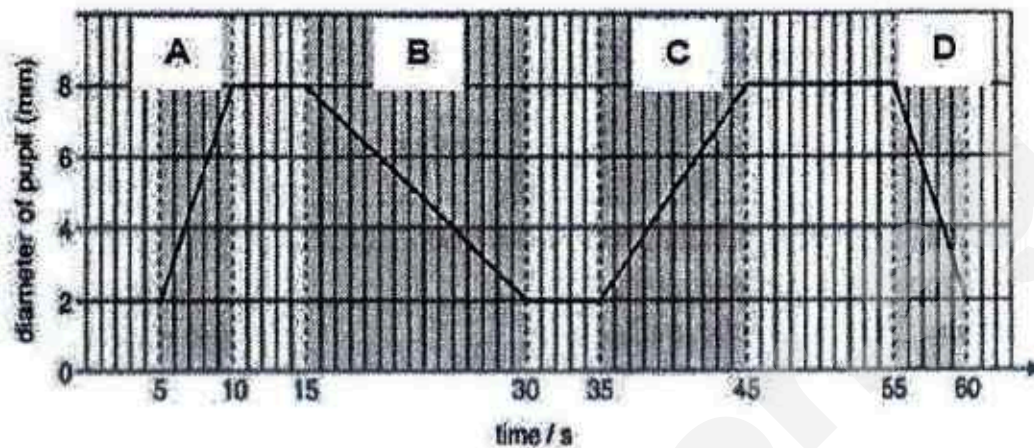
22 Which of the following labels are correct?

	receptor	effector	relay neurone	sensory neurone	motor neurone
A	5	9	4	8	3
B	9	5	8	3	4
C	9	5	3	4	8
D	5	9	4	3	8

23 A cut is made at X. Which of the following will happen when the hand is heated?

- A The person is unable to feel the pain but the hand will be withdrawn once he saw that the flame was heating his hand.
- B The person is unable to feel any pain and he could not voluntarily move his hand.
- C The person is able to feel the pain and move his hand spontaneously.
- D The person is able to feel the pain but he is unable to voluntarily move his hand.

- 24 The graph below shows how the diameter of a boy's pupil changes as light intensity is varied.



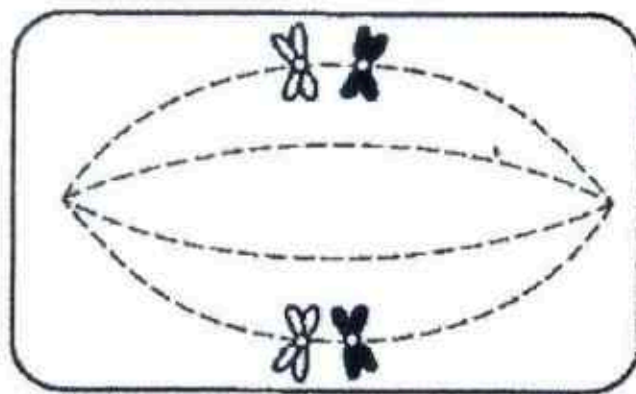
During which period of time does the light intensity decrease the fastest?

- 25 Mammalian skin cells in tissue culture were supplied with a source of radioactive thymine.

At which stage in the cell cycle will the thymine be used in the nuclei?

- A interphase
- B metaphase
- C prophase
- D telophase

- 26 The diagram shows a stage in a type of cell division.



Which of the following is **not** true of the daughter cells that are formed from such cell division?

- A They are involved in fertilization.
- B Four daughter cells are formed after one cell cycle.
- C Homologous chromosomes are present.
- D Genetically varied from the parent cells.

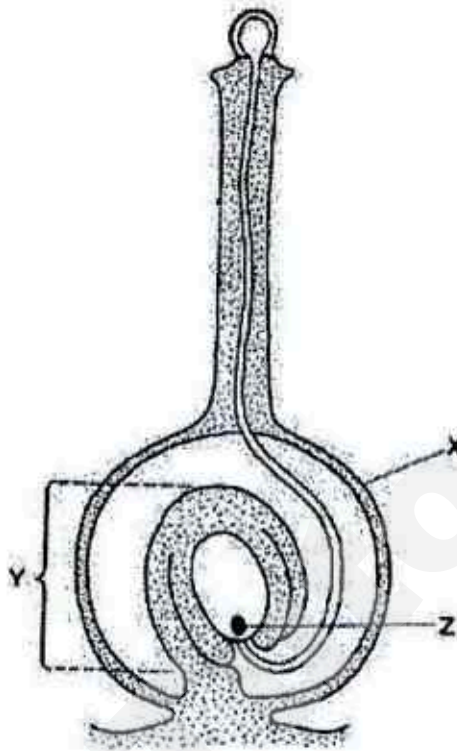
27 What are characteristics of all neurones?

	carry information within the brain	stimulate muscles or glands	transmit electrical impulses
A	✓	✓	x
B	✓	x	✓
C	x	✓	x
D	x	x	✓

28 What describes the chromosome number of these human cells?

	egg-producing cell in ovary	sperm	zygote	cell in an embryo
A	diploid	diploid	haploid	haploid
B	diploid	haploid	diploid	diploid
C	diploid	haploid	haploid	diploid
D	haploid	haploid	diploid	diploid

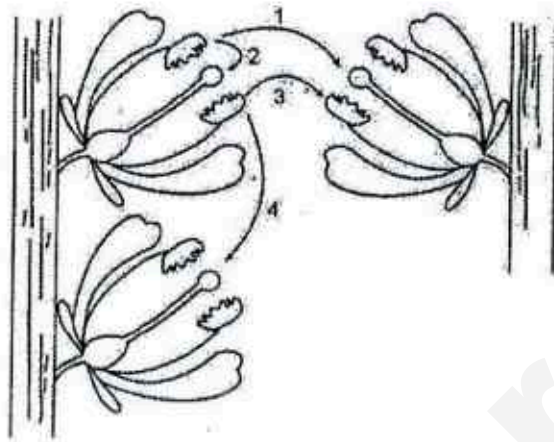
- 29 The diagram below shows a vertical section through a carpel during fertilization.



What are the labelled parts X, Y and Z?

	X	Y	Z
A	ovary wall	ovule	ovum
B	ovary wall	ovum	ovule
C	ovule	ovary wall	ovum
D	ovule	ovum	ovary wall

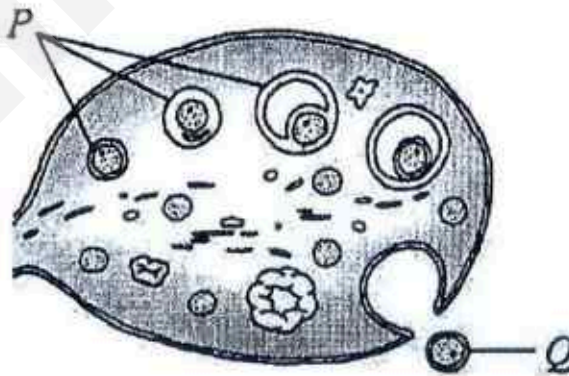
- 30 The diagram below shows two plants of the same species.



Which arrow(s) will lead to sexual reproduction but will produce offspring with lesser adaptability?

- A 1 only
- B 2 only
- C 2 and 4 only
- D 3 and 4 only

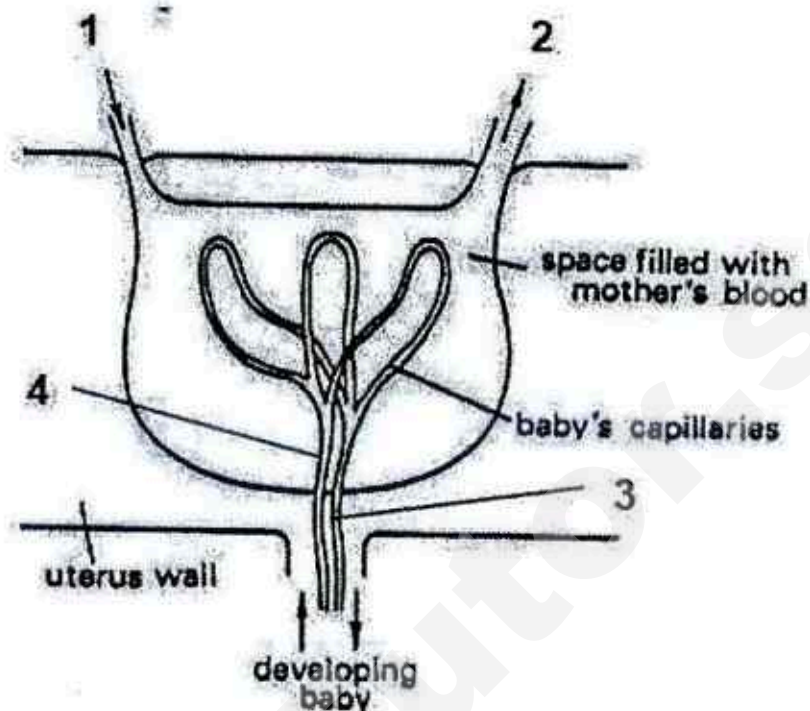
- 31 The diagram shows the female ovary.



The development of P and release of Q are caused by

	development of P	release of Q
A	oestrogen	progesterone
B	progesterone	oestrogen
C	LH	FSH
D	FSH	LH

- 32 The diagram shows part of the human placenta.



Which of the following correctly describes a higher concentration of the substances at the numbered parts 1, 2, 3, 4?

	1	2	3	4
A	bicarbonate ions	oxyhaemoglobin	urea	glucose
B	oxyhaemoglobin	bicarbonate ions	urea	glucose
C	bicarbonate ions	oxyhaemoglobin	glucose	urea
D	oxyhaemoglobin	bicarbonate ions	glucose	urea

- 33 Which of the choices below may be heterozygous?

- A a haploid cell
- B an allele of a gene
- C an organism with a dominant phenotype
- D an organism with a recessive genotype

- 34 Two parents, both with blood group A, have a daughter with blood group O. What is the probability that their next child will be a boy with blood group O?
- A 0.0625
B 0.125
C 0.375
D 0.5
- 35 Which of the following increases variation in both asexually and sexually reproduced organisms?
- A crossing over
B gene mutation
C random fusion of gametes
D independent assortment of chromosomes
- 36 Intelligence in the human population is an example of continuous variation. This is due to
- i. mutation
ii. multiple genes
iii. natural selection
iv. the environment
- A i only
B iii only
C ii and iv only
D i and iii only
- 37 Over time, a species of bird develops a more pointed beak. The more pointed shape of the beak helps the birds to catch small insects that may be hiding in cracks in the rocks.
- What is a reason for the change in the shape of the birds' beak?
- A Birds develop more pointed beaks as they search for insects in cracks in the rocks.
B Individuals with less pointed beaks are better fitted to their environment and more likely to survive.
C Individuals with more pointed beaks are better able to compete for food.
D When reproducing, birds are more likely to seek out mates with less pointed beaks because these are better adapted.

- 38 In a DNA molecule, the base sequence AGT codes for the amino acid serine.

What is the base sequence on the anti-codon on the tRNA to which serine becomes attached?

- A AGU
- B GAU
- C TCA
- D UCA

- 39 Human insulin can be manufactured by inserting the gene to make insulin into the plasmid of bacteria.

Which of the following is the main advantage of such genetic engineering technique?

- A Bacteria reproduce quickly thus producing large amounts of hormone.
- B Relatively little regulation of the process is required.
- C It leads to new genes being formed.
- D Other products can be harvested in the same process.

- 40 The use of restriction enzymes in genetic engineering is to

- A join the sticky ends of the donor DNA to the plasmid DNA.
- B make a complementary DNA copy of an RNA molecule.
- C recognize certain sequences of DNA.
- D cleave the DNA at specific points along its length.

-End of Paper-

BPGHS
Secondary 4 Biology
Preliminary Examinations
Paper 1

Answer Scheme

1	2	3	4	5	6	7	8	9	10
B	C	B	B	C	A	C	A	D	B

11	12	13	14	15	16	17	18	19	20
B	B	C	B	B	A	D	C	D	B

21	22	23	24	25	26	27	28	29	30
C	C	A	A	A	C	D	B	A	C

31	32	33	34	35	36	37	38	39	40
D	D	C	B	B	C	C	A	A	D

Name of Candidate: _____ () Class: _____ Calculator Model:



BUKIT PANJANG GOVERNMENT HIGH SCHOOL

Preliminary Examination 2017

SECONDARY FOUR EXPRESS

BIOLOGY

Paper 2

5158/02

Date: 14 August, 2017

Duration: 1h 45min

Time: 1115 – 1300h

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A [50 marks]

Answer all questions.

Write your answers in the spaces provided on the question paper.

Section B [30 marks]

Write your answers in the spaces provided on the question paper.

Write an E (for Either) or an O (for Or) next to the number 11 in the grid on the right hand side of this cover page to indicate which question you have answered.

You are advised to spend no longer than an hour on Section A and no longer than 45 minutes on Section B.

The number of marks is provided in brackets [] at the end of each question or part question.

For Examiner's Use	
Section A	/50
Q9	/10
Q10	/10
Q11	/10
Section B	/30
Paper 2	/80

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Section A [50 marks]

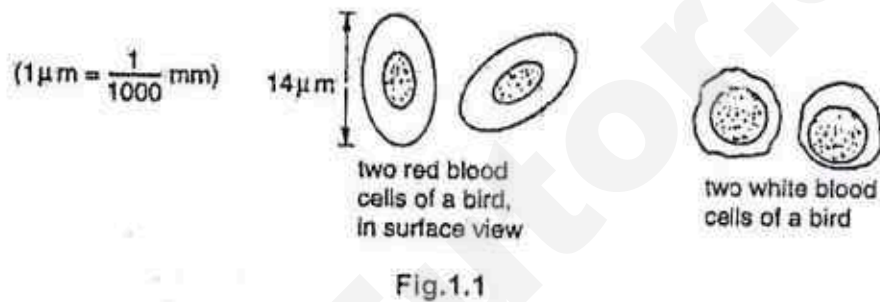
Answer all questions.
Write your answers in the spaces provided.

- 1 (a) State the role of iron in blood. [1]

.....

.....

(b) Fig.1.1 shows some red and white blood cells from a bird (all cells are drawn to the same magnification).



With reference to Fig.1.1, complete the table below to show two differences between the red blood cells of birds and humans. [2]

	Red blood cells	
	Birds	Humans
1		
2		

(c) Fig.1.2 below shows human blood cells in a type of blood vessel B passing between body cells.

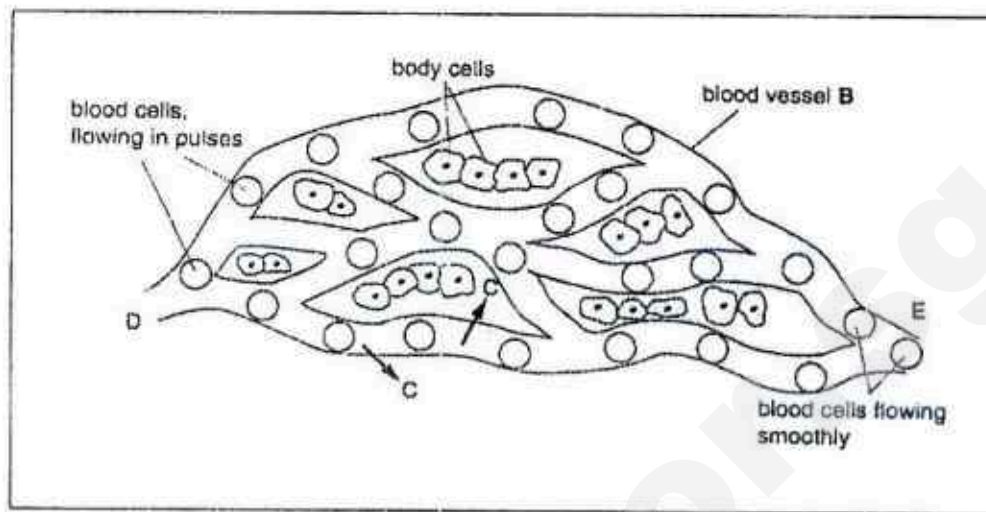


Fig.1.2

(i) Name blood vessel B and provide two reasons for your answer. [3]

Type of blood vessel:

Reasons:

(ii) Name the liquid that leaves the blood vessel at C. [1]

.....

(iii) Using information from Fig.1.2, explain why blood is under higher pressure at point D than at point E. [3]

.....

[Total:10]

- 2 Fig.2.1 shows an experiment on the uptake of water by a leafy shoot placed in a light, breezy environment.

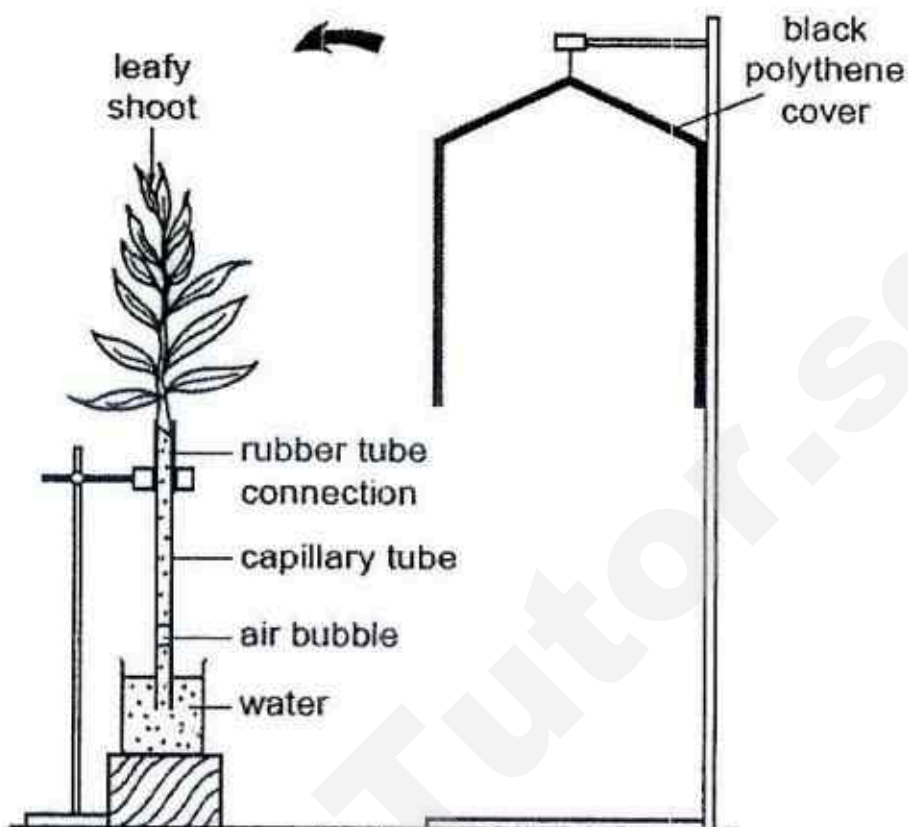


Fig.2.1

- (a) Explain what is likely to happen to the air bubble in the capillary tube. [2]

.....

.....

.....

.....

The black polythene cover is then placed over the plant.

- (b)(i) State the effect this is likely to have on what happens to the bubble. [1]

.....

.....

(ii) Explain your answer to b(i).

[4]

.....

.....

.....

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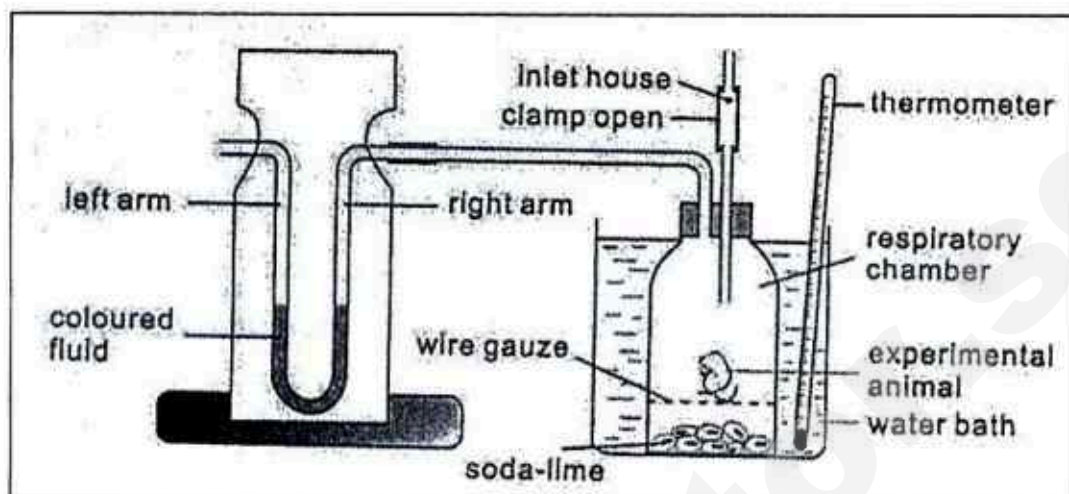
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[Total:7]

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- 3 The diagram below shows an experiment aimed to measure the rate of oxygen consumption of a mouse which has a body weight of 25g. At the beginning of the experiment, the clamp is closed. The height of the coloured fluid in the left arm and the starting time were recorded. After 30 mins, the height of the coloured fluid was recorded again.



The table below shows the results of the experiment.

	time	height of coloured fluid (cm)
starting time	11:00am	33.5
ending time	11:30am	18.5

- (a) State the purpose of soda lime in the experiment?

[1]

- (b) Using the data above,

(i) Calculate the rate of oxygen consumption by the mouse. Assume that 1cm of movement by the fluid will be caused by the addition of 1cm^3 of gas. Provide your answers in cm^3/h . Show all working. [2]

(ii) Explain the change in the height of the coloured fluid in the left arm.

[2]

(c) Explain this statement. "A smaller amount of glucose is required to maintain the same rate of cellular metabolism under aerobic conditions as compared to anaerobic conditions."

[3]

[Total:8]

- 4 Fig.4.1 shows how pollination takes place in two different species of plant, species P and species Q.

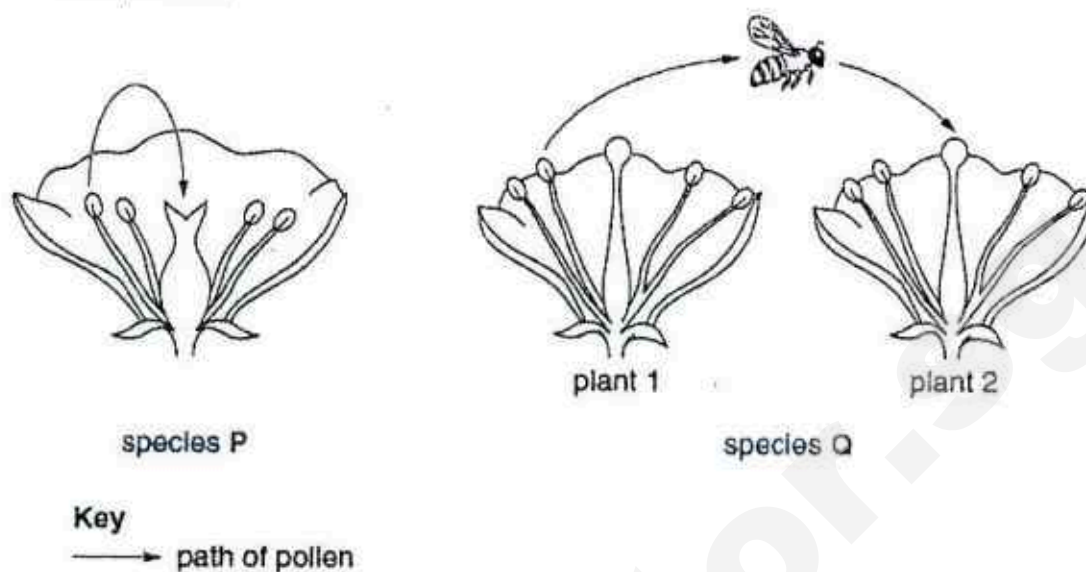


Fig.4.1

- (a) Suggest two ways in which a flower from a plant of species Q in Fig.4.1 may be adapted to increase the likelihood of pollination taking place. [2]

- (b) State why species Q shows more variation in its phenotype than species P. [1]

- (c) Describe the events that take place in a flower after pollination until fertilization has taken place. [3]

[Total:6]

- 5 The structure on the head of a chicken (the comb) can be of different shapes. Fig.5.1 shows how two different shapes of comb, 'walnut' and 'pea', were inherited in an experiment. Walnut comb is dominant.

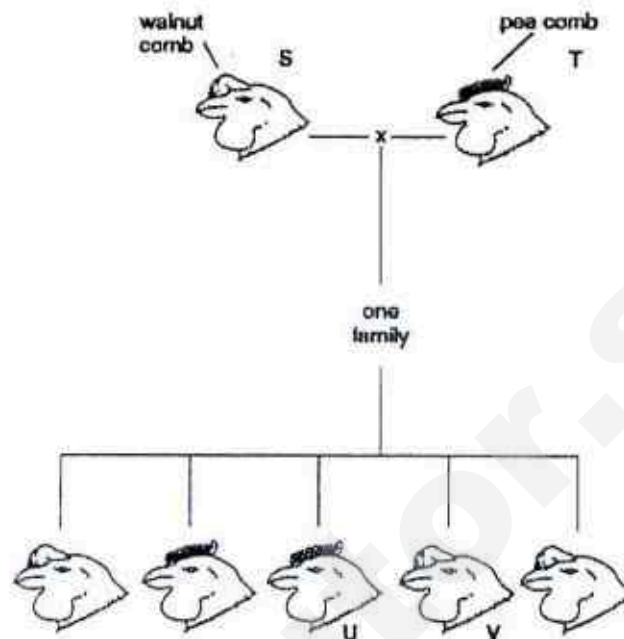


Fig.5.1

- (a) Assuming that comb shape is controlled by one pair of alleles, use Q for the dominant allele and q for the recessive allele to show the genotypes of the following chickens. [1]

S

T

U

V

- (b) Chickens S and V were bred together. Use a genetic diagram to show the proportion of their offspring having a pea comb. [3]

[Total:4]

- 6 Fig.6.1 represents some alleles on part of the sex chromosomes of a man and of a woman.

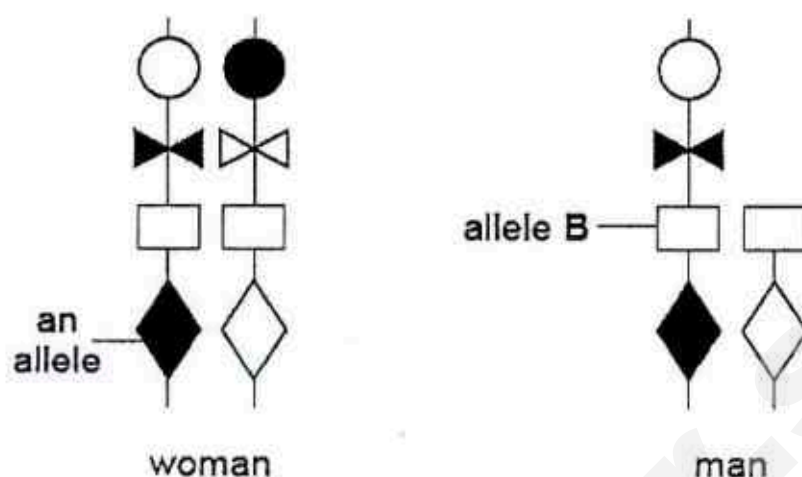


Fig.6.1

- (a) In the space below, draw these alleles as they might appear in a sperm cell that carries the Y chromosome. [1]

- (b) Fig.6.2 below shows how the alleles on one of the chromosomes might appear in a cell taken from somewhere else in the man's body. Allele B shows a mutation.

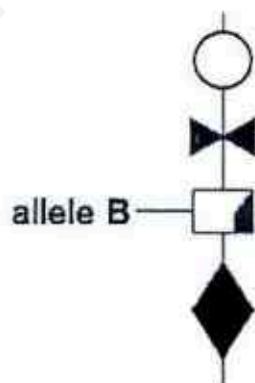


Fig.6.2

- Suggest two causes of the mutation. [2]

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(c) Mutated alleles such as that shown in Fig.6.2 are usually recessive. Use your knowledge of genetics to explain why society discourages marriage between closely-related people. [3]

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[Total:6]

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7 (a) Fig.7.1 shows two processes taking place in a cell.

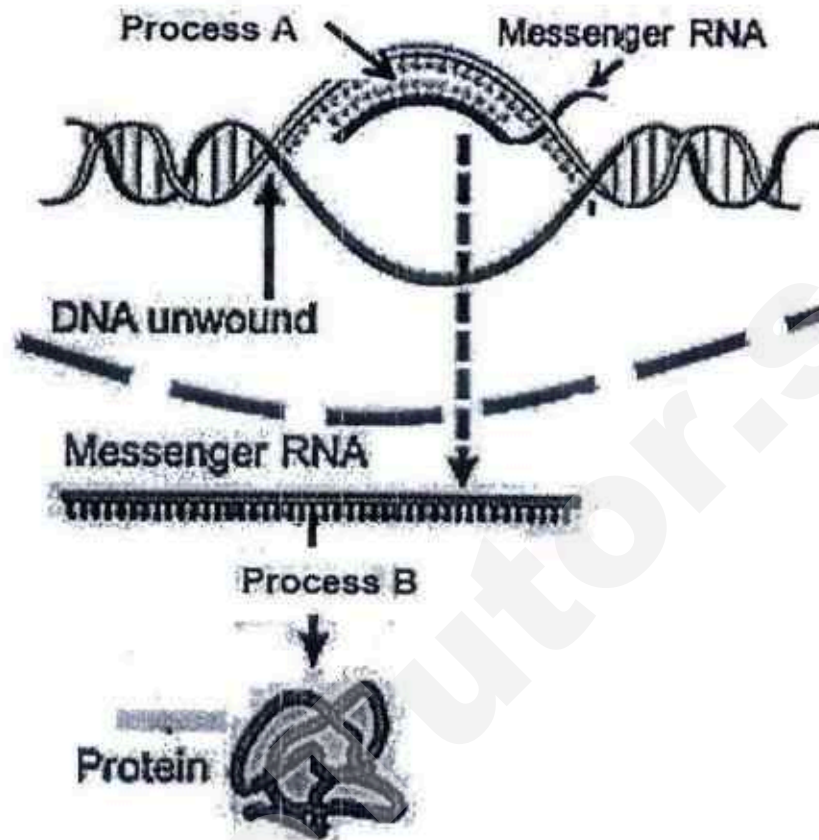


Fig.7.1

Name the two processes in Fig.6.1 and state the location within the cell in which they occur. [2]

Process A Location

Process B Location

(b) In the 1950s, Erwin Chargaff determined the relative quantities of the four bases in DNA in different organisms. His results proved important evidence for the model of DNA proposed by James Watson and Francis Crick in 1953. Some of Chargaff's data is shown in Table 7.2 below.

Organism	% Adenine	% Thymine	% Guanine	% Cytosine
Yeast	31.3	32.9	18.7	17.1
Wheat	27.3	27.2	22.7	22.8
Octopus	33.2	31.6	17.6	17.6

Table 7.2

(i) With reference to Table 7.2, explain how the data suggests that nitrogenous bases form complementary pairs. [1]

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(ii) Suggest another conclusion that can be drawn from Table 7.2. [1]

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Table 7.3 below shows Chargaff's data for a double-stranded RNA of an unknown organism.

Organism	% W	% X	% Y	% Z	% Uracil
Unknown	25.1	24.9	0	24.8	25.2

Table 7.3

(iii) Based on the information provided in Table 7.3, suggest which nucleotides (W, X, Y or Z) are the bases adenine and thymine respectively. Explain your answer clearly. [3]

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[Total:7]

8 Fig. 8.1 shows some stages in human reproduction.

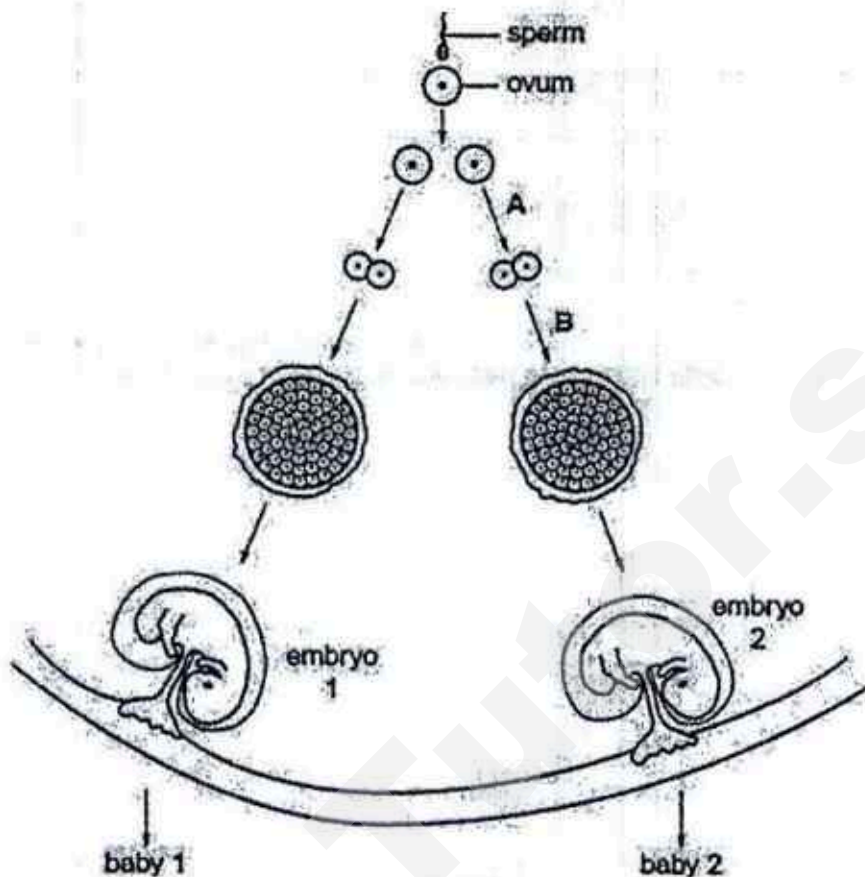


Fig. 8.1

(a) Name the type of cell division taking place at A and B.

[1]

The two embryos develop, are born and grow to become adults.

(b) Suggest two ways in which these two adults must be similar to each other, and explain your answers.

[2]

[Total:3]

~End of Section A~

Section B [30 marks]

Answer three questions only.

Question 11 is in the form of an Either/Or question. Only one part should be answered.

- 9 Fig.9.1 below shows the thickness of the uterine lining of a woman for the first 8 days of a 40-day assessment period.

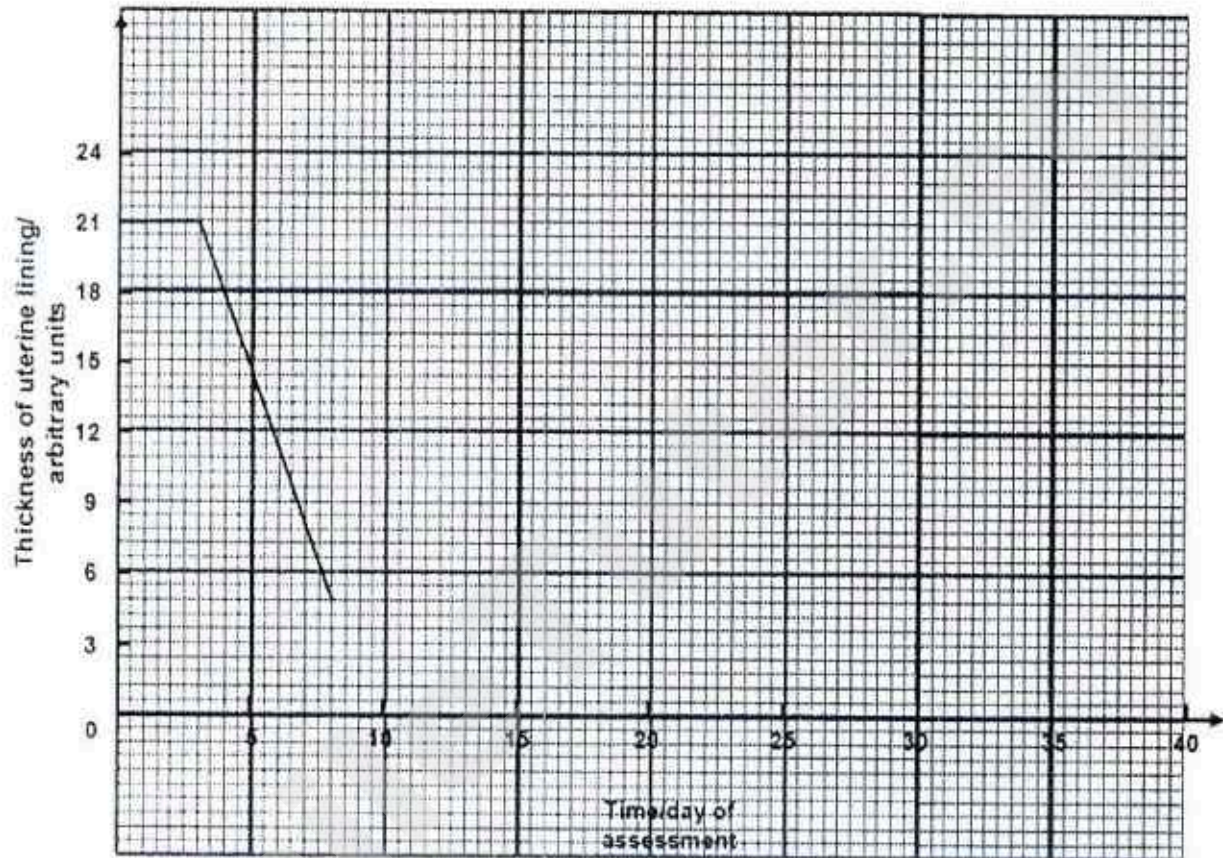


Fig.9.1

- (a) Using Table9.2 below, complete the graph of the thickness of the uterine lining for the remaining period of the assessment. [2]

Time/day of assessment	Thickness of uterine lining/ arbitrary units
10	3
16	9
20	21
24	21
28	21
32	24
36	24
40	24

Table9.2

(b) The woman's menstrual cycle lasts an average of 28 days.

With reference to the graph drawn in Fig.9.1, outline the key biological events that would have taken place in her female reproductive system (including ovaries, fallopian tubes and uterus) for the following period of time:

(i) Day 10 to Day 16 of assessment

[2]

(ii) Day 17 to Day 40 of assessment

[4]

(c) A foetus in a woman's womb is suspended in amniotic fluid. Describe the functions of amniotic fluid.

[2]

[Total: 10]

10 (a) Describe the conditions required for the chemical digestion of proteins in the human body. [4]

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(b) Explain how amino acids in the small intestine are assimilated into muscle tissues. [4]

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(c) Outline the role of proteins in animals. [3]

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[Total:10]

Either (a) Compare or contrast the nervous and hormonal systems.

[5]

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(b) (i) Describe how structures in the eye work to facilitate accommodation.

[4]

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(ii) In Lasik surgery to treat myopia, the procedure of anaesthetizing and opening up the eye is carried out to enable the surgeon to use laser to reduce the curvature of the cornea.

Explain why reducing the curvature of the cornea helps treat myopia.

[1]

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[Total:10]

OR (a) Describe what happens to both glucose and urea molecules in the blood entering the glomerulus of a kidney nephron. [4]

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(b) Patients with kidney failure may be put on a dialysis machine. Outline how a dialysis machine works. [4]

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(c) Name a gland that is also involved in homeostasis and outline its role. [3]

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[Total:10]

~This is the end of the paper. ☺~

Answers

Answers		Mark															
1a	Component of <u>haemoglobin</u> That binds to <u>oxygen</u> for its <u>transportation</u> around the body	$\frac{1}{2}$ $\frac{1}{2}$															
1b	<table border="1"> <thead> <tr> <th></th><th colspan="2">Red blood cells</th></tr> <tr> <th></th><th>Birds</th><th>Humans</th></tr> </thead> <tbody> <tr> <td>1</td><td><i>oval shape</i></td><td><i>biconcave</i></td></tr> <tr> <td>2</td><td><i>presence of nucleus</i></td><td><i>absence of nucleus</i></td></tr> <tr> <td>3</td><td><i>larger than their white blood cells</i> <i>(R: Stating larger without comparison)</i></td><td><i>smaller than their white blood cells</i> <i>(R: Stating smaller without comparison)</i></td></tr> </tbody> </table>		Red blood cells			Birds	Humans	1	<i>oval shape</i>	<i>biconcave</i>	2	<i>presence of nucleus</i>	<i>absence of nucleus</i>	3	<i>larger than their white blood cells</i> <i>(R: Stating larger without comparison)</i>	<i>smaller than their white blood cells</i> <i>(R: Stating smaller without comparison)</i>	Any 2
	Red blood cells																
	Birds	Humans															
1	<i>oval shape</i>	<i>biconcave</i>															
2	<i>presence of nucleus</i>	<i>absence of nucleus</i>															
3	<i>larger than their white blood cells</i> <i>(R: Stating larger without comparison)</i>	<i>smaller than their white blood cells</i> <i>(R: Stating smaller without comparison)</i>															
1ci	<p>Capillary</p> <p>Any 2 reasons</p> <ul style="list-style-type: none"> blood cells pass through blood vessel B in a <u>single file</u> showing that the blood vessel B has a very <u>small lumen</u> blood vessel that passes between <u>body cells</u> <u>one-cell thick wall</u> because C shows <u>diffusion/exchange</u> of substances through its partially permeable wall blood vessels forming a <u>network/ branching</u> <p>The blood vessel is not one cell thick; the wall is.</p>	1 2															
1cii	<p>Plasma</p> <p>Some students were confused between blood plasma and tissue fluid. Tissue fluid does not leave from blood. Red blood cells cannot diffuse through capillaries.</p>	1															
	<p>From the <u>direction of the fluid</u> lost from blood vessel B, it is deduced that blood flows from point D to E. / <u>pulses at D and smooth blood flow at E.</u></p> <p>Blood pressure at arterioles is higher than that in the venules because they are <u>nearer the heart</u></p> <p>and also due to the <u>resistance of blood flow</u> in blood vessel B as the <u>lumen is very narrow.</u></p> <p>Therefore, blood pressure at point D is higher than at point E.</p> <p>Many answers explained the purpose of low vs high blood pressure in blood vessels; minimal reference to diagram.</p>	1 1 1															
2a	<u>Moves towards plant / upwards</u>	$\frac{1}{2}$															

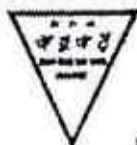
	<p>As <u>water is used up</u> during <u>photosynthesis</u> <u>Lost during transpiration</u> / evaporation from leaves Ref. <u>transpiration pull</u></p>	<p>$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$</p>
	Water is not "used up" during transpiration	
bi	<p>Movement of <u>bubble slows down/stops</u> R: Bubble goes down</p> <p>Bubbles are not produced (some students confused this experiment with the submerged hydrilla question).</p> <p>The cover is added on top of the ongoing experiment; it is not a new experiment.</p>	1
ii	<p>Evaporation of water from leaf causes <u>Vapour builds up</u> around / stays close to leaf / <u>increased humidity</u> Cover <u>prevents air current</u> / wind reaching leaf Slower rate of water loss / <u>transpiration</u> / <u>evaporation</u> Diffusion gradient <u>less steep</u> AW</p> <p><u>Photosynthesis stops</u> due to <u>absence of light</u> <u>Stomata closes</u> <u>Less water used</u> by shoot</p> <p>Many students only used one process as an explanation; they have to understand it is the combined effect of a few processes.</p> <p>Misconception: Some students unable to differentiate transpiration pull vs transpiration vs water uptake vs evaporation.</p> <p>Some students also unable to differentiate respiration vs transpiration vs photosynthesis.</p>	<p>$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ [3]</p>
3a	Soda lime is used to absorb carbon dioxide	1
3bi	$(33.5 - 18.5) \times 2$ (R: Working is not clear) $= 30 \text{ cm}^3/\text{h}$ (R: without units)	<p>1 1</p>
3bii	<p>The mouse will be <u>taking in oxygen and releasing carbon dioxide</u> through <u>respiration</u> As <u>soda lime will absorb the carbon dioxide</u> the <u>negative pressure / decrease in gaseous volume</u> will cause the height of the fluid to drop</p>	<p>$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$</p>
3c	<p>Glucose is <u>completely broken down/ oxidized</u> in <u>aerobic respiration</u> <u>more energy is released</u> In <u>anaerobic respiration</u>, glucose is <u>not completely broken down/ oxidized</u> <u>less energy is released</u> Therefore, <u>more glucose</u> is needed to release the <u>same amount of energy</u> during <u>anaerobic respiration</u> compared to aerobic respiration R: Answer compares same amount of glucose instead of energy released needed to meet energy demand for cellular metabolism/ same amount of energy is needed for same rate of cellular metabolism Link between energy needed and rate of cellular metabolism must be clear</p>	<p>$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$</p>
4a	Large brightly coloured petals	1

	<p>Scented Nectar / nectar guides Sticky pollen or stigma</p> <p>This flower is insect-pollinated; any answers about the protrusion of stigma and stamen will be rejected (reference to wind-pollination).</p>	<p>1 1 1 [2]</p>
4b	<p>Cross pollination Ref. to two parents or two (different) plants</p> <p>R: two different flowers (which may be from the same plant)</p>	<p>$\frac{1}{2}$ $\frac{1}{2}$</p>
4c	<p>Pollen tube grows Enzymes digest Break down style tissue To embryo sac / micropyle Male + female gametes fuse * Ref. to <u>nuclei</u> (of gametes that fuse)</p> <p>Last point on nuclei of male and female gametes fusing was not mentioned by most students. Many also wrongly mentioned that it is the pollen grain that fused with the ovum, or even the male gamete that fused with the ovule.</p>	<p>$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$</p>
5a	<p>Qq qq qq Qq</p> <p>[No $\frac{1}{2}$ mark]</p>	<p>1</p>
5b	<p>Parental phenotype Parental genotype</p> <p>Gametes (should be in circles, but no penalty for this) Random fertilization</p> <p>F1 genotype F1 phenotype Ratio</p> <p>Students were penalized if they did not mention on the left side the words necessary for a genetic diagram. Many students also wrote the genotypes of chickens S and V wrongly, while answering part (a) accurately.</p>	<p>1 1 1</p>
6ai		<p>1</p>

	<p>Radiation type named (UV, gamma, alpha etc.)</p> <p>Chemical or mutagenic chemical named (mustard gas, benzene, tar etc.)</p> <p>R: genetic variations, independent assortment of chromosomes, change in the gene or chromosome number</p> <p>Badly answered.</p> <p>Question asked for <u>causes</u> of mutation, not what mutations are.</p>	<p>1</p> <p>1</p>
	<p>Parents with normal phenotype / appear normal / do not have (express) the mutational condition</p> <p>May be heterozygous / carriers of the recessive allele</p> <p>Greater chance</p> <p>Each to pass the recessive allele down to the next generation</p> <p>Children inheriting 2 recessive alleles / being homozygous</p> <p>Suffer from mutational condition / express the mutation</p> <p>R: recessive gene changing to a dominant gene</p> <p>R: the homozygous recessive individual will be infected (it is not a disease!)</p>	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p>
7a	<p>Process A – transcription, nucleus</p> <p>Process B – translation, cytoplasm/ribosome</p>	<p>$\frac{1}{2}$, $\frac{1}{2}$</p> <p>$\frac{1}{2}$, $\frac{1}{2}$</p>
bi	<p>A percentage approximately = T percentage</p> <p>C percentage approximately = G percentage</p>	1
bii	<p>Genetic code is universal OR</p> <p>Only bases are A, T, G and C in all species</p> <p>R: % of A+T > % of G+C (This is shown in the table, but is not true and therefore not a conclusion that can be drawn.)</p>	1
biil	<p>Adenine – W</p> <p>Thymine – Y</p> <p>RNA no Thymine (0%)</p> <p>But with Uracil</p> <p>R: thymine is converted or translated to uracil in RNA</p> <p>A and U complementary, same %</p>	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>1</p>
8a	<p>Mitosis</p>	1
	<p>any 2 specific genetic similarities</p> <ul style="list-style-type: none"> - Sex / eye colour / blood groups / shape of ears or nose etc. <p>(A: any other reasonable answer)</p> <p>(R: look alike, same age, same chromosomes)</p> <p>Explanation</p> <ul style="list-style-type: none"> - Both arise from same zygote / one sperm + one egg <p>(R: both arise from same embryo)</p>	<p>1</p> <p>1</p>
Section B		
9(a)	<p>Correct plots (x crosses to be drawn in)</p> <p>Line of best fit</p>	<p>1</p> <p>1</p>

	No curves	
(b)(i)	Repair and thickening of uterine lining Development of follicle/primary follicle to <u>Graafian follicle</u> Secretion / high levels of oestrogen Ovulation / release of mature egg	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$
(b)(ii)	Fertilisation Migration of <u>zygote</u> From fallopian tube to uterus Mitosis of zygote to form embryo / ball of cells Implantation of embryo (R: zygote) onto uterine lining Corpus luteum stage Continued secretion / high levels of progesterone Further thickening of uterine lining Day 30/31 to 40 – no shedding of uterine lining / endometrium continues to thicken	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ [max 4]
	Support and cushions the foetus Absorbs shock and protects foetus against physical injury During birth, it lubricates and reduces friction in the vagina/birth canal It allow foetus to move freely during growth, promotes muscular development R: food/nutrient provision to foetus R: insulation Need the full explanation to receive the full one mark.	1 1 1 1 [max 2]
10(a)	Proteins are broken down into <u>polypeptides</u> by <u>pepsin</u> in the <u>stomach</u> which has an <u>acidic condition</u> . They are also broken down <u>into polypeptides</u> by <u>trypsin</u> in the <u>small intestine</u> which has an <u>alkaline condition</u> . The <u>polypeptides</u> are broken down into <u>amino acids</u> by <u>peptidases</u> , in the <u>small intestine</u> , under <u>alkaline conditions</u> . All these enzymes work best at <u>37°C</u> .	1 1 1 1
10(b)	amino acids <u>pass through/ diffuse</u> through <u>ileum wall / epithelium or lining or wall of villus</u> absorbed into <u>blood (stream) / blood capillary</u> amino acids <u>synthesized into proteins</u> Assimilation is not what happens to excess amino acids (ie. deamination). Assimilation has to be explained on how the nutrients are first used for a variety of purposes before the excess is removed.	1 1 1 [3]
10(c)	Any 3 of the following: reference to growth / repair / formation of new cells reference to hormones reference to enzymes constituent of cell membranes(or alternative wording) reference to haemoglobin reference to collagen reference to keratin reference to antibodies	3

	OR	
	Pituitary Gland	1
	Secretes less ADH when water potential of blood is high. Less reabsorption of water	$\frac{1}{2}$
	Secretes more ADH when water potential of blood is low. Low reabsorption of water	$\frac{1}{2}$
	OR	
	Sweat Gland	1
	Releases more sweat when body temperature is high. More heat lost through latent heat of evaporation.	$\frac{1}{2}$
	Releases less sweat when body temperature is low. Less heat lost through latent heat of evaporation.	$\frac{1}{2}$
		[2]



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Parent's Signature _____

PRELIMINARY EXAMINATION 2017
SECONDARY 4

BIOLOGY

5158/01

Paper 1 Multiple Choice

15 September 2017

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, class and index number on the Answer Sheet in the spaces provided unless this has been done for you.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers A, B, C and D.

Choose the one answer you consider and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

This document consists of 17 printed pages.

1 Which statement about cells or tissues is correct?

- A Muscle cells are biconcave.
- B Red blood cells have no nucleus.
- C Xylem vessels have ciliated cells.
- D Cells in the respiratory tract are long and thin.

2 Which structures must be present in a cell for osmosis to take place?

- A cell (sap) vacuole and cell wall
- B cell wall and cell membrane
- C chloroplast and cytoplasm
- D cytoplasm and cell membrane

3 A list of functions in cells is listed below. Match the functions with the structures stated in the table.

- I where carbon dioxide is reduced to carbohydrate
- II where glucose is oxidized and energy is released
- III a fully permeable outer layer
- IV a selectively permeable outer layer
- V the centre of protein synthesis

	I	II	III	IV	V
A	mitochondrion	chloroplast	cell membrane	cell wall	nucleus
B	ribosome	mitochondrion	cell membrane	cell wall	nucleus
C	chloroplast	ribosome	cell wall	cell membrane	mitochondrion
D	chloroplast	mitochondrion	cell wall	cell membrane	ribosome

For questions 4 and 5 refer to the table below, which shows the percentage change in mass of the potato strips. The four groups of potato strips have been immersed separately in different solutions (I to IV) for one hour.

solution	change in mass of potato strips/%
I	+8
II	-6
III	-3
IV	0

4 What conclusion can you draw from the results of this experiment?

- A Solution I has the highest water potential.
- B Solution II has a higher water potential than solution III.
- C Solution III has the highest water potential.
- D Solution IV is distilled water.

- 5 If the cells content has a concentration of about 0.3% sugar solution, which situation would explain the result shown in solution II?
- A If it were moved from a 0.3% sugar solution to a 0.1 % sugar solution.
 - B If it were moved from a 0.5% sugar solution to a 0.3% sugar solution.
 - C If it were moved from a 0.1 % sugar solution to 0.3% sugar solution.
 - D If it were moved from a 0.1 % sugar solution to a 0.5% sugar solution.
- 6 Equal quantities of a protein-digesting enzyme were added to 5 cm³ of protein solutions of different pH. Each tube was kept at 37 °C.

The amount of amino acid in each tube was measured after 3 minutes. The results are shown in the table.

pH	amount of amino acid / arbitrary units
1	10
2	9
3	7
4	2
5	1
6	1
7	1
8	0

At which pH was the enzyme most active?

- A 1
- B 4
- C 5
- D 8

- 7 The table below shows the results obtained when different food tests were performed on food, X and Y.

food test	X	Y
boiling with Benedict's solution	red precipitate formed	solution remained blue
addition of iodine solution	solution turned blue-black	solution turned blue-black
addition of sodium hydroxide solution and 1% copper sulphate solution dropwise	solution remained blue	solution turned violet

Which of the following options correctly states the nutrients found in both food?

	X	Y
A	Sucrose and starch	Protein
B	Protein and starch	Glucose
C	Protein	Glucose and starch
	digestive juice Z and starch extracted from here	Protein and starch liver

- 8 The diagram shows part of a mammalian digestive stomach

Digestive
was

Digestive
was

An experiment was conducted with juices W and Z on peanut oil. What could be the possible results obtained?

- A Juice W + peanut oil results in highest quantity of fatty acids formed.
- B Juice Z + peanut oil results in no fatty acids formed.
- C Juice W + Z + peanut oil results in highest quantity of fatty acids formed.
- D Juice Z + peanut oil results in highest quantity of fatty acids formed.

9 Which processes require enzymes?

- I hydrolysis of protein to form amino acids
- II digestion of fats to form fatty acids and glycerol
- III oxidation of sugar to form carbon dioxide and water
- IV emulsification of oil to form oil droplets
- V absorption of water into the blood capillaries of the small intestine

- A I and II
- B II and IV
- C I, II and III
- D I, III and V

10 Respiratory energy is believed to be used in the absorption of mineral salts by plant roots. Which observation best supports that hypothesis?

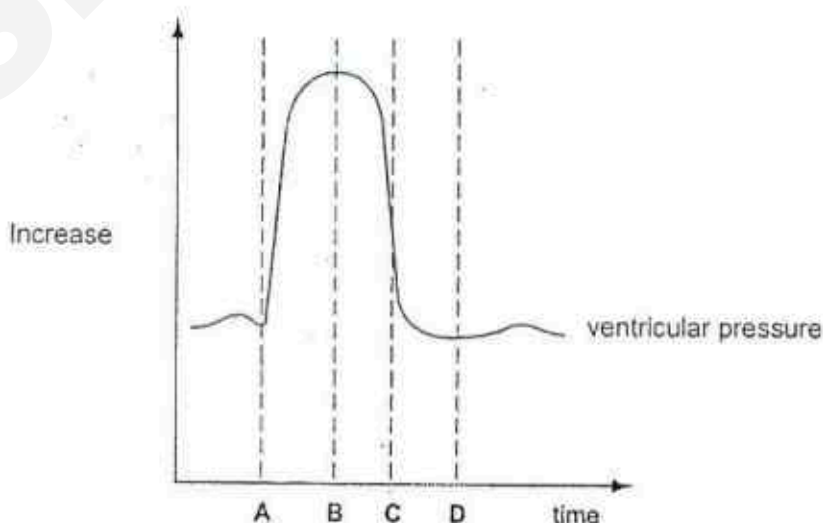
- A Chloride uptake is reduced in lower oxygen concentrations.
- B Carbohydrate is stored in the roots.
- C The root hairs provide a large surface area for gas exchange.
- D Living roots give off carbon dioxide.

11 Experimentally, it is found that the rate of metabolism of a rat is higher than that of an elephant. How do you account for this experimental finding?

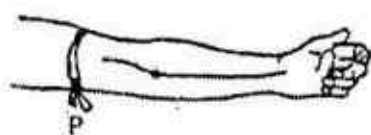
- A Rate of heat loss is directly proportional to body size.
- B Structures of small mammals are simpler than that of large mammals so that the conservation of heat is poorer in the former.
- C Small mammals have a bigger surface area to volume ratio so that more heat is lost per unit time.
- D Small mammals, due to their body sizes are much less active.

12 The diagram shows the ventricular pressure of a beating heart.

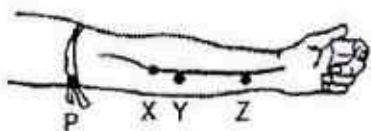
At which time are the atrioventricular valves fully closed and the aortic valves fully open?



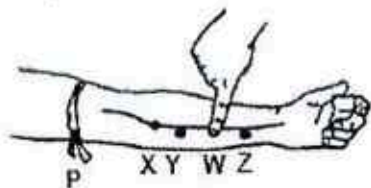
- 13 The diagram shows how to demonstrate the flow of blood in the veins of the lower arm.



Bandage arm at P to slow return of blood to the heart.



Veins become visible, and valves show as swelling at X, Y and Z.



Press one finger down at W.

Use another finger to stroke the vein as far as position X and then remove this finger.

Vein 'disappears' between W and Y.

Some possible reasons why the vein 'disappears' between W and Y are listed.

1. The bandage at P prevents backflow.
2. The finger pressed at W prevents more blood entering.
3. The valve at Y prevents backflow.
4. The valve at Z prevents more blood entering.

Which are the correct reasons?

- A 1 and 2
B 1 and 4
C 2 and 3
D 2 and 4

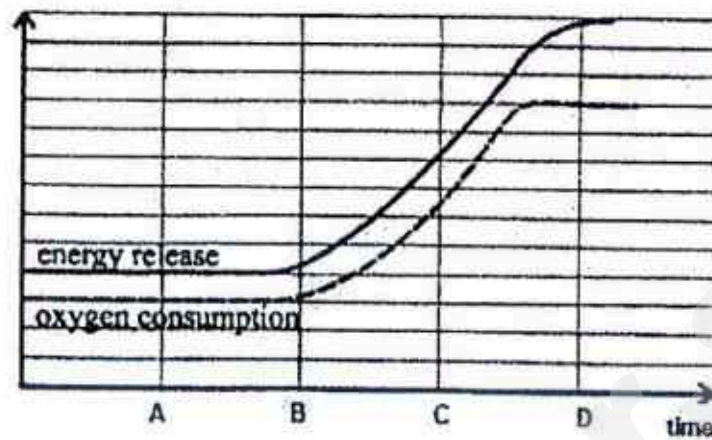
- 14 In an experiment with a potometer, the leafy shoot was subjected to four different environmental conditions. The table lists the distance travelled by the air bubble in a certain interval.

condition	distance travelled by the bubble (mm)	time taken (minute)
P	8	1.0
Q	12	1.0
R	8	2.0
S	9	1.5

From the result, it can be concluded that _____.

- A the rate of transpiration is highest in condition Q
B condition P is brightest and condition R is dimmest
C the rate of transpiration is the same under condition Q and condition S
D the light intensity in condition Q and condition S are the same

- 15 The graph shows the oxygen consumption and energy released during a period of exercise.

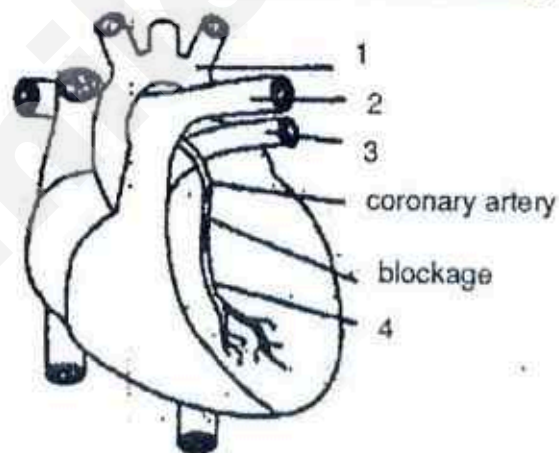


At which point in time is an oxygen debt incurred?

- 16 On a dry, sunny day, how does water vapour move through the stomata of a leaf?

- A into the leaf by diffusion
- B into the leaf by osmosis
- C out of the leaf by diffusion
- D out of the leaf by osmosis

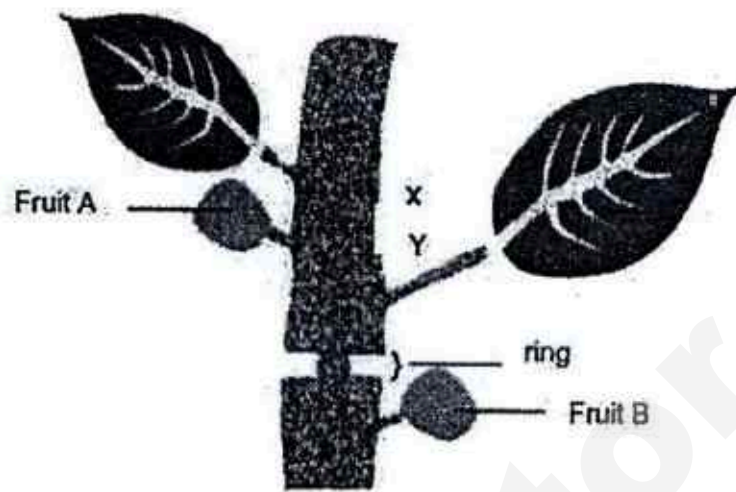
- 17 The diagram below shows a human heart that has a blockage in its coronary artery.



The coronary artery blockage can be treated by attaching a blood vessel to bypass the blockage. Which two vessels should be joined?

- A 1 and 2
- B 1 and 4
- C 2 and 3
- D 3 and 4

- 18 The diagram below shows a stem of a potted plant with a ring of bark containing phloem removed. The leaves remain alive after a few days.



If cuts are made at X and Y respectively and a ring of certain tissues is removed. After two days, the lower leaf is observed to grow normally and remained turgid, while the upper leaf began to wilt.

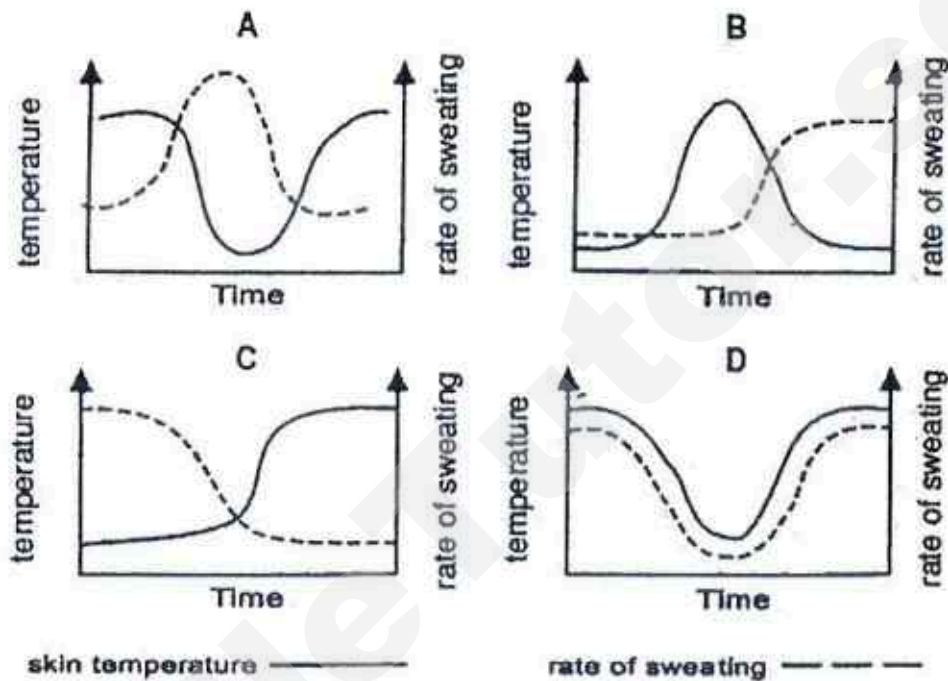
Which of the following about this experiment is incorrect?

- A The ring of tissues which is removed contains xylem.
 - B The upper leaf wilted because it could not get any water supply while continuously losing water.
 - C Organic nutrients from the upper leaf cannot reach the lower leaf.
 - D If red water is now supplied to the plant, the whole xylem vessel will be stained red except between the cuts.
- 19 Which statement describes how high blood pressure is maintained in a glomerulus?
- A Filtrate present in the Bowman's capsule tends to draw further filtrate from the bloodstream by osmosis.
 - B Plasma proteins in the bloodstream tend to force small molecules out of the blood.
 - C The blood vessel supplying a glomerulus contains blood arriving from the renal vein.
 - D The blood vessel leaving a glomerulus is narrower than the one entering it.
- 20 Two organs secrete substances that affect the body.
- Organ 1 → Product 1
- Organ 2 → Product 2

Negative feedback control of product 2 would be achieved if _____.

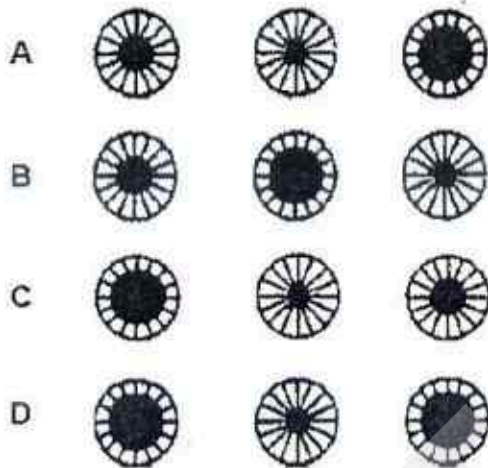
- A Product 1 counteracts product 2.
- B Product 1 reinforces the effect of product 2.
- C Product 2 inhibits organ 1 and product 1 stimulates organ 2.
- D Product 2 stimulates organ 1 and product 1 stimulates organ 2.

- 21 A man is placed in a room where the temperature is controlled at 40°C. Measurements of his skin surface temperature and the rate of sweating are recorded over a period of time. Which figure would most accurately represent the above situation?

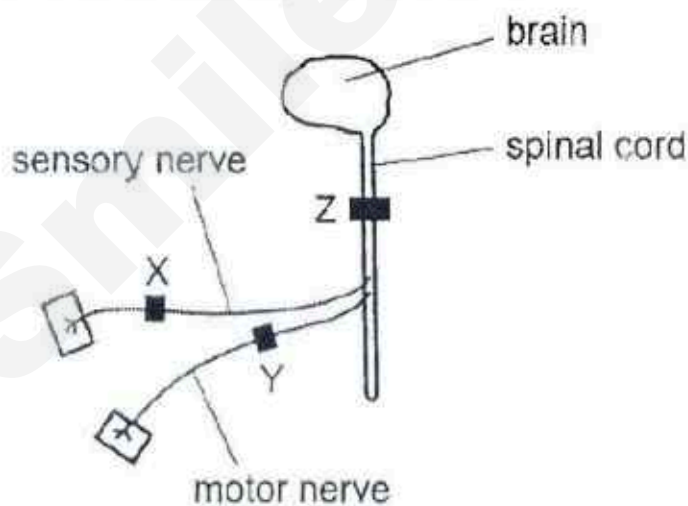


- 22 A receptor and an effector are necessary for any reflex action. When the pupil of the eye dilates, the receptor and effector are respectively
- A the fovea and the ciliary muscles.
 - B the fovea and the iris muscles.
 - C the pupil and the ciliary muscles.
 - D the pupil and the iris muscles.

- 23 A man was busy developing photographic film in his dark room on a bright sunny afternoon. He then went out of the dark room into his living room for a drink. The man then drew the curtains together to shade the room before sitting down for a drink. Which of the following shows the sequence of changes taking place in the size of his pupils?



- 24 The diagram represents a central nervous system. X, Y and Z show possible sites where the system could be blocked by a local anaesthetic.



Of four men, one had no anaesthetic block and the other three had only one anaesthetic block at X, Y or Z. One of the men can feel a pinprick on his leg but could not move it. Where is the anaesthetic block?

- A block is at X
- B block is at Y
- C block is at Z

D no block

25 Which statement concerning hormones is incorrect?

- A They are produced by ductless glands.
- B They are transported in the blood.
- C They are chemicals.
- D They are destroyed by kidney.

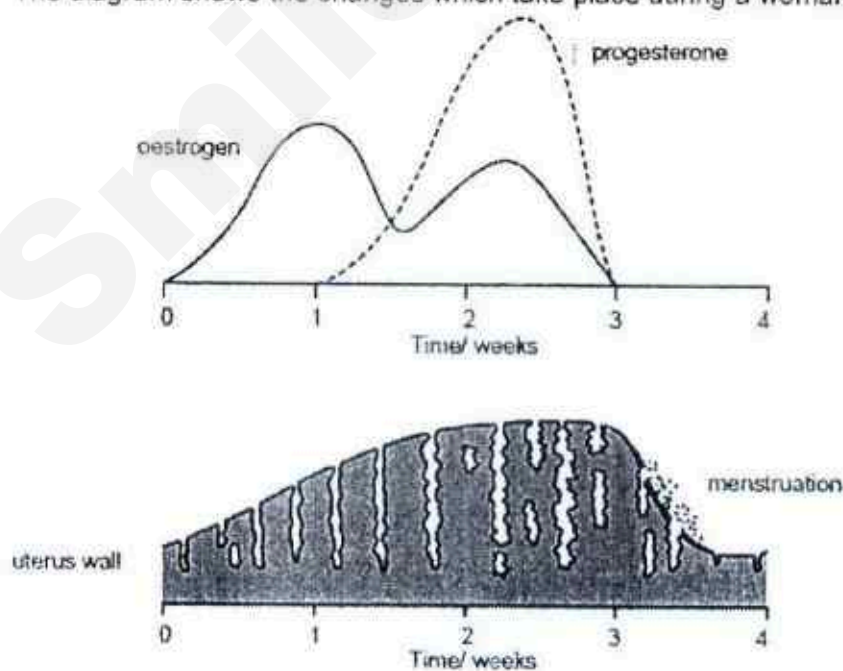
26 The chart provides information about the flowers of three different plants.

flower characteristics	flowers		
	plant X	plant Y	plant Z
petal colour	white	purple	bright yellow
aroma	none	rotting meat, strong	sweet, strong
petal size	0.3 cm	10.0 cm	4.0 cm
nectar size	none	medium amount	large amount

Which inference is valid concerning the method of pollination for plants X, Y and Z?

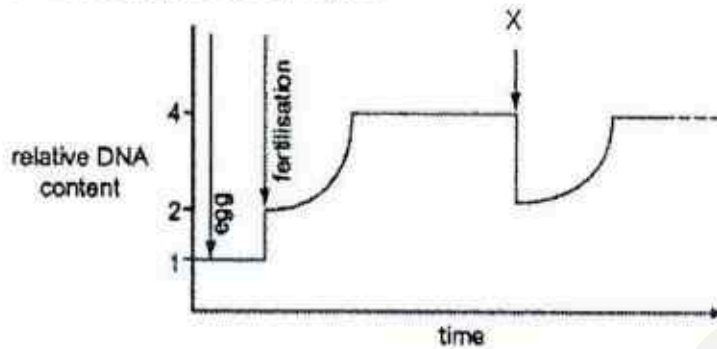
- A All three plants are wind pollinated.
- B All three plants are insect pollinated.
- C Plant X is wind pollinated, but plants Y and Z are insect pollinated.
- D Plants X and Y are insect pollinated, but plant Z is wind pollinated.

27 The diagram shows the changes which take place during a woman's menstrual cycle.



What is occurring at the time of ovulation?

- A a fall in the levels of oestrogen and progesterone
 B a fall in the level of oestrogen and a rise in progesterone
 C a rise in the levels of oestrogen and progesterone
 D a rise in the level of oestrogen only
- 28 The graph represents the changes in the quantity of DNA present in one nucleus at different stages in the life cycle.



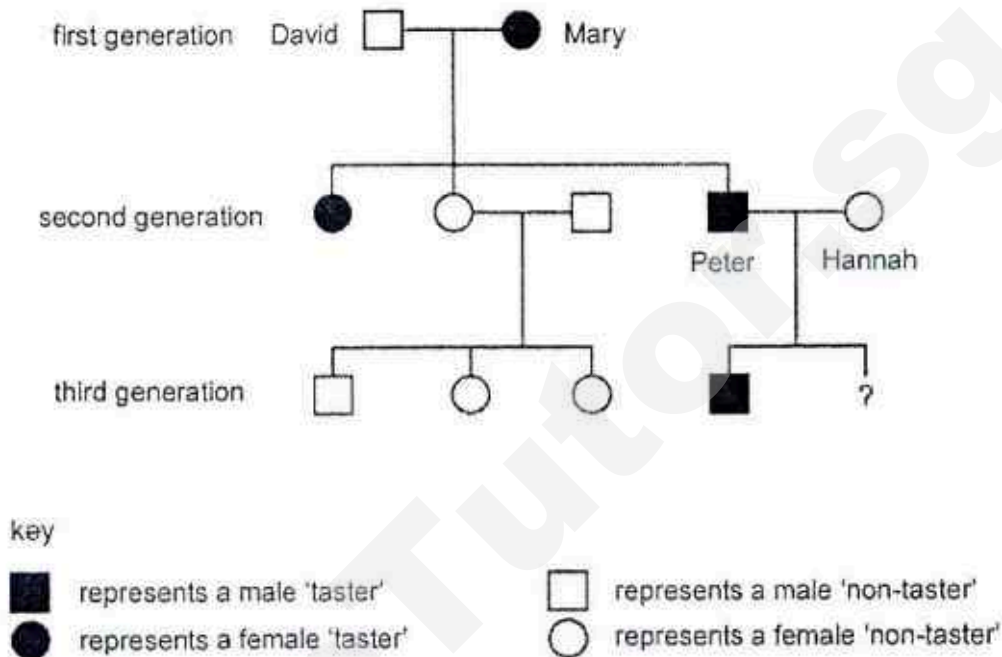
Which stage takes place at X?

- A cytokinesis
 B interphase
 C prophase
 D metaphase
- 29 The tortoiseshell cat has a combination of black and orange fur. The gene for black fur is represented by X^b and the gene for orange fur is represented by X^o . A tortoiseshell female cat ($X^b X^o$) mates with an orange male cat ($X^o Y$).

Which alternative shows the probable percentages of coat colours in the litter of kittens?

- A 50% tortoiseshell females and 50% orange males
 B 50% orange females and 50% tortoiseshell males
 C 25% black females, 25% orange females, 25% black males, 25% orange males
 D 25% tortoiseshell females, 25% orange females, 25% black males, 25% orange males

- 30 The family tree shows the inheritance of the ability to taste a certain substance. The allele for the ability to taste this substance is dominant to the allele for the inability to taste it.

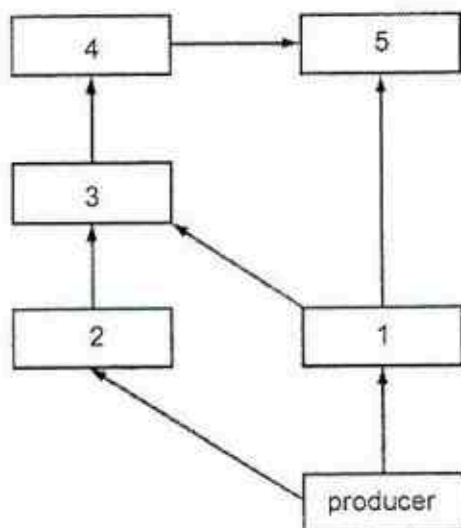


What is the chance of the second child of Peter and Hannah being a 'non-taster'?

- A 1 in 1
B 1 in 2
C 1 in 3
D 1 in 4
- 31 There is a gene for Rhesus positive and negative. Rhesus negative is symbolized by a genotype of rr.
- With respect to this gene, there _____.
- A are three different phenotypes possible
B is one genotype for a Rhesus positive person
C are two different genotypes for a Rhesus positive person
D are two possible genotypes for a Rhesus negative person
- 32 A man who is heterozygous for the Rhesus gene and has blood type AB has a child with his partner who is heterozygous for blood type A and is Rhesus negative. What is the chance the child is blood type B and Rhesus positive?
- A 0.125
B 0.25

- C 0.50
D 1

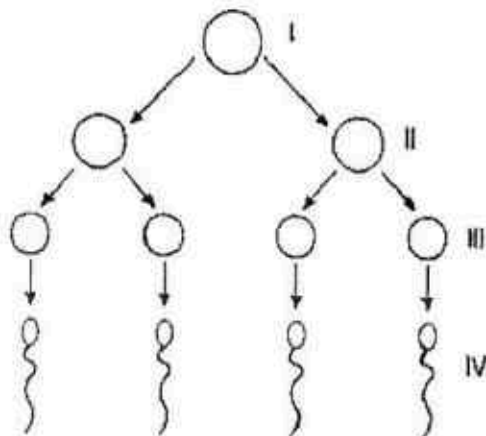
33 The diagram shows a food web.



Which organisms occupy the same trophic level?

- A 1 and 4
B 2 and 3
C 2 and 5
D 3 and 5
- 34 The rate of absorption of the light energy measured in a field is $6300 \text{ kJ m}^{-2} \text{ day}^{-1}$. Only 1% of this energy is converted into new plant production. 10% of the net plant production at one trophic level is transferred to the next trophic level. How much of energy is entering the primary consumer?
- A 0.063 kJ
B 0.63 kJ
C 6.3 kJ
D 63 kJ

- 35 The diagram below shows the process of sperm production in the testes.



Which of the following correctly represents whether the cells labeled I – IV are diploid ($2n$) or haploid (n)?

	I	II	III	IV
A	n	n	n	n
B	$2n$	n	n	n
C	$2n$	$2n$	n	n
D	$2n$	$2n$	$2n$	n

- 36 Which of the following is correct about natural selection?

- A Natural selection is the only force acting to produce an evolutionary change.
- B Natural selection requires aggressive encounters among members of a population.
- C Some individuals in a population are able to pass along to the next generation useful abilities they have acquired during their lives.
- D Variation is essential before natural selection can take place.

- 37 The oxygen requirements of water from a particular site are measured by taking a sample of the water and measuring its oxygen content with an electronic meter.

After keeping it sealed in the dark for 5 days at 20°C , the oxygen content is measured again. The rate at which the oxygen has been used up is known as the biological oxygen demand (BOD). The BOD of an unpolluted river is about 3mg O_2 per litre of water while that of raw sewage is about 325mg O_2 per litre of water.

Which of the following reasons below explain the relatively high BOD of raw sewage?

- I increased population of decomposing bacteria in raw sewage
- II decreased levels of carbon dioxide in raw sewage
- III increased levels of organic wastes in raw sewage
- IV decreased amounts of dissolved oxygen in raw sewage

- A I and II

- B I and III
C II and III
D I and IV

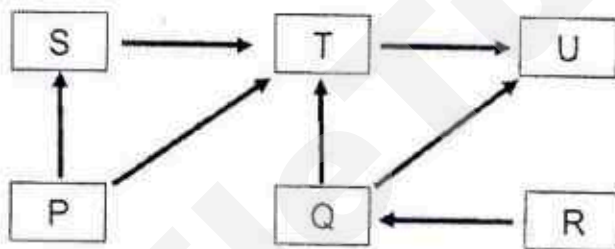
- 38 Since the introduction of the poisonous cane toad in Australia in 1935, there has been an increase in the ratio of body length to head size in two species of snakes, the Red-bellied Black Snake and the Green Tree Snake.

A smaller headed snake cannot consume a large prey and hence cannot swallow a large cane toad that has sufficient toxin to kill the snake.

The rapid evolution of body dimensions in the Red-bellied Black Snake and the Green Tree Snake most likely came about because

- A cane toad toxins reduced the head size of the snakes by inducing mutation in the snakes.
B larger headed snakes were killed by the levels of toxin ingested when they ate a large cane toad.
C smaller headed snakes are better at catching cane toads than large headed snakes.
D smaller heads allowed better camouflage in the cane toads' habitat and this advantage caused a mutation in the snakes.

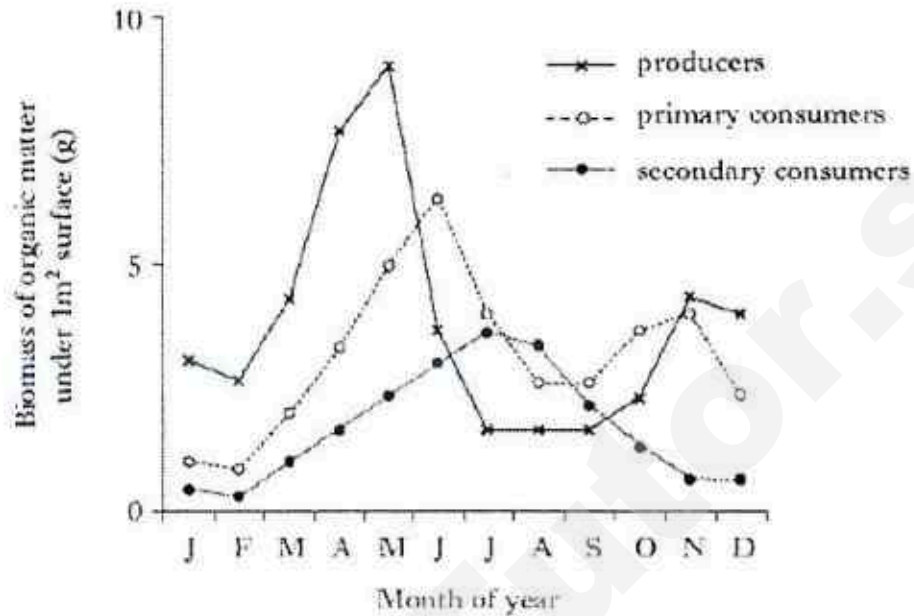
- 39 The following diagram represents a food web.



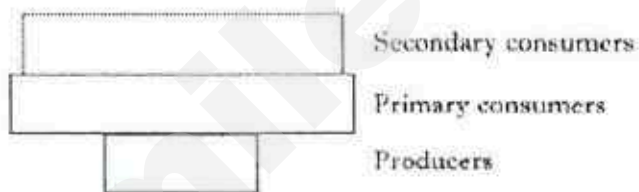
Which line in the table below correctly describes the organisms?

	producer	herbivore	omnivore	carnivore
A	P	Q	U	S
B	P	U	T	Q
C	Q	R	S	T
D	R	S	T	U

- 40 The graph below shows variation in biomass throughout one year in an aquatic ecosystem.



During which month of the year would the following pyramid of biomass be applicable?



- A August
- B July
- C June
- D May

Chung Cheng High School (Main)
Secondary 4
Preliminary Examination 2017

Paper 1

1. B	2. D	3. D	4. A	5. A
6. A	7. D	8. C	9. C	10. A
11. C	12. B	13. C	14. A	15. D
16. C	17. B	18. C	19. D	20. B
21. A	22. B	23. C	24. B	25. D
26. D	27. B	28. A	29. D	30. D
31. B	32. C	33. D	34. C	35. B
36. D	37. B	38. B	39. D	40. B

Name:	Class	Class Register Number
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中正中學

CHUNG CHENG HIGH SCHOOL (MAIN)

Chung Cheng High School, Chung Cheng High School, Chung Cheng High School, Chung Cheng High School, Chung Cheng High School,
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Chung Cheng High School, Chung Cheng High School, Chung Cheng High School, Chung Cheng High School, Chung Cheng High School

Parent's Signature

**PRELIMINARY EXAMINATION 2017
SECONDARY 4**

BIOLOGY

5158/02

Paper 2

12 September 2017

1 hour 45 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.

Write your name, class and index number clearly in the spaces provided at the top of this page.

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

Do not use highlighters or correction fluid.

Section A

Answer all questions in the spaces provided.

Section B

Answer all three questions, the last question is in the form either/or.

Answer all questions in the spaces provided.

The number of marks is given in brackets [] at the end of each question or part question.

The use of an approved scientific calculator is expected, where appropriate.

For Examiner's Use	
Paper 1	
Paper 2	
Section A	
Section B	
7	
8	
9 E/O	
Total	

This document consists of 20 printed pages.

Section A

Answer all questions.

Write your answers in the spaces provided.

- 1 Fig. 1.1 shows what happens to some of the energy in the food that a cow eats.

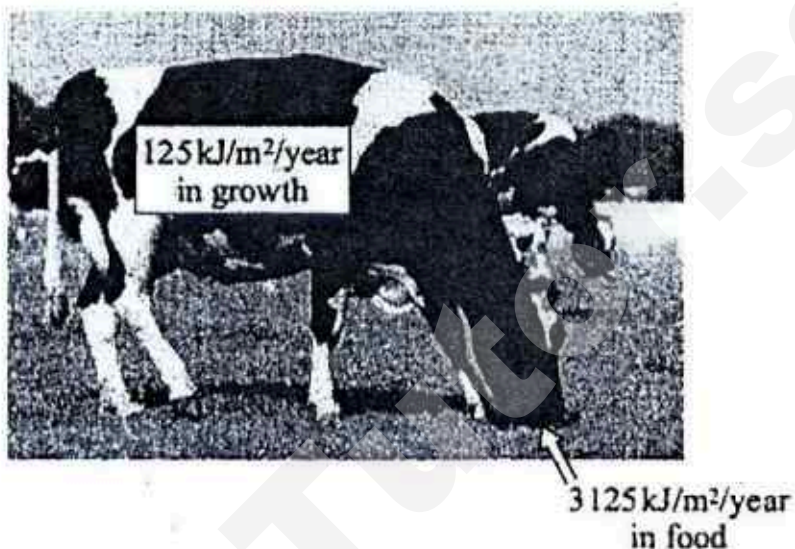


Fig. 1.1

- (a) (i) Calculate the percentage of the energy in the cow's food that is transferred into new growth of the cow.
Show clearly how you work out your answer.

Answer =% [2]

- (ii) The energy from the cow's food which is not transferred into new growth of the cow is lost.
Give two ways in which this energy is lost.

1.

.....

2.

..... [2]

- (b) Explain why the animals that we raise for food are usually herbivores rather than carnivores.

.....

.....

.....

.....

..... [2]

[Total:6]

- 2 Fig. 2.1 shows an experiment to investigate the uptake of glucose by cells of the villi in the small intestine.
- Two leak-proof bags were set up.
 - One bag was made from artificial partially permeable membrane (Visking tubing).
 - The other bag was made from a piece of small intestine containing living cells, with its inner surface inside the bag.
 - The bags were filled with equal volumes of a dilute glucose solution.
 - The bags were suspended in the same glucose solution for two hours.
 - After two hours, the volumes of the bags were measured and the contents were tested for the concentration of glucose.

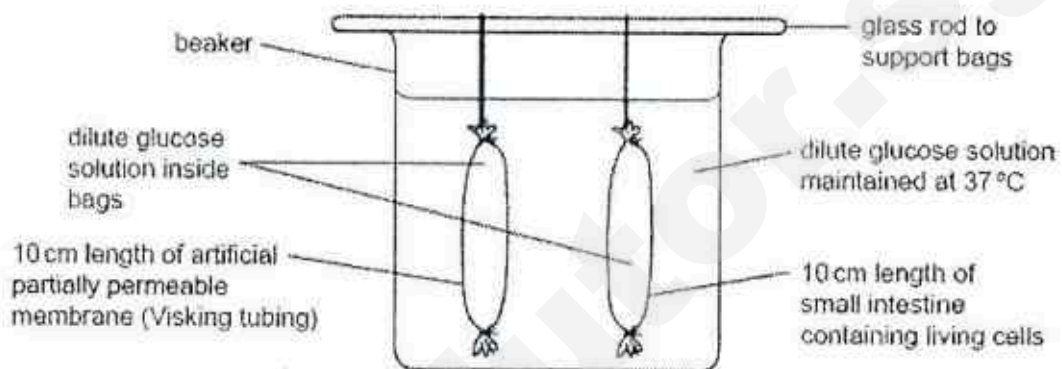


Fig. 2.1

Inside the bag made from small intestine the volume and concentration of the glucose solution decreased. There were no changes to the volume and concentration in the Visking tubing bag.

- (a) State and explain the process responsible for the decrease in the glucose concentration in the bag made from small intestine.

.....

 [2]

- (b) After two hours there was less water in the bag made from small intestine. The volume of water in the bag made from small intestine decreased, but the volume in the bag made from Visking tubing did not change. Explain why.

.....

 [2]

An investigation studied the flow of water into and out of the human alimentary canal. Table 2.1 shows the results.

water into the alimentary canal		water out of the alimentary canal	
source of water	Volume of water/ dm ³ per day	method of water loss	Volume of water/ dm ³ per day
Water from diet	2.5	stomach to the blood	0.00
Saliva	2.5	Small intestine to the blood	9.00
Gastric juice	2.4	large intestine to the blood	0.85
Bile	0.8	in the faeces	0.15
Pancreatic juice	0.8		
Intestinal secretions	2.0		

Table 2.1

- (c) (i) Name the part of the alimentary canal that secretes most water in a digestive juice.
[1]
- (ii) Name the part of the alimentary canal that absorbs most water into blood.
[1]
- (d) Explain why water is added to food by the secretions shown in Table 2.1.

[2]

[Total:8]

- 3 A healthy kidney controls the excretion of urea and other waste products of metabolism from the blood. After kidney failure there are two possible treatments: dialysis or a kidney transplant. Fig. 3.1 shows how blood and dialysis fluid move through a dialysis machine.

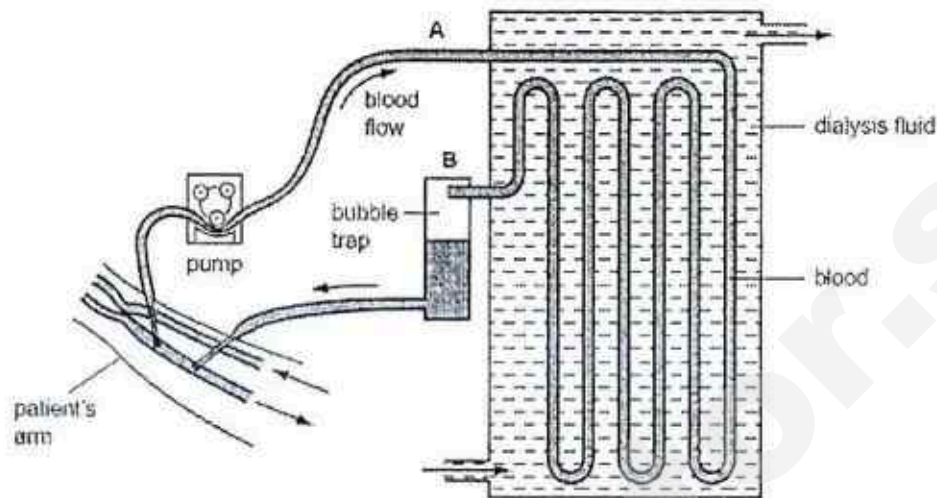


Fig. 3.1

- (a) Describe the changes that occur to the blood as it flows through the dialysis machine from A to B.

.....

 [2]

- (b) Describe and explain two features of the dialysis machine that allow it to perform its function efficiently.

.....

 [2]

- (c) Suggest two advantages of kidney transplants compared with dialysis.

1.

 2.
 [2]

- (d) Two brothers have to make a difficult decision.
 One brother, with blood group AB, has kidney failure and is on dialysis.
 The healthy brother has agreed to donate one of his kidneys to his brother. He has to have a blood test.
 Their father has blood group A and their mother has blood group B.
 The brothers have a sister who has blood group O.
- (i) Explain how the sister has blood group O when her parents have different blood groups [3]

<i>parental phenotypes</i>	blood group A	×	blood group B
<i>parental genotypes</i>	.....	×	.....
<i>gametes</i>	.....	+	.....
<i>girl's genotype</i>	.....	
<i>girl's phenotype</i>	.....	

- (ii) The healthy brother can only donate the kidney to his brother if they both have the same blood group.
 What is the probability that the healthy brother also has blood group AB?

.....[1]

[Total:10]

- 4 (a) Name the artery that transport oxygenated blood away from the heart.

.....[1]

- (b) The walls of arteries contain elastic tissue.
Explain the function of the elastic tissue.

.....

.....

.....

.....[2]

Table 4.1 shows some features at different times during a cardiac cycle. The times are not in the correct sequence.

time during cardiac cycle	ventricular volume/cm ³	atrio-ventricular valves	semilunar valves
A	70	open	shut
B	105	shut	open
C	125	open	shut
D	80	shut	open

Table 4.1

- (c) Starting with A, put the times during the cardiac cycle in the correct sequence. [1]

A			
---	--	--	--

- (d) At which time during the cardiac cycle, A, B, C or D, does the blood first leave the ventricle?
Give the reason for your answer.

time: [1]

reason.....

.....

.....

.....[2]

[Total:7]

- 5 Fig. 5.1 shows the structure of the placenta and parts of the fetal and maternal circulatory systems.

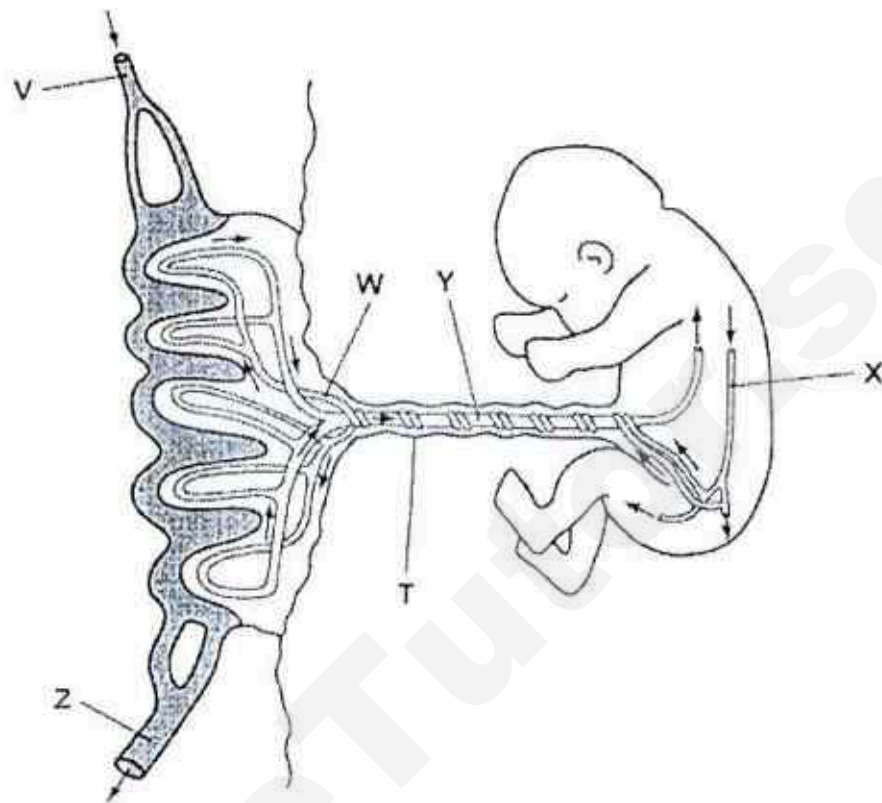


Fig. 5.1

- (a) Complete Table 5.1 by listing the blood vessels that carry oxygenated blood. Use the letters in Fig. 5.1 to identify the blood vessels. [2]

circulatory system	blood vessels that carry oxygenated blood
maternal	
fetal	

Table 5.1

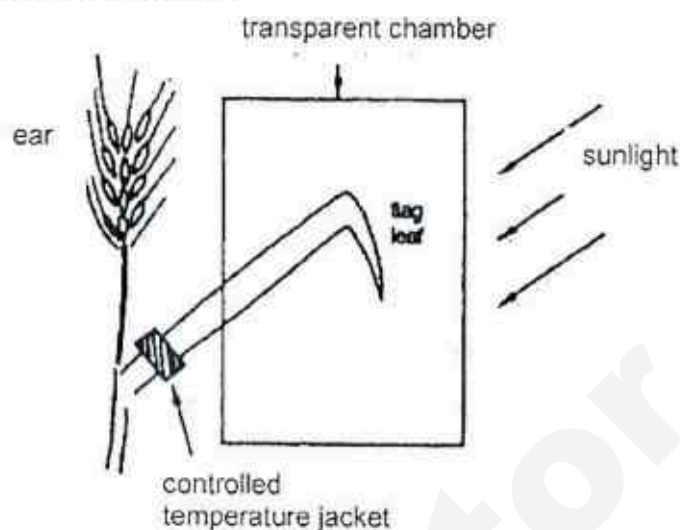
- (c) Explain how smoking may affect the development of her fetus.

[4]

[3]

[Total:9]

- 6 The flag-leaf of a wheat plant is the leaf immediately below the developing flower, or ear, of wheat. It has been shown that the growth of the ear is largely dependent on a supply of materials derived from photosynthesis in the flag-leaf.

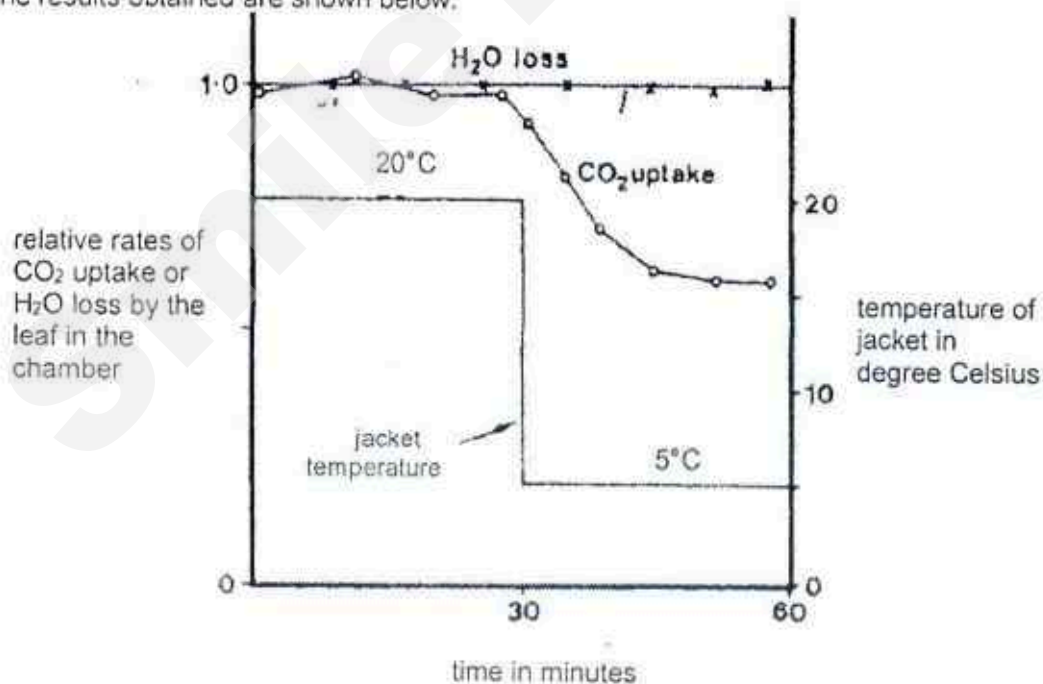


An experiment was designed to assess the effect of altering the temperature of the base of the flag leaf on the rate of water loss and carbon dioxide uptake of this leaf. The transparent chamber was maintained at 25°C throughout the experiment.

During the experiment:

- The temperature of the jacket was adjusted to 20°C and left for 30 minutes.
- Next, the temperature of the jacket was lowered to 5°C and left for a further 30 minutes.

The results obtained are shown below:



- (a) From the graph explain how the change in jacket temperature affected the flag-leaf transpiration rate.

.....
 [1]

- [2]

- [2]

- [3]

- (e) What would happen to the sugars that were being transported to the flower or ear of the wheat?

.....

.....

.....

..... [2]

[Total:10]

Section BAnswer **three** questions.Question 9 is in the form of an **Either/Or** question.

Only one part should be answered.

Write your answers in the spaces provided.

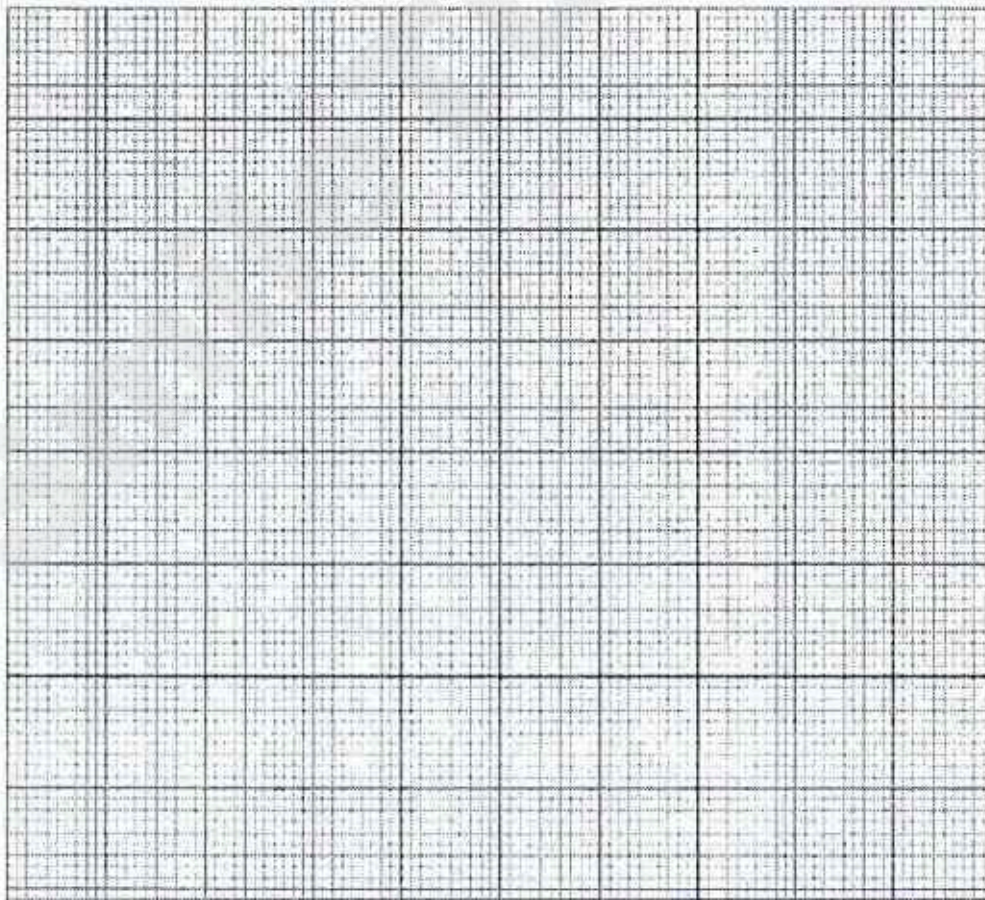
- 7 An experiment was conducted for twenty-five individuals aged between 10 and 60. Upon hearing a whistle blow, they were to grab a small rubber ball placed across a table and place it in a basket near the edge of the table where they are standing. The time taken from the start to the instant the ball was grabbed was recorded and termed the reaction time. The average timing of 4 trials of individuals and their ages is recorded by a student in Table 7.1.

age group	age group's average reaction time/s
10 - 20	0.30
20 - 30	0.46
30 - 40	0.53
40 - 50	0.66
50 - 60	0.87

Table 7.1

- (a) Plot a suitable graph to display the information in Table 7.1.

[4]



- (b) Using your knowledge of the nervous system, describe the relationship of the data in your graph in (a) and suggest an explanation for it.

relationship

.....

explanation

.....[2]

While the student was attempting to check the reaction times of very young people, he observed that if the cheek of a newborn baby is brushed with a finger, as shown in Fig. 7.1, the baby will turn its head towards the finger.



Fig. 7.1

- (c) The observation in Fig. 7.1 is an example of a reflex action shown by infants. Describe the events which lead to the baby's head turning towards the finger.

.....

.....

.....

.....

.....

.....

.....

.....[4]

[Total:10]

8 (a) Explain what is meant by the term homeostasis.

[2]

(b) Using a named example, explain the term negative feedback.

[3]

(c) In extremely cold conditions people may get frostbite. This causes the cells in the toes and fingers to die. Explain why this takes place even if thick gloves, socks and shoes are worn.

[5]

[Total:10]

9 Either

They carried out an investigation by dividing a field into four plots, E to H. The potatoes in each plot received different treatments:

F – manure only

H – manure and chemical fertiliser

Their results are shown in Table 9.1.

Table 9.1

- Answer = % [1]

- [3]

- (c) Manure and chemical fertilisers provide plants with nitrate ions.
Explain how extra nitrate ions in the soil may have increased the yield of the potatoes.

.....

.....

.....

..... [2]

- (d) State why plot E was included in this investigation.

.....

..... [1]

- (e) Describe the impact of adding excessive chemical fertilisers to crops on the environment.

.....

.....

.....

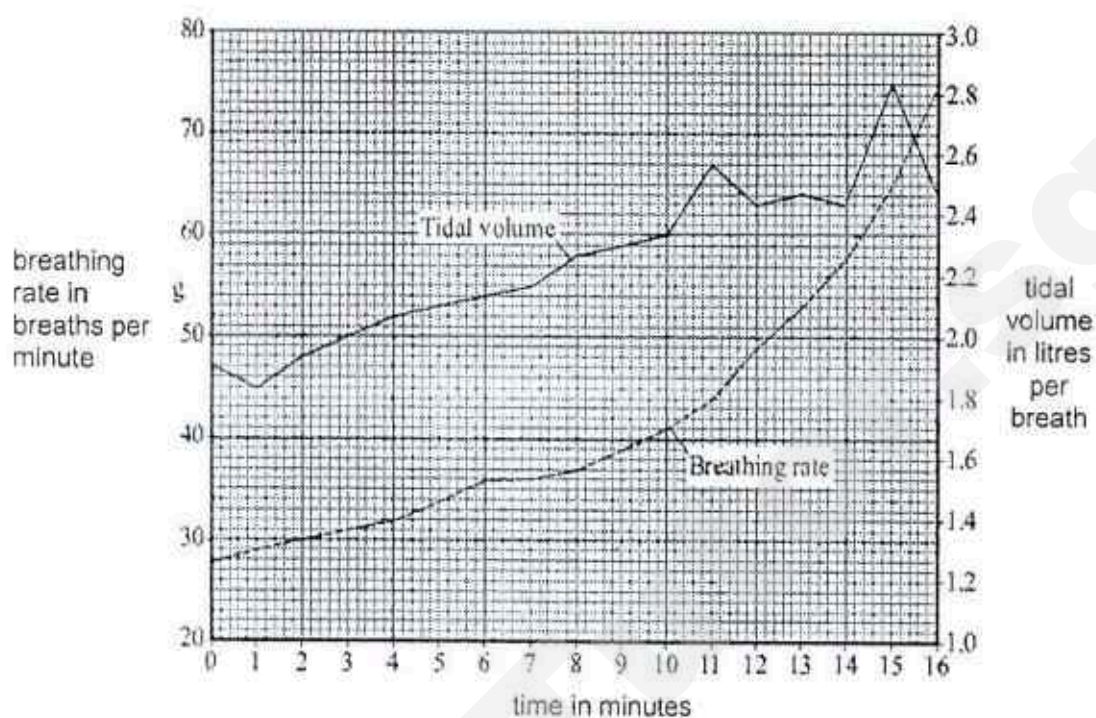
.....

.....

..... [3]

[Total:10]

- 9 An athlete exercised on a running machine. The machine increased in speed every 60 seconds. The graph below shows the effect of the exercise on the athlete's breathing rate and tidal volume.



- (a) (i) What is the athlete's tidal volume at 3 minutes?

..... [1]

- (ii) The difference in breathing rate from 0 to 8 minutes is 9 breaths per minute. Calculate the difference in breathing rate from 8 to 16 minutes.

[1]

(b) Explain why breathing rate changes as exercise increases.

[3]

(c) Describe how mammalian breathing mechanism works.

[5]

[Total:10]

Chung Cheng High School (Main)
Secondary 4
Preliminary Examination 2017

Paper 1

1. B	2. D	3. D	4. A	5. A
6. A	7. D	8. C	9. C	10. A
11. C	12. B	13. C	14. A	15. D
16. C	17. B	18. C	19. D	20. B
21. A	22. B	23. C	24. B	25. D
26. D	27. B	28. A	29. D	30. D
31. B	32. C	33. D	34. C	35. B
36. D	37. B	38. B	39. D	40. B

Paper 2

Question			Marking Point	Remarks
1	(a)	(i)	125/3125 ($\times 100$); 4%;	
		(ii)	excreted / urine / urea during excretion; undigested materials / faeces during egestion; in form of heat during respiration; movement during locomotion;	Max [2]
	(b)		less energy lost as shorter food chain; cheap(er) to feed herbivores;	
2	(a)		either active transport ; glucose molecules move against concentration gradient out of bag / uses energy / needs ATP;	
	(b)		small intestine lower water potential outside bag ; Accept ora water molecules moves / diffuses, out of bag ; by osmosis ; Visking tubing no difference in, water potential / concentration ; no (net), osmosis / diffusion of water ; Reject 'no diffusion'	Max [2]
	(c)	(i)	stomach ;	
		(ii)	small intestine / ileum / duodenum ;	
	(d)		for chemical digestion/ breakdown of (large / insoluble) food (molecules) / hydrolysis; solvent for dissolving, enzymes;	Max [2]

		softens food ; makes it easier to move food (in alimentary canal) / AW ;	
3	(a)	urea (concentration) decreases + urea molecules diffuse out of the bag ; water (content) increases / decreases ; salt (concentration), decreases ; ref to, glucose / sugar could be increase, decrease or stays the same; Must use phrases like passes out of blood' / 'passes into blood' / removed / taken out / diffuses in / diffuses out	Max [2]
	(b)	Visking tubing is partially/selective permeable therefore allows certain substance to pass through; dialysis fluid are replaced constantly to maintain a steep concentration gradient; Visking tubing are highly coiled to increase surface area (to volume ratio) + for faster rate of diffusion of urea out of blood; Countercurrent flow of dialysate and blood	Max [2]
	(c)	long term solution / person no longer needs (regular) dialysis; better / more efficient, control of composition of blood ; ref. to cost or economic benefit – to health service or to individual ;	Max [2]
	(d)	$I^A I^O \times I^B I^O$; $I^A, I^O + I^B, I^O$; $I^O I^O$, (blood group) O ; (allele) I^O recessive to I^A and I^B ; parents must both, have I^O / O / be heterozygous ;	Max [3]
	(e)	25% / 0.25 / $\frac{1}{4}$ / 1 in 4 ; Reject ratio e.g. 1:3	
4	(a)	Aorta;	
	(b)	Causes recoil / allows stretching; maintains blood pressure or to allow smoother / more constant blood pressure / prevents rupture (physical damage); (A) C B D;	
	(d)	B; Semi-lunar valve open; volume higher / pressure lower (than D);	
5	(a)	maternal V ;	

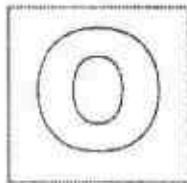
		fetal Y	
	(b)	<p>oxygen, from maternal / to fetal ; carbon dioxide, from fetal / to maternal ; named nutrients from maternal / to fetal ; water, either direction or both ; antibodies, from maternal / to fetal ; urea / nitrogenous waste, from fetal / to maternal ; passage of hormones, from maternal / to fetal / both directions;</p> <p>Must mention one of the following: reactants for respiration to release energy for other chemical processes; materials for synthesis of protoplasm;</p> <p>Use of phrases like: diffusion in correct context ; active transport in correct context ;</p>	
	(c)	<p>Carbon monoxide diffuse across placenta; Or Carbon Monoxide reacts with maternal's haemoglobin to form carboxyhemoglobin; React with fetal's haemoglobin to form carboxyhemoglobin; Reduce oxygen carrying capacity of maternal blood and fetal blood Less oxygen available for the fetal's cells respiration hence less energy released for cellular activity</p> <p>Carbon Monoxide reacts with maternal's haemoglobin to form carboxyhemoglobin;</p> <p>Nicotine causes vasoconstriction in maternal blood circulation; Reduce blood flow to placenta; Reduce diffusion of nutrient to fetal bloodstream;</p>	Max [3]
6	(a)	Decrease in temperature does not affect the rate of water loss	
	(b)	<p>Humidity of air; Light intensity of environment; Temperature of environment; Wind Velocity;</p>	Max [2]
	(c)	<p>Rate of water loss is constant meaning no decrease in stomata size; As both water and carbon dioxide are exchange through the stomatal aperture;</p>	

	(d)	Lower temperature reduce rate of photosynthesis/ accumulation of manufactured food reduce rate of photosynthesis; Decrease rate of photosynthesis reduce usage of carbon dioxide; Reduce diffusion gradient between plant and environment hence reduce intake of carbon dioxide;	
	(e)	Use for synthesis of Pollen/nectar; Convert to starch for storage; Incorporate nitrate to form amino acids and then converted to plant protein; Use for respiration;	
7	(a)	Scale occupy the entire graph area Histogram with no gaps Axes followed what is given in the table penalize for units Plot The bars must have equal width	
	(b)	Describe : The older the person, the slower the reaction time; Explain : neuron has shorter axons / dendrons / dendrites, resulting in slower transmission to the next neuron; Nerve cell degenerate, resulting in lesser neurones to respond to stimuli; Bigger synapses (resulting in increased neurotransmitter diffusion time);	Max [1] for explanation
	(c)	Touch / stimulus from finger stimulates nerve endings of sensory neurone to generate impulses; Impulses generated travel along sensory neurone; In the brain + impulses are transmitted across a synapse to the relay neurone; And across another synapse to the motor neurone; Motor neurone transmits the impulses to effector (neck muscles) to contract and head turns in the direction of the fingers;	Max [4]
8	(a)	Maintenance of internal environment of the cell such as blood plasma/tissue fluid; Within narrow limits/range;	
	(b)	Named example: thermoregulation/blood glucose regulation/ osmoregulation; When a stimulus causes the condition to be above/below the norm. The receptor senses the change and sends signals to the control centre;	

			which will set off corrective mechanisms that will have the opposite effects as the stimulus and restore the condition back to norm;	
	(c)		Clothing only reduce heat loss to environment; Blood directed to the vital internal organs; Vasoconstriction of arterioles in skin to reduce blood flow to skin; Reduce heat loss to environment; Less oxygen and nutrient to the skin cells; Respiration in cell cease/cell death;	
E				
9	(a)		92.9%;	
	(b)		state link between height and yield (using data from table) ; taller plants have more leaves ; more leaves, increases surface area to absorb light / have more chlorophyll or chloroplasts ; more leaves increases photosynthesis ; more photosynthesis / more leaves, leads to increased, food production / potatoes / yield ;	Max [3]
	(c)		nitrate used to make, amino acids / proteins ; ref to protein required for growth/synthesis of new protoplasm ; ref to enzymes;	Max [2]
	(d)		As a control to determine / compare, the effect of adding, chemicals / fertilisers / manure ;	
	(e)		fertiliser lost from land by leaching / run off (into waterways) ; leads to eutrophication / growth of algae / algal bloom ; leads to death / migration of fish / invertebrates / animals from their habitat ;	
O				
9	(a)	(i)	2.0 litre	
		(ii)	$74 - 37 = 37$ per breath	
	(b)		Rate of breathing increase Increase rate of oxygen diffuse into the blood stream Increase rate of respiration More energy release for muscle contraction Increase rate of carbon dioxide diffuse out of the alveoli Maintain pH of blood	Max [3]
	(c)		1. During exhalation/inhalation 2. Internal intercostal muscle contract/relax 3. External intercostal muscle relax/contract 4. Diaphragm contracts/relax 5. Rib cage original position/ upwards 6. Sternum original position/upwards	Max [5]

			7. Decrease/Increase in volume 8. Increase/Decrease in pressure	
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GAN ENG SENG SCHOOL
Preliminary 2 Examination 2017



CANDIDATE
NAME

CLASS

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INDEX
NUMBER

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BIOLOGY

Paper 1 Multiple Choice

5158/01

28 August 2017

1 hour

Sec 4 Express

Additional Materials: OTAS

Calculators are allowed in the examination

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, class and index number on the OTAS. Shade your index number on the OTAS.

There are forty questions in this paper. Answer **all** questions. For each question there are four possible answers A, B, C, and D.

Choose the one you consider correct and record your choice in **soft pencil** on the separate OTAS.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Read the instructions on the OTAS very carefully.

Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

Total Marks
40

This paper consists of 17 printed pages including the cover page

- 1 Which of the following shows the correct order of organelles when protein is synthesized and secreted from a cell?
- A Golgi body → endoplasmic reticulum → ribosome → nucleus
 B Nucleus → ribosome → Golgi body → vesicle
 C Ribosome → nucleus → endoplasmic reticulum → Golgi body
 D Vesicle → Golgi body → nucleus → ribosome
- 2 An animal cell was unable to undergo cell division. Which of the following structures could have been damaged or missing from the cell?
- A Cell plates and mitochondria
 B Chromatin and centrioles
 C Golgi apparatus and vacuoles
 D Nucleus and endoplasmic reticulum
- 3 The diagram shows four specialised cells.



Which feature is not common to all of these cells?

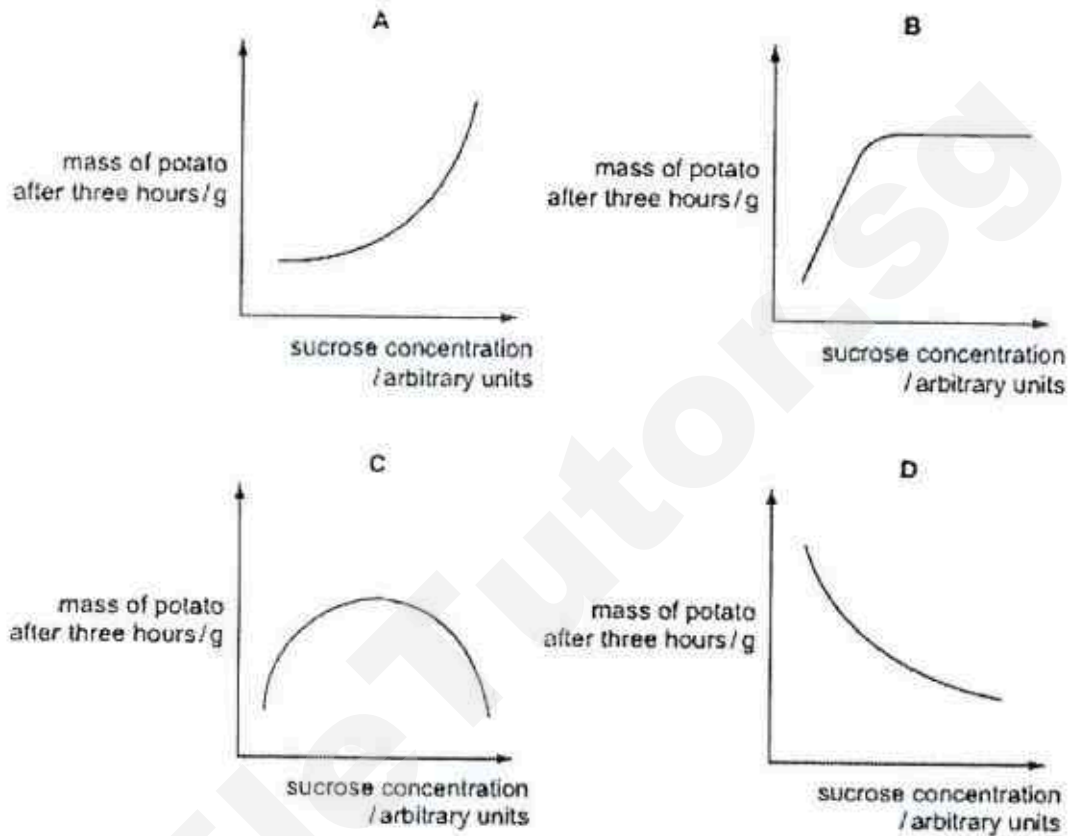
- A Cell membrane
 B Cytoplasm
 C Nucleus
 D Diploid chromosomes
- 4 A student carried out four test on biological molecules. The observations are shown in the table below.

Test	Observations
Benedict's test	Blue
Biuret	Purple
Ethanol emulsion	Clear
Iodine	Yellow

Which molecule is likely to be present in the solution?

- A $(C_6H_{10}O_5)_n$
 B $C_6H_{12}O_6$
 C $C_{29}H_{41}N_9O_{10}$
 D $CH_3(CH_2)_3COOH$

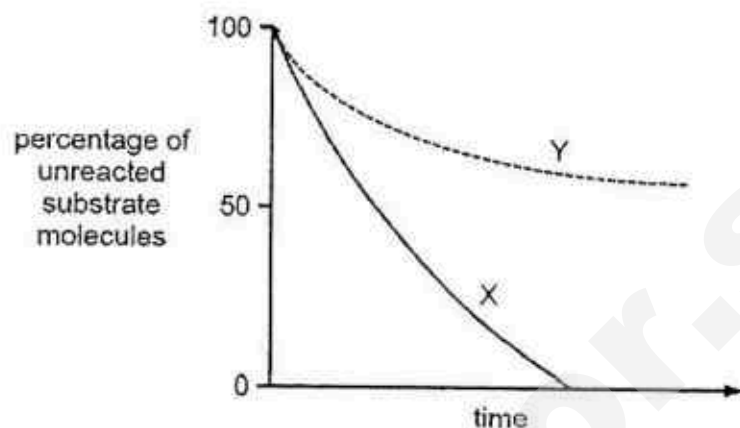
- 5 Identical pieces of potato are placed in sucrose solutions of different concentrations. After three hours, the mass of each potato piece is measured. Which graph shows the results of this experiment?



- 6 Food tests were carried out on glomerular filtrate, plasma and tissue fluid from a healthy person. Which of the following shows the correct results?

	Benedict's test			Biuret test		
	Filtrate	Plasma	Tissue fluid	Filtrate	Plasma	Tissue fluid
A	Red precipitate	Red precipitate	Red precipitate	Blue solution	Violet solution	Blue solution
B	Red precipitate	Red precipitate	Blue solution	Blue solution	Violet solution	Blue solution
C	Blue solution	Blue solution	Red precipitate	Violet solution	Violet solution	Blue solution
D	Blue solution	Red precipitate	Blue solution	Blue solution	Blue solution	Blue solution

- 7 Line X shows the entire course of a reaction catalysed by an enzyme under optimal conditions. The experiment was repeated with one variable change and the results are represented by Line Y. The diagram shows the results obtained at the end of the experiment



Which change in variable could give the results shown by line Y?

- A Decreased enzyme concentration B Decreased substrate concentration
C Increased enzyme concentration D Increase pH condition
- 8 The table shows the conditions set up in an experiment.

Tube 1	1 ml of oil	5 ml of lipase	0.05 g of bile salts	5 ml of pH 9 buffer
Tube 2	1 ml of oil	5 ml of water	0.05 g of bile salts	5 ml of pH 9 buffer
Tube 3	1 ml of oil	5 ml of lipase	-	5 ml of pH 9 buffer

Three drops of pH indicator was added to each test tube. The colour changes for the pH indicator are as follows.

pH 3	pH 5	pH 7	pH 9
Red	Pink	Orange	Yellow

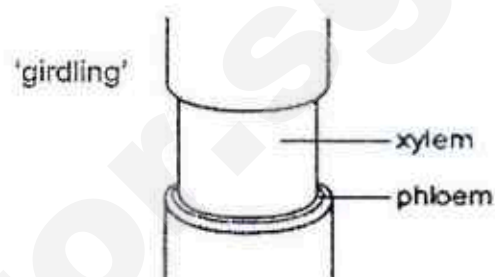
What colour would you expect to see in the test-tubes after 30 minutes?

	Tube 1	Tube 2	Tube 3
A	Red	Red	Yellow
B	Orange	Yellow	Pink
C	Pink	Yellow	Red
D	Red	Yellow	Pink

- 9 Which row correctly shows what happens in photosynthesis?

	Energy conversion	Immediate by-product	Storage product
A	Chemical to light energy	Glucose	Starch
B	Chemical to light energy	Starch	Glucose
C	Light to chemical energy	Glucose	Starch
D	Light to chemical energy	Starch	Glucose

- 10 Farmers commonly carry out 'girdling' to branches bearing fruit in order to maximise fruit yield. If there are multiple fruits growing on a branch, some are also removed so that only one fruit is allowed to grow on each branch. This practice produces bigger fruits for those allowed to grow.



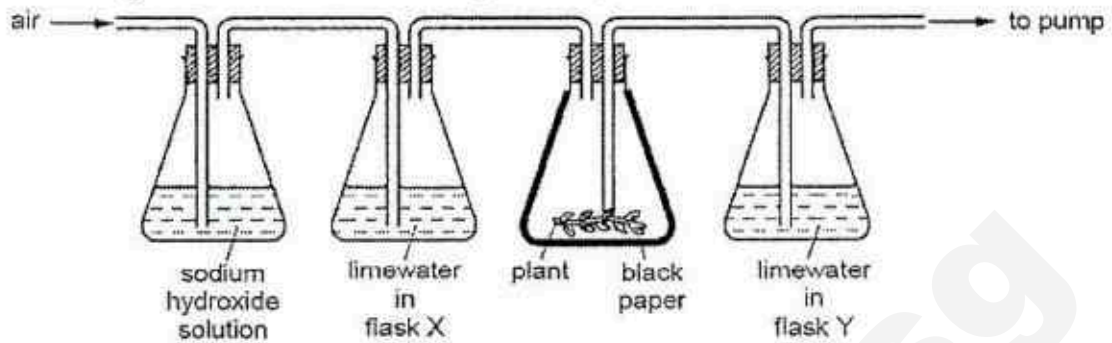
The diagram below shows a young branch. Which two fruits should be removed and where should 'girdling' be carried out to yield the biggest single fruit?



	Fruits to be removed	Region for girdling
A	X and Y	1
B	Y and Z	1
C	X and Y	2
D	Y and Z	2

- 11 The rat poison warfarin inhibits the synthesis of the plasma protein prothrombin in the liver. Which of the following statements best describes how warfarin will cause the death of the rats?
- A By causing the accumulation of amino acids in the blood.
- B By preventing the maintenance of the glucose content of the blood.
- C By slowing the clotting process after internal bleeding.
- D By stimulating the production of too many red blood cells.

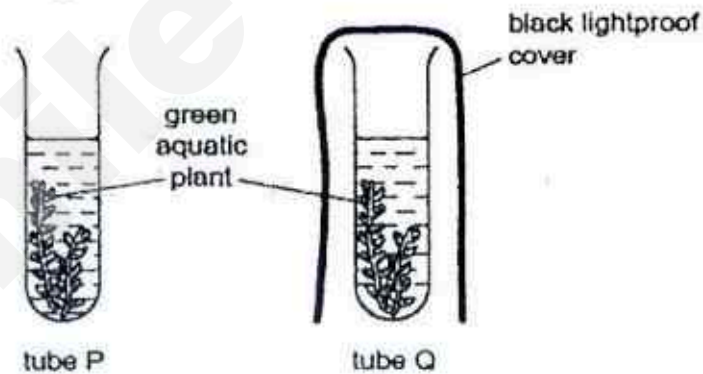
- 12 An investigation was carried out using the setup as shown.



What would happen to the limewater in flasks X and Y when the pump is switched on?

	Flask X	Flask Y
A	Clear	Cloudy
B	Clear	Clear
C	Cloudy	Clear
D	Cloudy	Cloudy

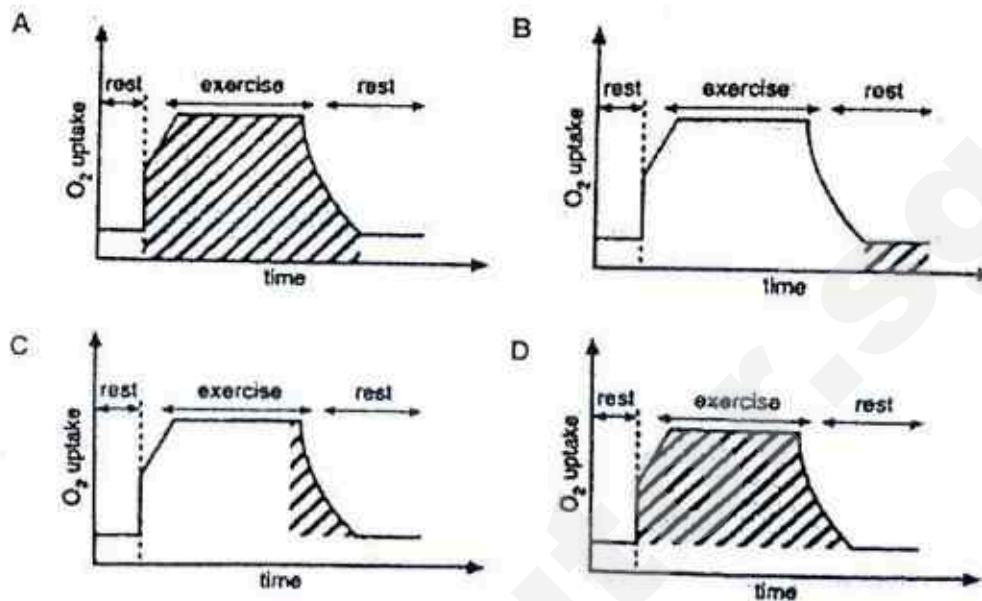
- 13 Two test-tubes, P and Q, were set up each containing a solution of red hydrogen carbonate indicator. An aquatic plant was placed into tubes P and Q. Tube P was uncovered, tube Q was covered with a black lightproof cover. The tubes were left in a warm room in sunlight for four hours.



What would be the colour of the hydrogen carbonate indicator in the two tubes after four hours?

	Tube P	Tube Q
A	Purple	Yellow
B	Purple	Red
C	Red	Yellow
D	Yellow	Red

- 14 The following graphs show oxygen consumption at rest and during exercise plotted against time. In which graph does the shaded portion show oxygen debt?



- 15 The table refers to blood vessels in the human body.

Vessel	Direction of blood flow		Oxygen content
	From	To	
Aorta	P	All organs except lungs	Oxygenated
Pulmonary vein	Lungs	Heart	Q
Hepatic artery	Aorta	R	Oxygenated
Hepatic portal vein	Alimentary canal	Liver	S

What are P, Q, R and S?

	P	Q	R	S
A	Left ventricle	Deoxygenated	Kidney	Deoxygenated
B	Left ventricle	Oxygenated	Liver	Deoxygenated
C	Right ventricle	Deoxygenated	Kidney	Oxygenated
D	Right ventricle	Oxygenated	Liver	Oxygenated

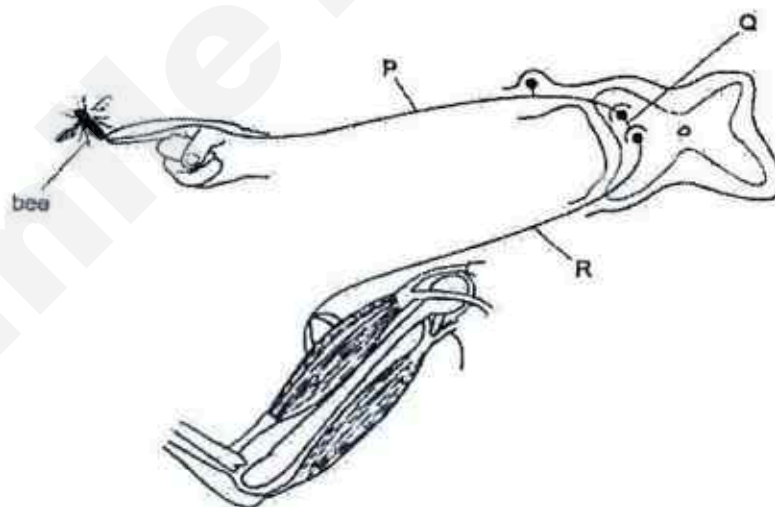
- 16 A man stands ten metres away from a signboard and can read it clearly. He then walks towards the sign and stops a metre from the signboard. What changes should occur in his eye so that the signboard is still in focus?

	Ciliary muscle	Suspensory ligaments	Lens thickness	Extent of refraction
A	Contract	Slacken	Increase	Increase
B	Contract	Tighten	Decrease	Decrease
C	Relax	Slacken	Decrease	Decrease
D	Relax	Tighten	Increase	Increase

- 17 Opticians often place drops of a chemical in a patient's eye. This chemical will cause muscles in the patient's eye to contract to keep the pupil wide open. What muscles are these?

- A Circular muscles in the iris
- B Longitudinal muscles in the iris
- C Radial muscles in the iris
- D Radial muscles in the pupil

- 18 The diagram shows a reflex arc in which a bee sting causes the arm to be moved quickly.



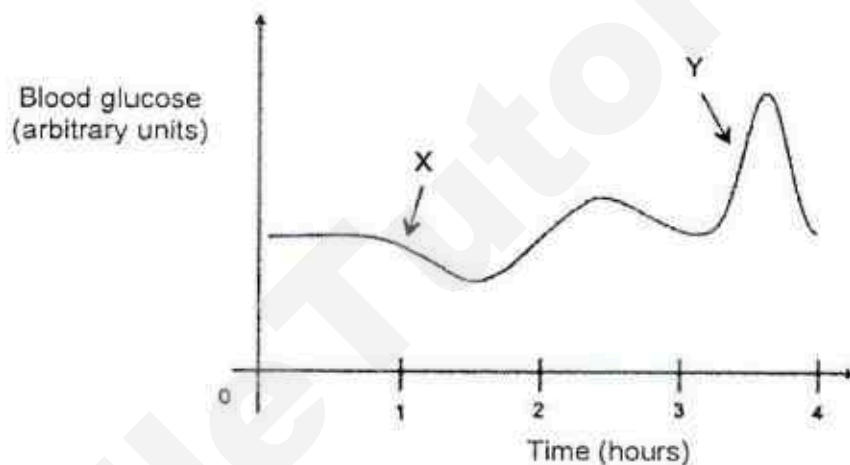
If the neurone at R is damaged, how will the transmission of nerve impulses in the reflex arc be affected?

	Pain felt	Movement of arm
A	No	No
B	No	Yes
C	Yes	No
D	Yes	Yes

- 19 Type 1 diabetic patients who are on rapid-acting insulin are advised not to wait more than 15 minutes to eat after taking an insulin injection. Which one of the following best explains why this is so?

A The liver and muscle cells will be stimulated by insulin to store fats.
 B Insulin is required for the proper absorption of nutrients from the diet.
 C The injection of insulin can lead to dangerously low blood glucose concentrations.
 D The injection of insulin will prevent the body from secreting the necessary amount of insulin to maintain the blood glucose level.

- 20 The graph below shows changes in a person's blood glucose concentration over a four-hour period.



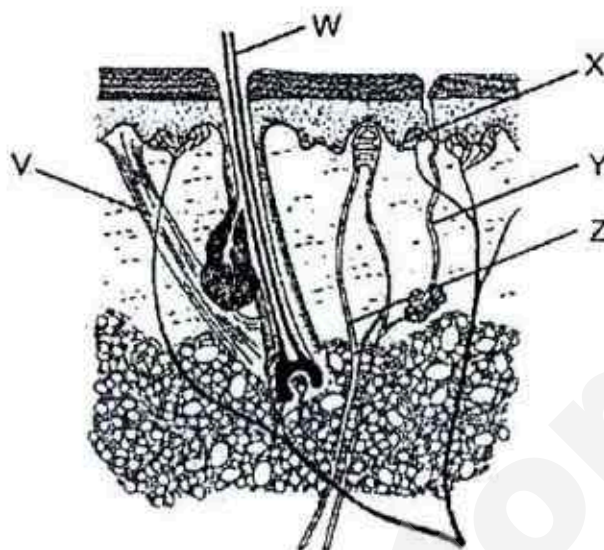
What of the following shows the correct causes for the changes at X and Y?

	X	Y
A	Decreased insulin	Increased adrenaline
B	Increased insulin	Decreased adrenaline
C	Increased insulin	Increased glucagon
D	Increased insulin	Increased adrenaline

- 21 Which process is not a result of negative feedback?

A Decrease in surrounding temperature leads to a decrease in respiration rate.
 B Decrease in the surrounding temperature leads to a decrease in sweating.
 C Decrease in the surrounding temperature leads to shivering.
 D Decrease in the surrounding temperature leads to a decrease in blood flow through the skin surface.

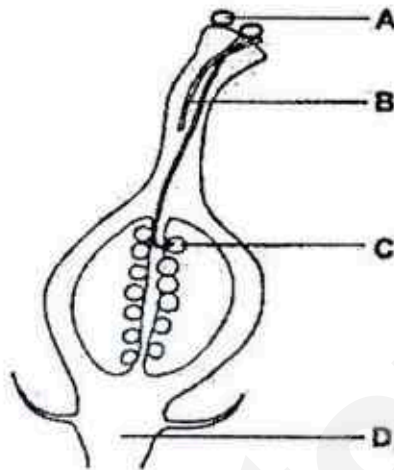
- 22 The diagram shows the internal structures of the human skin. Which would occur in the skin if the person moves from an air-conditioned room to a sunny beach?



- A Contraction of V and Z
 B Increased flow of fluid in Y and relaxation of V
 C Detection of temperature change by W and relaxation of Z
 D Detection of temperature change by X and decreased flow of fluid in Y
- 23 Which of the following shows the functions of the relay, motor and sensory neurone in a reflex response?

	Relay neurone	Motor neurone	Sensory neurone
A	Connect neurones within central nervous system	Conduct impulses from central nervous system to effector	Conduct impulses from receptor to central nervous system
B	Conduct impulse to effector	Connect neurones within central nervous system	Receive the stimulus
C	Conduct impulses from central nervous system to effector	Conduct impulses from receptor to central nervous system	Connect neurones within central nervous system
D	Conduct impulses from receptor to central nervous system	Conduct impulses from receptor to central nervous system	Conduct impulse to effector

- 24 New plants may be grown from groups of cells that are taken from other plants. The diagram shows part of plant X. From which structure will cell samples grow into new plants that are genetically identical to plant X?

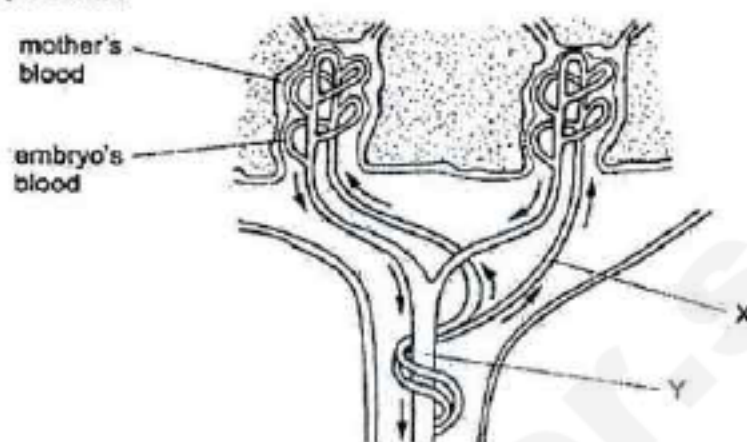


- 25 Flowering plants use different methods to ensure that their flowers are pollinated successfully. Some of these methods are listed.
- I Plant 1 has flowers in which the female parts ripen before the male parts.
 - II Plant 2 has separate male and female flowers.
 - III Plant 3 has separate male and female plants.
 - IV Plant 4 has flowers in which the male parts ripen before the female parts.
 - V Plant 5 has flowers in which the male and female parts ripen at the same time.

Which method(s) make it more likely that cross-pollination will take place?

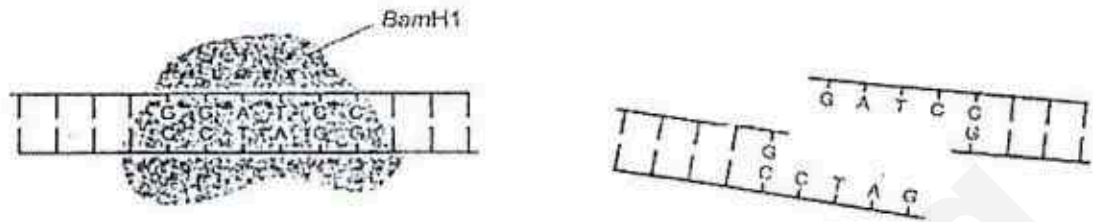
- | | |
|--------------------------|-----------------|
| A I, II, III and IV only | B I and IV only |
| C II and III only | D V only |
- 26 Which statement correctly describes advantages or disadvantages of self-pollination to a plant?
- A It needs a lot of pollen but can happen when a plant is on its own.
 - B It needs little pollen and there is a high chance of pollination.
 - C It needs no agent to transfer pollen but pollination is unlikely.
 - D It needs two plants of the same species but there is little variation in the offspring.

- 27 The diagram shows how the blood of a human embryo flows close to the mother's blood in the placenta.

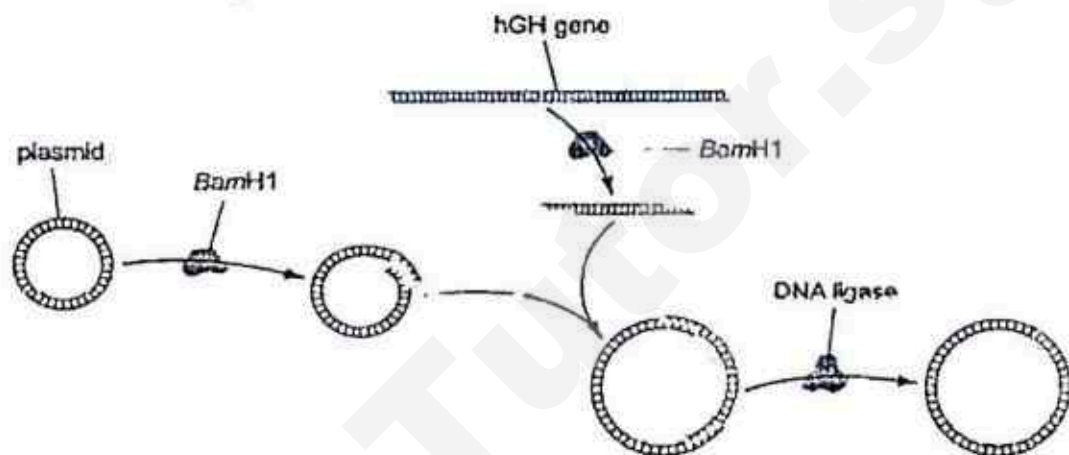


- Which substances are present at X in higher concentrations than at Y?
- | | |
|------------------------------|---------------------------|
| A Carbon dioxide and glucose | B Carbon dioxide and urea |
| C Glucose and oxygen | D Glucose and urea |
- 28 Which of the following statements is incorrect?
- Self-pollination is part of sexual reproduction in plants.
 - Humans are incapable of carrying out asexual reproduction.
 - Male gametes of plants and humans are able to move towards ovum.
 - The male gametes of plants and humans are produced in greater quantities as compared to female gametes.
- 29 Two polynucleotide strands make up a DNA molecule. Which of the following descriptions is correct?
- The percentage of cytosine is 50% of that of guanine in the whole molecule.
 - The percentage of cytosine is the same in each strand of the molecule.
 - The percentage of cytosine is the same as that of guanine in each strand.
 - The percentage of cytosine is the same as that of guanine in the whole molecule.
- 30 DNA from a mammal and a reptile was analysed. Both had the same proportion of the different types of nucleotides. Which best explains why both animals differ in their physical characteristics?
- The amino acids used to make proteins are different in both organisms.
 - The chromosome number of both organisms is different.
 - The total number of nucleotides in both organisms is different.
 - The sequence of DNA is different in both organisms.

- 31 *Bam*H1 is a restriction enzyme that cuts DNA as shown in the diagram.



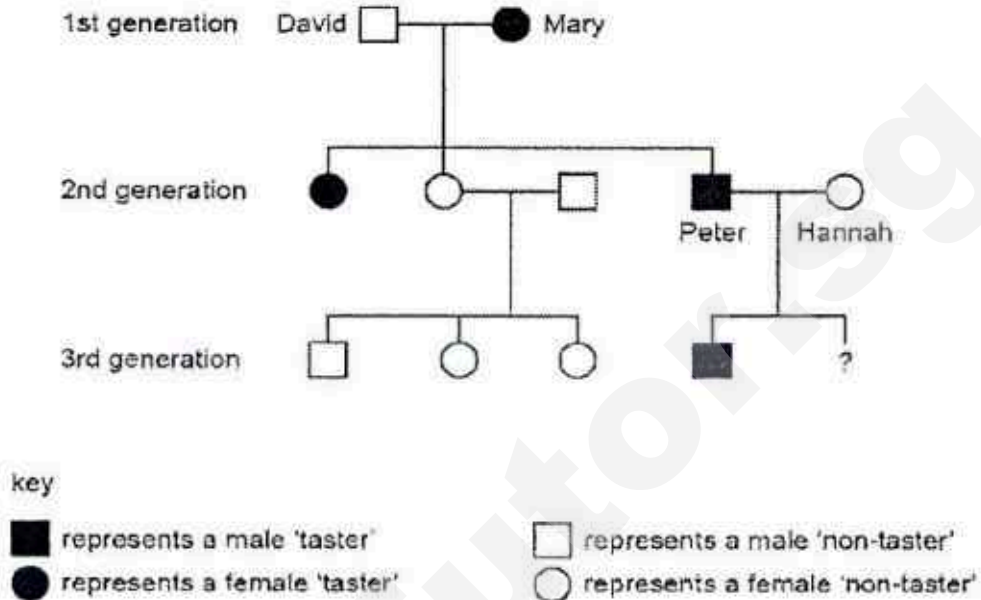
The diagram below shows part of the procedure for producing bacteria that will synthesise human growth hormone hGH.



At the end of this process, many plasmids do not contain the hGH gene. What could explain this?

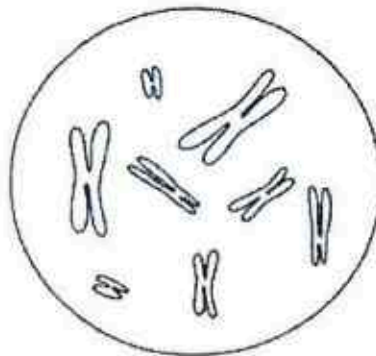
- A Different alleles of the hGH gene have different sticky ends.
 - B Not all of the plasmids cut by *Bam*H1 have sticky ends.
 - C Some of the plasmids are cut at more than one position.
 - D The sticky ends of some of the plasmids rejoin with each other.
- 32 Some fruit flies have orange eyes and others have red eyes. If two orange-eyed fruit flies are crossed, their offspring always have orange eyes. If two red-eyed fruit flies are crossed, their offspring sometimes include both orange-eyed and red-eyed flies. What may be concluded about the alleles from these observations?
- A Allele for red eyes is dominant.
 - B Allele for orange eyes is dominant.
 - C Both alleles are co-dominant.
 - D It is not possible to conclude which allele is dominant.

- 33 The family tree shows the inheritance of the ability to taste a certain substance. The allele for the ability to taste this substance is dominant to the allele for the inability to taste it.



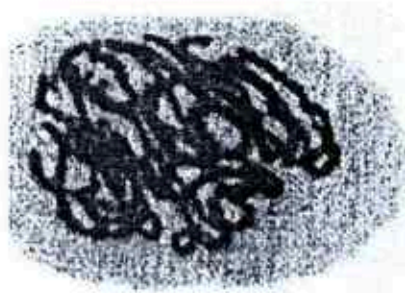
What is the chance of the second child of Peter and Hannah being a 'non-taster'?

- A 100% B 50% C 67% D 25%
- 34 The diagram shows a cell nucleus in prophase of mitosis. Which statement describes the chromosomes found in each daughter nucleus immediately following cell division of this cell by mitosis?



- A 4 chromosomes, each containing 2 chromatids
 B 4 chromosomes, each consisting of 4 chromatids
 C 8 chromosomes, each containing 1 molecule of DNA
 D 8 chromosomes, each consisting of 2 molecules of DNA

- 35 The diagram shows a stage of mitosis.



For the next stage in this nuclear division, what would be correct?

	Paired chromosomes	Nuclear membrane	Spindle fibres
A	Present	Breaking down	Present
B	Absent	Absent	Present
C	Present	Absent	Present
D	Absent	Reforming	Absent

- 36 Induced chromosome mutations produced a fertile hybrid species from cabbage and radish. The table shows the chromosome numbers in the parental species and the hybrids.

Type of cell	Number of chromosomes per cell
Parental cabbage	18
Parental radish	18
Parental gametes	9
F ₁ hybrids	18
F ₁ gametes	18
F ₂ hybrids	36
F ₂ gametes	18
F ₃ hybrids	36

At which stage did chromosome mutation occur?

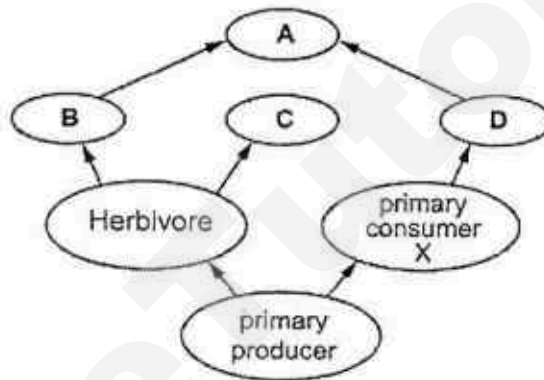
- A During fusion of F₁ gametes.
- B During formation of F₁ gametes.
- C During formation of F₂ gametes.
- D During fusion of parental gametes.

- 37 A farmer is growing wheat in a field. The farmer uses insecticides to kill insect pests and chemicals to kill weeds in the field. Which statements about this field are correct?

- I Both the wheat and the weeds are producers.
- II Insects feed at the first trophic level.
- III Weeds may use light, water and mineral ions that the wheat plants need.

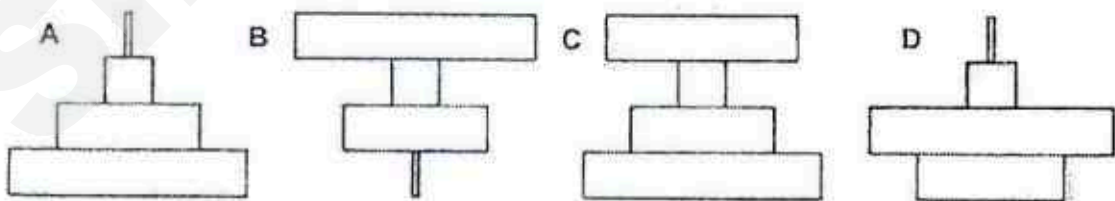
- A I and II only B I and III only
C II and III only D I, II and III only

- 38 A primary consumer, X, is lost from a community due to a lethal viral infection. After a time, the size of the populations of some of the organisms shown in the food web changed. Which population of organisms increased?

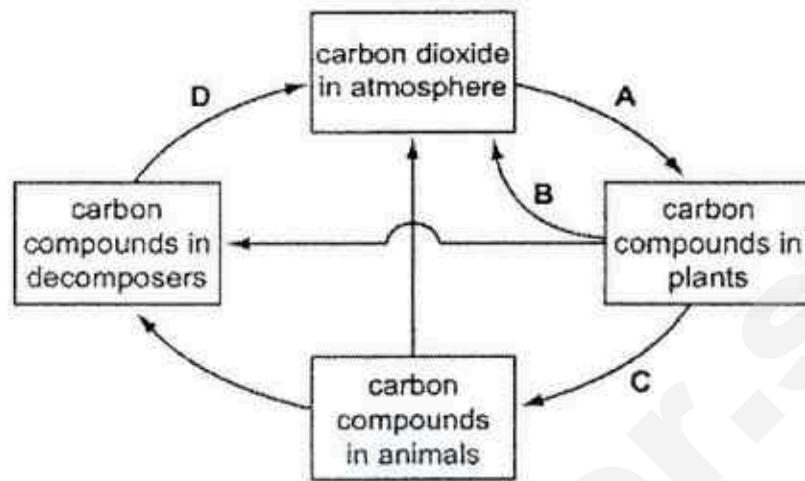


- 39 Which diagram best represents the following food chain as a pyramid of numbers?

grass → gazelle (antelope) → lion → flea



40 The diagram shows part of the carbon cycle.

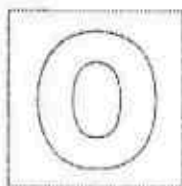


Which process causes the largest amount of carbon to be converted?

END OF PAPER

Gan Eng Seng Secondary School

1	B	11	C	21	A	31	D
2	B	12	A	22	B	32	A
3	D	13	A	23	A	33	B
4	C	14	C	24	D	34	C
5	D	15	B	25	A	35	B
6	A	16	A	26	B	36	B
7	D	17	C	27	B	37	B
8	D	18	C	28	C	38	C
9	C	19	C	29	D	39	C
10	B	20	D	30	D	40	A



GAN ENG SENG SCHOOL
Preliminary 2 Examination 2017



CANDIDATE
NAME

CLASS

INDEX
NUMBER

BIOLOGY

Paper 2

5158/02

22 August 2017
1 hour 45 minutes

Sec 4 Express

Candidates answer on the Question Paper.

Calculators are allowed in the examination

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name on the cover page.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid/tape.

Section A

Answer all questions.

Write your answers in the spaces provided on the Question Paper.

Section B

Answer three questions. Write your answers in the spaces provided on the Question Paper.
Question 9 is in the form of Either/Or question. Only one part should be answered.

The use of an approved scientific calculator is expected, where appropriate.

* You are advised to spend no longer than one hour on Section A and no longer than 45 minutes on Section B.

The number of marks is given in brackets [] at the end of each question or part question.

For Examiner's Use	
Section A	
Section B	
7	
8	
9 Either/Or	
Total	80

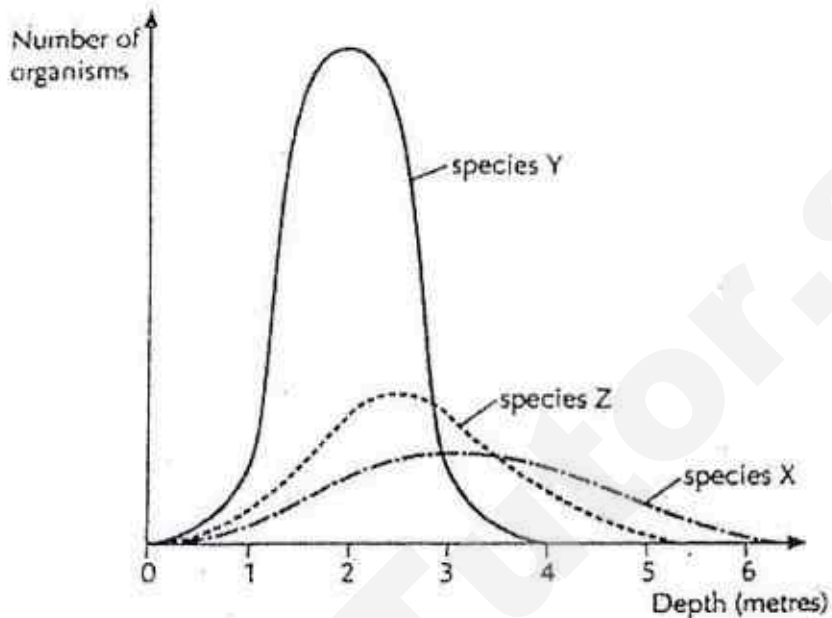
This paper consists of 17 printed pages including the cover page

SECTION A (50 Marks)

Answer all the questions in this section.

1

The figure shows the distribution of three different types of organisms at different depths of a river where they form a food chain.



- (a) State the species that has the widest vertical distribution. [1]

- (b) Explain which of the three species would likely be the producer. [2]

- (c) Explain in which species would the pesticide levels be the highest, if run-offs into the river contained pesticides. [1]

- (d) Explain why any given food chain rarely contains more than five trophic levels. [2]

- 2 (a) (i) A man of blood group A is married to a woman of blood group B. Construct a genetic diagram to show how it was possible for the couple to have a child with blood group O. [4]

- (ii) Calculate the probability of their first child being a girl with blood group A. Show your working. [1]

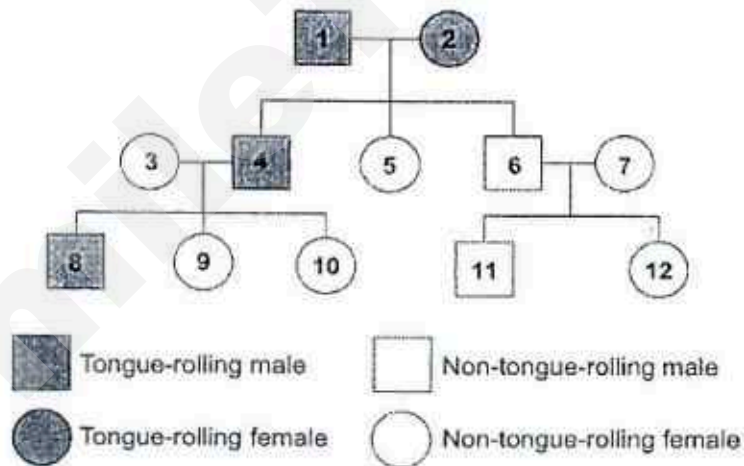
- (iii) The couple had four children and all had the same blood type. Explain why the observed ratio differs from the expected ratio. [2]

- (b) The table shows the percentage frequency of blood groups in two populations.

Population	Frequency as a percentage of the population/ %			
	Group A	Group B	Group O	Group AB
1	38	0	62	0
2	27	32	21	20

Using only the information given, suggest how it was possible for the lack of blood group AB in Population 1. [2]

- (c) The figure shows the inheritance ability of tongue-rolling in a family across three generations.



- (i) Based on the figure, what conclusion can be drawn regarding the ability of tongue-rolling and the allele that causes it? [1]

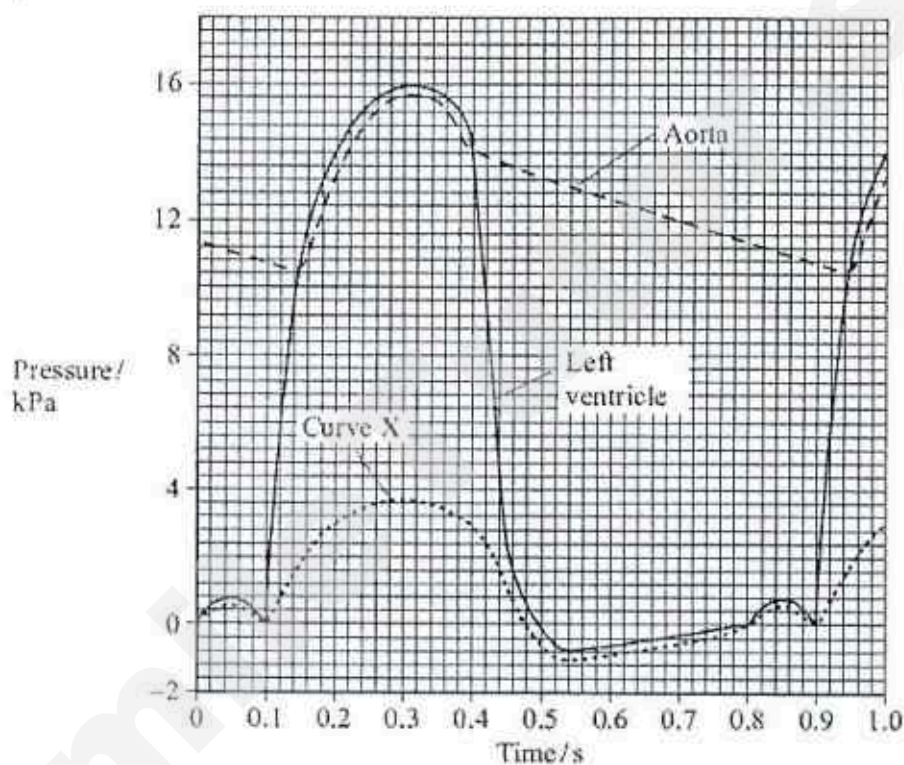
- (ii) State the type of variation exhibited by the ability of tongue-rolling. [1]

(iii) State and explain the genotype of Individual 8.

[2]

3

The graph shows changes in pressure in different parts of the heart during a period of one second.



(a) State the time interval at which the semi-lunar valves were closed.

[1]

(b) Calculate the heart rate in beats per minute. Show your working.

[1]

(c) Calculate the total time that blood flows out of the left side of the heart during one minute when beating at the rate calculated in (b). Show your working.

[1]

- (d) Suggest which part of the heart does X represent. Explain your answer. [2]

The volume of blood pumped out of the left ventricle during one cardiac cycle is known as the stroke volume. The volume of blood pumped out of the left ventricle in one minute is known as the cardiac output, which is calculated using the given equation:

$$\text{Cardiac output} = \text{stroke volume} \times \text{heart rate}$$

- (e) After several months of training, an athlete had the same cardiac output but a lower resting heart rate than before. Explain this change. [2]

- (f) Explain how the difference in the pressure of the blood in the pulmonary artery and in the aorta is related to the structure of the ventricles and where the blood is going. [3]

- 4 *Rigor mortis* is the gradual stiffening of the muscles in the body after death. In a dead animal, muscle cells may continue to contract involuntarily due the passive movement of calcium ions into the cytoplasm of the cells.

However, as breathing and circulation has stopped, muscle cells are unable to respire normally and release enough energy for the relaxation of muscles. As such, the muscles remain in a contracted state resulting in the post-mortem stiffening of muscles known as *rigor mortis*. Nonetheless, before cell death, the muscle cells continue to respire and produce acidic substances, which slowly cause the fusion of proteins in the muscle cells, resulting in the formation of compounds that increases rigidity of the muscles until decomposition begins.

- (a) State the process by which calcium ion enters the cytoplasm of muscle cells. [1]

.....

- (b) Differentiate the terms breathing and respiration. [2]

.....

.....

.....

- (c) Using proper biological terms, explain what did the author mean by "muscle cells are unable respire normally". [1]

.....

- (d) During vigorous exercise, the same acidic substances are produced. State the word equation for one reaction that produces such acidic substances. [1]

.....

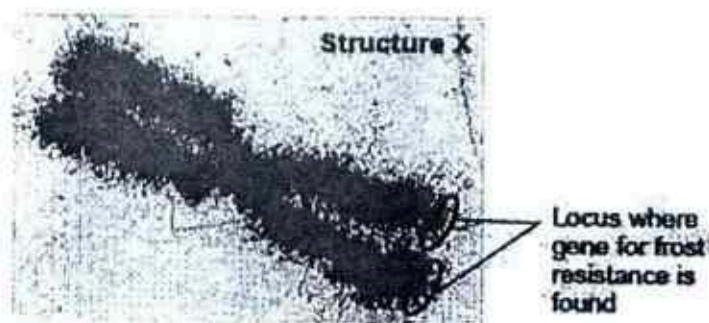
- (e) Explain why this acidic substance does not cause a similar stiffening of muscles, like in *rigor mortis*, after vigorous exercise. [2]

.....

.....

.....

5. Structure X is found in the nucleus of a dividing strawberry plant cell.



- (a) Outline the relationship between DNA, genes and Structure X.

[3]

The following excerpt was reported in a news article.

DNA is found in all living things. Contrary to the mad scientist image of an evil genius stitching animal parts together and creating a monster, genetic engineering is a precise science. It makes use of special biochemical scissors and glue, which allows scientists to cut and paste specific genes from one living thing to another. The newly introduced DNA brings a new characteristic to the resultant organism. But when genetically modified food is eaten, it is simply digested like any regular food.

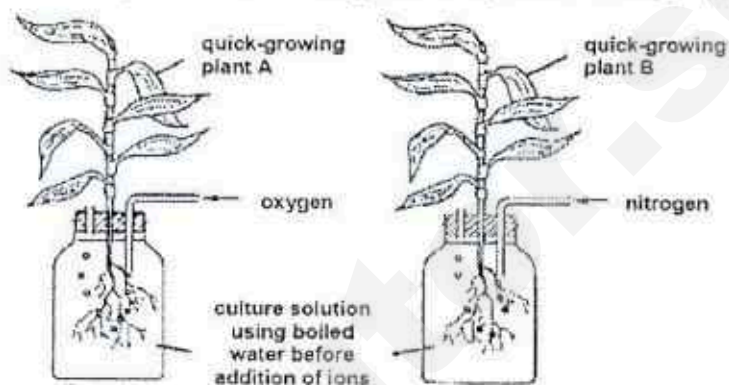
- (b) A gene for frost resistance was "cut" from the arctic flounder, a fish that lives in very cold water, and "pasted" into the DNA from the strawberry plant. With reference to Structure X in the above figure, identify the "scissors and glue" and briefly describe how they are used to carry out this genetic engineering procedure. [3]

- (c) Explain how a gene brings about a characteristic to the organism.

[2]

- (d) Some religious groups are against genetic engineering as it is seen as "playing God". Suggest another reason why members of the public may be against the creation of genetically modified food. [1]

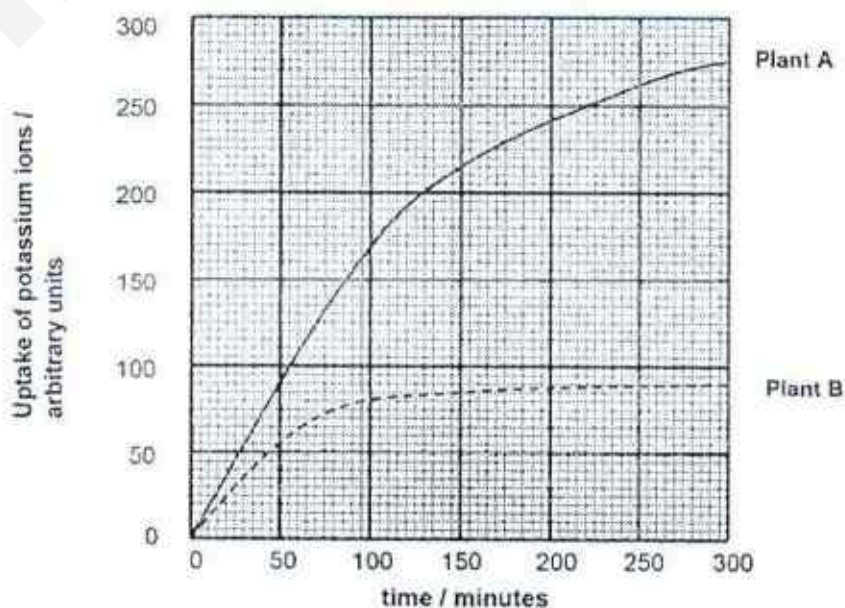
6 The figure shows an experiment to investigate the uptake of ions by a plant.



The culture solutions contained measured quantities of all the ions necessary for plant growth which had been boiled to remove dissolved gases.

- (a) Identify the process, characteristics of all plant cells, which the roots of Plant B will not be able to carry out. [1]

Using the radioactive form of an ion, the rate at which it is absorbed from the culture solutions can be measured. The graph shows the rate of uptake of one particular ion from the two solutions in the above figure.



- (b) Calculate the difference in uptake of the ion between the two plants after 2.5 hours. Show your working. [1]

- (c) Describe and explain the difference in the uptake between the two plants. [3]

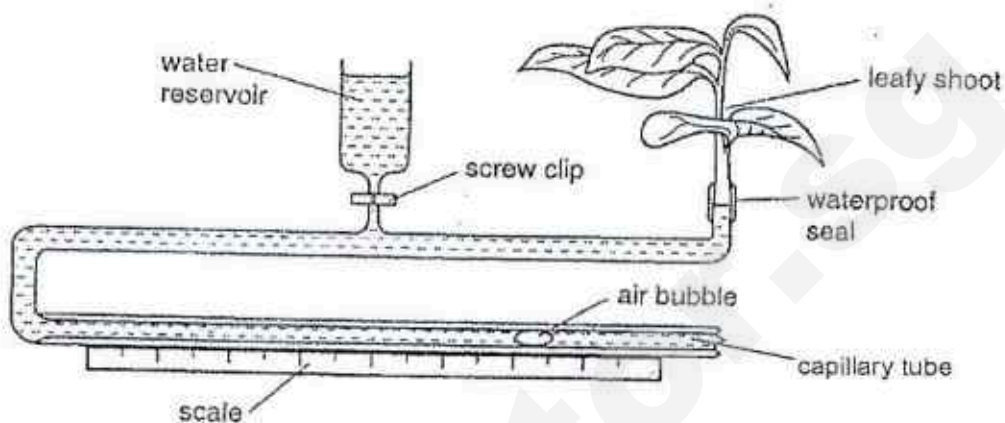
END OF SECTION A

Section B (30 Marks)

Answer three questions in this section.Question 9 is in the form of an either/or question. Only one part should be answered.

7

The apparatus shown below was used to measure the rate of transpiration in a leafy shoot.



The time taken for the air bubble to move a distance of 5 cm, under different light intensities in the capillary tube is recorded in the table below.

Light Intensity (arbitrary units)	Time (s)	Rate of movement of air bubble (cm per second)
5	50.2	0.10
10	16.7	0.30
20	10.6	0.47
25	8.2	
30	7.5	0.67
35	7.0	0.71

(a) Define transpiration.

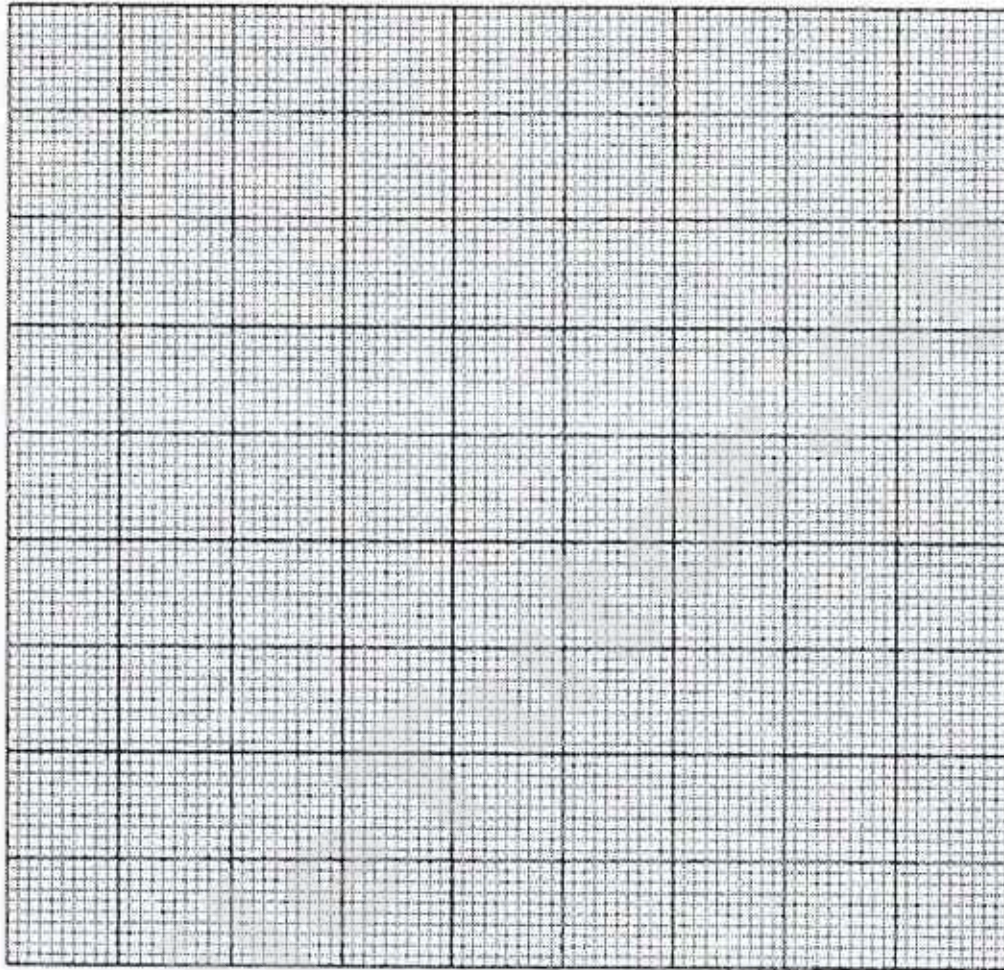
[1]

(b) Complete the table by calculating the rate of movement of the air bubble when light intensity is at 25 arbitrary units.

[1]

- (c) Plot the data on the graph.

[4]

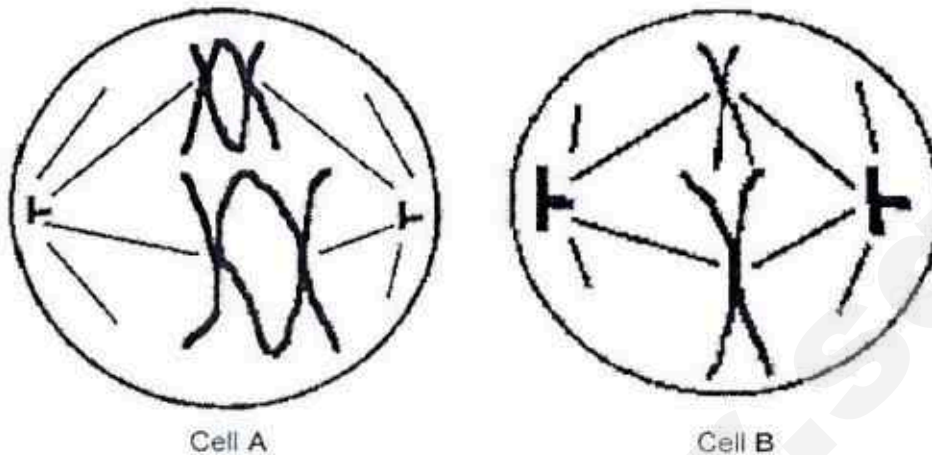


- (d) From the graph, find the transpiration rate at light intensity of 18 arbitrary units. [1]

- (e) Using your graph, describe and explain the effect of light on the transpiration rate of the shoot. [3]

8

The figure shows two cells extracted from different parts of the same plant.



- (a) Identify the respective stages of cell division cells A and B are undergoing. [2]

Cell A _____

Cell B _____

- (b) With reference to the diagram, state one difference between the stages that cells A and B are in. [1]

- (c) Describe the process that has taken place between the chromosomes prior to the stage in cell A. Explain how this process contributed towards variation in the organism. [2]

- (d) A student viewed a large number of cells from an onion root tip under the microscope and recorded the number of cells in each stage of mitosis.

Stage of mitosis	Number of cells in stage
Interphase	176
Prophase	20
Metaphase	12
Anaphase	6
Telophase	7

- (i) Calculate the percentage of cells that were observed in telophase. [1]

- (ii) State one conclusion that can be drawn from the student's results about the relative time spent by an onion root tip cell in each stage of mitosis. [1]

- (iii) The student then viewed cells from a different part of the onion root. Suggest a reason why all of the nuclei seen in this part of the root were in Interphase. [1]

- (e) Explain the importance of meiosis in the reproduction process. [2]

9 Either

- (a) Describe the difference between the terms excretion and egestion with reference to **named** substance(s). [3]

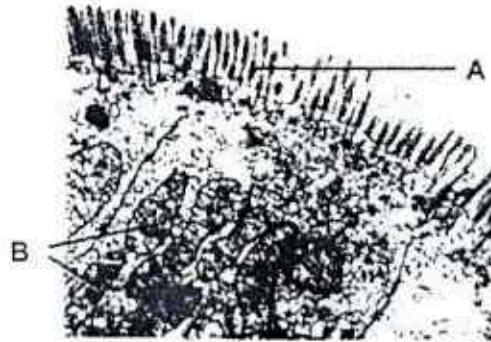
- (b) A person exercised vigorously on a hot day without drinking any water. Explain [5]
how his body would regulate the water potential of his body fluids under such conditions.

- (c) The kidneys filter about 180 litres of fluid every day. Only 1.5 litres of fluid are excreted in urine. Suggest which organ would result in a higher volume of urine being formed if that organ fails to function normally. Give a reason for your answer. [2]

9 Or

- (a) With a named example of an enzyme, substrate and product, explain how the effect of temperature affects the rate of enzymatic reaction. [6]

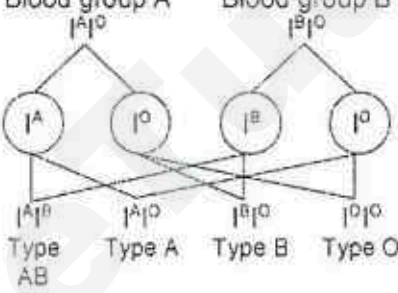
- (b) The figure shows the structure of the epithelium lining of the small intestine.



Structures A and B assist in the absorption of the products of protein digestion. [4]
Identify both structures and explain how they do so.

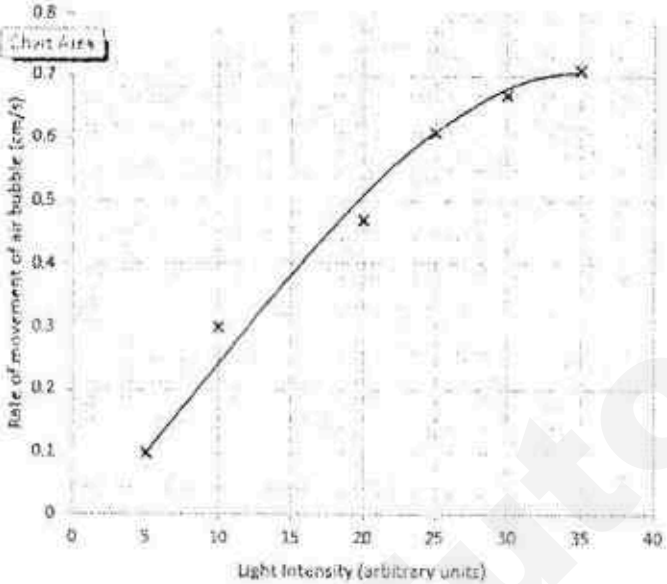
END OF PAPER

Answers for Secondary 4 Express Biology Prelim 2 P2 2017

1	<p>(a) Species X; [1]</p> <p>(b) Species Y as it has the <u>largest numbers</u> of organisms, hence have <u>large biomass</u> to support higher trophic levels; Also found <u>near the surface of the water</u>, allowing it to get <u>sunlight for photosynthesis</u>; [2]</p> <p>(c) Species X as it is likely the <u>top predator</u>, and bioamplification occurs across the trophic levels; [1]</p> <p>(d) Most of the available energy (90%) is lost at each trophic level, largely in the form of heat during respiration; There is <u>insufficient energy</u> left at the top of the food chain to support another level of organisms; [2]</p>		Total: 6 marks
2	<p>(a) Parental phenotype Blood group A Parental genotype Blood group B</p> <p>Gametes</p> <p>Offspring genotype</p> <p>Offspring phenotype</p>  <p>i. Parental genotype; Gametes; Offspring genotype; Offspring phenotype;</p> <p>ii. $\frac{1}{2} \times \frac{1}{4} = \frac{1}{8}$; [1]</p> <p>iii. The expected ratio shows the probability of each phenotype. However, the offspring's phenotype is independent of each other and not affected by another offspring; Observed ratios do not follow expected ratios for small populations (phenotypic ratio only approaches expected ratio for large populations); [2]</p> <p>(b) Blood group AB requires allele I^A from blood group A and allele I^B from blood group B; However, there is no one in population 1 with blood group B (or AB), indicating absence of allele I^B; [2]</p> <p>OR Both blood group AB and B need allele I^B allele to be present in individual genotype;</p>		

	Since both groups are absent, I^B allele is absent from population;		
(c)	i. The allele that causes the ability to tongue-roll is dominant;	[1]	Total: 13 marks
	ii. Discontinuous variation;	[1]	
	iii. Individual 8 is of a heterozygous genotype of Rr; He would have inherited one of the recessive alleles from parent 3 and one dominant allele (tongue-rolling) from parent 4, thus giving him a heterozygous genotype;	[2]	
3	(a) 0.4 to 0.95s (or 0.94s) OR 0 to 0.14s <u>and</u> 0.4 to 0.8s	[1]	Total: 10 marks
	(b) $60 / 0.8 = 75$;	[1]	
	(c) $0.26 \times 75 = 19.5s$; OR $0.25 \times 75 = 18.75 s$; (Depending on answer in (a))	[1]	
	(d) Right ventricle; <u>Similar pattern</u> for left ventricle but <u>lower pressure</u> ; (because of thinner muscles in right ventricle, hence contract with lesser force and generates lesser pressure)	[2]	
	(e) Increase in volume of ventricle OR increase in strength of heart muscles; More blood leaves heart in each contraction OR increase in stroke volume;	[2]	
	(f) Left ventricle <u>thicker wall</u> than right ventricle, hence blood pumped with higher pressure; Pulmonary artery has lower pressure than aorta as blood is only <u>transported to lungs</u> at a shorter distance away; While blood in aorta is <u>transported to all parts of the body</u> ;	[3]	
4	(a) Diffusion;	[1]	
	(b) Breathing is a mechanical process while respiration is a (bio)chemical reaction; Breathing functions to transport air in and out of the lungs to facilitate gaseous exchange while respiration functions to release energy from glucose;	[2]	
	(c) Muscle cells are unable to respire aerobically in the absence of oxygen;	[1]	
	(d) Glucose \rightarrow lactic acid + small amount of energy;	[1]	

	<p>(e) Lactic acid that is produced is transported away from the muscles to liver; (Lactic acid diffuses out of the muscle cells into the blood stream down the concentration gradient and the blood stream removes lactic acid continuously to maintain steep concentration gradient) where it is <u>oxidized to release energy or converted to glucose</u> for future use, reducing concentration;</p>	[2]	Total: 7 marks
5	<p>(a) A DNA coils and condenses into a compact structure known as chromosome which is structure X; Gene is a <u>short segment of DNA</u> on the chromosome; Which <u>codes for the formation of a single polypeptide</u>;</p> <p>(b) The same scissors, a restriction enzyme, is used to cut the gene of interest from the chromosome of the fish and plant; This generates <u>complementary sticky ends</u> and the fragments are mixed together; The glue, DNA ligase, is then used to ligate the frost resistance gene to the DNA from the strawberry plant;</p> <p>(c) Gene contains information for the formation of a polypeptide which forms a protein; Presence of a protein is responsible for the phenotype in the organism;</p> <p>(d) Allergic reaction to the protein / crop plants may be sterile, resulting in financial strain on farmers as they have to buy the seeds from the company every year / presence of pesticide resistance gene which can result in the formation of super weeds if they crossbreed;</p>	<p>[3]</p> <p>[3]</p> <p>[2]</p> <p>[1]</p>	Total: 9 marks
6	<p>(a) Aerobic respiration; (A: Active transport)</p> <p>(b) $215 - 85 = 130$ arbitrary units;</p> <p>(c) Speed of absorption by A is twice as fast as B; Plant A can absorb by both diffusion and active transport; Presence of oxygen, aerobic respiration can occur to release energy to transport ions against concentration gradient;</p>	<p>[1]</p> <p>[1]</p> <p>[3]</p>	Total: 5 marks

7	<p>(a) The loss of water vapour from the aerial parts of the plant, especially through the stomata of the leaves; [1]</p> <p>(b) $5/8.2 = 0.61$; [1]</p> <p>(c)  [4]</p> <p>Correct scale; Correct axes with units; Points correctly plotted; Line of best fit;</p> <p>(d) Reading based on student graph; ~ 0.47 cm/s [1]</p> <p>(e) As the light intensity increases, the rate of transpiration increases; [3] As light intensity increase, stomata size increases due to increase in rate of photosynthesis; Hence, as stomata opens for diffusion of carbon dioxide into the leaves, water vapour will escape through the stomata, increasing rate of transpiration;</p>	<p>Total: 10 marks</p>
8	<p>(a) A – Metaphase I; B – Metaphase II; [2]</p> <p>(b) For A, homologous chromosomes are aligned at equator while for B, chromosomes are aligned; [1]</p> <p>(c) Crossing over between homologous chromosomes during Prophase I; Produces new combinations of genes / Forms different gametes, resulting in variation; [2]</p>	

(d)	<p>i. $7/221 \times 100\% = 3.2\%$;</p> <p>ii. Most of the time is spent on interphase / Little time spent in nuclear division stage, comprising of mitosis and cytokinesis;</p> <p>iii. Cells in this region could be matured (differentiated) which no longer undergo cell division;</p>	<p>[1]</p> <p>[1]</p> <p>[1]</p>	Total: 10 marks
(e)	Production of haploid gametes; Allow for diploid number in zygote to be restored during fertilisation;	[2]	
9E (a)	<p>Any appropriate examples given (urea or carbon dioxide removal); Excretion is the removal of metabolic waste products; While egestion is the removal of undigested food;</p>	[3]	Total: 10 marks
(b)	<p><u>Water potential</u> of blood becomes lower than normal; <u>Hypothalamus</u> detects low water potential in blood and stimulates pituitary gland to secrete <u>more anti-diuretic hormone</u> (ADH); More ADH reaching kidney tubules <u>increases permeability</u> of the tubules; And causes <u>more water to be reabsorbed</u> back into bloodstream; Water potential in blood plasma increases and less water excreted in urine and urine becomes more concentrated;</p>	[5]	
(c)	<p>Pituitary gland/ hypothalamus/ brain; Amount of ADH secreted is not regulated, affecting amount of water reabsorbed back into bloodstream;</p>	[2]	
9O (a)	<p>Correct match of any enzyme, substrate and product; At low temperatures, enzymes and substrates have lower kinetic energy, hence the enzymes are inactive; As temperature increases, the rate of enzyme activity increases due to the increased kinetic energy and frequency of effective collisions between the enzyme and substrates, forming ES complexes; The rate of enzyme activity is the highest at optimum temperature; At temperatures beyond optimum, denaturation of enzymes occurs, resulting in the change in the three-dimensional configuration of the active site; Substrates are no longer complementary to the shape of the active site, hence rate of reaction decreases rapidly;</p>	[6]	

(b)	<p>Villi increases the surface area to volume ratio of the inner walls of the small intestine, increasing rate of absorption of amino acids;</p> <p>Presence of continuous network of blood capillaries in the villi to transport away the absorbed amino acids quickly, maintaining the concentration gradient and facilitating diffusion;</p> <p>In situations where the concentration of amino acids in the small intestine is lower than that in the blood, absorption occurs via active transport;</p> <p>Presence of mitochondria to carry out aerobic respiration to release energy for active transport of amino acids against concentration gradient;</p>	[4]	Total: 10 marks
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Geylang Methodist School (Secondary) Preliminary Examination 2017

BIOLOGY

Paper 1

5158/01
Sec 4 Express

Additional materials: Optical Answer Sheet

1 hour

29 Aug 2017

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid on the Optical Answer Sheet.

Write your name, class and index number on the Optical Answer Sheet provided.

There are forty questions on this paper. Answer **all** questions.

For each question, there are four possible answers, **A, B, C** and **D**. Choose the **one** you consider correct and record your choice in **soft pencil** on the separate answer sheet.

Read the instructions on the answer sheet very carefully.

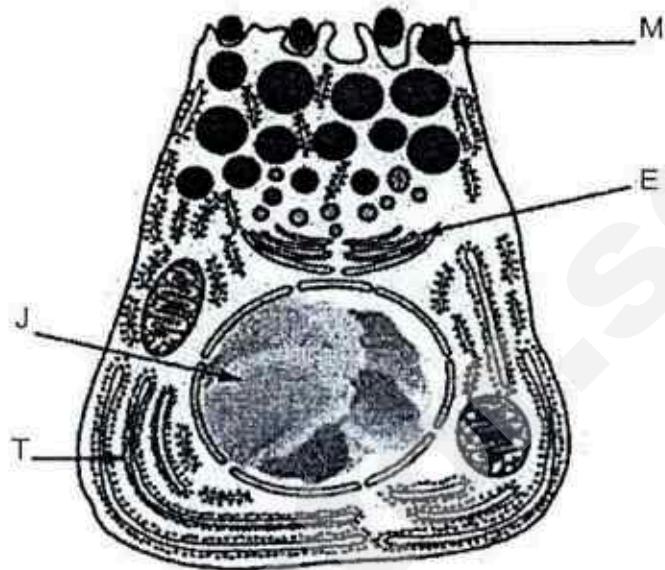
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

This document consists of 26 printed pages.

[Turn over

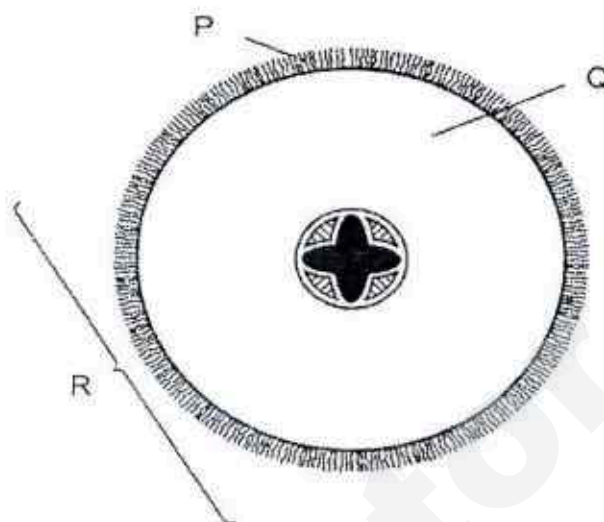
- 1 The diagram below shows a pancreatic cell.



The order in which the parts of the cell play a role in the production and secretion of enzymes is

- | | | | |
|---|------------|---|------------|
| A | M, E, J, T | B | T, J, M, E |
| C | J, T, E, M | D | E, M, T, J |

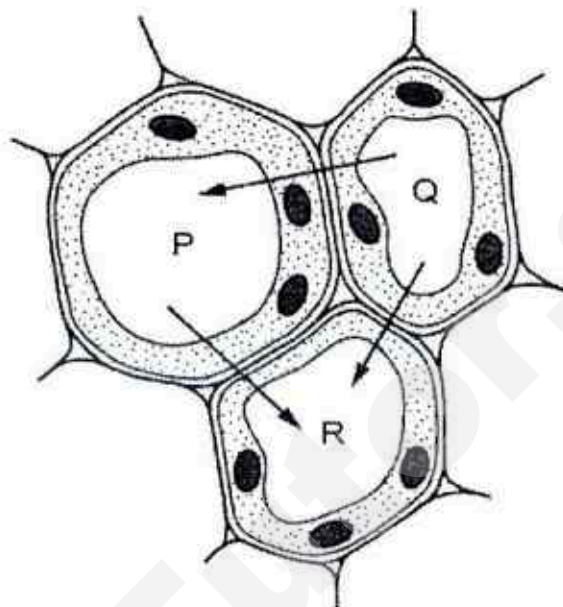
- 2 The diagram shows a section through a root.



What are the levels of organisation of the labelled structures?

	cell	organ	tissue
A	P	Q	R
B	P	R	Q
C	Q	R	P
D	R	Q	P

- 3 The diagram shows three plant cells labelled P, Q and R. The arrows show the direction of water movement by osmosis.



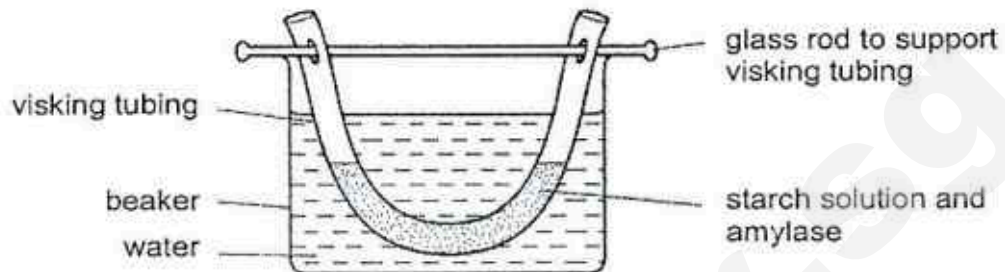
What is the correct order of water potential in the cells, from the highest to the lowest?

	highest	middle	lowest
A	P	Q	R
B	P	R	Q
C	Q	P	R
D	R	P	Q

- 4 Which processes are responsible for the uptake of ions from the soil by a plant and the uptake of glucose into the villi of a human?

	uptake of ions by a plant	uptake of glucose into the villi
A	active transport	active transport
B	active transport	osmosis
C	diffusion	osmosis
D	osmosis	active transport

- 5 An investigation is carried out on digestion and absorption in the alimentary canal. The diagram shows the apparatus used. The visking tubing is permeable to small molecules such as glucose but not to large molecules such as starch.

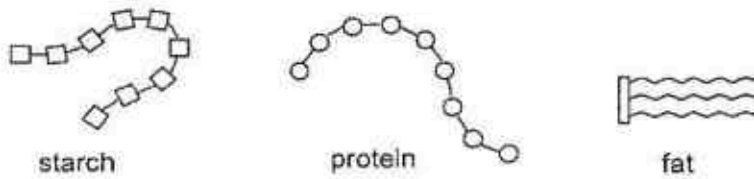


After one hour, samples of water in the beaker are tested with Benedict's solution and with iodine solution.

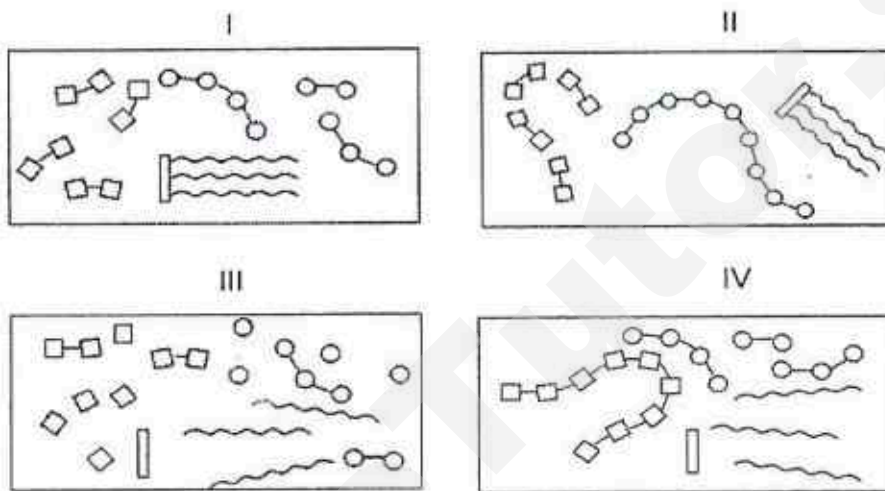
Which colours are obtained?

	colour obtained after heating with Benedict's solution	colour obtained after adding iodine solution
A	blue	blue-black
B	blue	yellow-brown
C	brick-red	blue-black
D	brick-red	yellow-brown

- 6 The diagrams below represent food molecules of starch, protein and fat.



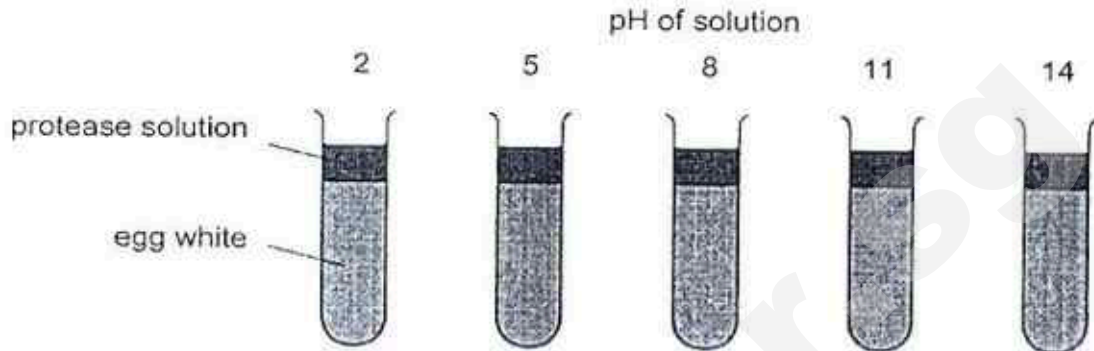
The following shows the mixtures of food taken from part of the human alimentary canal during digestion of the above food molecules.



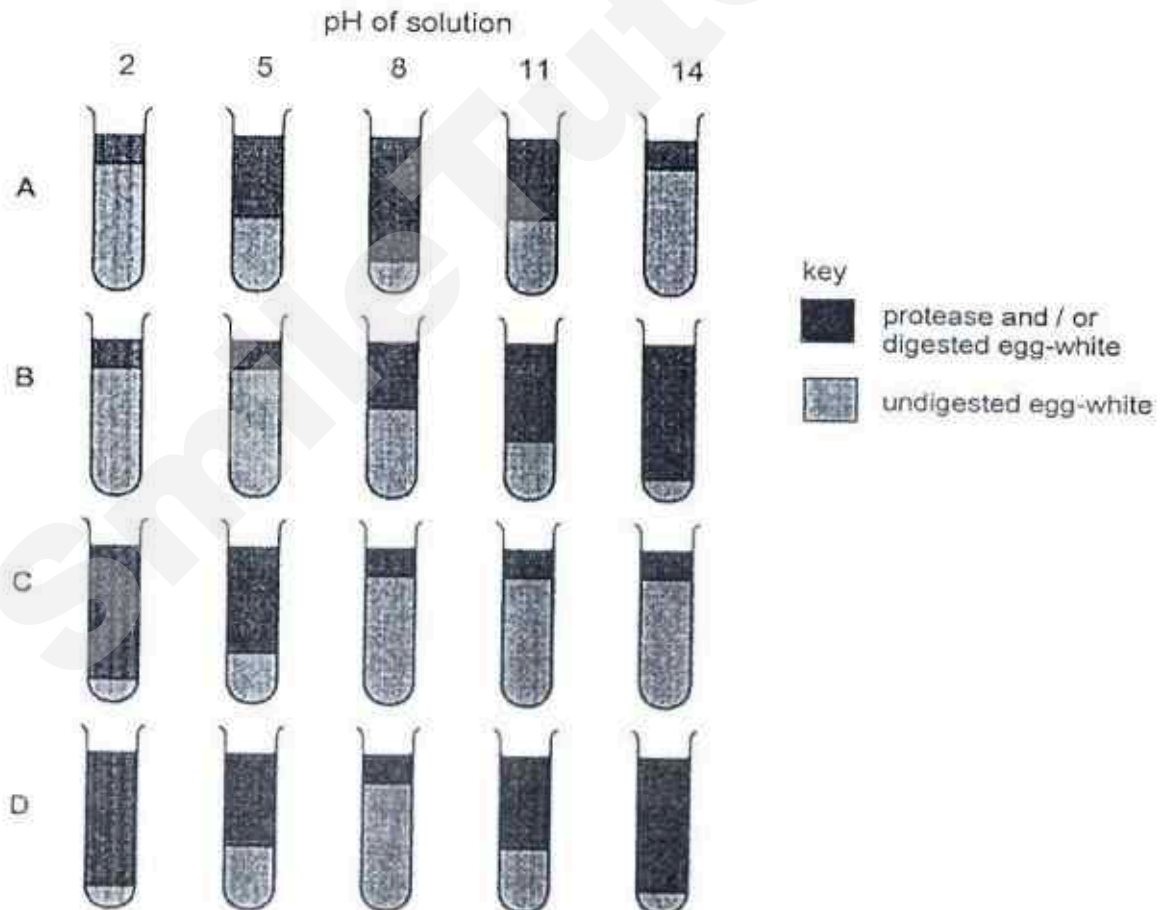
Which of the following gives a correct identification to the locations of the food molecules?

	mouth	stomach
A	I	III
B	II	I
C	II	III
D	IV	III

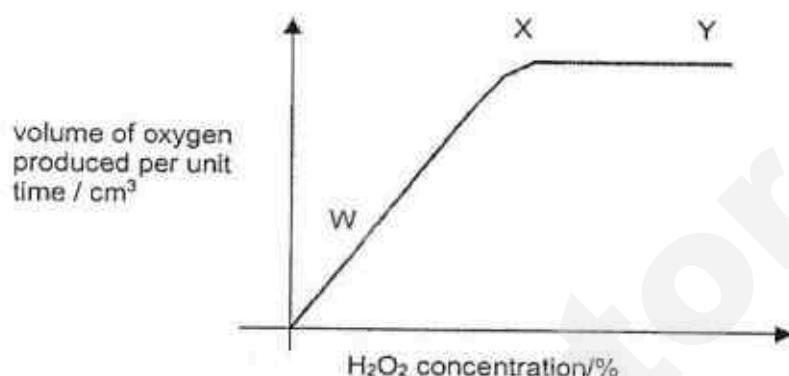
- 7 Five tubes containing cooked egg-white are set up as shown. Protease solutions of different pH are added to each tube.



Which diagram shows the results of this experiment for a protease from the stomach?

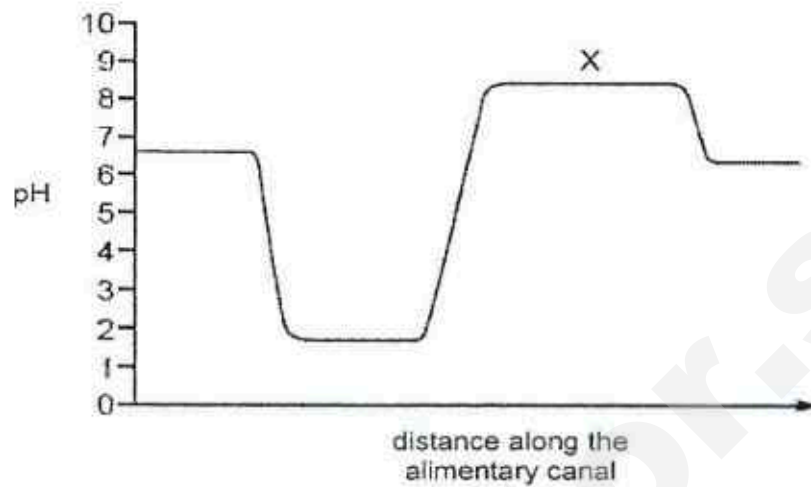


- 8 Hydrogen peroxide (H_2O_2) decomposes naturally into oxygen and water. The rate of this reaction can be increased by the addition of the enzyme, catalase.
- A student investigated the effect of hydrogen peroxide concentration on the rate of catalase activity and the graph below was obtained.



- Which statement about the graph is incorrect?
- A Between X and Y, the number of catalase molecules is limiting.
 - B Between X and Y, the number of H_2O_2 molecules is limiting.
 - C Between W and X, the number of H_2O_2 molecules is limiting.
 - D Between X and Y, the concentration of oxygen remains the same.
- 9 The liver of a mouse was removed surgically and the hepatic portal vein was connected to the hepatic vein. Measurements of amino acids and urea concentration in the blood were carried out.
- Which one of the following would be expected during the next 24 hours?
- A a decrease in both the amino acid and urea concentrations
 - B a decrease in the amino acid concentration and an increase in the urea concentration
 - C a decrease in the urea concentration and an increase in the amino acid concentration
 - D an increase in both the amino acid and urea concentration

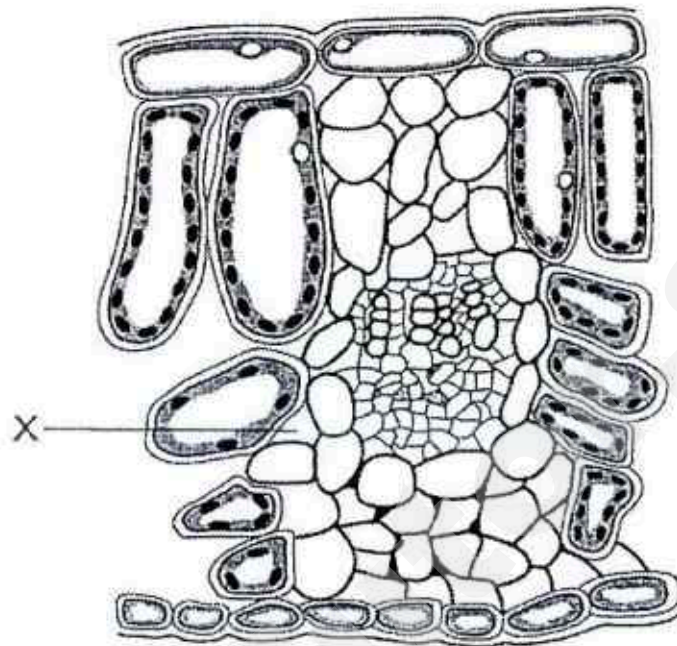
- 10 The graph shows how the pH changes along the alimentary canal.



What is the region labelled X?

- | | | | |
|---|-----------------|---|------------|
| A | large intestine | B | oesophagus |
| C | small intestine | D | stomach |
- 11 If a green plant was fed with water containing radioactive oxygen (^{18}O), radioactivity would finally be located in
- A the carbon dioxide formed in respiration.
 - B the cellulose cell walls.
 - C the oxygen formed by photosynthesis.
 - D the starch granules in a leaf.

- 12 The diagram represents a cross section of part of a leaf.

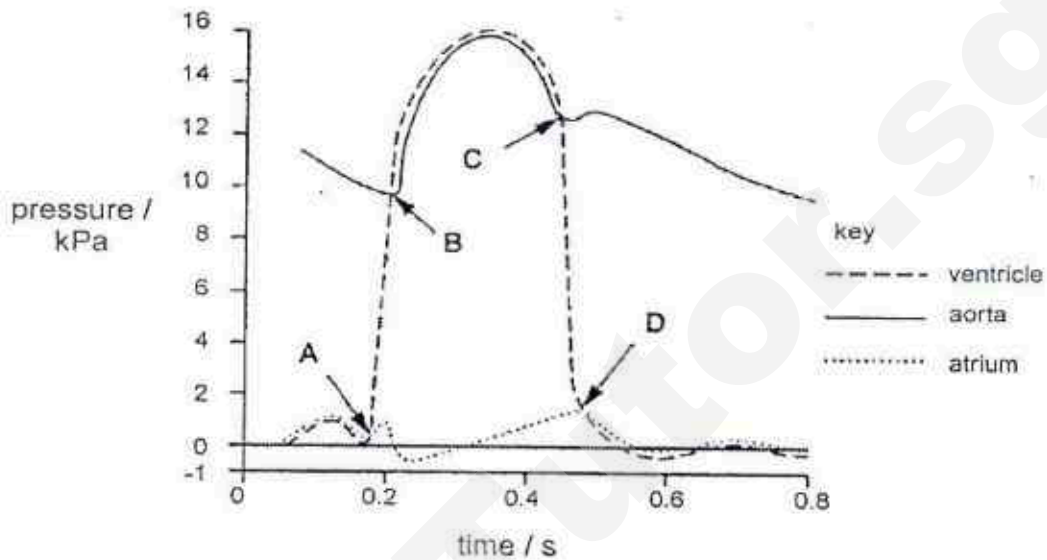


How does the oxygen content of the air at X compare to normal atmospheric air, when the leaf is in the light and when it is in the dark?

	in the light	in the dark
A	lower	the same
B	lower	higher
C	higher	the same
D	higher	lower

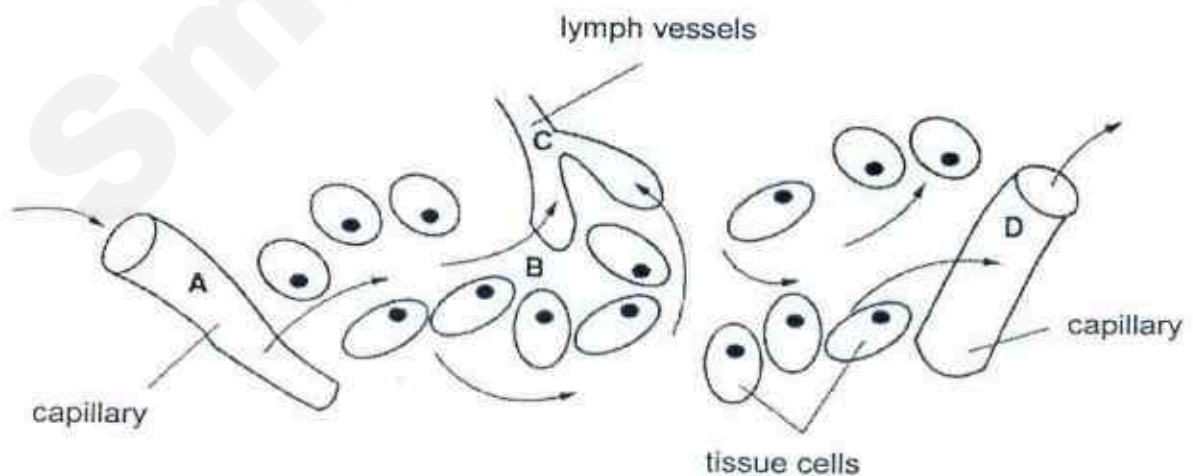
- 13 The diagram shows pressure changes in the left side of the heart during part of the human cardiac cycle.

At which point do the atrioventricular valves close?






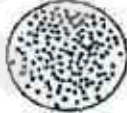


- 14 The diagram shows part of a tissue. The arrows show movement of fluids.

At which point is the pressure highest?



- 15 The blood of three people S, T and V were tested to determine their blood groups. The results are shown below.

blood of person	S	T	V
serum from blood of group A	 clumping	 clumping	 no clumping
serum from blood of group B	 no clumping	 clumping	 no clumping

Which of the following shows the correct blood types of people S, T and V?

	S	T	V
A	A	AB	O
B	B	AB	O
C	A	O	AB
D	B	O	AB

- 16 Four similar leafy shoots are exposed to different conditions. The rates of water uptake and the rates of water loss are measured.

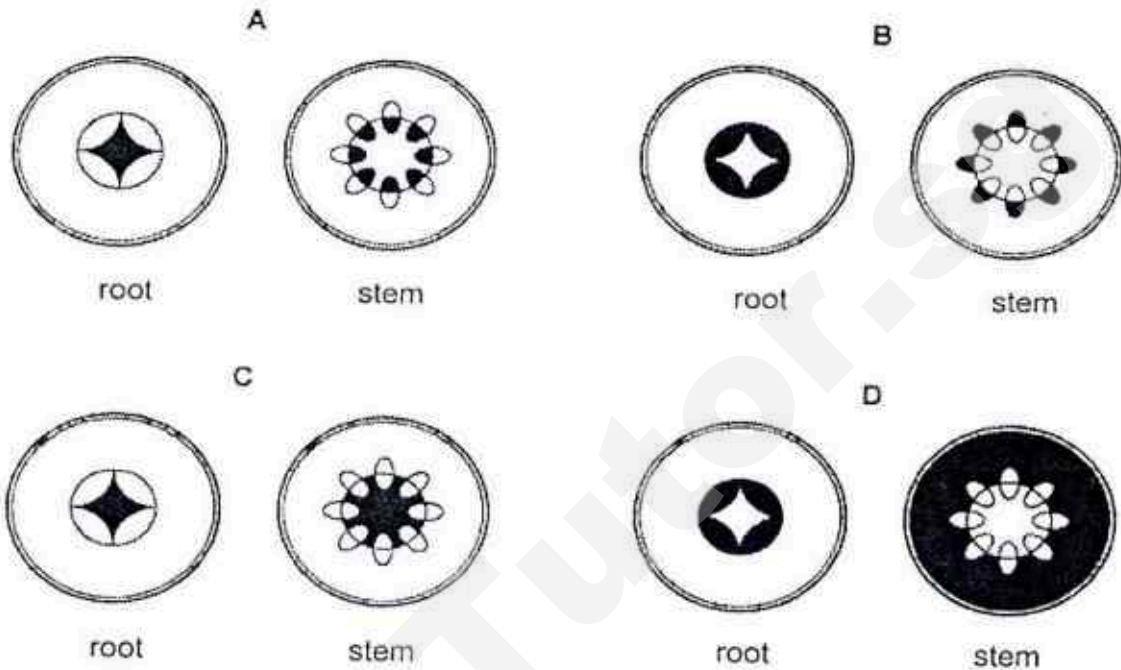
The results are shown in the table.

Which shoot is most likely to wilt?

	water uptake / mm ³ per min	water loss / mm ³ per min
A	14	13
B	10	12
C	5	5
D	4	2

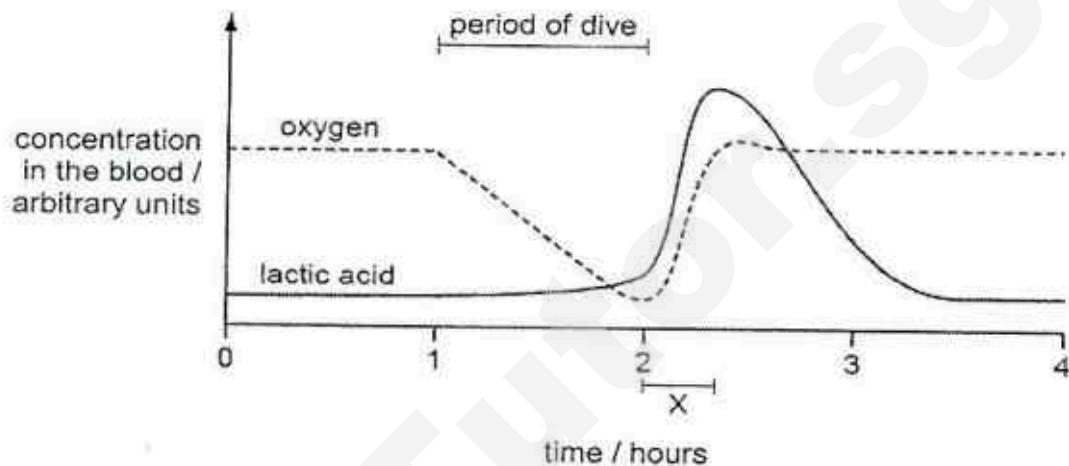
- 17 A plant was placed in water containing black dye. After 24 hours, the plant was removed and sections were taken from the root and the stem.

Which diagram shows the results?



- 18 Seals are marine mammals. When they dive under water, they are capable of respiring anaerobically for long periods. During this time, blood flow to the muscles is greatly reduced but the muscles are able to tolerate high concentrations of lactic acid.

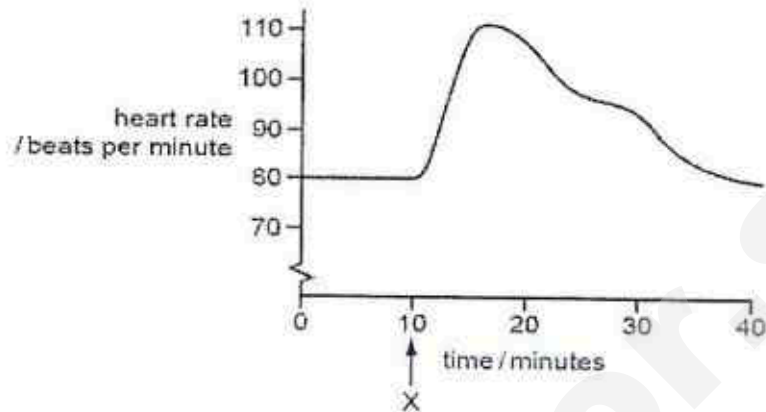
The graph shows the concentrations of lactic acid and oxygen in the blood of a seal before, during and after a dive.



What explains the change in lactic acid concentration during time X?

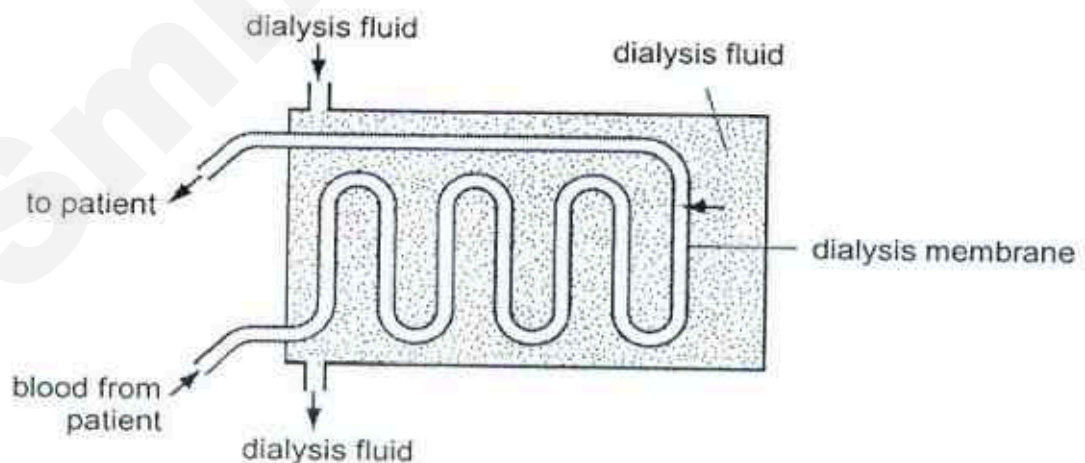
- A increased lactic acid production
- B increased blood flow to the muscles
- C increased rate of aerobic respiration
- D reduced rate of anaerobic respiration

- 19 A person begins to smoke a cigarette at time X. The graph shows how their heart rate changes.



Which substance in cigarette smoke is the main cause of the change in heart rate between 10 and 18 minutes?

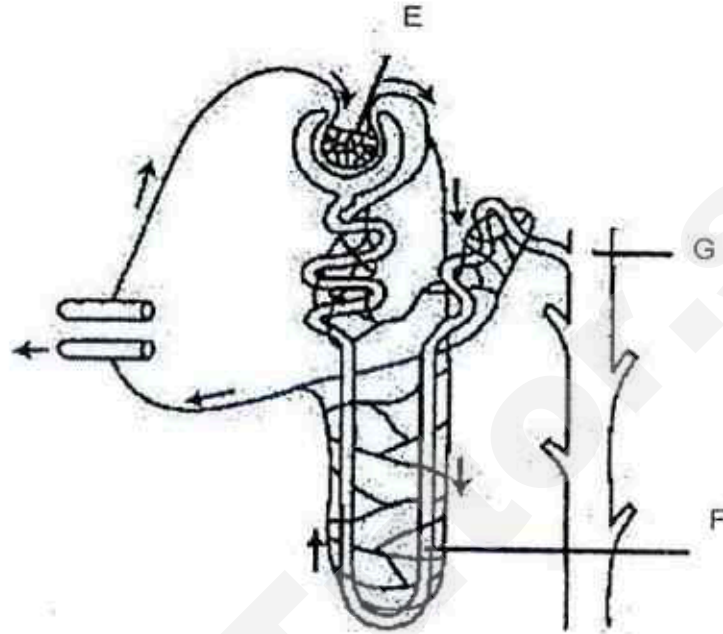
- | | | | |
|---|-----------------|---|----------|
| A | carbon monoxide | B | nicotine |
| C | smoke particles | D | tar |
- 20 The diagram shows the flow of blood and dialysis fluid through a kidney machine.



Which substance cannot diffuse through the dialysis membrane?

- | | | | |
|---|---------|---|---------|
| A | glucose | B | insulin |
| C | sodium | D | urea |

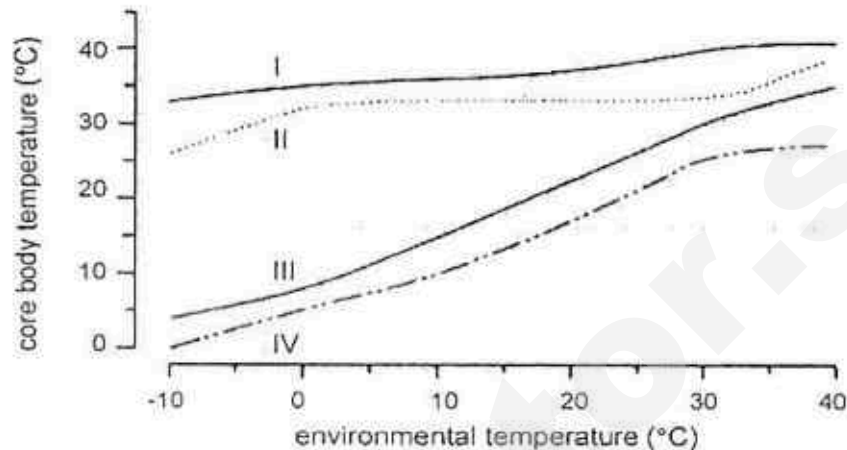
- 21 The following shows the kidney nephrons and its associated features.



Which of the following states correctly some of the component(s) found in the fluids inside E, F and G in a healthy person at any time of the day?

	E	F	G
A	amino acids, salts	white blood cells, urea	amino acids, water
B	amino acids, urea	glucose, salts	platelets, water
C	white blood cells, proteins	water, salts	salts, water, urea
D	red blood cells, amino acids	proteins, salts	urea, glucose

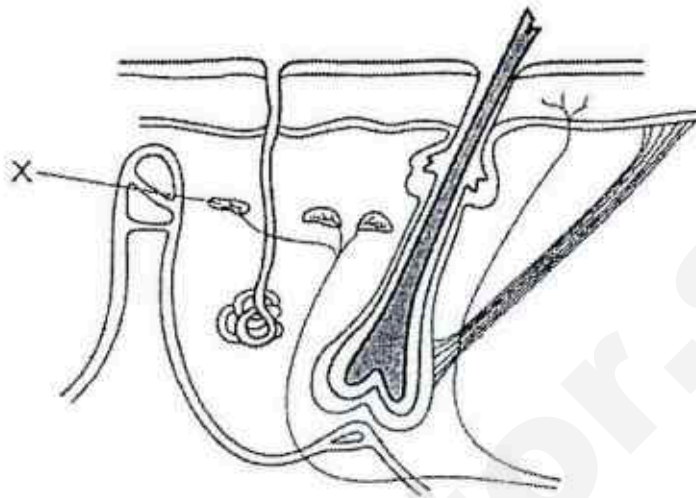
- 22 Four different animals were maintained in a laboratory in habitats similar to that of their natural environment. The core body temperature of the animals was measured in response to changes in the temperature of the laboratory environment and plotted in the graph shown below.



Which of the following conclusions can be drawn from the graph?

- A Animals I and II are most likely mammals.
- B Animal I maintains its core body temperature relatively constant by making its sweat glands less active when environmental temperature falls below 37°C.
- C Animal III becomes warm blooded as environmental temperature increases.
- D Animal IV is most likely a marine mammal.

- 23 The diagram shows some of the structures seen in a section through human skin.

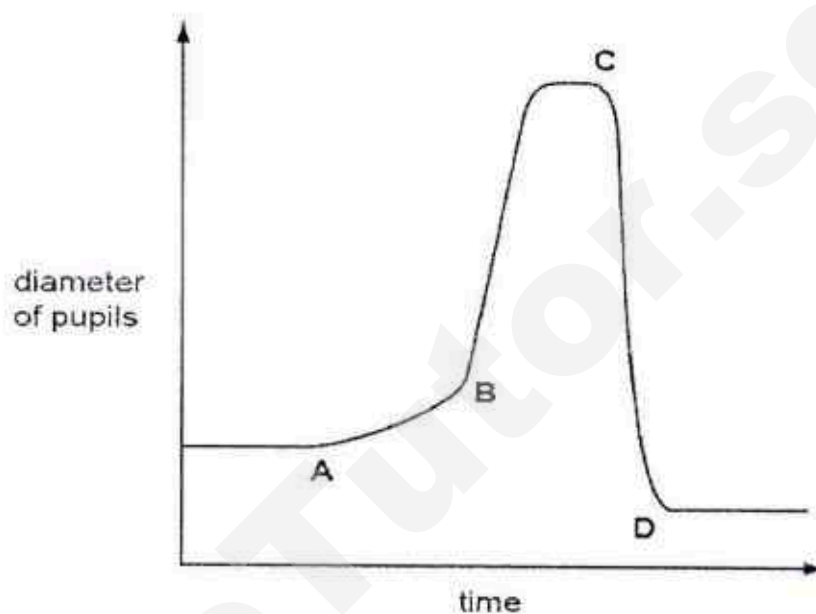


What is the function of structure X?

- A to cause capillaries to constrict
 - B to detect changes in temperature
 - C to receive impulses from the central nervous system
 - D to stimulate sweat glands to release sweat
- 24 Which of the following results from increased secretion of adrenaline?
- 1 dilated air passages
 - 2 decreased blood flow to skeletal muscles
 - 3 increased heart rate
 - 4 increased insulin production
 - 5 increased glucagon production
- | | |
|-------------------|-------------------|
| A 2 and 3 only | B 2 and 4 only |
| C 1, 3 and 5 only | D 1, 4 and 5 only |

- 25 The graph shows changes in the diameter of a person's pupils while outdoors on a sunny day.

At which time did the person take off a pair of sunglasses?



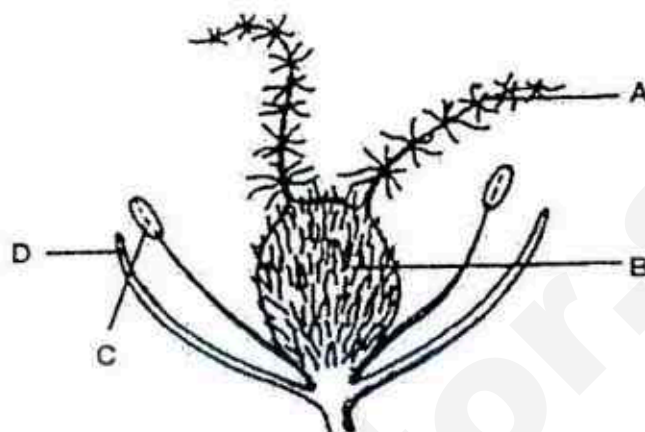
- 26 The diagram shows part of the nervous system, including a reflex arc. It has been cut along the line XX. The finger is accidentally pricked by a pin, as shown.



What are the effects of this pin prick?

	pain felt	arm moved
A	no	no
B	no	yes
C	yes	no
D	yes	yes

- 27 The diagram shows a longitudinal section of a flower.



In which of the labelled structures do pollen tubes start to develop?

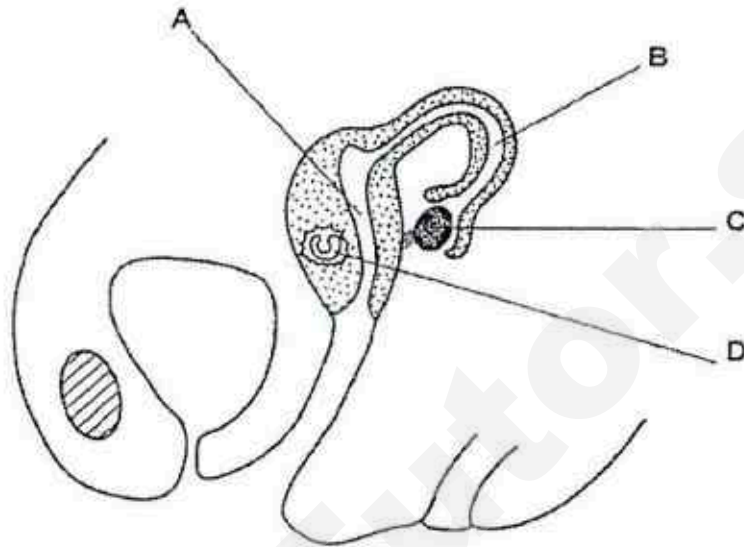
- 28 An experiment was set up using four groups of insect-pollinated flowers in a field. In each group, different parts of the flowers were removed, as shown in the table below, and insects were allowed to visit all the flowers freely.

Which group of flowers would produce the most seeds?

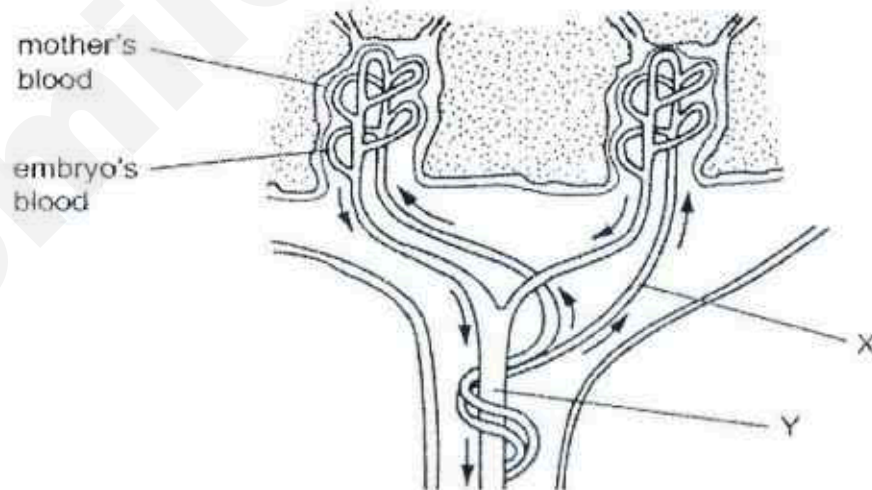
group of flowers	stigma	anthers	petals
A	left	removed	left
B	left	left	removed
C	removed	left	removed
D	removed	removed	left

- 29 The diagram shows a side view of the female reproductive system with a developing embryo.

In which part is fertilisation likely to have taken place?



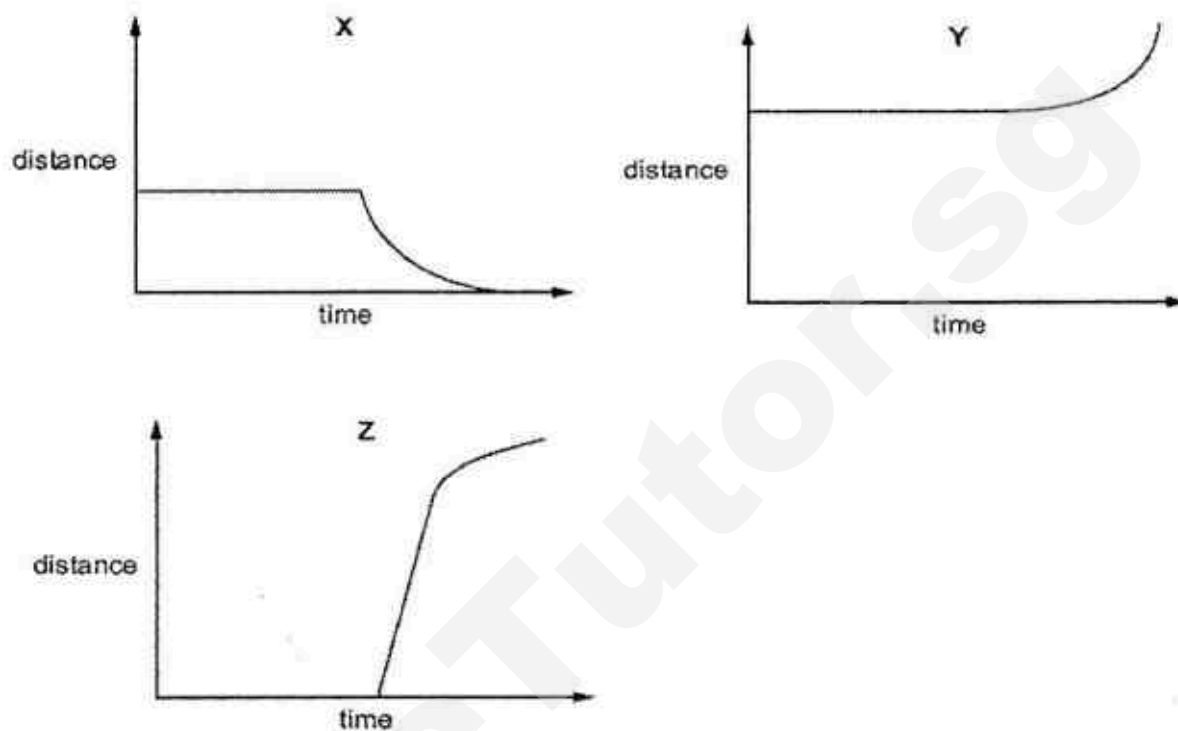
- 30 The diagram shows how the blood of a human embryo flows close to the mother's blood in the placenta.



Which substances are present at X in higher concentrations than at Y?

- A carbon dioxide and glucose
- B carbon dioxide and urea
- C glucose and oxygen
- D glucose and urea

- 31 The graphs show various measurements taken from metaphase of mitosis onwards. The graphs are to scale when compared to one another.

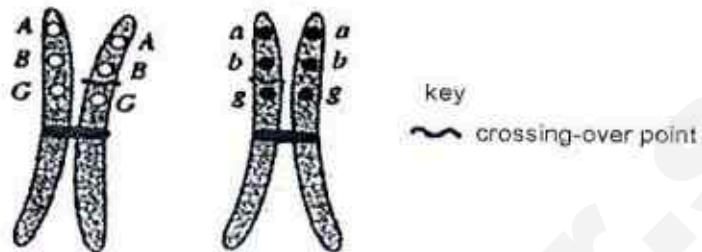


Which row correctly identifies each graph?

	X	Y	Z
A	distance between poles of spindles	distance between sister chromatids	distance of centromere from pole of spindle
B	distance between poles of spindles	distance of centromere from pole of spindle	distance between sister chromatids
C	distance of centromere from pole of spindle	distance between poles of spindles	distance between sister chromatids
D	distance of centromere from pole of spindle	distance between sister chromatids	distance between poles of spindles

- 32 The diagram below represents one pair of homologous chromosomes during meiosis.

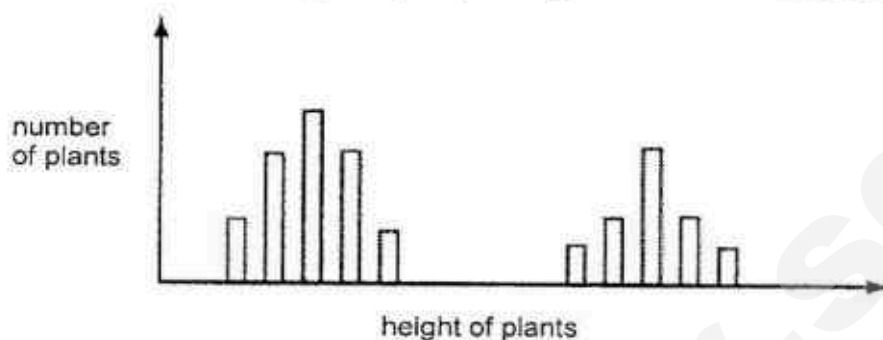
Crossing over occurs and random segregation takes place.



What are the genotypes of the resulting gametes?

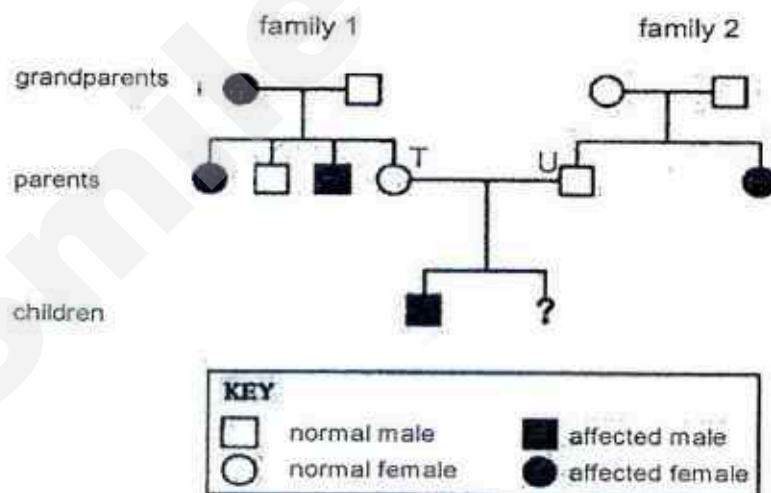
- A ABG, abG, ABg, abg
 - B ABG, aBg, AbG, abg
 - C ABG, ABG, abg, abg
 - D ABG, aBG, Abg, abg
- 33 A person with Down's syndrome is born with 47 chromosomes in each cell, instead of 46.
- What could cause this?
- A A mutation happened during the production of the egg cell.
 - B More than one sperm fused with the egg at fertilisation.
 - C Radiation caused a change in structure of a gene in the father's sperm.
 - D The mother was exposed to harmful chemicals while she was pregnant.

- 34 The bar chart shows the height of pea plants grown from 1000 seeds.



What variation do the plants show?

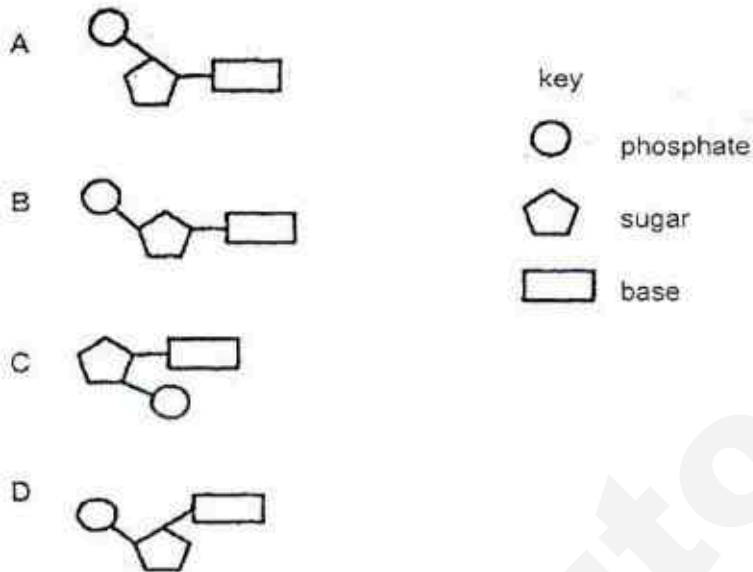
- A continuous variation only
 - B discontinuous variation only
 - C both continuous variation and discontinuous variation
 - D neither continuous variation nor discontinuous variation
- 35 The diagram shows the inheritance of a particular genetic characteristic.



What is the probability that a daughter of T and U would be affected?

- A 0%
- B 25%
- C 50%
- D 100%

36 What is the correct arrangement for the components in a nucleotide?

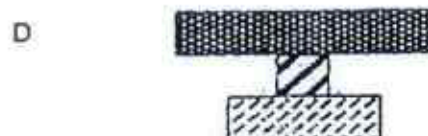
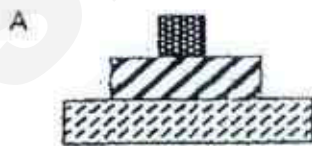


37 If 30% of the bases in DNA extracted from an organism is cytosine, what percentage of its bases would be adenine?

- | | | | |
|---|-----|---|-----|
| A | 10% | B | 20% |
| C | 30% | D | 40% |

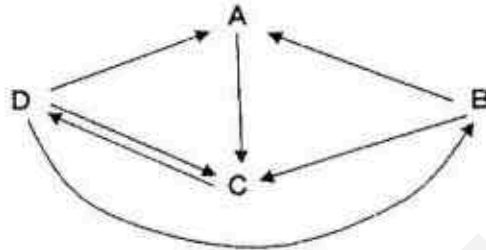
38 Which pyramid of numbers represents the following food chain:

grass → cows → ticks



- 39 In the diagram below, arrows represent the movements of carbon compounds in the carbon cycle. A, B, C and D represent carbon compounds in animals, decomposers, plants and the atmosphere.

Which represents the producer?



- 40 Inorganic fertiliser is applied each year to fields bordering a lake. The fertiliser runs off into the lake and causes six changes which together make the fish die.

- 1 Aerobic bacteria feed on dead plants.
- 2 Algae reproduce faster.
- 3 Light cannot penetrate the water.
- 4 Oxygen levels fall.
- 5 Water becomes green.
- 6 Underwater plants die.

In which order do the changes take place?

- A 2 → 5 → 1 → 6 → 4 → 3
 B 2 → 5 → 3 → 6 → 1 → 4
 C 3 → 6 → 1 → 4 → 2 → 5
 D 4 → 6 → 1 → 2 → 5 → 3

End of Paper

GEYLANG METHODIST SCHOOL (SEC)
PRELIMINARY EXAMINATIONS 2017
4EXP PURE BIOLOGY MARKING SCHEME

P1

1	2	3	4	5	6	7	8	9	10
C	B	C	A	D	B	C	B	C	C
11	12	13	14	15	16	17	18	19	20
C	D	A	A	B	B	A	B	B	B
21	22	23	24	25	26	27	28	29	30
C	A	B	C	C	B	A	A	B	B
31	32	33	34	35	36	37	38	39	40
C	A	A	C	B	B	B	C	D	B



Geylang Methodist School (Secondary) Preliminary Examination 2017

Candidate
Name

Class

Index Number

BIOLOGY

5158/02

Paper 2

Sec 4 Express

Additional materials: Nil

1 hour 45 minutes

29 Aug 2017

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you hand in.
Write in dark blue or black pen in both sides of the paper.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A

Answer all questions in the spaces provided on the question paper.

Section B

Answer all the questions.

Write your answers in the spaces provided on the Question Paper.

Write an **E** (for Either) or an **O** (for Or) next to the number 9 in the grid below to indicate which question you have answered.

You are advised to spend no longer than one hour on Section A and no longer than 45 minutes for Section B.

At the end of the examination, hand in Section A and Section B **separately**.

The number of marks is given in brackets [] at the end of each question or part question.

For Examiner's Use	
Section A	
Section B	
7	
8	
9	
Total	

This document consists of 21 printed pages and 1 blank page.

[Turn over]

Section A (50 marks)Answer **all** questions.

Write your answers in the spaces provided.

- 1 Fig. 1.1 below shows two experiments to investigate the partial permeability of Visking tubing.

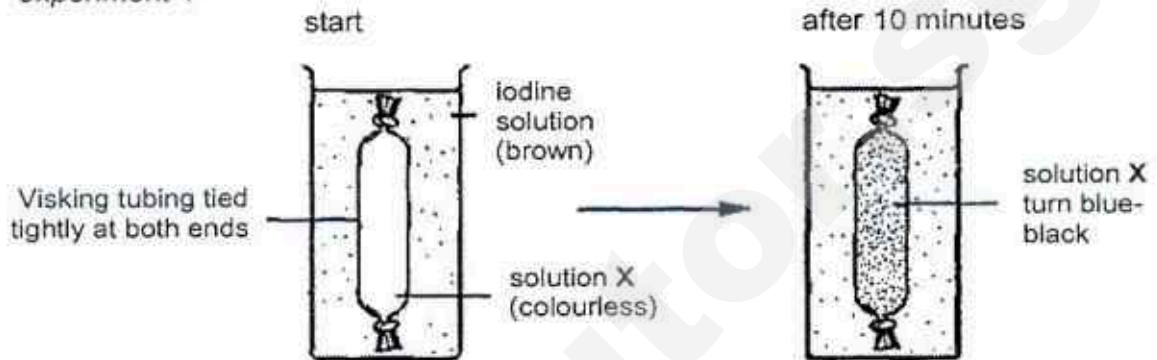
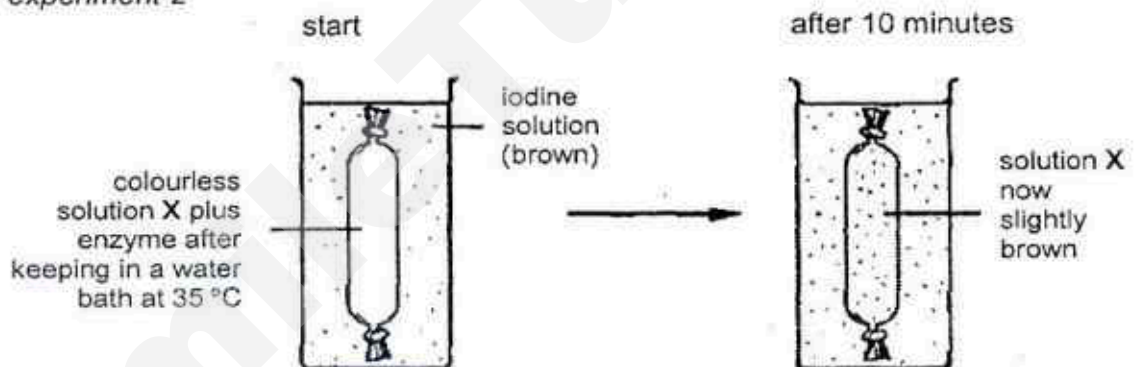
experiment 1*experiment 2*

Fig. 1.1

- (a) Suggest what solution X was likely to have been.

[1]

- (b) In experiment 1, explain why
(i) solution X turned from colourless to blue-black;

[2]

- (ii) the iodine solution remained brown.

.....
.....[1]

In experiment 2, solution X and an enzyme were placed in a Visking tubing bag which was kept at 35°C for 30 minutes. After this time, the bag was placed in iodine solution. This experiment and the results are also shown in Fig. 1.1.

- (c) In experiment 2, explain

- (i) why the bag was first kept at 35°C for 30 minutes;

.....
.....
.....[1]

- (ii) why solution X did not turn blue-black.

.....
.....
.....[1]

At the end of experiment 2, the student noticed a change in the condition of the Visking tubing bag after 24 hours.

- (d) (i) What change might have been noticed?

.....[1]

- (ii) Explain what caused this change.

.....
.....
.....
.....[2]

[Total: 9]

- 2 Fig. 2.1 shows the body temperature of a student over a 32-hour period.

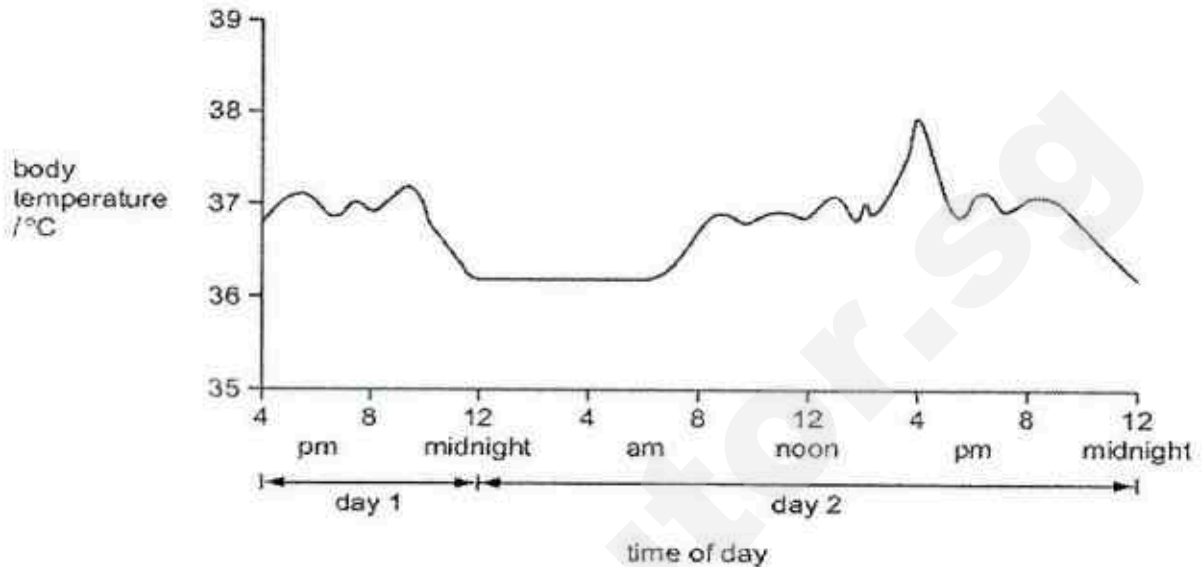


Fig. 2.1

- (a) Between 2.30pm and 4.15pm on day 2 the student was involved in gymnastics training.

Explain why the body temperature increased during the training.

.....

.....

.....

.....[2]

- (b) The student had a normal body temperature of 36.8 °C. If the body temperature rises above normal, homeostasis takes place.

- (i) Define homeostasis.

.....

.....[1]

Blank handwriting practice lines.

[Total: 6]

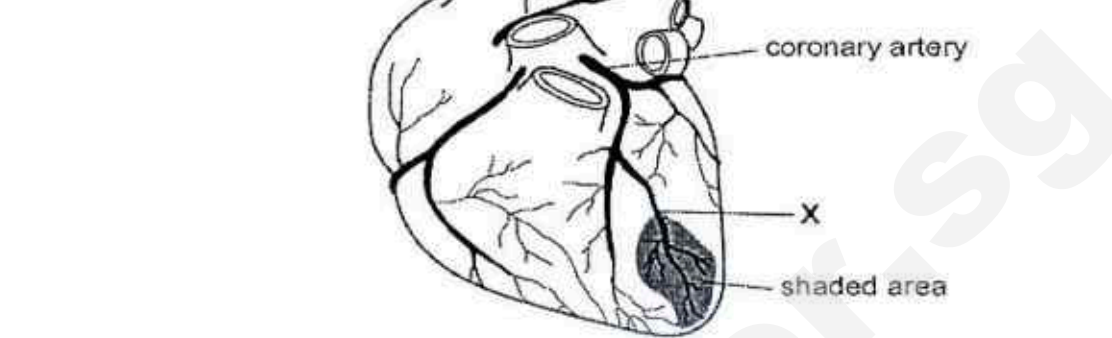


Fig. 3.1

- (a) A blood clot is stuck at X. Explain what will happen to the heart muscle cells in the shaded area on Fig. 3.1.

[4]

- (b) List two actions people can take to reduce the risk of having a blood clot in the coronary arteries.

[2]

- (c) Fig. 3.2 shows one type of artificial heart.
Fig. 3.3 shows how this artificial heart is fitted inside the body.



Fig. 3.2

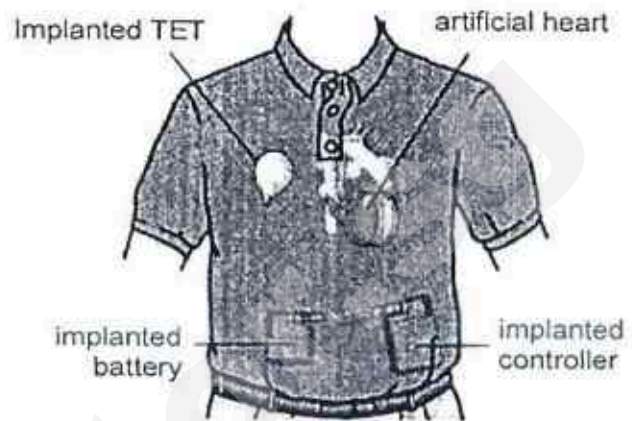


Fig. 3.3

Read the information about this artificial heart.

The first patient to receive the heart lived for 151 days before dying from a stroke.

The second patient was given less than a 20 % chance of surviving 30 days at the time of his surgery. He lived for 512 days after receiving the heart. He died because an internal membrane in the device wore out.

Suggest advantages and disadvantages of treating patients with this artificial heart.

Advantages:

.....

.....

.....

Disadvantages

.....

.....

.....

.....

[5]

[Total: 11]

- 4 Fig. 4.1 shows leaves from three plants D, E and F, of the same species.

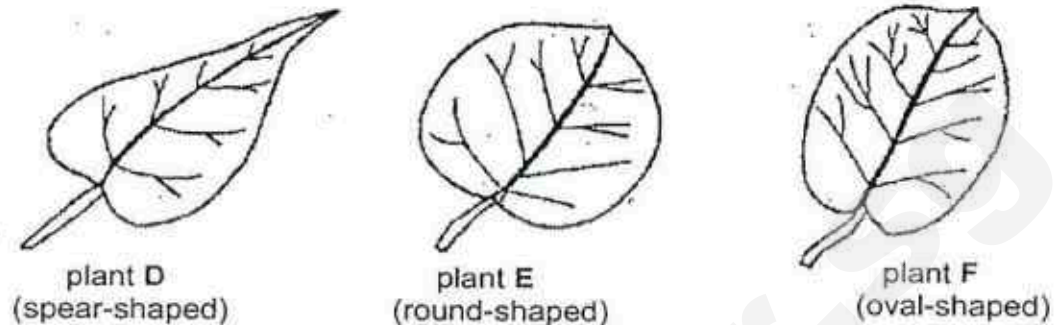


Fig. 4.1

In this species of plant, leaf shape is controlled by two alleles, S^1 and S^2 . Plants D and E are both homozygous for leaf shape and plant F is heterozygous.

- (a) State the phenotype of the heterozygous plant.

.....[1]

- (b) (i) In the space below, construct a genetic diagram to show how a particular cross will always result in all offspring having a different phenotype from both parents. [5]

- (ii) Suggest an explanation for the offspring in your answer to (b)(i) always having leaves of a different shape from either of the parent plants.

.....

.....

.....

.....

..... [2]

[Total: 8]

- 5 Fig. 5.1 shows a cell of a female fruit fly during a stage in mitosis.

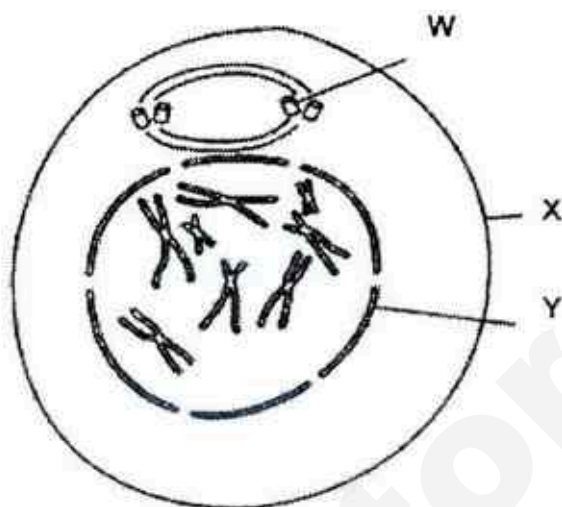


Fig. 5.1

- (a) Name the parts labelled W, X and Y.

W [1]

X [1]

Y [1]

- (b) (i) Name the stage of mitosis shown in Fig. 5.1.

..... [1]

- (ii) On Fig. 5.1, circle a pair of homologous chromosomes. [1]

- (c) (i) Predict the number of chromosomes found in the ovum of the fruit fly.

..... [1]

- (ii) Predict the number of chromosomes found in a cell at prophase I of meiosis.

..... [1]

- Blank handwriting practice lines.

-
-
-

[Total: 11]

- 6 Fig. 6.1 below shows information about living things in a lake.

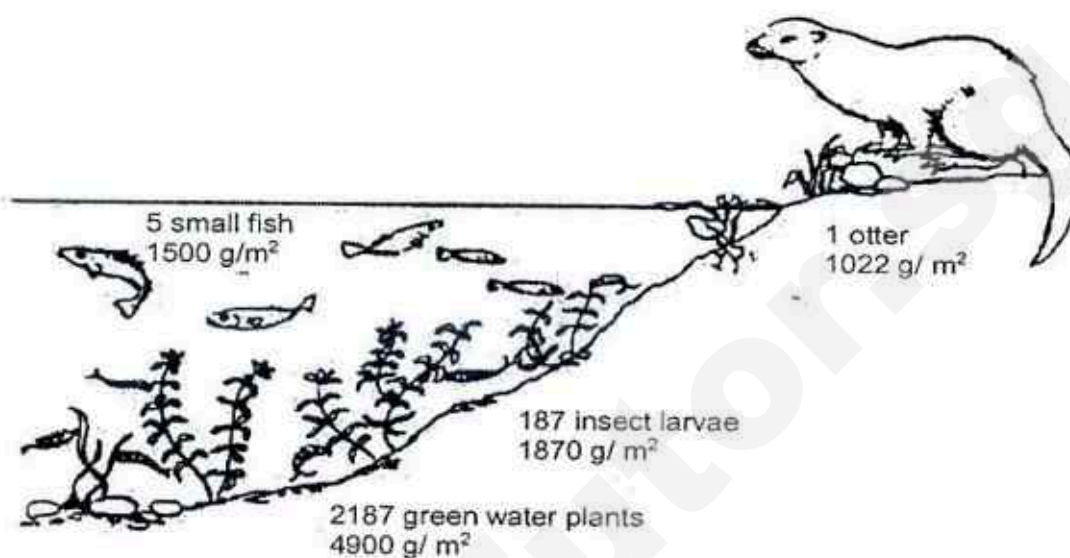


Fig. 6.1

- (a) Use the information shown in Fig. 6.1 to answer the questions below.
- (i) All the organisms shown in the diagram form a food chain. Draw and label a pyramid of biomass to represent this food chain.

[2]

- (ii) Use your knowledge of energy transfer to explain the difference in biomass between the fish and their predators.

.....

.....

.....

.....

[1]

- (b) A biologist tested the lake and the living organisms for organochlorides, a compound found in insecticides and recorded his findings below.

	parts per million (ppm) of organochlorides
water	0.03
insect larvae	1.20
small fish	2.56
otter	1680.00

Suggest how the organochlorides may have entered the lake and explain the relationship between the content of the diet and the concentration of organochlorides found in the organisms.

.....

.....

.....

..... [2]

[Total: 5]

End of Section A

Answer three questions.

Only one part should be answered.

7 (a) A student looks at a clock at the far end of an examination room and then looks at a diagram on her examination paper.

(The page contains faint horizontal lines and a large diagonal watermark reading "Smile Tuto")

- (b) The shortest distance from the eye at which a clear focus is possible is known as the near point. As a person gets older this distance changes.

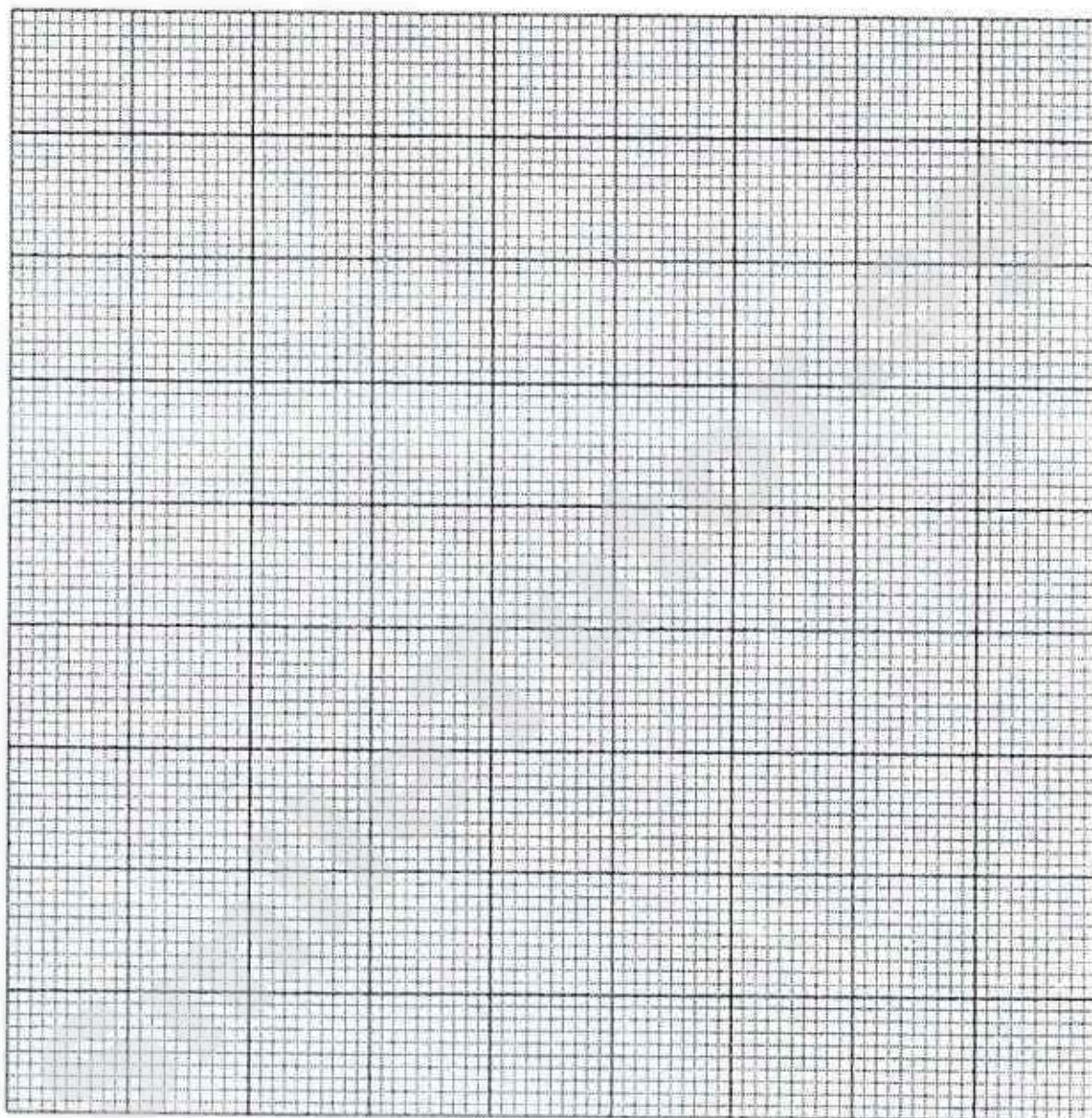
Table 7.1 shows the near point for people of different ages who have normal vision.

age/ years	distance of near point / cm
10	7.0
15	8.5
20	10.0
25	12.5
40	22.0
50	40.0
60	80.0

Table 7.1

- (i) Plot the data in Table 7.1 on the grid on the next page.

[4]



- (ii) Use the graph to estimate the distance of the near point for a 30-year-old person.

..... [1]

- (iii) Use the graph to estimate the age of a person whose near point is 32.0 cm.

..... [1]

[Total: 10]

- (i) the diaphragm;

[4]

- 8
- [4]

(b) Describe the function of cilia in the trachea.

.....

.....

.....

.....

..... [2]

[Total: 10]

9

- (a) Distinguish between self-pollination and cross-pollination.

(The page contains faint horizontal lines, suggesting it was part of a document or form.)

- (b) With reference to its structural features, describe how pollination occurs in a named insect-pollinated flower.

re

[Total: 10]

9 Or

- (a) Explain with details how the transpiration rate of a plant is affected by
- (i) decreasing humidity of the surrounding air and

1. The following table shows the number of students who took part in a school sports day. The table is divided into two parts, A and B. Part A shows the number of students who took part in each of the four events. Part B shows the number of students who took part in each of the four events, but only those who were not in Part A.

Event	Part A	Part B
100m	15	10
200m	12	8
400m	18	12
800m	20	15

2. The following table shows the number of students who took part in a school sports day. The table is divided into two parts, A and B. Part A shows the number of students who took part in each of the four events. Part B shows the number of students who took part in each of the four events, but only those who were not in Part A.

Event	Part A	Part B
100m	15	10
200m	12	8
400m	18	12
800m	20	15

- (ii) wind or air movement in the surrounding.

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- Authorised

[3]

[Total: 10]

End of Paper

GEYLANG METHODIST SCHOOL (SEC)
PRELIMINARY EXAMINATIONS 2017
4EXP PURE BIOLOGY MARKING SCHEME

P1

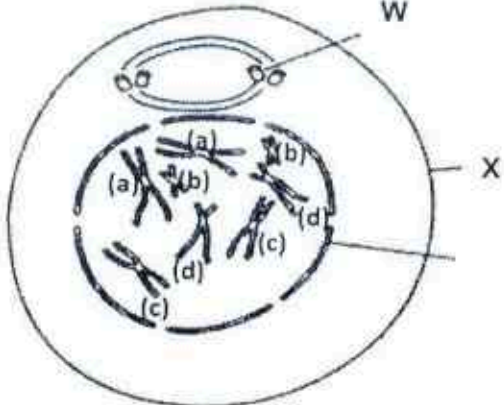
1	2	3	4	5	6	7	8	9	10
C	B	C	A	D	B	C	B	C	C
11	12	13	14	15	16	17	18	19	20
C	D	A	A	B	B	A	B	B	B
21	22	23	24	25	26	27	28	29	30
C	A	B	C	C	B	A	A	B	B
31	32	33	34	35	36	37	38	39	40
C	A	A	C	B	B	B	C	D	B

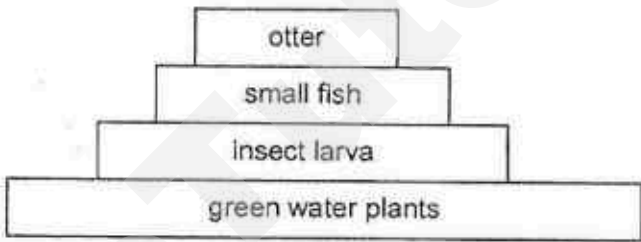
P2

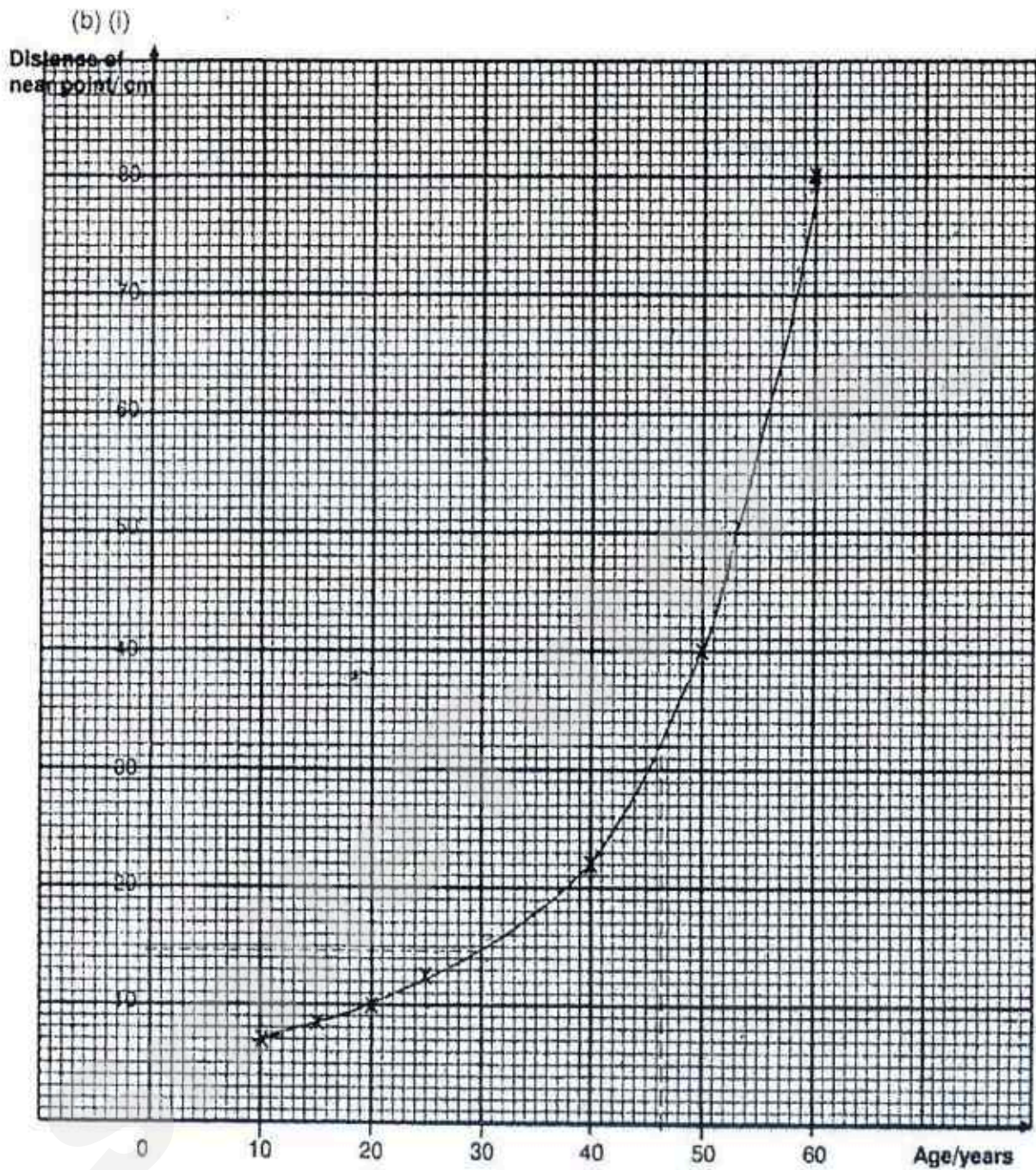
Section A

Qn No.	Answers
1 (a)	Starch [1m]
(b) (i)	There is a higher concentration of iodine molecules in the container than in the Visking tubing [1m]. Thus, iodine solution diffused [1m] into the tubing and reacts with starch solution to turn blue-black.
(ii)	Starch molecules are too large to diffuse out of the Visking tubing [1m]. Thus, iodine solution remained brown.
(c) (i)	This is to provide the enzyme to be at its optimal temperature for reacting with starch [1m].
(ii)	Starch in solution X was completely broken down by the enzyme to maltose [1m]. As there is no more starch, no blue-black colour was seen.
(d) (i)	The Visking tubing has become firmer and bigger [1m].
(ii)	There is a higher water potential in the container than in the visking tubing [1m]. Thus, water moves into the Visking tubing by osmosis [1m].
2 (a)	1. Increased muscle activity; 2. increased / faster release of energy / heat; 3. from increased respiration; any two – 1 mark each
(b) (i)	It is the maintenance of a constant internal environment. [1m]

(ii)	<ol style="list-style-type: none"> 1. sweat secreted (onto surface of skin / body); [1m] 2. evaporation of water requires heat energy which is obtained from latent heat of vaporization; [1m] 3. body temperature falls; [1m]
3 (a)	<p>Blood is unable to reach the muscle cells in the shaded region [1]. Less oxygen and glucose reaches the muscle cells [1].</p> <p>With less oxygen, respiration slows down and thus energy release is less [1].</p> <p>Muscle cells die causing heart attack. [1]</p>
(b)	<ol style="list-style-type: none"> i. exercise regularly; ii. reduce / stop smoking; iii. avoid stressful lifestyle; iv. reduce intake of fatty food. <p>[any 2 – 2m]</p>
(c)	<p><u>Advantages:</u></p> <ul style="list-style-type: none"> • useful where no other treatment available / patients near to death [1m] • extends lifespan [1m]. <p><u>Disadvantages</u></p> <ul style="list-style-type: none"> • low success rate [1] • device has limited lifespan [1] • battery will need charging [1] • discomfort from heart / battery / controller [1] • risk of infection [1] <p>[any 5 – 5m; must have at least 2 advantages and disadvantages]</p>

4 (a)	Oval-shaped leaves[1m]									
(b)(i)	<p>Let S^1 represents spear-shaped leaf allele and S^2 represents round shaped leaf allele.</p> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="margin-right: 10px;"> <p>1m {</p> <p>Parents phenotype</p> <p>Parents genotype</p> <p>1m Gametes</p> </div> <div style="margin-right: 20px;"> <p>spear-shaped leaf</p> <p>$S^1 S^1$</p> <div style="display: flex; gap: 10px;"> <div style="border: 1px solid black; border-radius: 50%; padding: 2px 5px;">S^1</div> <div style="border: 1px solid black; border-radius: 50%; padding: 2px 5px;">S^1</div> </div> </div> <div style="margin-right: 20px;"> <p>X</p> <p>$S^2 S^2$</p> <div style="display: flex; gap: 10px;"> <div style="border: 1px solid black; border-radius: 50%; padding: 2px 5px;">S^2</div> <div style="border: 1px solid black; border-radius: 50%; padding: 2px 5px;">S^2</div> </div> </div> <div> <p>round-shaped leaf</p> </div> </div> <table border="1" style="margin: 10px auto; text-align: center;"> <tr> <td></td><td>S^1</td><td>S^1</td></tr> <tr> <td>S^2</td><td>$S^1 S^2$ (oval-shaped)</td><td>$S^1 S^2$ (oval-shaped)</td></tr> <tr> <td>S^2</td><td>$S^1 S^2$ (oval-shaped)</td><td>$S^1 S^2$ (oval-shaped)</td></tr> </table> <div style="margin-top: 10px;"> <p>1m F1 generation genotype } as shown above</p> <p>1m F1 generation phenotype }</p> </div> <p style="margin-top: 20px;">All offspring are oval-shaped and have different genotype from its parents [1m].</p>		S^1	S^1	S^2	$S^1 S^2$ (oval-shaped)	$S^1 S^2$ (oval-shaped)	S^2	$S^1 S^2$ (oval-shaped)	$S^1 S^2$ (oval-shaped)
	S^1	S^1								
S^2	$S^1 S^2$ (oval-shaped)	$S^1 S^2$ (oval-shaped)								
S^2	$S^1 S^2$ (oval-shaped)	$S^1 S^2$ (oval-shaped)								
(b)(ii)	<p>The allele for leaf shape is co-dominant / incomplete dominance [1m].</p> <p>Allele for round- and spear-shaped leaf is neither dominant over each other [1m]. This results in the offspring having a different shape from the parent plants.</p>									
5 (a)	<p>W centriole [1m]</p> <p>X cell/plasma membrane [1m]</p> <p>Y nuclear membrane/envelope [1m]</p>									
(b)(i)	Prophase [1m]									
(ii)	<div style="display: flex; align-items: center;"> <div style="margin-right: 20px;"> <p>shade a pair of homologous chromosomes: pairs (a), (b) (c) & (d) (must be of the same length and centromere position); [1m]</p> </div>  </div>									

(c)(i)	4 chromosomes [1m]
(ii)	8 chromosomes [1m]
(d)	<ul style="list-style-type: none"> – Mitosis occurs during growth and development of a multicellular organism [1m]; – Mitosis occurs during the replacement of worn-out parts of the body [1m]; – Mitosis is the basis of asexual reproduction, which results in a colony of identical individuals, i.e. clones [1m].
(e)	<p>Chromatids of homologous chromosomes cross over at prophase I of meiosis but there is no crossing over of chromatids at prophase at mitosis [1m] OR</p> <p>pairing up of homologous chromosomes at prophase I of meiosis(synapsis) but not in prophase of mitosis [1m].</p>
6	
(a) (i)	 <p><i>Pyramid of similar shape [1m]</i> <i>Correct labelling of organism for each trophic level [1m]</i></p>
(ii)	Only 10% of energy is transferred from fish to their predator (as 90% is lost through processes such as respiration and excretion). Thus, biomass of fish must be greater to be able to sustain the next trophic level [1m]
(b)	<p>Organochlorides may have run-off from nearby farms that use insecticides [1m].</p> <p>As the organochlorides do not break down/non-biodegradable and are passed along from one organism to the next in the food chain, it will accumulate and will be present in the highest concentration in the top most consumer, the otter [1m]</p>
Section B	
7 (a)	<ol style="list-style-type: none"> 1. ciliary muscles contract relaxing the pull on the suspensory ligaments [1]. 2. suspensory ligaments slacken, relaxing their pull on the lens [1]. 3. lens becomes more convex / curved to decrease the focal length [1]. 4. light rays from near object/ diagram are sharply focused on to the retina / fovea;

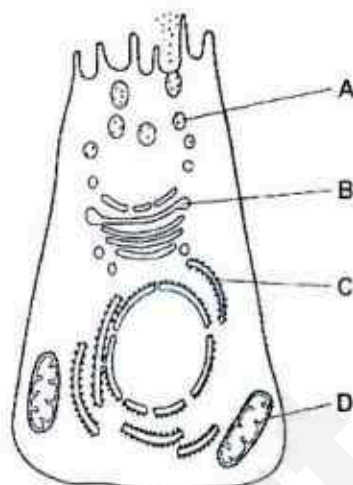


(ii)	14.5 cm / read value from graph [1m]
(iii)	46.3 years / To read value from graph [1m]

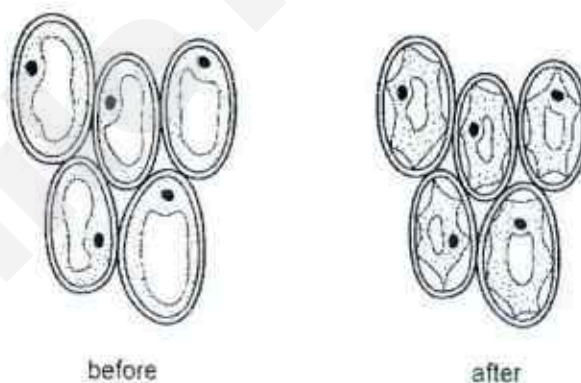
8 (a) (i)	<p>When the diaphragm contracts, the diaphragm flatten downwards [1m].</p> <p>The flattening of diaphragm helps to increase the volume of the thoracic cavity and thus lungs expands [1m] causing the pressure in the lungs to decrease [1m].</p> <p>Atmospheric pressure is higher than the pressure within the lungs. Thus, air enters the lungs through the nose, trachea and the bronchi [1m].</p> <p>OR</p> <p>Use expiration to answer.</p> <p>When the diaphragm relaxes, the diaphragm arches upwards [1m].</p> <p>The arching of diaphragm decreases the volume of the thoracic cavity and thus lungs are compressed [1m], causing the pressure in the lungs to increase [1m].</p> <p>The pressure within the lungs is higher than atmospheric pressure. Thus, air is forced out of the lungs to the exterior [1m].</p>
(ii)	<p>The external and internal intercostal muscles are found in between the ribs help to raise or lower the ribs [1m].</p> <p>During inhalation, the external intercostal muscles contract and the internal intercostal muscles relax [1m].</p> <p>Thus, the ribs is raised upwards and outwards. The sternum moves upwards and forward, thus increasing the volume of the thorax and decreasing the pressure in the lungs [1m].</p> <p>Thus, atmospheric air enters the lungs [1m].</p> <p>OR</p> <p>Use expiration to answer</p> <p>The external and internal intercostal muscles are found in between the ribs help to raise or lower the ribs [1m].</p> <p>During exhalation, the external intercostal muscles relax and internal intercostal muscles contract [1m].</p> <p>The ribs moved downwards and inwards, bringing the sternum inwards. The volume of the thorax is reduced and the pressure in the lungs increase [1m].</p> <p>Thus, air is forced out of the lungs to the exterior environment [1m].</p>
(b)	<p>The gland cells in the epithelium of trachea secrete mucus to trap dust particles and bacteria [1m].</p> <p>Cilia sweep the dust-trapped mucus up the trachea to the pharynx [1m].</p>

<p>9 E</p> <p>(a)</p>	<p>Self-pollination is the transfer of pollen from the anther to the stigma [1m] of the same flower or another flower of the same plant [1m].</p> <p>Cross-pollination is the transfer of pollen from the anther [1m] of one flower to the stigma of another flower of another plant of the same species [1m].</p>
<p>(b)</p>	<p>Clitoria is an insect-pollinated flower [1m] and is generally pollinated by bees. When the bee visits the deep blue coloured flower, it lands on the standard petal [1m].</p> <p>The insect follows the nectar guide into the flower to the nectary [1m].</p> <p>The insect forces the keel petals upwards to expose the enclosed stigma and the anthers [1m].</p> <p>The stigma and anther brushes against the hairy back/ abdomen and legs of the insect. When this happens, some pollen grains stick to the hairy back/ abdomen and legs [1m]. At the same time, some pollen grains from the hairy back/ abdomen and legs (from another flower which the insect visited earlier) are transferred to the sticky stigma [1m].</p> <p>When the insect leaves the flower, the keel petal springs back to its original position to enclose the stamens and the stigma again.</p>
<p>9O</p> <p>(a) (i)</p>	<p>Transpiration is the loss of water vapour from a plant, mainly through the stomata of the leaves [1m].</p> <p>The intercellular air spaces in the leaves are normally saturated with water vapour [1m].</p> <p>There is water vapour concentration gradient between the leaf and the atmosphere [1m].</p> <p>The drier or less humid the air outside the leaf, the steeper the concentration gradient is, thus the rate of transpiration will increase [1m].</p>
<p>(ii)</p>	<p>Wind blows away the water vapour that accumulates outside the stomata [1m]. This maintains the water vapour concentration gradient between the leaf and the surrounding air [1m].</p> <p>Thus, the stronger the wind, the higher the rate of transpiration [1m].</p>
<p>(b)</p>	<ul style="list-style-type: none"> • Mesophyll cells with thin film of moisture lining allow carbon dioxide to diffuse into the leaf easily for photosynthesis. But due to this feature, water from thin lining of moisture is lost easily into the intercellular air space and out through stomata during transpiration. • Also large intercellular and sub-stomatal air spaces in the leaf that allow carbon dioxide to diffuse easily also allow water to be lost easily by transpiration. • The greater the number of stomata, the greater is the rate of water loss through transpiration. • The greater the size of stomatal opening, the greater is the rate of water loss through transpiration. [any 3 – 3m]

- 1 The diagram is taken from an electronmicrograph of a cell which secretes enzymes.
Where are these enzymes synthesised?



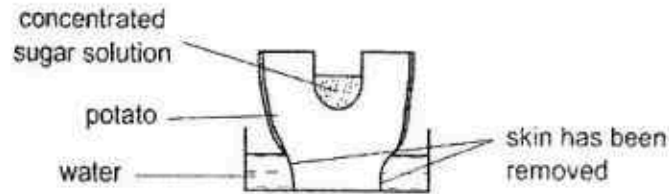
- 2 The diagrams show plant cells before and after being placed in a concentrated sugar solution.



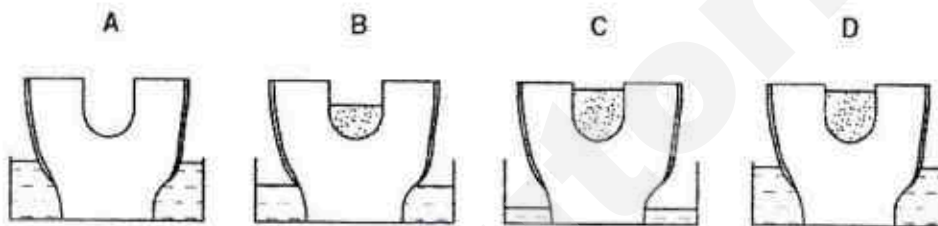
What is the reason for the difference and which process has caused it?

	reason	process
A	sugar passes into the cells	active transport
B	sugar passes out of the cells	active transport
C	water passes into the cells	osmosis
D	water passes out of the cells	osmosis

- 3 The diagram shows an experiment using an uncooked potato. The skin of the potato was removed as shown.



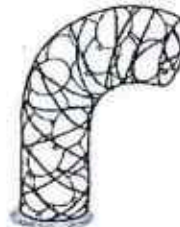
Which diagram shows the result of the experiment after 4 hours?



- 4 The diagrams show a cylindrical net packed with inflated rubber balloons full of air. The structure is used by a teacher to explain wilting.



all the balloons fully inflated



the same number of balloons with some of the air let out

What is represented by the parts of the structure shown?

	net	rubber	air	balloons
A	cell walls	epidermis	cells	cell sap
B	epidermis	cell walls	cell sap	cells
C	cell sap	cells	cell walls	epidermis
D	cells	cell sap	epidermis	cell walls

5 Listed below are elements that occur in biological molecules.

- I carbon
- II hydrogen
- III nitrogen
- IV oxygen
- V phosphorus
- VI sulfur

Which elements are common to carbohydrates, fats and proteins?

- A I, II, III
- B I, II, IV
- C I, IV, V
- D I, III, VI

6 A student tested four samples of food, A, B, C and D, for the presence of

- fats
- protein
- reducing sugars
- starch

One of the food samples, milk, was found to contain fats, protein and reducing sugar.

Which of the food samples, shown in the results below, is milk?

sample	observation			
	adding biuret reagent	adding iodine solution	boiling with Benedict's solution	mixing with ethanol and adding to water
A	lilac	yellow-brown	orange precipitate	milky emulsion
B	lilac	blue-black	blue	milky emulsion
C	pale blue	blue-black	blue	clear
D	pale blue	yellow-brown	orange precipitate	clear

7 Which substances diffuse from the ileum into the lacteals of the villi?

- A amino acids and glucose
- B amino acids and glycerol
- C fatty acids and glycerol
- D glycogen and starch

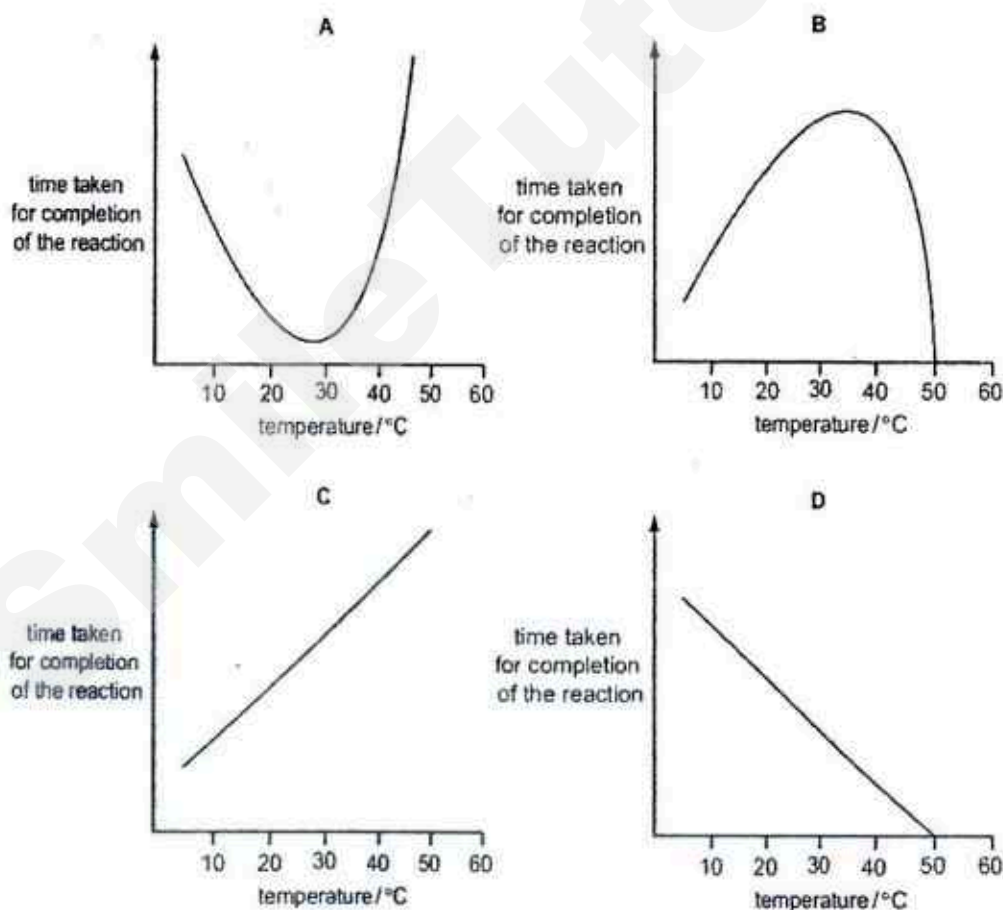
- 8 There is a lower concentration of glucose in the hepatic vein than in the hepatic portal vein after eating a meal.

What is the best explanation for this?

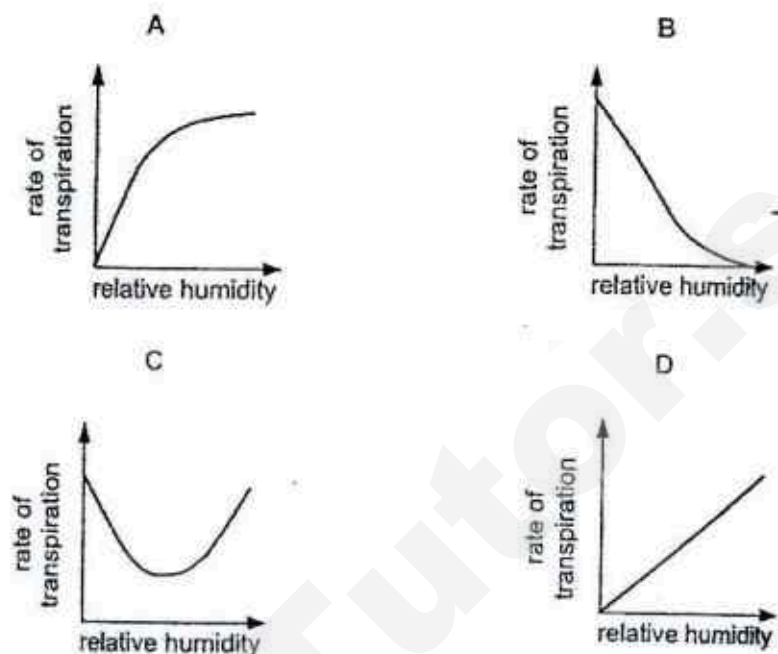
- A Glucose molecules are stored in the liver.
- B Glucose is turned into glycogen in the liver.
- C Glucose leaves the liver in the hepatic portal vein.
- D Glucose is turned into urea in the liver.

- 9 An enzyme is completely denatured at 50 °C. A fixed concentration of this enzyme is added to a fixed concentration of its substrate. The time taken for completion of the reaction is measured at different temperatures.

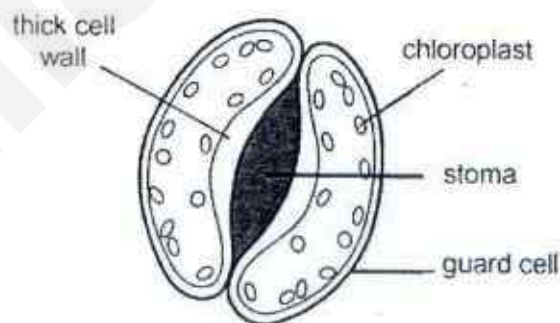
Which graph shows the results?



- 10 Which graph shows the relationship between rate of transpiration and relative humidity?



- 11 The diagram shows a stoma and its guard cells in the lower epidermis of a leaf.



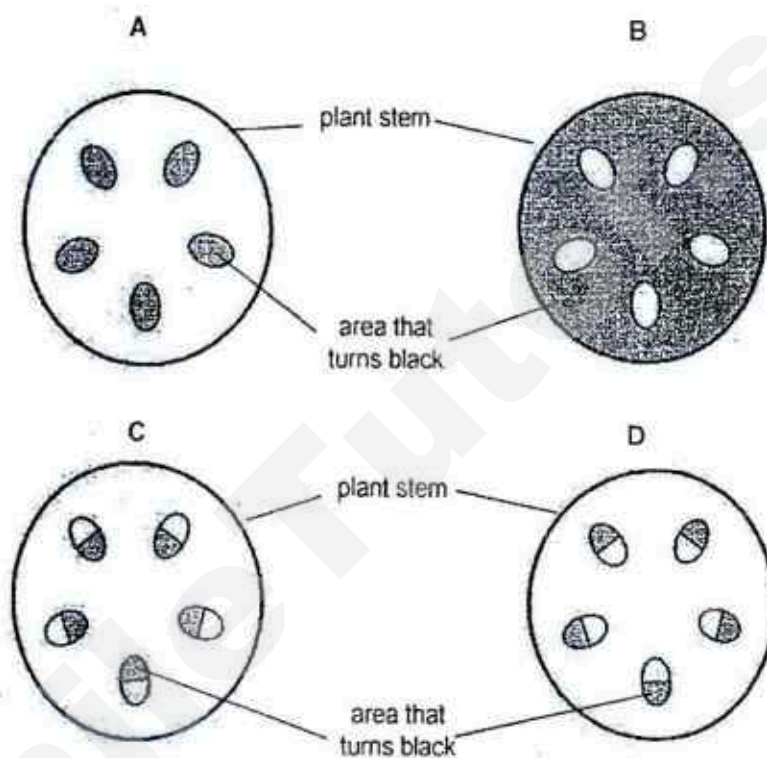
Which of the following describes the conditions which result in the stoma being fully open as shown in the diagram?

	lighting conditions	condition of guard cells
A	light	flaccid
B	dark	flaccid
C	light	turgid
D	dark	turgid

- 12 The leaves of a plant were exposed to carbon dioxide containing radioactive isotope ^{14}C for two hours in sunlight.

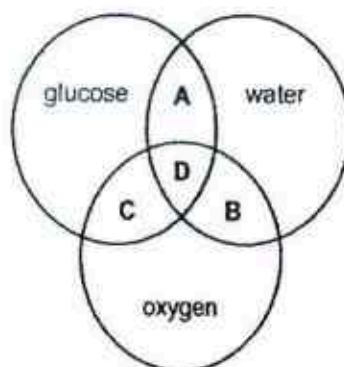
A section of the stem of the plant was then removed and exposed to X-ray film. X-ray film turns black when exposed to radioactivity.

Which of the following correctly shows the final appearance of the X-ray film?

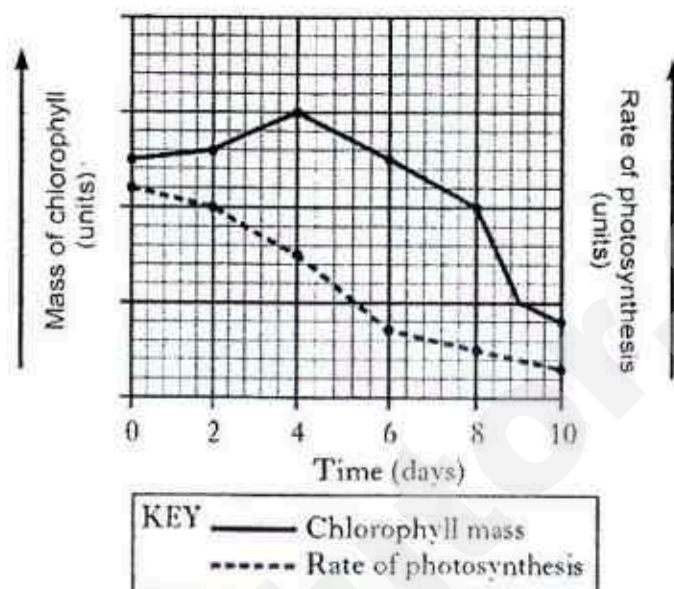


- 13 The diagram refers to some substances found in plant cells.

Which area of the diagram represents the end products of photosynthesis?



- 14 The graph shows changes in the mass of chlorophyll and rate of photosynthesis in leaves during a 10-day period in autumn.

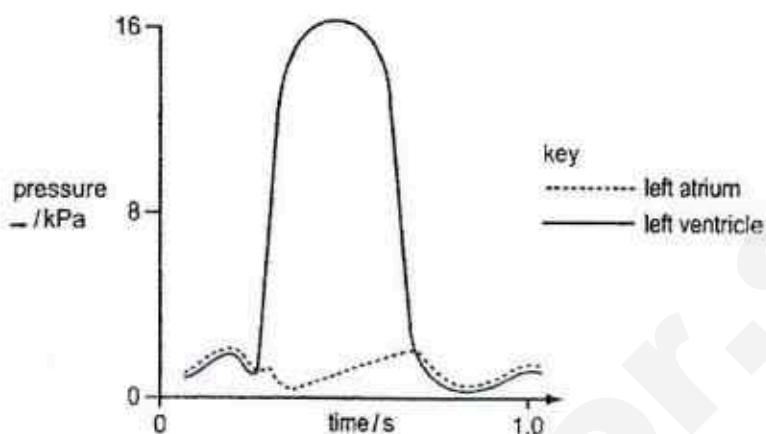


Chlorophyll content of leaves can limit the rate of photosynthesis.

During which period do the results not support this statement?

- A 0 to 4 days
- B 4 to 8 days
- C 8 to 9 days
- D 9 to 10 days

- 15 The graph shows pressure changes in the left side of the heart during a single heartbeat.



Which of the following statements about the changes in the heart during a heartbeat is correct?

- A The atrium and ventricle contract at the same time.
- B Atrial systole lasts longer than ventricular systole.
- C Ventricular pressure is *always* higher than atrial pressure.
- D Ventricular systole results in greater pressure change than atrial systole.

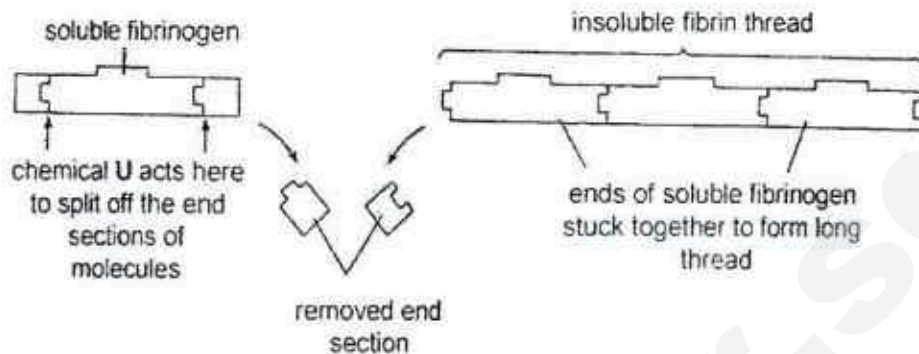
- 16 The table shows the results of a blood test of three students, X, Y and Z for blood transfusion.

		donor		
		X	Y	Z
recipient	X		agglutination	no agglutination
	Y	no agglutination		no agglutination
	Z	agglutination	agglutination	

Which of the following may be the blood types of students X and Y?

	student X	student Y
A	A	AB
B	A	O
C	B	B
D	O	AB

- 17 The diagram illustrates the formation of long insoluble fibrin threads during the clotting of blood at a cut in the skin.



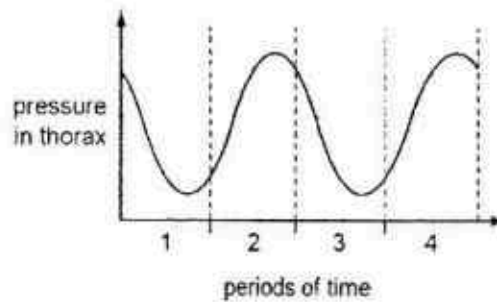
Person V is unable to produce chemical U.

What is a possible effect of person V's condition?

- A V will lose more blood than a normal person when injured.
 - B V has a greater likelihood of suffering from embolisms (blood clots in blood vessels).
 - C V's platelets will not function properly.
 - D V will suffer from fainting spells because of low blood pressure.
- 18 What are the effects of tobacco smoke on the gas exchange system?

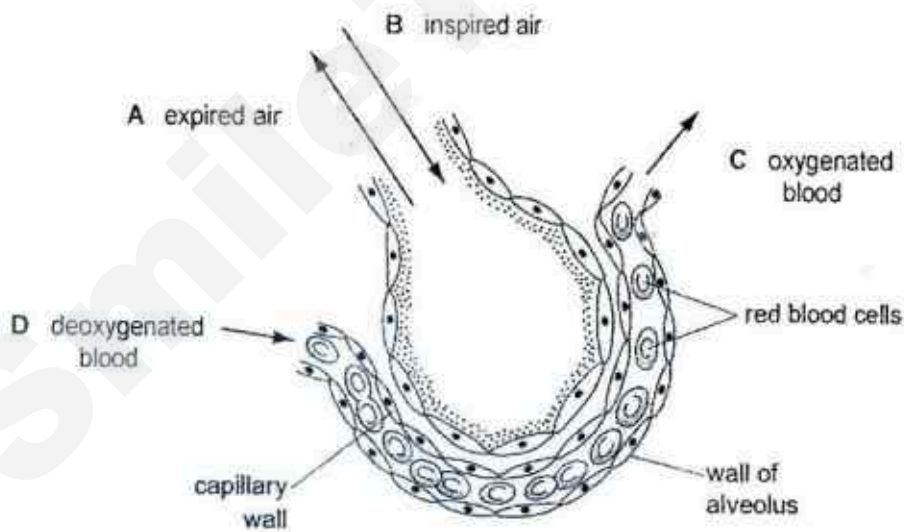
	mucus in the airways	chance of lung infection
A	decreased	decreased
B	decreased	increased
C	increased	decreased
D	increased	increased

- 19 The graph shows pressure changes in a person's thorax during a short period of time.



During which periods of time is the person breathing in?

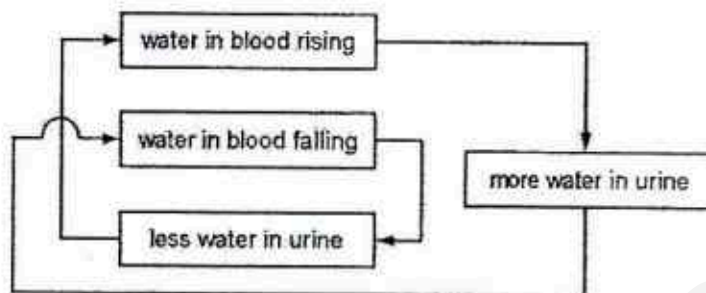
- A 1 and 3
 - B 1 and 4
 - C 2 and 3
 - D 2 and 4
- 20 The diagram shows one alveolus and one blood capillary.
- Which label shows the condition that has affected the rate of breathing?



- 21 Which of the following is not an example of homeostatic response?

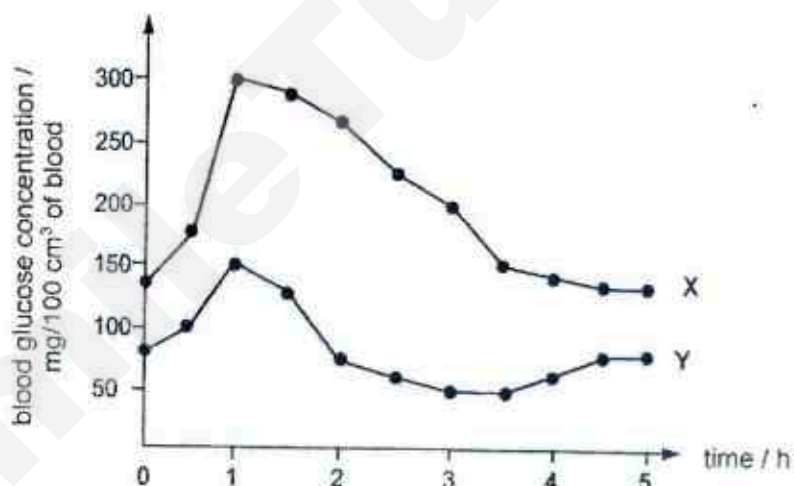
- A decreased rate of sweat production on a cold day
- B increased absorption of water in the large intestine after drinking soft drinks
- C increased breathing rate during exercise
- D increased secretion of glucagon 5 hours after a meal

- 22 The diagram refers to the control of water concentration in the blood.



Why is this a negative feedback system?

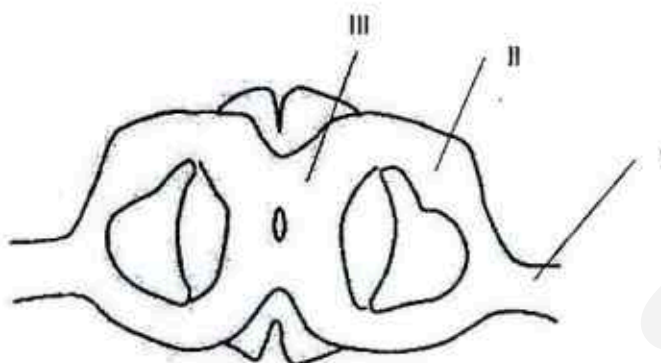
- A It decreases the amount of water in the blood.
 - B It increases any change in the amount of water in the blood.
 - C It increases the amount of water in the blood.
 - D It reverses any change in the amount of water in the blood.
- 23 The graph shows the blood glucose level of a healthy person and a person suffering from untreated diabetes mellitus.



Which of the following reason/s accounts for the drop in blood glucose level of person X between the first and second hours?

- I excretion of glucose through the kidneys
 - II increased uptake of glucose by tissue cells
 - III rapid conversion glucose to glycogen
 - IV respiration in tissue cells
- A I only
 - B I and III only
 - C II and IV only
 - D I, II, III and IV.

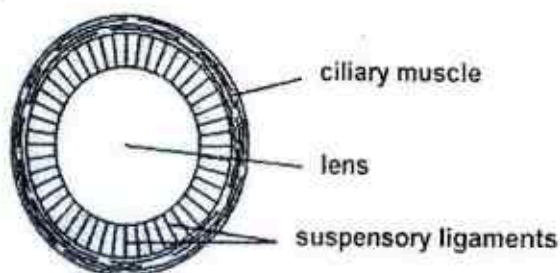
- 24 The diagram shows a cross section of the spinal cord of a mammal.



What can be found in regions I, II and III?

	I	II	III
A	sensory neurone	relay neurone	motor neurone
B	motor neurone and sensory neurone	sensory neurone	relay neurone
C	motor neurone	relay neurone	motor neurone
D	sensory neurone and relay neurone	sensory neurone	relay neurone

- 25 The diagram shows a section of a part of the eye when looking at an object from a distance.



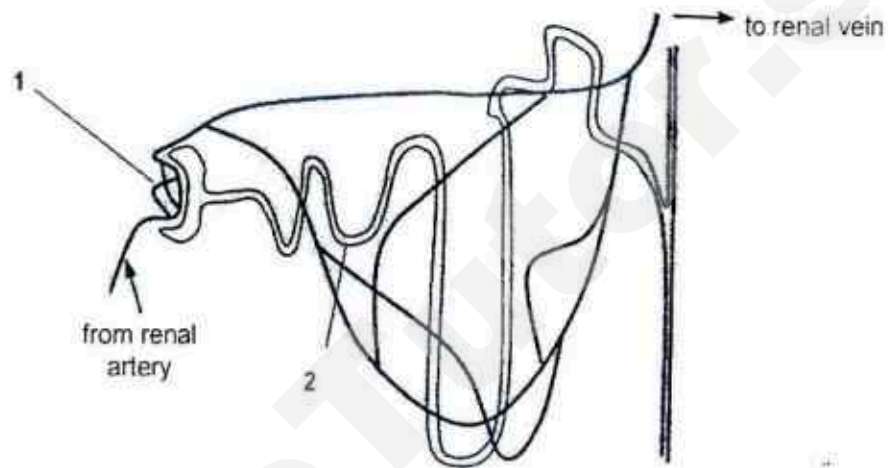
What happens when the eye focuses on an object that is getting further away?

	ciliary muscle	suspensory ligament	lens shape
A	contracts	less taut	more convex
B	contracts	less taut	less convex
C	relax	more taut	more convex
D	relax	more taut	less convex

26 Which component of faeces is an excretory product?

- A bacteria
- B bile pigments
- C cellulose
- D undigested food

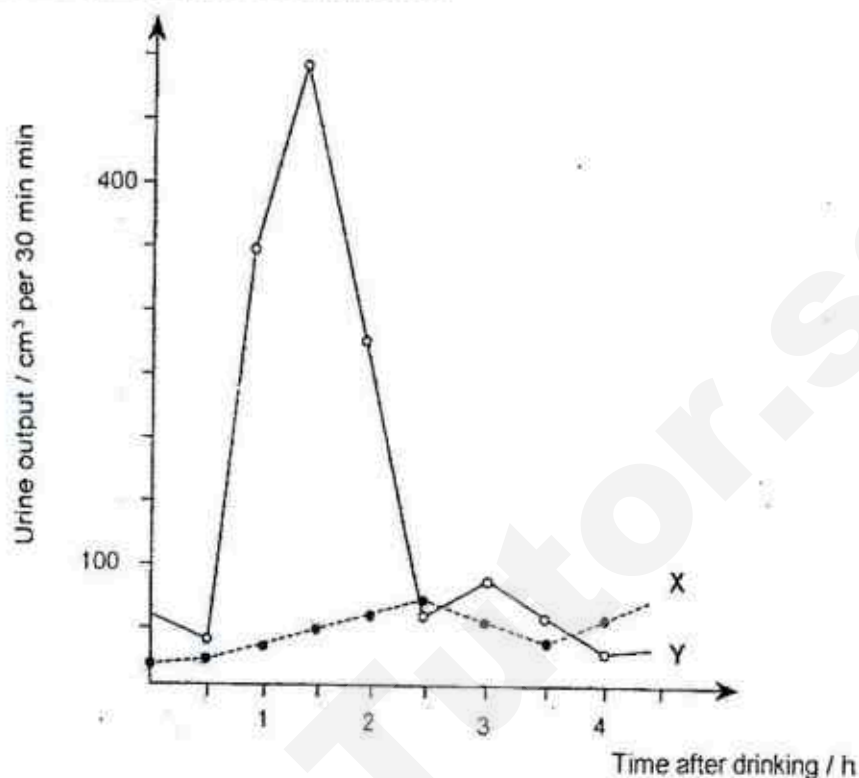
27 The diagram shows the structure of a human nephron and its associated blood vessels. Glucose moves between blood and the fluid in the nephron at sites 1 and 2.



Which of the following correctly identifies the processes that cause glucose to move at sites 1 and 2

	site 1	site 2
A	filtration	active transport
B	diffusion	diffusion
C	filtration	osmosis
D	active transport	diffusion

- 28 The graph shows the effect of drinking 1 litre of water and 1 litre of concentrated salt solution on urine output in a healthy person.



Which correctly identifies each line and the explanation for it?

	drinking 1 litre of water	drinking 1 litre of concentrated salt solution	explanation
A	X	Y	Drinking water causes less ADH to be produced.
B	X	Y	Drinking water causes more ADH to be produced.
C	Y	X	Drinking concentrated salt solution causes less ADH to be produced.
D	Y	X	Drinking concentrated salt solution causes more ADH to be produced.

- 29 The following shows the first part of a sequence of a gene, which will eventually produce a protein.

TGC ATT TGA CCA ACG CCC GGC AGA ...

After transcription and translation, the corresponding amino acid sequence of the protein is:

aa1 – aa2 – aa3 – aa4 – aa5 – aa6 – aa7 – aa8 ...

A student commented that the following are the effects of an accidental deletion of the sequence TGA from the original sequence.

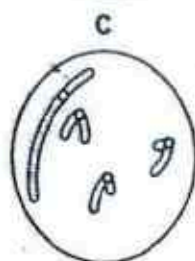
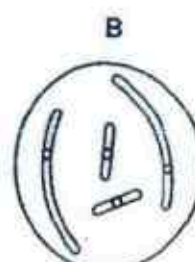
- I resulting amino acid sequence will change
- II transcription would cease
- III translation would cease
- IV the protein produced may be non-functional

Which of the above statement is correct?

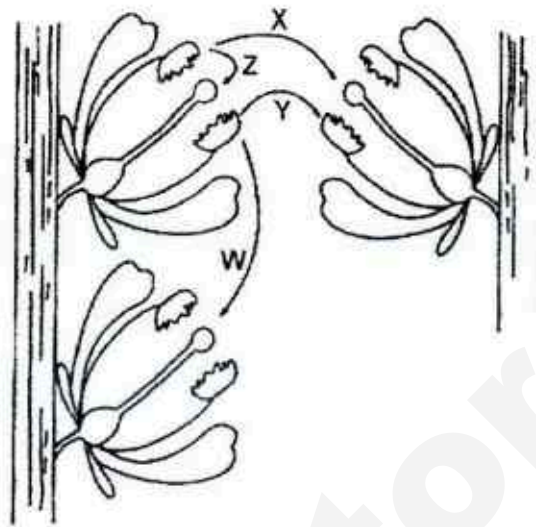
- A I and III
 - B I and IV
 - C II and III
 - D II and IV
- 30 The diagram shows a cell undergoing meiosis.



Which of the following cell correctly shows the resultant daughter cell produced at the end of meiosis?



- 31 The diagram shows two plants of the same species.

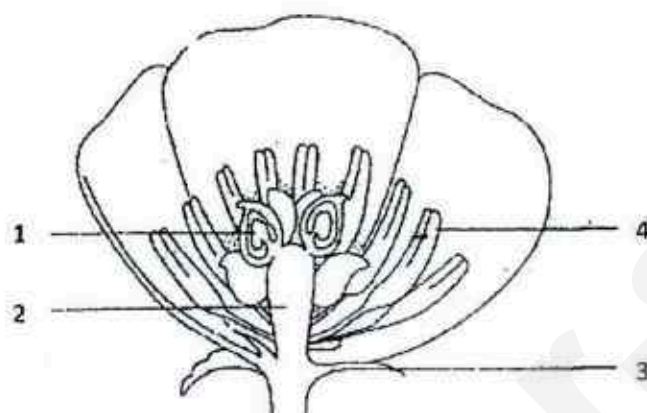


Which arrow(s) indicate(s) a pollination process that would

- I lead to sexual reproduction, and
 II greater adaptability of the plant species to changing environmental condition?

	I	II
A	X	X and Z
B	W, X and Z	W and X
C	W, X and Z	X
D	W, X, Y and Z	X and Z

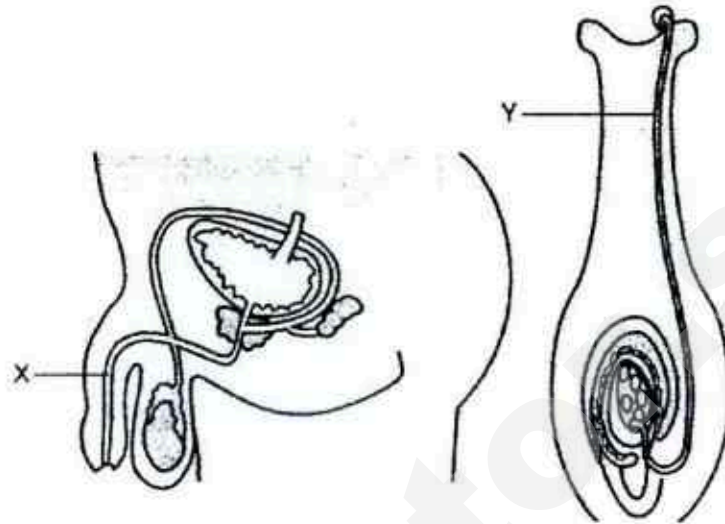
- 32 The diagram shows half of a flower.



Inside which numbered parts are gametes produced?

- A 1 and 2
- B 1 and 4
- C 2 and 3
- D 2 and 4

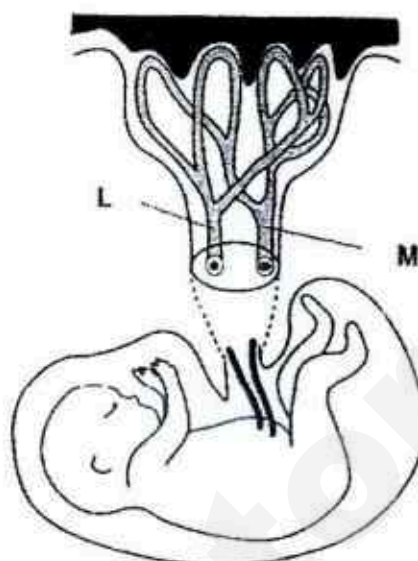
- 33 The following diagrams represent the reproductive systems of a human and a flowering plant.



What are the functions of the two tubes marked X and Y?

	X	Y
A	carries out fertilisation	carries out pollination
B	carries male gamete to female gamete	transfers gametes
C	carries male gamete to female gamete	carries out fertilisation
D	transfers gametes	carries out pollination

- 34 The diagram shows the placenta and its associated blood vessels.



Which of the following correctly describes the function of vessel L in relation to vessel M?

	urea	amino acids	oxygen
A	higher than M	lower than M	lower than M
B	lower than M	higher than M	higher than M
C	higher than M	higher than M	higher than M
D	lower than M	lower than M	lower than M

- 35 Which statement is evidence that genes are copied and passed on to the next generation?

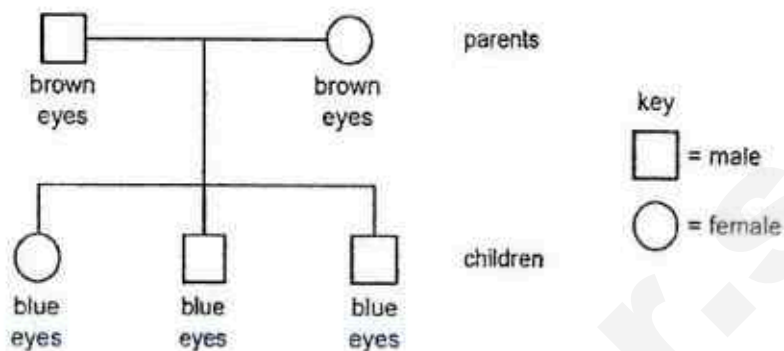
- A Asexual reproduction produces genetically identical offspring.
- B Different alleles of a gene can produce variation in phenotype.
- C Each species of a plant or animal has a fixed number of chromosomes.
- D Sexual reproduction produces genetically different offspring.

- 36 Which statement is correct?

- A Evolution is natural selection.
- B Evolution results in natural selection.
- C Natural selection and evolution are independent of each other.
- D Natural selection results in evolution.

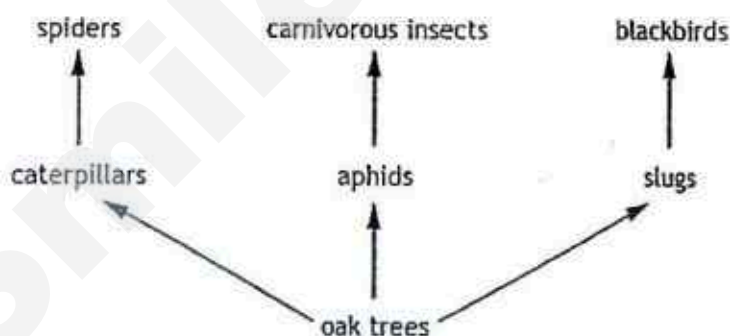
- 37 An example of monohybrid inheritance is a certain blue or brown eye colour.

The diagram shows the inheritance of this eye colour in a family.



What conclusions can be made from this diagram?

- A Blue eyes is controlled by a dominant allele.
 - B Both parents have dominant alleles for blue eyes.
 - C Both parents have dominant and recessive alleles.
 - D Brown eyes is controlled by a recessive allele.
- 38 The diagram shows part of a food web in an oak woodland.

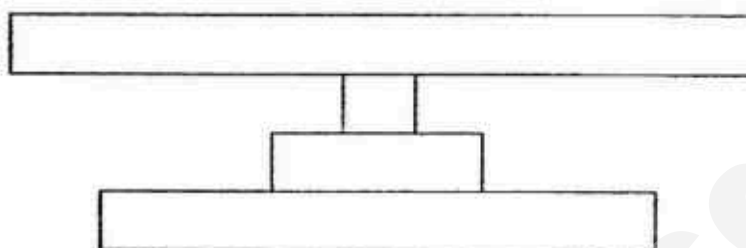


The use of insecticides in a nearby field resulted in the death of most aphids and caterpillars.

Which of the following identifies the effect on the numbers of slugs and carnivorous insects?

	Number of slugs	number of carnivorous insects
A	decreases	stays the same
B	deceases	increases
C	increases	decreases
D	increases	stays the same

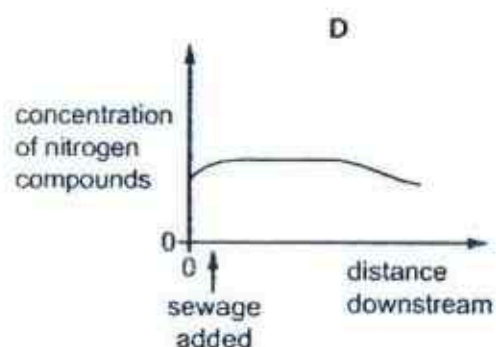
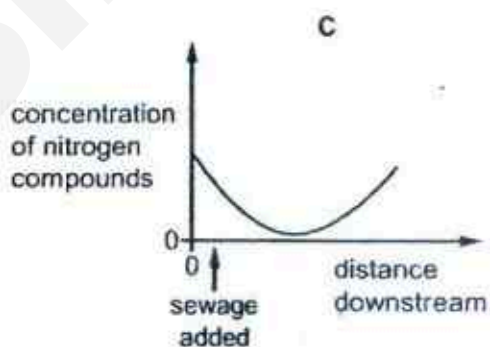
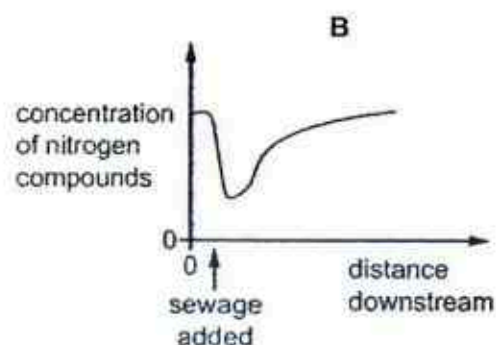
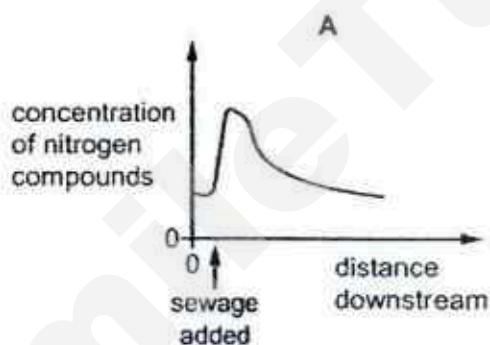
- 39 The diagram shows a pyramid of numbers.



Which food chain is represented by this pyramid of numbers?

- A grass → antelope → lion → flea
- B mahogany tree → caterpillar → finch → hawk
- C microscopic plants → microscopic animals → small fish → shark
- D pond plant → snail → large beetle → fish

- 40 Which graph shows changes that occur in a river after being polluted by sewage?



End of Paper

ANSWERS

1. C	2. D	3. C	4. B	5. B	6. A	7. C	8. B	9. A	10. B
11. C	12. D	13. D	14. A	15. D	16. A	17. A	18. D	19. A	20. D
21. B	22. D	23. A	24. B	25. D	26. B	27. A	28. D	29. B	30. D
31. C	32. B	33. B	34. A	35. A	36. D	37. C	38. C	39. A	40. A

MGS Sec 4 Prelim 2017

13. Water also a product of photosynthesis.

14. 0 to 4 days :

As mass of chlorophyll \uparrow , rate of photosynthesis \downarrow

21. B: absorption of water not a homeostatic response

23. Diabetic patient unable to produce/utilise insulin

31. Cross-pollination: transfer of pollen grains from anther to stigma of another plant.

34. L: artery; M: vein

37. Blue eyes not seen in parental generation

39. Fleas are much smaller than lions.

Section A

Answer all questions.

Write your answers in the spaces provided.

- 1 An investigation to find the effects of temperature on the activity of amylase was carried out.

5 water baths of different temperatures were prepared. In each water bath, 2 test tubes, one containing 10 cm³ of starch suspension and the other containing 2 cm³ of amylase solution were immersed for five minutes.

The amylase solution was then added to each of the test-tubes of starch suspension, A to E, at the same time to begin the reaction as shown in Fig. 1.1.

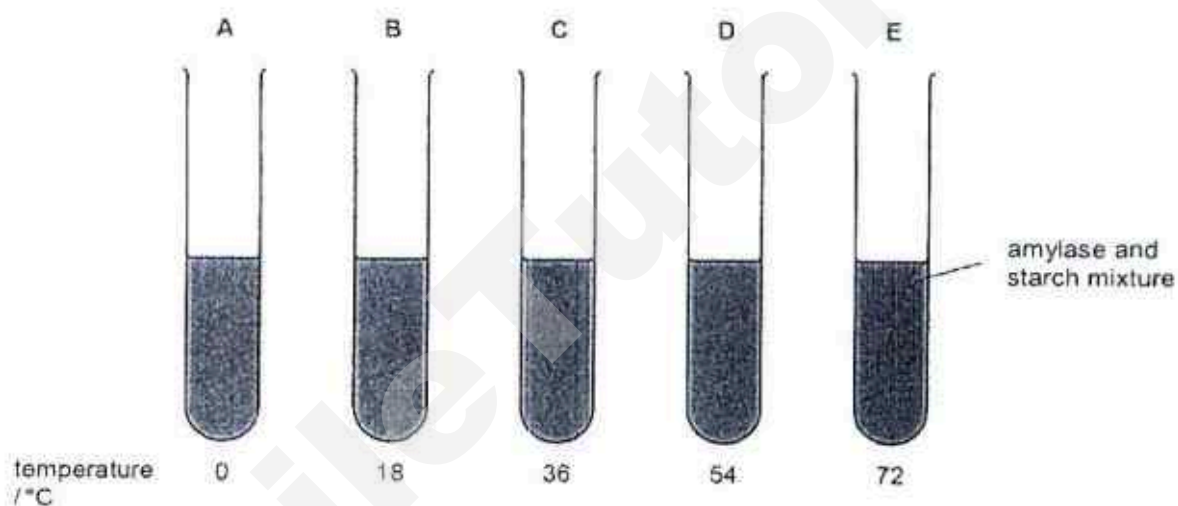


Fig. 1.1

At one minute intervals a drop of amylase and starch mixture was taken from each test-tube and added to a drop of iodine solution on a white tile. The results are shown in Table 1.1.

time / min	test-tube				
	A	B	C	D	E
1	●	●	●	●	●
2	●	●	●	●	●
3	●	●	○	●	●
4	●	●	○	○	●
5	●	○	○	○	●

key ● blue-black
○ brown

Table 1.1

- (a) Explain why the tubes were left for five minutes in their respective water baths before mixing amylase and starch.

[1]

- (b) Explain the results in test-tubes A and E.

[2]

- (c) In test tube B, C and D, the contents of the test tubes turned brown after some time. The results in Table 1.1 show that the brown colour did not appear at the same time.

Explain the results in test-tubes B, C and D.

[3]

- (d) At the beginning of the investigation the starch suspension was cloudy. After five minutes, the contents of test-tubes B, C and D were clear but the contents of test-tubes A and E were still cloudy.

Explain why the appearance of the contents of test-tubes B, C and D changed over the five minutes.

[3]

[Total: 9]

- 2 A contractile vacuole is a structure found in some unicellular organisms that periodically expands, filling with water, and then contracts, expelling its contents to the cell exterior.

In an experiment, a marine unicellular organism was placed in a series of dilutions of seawater. The output of its contractile vacuole and the changes in its body volume were measured and recorded. Fig. 2.1 shows the data collected during the experiment.

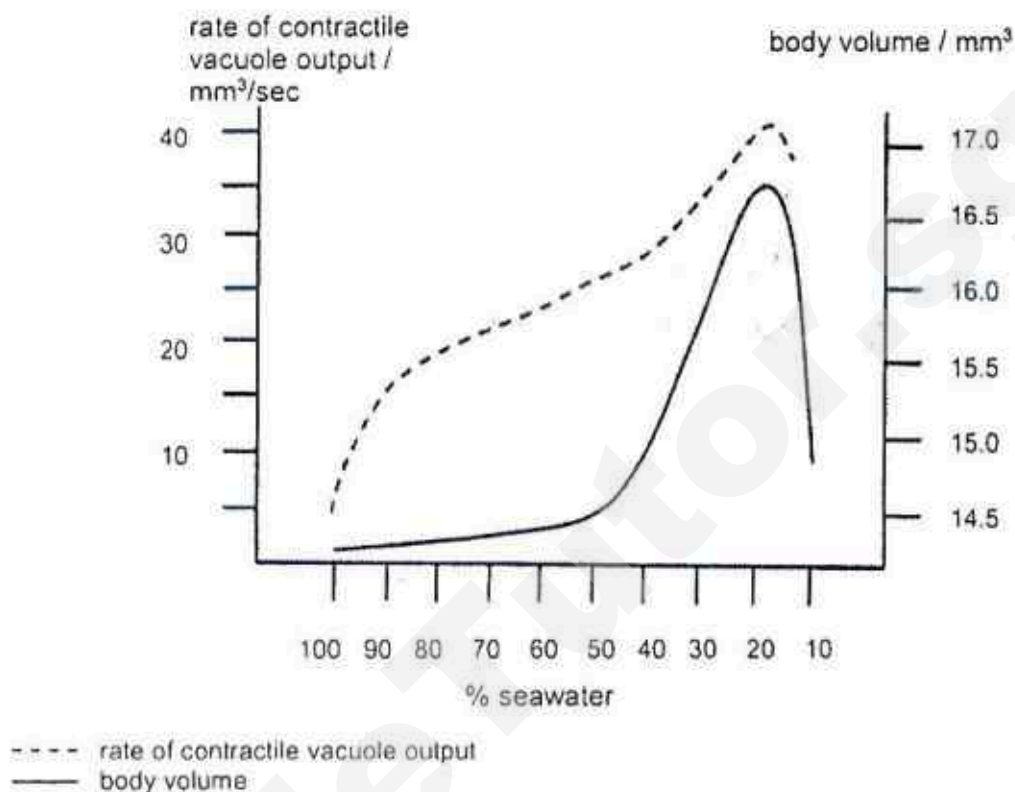


Fig. 2.1

- (a) Describe the relationship between % seawater and the rate of contractile output between 20% and 100% seawater.

Give a reason for the relationship.

.....

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.....

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[3]

- (b) Describe one other relationship observed in Fig. 2.1 from 20% to 100% seawater.

.....

.....

[1]

- (c) Suggest what has happened to the marine unicellular organism at 10% seawater.

Explain why this occurs.

.....

.....

..... [2]

[Total: 6]

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- 3 Table 3.1 shows blood flow through some regions of the body while at rest and during exercise.

region	rate of blood flow / cm^3/min	
	at rest	during exercise
kidneys	1 000	600
skin	550	1950

Table 3.1

- (a) Account for the change in blood flow observed in the

- (i) kidneys

.....

.....

.....

..... [2]

- (ii) skin

.....

.....

.....

..... [2]

- (b) Identify a region of the body, not shown in Table 3.1, which is likely to have the greatest increase in blood flow during exercise.

..... [1]

- (b) Briefly describe the nervous pathway involved in maintaining a constant body temperature when exercising.

.....

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.....

.....

[3]

[Total: 8]

- 4 (a) Fig. 4.1 shows the external structure of a heart.

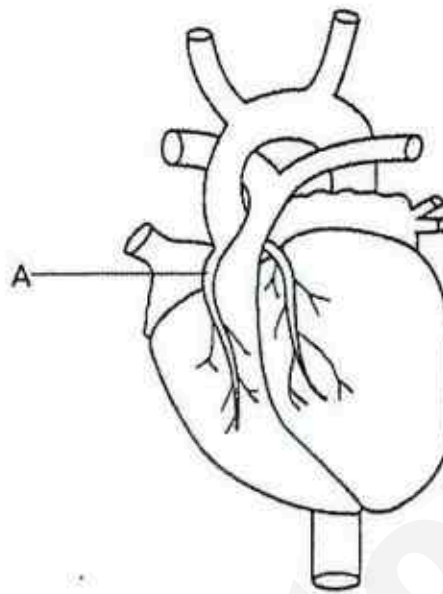


Fig. 4.1

- (i) Name structure A.

[1]

- (ii) In some people, structure A becomes blocked. It can be replaced with a vein from another part of the patient's body during an operation.

Explain why great care must be taken to ensure that the vein is sewn into place in the correct direction.

[2]

- (b) By making reference to the structures of the heart, explain how the heart ensures that blood flows in one direction.

.....

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.....

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.....

.....

[4]

[Total: 7]

5 The gene for the ABO blood group has three alleles, I^A , I^B and I^O .

(a) A person with blood group O has parents who have blood groups A and B.

Draw a genetic diagram to show how this is possible.

Use the symbols, I^A , I^B and I^O , for the blood group alleles.

[4]

(b) The same person marries someone with blood group AB.

Explain why is it not possible for the couple to have a child with blood group O.
(Genetic diagram not required.)

[2]

[Total: 6]

- 6 Fig. 6.1 shows a carpel after pollination has occurred.

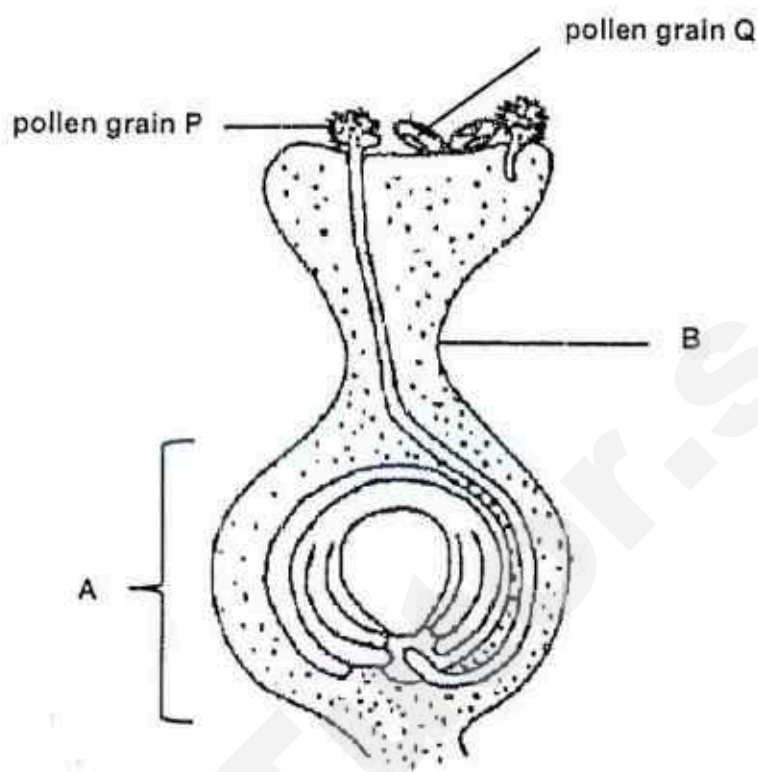


Fig. 6.1

- (a) (i) Name structures A and B.

A:

.....

B:

.....

[2]

- (ii) Place an "X" on Fig. 6.1 where a female gamete is found.

[1]

- (b) (i) Suggest how pollination is likely to have occurred in this flower.

Give one reason for your answer.

.....

 [2]

- (ii) Suggest why pollen grain Q did not germinate.

[1]

Fig. 6.2 is an enlarged view of the cross section through the carpel shown in Fig. 6.1, several days after fertilization had occurred.

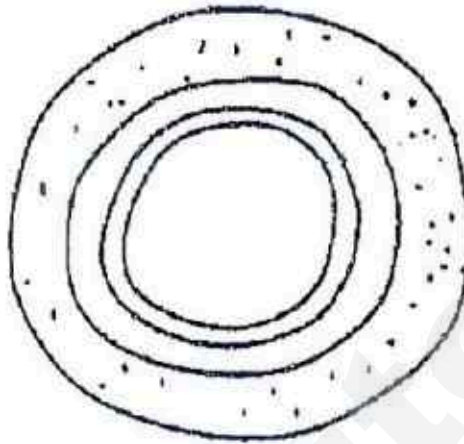


Fig. 6.2

- (c) Draw a line through the carpel in Fig. 6.1 to show the region through which the section shown in Fig. 6.2 was taken. [1]

[Total: 7]

- 7 Some integrated farming systems involve making best use of all available resources without the use of large inputs of energy in the form of fossil fuels.

When growing crops in a low-lying area, a wall may be built to prevent the sea or river or pond from covering that area. This wall is called a dyke.

A study looked at what happened to light energy that was the major energy input to farms in the Zhujiang delta in China. The farms are based on a dyke-pond system as shown in Fig. 7.1.

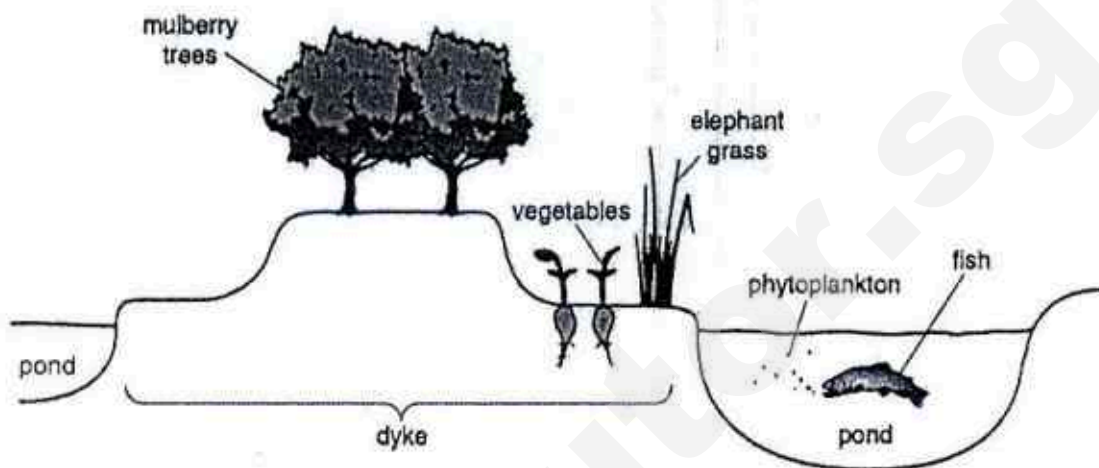


Fig. 7.1

Elephant grass, vegetables and mulberry trees are grown on the dykes in between the ponds. The elephant grass is grown and then cut to feed the fish. Vegetables and fish are used for human consumption. Silkworms feed on the mulberry trees. Phytoplankton are the main producers in the pond and are eaten by the fish.

- (a) Explain the meaning of the term *producer*.

[2]

- (b) Use the information provided in the paragraph above and in Fig. 7.1 to complete a food web for the farm. Some of the producers have been drawn for you. [2]

mulberry trees

vegetables

phytoplankton
in the pond

- (c) In the study, the researchers discovered that the vegetables absorbed 1560 MJ/m^2 per year of light energy. The energy which was transferred from the vegetables to humans was 3 MJ/m^2 per year.

Explain what happens to the energy that is absorbed by the vegetables but is not transferred to humans.

.....

.....

.....

..... [2]

- (d) A farmer may include ponds stocked with fish in an integrated farming system. Suggest an advantage of this practice.

.....

..... [1]

[Total: 8]

Section B

Answer three questions

Question 10 is in the form of an Either/Or question. Only one part should be answered.

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- 8 In an investigation, transpiration in leaves of geranium and ivy plants (2 different species of plants) was observed. Geranium and ivy leaves were removed from well-watered plants and treated in a variety of ways summarized in Table 8.1.

experiment	treatment of leaves	illumination	mean loss in mass of 10 leaves in each treatment / mg/mm ² of leaf surface	
			geranium	ivy
1	none	light	5.7	11.2
2	none	dark	0.8	0.4
3	upper surface of leaf coated with Vaseline	light	3.5	11.0
4	lower surface of leaf coated with Vaseline	light	1.8	0.1

Table 8.1

10 leaves were used in each experiment. The 10 leaves were weighed before each treatment and again 24 hours after treatment. The humidity was maintained at 50% throughout the investigation.

- (a) State the measurements that must be made before the mean loss in mass for each treatment can be calculated.

[2]

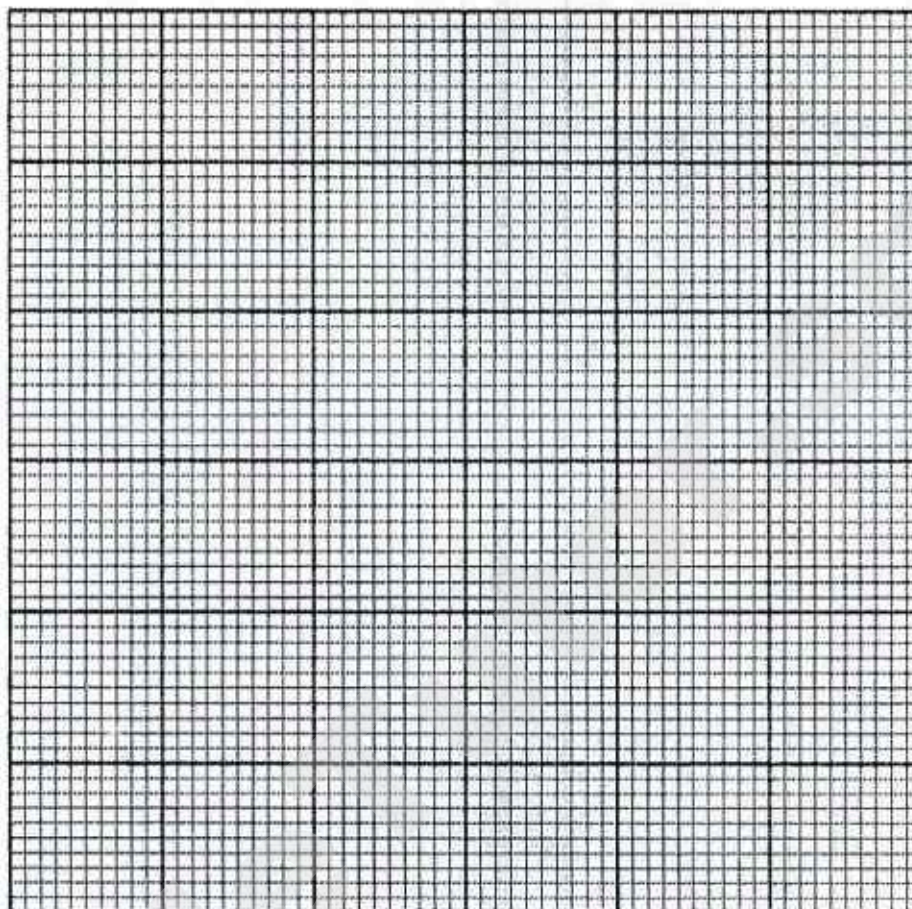
- (b) (i) State a conclusion that can be made based on the results of experiment 1 and 2.

[1]

- (ii) Explain your answer in (b)(i).

[3]

- (c) Draw a bar graph of the mean loss in mass of 10 leaves for the 2 species of plants for experiments 3 and 4 in the grid provided.



[3]

- (d) Assuming that both species of plants have the same distribution of stomata on leaf surfaces, describe the difference between the waxy cuticles of the leaves of the 2 species of plants by referring to the differences in the mean loss in mass of 10 leaves.

Explain your answer with reference to information from Table 8.1.

.....

.....

.....

[2]

[Total: 11 m]

- 9 (a) Fig. 9.1 shows the thickness of the endometrium in one menstrual cycle.

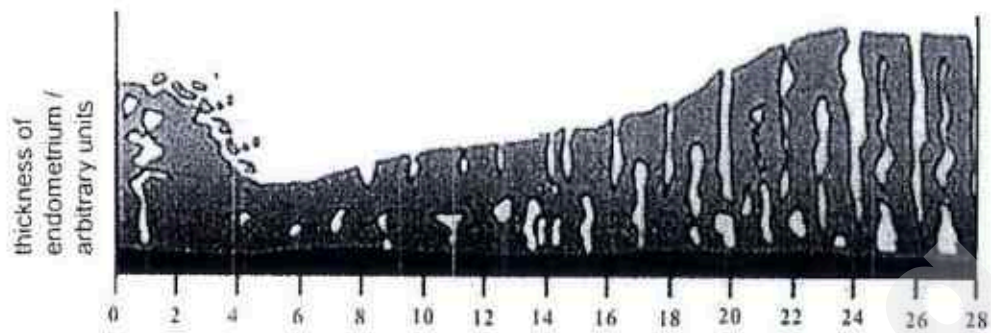


Fig. 9.1

Describe the effect of the concentration of progesterone on the thickness of the endometrium between day 18 and 28.

.....

.....

.....

.....

.....

.....

[3]

- (b) Some birth control pills are a synthetic form of progesterone.

Suggest and explain how birth control pill prevent pregnancy.

.....

.....

.....

[2]

(c) Describe how a fully-formed fetus in the uterus develops after fertilisation.

.....

.....

.....

.....

.....

.....

[4]

[Total: 9]

10 Either

Some muscles in our body work as antagonistic pairs to create movement. In these pairs of muscles, when one muscle contracts, the other muscle relaxes.

With reference to named muscles, describe how antagonistic pairs of muscles bring about the following:

- (a) moving of food bolus in the oesophagus after ingestion of food

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.....

.....

.....

.....

[4]

- (b) limiting the amount of light entering the eye in a brightly lit environment

.....

.....

[2]

- (c) breathing in air from the atmosphere into our lungs

.....

.....

.....

.....

[4]

[Total: 10]

10 Or

Specialized exchange surfaces allow the efficient transfer of substances across them via mechanisms such as diffusion or active transport. To maximise the efficiency of the transfer of substances, these exchange surfaces have the following adaptations:

- increase surface area to volume ratio
- thin barrier
- steep concentration gradient to the substances

With reference to two named examples of mammalian exchange surfaces, describe how these adaptations supports the transfer of named substances across the surfaces.

(a) Example 1: _____

.....

.....

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.....

.....

[5]

[5]

END OF PAPER

Marking Scheme

1(a)	to allow time to reach stated temperature / equilibration	[1]
(b)	A 0 °C enzyme amylase is inactive due to low temperature; E 72 °C enzyme amylase is denatured ;	[2]
(c)	B 18 °C (negative for starch at) 5 minutes: enzyme works slowest (of these 3); C 36 °C (negative for starch at) 3 minutes: optimum temperature; D 54 °C (negative for starch at) 4 minutes: enzyme works slower (than at 36°C);	[3]
(d)	<ul style="list-style-type: none"> When starch is present and the contents appear cloudy as starch is insoluble / forms suspension; When large starch molecules are digested / broken down by amylase; they become simpler / soluble products i.e. maltose; 	[3]
		Total:9

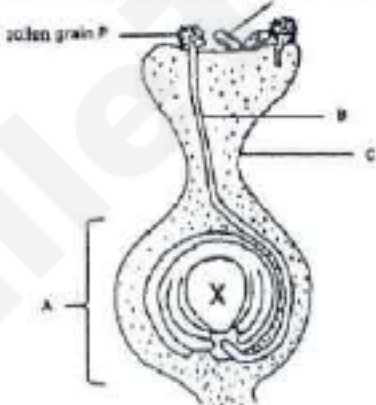
2(a)	<ul style="list-style-type: none"> The lower the % seawater, the greater the rate of contractile vacuole output/ the more water is expelled by the contractile vacuole. Lower % seawater has higher water potential than the cytoplasm , water moves into the cell by osmosis Contractile vacuoles expels water to prevent overexpansion/ cell from bursting. 	[3]
(b)	The lower the seawater %, the larger the body volume	[1]
(c)	The cell has burst The contractile vacuole is ineffective in expelling water (at % lower than 20% seawater.	[2]

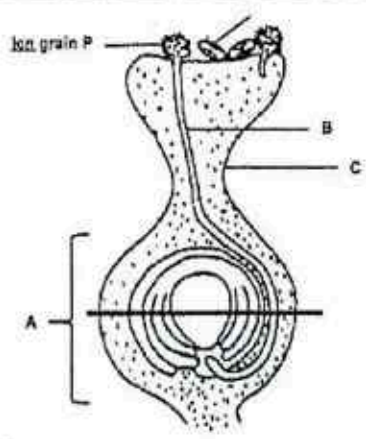
3(a) (i)	<ul style="list-style-type: none"> During exercise, increase in body temperature leads to increased sweating Less blood volume flowing to kidney, reduces volume of urine formed 	[2]
(ii)	<ul style="list-style-type: none"> During exercise, body temperature increases because of heat released in increase in respiration Increased blood flow to skin allows more heat to be brought to surface of skin to be lost through convection, conduction and radiation from the skin. OR Allows increase in secretion of sweat in the sweat gland to increase heat loss through evaporation of water. 	[2]
(b)	<ul style="list-style-type: none"> Receptors in skin detect high/warm temperature Nerve impulse sent to brain Brain sends message/ impulse to of arterioles in skin to cause arterioles to dilate OR Sweat glands to increase secretion of sweat 	[3]
(c)	muscles (skeletal)	[1]

4(a)	<ul style="list-style-type: none"> Walls /muscles of heart chambers contract cause pressure in chamber to increase. Pressure forces valves to open and allow them to flow through from atria to ventricle and from ventricle to arteries. 	[4]
------	---	-----

	<ul style="list-style-type: none"> When walls of heart chamber relax, pressure drops Valves will close to prevent backflow of blood 	
(b)(i)	<ul style="list-style-type: none"> Coronary artery 	[1]
(ii)	<ul style="list-style-type: none"> Veins contain <u>semi lunar valves</u> If vein inserted in wrong direction, <u>valve will close</u> and blood cannot flow along the inserted vein (opp argument accepted) 	[2]

5(a)	Correct parental genotypes: $I^A I^O \times I^B I^O$; Correct gametes (must be circled); Correct offspring genotype $I^A I^B \times I^B I^O$, $I^A I^O \times I^O I^O$ Correct phenotype and phenotypic ratio;	[4]
(b)	<ul style="list-style-type: none"> Genotype of person with Blood group AB is $I^A I^B$ Not possible for child to have blood group O since cannot get an I^O allele from parent with blood group AB 	[2]

6ai	A: ovary [1] B: Style	[2]
6aii		[1]
6bi	Insect pollination [1] Pollen grain Q which has successfully germinated has rough surfaces [1]. R: Stigma is compact	[2]
6bii	The pollen grain belongs to a wind pollinated flower/ Pollen grain is from plant of different species to that of Pollen grain Q [1]	[1]

6c	 <p>1 mark</p>	[1]
----	---	-----

7(a)	organism that makes its own organic nutrients / food ; using energy from the Sun / by photosynthesis ;	[2]
(b)	elephant grass added (at the producer level) ; phytoplankton and elephant grass arrows go to fish ; mulberry trees arrow goes to silkworms ; vegetables and fish arrows go to humans ;	[2]
(c)	Any 2 <ul style="list-style-type: none"> not all of the plants are edible / some not digested faeces / egestion dead leaves / AW, to decomposers plants lose heat energy as a result of respiration (essential marking pt) 	Max [2]
(d)	Any 1 <ul style="list-style-type: none"> (another) source of income provides source of, protein / vitamins feed on waste materials / elephant grass cuttings / phytoplankton (from the dykes) so do not need feed bought in / no waste removal required reduced risk of eutrophication / biological control 	[1]

Section B

8(a)	<ul style="list-style-type: none"> Initial mass of leaves and Final mass of leaves OR change in mass of leaves Surface area of leaves 	[2]
(b)(i)	<ul style="list-style-type: none"> There is a lower rate of transpiration/ water loss/mean loss of mass of leaves in the dark than in the light 	[1]

(b)(ii)	<ul style="list-style-type: none"> Transpiration /water loss occurs mainly through the <u>stomata</u> In the dark, <u>guard cells do not photosynthesise</u> K⁺ ions are lost, <u>water leaves the cells</u> and the cells are <u>flaccid</u> and <u>stomata are closed</u> and thus <u>less water vapour diffused</u> through stomata 	[3]
(c)	<ul style="list-style-type: none"> Axes labelled with units and suitable scale Correct values for each bar plotted Bar graph plotted – must have gap between each bar. 	[3]
(d)	<ul style="list-style-type: none"> The waxy cuticle of the germanium leaves is thicker than the ivy With ref to exp 1, there is less loss in mass/ transpiration in germanium than ivy. 	[2]

9a	<p>There is an increased in progesterone level [1].</p> <p>Progesterone stimulates the endometrium lining to further thicken and become supplied with blood vessels [1].</p> <p>This is to prepare the uterine lining for implantation of embryo [1]</p>	[3]
9b	<p>Progesterone in the pill inhibit ovulation [1]</p> <p>Without a mature ovum released from the ovary into the oviduct, fertilization by a sperm is not possible [1]</p>	[2]
9c	<ul style="list-style-type: none"> Fertilization of sperm and ovum nucleus forms a zygote [1] in fallopian tube Zygote divides mitotically to form a ball of cells/blastocyst/embryo [1] Upon arriving at uterus, embryo forms finger-like projections and embed these projections into the endometrium. This is call implantation. [1] Embryo stays implanted in the endometrium and obtain nutrients and oxygen from mother and develop in a foetus [1] 	[4]

10Ea	<p>Circular muscle contracts + longitudinal muscle relaxes – oesophagus constricts [1]</p> <p>Circular muscle relaxes + longitudinal muscle contracts– oesophagus widen [1]</p> <p>Squeezes and pushes the bolus along [1] by peristalsis [1]</p>	[4]
10Eb	<p>Circular muscles contract + radial muscle relaxes [1]</p> <p>Pupil becomes smaller [1]</p>	[2]
10Ec	<p>Internal intercostal muscles relax + external intercostal muscle contract [1]</p> <p>Raised the ribcage upwards and outwards [1]</p> <p>Together with the help of a lowered diaphragm [1]</p> <p>Volume in chest cavity increases + pressure lower than atmosphere [1]</p>	[4]

10Oa and	<p><u>Any two of the three [for substances must mentioned minimum the names of 2]-</u></p> <p>Example: Placenta [1]</p>
-------------	---

10Ob	<ul style="list-style-type: none"> Embryonic villi grows into the uterine lining which contains numerous blood capillaries + The fast and continuous blood flow in the capillaries [1] ensures a steep concentration gradient for diffusion of substances such as oxygen, carbon dioxide, glucose, amino acids, urea at the exchange surface [1] Embryonic villi increases the surface area to volume ratio for diffusion of the above mentioned substances [1] In placenta, blood capillaries of fetus are separated from mother's blood system by only a thin layer of tissue [1] <p>Example: Small intestines/Ileum[1]</p> <ul style="list-style-type: none"> Inner walls have finger-like projections called Villi that increases surface area to volume ratio /and microvilli that further increases the surface area to volume ratio for absorption of substances [1] The Villi has thin wall or membrane or one cell thick epithelium [1] In each villus, there is blood capillaries and lymphatic capillaries +The fast and continuous flow of blood and lymph flow in the capillaries [1] ensures a steep concentration gradient for diffusion of transport digested food such as glucose, amino acids [blood capillaries], fats [lymphatic capillaries] [1] <p>Example: Lungs[1]</p> <ul style="list-style-type: none"> Numerous alveoli [1] increases surface area to volume ratio for diffusion of gases Wall of alveolus is one cell thick – provides shorter diffusion path for gases hence faster diffusion [1] The walls of the alveoli are richly supplied with blood capillaries + The fast and continuous flow of blood [1] maintained a steep concentration of gases such as carbon dioxide and oxygen [1] <p>Max 5 marks per example</p>
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Name: Register no: Class:



NGEE ANN SECONDARY SCHOOL

E

PRELIMINARY EXAMINATION

BIOLOGY

5158/1

Paper 1

1 hour

Additional Materials: Optical Answer Sheet (OAS)

Instructions to Candidates

Write your name, index number and class at the top of this page.

Write in dark blue or black ink.

The use of an approved scientific calculator is expected, where appropriate.

There are 40 Multiple Choice Questions. Answer **all** questions.

For each question, there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the OAS provided.

Hand in the question paper and OAS separately.

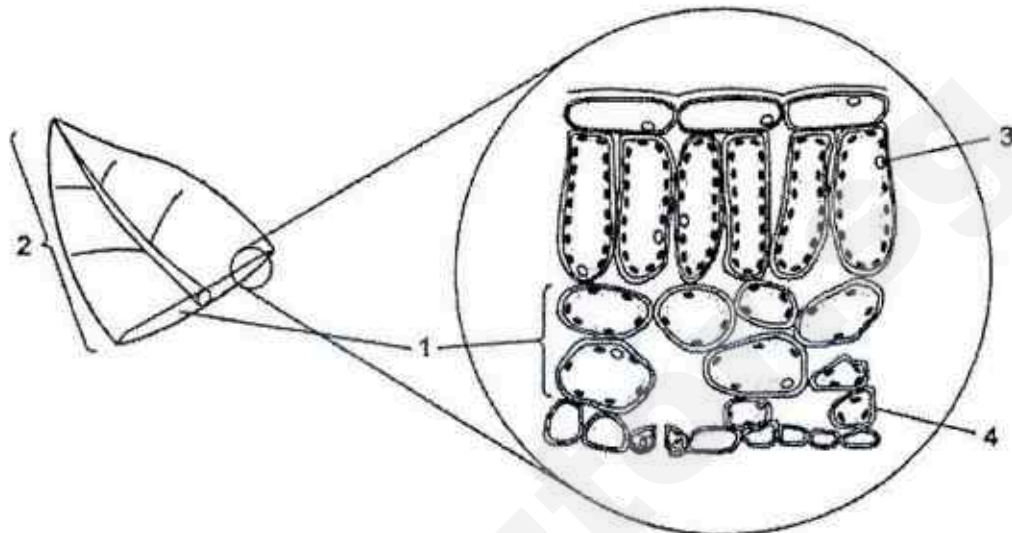
The total number of marks for this paper is 40.

This document consists of 20 printed pages and 0 blank page.

Multiple Choice Questions [40 marks]

Choose the most appropriate option and shade your choice in the OAS provided.

- 1 The diagram shows the structure of a leaf.



Which labelled part identifies a cell, a tissue and an organ?

	cell	tissue	organ
A	3	2	4
B	1	4	3
C	4	1	2
D	2	3	1

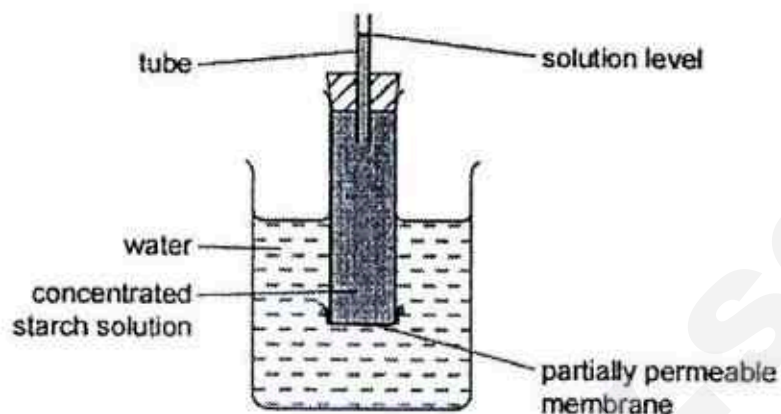
- 2 When mucus is secreted from a goblet cell in the trachea, these events take place.

- 1 addition of carbohydrate to protein
- 2 fusion of the vesicle with the plasma membrane
- 3 secretion of a glycoprotein
- 4 separation of a vesicle from the Golgi apparatus

What is the sequence in which these events take place?

- A** 1 → 4 → 2 → 3
- B** 1 → 4 → 3 → 2
- C** 4 → 1 → 2 → 3
- D** 4 → 1 → 3 → 2

- 3 The diagram shows an experimental set-up used to investigate osmosis.



Which molecules will move across the partially permeable membrane and which change will occur in the solution level?

	molecules	solution level
A	starch	fall
B	starch	rise
C	water	fall
D	water	rise

- 4 Some processes which occur in flowering plants are listed.

- 1 ion uptake by roots hairs
- 2 water uptake by root hairs
- 3 ion movement up the xylem in the stem
- 4 water vapour loss by the mesophyll cells of the leaves

Which processes are controlled by cell surface membranes?

- A 1 only
 B 1 and 2
 C 2 only
 D 2, 3 and 4

- 5 Single-celled animals that live in fresh water have a vacuole that contracts regularly to remove excess water. Single-celled plants that live in fresh water do not have a similar vacuole.

Which statement best explains why these animals need this vacuole but plants do not?

- A Plant cell cytoplasm and animal cell cytoplasm both have a lower water potential than fresh water.
- B Plant cell sap has the same water potential as fresh water, animal cytoplasm has a lower water potential than fresh water.
- C Plant cell walls are impermeable to water, animal cell surface membranes are permeable to water.
- D Plant cell walls restrict the entry of water, animal cell membranes allow the entry of water.
- 6 Two solutions, 1 and 2, one containing starch and sucrose, and the other containing glucose and protein, were tested with a variety of reagents to confirm their identity.

The table shows the conclusions from the results recorded for the various tests. Which row identifies the two solutions?

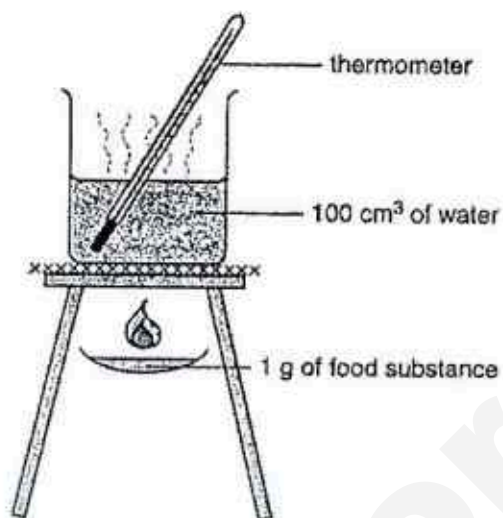
	add iodine solution		boil with Benedict's solution		boil with Benedict's solution after acid hydrolysis		add biuret solution	
	1	2	1	2	1	2	1	2
A	+	-	+	-	-	+	-	+
B	-	+	+	-	+	-	-	+
C	+	-	-	+	+	-	-	+
D	-	+	+	-	+	+	+	-

key

+ = biological molecule present

- = biological molecule absent

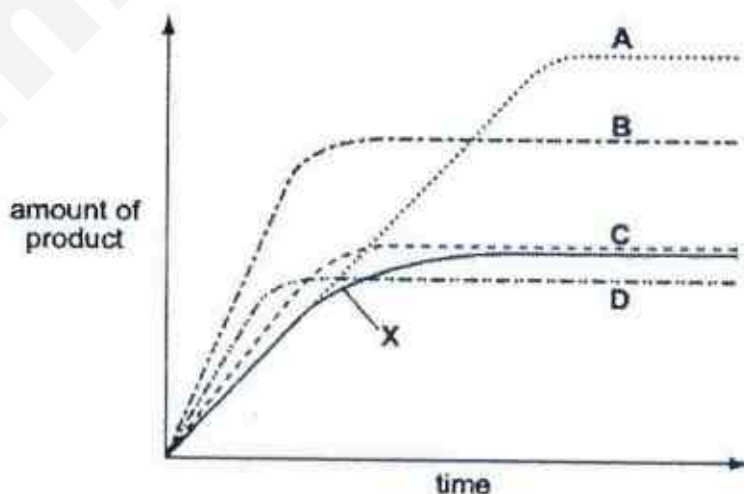
- 7 The apparatus shown can be used to compare the energy values of various food substances.



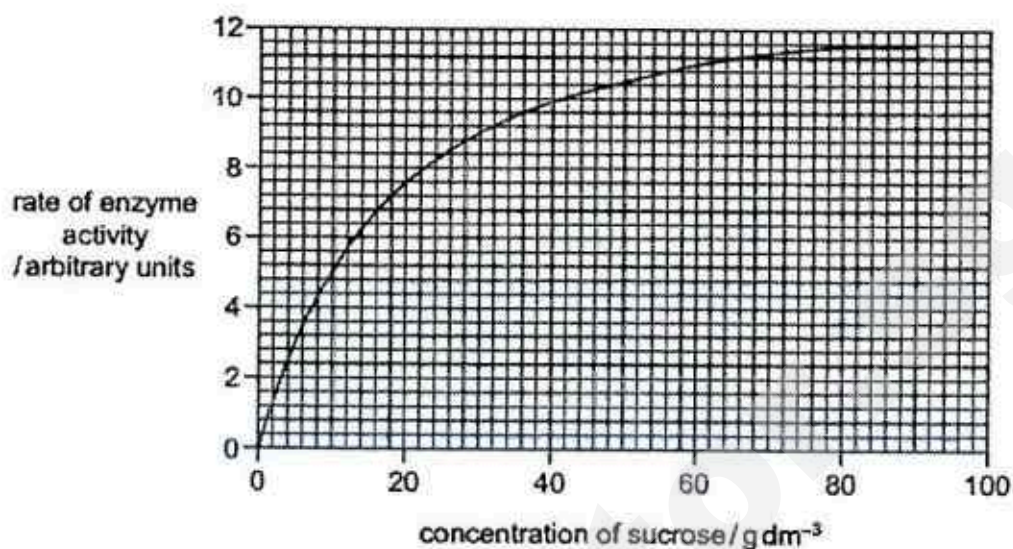
Which food substance would give the greatest rise in the temperature of water if 1 g of it were burnt?

- | | | | |
|---|-------------|---|--------|
| A | beef | B | butter |
| C | cooked rice | D | potato |
- 8 The curve X shows the activity of an enzyme at 20 °C. Curves A, B, C and D show the effect of different conditions on the activity of the enzyme.

Which curve shows the effect of increasing the temperature by 10°C and adding extra substrate?



- 9 The graph shows the rate of activity of the enzyme sucrase plotted against the concentration of sucrose.



Why does the rate of enzyme activity remain constant from 80–90 g dm⁻³?

- A All the enzyme has been inhibited.
 - B All the substrate has been used up.
 - C The concentration of the enzyme is limiting the rate.
 - D The concentration of the substrate is limiting the rate.
- 10 Which processes take place in the mouth (buccal) cavity?

	chemical digestion	mechanical digestion	dissolving of nutrients
A	✓	✓	✓
B	✓	✓	x
C	✓	x	✓
D	x	✓	✓

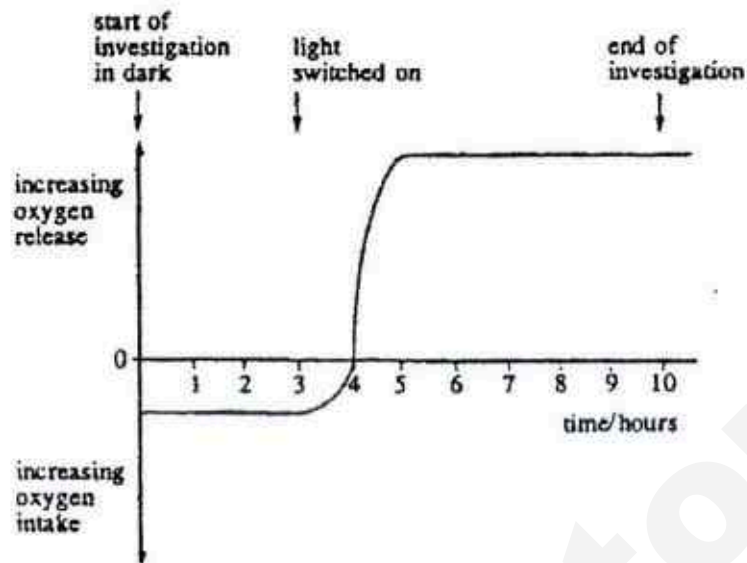
- 11 Which features make a villus well adapted for absorbing amino acids from the ileum?
- A large surface area, thin walls, lacteal
 - B large surface area : volume ratio, good blood supply, thin walls
 - C small surface area, good blood supply, lacteal
 - D small surface area : volume ratio, good blood supply, thin walls
- 12 The table shows the results of an investigation of the absorption of products of digestion in the presence and absence of oxygen.

product of digestion	absorption in the presence of oxygen / arbitrary units	absorption in the absence of oxygen / arbitrary units
amino acids	5.3	1.7
fatty acids	1.9	2.0
glucose	6.4	2.3
glycerol	4.8	4.7

Which conclusion can be drawn from these results?

- A All products of digestion are absorbed by both active transport and diffusion.
- B All products of digestion are absorbed by diffusion only.
- C Amino acids and glucose are absorbed by active transport only.
- D Fatty acids and glycerol are absorbed mainly by diffusion.

- 13 The graph shows the result of an investigation into oxygen release and oxygen intake by a green plant in different light conditions.



For how many hours did respiration and photosynthesis take place during the investigation?

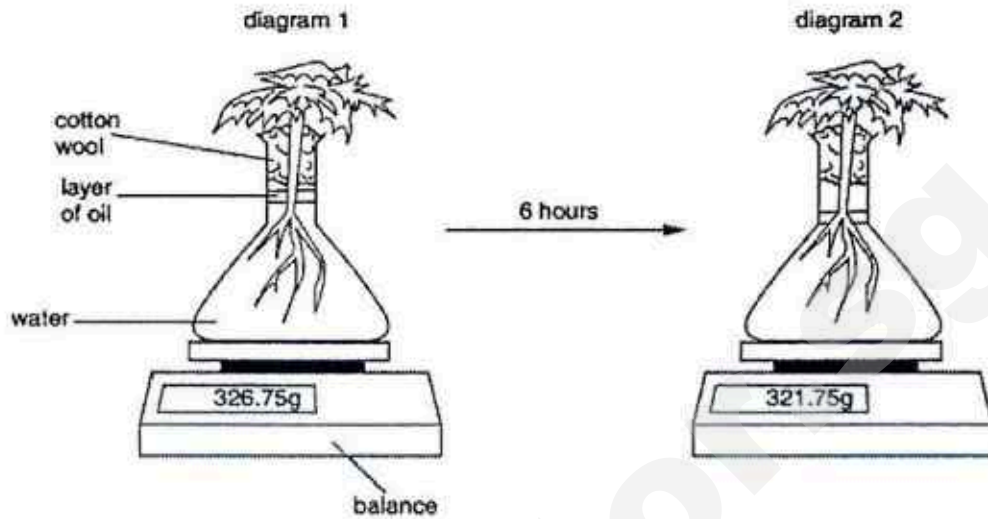
	Respiration hours	Photosynthesis hours
A	3	5
B	3	6
C	4	7
D	10	7

- 14 For which processes do plants need either nitrate ions or magnesium ions?

	synthesis of cellulose	synthesis of chlorophyll	synthesis of proteins
A	✓	✓	✓
B	✓	✓	x
C	✓	x	x
D	x	✓	✓

key
 ✓ needed
 x not needed

- 15 The diagrams show a plant in a flask of water. It is left for six hours on a warm and windy day in bright sunshine.

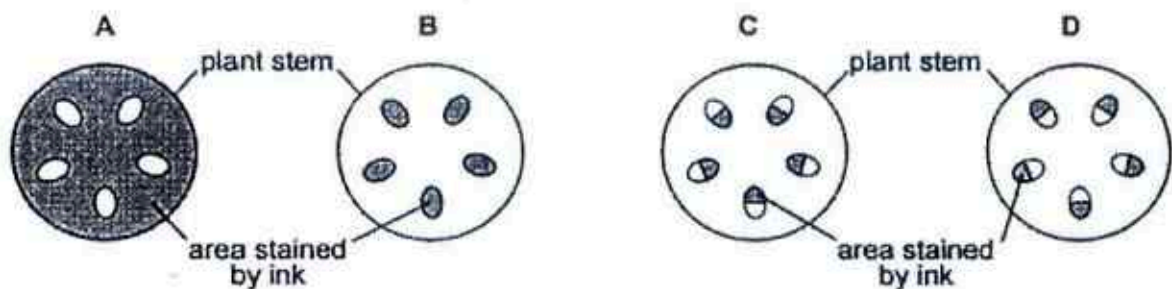


Which process explains the result shown in diagram 2?

- A active transport of water into the root hairs
 - B evaporation of water from the flask
 - C photosynthesis in the leaves of the plant
 - D transpiration from the leaves of the plant
- 16 A plant shoot is left in ink solution for several hours.



A section is cut through the stem. What would you see?

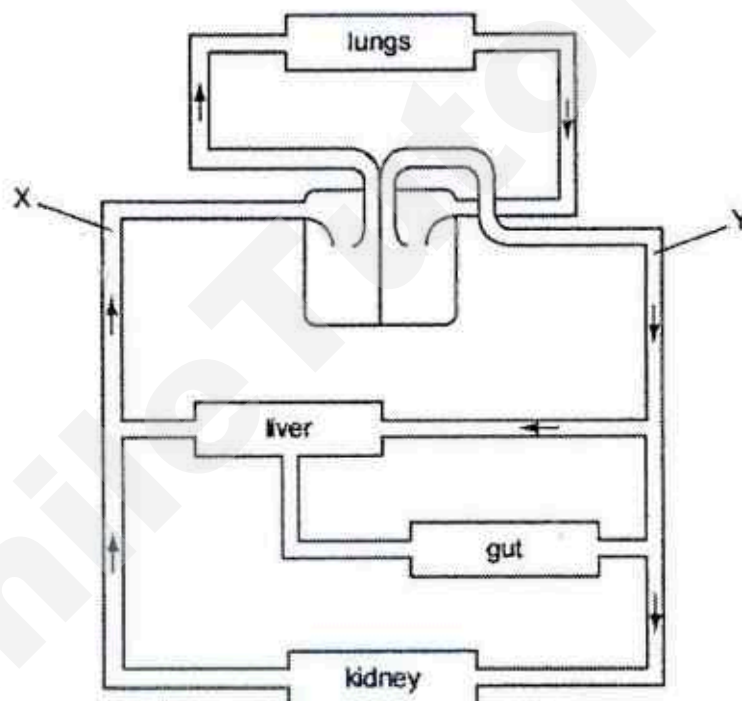


- 17 A young plant may wilt when dug up and re-planted in another place.

What causes this?

- A The leaves lose less water.
- B The roots cannot take up mineral salts.
- C The stem cannot transport water.
- D The surface area of the root is reduced.

- 18 The diagram shows a plan of part of the circulatory system.



Which vessel must the blood pass through in flowing from X to Y?

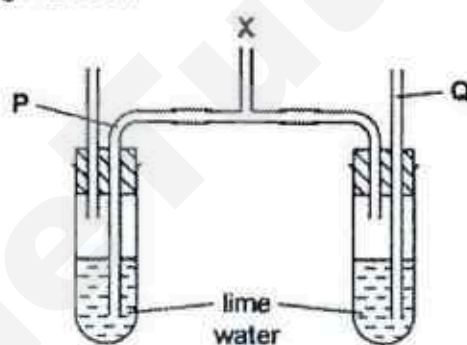
- A hepatic artery
- B hepatic portal vein
- C pulmonary artery
- D renal vein

- 19 The table shows the blood groups of four people and the type of blood each received in a transfusion

	Blood group under ABO system	Blood type received in transfusion
K	A	A
L	B	AB
M	AB	O
N	O	B

Which two people are at risk of agglutination?

- A K and L
B K and M
C L and N
D M and N
- 20 The diagram shows apparatus used to investigate inspired and expired air. A person breathes in and out through tube X.



What are the carbon dioxide concentrations at P and Q?

	CO ₂ at P (%)	CO ₂ at Q (%)
A	16	20
B	0.04	4.00
C	4.00	0.04
D	20	16

21 Which word equation shows anaerobic respiration in yeast?

- A glucose \rightarrow ethanol
- B glucose \rightarrow ethanol + carbon dioxide
- C glucose \rightarrow lactic acid
- D glucose \rightarrow lactic acid + carbon dioxide

22 Some of the structures in the excretory system are listed.

- 1 bladder
- 2 ureter
- 3 urethra

In which order does a molecule of urea pass through these structures?

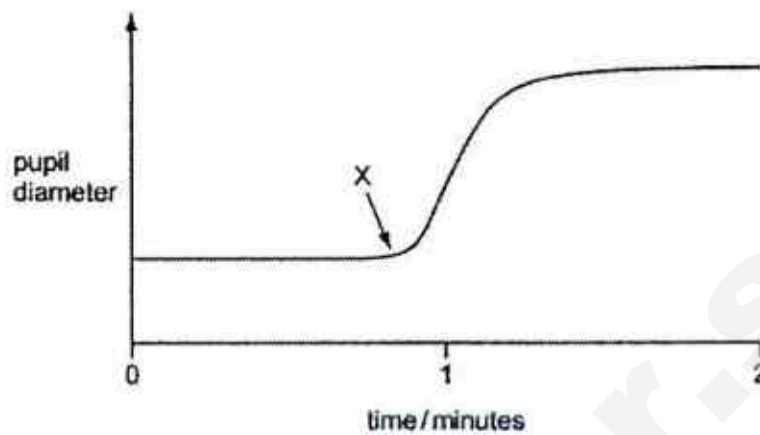
First \longrightarrow Last

- A 1 2 3
- B 1 3 2
- C 2 1 3
- D 3 1 2

23 What are characteristics of all neurones?

	carry information within the brain	stimulate muscles or glands	transmit electrical impulses
A	✓	✓	x
B	✓	x	✓
C	x	✓	x
D	x	x	✓

- 24 The graph shows how the diameter of the pupil of a person's eye changed during the course of two minutes.



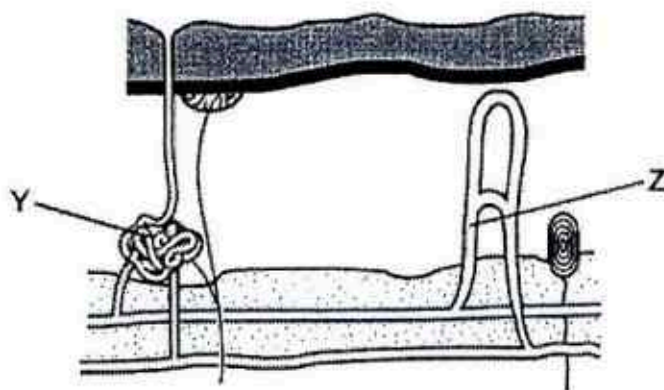
What happens to the light intensity at X and which muscles begin to contract?

	light intensity	iris muscles contracting
A	decreases	circular
B	decreases	radial
C	increases	circular
D	increases	radial

- 25 What are the cause, signs and symptoms and treatment for diabetes mellitus?

	cause	signs and symptoms	treatment
A	damaged pancreas cells	excess sugar in blood	adrenaline injections
B	damaged pancreas cells	sugar in urine	insulin injections
C	sugar in urine	damaged pancreas cells	insulin injections
D	sugar in urine	damaged pancreas cells	adrenaline injections

- 26 The diagram shows some of the structures in human skin.



Which labels describe the structures Y and Z in hot conditions?

	Y	Z
A	active	constricted
B	active	dilated
C	inactive	constricted
D	inactive	dilated

- 27 The main function of a flower is to _____.

- A attract insects for pollination
- B ensure genetic variation
- C produce fruits and seeds
- D protect the fruit

- 28 A male gamete leaves the pollen tube immediately after the pollen tube has entered which structure?

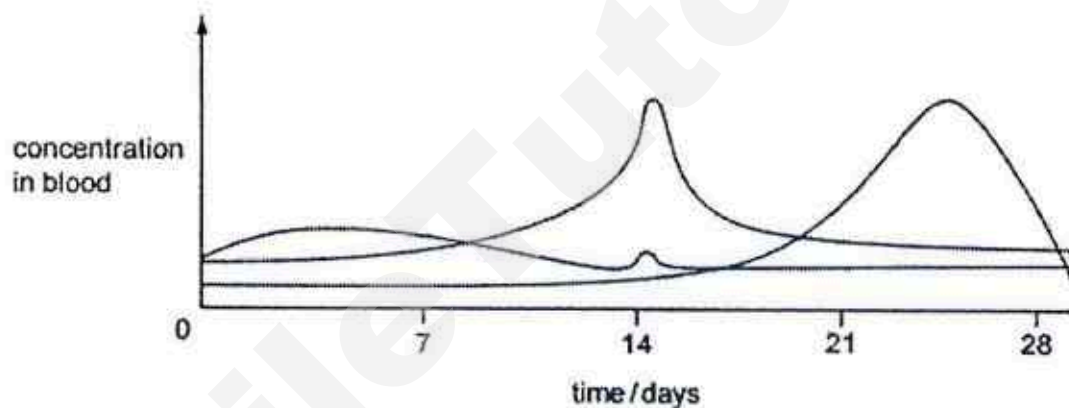
- A ovary
- B ovule
- C stigma
- D style

- 29 An insect carries pollen from one flower to another flower on the same plant.

What is the type of reproduction and what is the type of pollination in this plant?

	reproduction	type of pollination
A	asexual	cross-pollination
B	asexual	self-pollination
C	sexual	cross-pollination
D	sexual	self-pollination

- 30 The graph shows the concentration in the blood of three of the four hormones FSH, LH, oestrogen and progesterone.



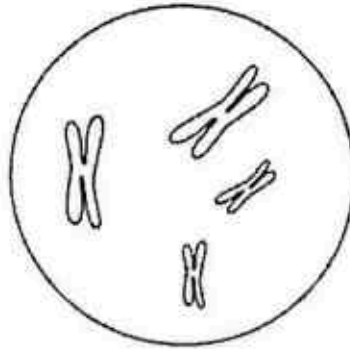
Which hormone is not shown?

- A FSH
B LH
C oestrogen
D progesterone

- 31 What are the conditions in a human cell just before the cell enters prophase?

	number of chromatids	number of molecules of DNA in nucleus	spindle present	nuclear envelope present
A	46	46	yes	no
B	92	46	no	yes
C	46	92	yes	yes
D	92	92	no	yes

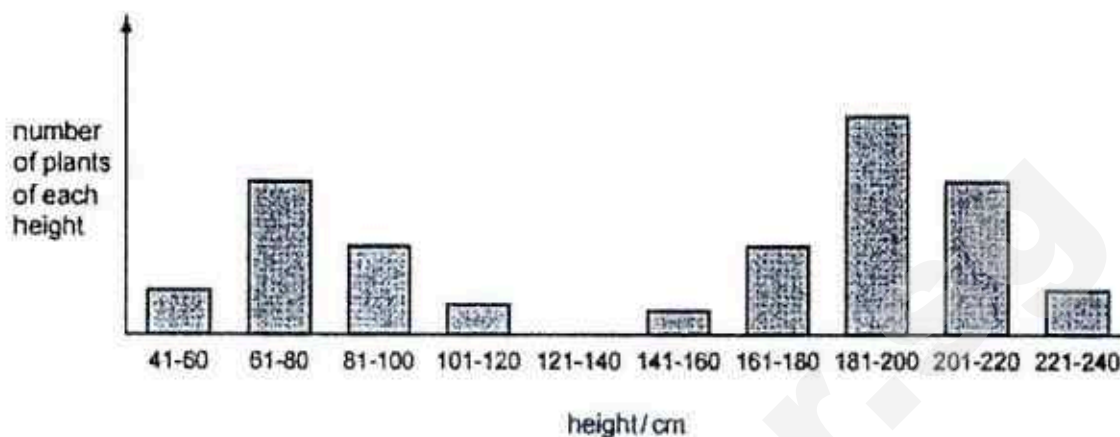
- 32 The diagram shows a cell nucleus in prophase of mitosis.



Which statement describes the chromosomes found in each daughter nucleus immediately following division of this cell by mitosis?

- A 2 chromosomes, each consisting of 2 chromatids
 - B 4 chromosomes, each consisting of 2 chromatids
 - C 8 chromosomes, each containing 1 molecule of DNA
 - D 4 chromosomes, each containing 1 molecule of DNA
- 33 The genotype for the height of an organism is written as Tt.
- What conclusion may be drawn?
- A The allele for height has at least two different genes.
 - B There are at least two different alleles of the gene for height.
 - C There are two different genes for height, each having a single allele.
 - D There is one allele for height with two different forms.

- 34 The heights of 500 pea plants of the same age were measured to the nearest 20 cm. The results are shown in the chart below.



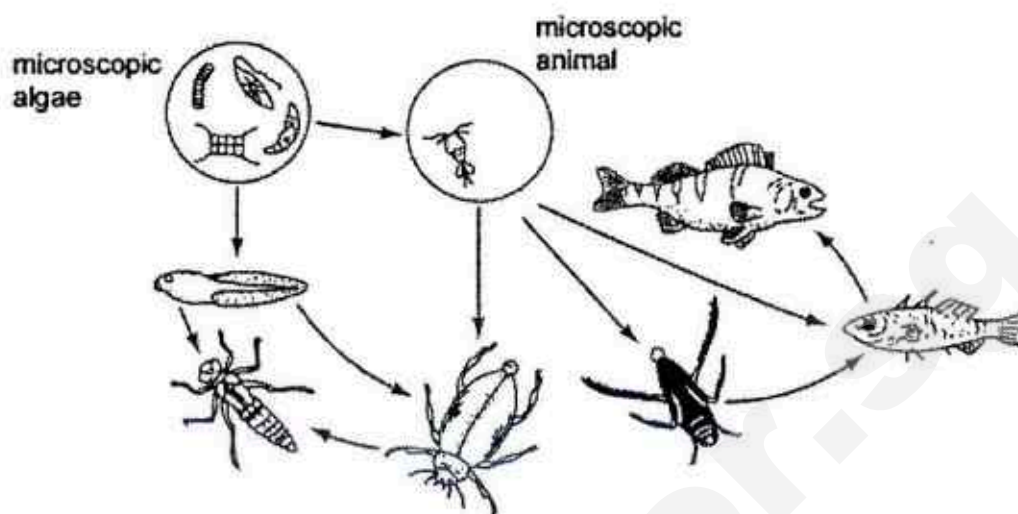
Variation in height of these pea plants shows

- A continuous variation only.
 - B discontinuous variation only.
 - C both continuous and discontinuous variation.
 - D neither continuous nor discontinuous variation.
- 35 In a genetic engineering experiment a piece of double-stranded DNA containing 6000 nucleotides is transcribed and translated.

What is the total number of amino acids used?

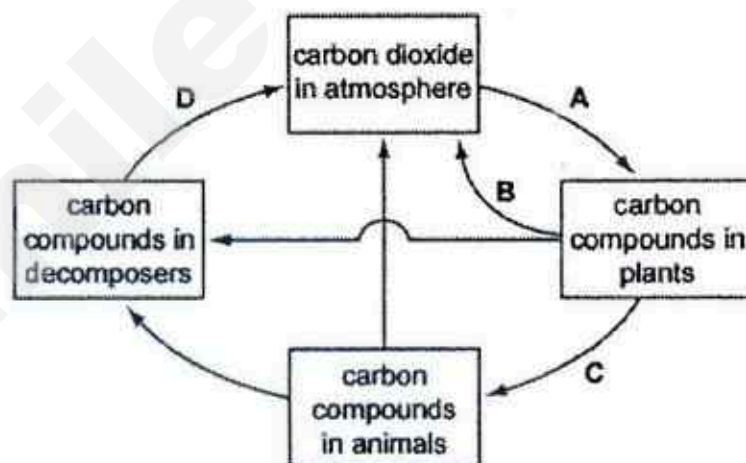
- | | |
|--------|--------|
| A 500 | B 1000 |
| C 2000 | D 3000 |
- 36 One gene provides the code for the production of which molecule?
- A amino acid
 - B DNA
 - C nucleotide
 - D polypeptide

- 37 The diagram below shows part of a pond food web.

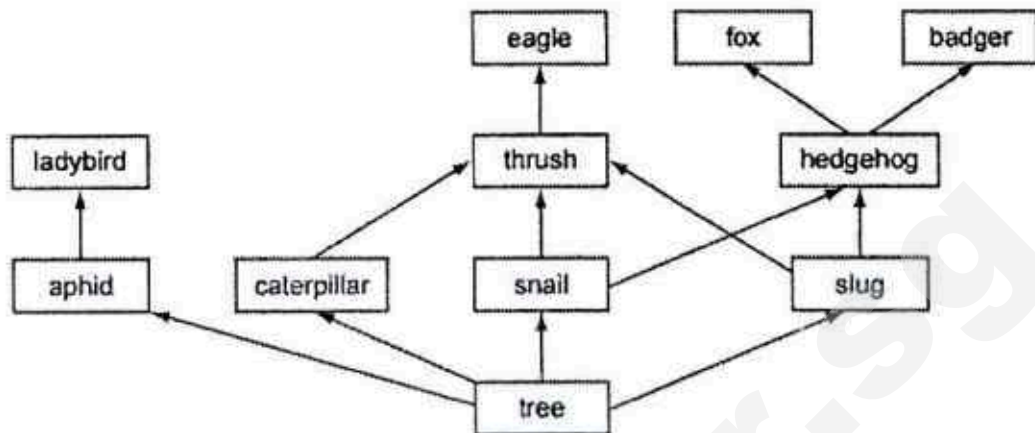


How many primary consumers are there?

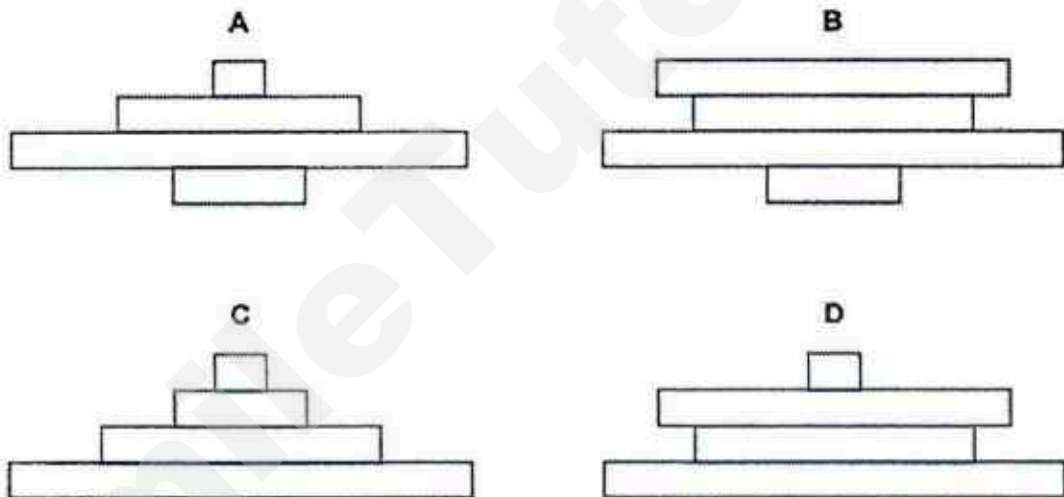
- A 1
B 2
C 3
D 4
- 38 The diagram shows part of the carbon cycle. Which process causes the largest amount of carbon to be converted from one form to another?



39 The diagram shows part of a food web.



Which is a pyramid of numbers based on this food web?



- 40 A farmer sprays some fields with nitrogen fertilizers. Soon afterwards, the fertilizer is washed off by heavy rain into a nearby lake. Then, a few weeks later, most of the organisms in the water die.

The list includes the main stages that led to the death of the organisms.

- P Light is blocked from deeper water plants.
- Q Plants cannot photosynthesise and die.
- R Algae multiply rapidly on the lake surface.
- S Oxygen levels fall and aerobic organisms die.
- T Aerobic bacteria feed on dead plants.

In what order do these stages occur?

- A $P \rightarrow R \rightarrow T \rightarrow Q \rightarrow S$
- B $Q \rightarrow S \rightarrow P \rightarrow R \rightarrow T$
- C $R \rightarrow P \rightarrow Q \rightarrow T \rightarrow S$
- D $S \rightarrow T \rightarrow P \rightarrow Q \rightarrow R$

--- END OF PAPER ---

Ngee Ann Secondary School

1	C	11	B	21	B	31	D
2	A	12	D	22	C	32	D
3	D	13	D	23	D	33	B
4	C	14	D	24	B	34	C
5	B	15	D	25	B	35	B
6	C	16	C	26	B	36	D
7	B	17	D	27	C	37	B
8	B	18	C	28	B	38	A
9	C	19	C	29	D	39	A
10	A	20	C	30	C	40	C

Name: Register no: Class:



NGEE ANN SECONDARY SCHOOL

0

PRELIMINARY EXAMINATION

BIOLOGY

5158/02

Paper 2

2 August 2017

1 h 45 min

Additional Materials: NIL

Instructions to Candidates

Write your name, index number and class at the top of this page.

Write in dark blue or black ink.

You may use a pencil for any diagrams, graphs, tables or rough working.

The use of an approved scientific calculator is expected, where appropriate.

You may lose marks if you do not show your working or if you do not use appropriate units.

Section A:

Answer ALL questions.

Write your answers in the spaces provided on the question paper.

Section B:

Answer ALL the questions.

For question 11, choose 11 **EITHER** or 11 **OR**.

Write your answers in the spaces provided on the question paper.

The number of marks is given in brackets [] at the end of each question or part question.

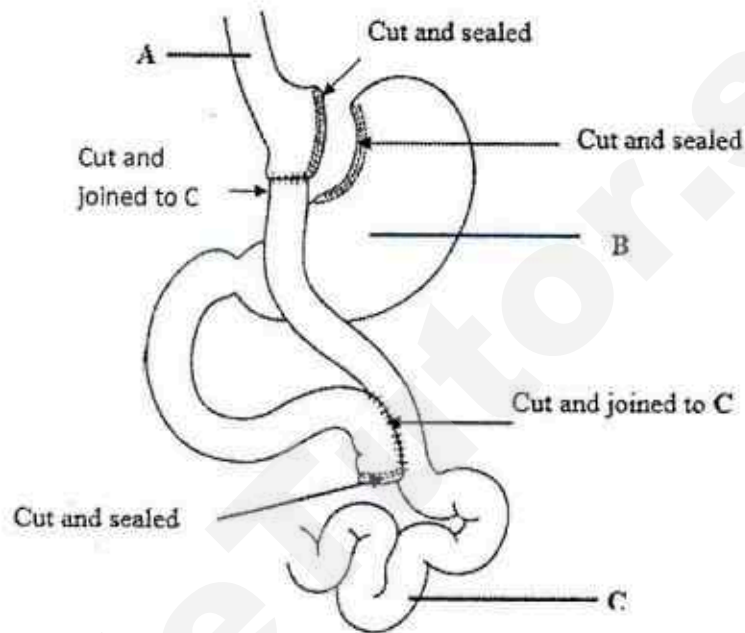
For Examiner's Use

Section	Marks
A	50
B	30
Total	80

This document consists of 17 printed pages and 1 blank page.

Section A: Structured Questions (50 marks)
Write your answers in the spaces provided only.

- 1 Gastric bypass procedure is used to treat morbid obesity where there is severe accumulation of weight due to fatty tissue. The surgeon reduces the size of the stomach significantly and the duodenum is bypassed. The smaller, upper stomach is re-attached to C. The Roux-en-Y gastric bypass procedure is shown in Fig. 1.



Source: IACC@2003 American College of Cardiology Foundation

Fig. 1

- (a) Label the structures A and C.

A:

C:

[2]

- (b) On Fig. 1 above, mark with the letter Z, the location of the pancreas.

[1]

- (c) Explain the advantage (to a person who underwent the gastric bypass) of attaching the smaller, upper stomach to the lower end of C.

[2]

[Total: 5]

2. Fig. 2 shows a section of the lung.

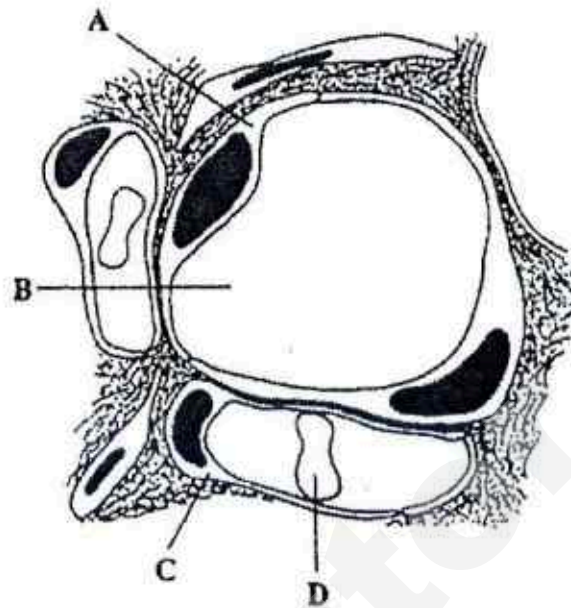


Fig. 2

- (a) Name and state the function of structure D.

[1]

- (b) Describe how one feature of structure B enables it to perform its function efficiently.

[2]

- (c) On Fig. 2, shade the structure that is broken down as observed in a person suffering from emphysema.

[1]

- (d) (i) Describe how emphysema affects the effectiveness of lung function.

[1]

- (ii) State one characteristic of a person suffering from emphysema.

[1]

[Total: 6]

3. Table 3 shows the concentration of certain substances found in the plasma of a patient suffering from kidney failure. Patients with kidney failure can be treated by dialysis.

Table 3

Fluid	Concentration		
	Sodium ions (mEq/L)	Glucose (mg/100 ml)	Urea (mg/100 ml)
Plasma	142	100	200
Dialysis fluid			

- (a) Complete Table 3 to show the approximate concentrations for the substances present in the dialysis fluid.
[3]

An alternative method of treatment is by peritoneal dialysis. Fig. 3 shows the procedure for peritoneal dialysis.

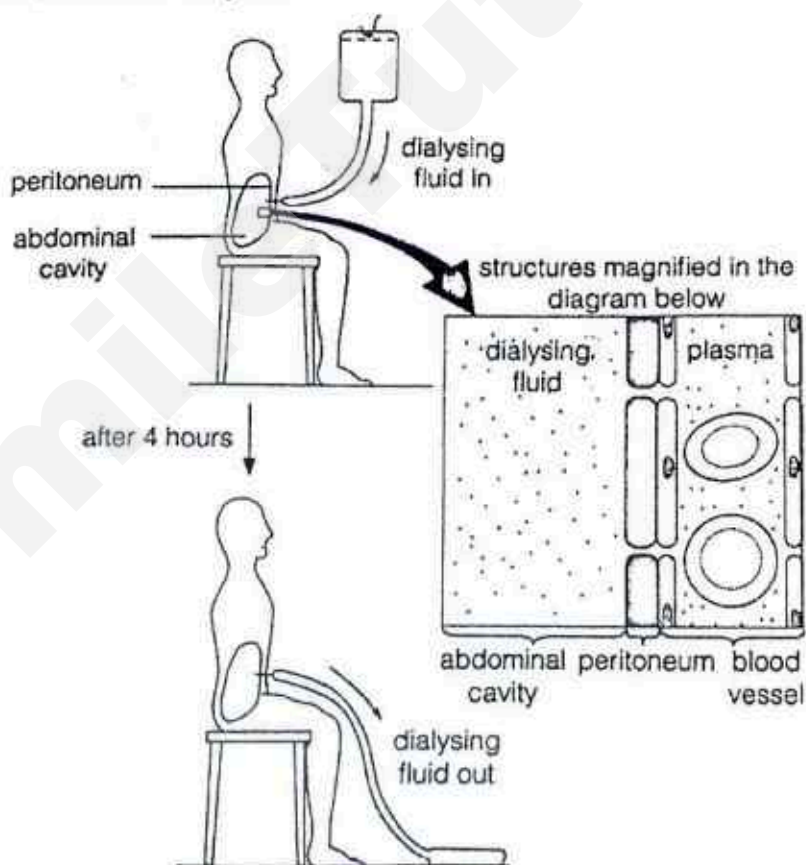


Fig. 3

- (b) Suggest why the dialysis fluid has to remain in the abdominal cavity for about 4 hours before it is removed from the body.

[1]

- (c) Explain why it is important for the patient to avoid excessive intake of proteins.

[2]

[Total: 6]

4. Fig.4 illustrates the principles of homeostasis.

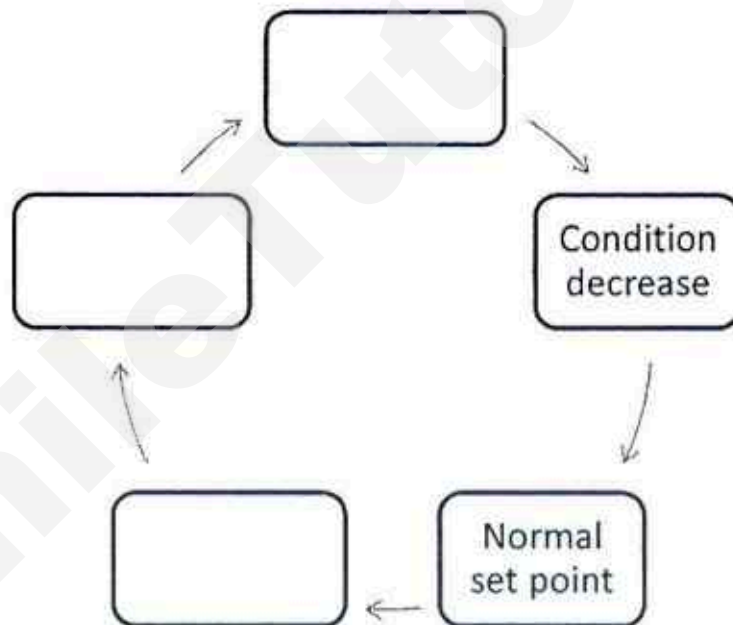


Fig. 4

- (a) Fill in the boxes in Fig. 4 with the appropriate terms. [1]
- (b) Use a dotted, labelled arrow (-->) to show where negative feedback takes place in Fig. 4. [1]
- (c) State one example, other than body temperature, that is under homeostatic control in a mammal.

[1]

- (d) Explain why the homeostatic control of the example given in (c) is essential for survival of the mammal.

[2]

[Total: 5]

5. Fig. 5 shows the leg of a person sitting with the foot clear off the ground. If a sharp tap is applied at X, the lower leg swings forward involuntarily.

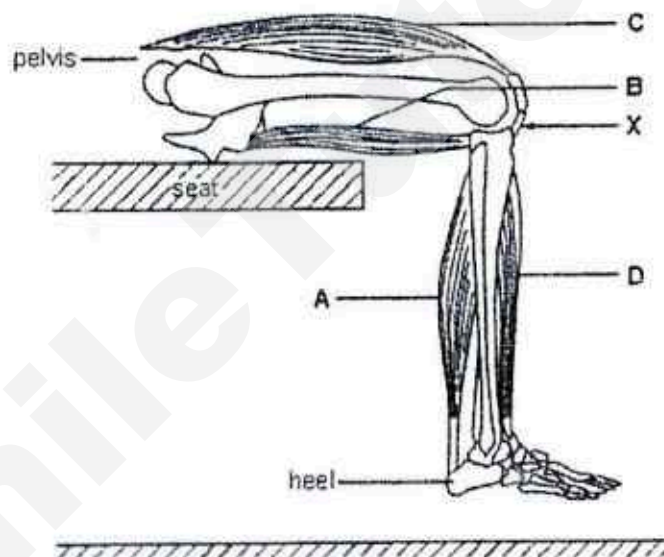


Fig. 5

- (a) (i) With reference to Fig. 5, describe the pathway of nerve impulses from the sharp tap to the movement of the leg.

[4]

- (ii) If the spinal cord is cut through near the chest, this reflex action will still take place. Suggest where the reflex centre is.

[1]

- (b) Another involuntary response occurs when a person is in the state of 'fight or flight'.

- (i) Name the hormone that the body releases, when in such a state.

[1]

- (ii) Describe and explain the changes in the eye when the above hormone is released.

[2]

[Total: 8]

6. Fig. 6.1 shows graphs of two hormones involved in the control of the human menstrual cycle. The concentration of each plasma hormone was plotted over an interval of 30 days.

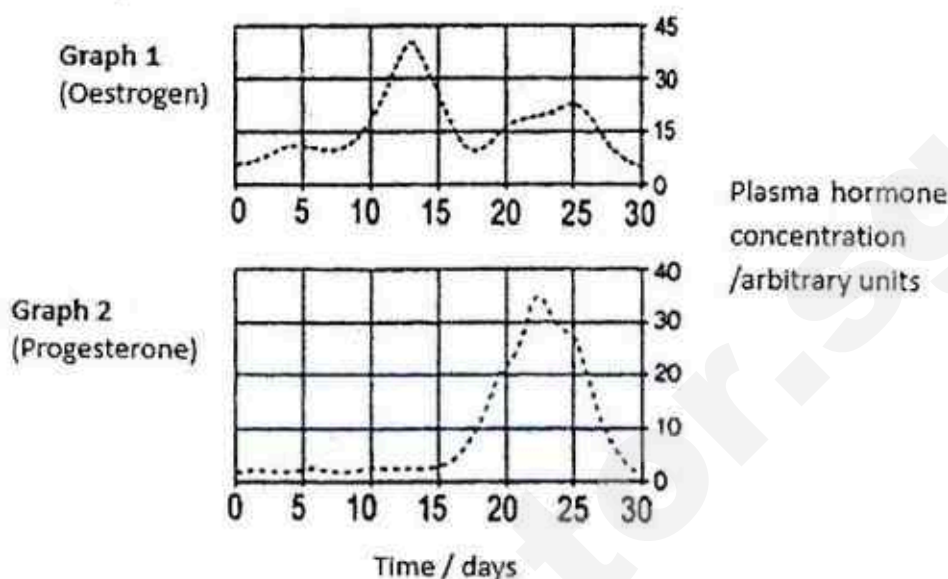


Fig. 6.1

- (a) Predict a day in the next cycle when implantation might occur, if a woman were to become pregnant. Explain your answer with reference to Fig. 6.1, graph 2.

[2]

Fig. 6.2 shows the sequence of events in the development of a follicle into a corpus luteum.

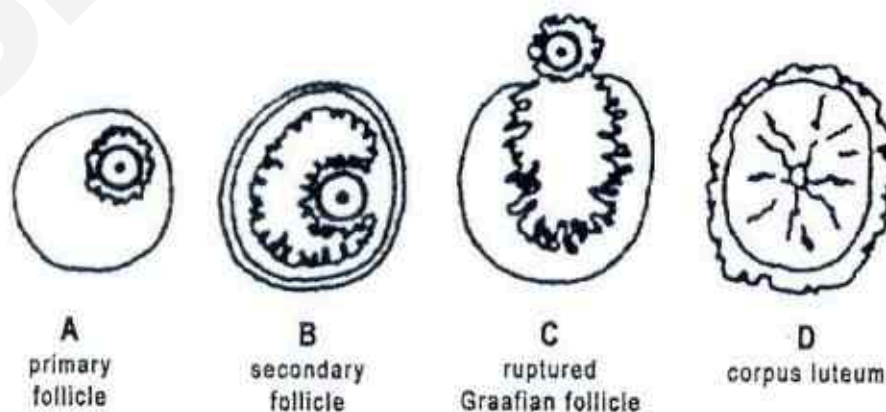


Fig. 6.2

- (b) (i) Which two stages in Fig. 6.2, from A to D, would you expect to find in the ovary of a woman during the early stages of pregnancy? Explain your

answer in terms of hormonal changes.

[3]

- (ii) Name the structure in plants that is equivalent to the structure shown in Fig. 6.2, stage B.

[1]

[Total: 6]

7. Fig. 7.1 represents four genes on a part of the X chromosomes from a body cell of a woman.

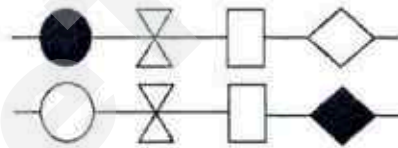


Fig. 7.1

- (a) (i) In the space below, draw these genes as they might appear in one of her ova.

[1]

- (ii) Name the process by which the ova is produced.

[1]

- (b) Fig. 7.2 shows the same section of an X chromosome in another cell of the same person in which the structure of one of the genes has been changed.

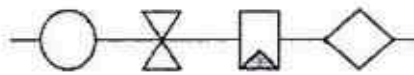


Fig. 7.2

- (i) State the name given to such a change in the gene.

[1]

- (ii) Suggest a possible cause of such changes in genes.

[1]

- (c) Fig. 7.3 shows the alleles of a person with blood group A



Fig. 7.3

- (i) Label the alleles in Fig 7.3 with the appropriate genetic symbols. [2]

- (ii) Describe the relationship between the alleles and blood group A.

[2]

[Total: 8]

8. Fig. 8 shows a food web which exists in the very cold waters of the Antarctic Ocean.

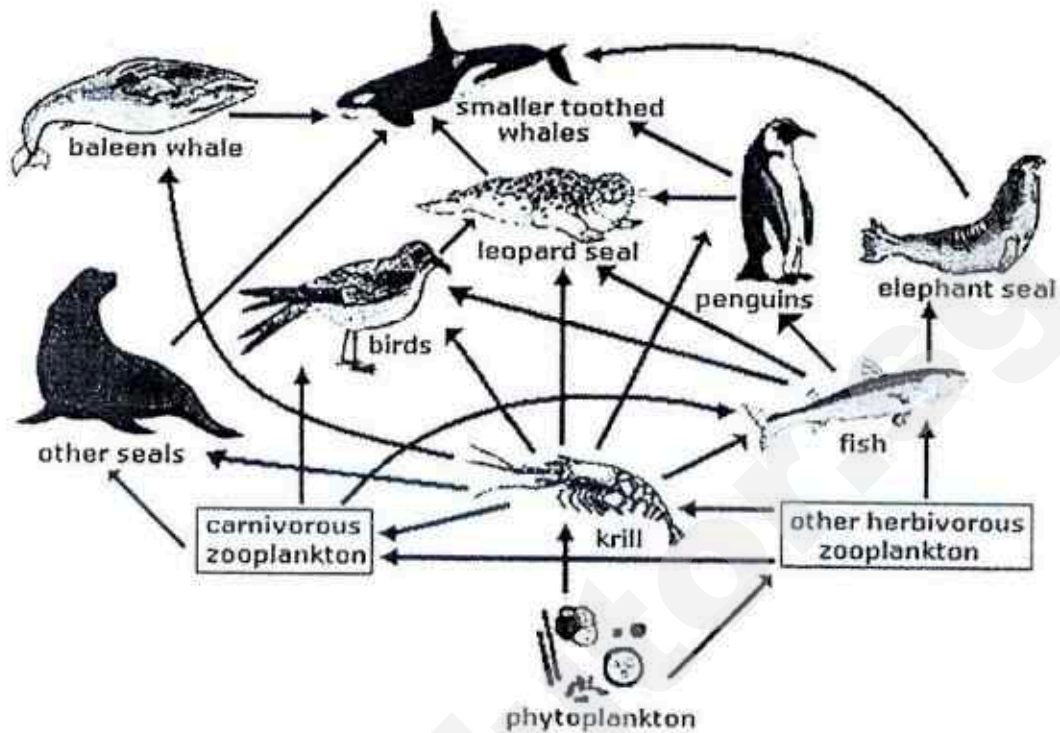


Fig. 8

- (a) In the food web, which one of the animals would you expect to find in the largest numbers? Give a reason for your answer.

[1]

- (b) Over the last few years there has been a gradual build-up of non-biodegradable pollutants in the waters of the Antarctic Ocean. Which one of the animals shown in Fig. 8 is likely to have the most pollutant in its body? Explain your answer.

[3]

- (c) Identify a food chain from Fig. 8, whereby the smaller toothed whales obtain the least amount of energy. Explain why this is so.

[2]

[Total: 6]

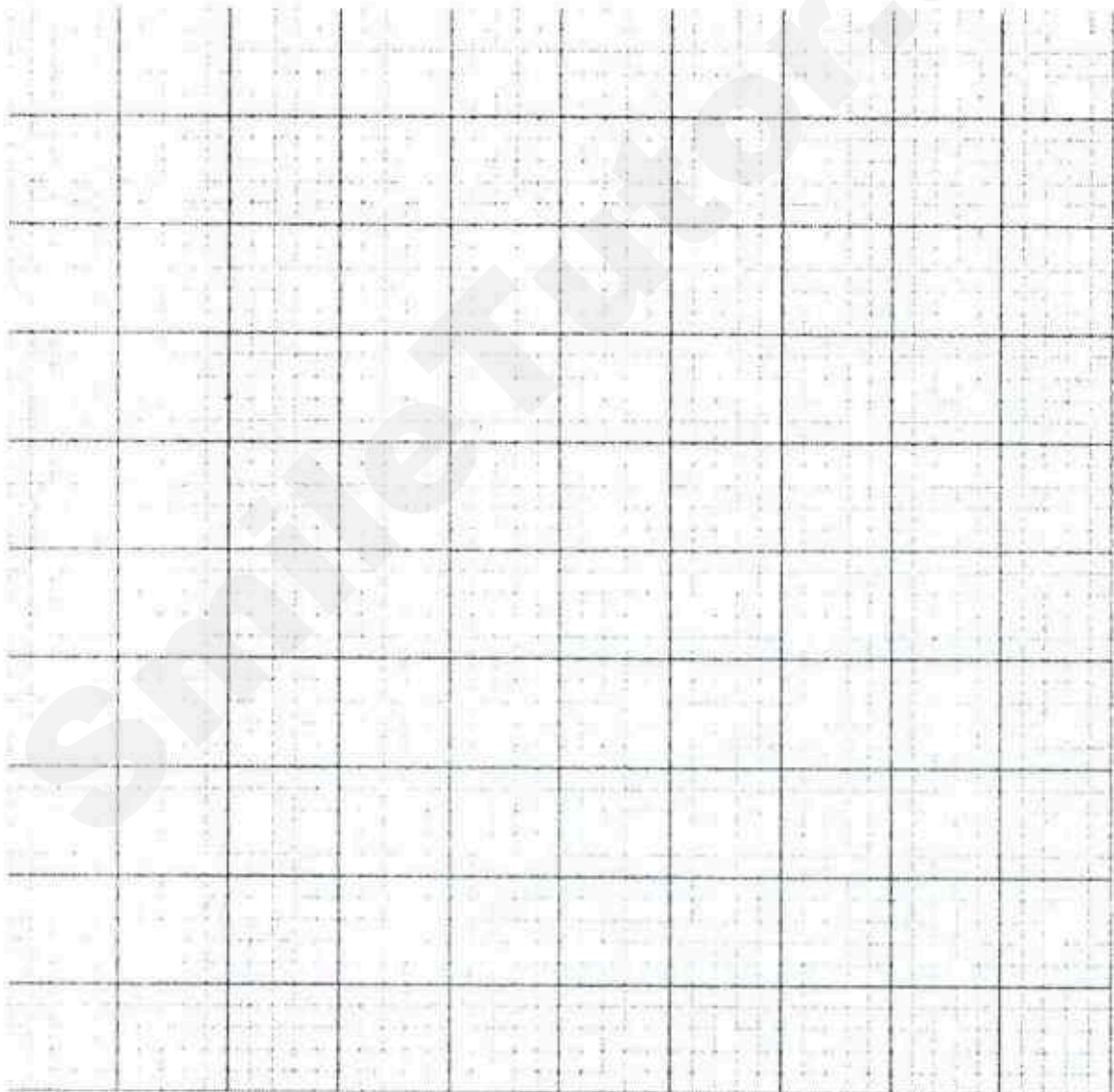
Section B: Open-Ended Questions (30 marks)Answer **three** questions in this section.Question 11 is in the form of an **Either/Or** question. Only one part should be answered.

9. The table shows the time taken for mammalian cells to divide by mitosis at different temperatures.

Table 9

Temperature (°C)	3	10	15	20	25
Time taken for cell division in hours	14	6	4	3	2

- (a) Plot the data on the grid provided.



[3]

- (b) Describe the effect of temperature on cell division.

[1]

- (c) Starting with one cell at 25°C, how many cells would there be after

2 hours: _____

8 hours: _____ [2]

- (d) Suggest some factors (other than cell organelles) that the mammalian cell requires for cell division to occur and provide an explanation for your choices.

[4]

[Total: 10]

10. (a) Outline how enzymes are made and secreted out of the cell.

[3]

- (b) Briefly describe the practical test for the biological molecule, enzyme.

[2]

[5]

[Total: 10]

11. Either

(a) With reference to photosynthesis, explain the term limiting factor.

5

(b) Describe how dissolved mineral salts from the soil reach a mesophyll cell.

5

[Total: 10]

11. OR

(a) Outline how bacteria is used to produce human insulin.

5

(b) Describe, with examples, the transfer of dissolved materials from the blood to the cells of the body.

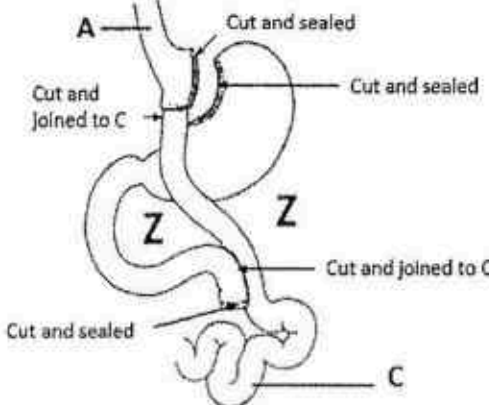
[5]

[Total: 10]

--- END OF PAPER ---

ANSWERS

Section A

1	(a)	A: Oesophagus [1] C: Small intestine/jejunum/ileum [1]															
	(b)	 <p>Source: TAACC©2008 American College of Cardiology Foundation</p>															
	(c)	<ul style="list-style-type: none">• Smaller stomach → Less digestion of proteins → less absorption of amino acids → Less weight gain → feel full faster → eat less food → less chance of putting on weight• Shorter upper small intestine → less digestion of protein/fats/carbohydrates → less absorption → less weight gain <p>(Any 2)</p>															
2	(a)	Red blood cell transports oxygen around the body [1]															
	(b)	<ul style="list-style-type: none">• B has one cell thick/thin walls [1] which reduced the distance for diffusion to occur.[1] OR <ul style="list-style-type: none">• B is near/surrounded by blood capillaries [1] this maintains the diffusion gradient for the efficient exchange of gases. [1] OR <ul style="list-style-type: none">• Thin film of moisture lining the inside of B [1] allows oxygen to dissolve [1] and diffuse into the blood stream.															
	(c)	Shade on alveolar wall [1] (walls of structure B)															
	(d)	Decrease in surface area available → Less oxygen is taken up by blood / less carbon dioxide removed [1]															
	(i)	Accepted: Reduced efficiency of gaseous exchange															
	(ii)	Breathlessness/ wheezing/ gasping for air [1]															
3	(a)	<table><tr><th rowspan="2">Fluid</th><th colspan="3">Concentration</th></tr><tr><th>Sodium ions (mEq/L)</th><th>Glucose (mg/100 ml)</th><th>Urea (mg/100 ml)</th></tr><tr><td>Plasma</td><td>142</td><td>100</td><td>200</td></tr><tr><td>Dialysis fluid</td><td>142 +/- 12</td><td>100 +/- 5</td><td>0</td></tr></table>	Fluid	Concentration			Sodium ions (mEq/L)	Glucose (mg/100 ml)	Urea (mg/100 ml)	Plasma	142	100	200	Dialysis fluid	142 +/- 12	100 +/- 5	0
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Plasma	142	100	200														
Dialysis fluid	142 +/- 12	100 +/- 5	0														
	(b)	To allow sufficient time for <u>urea</u> and excess mineral salts (or waste materials) to <u>diffuse</u> out of blood plasma into dialysis fluid. [1] Removal of substances / exchange of substances – not accepted Must state that diffusion occurred during the dialysis, and which substances diffused.															

	(c)	<p><u>Excess proteins</u> de-aminated / converted to <u>urea</u>, thereby increasing the concentration of urea in the blood. [1]</p> <p>Dialysis fluid needs to be changed more frequently / less efficient as concentration gradient reduced / more rounds of treatment needed / more time required for dialysis to remove urea [1]</p>							
4	(a) (b)								
	(c)	<p>Blood glucose level / concentration; Water potential of blood; Carbon dioxide / pH</p>							
	(d)	<table border="1"> <tr> <td>Blood glucose level / concentration;</td><td> <p>Glucose required for respiration to provide cells with energy [1]</p> <p>Low levels of glucose might cause lack of energy / loss of consciousness / dizziness; High levels of glucose might affect blood pressure / damage to organs / glucose in urine [1]</p> <p><i>Many students incorrectly wrote that high levels of glucose would cause diabetes.</i></p> </td></tr> <tr> <td>Water potential of blood</td><td> <p>Water potential of blood will affect composition of tissue fluid / osmotic concentration of cells / affect vital cell activities [1]</p> <p>Low water potential of tissue fluid would result in cells to crenate / high water potential would result in cells bursting [1]</p> <p><i>Water potential affecting blood pressure was not accepted, which was a common answer</i></p> </td></tr> <tr> <td>Carbon dioxide / pH</td><td> <p>The pH of blood plasma and tissue fluid is affected [1]</p> <p>Enzyme reactions will be affected, as enzymes have an optimum pH [1]</p> </td></tr> </table>	Blood glucose level / concentration;	<p>Glucose required for respiration to provide cells with energy [1]</p> <p>Low levels of glucose might cause lack of energy / loss of consciousness / dizziness; High levels of glucose might affect blood pressure / damage to organs / glucose in urine [1]</p> <p><i>Many students incorrectly wrote that high levels of glucose would cause diabetes.</i></p>	Water potential of blood	<p>Water potential of blood will affect composition of tissue fluid / osmotic concentration of cells / affect vital cell activities [1]</p> <p>Low water potential of tissue fluid would result in cells to crenate / high water potential would result in cells bursting [1]</p> <p><i>Water potential affecting blood pressure was not accepted, which was a common answer</i></p>	Carbon dioxide / pH	<p>The pH of blood plasma and tissue fluid is affected [1]</p> <p>Enzyme reactions will be affected, as enzymes have an optimum pH [1]</p>	
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Carbon dioxide / pH	<p>The pH of blood plasma and tissue fluid is affected [1]</p> <p>Enzyme reactions will be affected, as enzymes have an optimum pH [1]</p>								
5	(a)	<p>(i)</p> <ul style="list-style-type: none"> • <u>Receptor</u> at X detects the stimulus • Nerve impulse generated and <u>transmitted</u> by the <u>sensory neurone</u> • Across a <u>synapse</u> to a relay neuron • Across a synapse to a <u>motor neuron</u> • Which transmits the signal to the <u>effector muscle / muscle C</u> which contracts to swing the leg forward. 							
	(ii)	<p>lower part or base of spinal cord / spinal cord [1]</p>							
	(b)	<p>(i) Adrenaline [1]</p>							
	(ii)	<p>Radial muscles of the iris contract and the circular muscles of the iris relax [1]</p> <p>Causing the pupil to dilate / enlarged / increase in size [1] to allow more light to enter</p>							

		and more information collected
6	(a)	ONE day ,within the range of Day 19 – 23 [1] Graph 2 shows increase in level progesterone from Day 17 and peak at Day 23 (high levels of progesterone) to prepare the uterine lining for implantation [1]
	(b)	A and D; [1]
	(i)	If the woman is pregnant, the corpus luteum (D) will persist and continue to produce progesterone to maintain the thickness of the lining [1] High level of progesterone will inhibit FSH and LH which will prevent the development/growth of primary follicle (A) [1]
	(ii)	ovule
7	(a)	Either one strand
	(i)	(allow combinations that show crossing over)
	(ii)	meiosis
	(b)	(i) mutation
	(ii)	Exposure to ultraviolet rays/ radiation / (chemical) mutagens (mustard gas, ethidium bromide etc) / x-rays / errors in DNA replication
	(c)	(i) I^A and I^O
	(ii)	The alleles are alternative/different forms of the gene; [1] That codes for synthesis/formation of the polypeptide that form the antigen A on the red blood cell. [1]
8	(a)	Krill and It is a source of food for many animals in the trophic level above itself OR krill supports all other animals above its trophic level.
	(b)	Smaller toothed whales. [1] <ul style="list-style-type: none"> • Bioaccumulation occurs in the bodies of the consumer/organism as the non-biodegradable pollutants are <u>not excreted out</u>. [1] • Bioamplification/ biomagnification takes place when the pollutants are passed along the food chains, <u>increasing its concentration</u> in the bodies of the organisms along each trophic levels [1]
	(c)	Phytoplankton \rightarrow 1^O consumer \rightarrow 2^O consumer \rightarrow 3^O consumer \rightarrow smaller toothed whales [1] <ul style="list-style-type: none"> • In this food chain, the smaller toothed whales is at the highest trophic level, since there is only 10% of energy passed down / 90% energy lost from one trophic level to the next, at the 5th trophic level, there will be a very small amount of energy received by the smaller toothed whale through this food chain. [1]

Section B

		ANSWERS
9	(a)	<p>Correct axis & units [1]</p>

		Correct plotting & scale [1] Best fit line [1]																										
	(b)	As temperature increases, the rate of cell division increases.[1] OWTTE																										
	(c)	2 hours: 2 cells [1] 8 hours: 16 cells [1]																										
	(d)	Glucose [1] – substrate for respiration to occur and produce energy [1] for chromosomes to move and arrange themselves Oxygen [1] - Required for aerobic respiration for the production of energy [1] Appropriate temperature [1] - Allow enzymes to function properly as enzymes will be inactive at low temperatures and denatured at high temperatures[1] (max 4)																										
10	(a)	Synthesis at ribosome attached on the rough endoplasmic reticulum (rER); [1] transported from the rER in vesicles to the golgi apparatus for modification; [1] Packaged into secretory vesicles, fuse to cell membrane and released outside of the cell. [1]																										
	(b)	Add 2cm ³ of sodium hydroxide solution to 2cm ³ of sample in a test tube and shake thoroughly and then copper (II) sulfate solution drop by drop [1] OR 2cm ³ of biuret solution to 2cm ³ of sample; [1] Solution with change from blue to violet [1]																										
	(c)	<table border="1"> <thead> <tr> <th>Enzymes</th><th>Hormones</th></tr> </thead> <tbody> <tr> <td colspan="2">Both are effective in small amounts</td></tr> <tr> <td colspan="2">Both maintain homeostasis</td></tr> <tr> <td>Enzymes are always proteins</td><td>Hormones may be proteins, short peptides or steroids.</td></tr> <tr> <td>Enzymes are generally highly specific.</td><td>Hormones have a range of effects, acts on different tissues and/or organs.</td></tr> <tr> <td>Enzymes are secreted out through a duct from one location to another From exocrine gland</td><td>Hormones are released directly into the bloodstream From endocrine gland</td></tr> <tr> <td>Enzymes catalyse a reaction.</td><td>Hormones initiates a biochemical reaction.</td></tr> <tr> <td>Enzymes act quickly</td><td>Some hormones are quick acting, while some are slow acting with a lag period.</td></tr> <tr> <td>Short-term effect</td><td>Long term effect.</td></tr> <tr> <td>Enzymes work at a specific location.</td><td>Hormones are distributed throughout the body, where they may exert their effects upon a number of different target tissues.</td></tr> <tr> <td>Enzyme speeds up a reaction</td><td>Hormones regulate a metabolic process.</td></tr> <tr> <td>Enzymes are unchanged at the end of a reaction.(They are not used up in metabolic functions)</td><td>Hormones are changed in structure after the reaction. (They are destroyed after metabolic functions.)</td></tr> <tr> <td>Enzymes catalyse reversible reactions.</td><td>Hormones controlled reactions are not reversible.</td></tr> </tbody> </table> <p>Must have mixture of similarities and differences</p>	Enzymes	Hormones	Both are effective in small amounts		Both maintain homeostasis		Enzymes are always proteins	Hormones may be proteins, short peptides or steroids.	Enzymes are generally highly specific.	Hormones have a range of effects, acts on different tissues and/or organs.	Enzymes are secreted out through a duct from one location to another From exocrine gland	Hormones are released directly into the bloodstream From endocrine gland	Enzymes catalyse a reaction.	Hormones initiates a biochemical reaction.	Enzymes act quickly	Some hormones are quick acting, while some are slow acting with a lag period.	Short-term effect	Long term effect.	Enzymes work at a specific location.	Hormones are distributed throughout the body, where they may exert their effects upon a number of different target tissues.	Enzyme speeds up a reaction	Hormones regulate a metabolic process.	Enzymes are unchanged at the end of a reaction.(They are not used up in metabolic functions)	Hormones are changed in structure after the reaction. (They are destroyed after metabolic functions.)	Enzymes catalyse reversible reactions.	Hormones controlled reactions are not reversible.
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11	EITHER
(a)	<p>Factors that affect photosynthesis - Light intensity, temperature and carbon dioxide [1] Factor in shortest supply is the limiting factor [1] (Limiting factor is the factor that <u>directly affects</u> the rate of photosynthesis when its quantity is changed /the one in shortest supply) Factor + Explanation: Light intensity – As light intensity increases, the rate of photosynthesis increases; When the rate of photosynthesis remains constant even when light intensity is increased, light is no longer the limiting factor; <i>Some other factor becomes limiting e.g. carbon dioxide and temperature</i> Carbon dioxide concentration – Increased concentrations will greatly increase the rate of photosynthesis (at same light intensity) Temperature – at high concentrations of CO₂, increasing temperature will cause a large increase in the rate of photosynthesis (max 3marks for explanation)</p>
(b)	<ul style="list-style-type: none"> • Dissolved mineral salts enters the root hair cell by active transport when concentration is lower in the soil; • By diffusion when concentration in the soil solution is high; • water carrying the mineral salts move from the root hair cell to inner cells of the root by osmosis; • Move up to the leaf by root pressure, capillary action and transpiration stream/pull; • evaporation of water from the mesophyll cell causes the cell to have a lower water potential, • Thus <u>drawing the water from the xylem</u> as it moves by osmosis from a region of higher water potential to the mesophyll cells which have a lower water potential. <p>(max 5)</p>
OR	
11	(a)
	<ul style="list-style-type: none"> • cut out gene for insulin from the human genome/chromosome using restriction enzyme; • cut a bacterial plasmid using the same restriction enzyme to produce complementary sticky ends; • mix plasmid with insulin gene to allow complementary base-pairing to occur; • Add DNA ligase to ligate/join/seal the insulin gene to the plasmid; • Apply heat/electric shock to allow the recombinant plasmid to enter the bacteria; • Transgenic bacteria will make human insulin <p>(max 5)</p>
	(b)
	<ul style="list-style-type: none"> • Occurs in the capillaries; • High blood pressure at the arterial end of the capillary forces; • the blood plasma out through the one-cell thick capillary walls; • Forms tissue/interstitial fluid containing dissolved substances around the body cells. • Dissolved substances such as glucose, amino acids and oxygen will be present in the tissue fluid; • Glucose, amino acids and oxygen will diffuse from the tissue fluid into the surrounding cells. <p>(max 5)</p>

Name: Register/Index Number: Class:

PRESBYTERIAN HIGH SCHOOL



BIOLOGY

5158/1

Paper 1

15 September 2017

Friday

1 hour

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2017 SECONDARY FOUR EXPRESS / FIVE NORMAL PRELIMINARY EXAMINATION

INSTRUCTIONS TO CANDIDATES

DO NOT OPEN THIS QUESTION PAPER UNTIL YOU ARE TOLD TO DO SO.

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, class and register number on the Answer Sheet in the spaces provided.

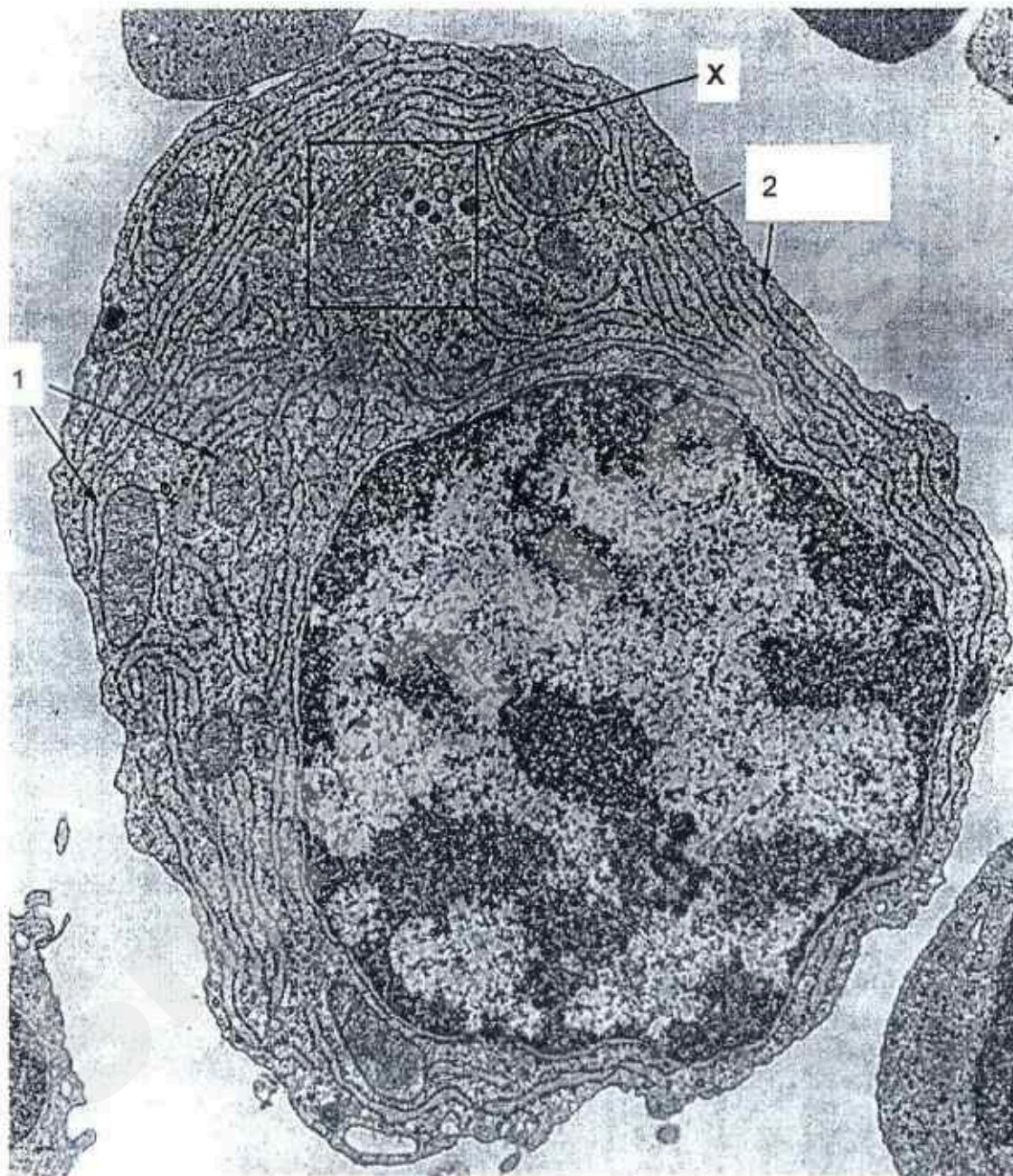
There are forty questions on this paper. Answer all questions. For each question there are four possible answers, A, B, C and D.

Choose the one you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this booklet.

This question paper consists of **20** printed pages (including this cover page).

For questions 1 and 2, refer to the electron micrograph of a lymphocyte below.



1 What are structures 1 and 2?

	1	2
A	golgi apparatus	endoplasmic reticulum
B	golgi apparatus	vesicles
C	mitochondria	endoplasmic reticulum
D	mitochondria	vesicles

[Turn over

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- 2 Lymphocytes are specialised blood cells of the immune system. How is the region labelled X involved in the function of lymphocytes?

- A secrete antibodies to clump bacteria
- B secrete antibodies to digest bacteria
- C secrete enzymes to digest bacteria
- D secrete hormones to attract bacteria

- 3 The length of three potato cylinders was measured before and after immersing in sucrose solutions at different concentrations for 1 hour. The results are shown in the table below.

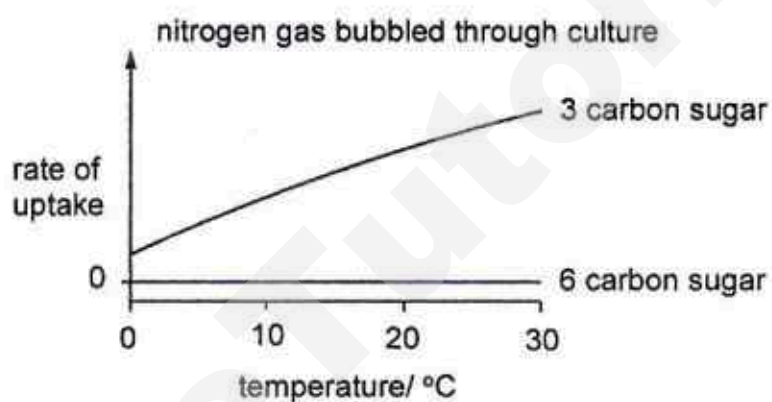
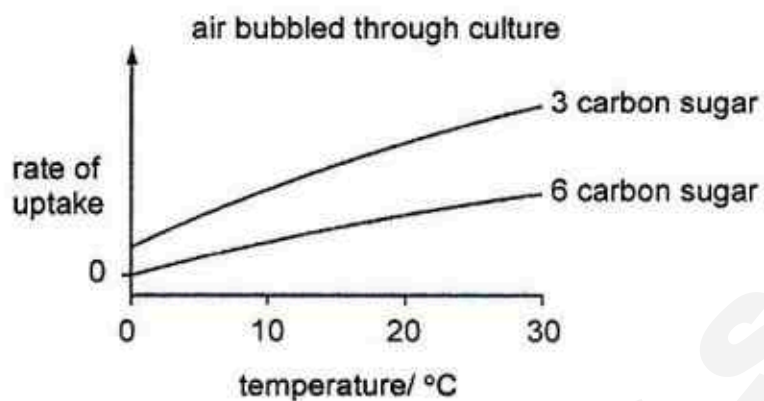
potato cylinder	initial length/ mm	final length/ mm
1	66	59
2	65	53
3	68	60

Which of the following shows the correct order of concentrations?

	lowest → highest		
A	1	2	3
B	1	3	2
C	2	3	1
D	3	2	1

[Turn over

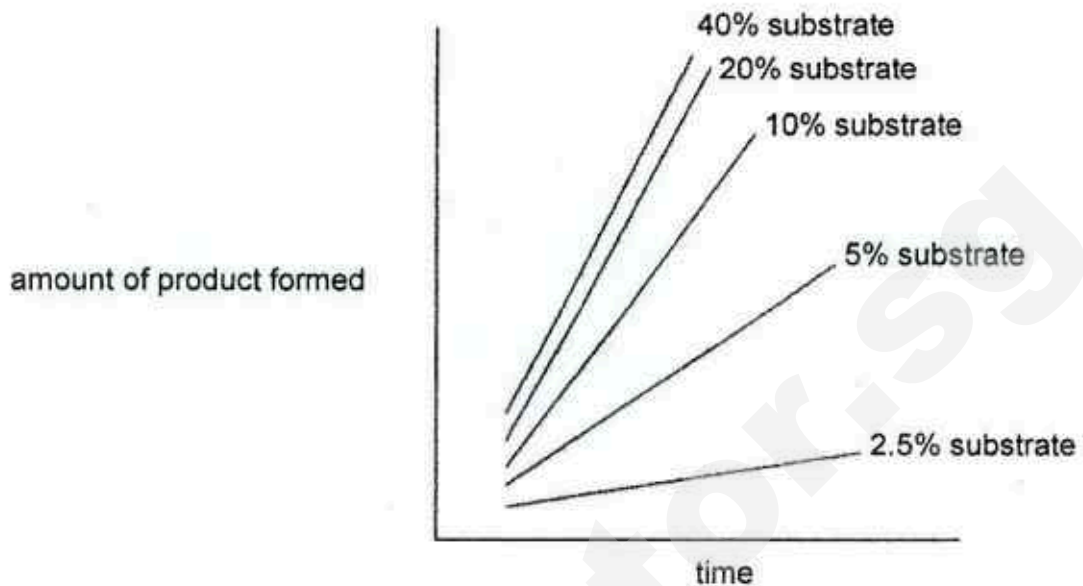
- 4 The graphs show the rate of uptake of sugars by a culture of animal cells, under different conditions.



How are the sugars taken up by the cells when air is bubbled through the culture?

	3-carbon sugar	6-carbon sugar
A	active transport	active transport
B	active transport	diffusion
C	diffusion	active transport
D	diffusion	diffusion

- 5 The graph below shows part of the effect of changing substrate concentration on an enzyme controlled reaction.

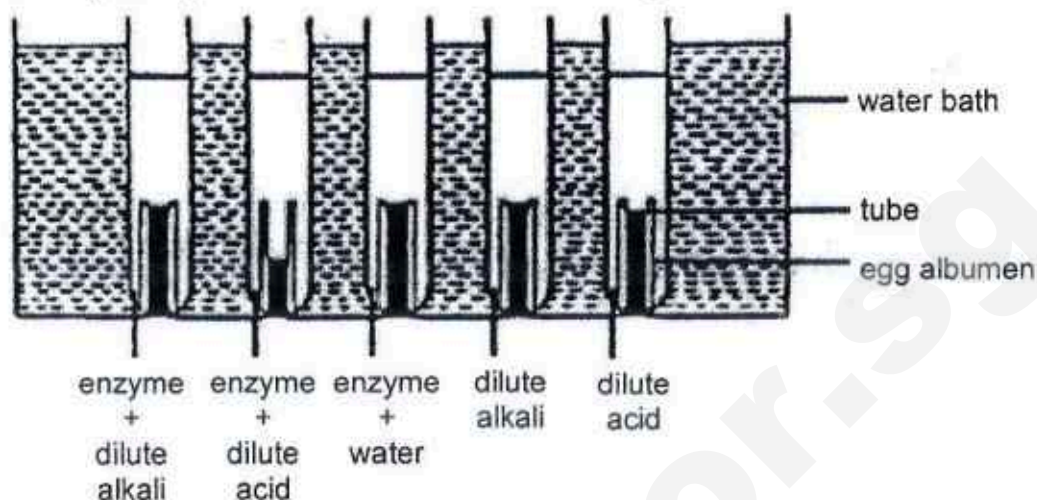


Which of the following is true for an enzyme controlled reaction?

- A amount of product formed will eventually reach a maximum for each concentration
- B increasing substrate concentration will decrease rate of reaction
- C increasing substrate concentration will increase rate of reaction indefinitely
- D rate of reaction will not be affected by any change in the substrate concentration.

For questions 6 and 7 refer to the diagram below.

An experiment was set up to investigate the effect of a mammalian enzyme on egg albumen (protein). The results are shown in the diagram.



6 What is the most suitable temperature for the water bath?

- A 15 °C
- B 25 °C
- C 35 °C
- D 45 °C

7 From which part of the digestive system was the enzyme extracted from?

- A liver
- B pancreas
- C salivary gland
- D stomach

8 The table shows the elements present in four substances. Which is a protein?

	carbon	hydrogen	nitrogen	oxygen
A	absent	present	present	present
B	present	absent	absent	present
C	present	present	absent	present
D	present	present	present	present

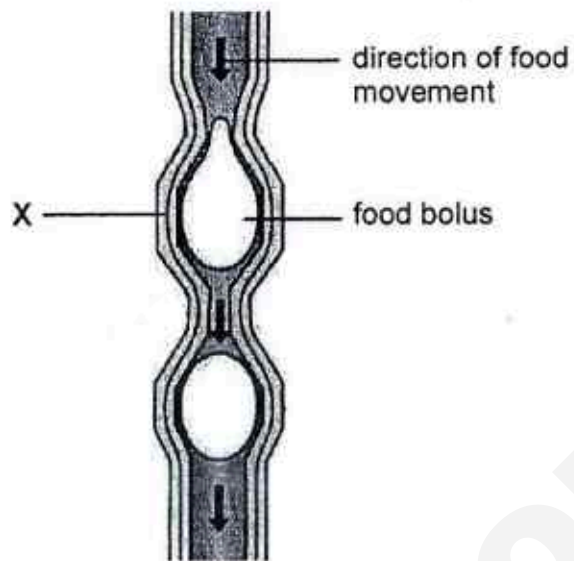
9 Why is glycogen a better storage molecule than glucose?

- A glucose affects water potential more
- B glucose is easily oxidised to release energy
- C glycogen can be used directly in respiration
- D glycogen occupies more space

[Turn over

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- 10 The diagram shows food moving through the oesophagus.



What is the state of the muscles at X?

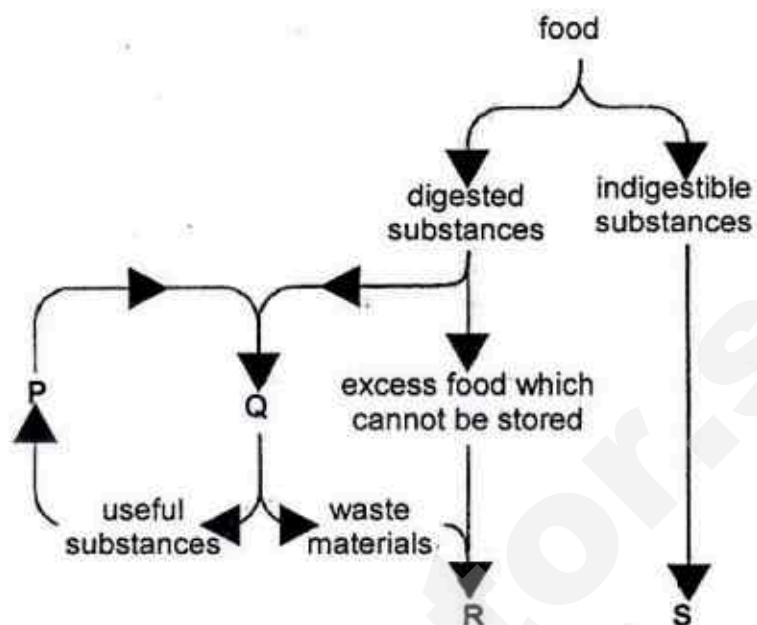
	circular muscles	longitudinal muscles
A	contracted	contracted
B	contracted	relaxed
C	relaxed	contracted
D	relaxed	relaxed

- 11 Food tests were done on intestinal juice extracted from the small intestine. Which of the following is correct?

	food test reagent	observation
A	Benedict solution	red precipitate
B	biuret solution	violet
C	ethanol	white emulsion
D	iodine	blue black

[Turn over

- 12 The diagram shows the fate of food in the body.



Which is correct?

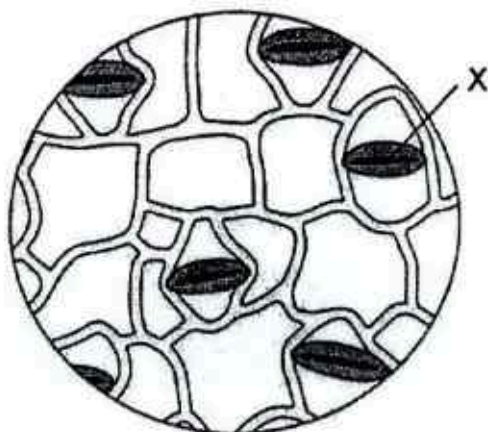
	P	Q	R	S
A	metabolism	secretion	egestion	excretion
B	secretion	metabolism	excretion	egestion
C	excretion	egestion	secretion	metabolism
D	egestion	excretion	metabolism	secretion

- 13 Which of the following correctly describes the level of glucose in various blood vessels after a meal?

	aorta	hepatic portal vein	vena cava
A	high	high	high
B	low	high	low
C	normal range	high	normal range
D	normal range	normal range	normal range

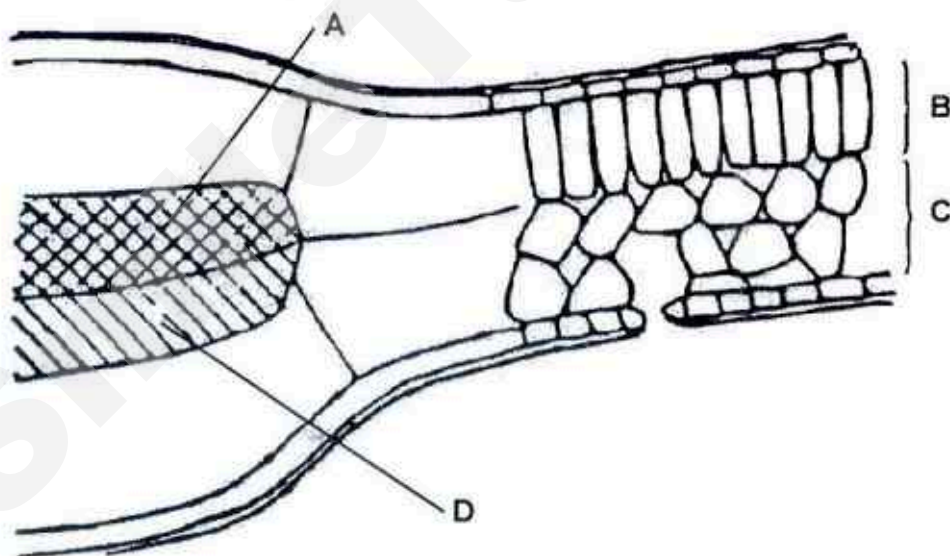
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- 14 The diagram shows the lower epidermis of a leaf under a light microscope.



Which is true for the structure X?

- A it is controlled by non-photosynthetic cells
 - B it is opened wide when the cells around it are flaccid
 - C purpose of structure X is to allow light to enter the leaf
 - D purpose of structure X is to control transpiration
- 15 The diagram shows a section through a leaf. Which region contains the most starch after a period of bright light?

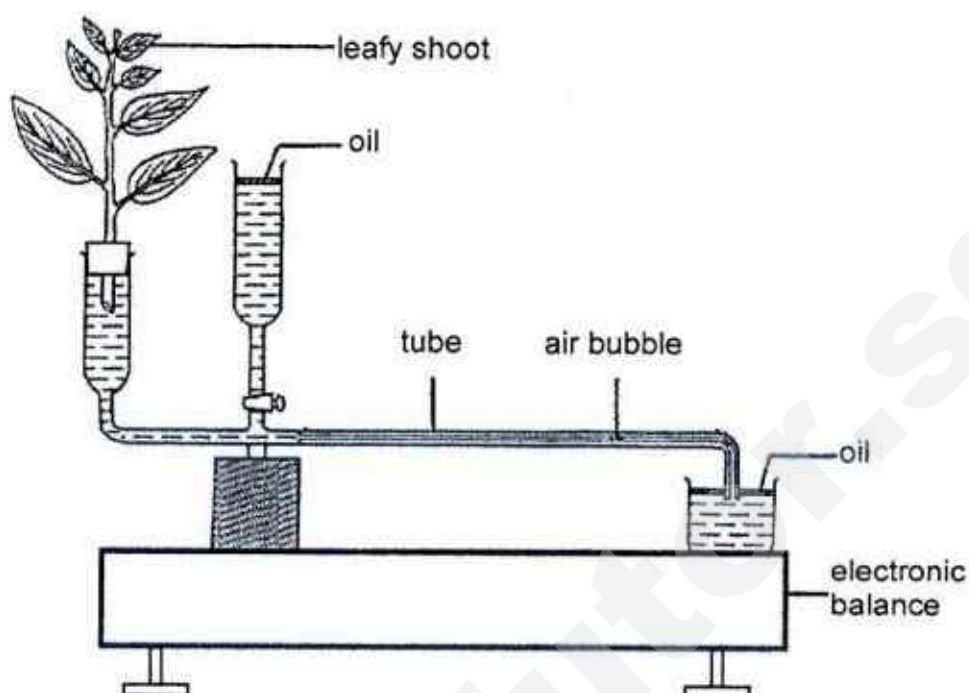


- 16 A green plant starts to wilt. It is then given water, and after a short time it recovers. Which process causes this recovery?
- A assimilation
 - B osmosis
 - C respiration
 - D transpiration

[Turn over

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- 17 The diagram bellows shows a set up at the start of an experiment carried out in sunlight.

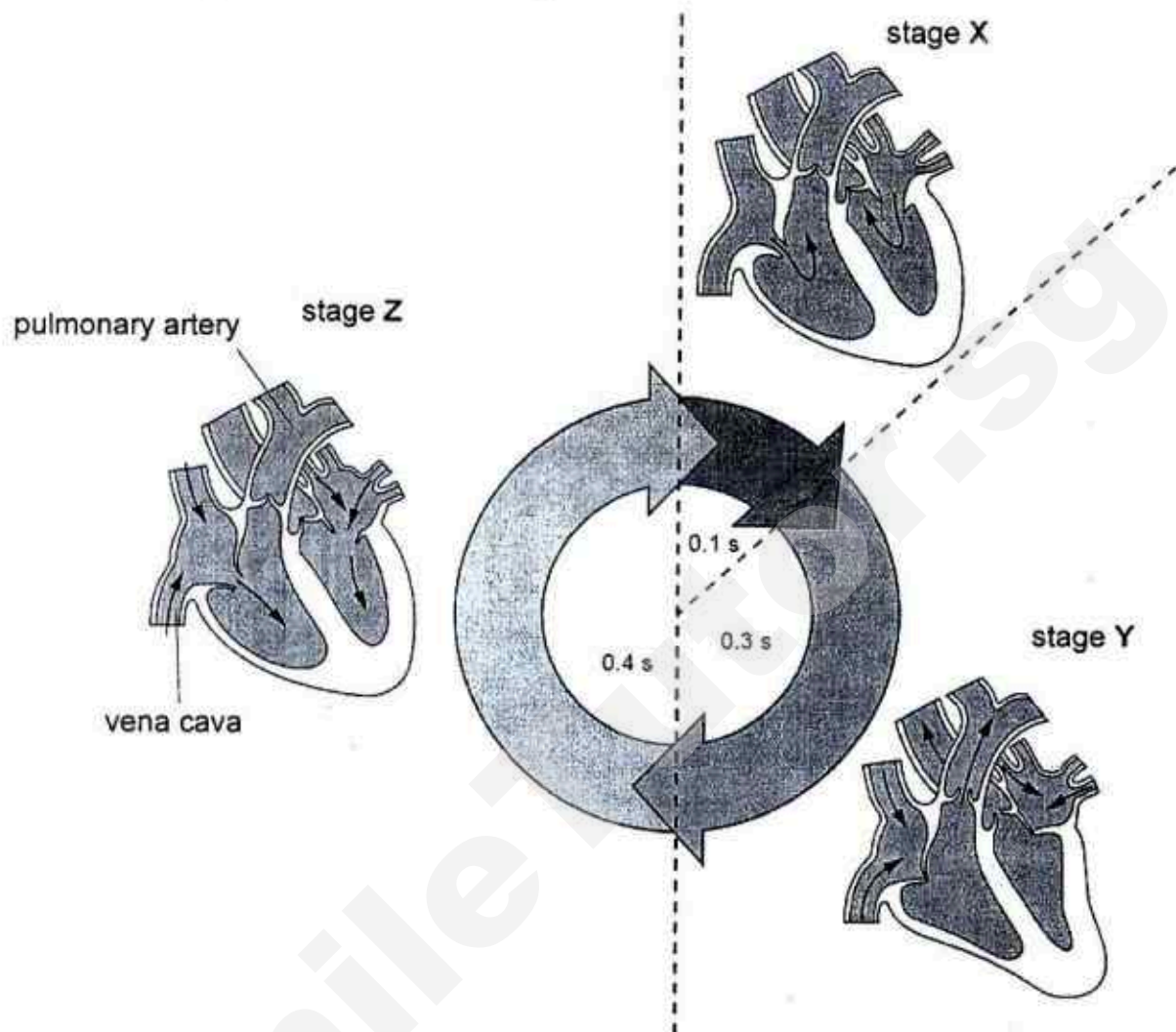


What is observed after an hour?

	mass	air bubble
A	decreases	move away from plant
B	decreases	move towards plant
C	increases	move away from plant
D	remains constant	move towards plant

[Turn over

18 The diagram shows the cardiac cycle.













Identify the stages.

	X	Y	Z
A	atrial diastole	ventricular diastole	atria and ventricular systole
B	atrial systole	ventricular systole	atria and ventricular diastole
C	atria and ventricular diastole	ventricular systole	atrial systole
D	ventricular systole	atrial systole	atria and ventricular systole

[Turn over

- 19 A blood group test was done on four samples of blood. The blood samples were mixed with reagents A and B separately.

	blood sample			
	P	Q	R	S
reagent A with antibody A				
reagent B with antibody B				

key  clumping of blood  no clumping of blood

What are the blood groups of Q and R?

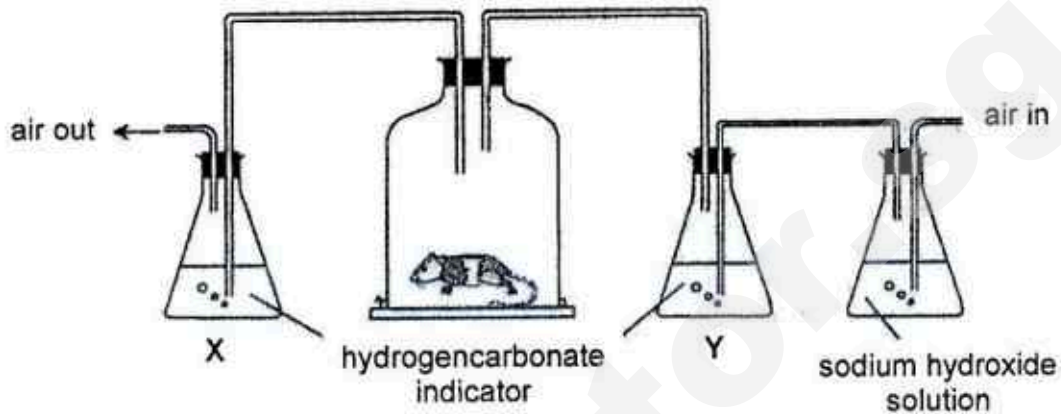
	Q	R
A	A	B
B	B	A
C	AB	O
D	O	AB

- 20 A blood clot contains a network of protein. What is the protein?

- A fibrin
- B fibrinogen
- C haemoglobin
- D thrombin

- 21 Which of the following correctly states the colour of the hydrogencarbonate indicator solution in flask X and Y after 20 minutes?

concentration of carbon dioxide/ %	colour
less than 0.04	purple
0.04	red
more than 0.04	yellow

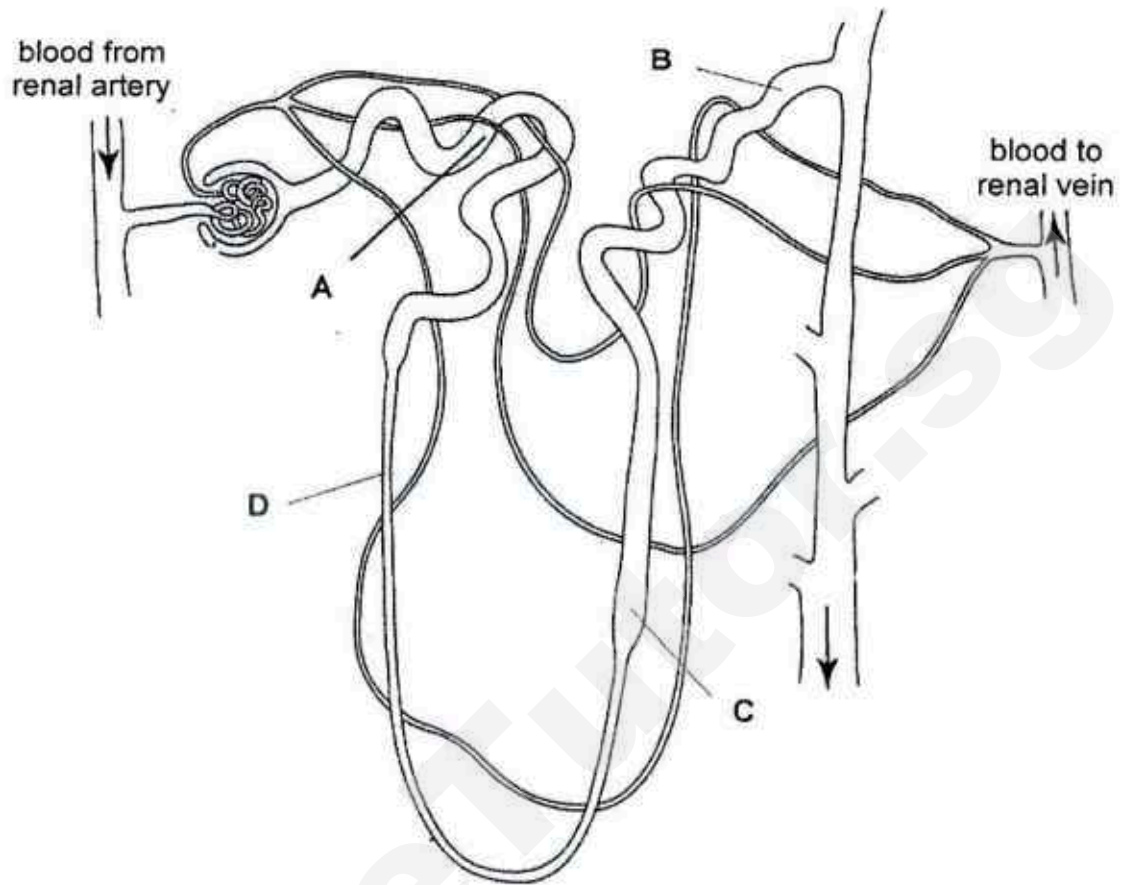


	X	Y
A	red	purple
B	red	yellow
C	yellow	purple
D	purple	red

- 22 What correctly describes the cause and effect of carcinogens on lung tissue?
- A Cells of the alveoli walls divide more rapidly than normal by meiosis causing a tumour to develop.
 - B Cilia are paralysed, mucus accumulates in the lungs, causing DNA to change, mitosis and a tumour to develop.
 - C DNA changes, causing bronchial epithelial cells to divide in an uncontrolled way by mitosis and a tumour to develop.
 - D Haemoglobin carries less oxygen, causing bronchial cells to divide in an uncontrolled way by mitosis and a tumour to develop.

[Turn over

- 23 Which part of the nephron shown below is impermeable to water molecules?

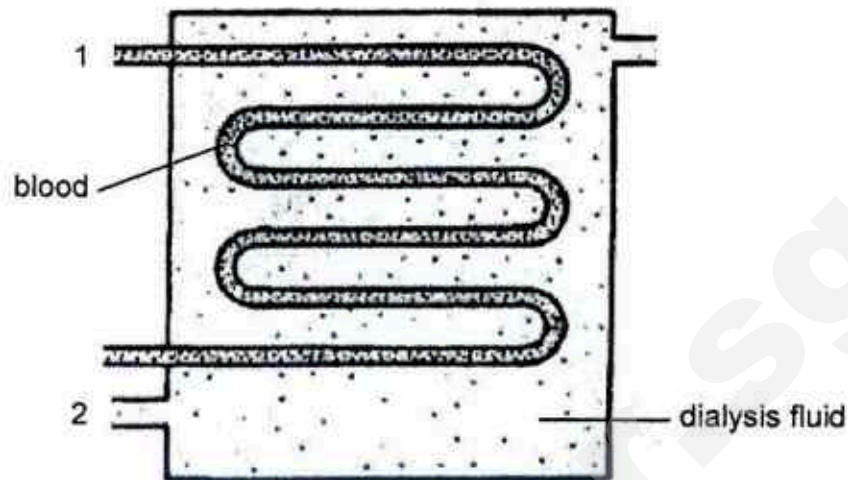


- 24 Which of the following is not found in the glomerular filtrate?

1. amino acids
2. glucose
3. protein

- A 1 only
 B 1 and 2
 C 1 and 3
 D 3 only

- 25 The diagram represents a kidney dialysis machine.

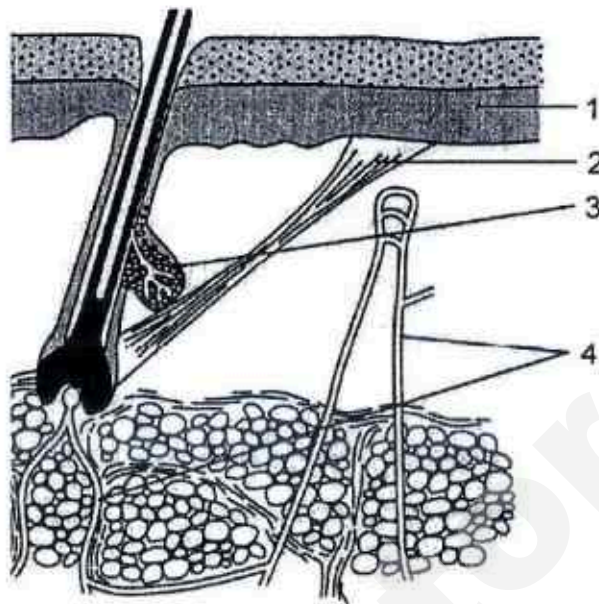


Which of the following is true for the movement of fluids in the machine?

	at 1	at 2	reason
A	blood in	dialysis fluid in	opposite flow for active transport
B	blood in	dialysis fluid out	to maintain diffusion gradient
C	blood out	dialysis fluid in	opposite flow for large diffusion gradient
D	blood out	dialysis fluid out	opposite flow for large diffusion gradient

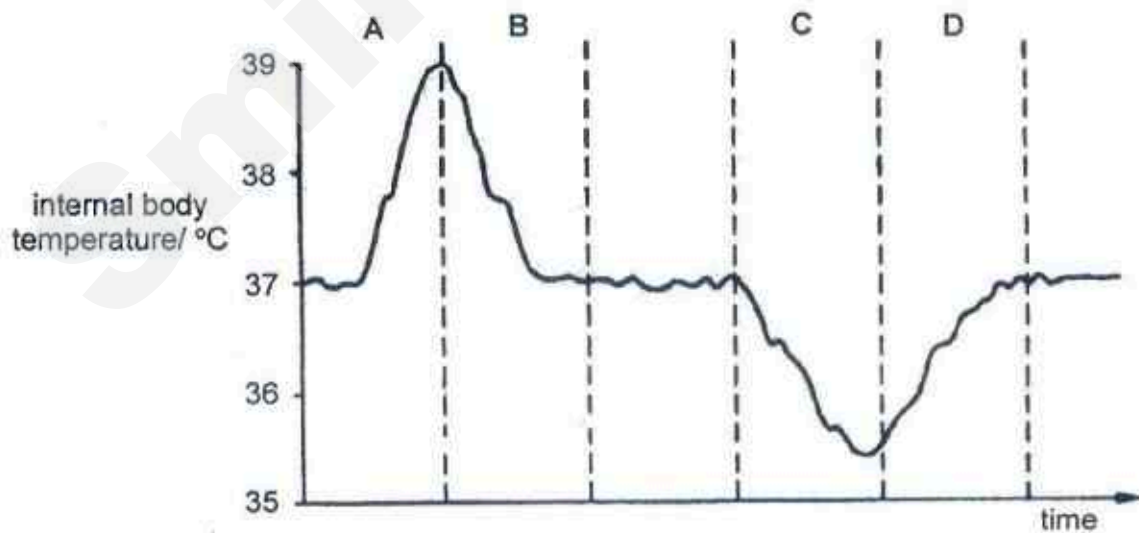
- 26 180 litres of fluid are filtered by the kidney each day. 1.5 litres are excreted in urine. A failure of which organ will result in a higher volume of urine being formed?
- A bladder
 B pancreas
 C liver
 D pituitary gland

- 27 The diagram below shows a section of the human skin.



Which of the parts are involved in temperature regulation?

- A 1 and 2
 - B 2 and 4
 - C 2, 3 and 4
 - D 3 and 4
- 28 The graph shows changes in a person's internal temperature over a period of time. During which period would the arterioles first become constricted?



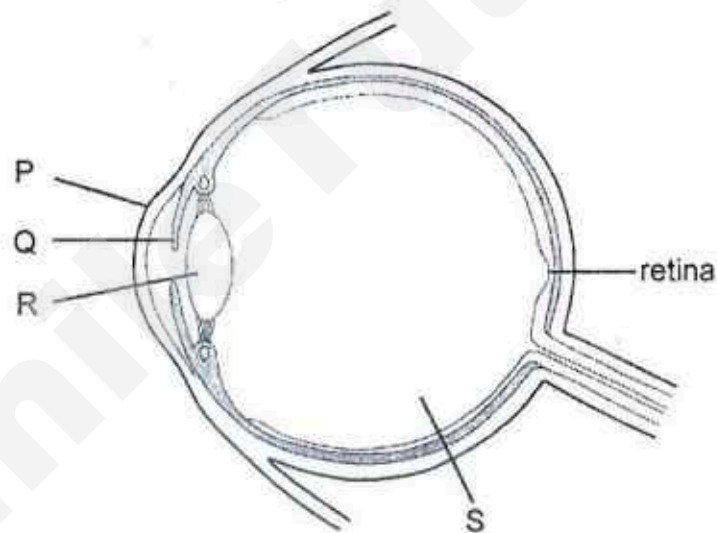
[Turn over

- 29 The table shows blood flow through different parts of the body at rest and during exercise.

region	blood flow/ cm^3 per min	
	at rest	during exercise
heart muscle	200	550
skin	330	640
small intestine	190	110

Which of the following explains the data in the table?

- A decreased blood flow at the small intestines to increase blood flow to muscles
 B decreased blood flow at the small intestines to increase efficiency of diffusion of digested food
 C increased blood flow at the skin for respiration of skin cells so more heat energy is released
 D increased blood flow to the heart muscles to decrease blood flow to the small intestine
- 30 The diagram shows a section through the eye.



Which pair of structures focus light rays onto the retina?

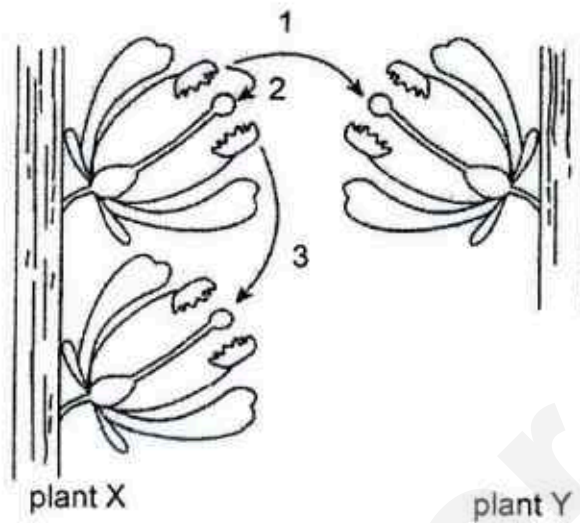
- A P and Q
 B P and R
 C Q and R
 D Q and S
- 31 A person is sitting in a dark room.
 What happens in the eye when the light is switched on?

	circular muscles of iris	size of pupil
A	contracts	decreases
B	contracts	increases
C	relaxes	decreases
D	relaxes	increases

[Turn over

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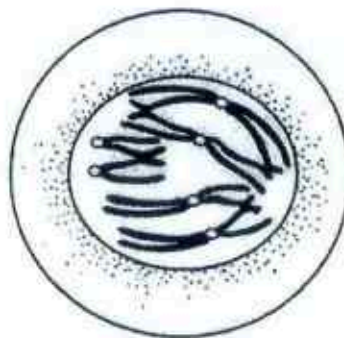
- 32 The diagram shows two plants of the same species and the movement of pollen.



If fertilisation occurred, which of the following is true of the offsprings?

	more variation	less variation
A	1 and 2	3
B	1	2 and 3
C	2	1 and 3
D	2 and 3	1

- 33 What is the route taken by a pollen tube upon successful pollination?
- A anther → stigma → ovary
 B style → stigma → ovary
 C stigma → filament → ovary
 D stigma → style → ovary
- 34 The diagram below shows a cell in meiosis. What can be deduced from this diagram?

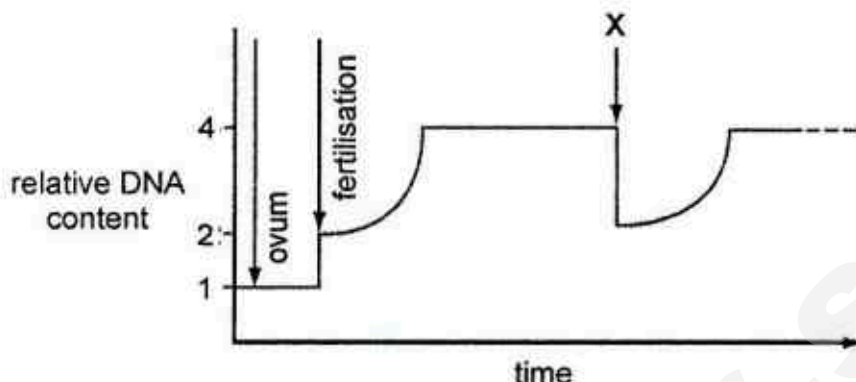


	stage of meiosis shown	haploid number of chromosomes in this cell
A	metaphase I	3
B	metaphase I	6
C	prophase I	3
D	prophase I	6

[Turn over

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- 35 The graph represents the changes in the quantity of DNA present in one nucleus at different stages in the life cycle.

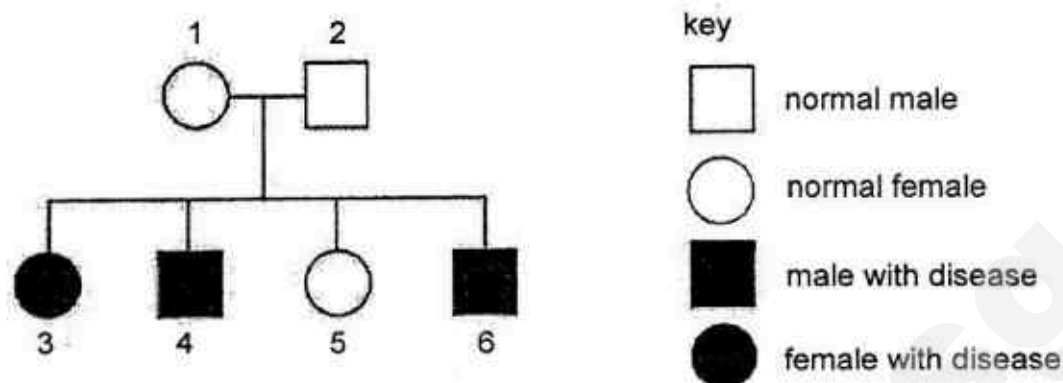


Which stage takes place at X?

- A interphase
 - B metaphase
 - C prophase
 - D telophase
- 36 A length of double-stranded DNA contains a total of 120 nucleotides and codes for polypeptide X. What is the maximum length of polypeptide X?
- A 20 amino acids
 - B 40 amino acids
 - C 60 amino acids
 - D 120 amino acids
- 37 The following are the stages of gene expression.
1. mRNA leaves nucleus via nuclear pore
 2. ribosome binds to mRNA
 3. peptide bond forms between amino acids
 4. template DNA is transcribed to mRNA
- Which is the correct order?
- A 1 → 4 → 2 → 3
 - B 3 → 2 → 1 → 4
 - C 4 → 1 → 2 → 3
 - D 4 → 1 → 3 → 2
- 38 Which of the following is true about ABO blood groups?
- A blood group O individual must have at least one parent with blood group O
 - B blood group O individual can produce children with blood group AB
 - C blood group AB individual must have at least one parent with blood group AB
 - D homozygous individuals can be of blood group A, B or O

[Turn over

- 39 The diagram below shows the inheritance of a disease in a family.



Which is true about the allele for this disease?

- A the allele is dominant because individual 5 has the same phenotype as both parents
- B the allele is dominant because the ratio of offspring with disease to normal offspring is 3:1
- C the allele is recessive because both parents are normal but some of the offspring have the disease
- D the allele is recessive because both parents have the same phenotype
- 40 When Charles Darwin visited the Galapagos Islands in 1800s, he observed four species of mockingbirds with similar population sizes.

Over a long period of time, it was observed that the population of mockingbird with long beak exceeds the other three species' population size.

Which sequence of events could have caused this?

1. compete advantageously for food
2. passing down the genes for long beak
3. presence of individuals with long beaks
4. random mutation in genes among individuals
5. fitter individuals survive and reproduce

- A 1 → 5 → 4 → 3 → 2
- B 3 → 4 → 1 → 5 → 2
- C 4 → 3 → 5 → 1 → 2
- D 4 → 3 → 1 → 5 → 2

END OF PAPER

1	2	3	4	5	6	7	8	9	10
C	A	B	C	A	C	D	D	A	C
11	12	13	14	15	16	17	18	19	20
B	B	C	D	B	B	B	B	C	A
21	22	23	24	25	26	27	28	29	30
C	C	C	D	D	D	B	C	A	B
31	32	33	34	35	36	37	38	39	40
A	B	D	C	D	A	C	D	C	D

4. N₂ gas inhibits respiration, energy cannot be released for active transport.
11. Intestinal juice contains enzymes which are protein in nature.
13. Hepatic portal vein transports glucose from small intestine to liver. Liver converts excess glucose to glycogen for storage, hence aorta and vena cava have normal range of glucose level.
18. Stage X shows that AV valves are open due to contraction of muscles in atria which is atrial systole.
19. Antibody A recognises antigen a and causes agglutination. Antibody B recognises antigen b and causes agglutination. Person Q has antigens a and b, so his blood group is AB.
23. Part C is the ascending limb of loop of Henle where active transport of ions (mineral salts) occurs, hence it is impermeable to water. Not in syllabus!
25. Movement of blood and dialysis fluid is in opposite direction to set up a concentration gradient to increase rate of diffusion of urea of the patient's blood. Blood enters from the bottom while dialysis fluid enters from the top to set up the opposite flow so 1 is where blood leaves and 2 is where dialysis fluid leaves.
27. Part 3 is the sebaceous gland, not the sweat gland! Part 2 is the hair erector muscle and part 4 are the arterioles.
34. Homologous chromosomes pair up during prophase I. There are 3 pairs of homologous chromosomes so diploid number is 6. Haploid number is half so it is 3.
35. After fertilisation, zygote undergoes mitosis to form a ball of cells (embryo). At X, the relative DNA content decreases to 2 due to end of mitosis which is the last phase, telophase.
36. The total of 120 nucleotides is found in double-stranded DNA. A single strand DNA which serves as the DNA template will have 60 nucleotides (120÷2). Every 3 nucleotides code for one amino acid so polypeptide X will have 20 amino acids (60÷3).
40. Mutations occur to give rise to genetic variations which include long beaks within the population. When a change in the environment (in this case, the competition for food) forces nature to select the "best suited" (those with long beaks). Birds with long beaks survive and reproduce, passing down the favourable gene of long beak to their offspring.



SINGAPORE CHINESE GIRLS' SCHOOL
Preliminary Examination
Secondary Four

CANDIDATE NAME

CLASS

4		
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INDEX NUMBER

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BIOLOGY

5158/01

Paper 1 Multiple Choice

Monday

7 August 2017

1 Hour

Additional Materials: Optical Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, class and index number on the Question Paper and Answer Sheet in the spaces provided.

There are **forty** questions in this paper. Answer **all** questions. For each question, there are four possible answers, A, B, C and D.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

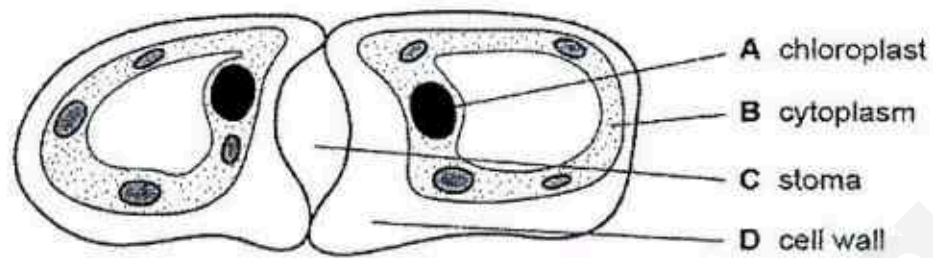
Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this booklet.

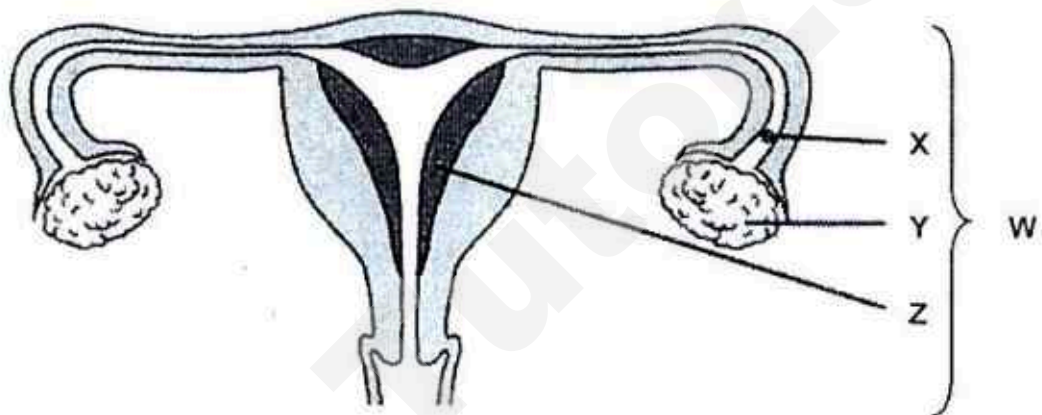
The use of an approved scientific calculator is expected, where appropriate.

This question paper consists of 25 printed pages.

- 1 The diagram shows a student's drawing of guard cells. Which label is **not** correct?



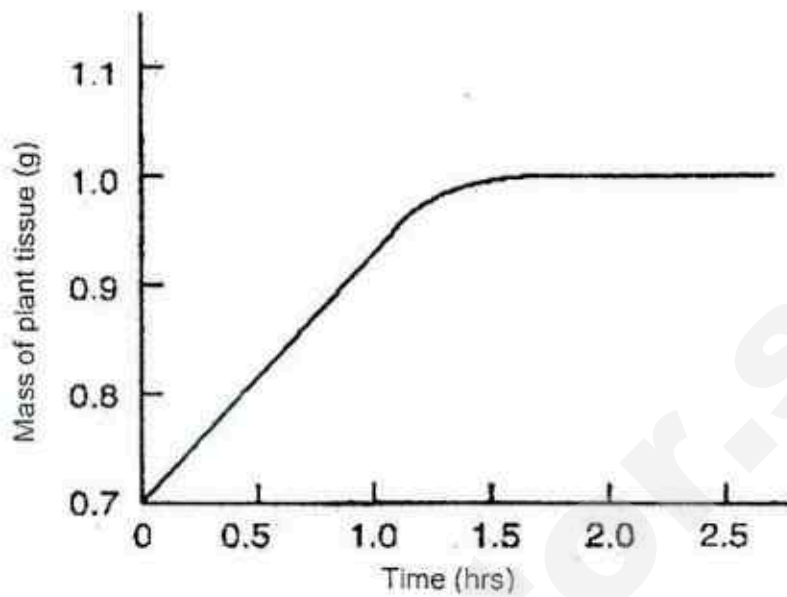
- 2 The diagram shows the female reproductive system.



Which level of organization are the structures W, X, Y and Z at?

	Cell	Tissue	Organ	Organ system
A	X	Y	W	Z
B	X	Z	Y	W
C	Y	X	Z	W
D	Y	W	Z	X

- 3 The graph shows the changes in the mass of a piece of plant tissue in distilled water at 30°C.



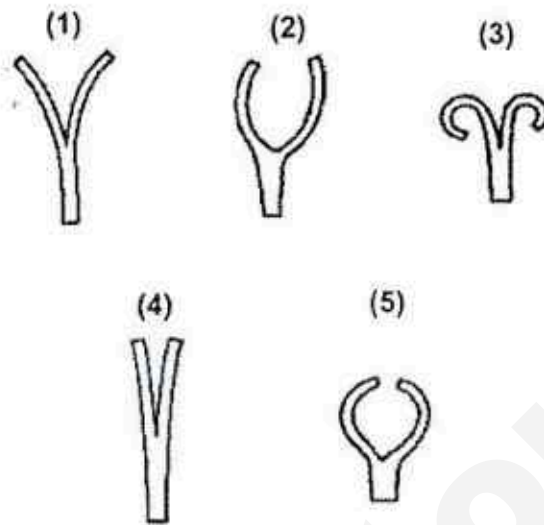
The following conclusions are made.

- 1 The plant cells are plasmolysed between 1.5 hrs to 2.5 hrs.
- 2 The plant cells are fully turgid between 1.5 hrs to 2.5 hrs.
- 3 The rate of osmosis is highest from 1.5 hrs to 2.5 hrs.
- 4 There was no movement of water molecules from 1.5 hrs to 2.5 hrs.

Which conclusion/s is/are correct?

- A 1 only
B 2 only
C 2 and 3 only
D 2, 3 and 4 only

- 4 Figure (1) represents the appearance of a freshly split petiole of a *Coleus*. The appearances of the petioles in solutions of different water potentials after 30 minutes are shown below.



Arrange the petioles in the order of how they appear in solutions of increasing water potential.

- A (3), (4), (2) and (5)
- B (3), (5), (2) and (4)
- C (5), (2), (4) and (3)
- D (5), (3), (4) and (2)

- 5 Which food would be best for a person suffering from anaemia?

	food	iron/mg per 100g of food	calcium/mg per 100g of food	vitamin C/mg per 100g of food	vitamin D/mg per 100g of food
A	bananas	0.4	7	10	0
B	fish	0.4	28	0	6.38
C	lentils	7.6	39	0	0
D	milk	0.1	120	0.5	0.002

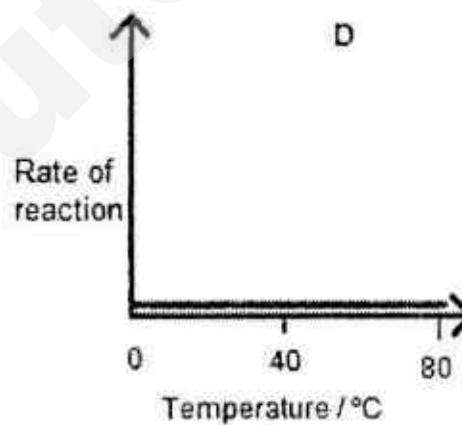
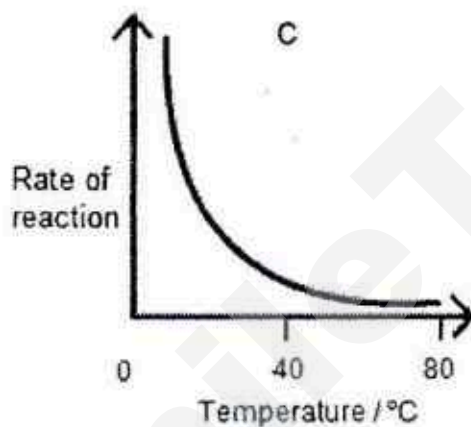
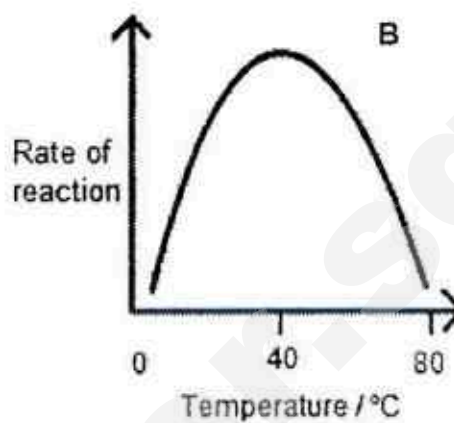
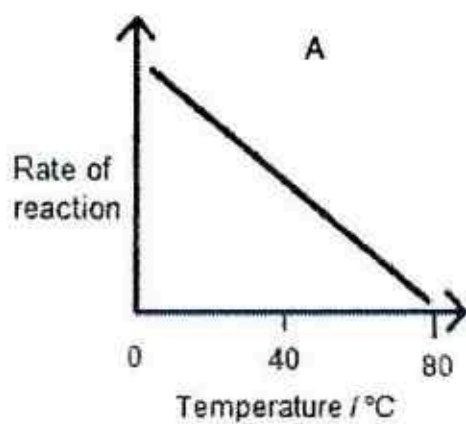
- 6 A student carried out an experiment to identify the two food substances present in each of three test tubes. The table shows the result of the student's tests.

test tube	reagent added to test tube		
	Biuret test	Benedict's test	Iodine test
X	turns violet	brick red precipitate	remains brown
Y	remains blue	remains blue	turns blue-black
Z	turns violet	remains blue	turns blue-black

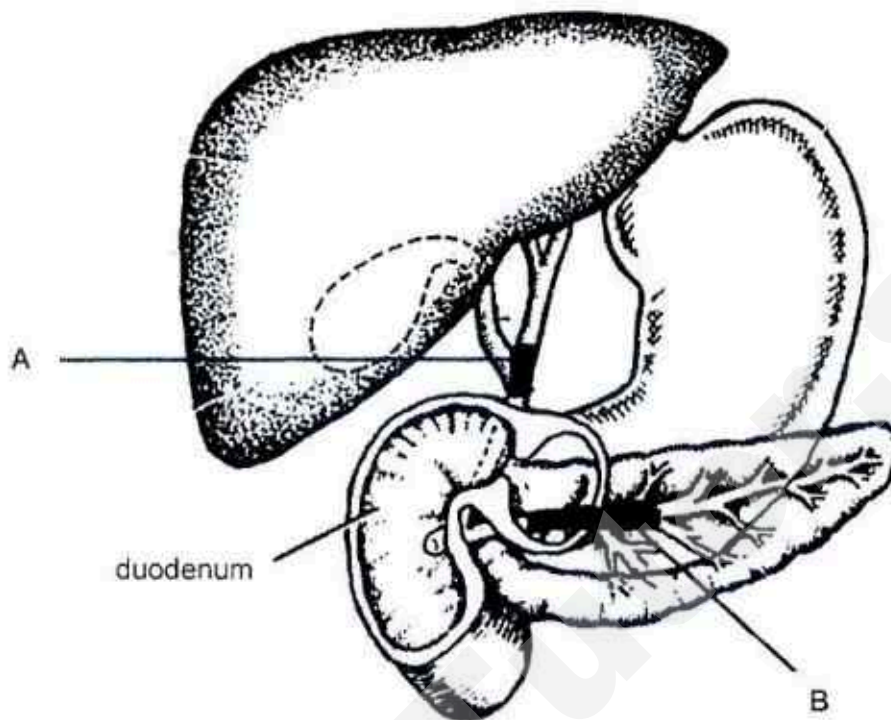
Which conclusion is consistent with the results?

- A Maltose and starch had been placed in tube Z.
- B Starch and sucrose had been placed in tube Y.
- C Maltose and sucrose had been placed in tube X.
- D Egg white and sucrose had been placed in tube X.

- 7 Which graph shows the changes in reaction rate when amylase is added to a hot starch solution at 80°C and the solution is then cooled down to 0°C ?



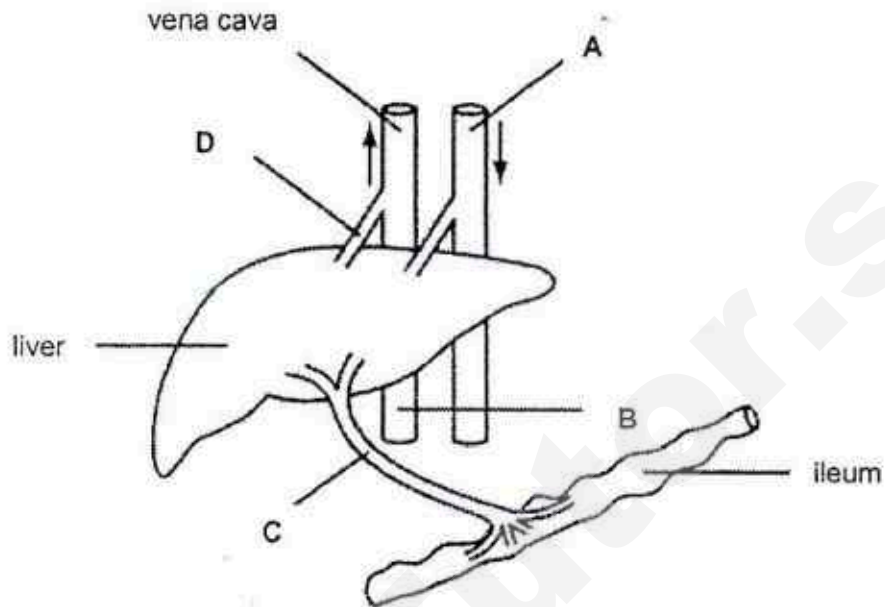
- 8 The diagram shows part of the digestive system of a mammal. What is a likely change in the duodenum due to the blockages at A and B?



- A decrease in pH of the duodenum
- B decrease in the release of glucagon
- C increase in the physical digestion of fats
- D increase in release of pancreatic proteases

- 9 The diagram shows the liver and its associated blood vessels.

If a person is fasting, which blood vessel would have the highest concentration of glucose after 24 hours?



- 10 Grace is a healthy girl. Blood samples from three veins (X, Y and Z) in her body were taken and the concentrations of carbon dioxide, oxygen and urea were measured.

The results, in arbitrary units, are shown in the following table.

vein	carbon dioxide concentration / arbitrary units	oxygen concentration / arbitrary units	urea concentration / arbitrary units
X	45	34	0.3
Y	48	37	6.8
Z	33	98	5.1

Alexis is suffering from some illness and his blood samples from similar locations (X, Y and Z) were taken and the concentrations of the substances were measured and recorded in the table below.

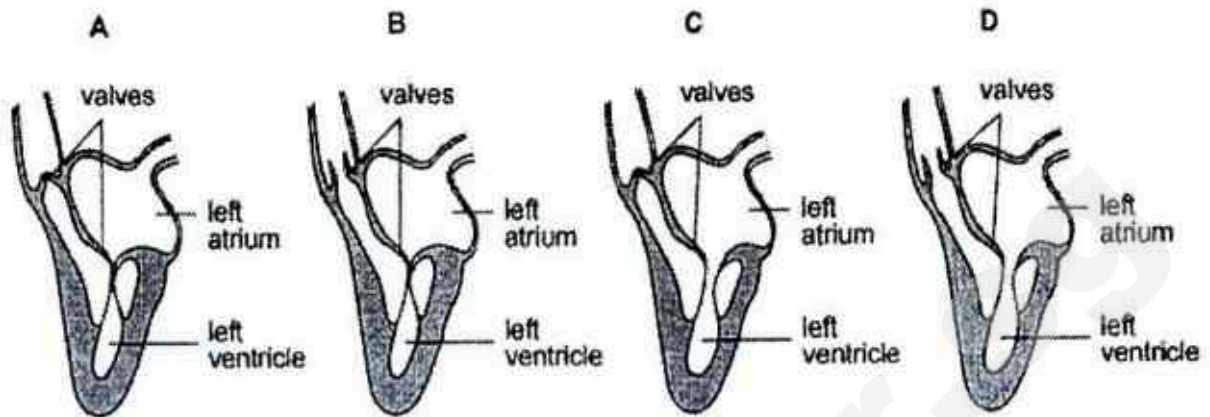
vein	carbon dioxide concentration / arbitrary units	oxygen concentration / arbitrary units	urea concentration / arbitrary units
X	43	33	2.9
Y	47	35	6.6
Z	33	97	5.3

What could Alexis be suffering from?

- A atherosclerosis
- B diabetes mellitus
- C emphysema
- D kidney failure

11 The diagrams show sections through the left side of the heart.

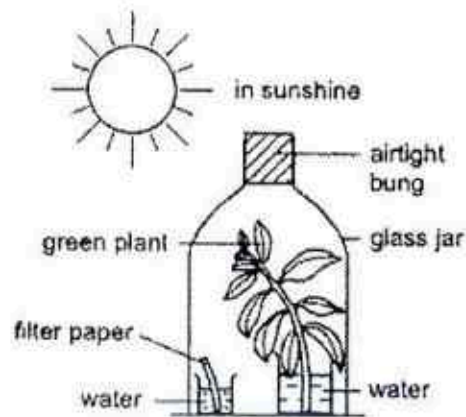
Which diagram shows the state of the valves during ventricular contraction?



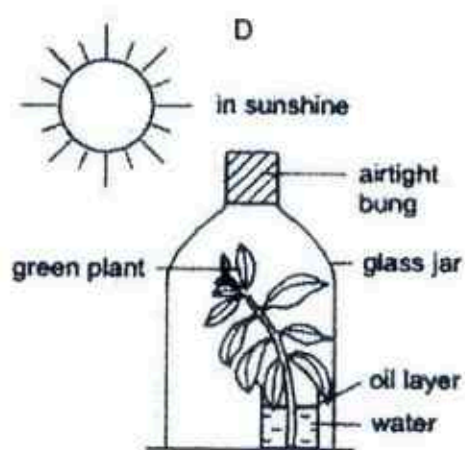
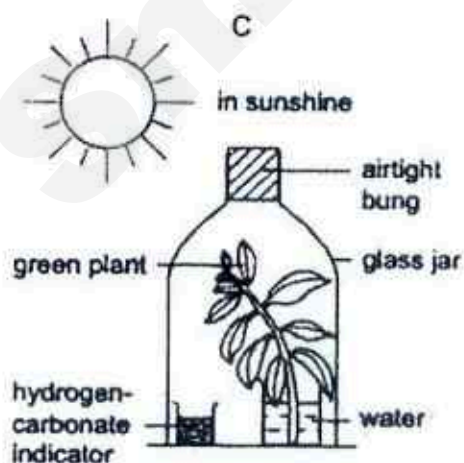
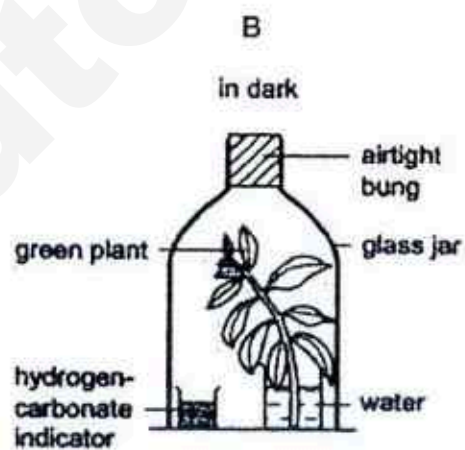
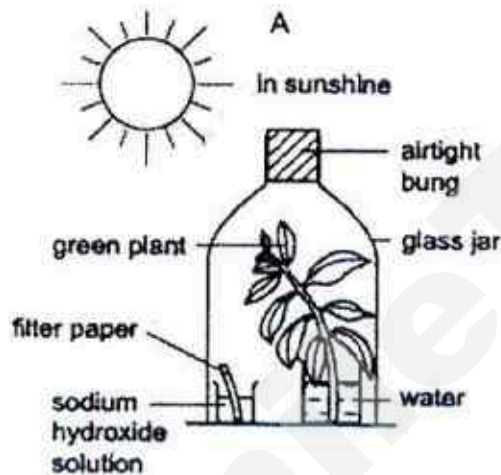
12 What is the function of platelets in wound healing?

- A to break down insoluble threads
- B to convert insoluble trypsinogen to soluble trypsin
- C to release thrombokinase
- D to synthesise soluble threads

- 13 The diagram shows a green shoot photosynthesizing under a glass jar. This was used as a control experiment to investigate the need for CO_2 in photosynthesis.

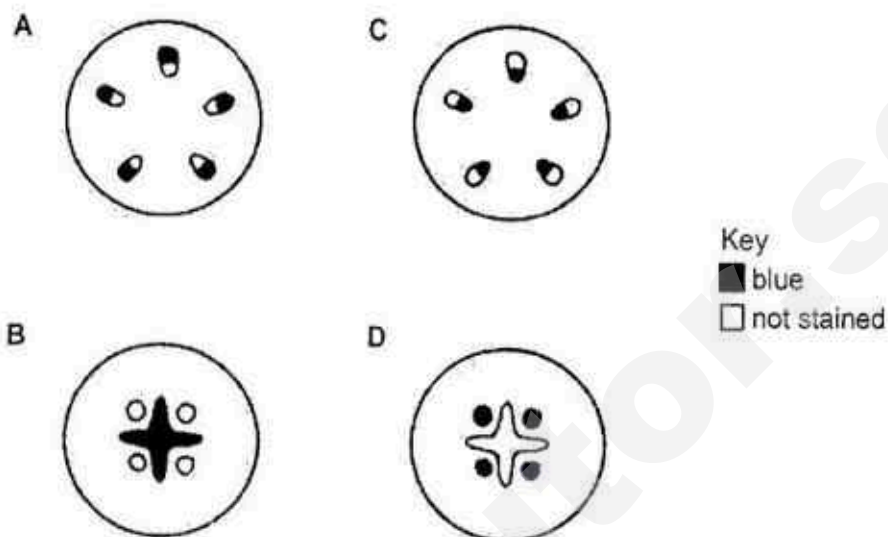


Which diagram shows the other set-up in order to ensure a fair experiment?

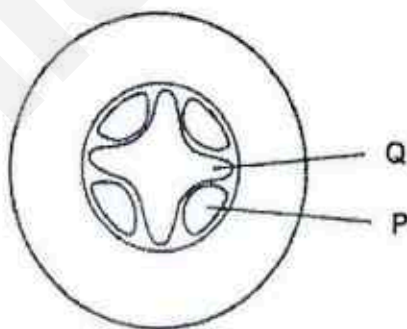


- 14 Joanna bought a bunch of blue flowers from the market. In order to find out if the colour was artificially introduced, she prepared a section of the root and observed it under a microscope.

Which of the following correctly shows the condition of the section if the colour of the flowers was artificially introduced?



- 15 A herbaceous plant, growing in a nutrient solution, is placed in a well-lit experimental chamber through which humid air is being passed slowly. The diagram shows a section through part of the plant.

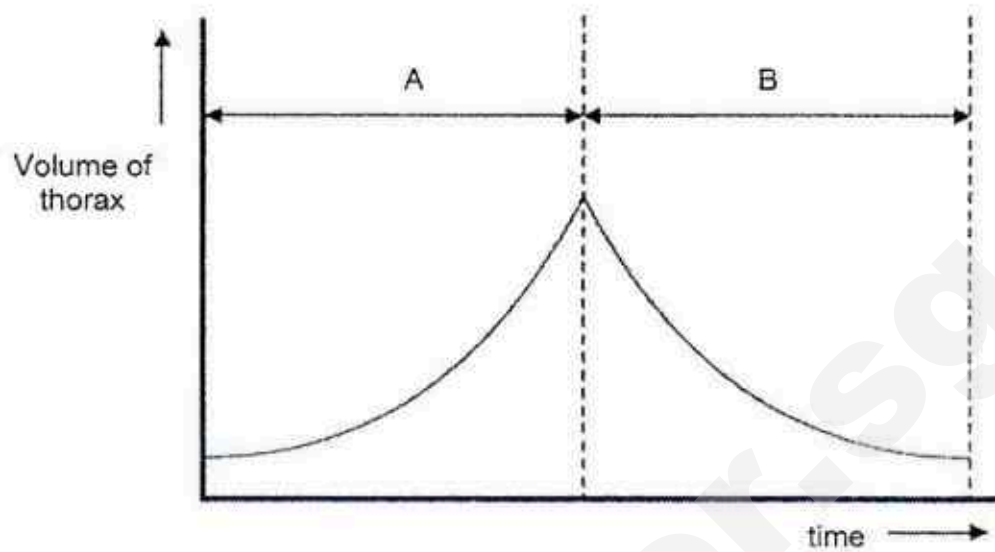


The speeds of the movement of the fluids in tissues P and Q are measured. The humid air is then replaced by dry air and the speeds of movement of the fluids change.

What are the changes in both tissues P and Q respectively?

	tissue P	tissue Q
A	little change	little change
B	greatly increased downward movement	little change
C	greatly increased downward movement	greatly increased upward movement
D	little change	greatly increased upward movement

- 16 The graph shows changes in the volume of the thorax during one breath.

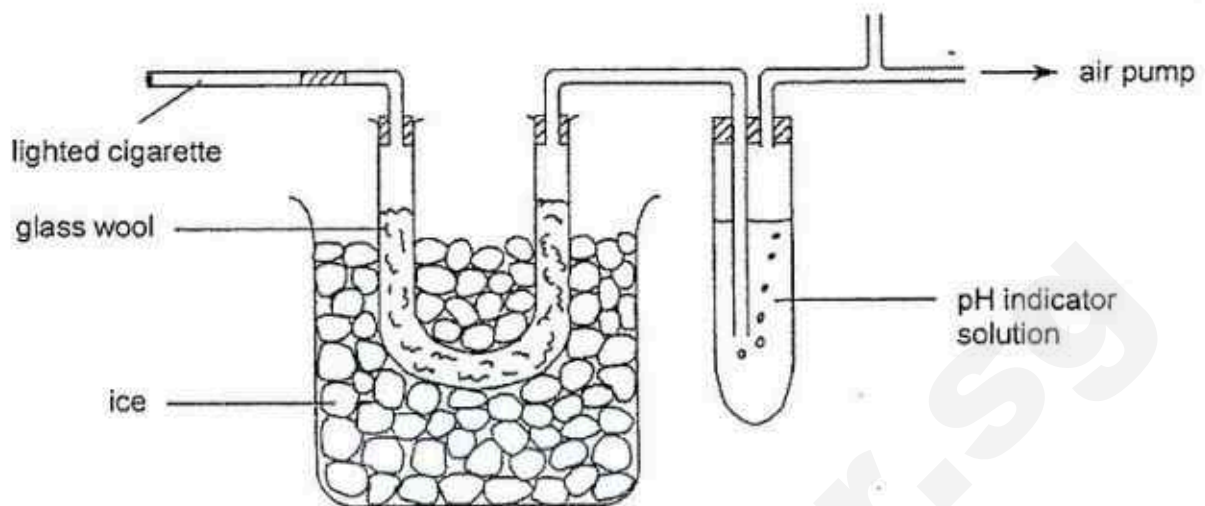


Which process(es) is/are likely to occur during time period A?

- 1 Diaphragm relaxes and flattens.
- 2 External intercostal muscles contract.
- 3 Ribcage moves upwards and outwards.

- A 2 only
B 1 and 2 only
C 2 and 3 only
D 1, 2 and 3

- 17 The experimental set-up was used to investigate the products of cigarette smoke.



After 20 minutes, a sticky brown substance was collected on the glass wool. A second cigarette was placed in the same apparatus and more of the same substance accumulated on the glass wool.

It was proposed that by smoking a second cigarette, the risk of a certain condition may be increased.

What is the most likely condition?

- A lung cancer
- B increased blood clot formation
- C reduced transport of oxygen by red blood cells.
- D increased heart rate and blood pressure

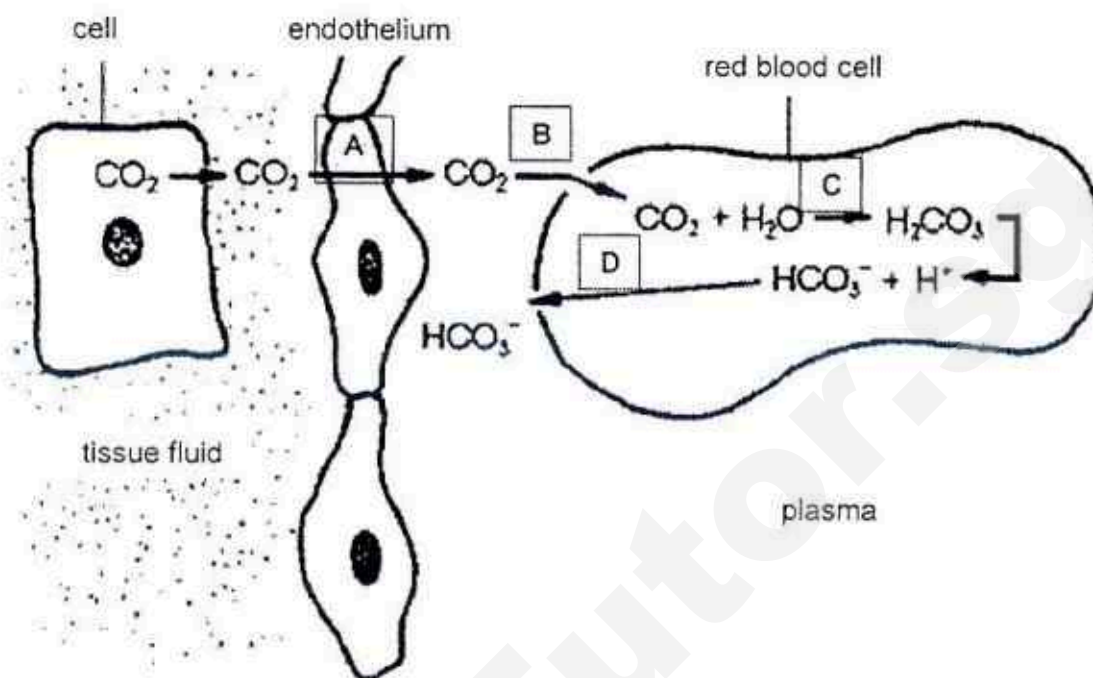
- 18 Five processes are listed below.

- 1 release of carbon dioxide
- 2 production of energy
- 3 release of oxygen
- 4 uptake of water
- 5 release of water

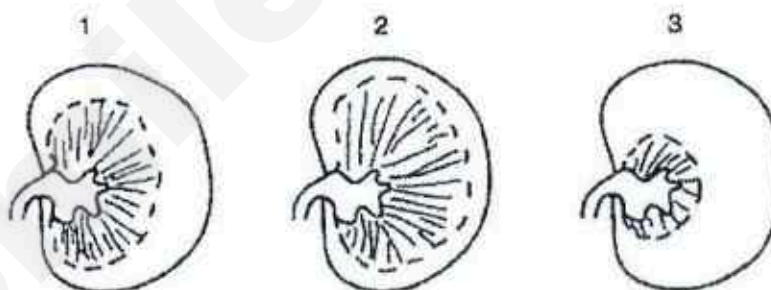
Which processes occur during aerobic respiration?

- A 1, 2 and 4 only
- B 1 and 5 only
- C 1, 2, 4 and 5 only
- D 1, 4 and 5 only

- 19 The diagram shows the relationship between tissue cells and blood capillaries in the transport of carbon dioxide. Which label shows the reaction catalyzed by carbonic anhydrase?



- 20 The diagrams vertical sections of the kidneys of coypu, brown rat and kangaroo rat. Note the relative sizes of cortex and medulla.



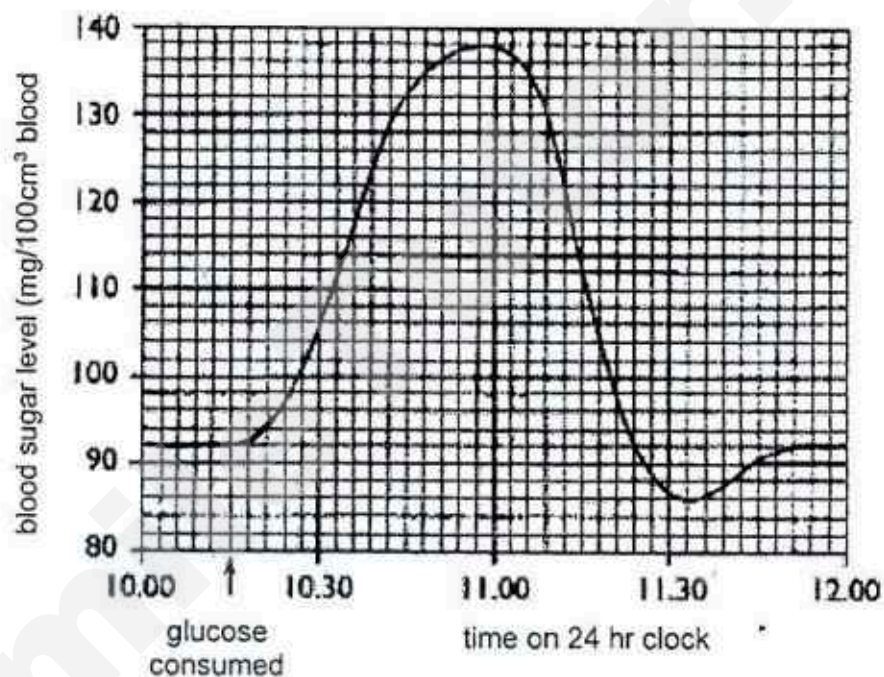
Coypu are found in fresh water and are never short of water to drink. Brown rats are able to go on for some days without drinking. Kangaroo rats are able to live in deserts without drinking at all.

Which kidney belongs to which animal?

	1	2	3
A	brown rat	coypu	kangaroo rats
B	brown rat	kangaroo rat	coypu
C	kangaroo rats	brown rat	coypu
D	kangaroo rats	coypu	brown rat

- 21 Which process is **not** a result of negative feedback?
- A A decrease in the surrounding temperature leads to a decrease in respiration rate.
 - B A decrease in the surrounding temperature leads to a decrease in sweating.
 - C A decrease in the surrounding temperature leads to a decrease in blood flow through the skin surface.
 - D A decrease in the surrounding temperature leads to shivering.

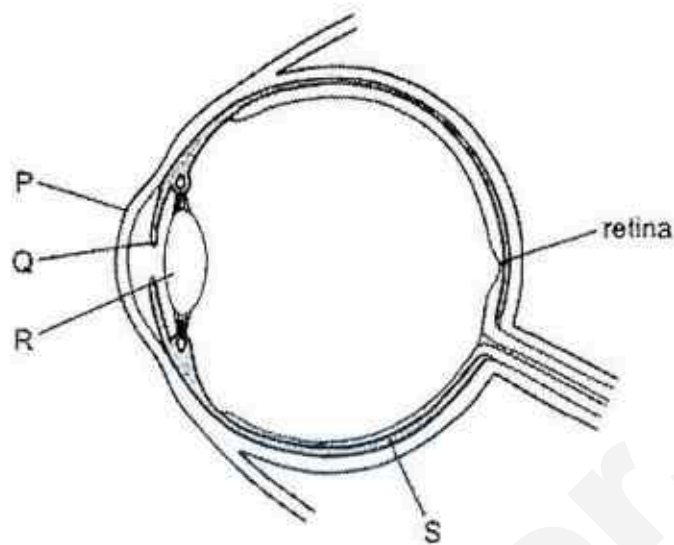
- 22 The graph shows the blood sugar level of a person who has consumed 50g of glucose at the time indicated.



At which time of the two-hour period would the secretion of insulin and glucagon increase?

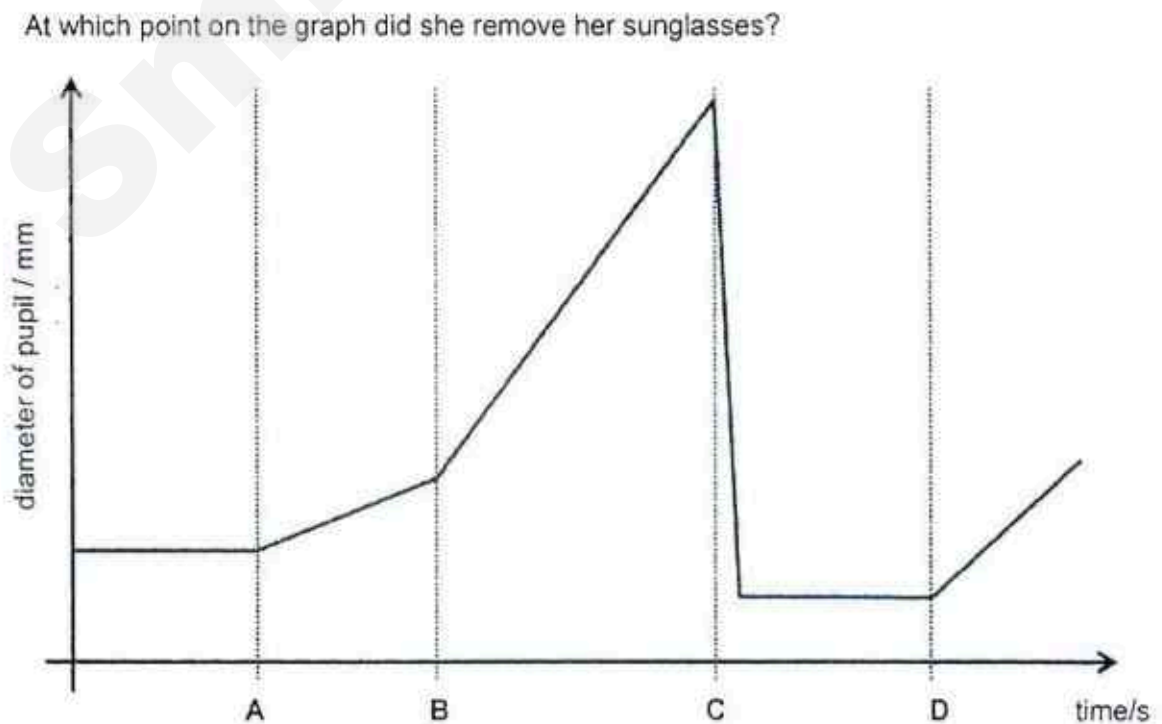
	increased amount of insulin	increased amount of glucagon
A	10.30	11.00
B	10.30	11.30
C	11.00	10.30
D	11.30	10.30

- 23 The diagram shows a section through the eye.



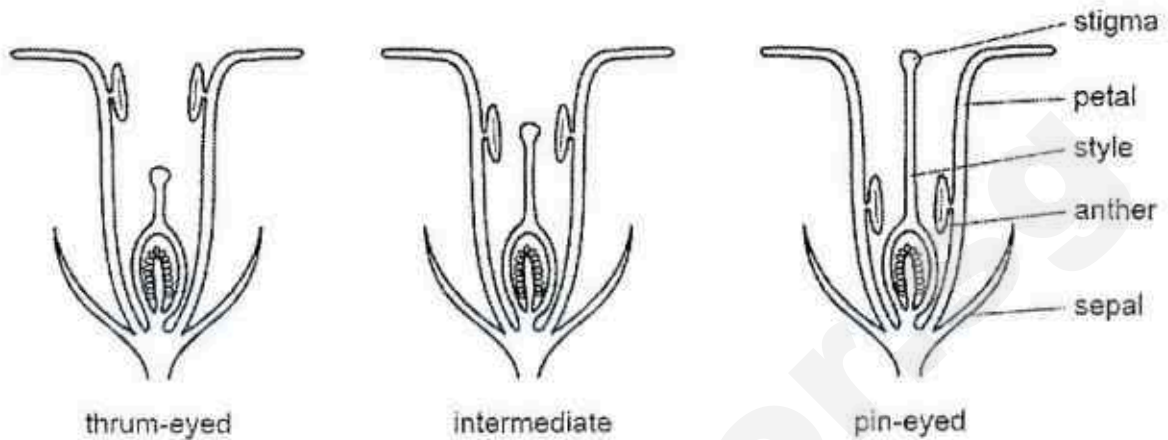
Which structures focus light rays onto the retina?

- A P and Q
 - B Q and R
 - C R and S
 - D P and R
- 24 Jessica was wearing a pair of sunglasses on a sunny day but removed it as she prepares to enter the pool to swim. The following is a graph of the diameter of her pupil against time.



- 25 The primrose, *Primula vulgaris*, is a small plant which is common in cooler areas of the Northern Hemisphere.

The flowers of the primrose have many different shapes adapted for pollination, of which three variations are represented below.



Which statement(s) is/are correct?

- 1 The stigma of the pin-eyed primrose is able to receive pollen grains by wind.
- 2 The intermediate primrose is pollinated by insects.
- 3 The pollen grains of the thrum-eyed primrose is pollinated only by wind and gravity.

- A 1 only
B 1 and 2 only
C 1 and 3 only
D 1, 2 and 3 only

- 26 The trigeminal nerve in a human connects the brain to the teeth and skin of the face.

When a dentist administers a local anaesthetic by injection in the mouth, a person can no longer feel pain there and cannot smile properly.

What can you conclude about the trigeminal nerve?

- A It contains only sensory neurons.
- B It contains only relay neurons.
- C It contains sensory and motor neurons.
- D It contains relay and motor neurons.

- 27 Which comparison about voluntary and reflex actions is incorrect?

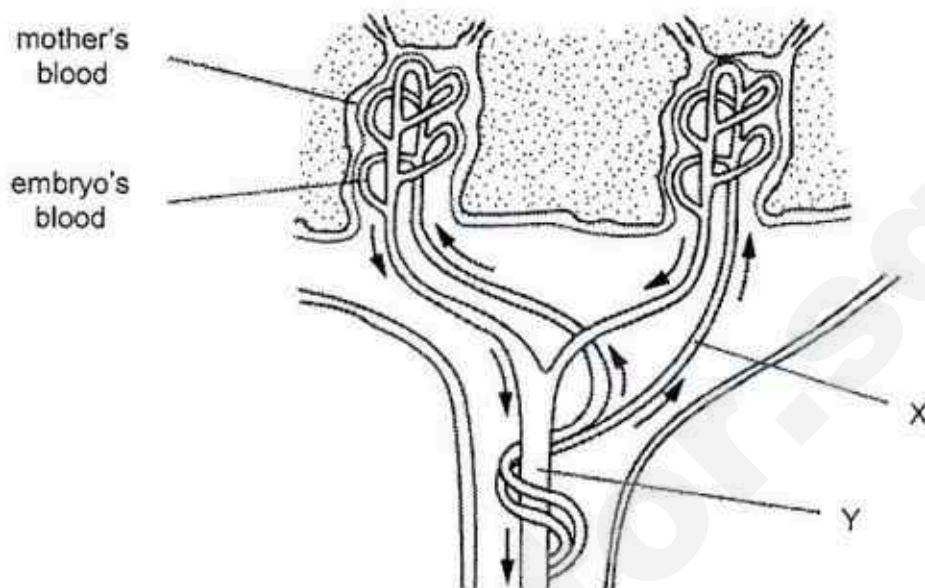
	voluntary action	reflex action
A	not inborn	inborn
B	may involve a stimulus	we are not aware of the action
C	we are aware of the action	we are not aware of the action
D	stimulus may lead to different responses	stimulus leads to the same response

- 28 Which of the following events(s) is/are under the influence of hormones in humans?

- 1 breakdown of endometrium
- 2 diffusion of glucose into cells
- 3 selective reabsorption in glomerulus

- A 1 only
- B 1 and 2 only
- C 2 and 3 only
- D 1, 2 and 3

- 29 The diagram shows how the blood of a human embryo flows close to the mother's blood in the placenta.



Which substances are present at X in higher concentrations than at Y?

- A carbon dioxide and glucose
 - B carbon dioxide and urea
 - C glucose and oxygen
 - D glucose and urea
- 30 The diagrams show the reproductive structures of a mammal, P and a flowering plant, Q.



Which of the following statement is correct?

- A Both P and Q are male gametes.
- B Both structures 1 and 4 carry the Y chromosome.
- C Both structures 1 and 4 contain the same number of chromosomes.
- D Both structures 2 and 3 enable the male gamete to meet the female gamete.

- 31 Two parents both have blood group A. Their first child has blood group O.

What is the probability that their second child will also have blood group O?

- A 0.00
- B 0.25
- C 0.50
- D 1.00

- 32 The table shows the genotypes and phenotypes for hair colour for the members of a family but one phenotype is shown incorrectly.

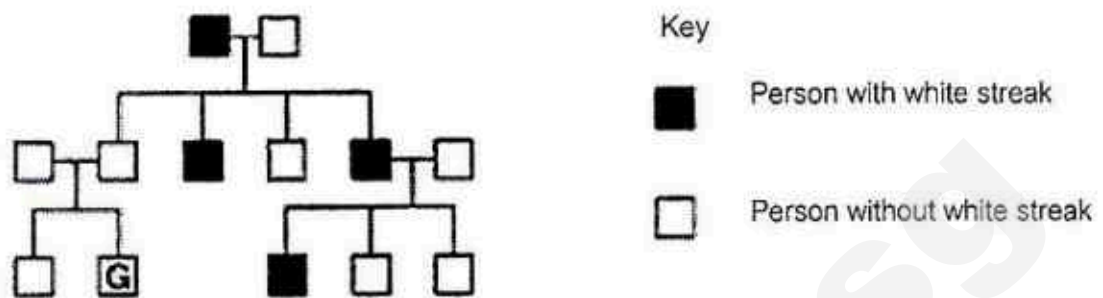
family member	genotype		phenotype
	allele 1	allele 2	hair colour
mother	a	A	brown
father	A	A	brown
son 1	a	A	blonde
daughter 1	a	a	blonde
son 2	A	A	brown
daughter 2	A	a	brown

Which family member has the incorrect phenotype?

- A daughter 1
- B daughter 2
- C son 1
- D son 2

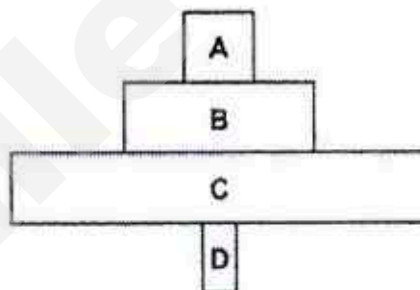
- 33 A white streak in dark hair is caused by the presence of a dominant allele.

The diagram shows how this white streak was inherited in a family.



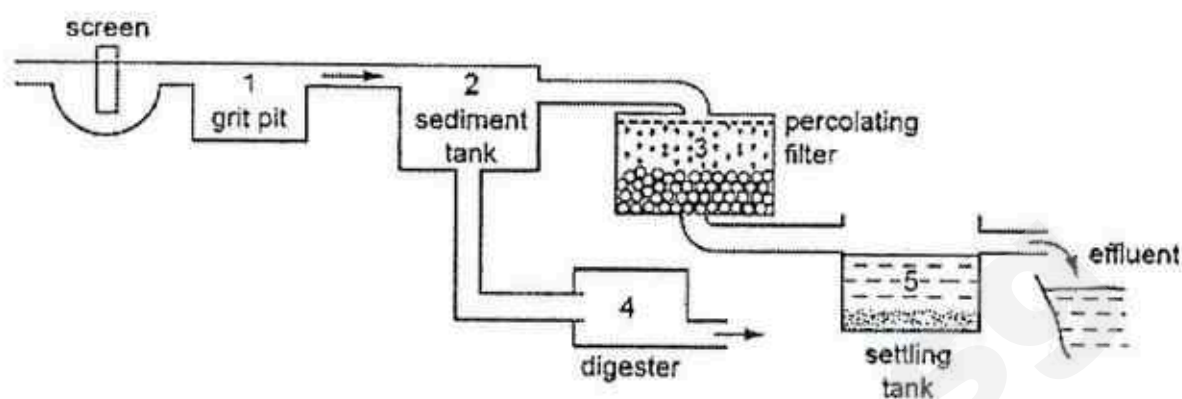
What is the chance that G will inherit the white streak?

- A 100%
 - B 75%
 - C 25%
 - D 0%
- 34 The diagram shows a pyramid of numbers in a woodland ecosystem.
- At which trophic level are the individual organisms largest in body size?



- 35 Which statement correctly describes relationships in ecosystems?
- A Carbohydrates are passed from decomposers to producers.
 - B Energy is passed from carnivores to herbivores.
 - C Proteins are passed from primary producers to secondary producers.
 - D Water is passed from respiring decomposers to producers.

- 36 The diagram shows a sewage treatment plant.

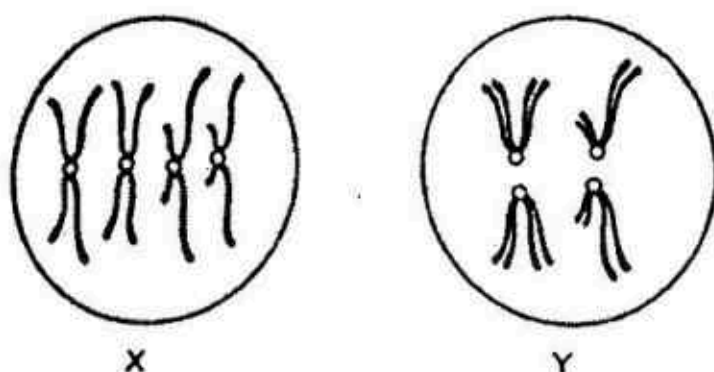


In which parts do aerobic and anaerobic bacteria become most active to help to digest sewage?

	Aerobic	Anaerobic
A	3	4
B	1	3
C	5	1
D	4	2

- 37 Grass carp is a type of freshwater fish and some of these fishes are triploid (i.e. they contain $3n$ chromosomes). Which one of the following best explains why triploid grass carps are infertile?
- A Homologous chromosomes cannot pair up to form bivalents during meiosis I, thus the organism cannot form functional gametes.
 - B The chromosome number is too large, thus leading to sterility as gametes cannot form.
 - C The fishes will not survive to sexual maturity and would not produce viable offspring.
 - D The gametes formed would be too large to be released, thus their gametes cannot fuse to form viable zygotes.

- 38 The diagram shows two cells undergoing cell division.



Which of the following combinations about diagram X and Y is wrong?

	Diagram X	Diagram Y
A	Cytoplasm divides once.	Cytoplasm divides twice.
B	Chromosomes replicate once.	Chromosomes replicate twice.
C	Chromosome number remains the same in daughter cells.	Chromosome number is reduced by half in daughter cells.
D	Genetic make-up of the daughter cell is same as that of parent cell	Genetic make-up of the daughter cells may be different from that of parent cell.

- 39 The list shows some changes that may occur in a lake that is polluted with nitrogen-containing fertiliser.

- 1 Concentration of oxygen decreases.
- 2 Decomposers feed on plants.
- 3 Green microorganisms grow and cover the surface.
- 4 Plants die.

In which order do these changes occur?

- A 2 → 3 → 1 → 4
- B 3 → 2 → 4 → 1
- C 3 → 4 → 2 → 1
- D 4 → 3 → 1 → 2

40 How does natural selection contribute to the theory of evolution?

- A Over time, natural selection results in changes in the inherited characteristics of a population.
- B Over time, natural selection causes mutation that creates variation in a population.
- C Over time, natural selection allows many different variations in a population to compete.
- D Over time, natural selection acts on populations which in turn may result in the evolution of individuals.

End of Paper

Singapore Chinese Girls' School

1	A	11	B	21	A	31	B
2	B	12	C	22	B	32	C
3	B	13	A	23	D	33	D
4	C	14	B	24	C	34	D
5	C	15	D	25	B	35	D
6	B	16	C	26	C	36	A
7	D	17	A	27	C	37	A
8	A	18	B	28	A	38	B
9	D	19	C	29	B	39	C
10	D	20	B	30	D	40	A



Anglo-Chinese School (Barker Road)

PRELIMINARY EXAMINATION 2017

SECONDARY FOUR EXPRESS

BIOLOGY PAPER 1

5158/1

TIME: 1 HOUR

INSTRUCTIONS TO CANDIDATES:

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name and index number on the answer sheet in the spaces provided.

There are forty questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the one you consider correct and record your choice in **soft pencil** on the separate answer sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.

Additional Materials provided by the School:

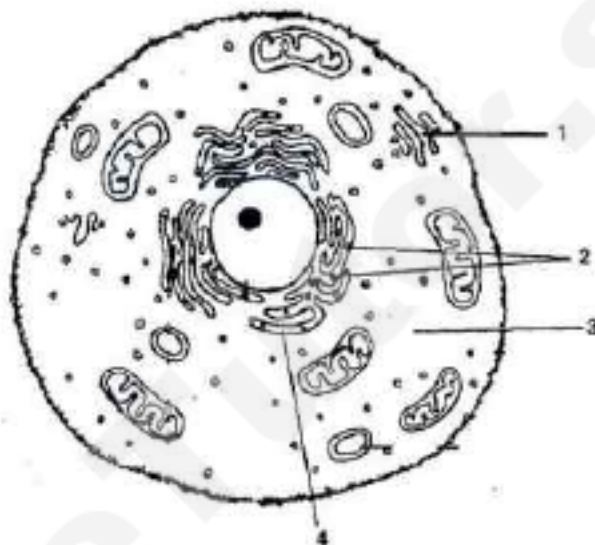
Answer Sheet

This question paper consists of 25 printed pages.

Paper 1 (40 marks)

Answer all questions

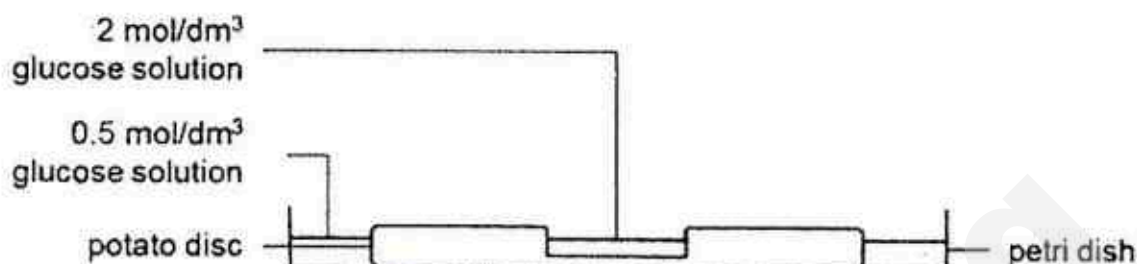
- 1 The diagram shows a typical animal cell with cell components are involved in the synthesis and secretions of an enzyme.



Which of the following identifies correctly the route taken by an amino acid molecule as it passes through these cell components?

- A 2 → 3 → 4 → 1
- B 2 → 4 → 3 → 1
- C 3 → 2 → 1 → 4
- D 3 → 4 → 2 → 1

Refer to the experimental setup below to answer questions 2 and 3.



- 2 The student conducting this experiment left the set-up for one hour.

Which correctly shows how the levels of solution in the well and the petri dish changed after an hour?

	well	petri dish
A	higher	higher
B	higher	lower
C	lower	higher
D	lower	lower

- 3 The student forgot about the set-up and left it standing overnight.

Which correctly describes the texture of the potato disc after 12 hours?

- A The bottom half of the potato would be flaccid while the top half would be turgid.
- B The bottom half of the potato would be turgid while the top half would be flaccid.
- C It would have uniform turgidity.
- D It cannot be inferred from the given data.

- 4 Which of the following situations **does not** involve diffusion?

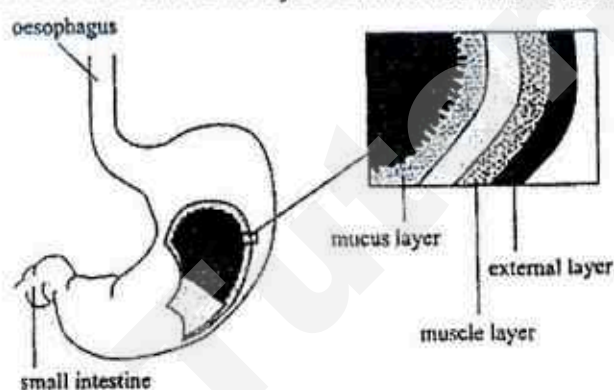
- A Production of lipase
- B Supply of oxygen to the cells
- C Supply of glucose to the cells
- D Removal of metabolic waste products

- 5 The table below shows the chemical elements present in four substances.

Which substance, A, B, C or D could be cellulose?

	carbon	hydrogen	nitrogen	oxygen
A	✓	✓	✓	×
B	✓	✓	×	✓
C	✓	✓	✓	✓
D	✓	×	✓	✓

- 6 The diagram below shows the different layers of tissues in the human stomach.

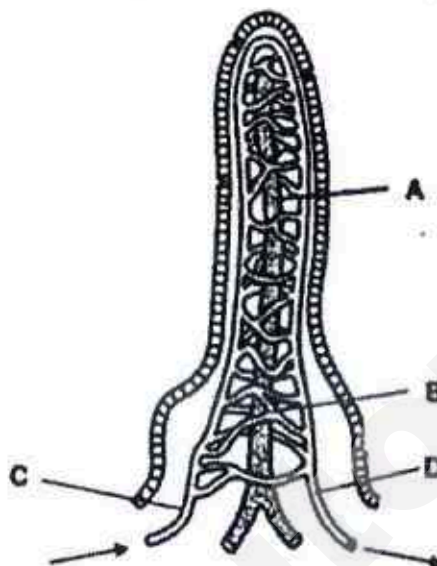


A certain disease results in a reduction in the innermost layer of mucus in the stomach. What is a likely consequence of this disease?

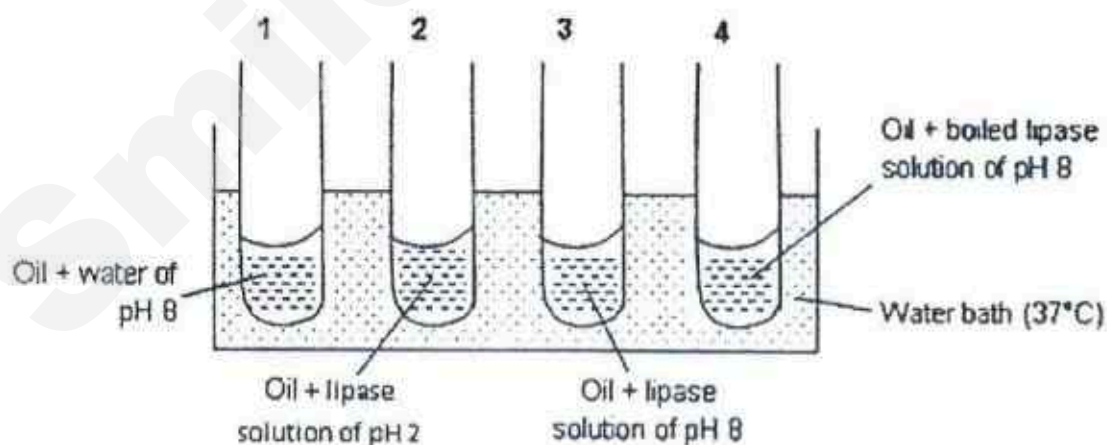
- A Destruction of the stomach wall by acid.
- B Greater production of gastric juice.
- C Rapid emptying of the stomach contents into the small intestine.
- D Reduced enzymatic action

- 7 The diagram shows a section through a villus in a small intestine. The arrows show the direction of flow in the vessels.

Which labelled part contains the highest concentration of glucose?



- 8 Four test tubes, labelled 1, 2, 3 and 4, were set up in an experiment. 1 cm³ of oil and 1 cm³ of solution are added to each test tube. The test tubes were incubated for one hour.

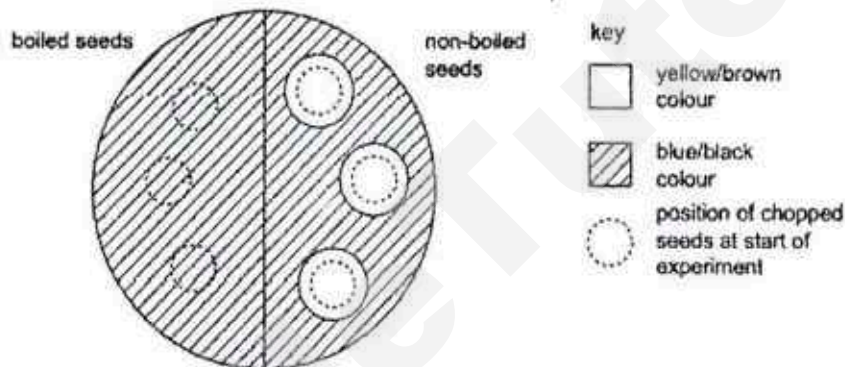


Which of the following shows the expected results when the ethanol emulsion test is carried out?

	1	2	3	4
A	cloudy	cloudy	clear	cloudy
B	cloudy	cloudy	cloudy	clear
C	clear	clear	clear	cloudy
D	clear	clear	cloudy	clear

- 9 A healthy person has decided to modify his diet by increasing his intake of proteins and lowering his intake of carbohydrates. What is a possible consequence of this change?
- A Less glucose is present in his urine
 - B More amino acids is present in his urine
 - C More proteins is present in his urine
 - D More urea is present in his urine
- 10 Six bean seeds were soaked in cold water. Three of them were boiled and cooled. The boiled and the non-boiled seeds were chopped up and then placed on the surface of the agar jelly containing starch.

After two days, all the chopped seeds were removed and the jelly was tested with iodine solution. The diagram shows the result of the experiment.



What is the explanation for the results with the non-boiled seeds?

- A They absorb iodine.
- B They absorb starch.
- C They contain acid.
- D They contain amylase.

- 11 The following table shows the results of blood transfusions between four individuals, P, Q, R and S.

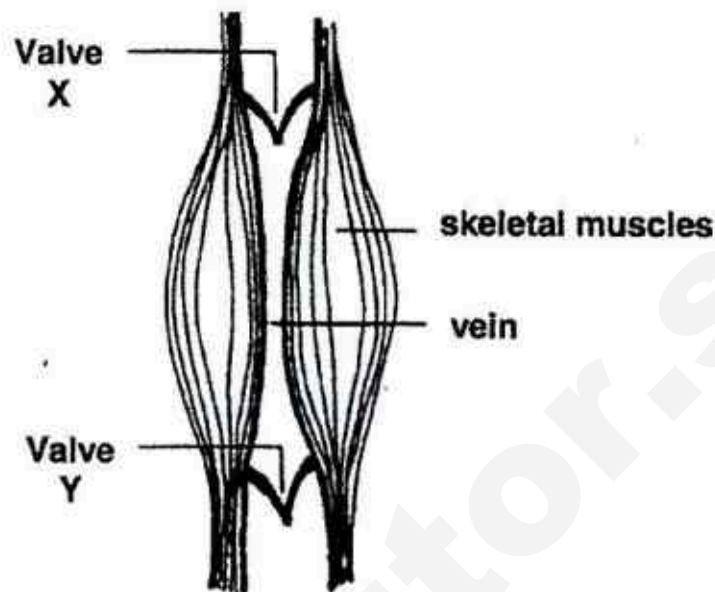
		Recipients			
		P	Q	R	S
Donors	P		✓	✓	✓
	Q	X		✓	✓
	R	X	X		X
	S	X	✓	✓	

✓	Successful transfusion
X	Unsuccessful transfusion

Which row correctly states the blood group of individuals P, Q, R, and S?

	P	Q	R	S
A	AB	A or B	O	A or B
B	AB	A	O	B
C	O	A or B	AB	A or B
D	O	B	AB	A

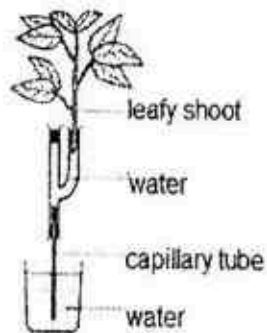
- 12 The diagram below illustrates a small portion of a vein and its neighbouring skeletal muscles.



Which of the following combinations shows the state of the muscle with the corresponding situations of valves X and Y?

	skeletal muscle	valve X	valve Y
A	contraction	opened	closed
B	contraction	closed	opened
C	relaxation	opened	opened
D	relaxation	closed	opened

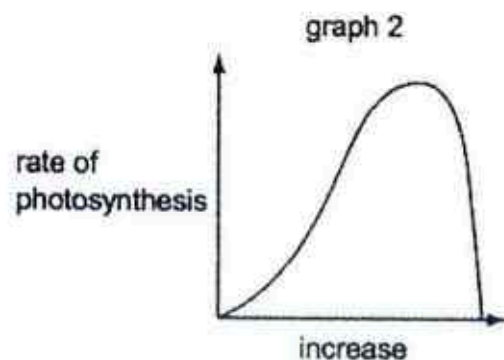
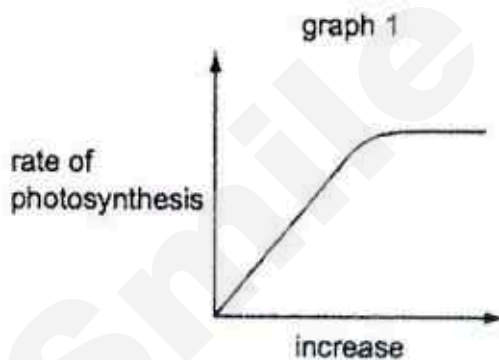
- 13 The following diagram illustrates a simple potometer which measures water uptake in plants.



Which combination of conditions would result in the fastest uptake of water?

- A High temperature and bright light
- B Moving air and low temperature
- C Bright light and humid air
- D High humidity and high temperature

- 14 The graphs show how two different conditions affect the rate of photosynthesis.

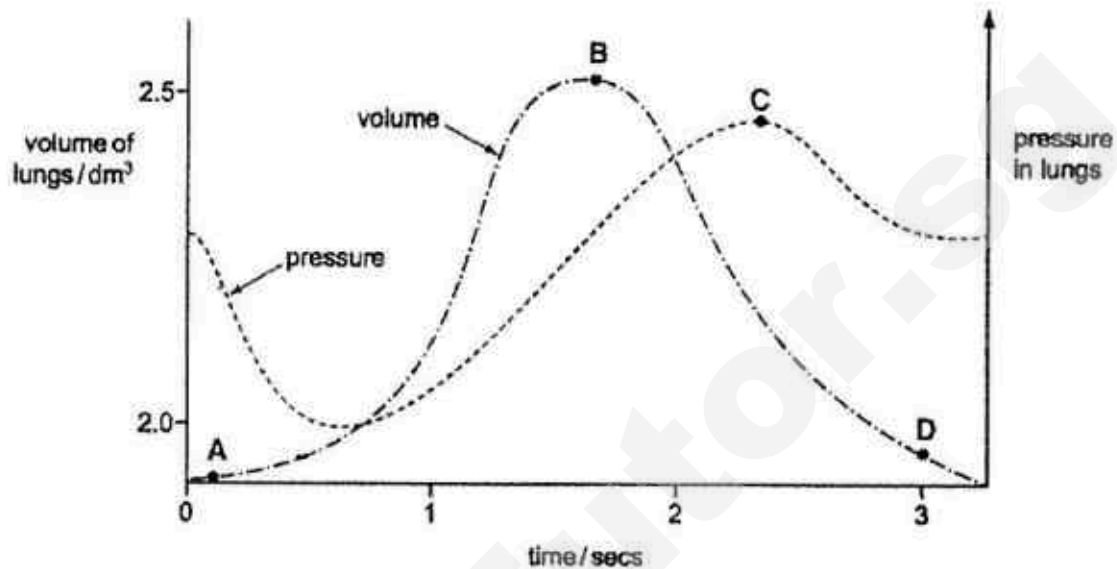


Which conditions are being altered in graphs 1 and 2?

	graph 1	graph 2
A	CO ₂ concentration	light intensity
B	CO ₂ concentration	temperature
C	temperature	CO ₂ concentration
D	temperature	light intensity

- 15 The graph shows how the pressure and volume inside the lungs change during one complete breath.

At which point are the muscles of the diaphragm starting to contract?



- 16 In the human respiratory system, which features maintain the carbon dioxide gradient between the alveoli and the outside air?

1. blood being continually pumped to the alveoli
2. breathing in and out
3. moist alveolar surfaces
4. thin alveolar walls

- A 1 and 2
B 1 and 4
C 2 and 3
D 3 and 4

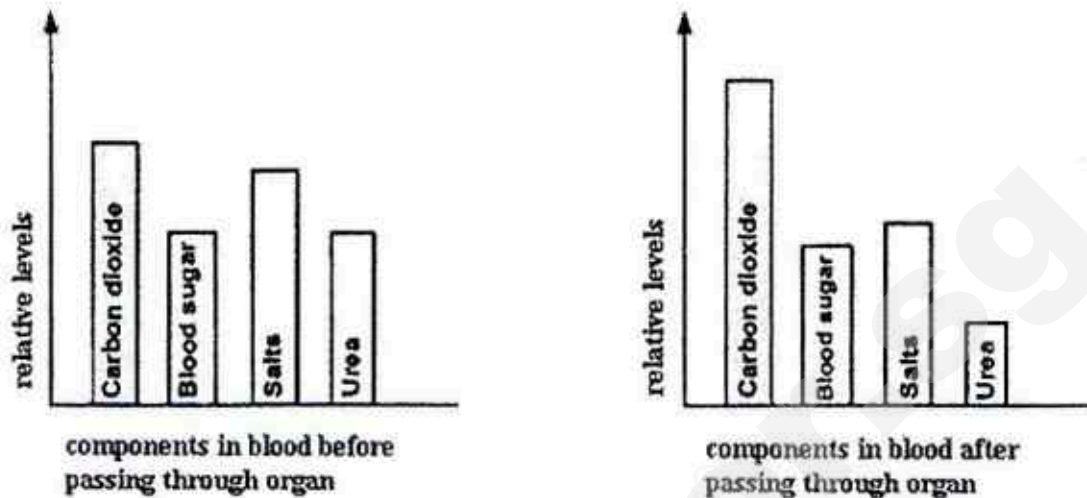
17 Reactions X and Y take place within the human body.

reaction	equation
X	$\text{Hb} + \text{O}_2 \leftrightarrow \text{HbO}_2$
Y	$\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{H}_2\text{CO}_3$

Which row correctly matches X and Y to the site where each occurs, and whether an enzyme is needed?

	reaction X		reaction Y	
	enzyme needed	location	enzyme needed	location
A	yes	alveoli	no	red blood cell
B	no	plasma	no	alveoli
C	no	red blood cell	yes	red blood cell
D	yes	red blood cell	yes	plasma

- 18 The bar charts show the relative levels of some substances in the blood before and after passing through a certain organ in the human body.



Which organ has the blood passed through?

- A kidney
 - B liver
 - C lungs
 - D small intestine
- 19 Three fluid samples are drawn at different parts of a nephron and the components of fluids analysed. The results are shown in the table below:

component	fluid X (g/L)	fluid Y (g/L)	fluid Z (g/L)
glucose	0.0	0.9	0.0
sodium ions	5.0	3.5	4.2
urea	20.0	0.3	0.3

Which correctly matches the fluids to parts of the nephron they were extracted from?

	fluid X	fluid Y	fluid Z
A	glomerulus	collecting duct	proximal convoluted tubule
B	collecting duct	glomerulus	proximal convoluted tubule
C	glomerulus	proximal convoluted tubule	collecting duct
D	proximal convoluted tubule	collecting duct	glomerulus

Use the following information to answer questions 20 and 21.

A group of research scientists conducted an experiment to test the reaction time of 10 volunteers. Each volunteer was blindfolded and touched on the left foot by an object. They were instructed to press a button as soon as they felt the touch. Each person did the test 30 times, and an average reaction time was calculated. The results are shown in the table.

individual	average reaction time /s
1	0.8
2	0.5
3	0.3
4	0.4
5	0.5
6	0.6
7	0.8
8	0.7
9	0.7
10	0.5

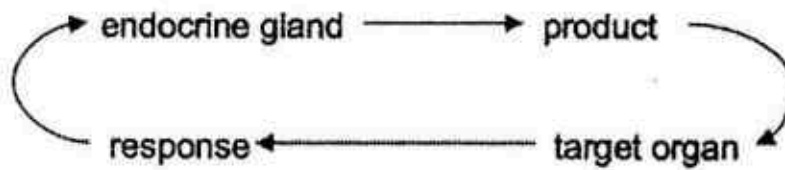
20 Which is the stimulus in this experiment?

- A pressing the button
- B feeling the touch
- C the skin receptors on the toe
- D the touch on the toe

21 Which correctly describes the response above?

	type of action	reason
A	not a reflex	touch was not painful
B	not a reflex	response was voluntary
C	reflex	presence of stimulus
D	reflex	response was quick and immediate

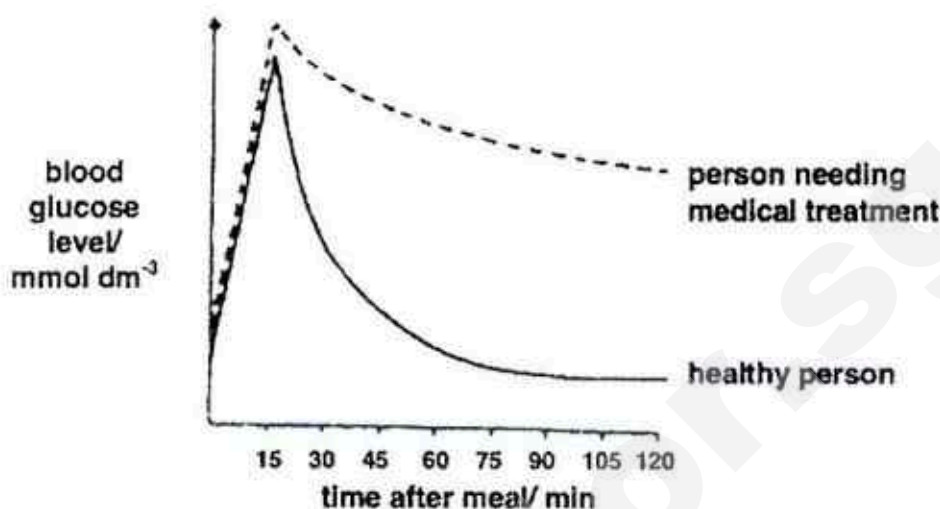
- 22 The diagram below shows the relationship between two organs and the changes/responses they bring about in the body.



If the response of the target organ is controlled by negative feedback, then the product of the endocrine gland

- A inhibits the target organ with no effect on response.
- B stimulates the target organ with no effect on response.
- C stimulates the target organ while the response inhibits secretion of the product.
- D inhibits the target organ while the response stimulates secretion of the product.

- 23 The graph shows changes in the blood glucose levels of two people after eating identical meals.

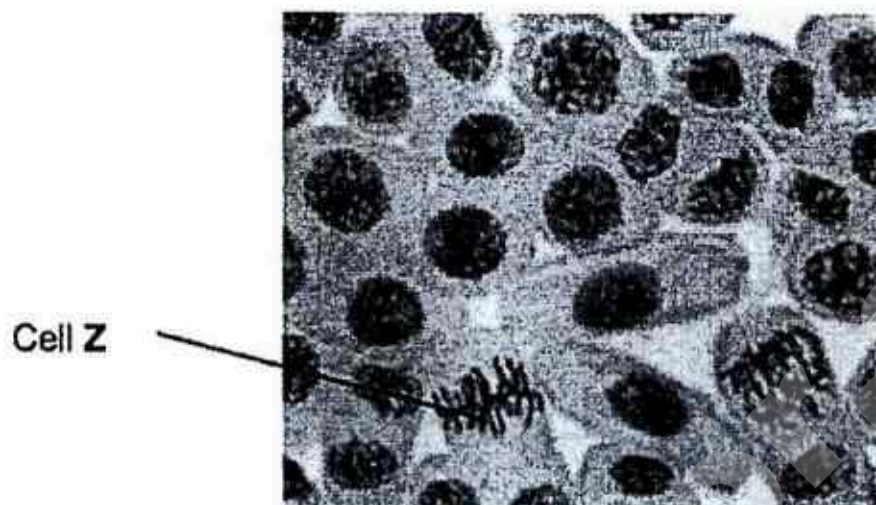


What should be the correct medical treatment for the person needing medical treatment?

- A blood transfusion
 - B dialysis by a kidney machine
 - C increase intake of proteins
 - D insulin injections
- 24 Which changes occur in the body when a person is shocked?

	increase in	decrease in
A	diameter of the pupil in the eye	speed of peristalsis
B	rate of conversion of glycogen to glucose	diameter of the pupil in the eye
C	rate of urine formation	rate of conversion of glycogen to glucose
D	speed of peristalsis	rate of urine formation

- 25 The photomicrograph shows the cells in an onion root tip undergoing cell division.



Which statement correctly describes what is occurring in cell Z?

- A Chromosomes are lining up at the equator
- B DNA is replicating
- C Homologous chromosomes are pairing up
- D Sister chromatids are separating

26 How does mitosis contribute in each of the following processes stated below?

Key:

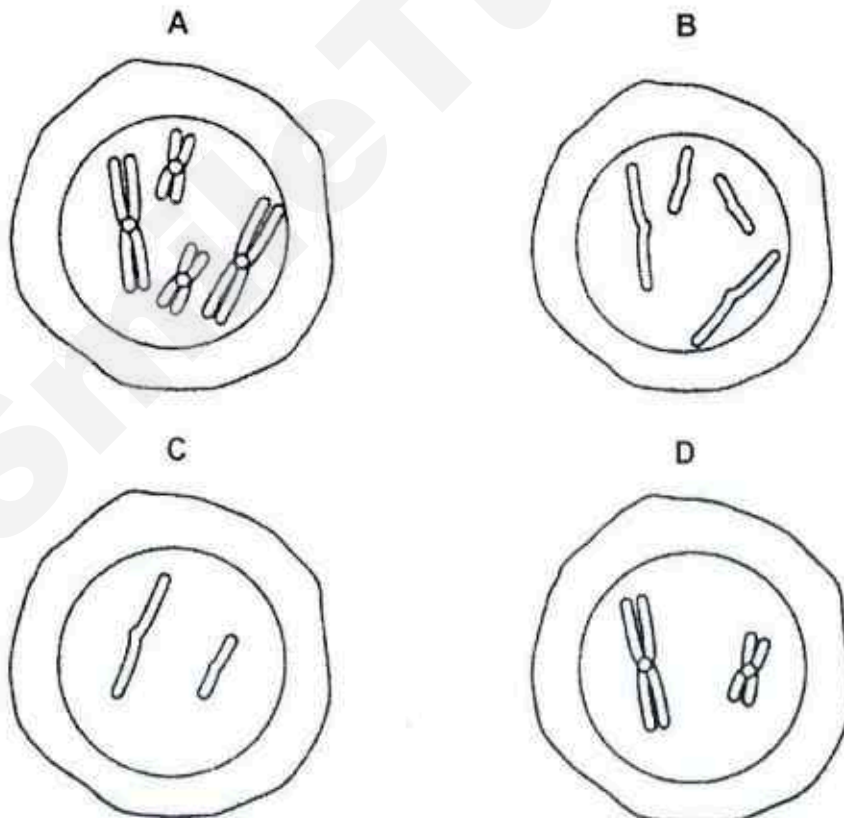
✓ = contributes to process

× = does not contribute to process

	genetic variation	increase in cell number	replacement of damaged cells
A	×	✓	✓
B	✓	×	×
C	✓	✓	×
D	×	×	✓

27 A cell containing two sets of chromosomes divides by meiosis.

Which diagram shows prophase II?

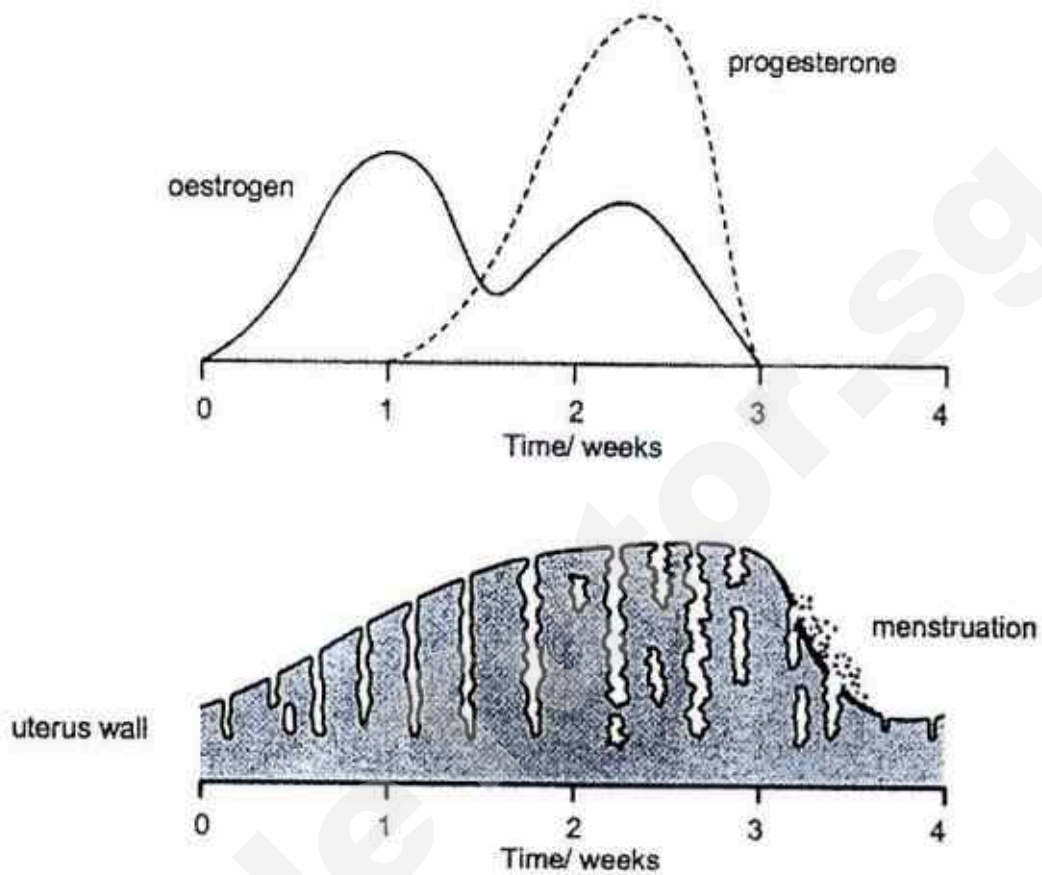


- 28 A student carried out an experiment to study the wind-pollinated flowers growing in the area. The flowers were divided into four different groups. In each group, selected structures were removed, as shown in the table below.

After a period of time, which group would produce the most number of seeds?

	Anther	Receptacle	Stigma
A	Removed	Removed	No change
B	No change	Removed	No change
C	No change	No change	Removed
D	Removed	No change	No change

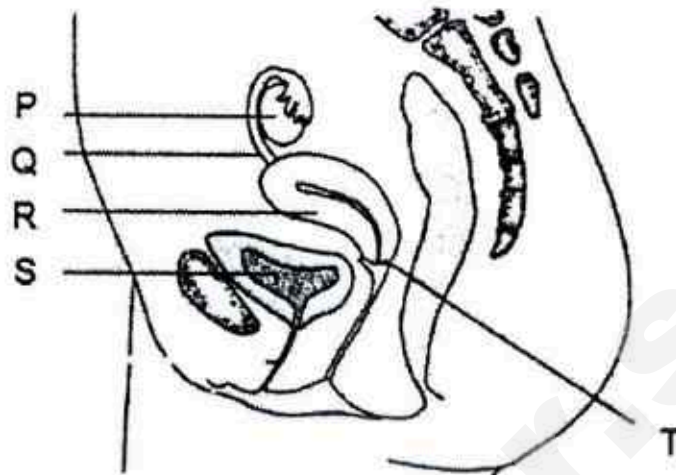
29 The diagram shows the changes which take place during a woman's menstrual cycle.



What is occurring at the time of ovulation?

- A a fall in levels of oestrogen and progesterone
- B a fall in the level of oestrogen and a rise in progesterone
- C a rise in the levels of oestrogen and progesterone
- D a rise in the level of oestrogen only

30 The diagram below shows a female reproductive system.



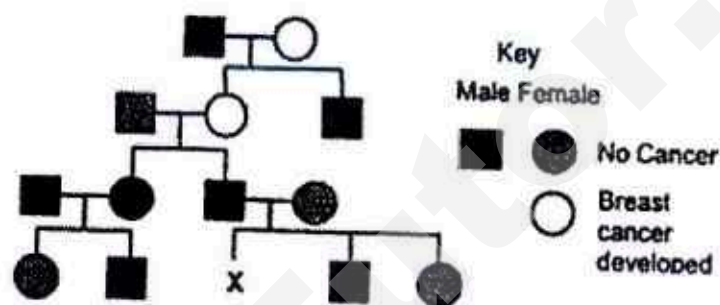
Which correctly shows the regions where the following events occur?

	implantation	fertilization	meiosis
A	R	Q	P
B	R	P	Q
C	S	Q	R
D	T	R	P

31 Which statement about discontinuous variation is true?

- A It is determined by a pair of alleles.
- B It can be affected by the environment.
- C There are many intermediate phenotypes present for a certain trait.
- D Blood group and gender are examples of discontinuous variation.

32 The diagram below shows the inheritance of a form of breast cancer. The presence of just one allele is enough for the cancer to express itself



What is the probability that the woman X develops breast cancer?

- A 0.00
- B 0.25
- C 0.75
- D 1.00

33 What is the number of chromosomes in a gamete that causes Down's Syndrome?

- A 21
- B 22
- C 23
- D 24

34 Which characteristics of a population would most likely indicate the lowest potential for evolutionary change in that population?

- A asexual reproduction and few mutations
- B asexual reproduction and many mutations
- C sexual reproduction and few mutations
- D sexual reproduction and many mutations

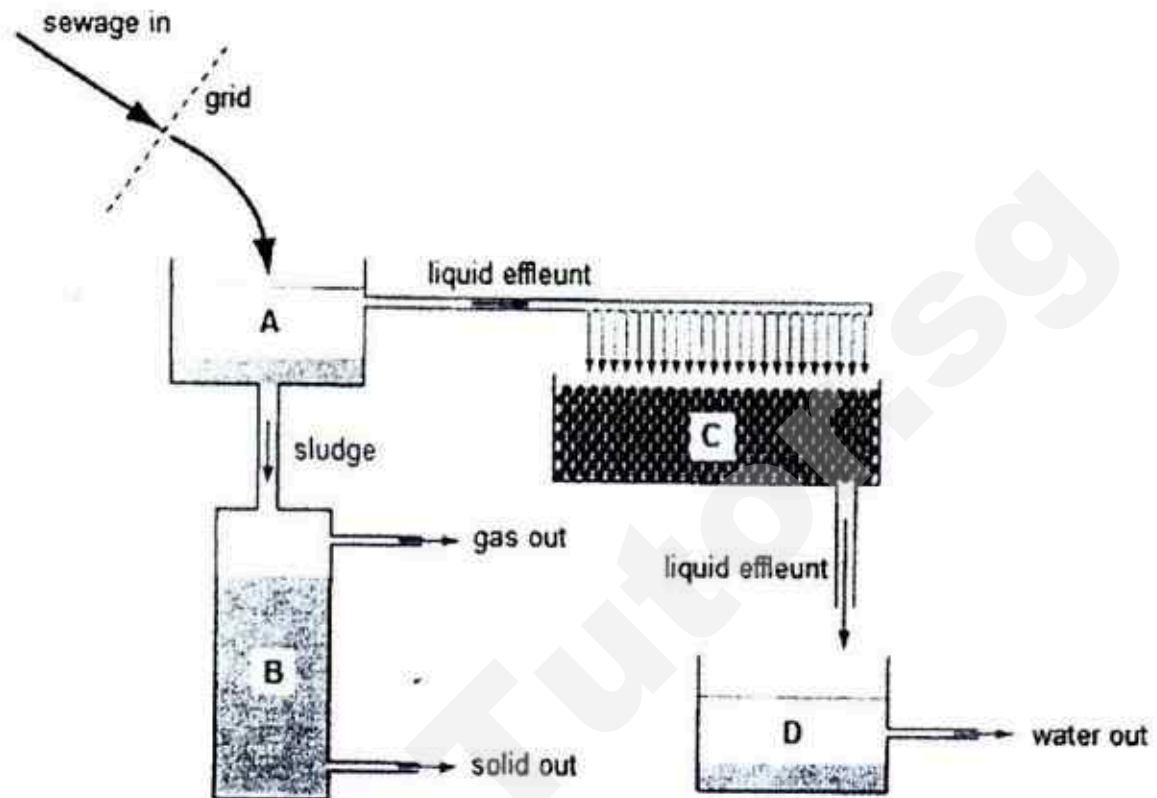
35 The table below shows the percentage of nucleotides found in an octopus and a starfish.

Source of DNA	Adenine (%)	Cytosine (%)	Guanine (%)	Thymine (%)
Octopus	28	22	22	28
Starfish	28	22	22	28

Which of the following best explains why these two animals differ greatly in their physical characteristics?

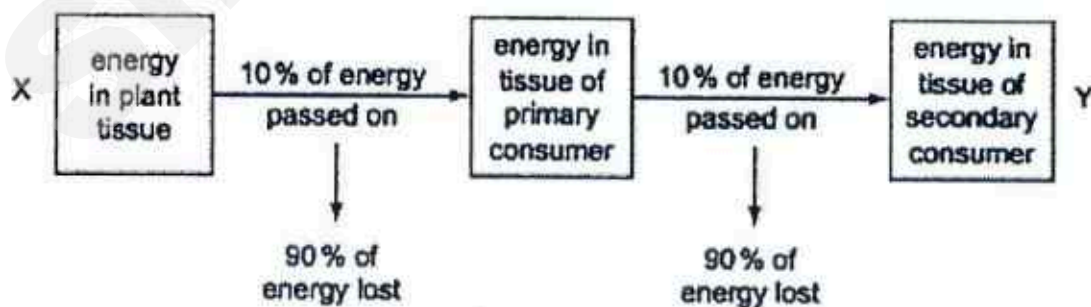
- A Amino acids used to produce proteins are different in both animals.
- B Deoxyribose is used in DNA of the octopus but ribose is used in the DNA of starfish.
- C The sequence of DNA are different in both animals and thus code for different proteins in their bodies.
- D The two animals follow different base pairing rules in their DNA strands.

- 36 The diagram shows a sewage treatment process.



Which labelled stage is likely to involve anaerobic bacteria?

- 37 The diagram shows how energy flows through a food chain.



By which processes is energy lost between X and Y?

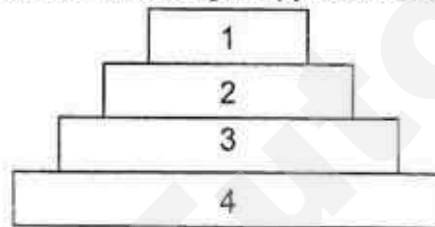
- A excretion and respiration
- B growth and excretion
- C growth and photosynthesis
- D photosynthesis and respiration

38 Which group(s) of organisms is/are not necessary for a carbon cycle to continue?

- I. Carnivores
- II. Decomposers
- III. Herbivores
- IV. Producers

- A I only
- B I and III only
- C II and III only
- D III and IV only

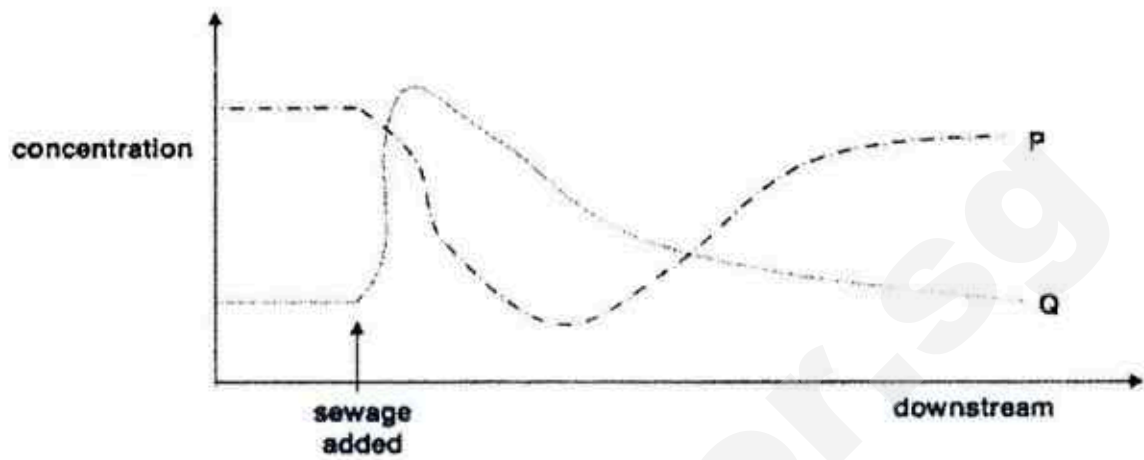
39 The following diagram shows an ecological pyramid of energy.



Which statement is always true?

- A Level 1 is occupied by a photosynthesising organism.
- B Energy flow is upwards from level 4 to 1.
- C Numbers in level 4 exceed those in level 3.
- D Cumulative toxins become more concentrated from level 1 down to level 4.

- 40 The graph below shows the changes in the concentration of two substances, P and Q in the river.



Identify P and Q.

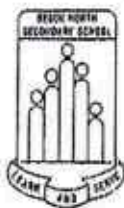
	P	Q
A	carbon dioxide	nitrogen compound
B	nitrogen compound	carbon dioxide
C	nitrogen compound	oxygen
D	oxygen	nitrogen compound

End of paper

Anglo-Chinese School (Barker Road)

1	B	11	C	21	B	31	D
2	B	12	B	22	C	32	A
3	D	13	A	23	D	33	D
4	A	14	B	24	A	34	A
5	B	15	A	25	A	35	C
6	A	16	A	26	A	36	B
7	D	17	C	27	D	37	A
8	A	18	A	28	B	38	B
9	D	19	B	29	C	39	B
10	D	20	D	30	A	40	D

BEDOK NORTH SECONDARY SCHOOL



Vision : Leaders for the Future; Creative Lifelong Learners; Morally Upright, Caring and Loyal.

Mission : To develop our students holistically through quality programmes within a nurturing environment.

Name:		Index Number:		Class:	
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PRELIMINARY EXAMINATION 2017 Secondary Four Express

25 August 2017

BIOLOGY

5158/01

Paper 1

1 hour

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on Answer Sheet provided.

Do not use staples, paper clips, highlighters, glue or correction fluid.

The use of an approved scientific calculator is expected, where appropriate.

There are **FORTY** questions on this paper. Answer **ALL** questions. For each question there are four possible answers A, B, C and D. Choose the one you consider correct and record your choice in soft 2B-pencil on the **Objective Test Answer Sheet (OTAS)**.

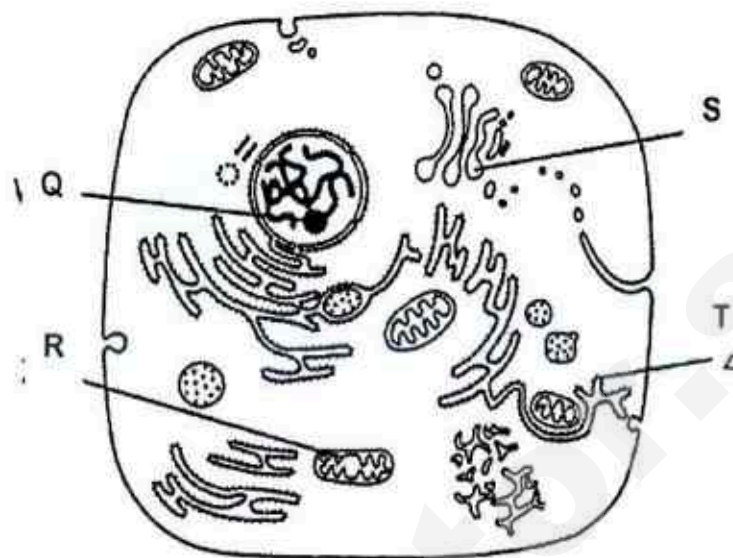
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

The number of marks is given in brackets [] at the end of each question or part question.

This question paper consists of **21** printed pages including the cover page.

1. The diagram below shows an animal cell with labelled organelles and membrane systems, Q, R, S and T.



Their functions are:

- 1 aerobic respiration
- 2 control center of the cell
- 3 formation of polypeptides
- 4 synthesis of fats

Which row in the table gives the correct match between label and function?

	Q	R	S	T
A	1	2	3	4
B	2	1	4	3
C	2	1	3	4
D	1	2	4	3

2. Which chemical changes can occur in a plant cell but not in animal cells?

- i) absorption of substances against concentration gradient
- ii) oxidation of glucose releases energy
- iii) synthesis of carbohydrates from inorganic substances
- iv) synthesis of cellulose from glucose
- v) synthesis of protein from amino acids

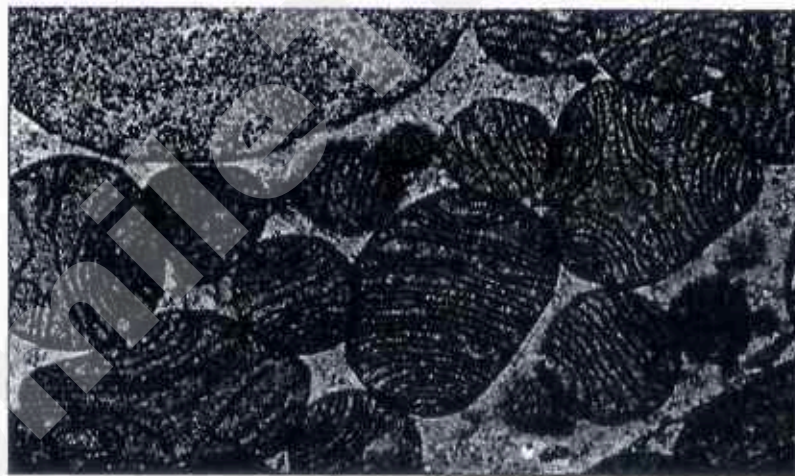
A i and ii only

B i, ii and v only

C iii and iv only

D iii, iv and v only

3. Examine the following muscle cell.



Based on the cell's internal structure, the cell is likely to

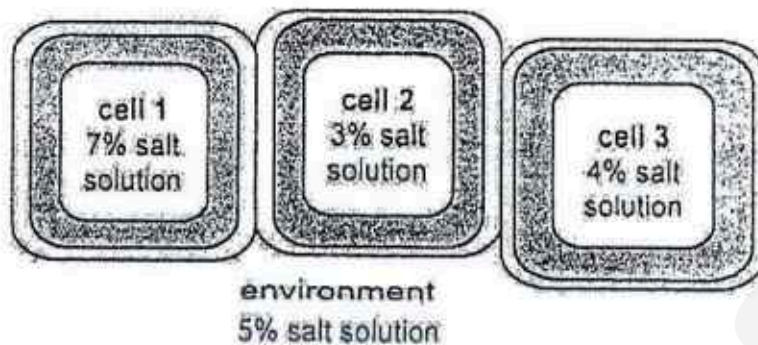
A be a cheek epithelial cell

B produce high levels of sugars

C require high levels of oxygen

D be a mature red blood cell

4. The diagram below shows the relative water potential in some plant cells and in their environment.



- Which statement describes the movement of water between these cells and between them and their environment?
- A All three cells are turgid, so no water moves.
 - B Water moves from the environment to cells 1, 2 and 3.
 - C Water moves from cell 1, cell 3 and the environment to cell 2.
 - D Water moves from cell 3 to the environment and from the environment to cell 1.
5. Which of the following statements is correct?
- A Proteins are important in the production of antibodies.
 - B Carbohydrates make up the main component in cell membranes.
 - C Fats are the main energy source.
 - D Water is not an essential nutrient.

6. Starch is digested by amylase into maltose.

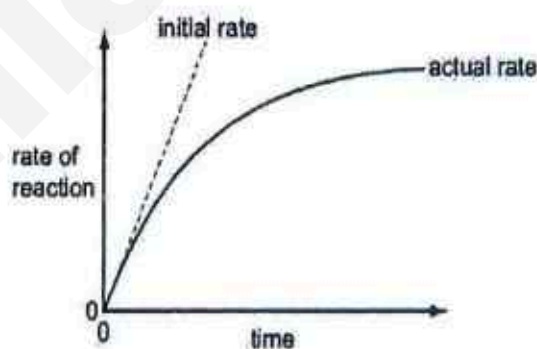
The following are some statements related to the action of amylase.

- 1 They are inactive by temperatures above 40°C.
- 2 They are proteins.
- 3 According to 'lock and key hypothesis', amylase is the lock, maltose is the key.
- 4 According to 'lock and key hypothesis', amylase is the lock, starch is the key.
- 5 The activation energy increases when enzymes are present.

Which of the following is/are correct for the action of amylase?

- A 1 and 2
B 2 and 4
C 2, 3 and 5
D 1 and 5

7. A fixed volume of the enzyme catalase was added to a fixed volume of hydrogen peroxide solution. The diagram below shows how the rate of reaction changed over the course of reaction.



Why did the actual rate of reaction decrease over time?

- A The products were all formed.
B The enzymes were denatured.
C The substrate molecules were used up.
D The enzymes become inactive over time.

8. Which of the following are examples of absorption and assimilation?

	Absorption	Assimilation
A	food enters plasma from ileum	formation of cell membranes using lipids
B	food enters cells from plasma	formation of carbon dioxide from glucose
C	food enters plasma from duodenum	formation of sweat from blood plasma
D	food enters cells from ileum	formation of urea from amino acids

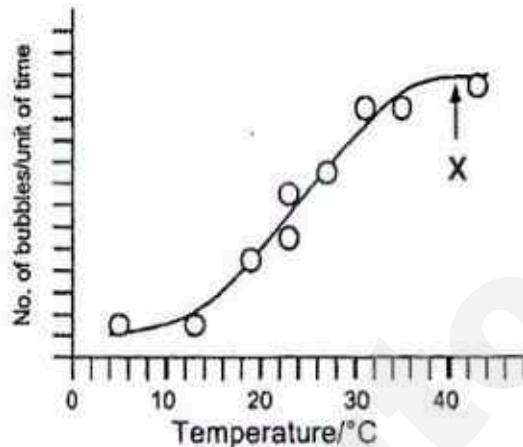
9. Which of the following comparisons about the blood contents in the hepatic portal vein and hepatic vein after a carbohydrate and protein-rich meal are correct?

	Hepatic vein	Hepatic portal vein
1	More oxygen	Less oxygen
2	More urea	Less urea
3	Less carbon dioxide	More carbon dioxide
4	Less waste products	More waste products
5	Less glucose	More glucose

- A 1 and 5
B 2 and 4
C 2 and 5
D 1, 3 and 4

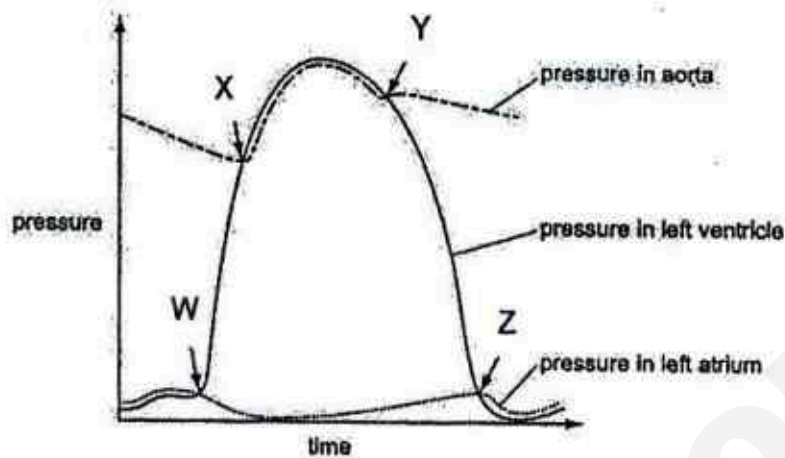
For questions 10 and 11, refer to the graph below.

The graph below shows the rate at which bubbles are produced by pond weed at different temperatures. All other factors, including light intensity are being kept constant.



10. What conclusions can be made from these results?
- A The rate of photosynthesis increases with increasing temperature up to a certain temperature.
 - B Green plants produce oxygen when illuminated.
 - C Heat increases the rate of production of oxygen by green plants at all temperatures.
 - D Light intensity affects the rate of photosynthesis.
11. What limits the rate of photosynthesis at X?
- A Carbon dioxide concentration
 - B Temperature
 - C Oxygen availability
 - D Water availability

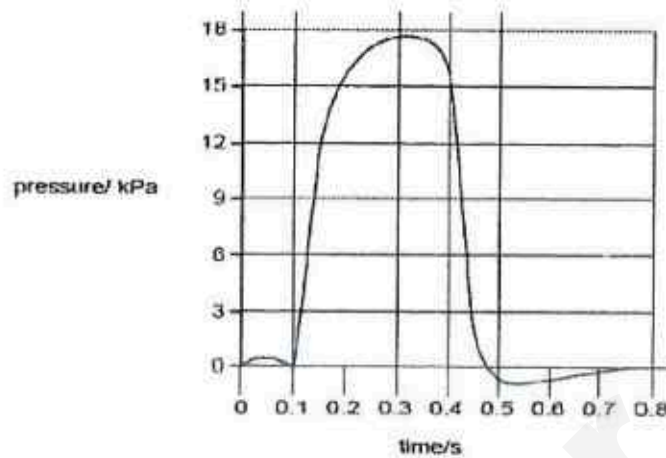
12. The graph below shows the pressure changes in the aorta and the left side of the heart during one cardiac cycle.



At which points do the bicuspid valve and aortic valve close respectively?

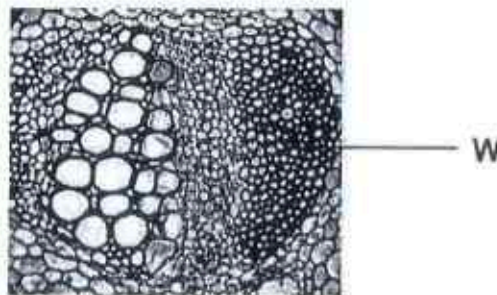
- A W and Z
 - B W and Y
 - C X and Y
 - D X and Z
13. At which stage of the blood clotting process is calcium needed?
- A When fibrinogen is converted to fibrin
 - B When the platelets are exposed to an open wound
 - C During the production of thrombokinase
 - D When prothrombin is converted to thrombin

14. The graph below shows changes in the blood pressure in the left ventricle of the heart.



What is the number of times that this person's heart beats in one minute?

- A 65
 - B 75
 - C 85
 - D 100
15. The figure below shows a tissue section from an organism as seen under a light microscope.



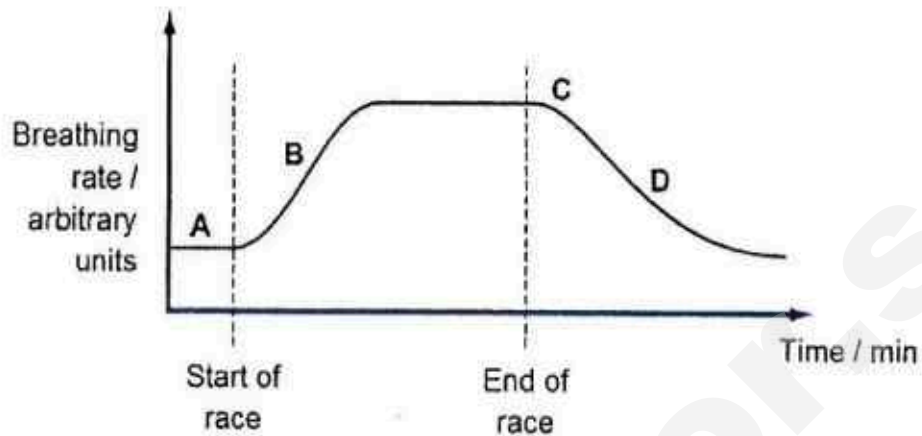
Which of the following functions is tissue W responsible for?

- A Structural support for organism
- B Transport of nutrient
- C Absorption of gases
- D Cooling down of organism

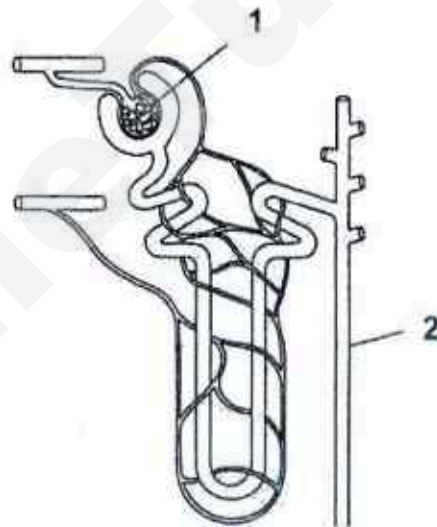
16. Which of the following sequences of events will occur when a person inhales?
- A The external intercostal muscles contract → atmospheric air rushes into the lungs → the lungs dilate
 - B The diaphragm muscles contract → the lungs dilate → atmospheric air rushes into the lungs
 - C The diaphragm muscles contract → atmospheric air rushes into the lungs → the lungs dilate
 - D The internal intercostal muscles contract → the lungs dilate → atmospheric air rushes into the lungs
17. Which of the following reactions occur(s) in the skeletal muscle when a person is performing vigorous exercise?
- (1) glucose → lactic acid
 - (2) glucose → lactic acid + carbon dioxide
 - (3) glucose + oxygen → carbon dioxide + water
- A (1) only
 - B (2) only
 - C (1) and (3) only
 - D (2) and (3) only

18. A boy takes part in a race. His breathing rate before, during and after the race is shown in the following graph.

At which point does his body contain the greatest amount of lactic acid?



19. The diagram below shows a kidney tubule.

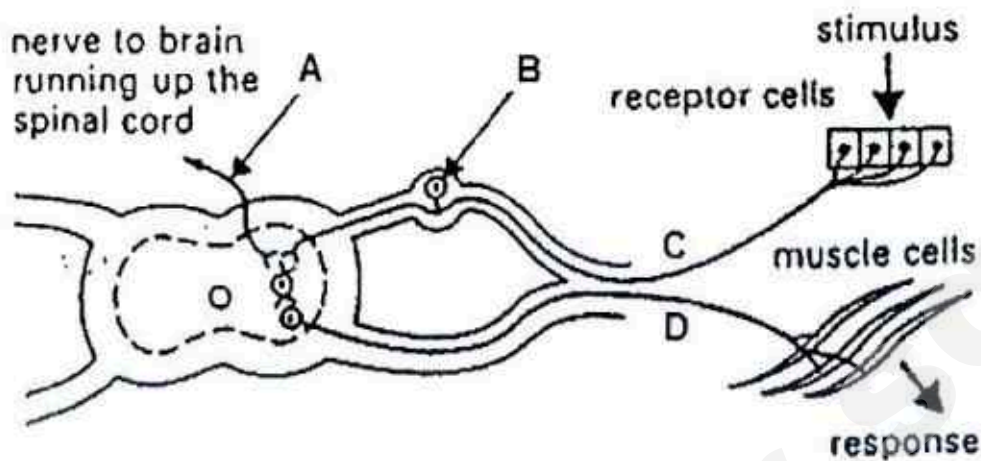


At which site does Anti-diuretic hormone have its effect and what effect does it have?

	Site	Effect
A	1	Less water reabsorbed
B	1	More water reabsorbed
C	2	Less water reabsorbed
D	2	More water reabsorbed

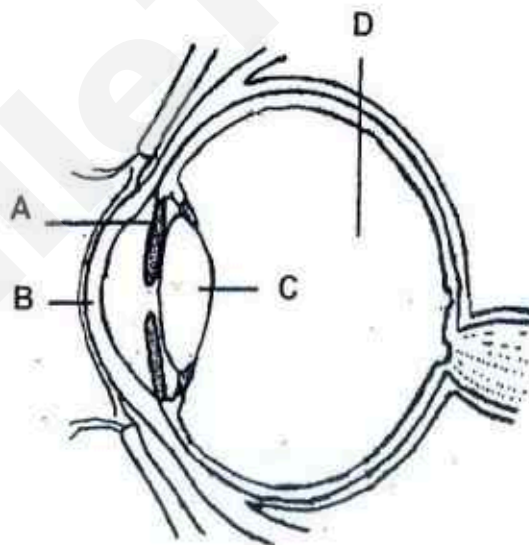
20. In a kidney machine, protein molecules are not lost from the blood.
How is the loss of protein prevented?
- A Proteins are actively transported back into the blood.
 - B Membranes prevent protein molecules diffusing out of the blood.
 - C The dialysis fluid contains protein, so there is no diffusion gradient.
 - D Proteins in blood is prefiltered prior to dialysis.
21. During which process does the body lose heat by the evaporation of water?
- (i) Urination
 - (ii) Sweating
 - (iii) Defecation
 - (iv) Exhalation
- A (i) and (ii)
 - B (i) and (iii)
 - C (ii) and (iv)
 - D (i), (ii), and (iii)
22. Which of the following does not describe a reflex action?
- A Involves only the spinal cord
 - B Not under conscious control of the will
 - C Involves a stimulus
 - D Response is rapid

23. The nerve pathway of a simple reflex arc is shown below.

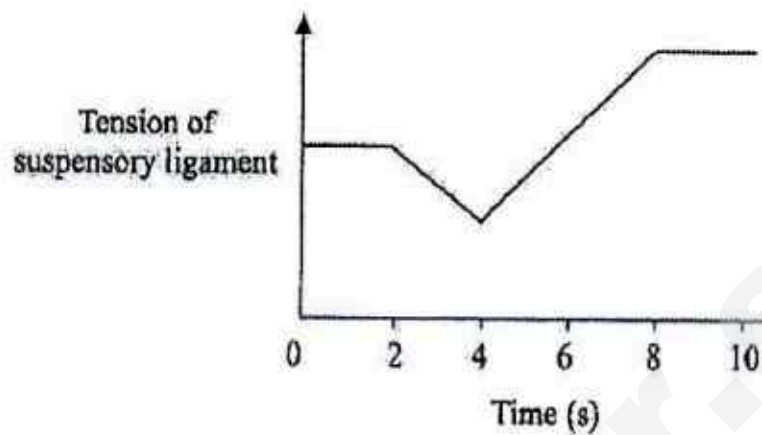


Where a cut should be made so that pain is felt but response is not enabled?

24. Which of the following labeled components of the eye is not involved in the refraction of light towards the retina?



25. The graph below shows the changes in the tension of the suspensory ligament of a boy's eye over 10 seconds.



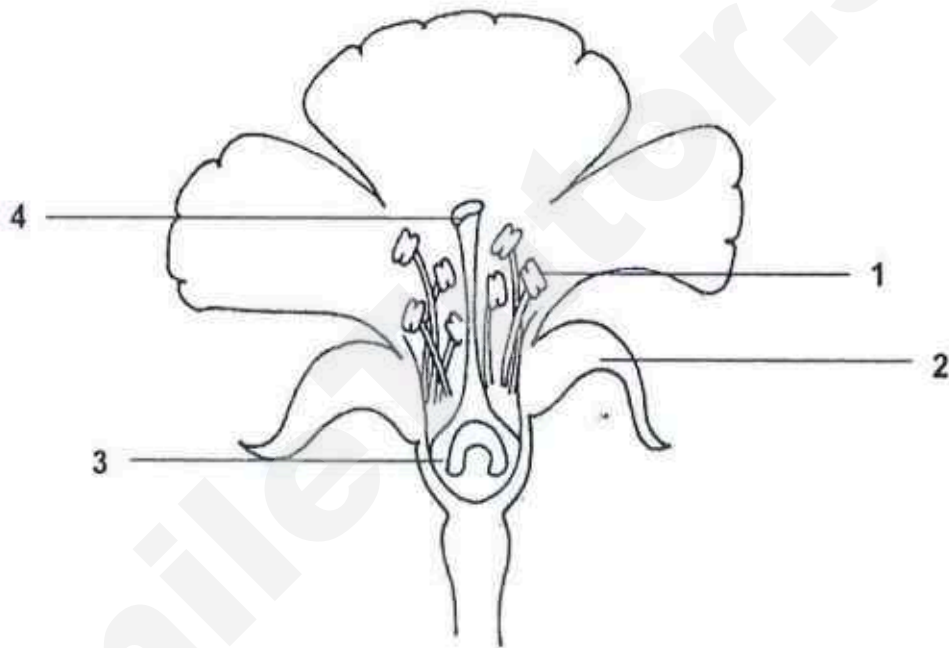
During which period was he looking at an object moving towards him?

- A 0 – 2 second
- B 2 – 4 second
- C 4 – 8 second
- D 8 – 10 second
26. In humans, which of the following is/are under the influence of hormones?
- (1) breakdown of endometrium
- (2) uptake of glucose into body cells
- (3) selective reabsorption in nephrons
- A (1) only
- B (1) and (3) only
- C (2) and (3) only
- D (1), (2) and (3)

27. Which of the following results from the increased secretion of adrenaline?

- A Dilation of the pupils in the eye and blood vessels in the skin.
- B Decrease in rate of converting glycogen to glucose in the liver.
- C Decrease in the speed of transmission of electrical impulses.
- D Increase in blood flow to stomach, ileum and colon.

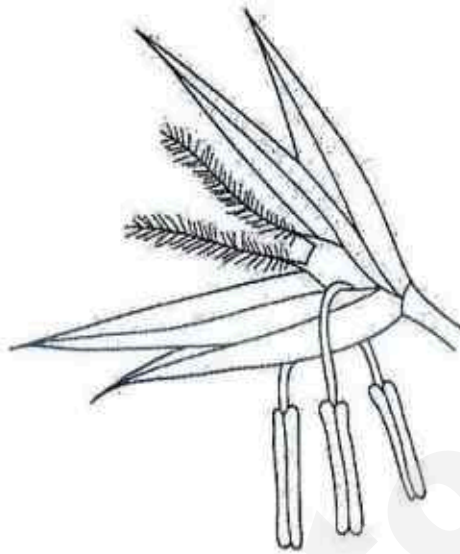
28. The diagram below shows half a flower.



Where are the gametes produced?

- A 1 and 3
- B 1 and 4
- C 2 and 3
- D 2 and 4

29. With reference to the diagram below, which of the following characteristics indicates that this flower is adapted to wind pollination?



- A Its anthers produce numerous pollen grains.
- B Its filaments are pendulous.
- C It is bisexual.
- D Its anthers lie below the stigma.

Use the following calendar for question 30. The calendar below shows the menstrual cycle of a woman in September 2017.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	1	2	3	4	5	6
7	8	9	10	11	12	13
14		16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

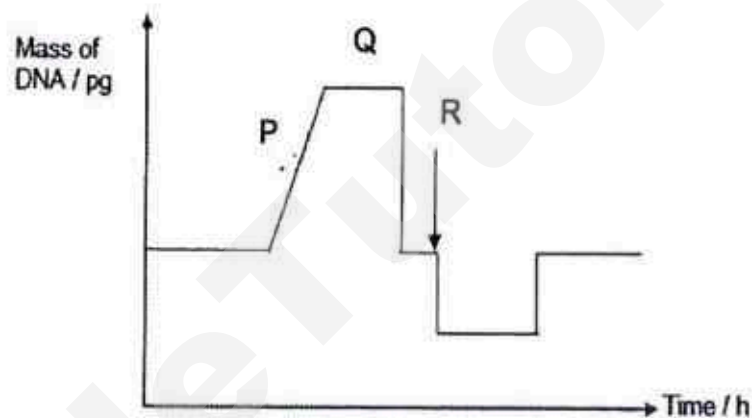
key



= ovulation

= menstruation

30. Why could fertilisation not take place if sperms are released into the vagina on 8th September?
- A The uterus lining is washed out of the female body during menstruation.
 - B Sperms are washed out of the female uterus by the menstrual flow.
 - C Sperms must be released after ovulation for fertilisation to take place.
 - D Sperms can survive in the female reproductive system only for 3 or 4 days.
31. The graph below shows the DNA content of a cell during the course of two divisions.



Which of the following correctly identifies the events at P, Q and R?

	P	Q	R
A	prophase I	metaphase I	cytokinesis I
B	prophase I	metaphase I	cytokinesis II
C	interphase	meiosis I	telophase I
D	interphase	meiosis I	telophase II

32. A chemical, known to inhibit cell plate formation, is applied to a mass of rapidly dividing plant cells in vitro.

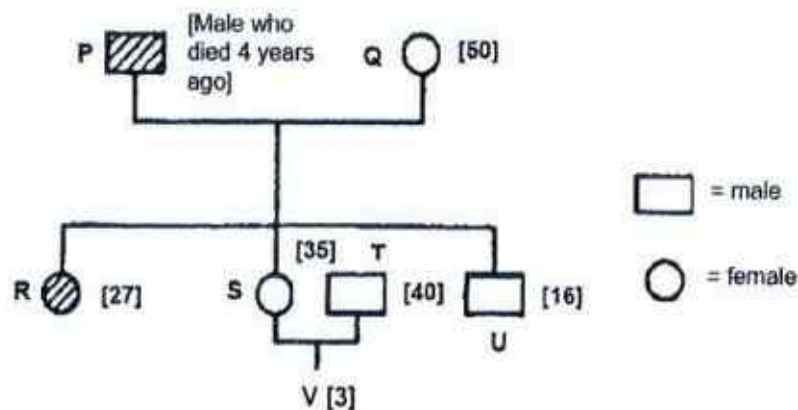
Which stage will the cells reach before they stop dividing?

- A Telophase
 - B Prophase
 - C Interphase
 - D Metaphase
33. Which two characteristics show continuous variation?
- A Length of feet and weight
 - B Tongue rolling ability and hand span
 - C Weight and blood group
 - D Gender and tongue rolling ability

For Questions 34 and 35, refer to the pedigree chart below.

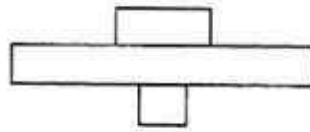
Huntington's chorea is a very rare, fatal neurological disorder caused by a dominant allele. It does not normally take effect until late 30s. Thereafter, death follows within a few years.

The diagram below illustrates an affected family. Present age are given in brackets. Person known to be affected are shaded.



34. What is the present probability that the boy V will eventually develop the disease?
- A Nil
 - B 25%
 - C 50%
 - D 75%
35. Given that individual R marries a man who is normal, what is the probability that their second child will be a son who is affected?
- A 12.5%
 - B 25%
 - C 50%
 - D 100%
36. The following DNA sequence is a part of the gene that codes for human insulin. ...CCA TAG CAC GTT ACA ACG TGA AGG TAA...
- Which of the following shows the correct sequence for the complementary mRNA molecule?
- A ...GGT ATC GTG CAA TGT TGC ACT TCC ATT...
 - B ...CCA UAG CAC GUU ACA ACG UGA AGG UAA...
 - C ...CCA TAG CAC GTT ACA ACG TGA AGG TAA...
 - D ...GGU AUC GUG CAA UGU UGC ACU UCC AUU...

37. Which food chain could be represented by the following pyramid of numbers listed below?



- A Cauliflower → human
- B Tree → caterpillars → birds
- C Grass → rabbits → snakes
- D Algae → fish → eagle

38. The diagram below shows pyramid of biomass for the food chain:

Grass → zebra → lion



Which process causes loss of biomass from this food chain?

- A Photosynthesis
- B Growth
- C Respiration
- D Digestion

39. It is often suggested that the most efficient method to sustain the human population is for humans to consume more cereals and grains rather than meat.

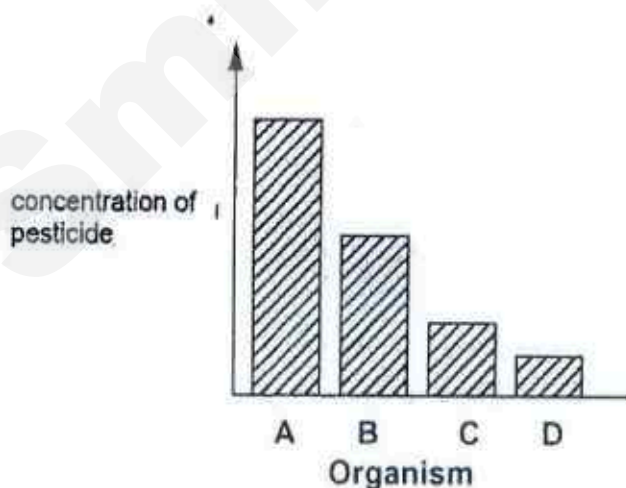
Which of the following best explains this?

- A Crop plants would provide more nutrients for humans.
 - B Crop plants have chloroplasts to convert light energy into chemical energy.
 - C Cereals and grains are digested a lot more efficiently.
 - D Greater proportion of energy in the ecosystem would be available to humans.
40. The diagram below shows part of a food chain in a lake.



The chart below shows the concentration of a pesticide in the bodies of each organism in the food chain.

Which organism on the chart is the carnivorous bird?



END OF PAPER

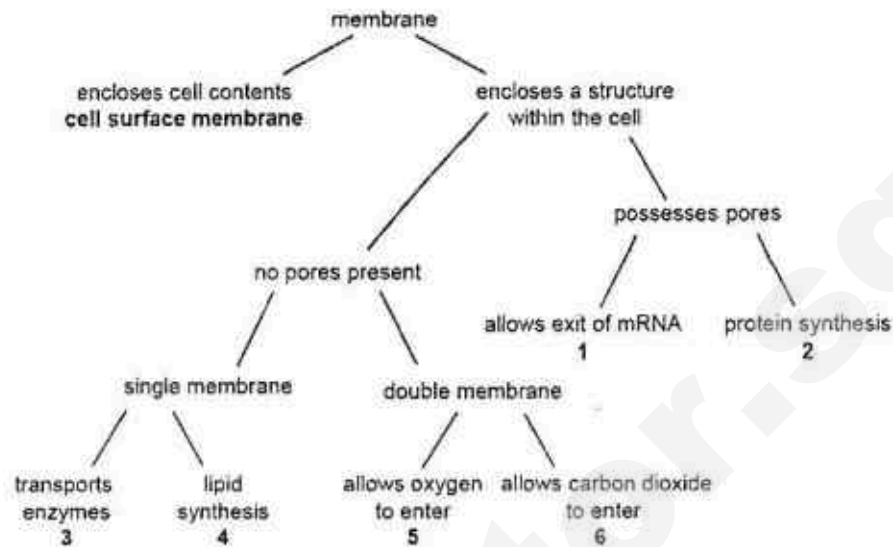
PAPER 1 (40 MARKS)

1	B	11	A	21	C	31	D
2	C	12	B	22	A	32	A
3	C	13	D	23	D	33	A
4	D	14	B	24	A	34	A
5	A	15	B	25	B	35	B
6	B	16	B	26	D	36	D
7	C	17	C	27	A	37	B
8	A	18	C	28	A	38	C
9	C	19	D	29	B	39	D
10	A	20	B	30	D	40	A

Maris Stella 2017 Prelim

2

- 1 Membranes within and at the surface of cells have different roles.

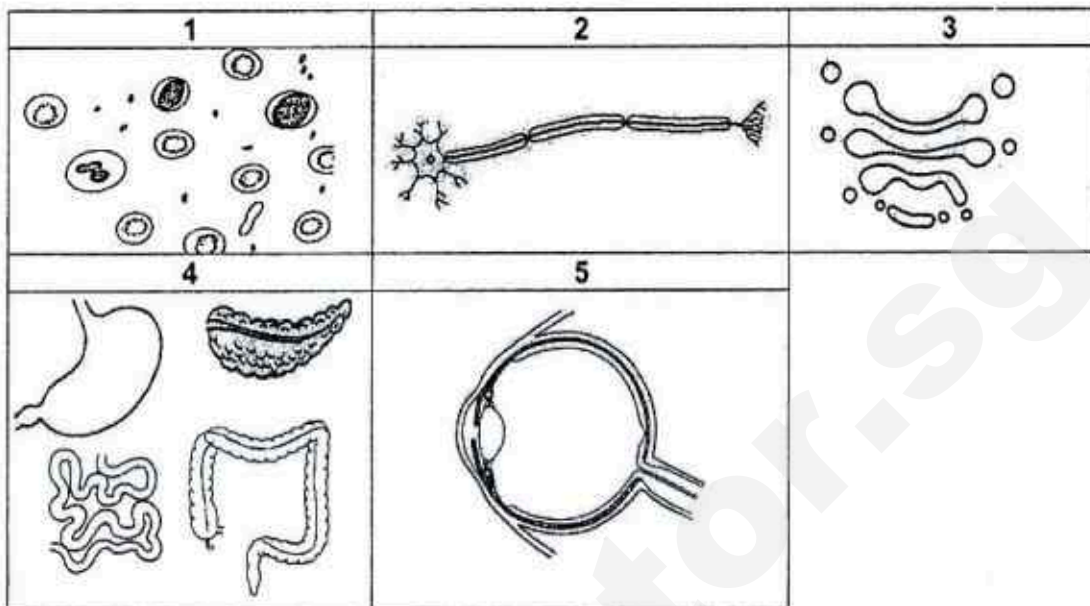


Which of the outcomes shown below correctly identifies the organelles that possess the membrane and function concerned?

	1	2	3	4	5	6
A	chloroplast	vesicle	smooth ER	rough ER	nucleolus	mitochondrion
B	nucleolus	rough ER	vesicle	smooth ER	nucleus	mitochondrion
C	nucleus	rough ER	vesicle	smooth ER	mitochondrion	chloroplast
D	nucleus	smooth ER	mitochondrion	rough ER	vesicle	chloroplast

2

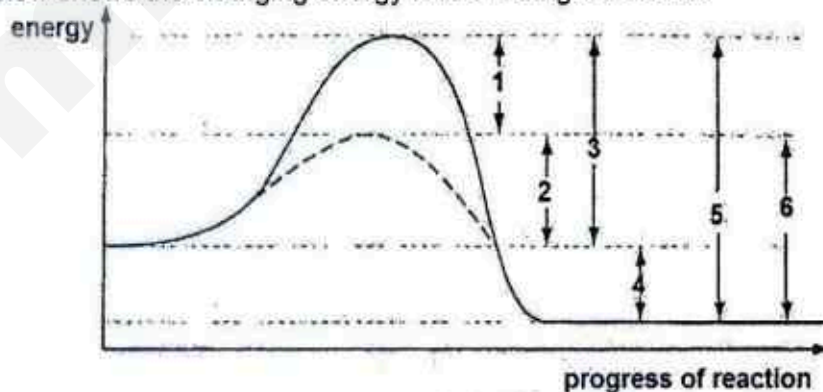
- 2 The following diagrams show some body components in the body. (The diagrams are not drawn to scale.)



Which of the following correctly identifies these body components?

	organelle	cell	tissue	organ	organ system
A	3	2	1	5	4
B	2	1	3	5	4
C	2	3	1	4	5
D	3	1	4	2	5

- 3 The graph below shows the changing energy levels during a reaction.

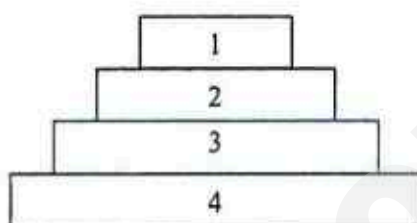


What is the activation energy of the reaction with and without the enzyme?

	activation energy of the reaction	
	with enzyme	without enzyme
A	3	2
B	2	3
C	6	5
D	1	4

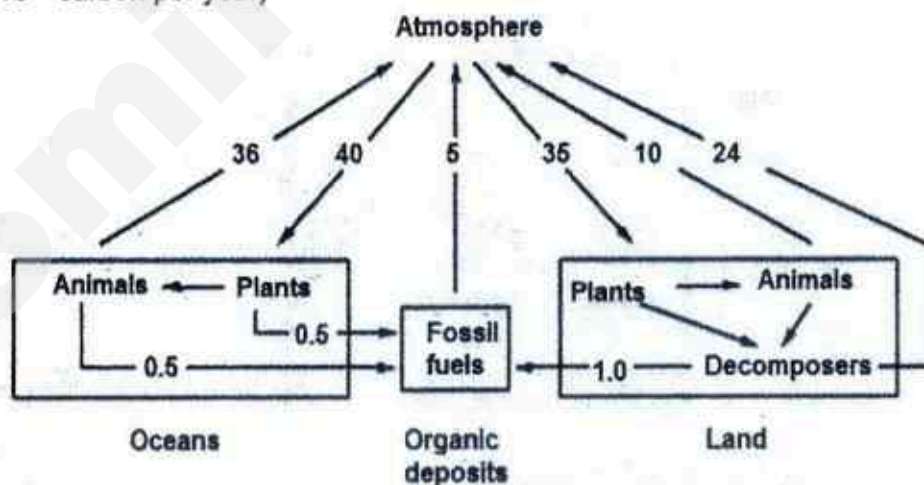
- 4 A substance T found in bananas causes them to turn brown when exposed to air. How would you determine that substance T is an enzyme?
- A Deprive the banana of oxygen and see if it turns brown.
 - B Test whether unpeeled bananas turn brown.
 - C Boil the banana and see if it turns brown when exposed to air.
 - D Test whether the banana turns brown in an atmosphere of pure carbon dioxide.

- 5 The following diagram shows an ecological pyramid.



Which of the following statement is always true?

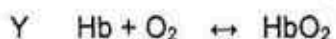
- A Level 1 is occupied by photosynthesising organism.
 - B Energy flow is upwards from level 4 to 1.
 - C Numbers in level 4 exceed those in level 3.
 - D Cumulative toxins become more concentrated from level 1 down to level 4.
- 6 The diagram below shows the relative movement of carbon within the carbon cycle. (Units are $\text{kg} \times 10^{12}$ carbon per year)



Which component of the carbon cycle is likely to be a carbon sink?

- A atmosphere
- B land
- C oceans
- D organic deposits

- 7 Which of the following best describes the function of the hepatic portal vein?
- A Transports by-products of respiration from the body to the kidney.
 - B Transports by-products of respiration from the body to the liver.
 - C Transports soluble end products of digestion from the ileum to the kidney.
 - D Transports soluble end products of digestion from the ileum to the liver.
- 8 Due to a viral infection, a person had part of his liver surgically removed. Which of the following is / are the expected consequence(s) of the removal of part of the liver?
- 1: lighter-coloured faeces
 - 2: reduced absorption of amino acids
 - 3: reduced production of bile
 - 4: slower fat digestion
- A 1 and 4 only
 - B 3 and 4 only
 - C 1, 2 and 3 only
 - D 1, 3 and 4 only
- 9 Both equations, Y and Z, are of reactions that take place within the red blood cells.



Key: Hb = Haemoglobin



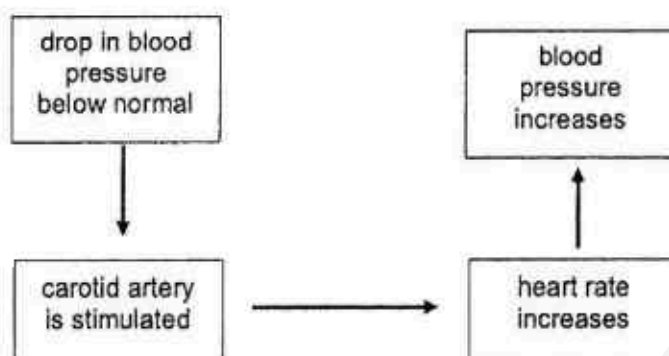
Which of the following gives its location in the body and the factors that determine the speed and direction of the reactions?

	reaction Y			reaction Z		
	concentration of reactants	correct enzyme present	location	concentration of reactants	correct enzyme present	location
A	✓	✓	alveolar cells	✓	×	red blood cells
B	✓	×	plasma	✓	×	alveolar cells
C	✓	×	red blood cells	✓	✓	red blood cells
D	×	✓	red blood cells	×	✓	plasma

key : ✓ = factor involved

× = factor not involved

10 The diagram below shows the regulation of blood pressure in the human body.



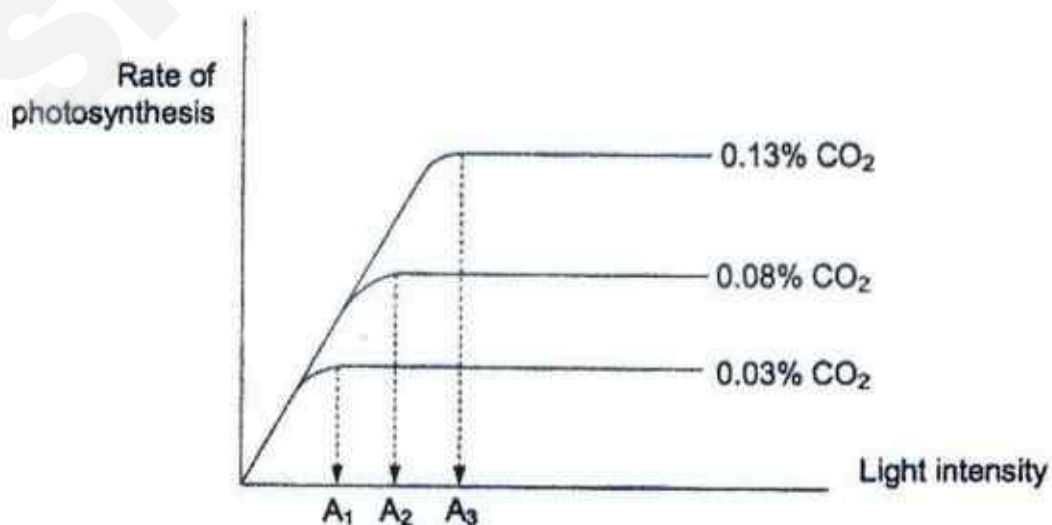
From the diagram, which of the following are the receptor and effector in the regulation of blood pressure?

	receptor	effector
A	carotid artery	carotid artery
B	carotid artery	heart
C	heart	carotid artery
D	heart	heart

11 At which stage of the blood clotting process is calcium needed?

- A During the production of thrombokinase.
- B When fibrinogen is converted to fibrin.
- C When prothrombin is converted to thrombin.
- D When the platelets are exposed to an open wound.

For questions 12 and 13, refer to the graph below that shows the effect of varying light intensity on the rate of photosynthesis.



12 Complete the sentence below.

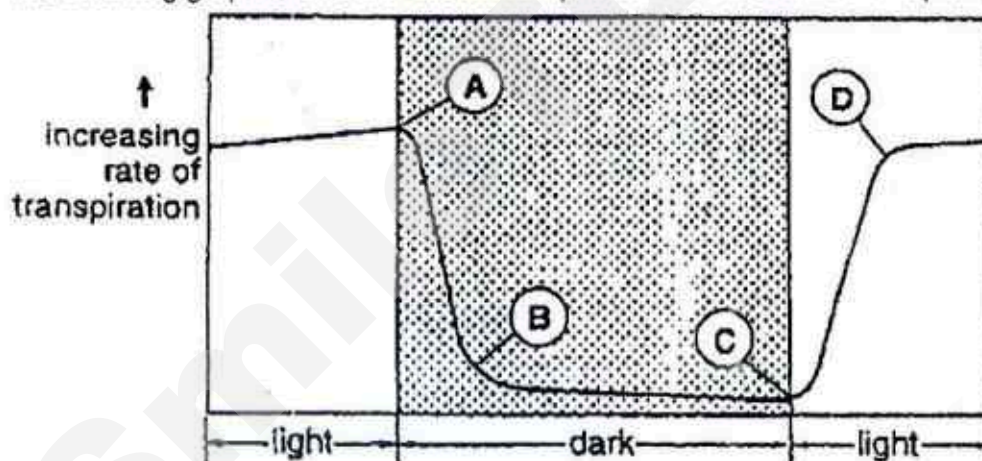
At _____ CO_2 , light intensity ceases to be a limiting factor of photosynthesis once it reaches _____.

- A 0.03%; A_1
- B 0.08%; A_1
- C 0.13%; A_1
- D 0.13%; A_2

13 What can be concluded from the three graphs?

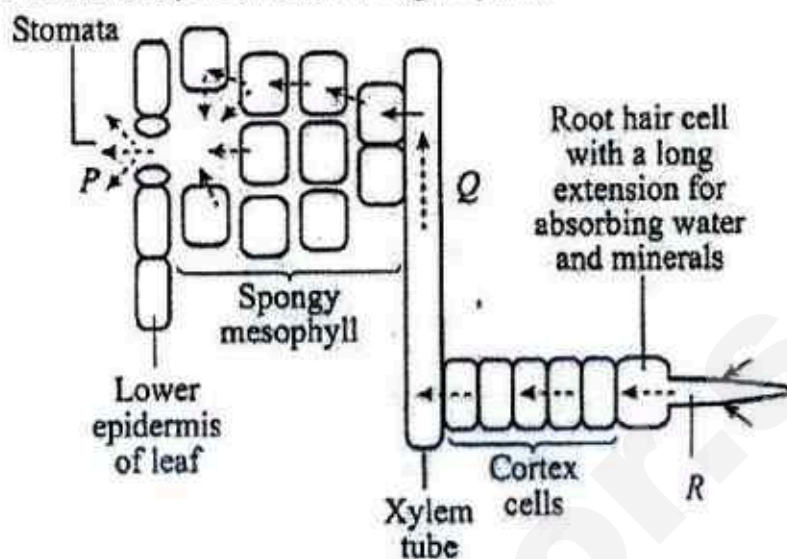
- A The rate of photosynthesis reaches a maximum beyond a certain level of light intensity.
- B The rate of photosynthesis reaches a maximum beyond a certain level of carbon dioxide concentration.
- C Light intensity has no apparent effect on the rate of photosynthesis.
- D The rate of photosynthesis always increases with light intensity.

14 The following graph shows the rate of transpiration from the leaves of a plant.



At which point (A, B, C, or D) do the stomata begin to open?

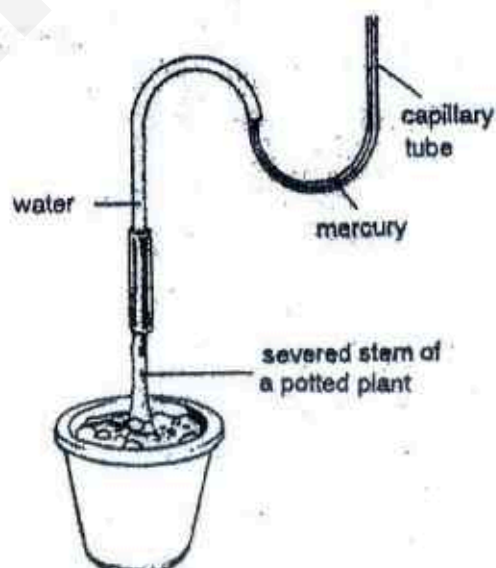
- 15 The diagram shows the transport of water through a plant.



What causes the movement of water at P, Q and R?

	P	Q	R
A	diffusion	transpiration pull	osmosis
B	transpiration pull	capillary action	osmosis
C	osmosis	capillary action	active transport
D	diffusion	transpiration pull	root pressure

Questions 16 and 17 refer to the following experiment in which a potted plant was cut off just above the soil level and was attached to a capillary tube as shown below.



16 After a while, the mercury level began to rise up in the vertical arm of the capillary tube. What is the best explanation for this?

- A The mercury was being drawn up the tube.
- B The mercury was being pushed down the tube.
- C The roots were taking up water from the soil and were exerting a transpiration pull.
- D The roots were taking up water from the soil and were forcing it upwards.

17 The magnitude of the root pressure is determined by the following factors except the

- A rate of transpiration available.
- B amount of soil water.
- C size of the root system.
- D health of the root system.

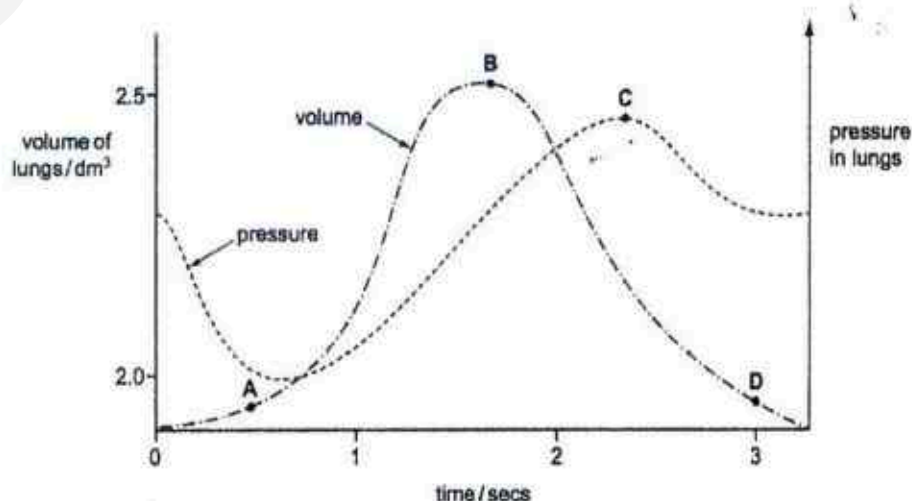
18 The following are some of the processes involved in breathing in a mammal.

- 1: air is forced into lungs
- 2: volume of thorax decreases
- 3: external intercostal muscles contract
- 4: diaphragm flattens
- 5: air pressure of thorax decreases

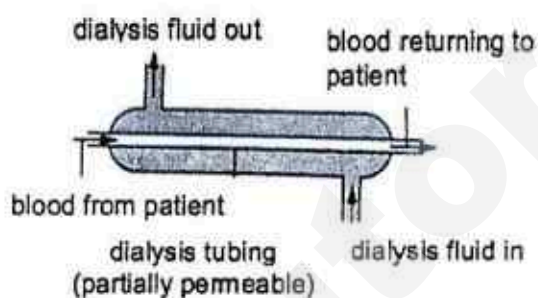
What is the correct order of the processes involved in the mechanism of breathing in?

- A 3, 4, 5, 1
- B 3, 1, 2, 4
- C 4, 3, 2, 5
- D 5, 1, 3, 4

19 The graph below shows how the pressure and volume inside the lungs change during one complete breath. At which point are the muscles of the diaphragm starting to contract?



- 20 What is the main limiting factor on the amount of work that muscles can perform during aerobic exercise?
- The volume of blood flowing through the lungs.
 - The volume of blood flowing through the muscles.
 - The percentage saturation of haemoglobin with oxygen in the lungs.
 - The speed at which oxygen leaves the haemoglobin in the muscles.
- 21 An engineer has been tasked to improve the efficiency of the dialysis machine shown in the diagram below.



Which of the following recommendations will improve the process of dialysis?

- increasing the length of the dialysis tubing
 - increasing the rate at which dialysis fluid is replaced
 - reducing the diameter of the dialysis tubing
- I only
 - II and III only
 - I and II only
 - I, II and III only
- 22 A person enters an air-conditioned room from a warm surrounding. The following are changes that will occur within the body inside the air-conditioned room.
- the temperature of the blood increases
 - shivering
 - brain detects the change in blood temperature
 - the temperature of the blood decreases
- Which of the following shows the order in which these changes occur?
- IV→III→II→I
 - I→III→II→IV
 - IV→II→III→I
 - I→II→III→IV

23 The following shows some of the information on adrenaline, insulin and glucagon in the body.

- I adrenaline is broken down in the liver.
- II glucagon decreases the blood glucose level.
- III insulin is transported by red blood cells.
- IV insulin and glucagon are produced by pancreas.

Which of the above statements is/are correct?

- | | |
|------------------------|-----------------------------|
| A I only | B II and III only |
| C I and IV only | D I, III and IV only |

24 Four processes that take place in the human body are listed below.

- I absorption of glucose through the cell surface membrane
- II production of lactic acid in skeletal muscles
- III maintenance of body temperature
- IV regulation of secretion of anti-diuretic hormone

Which two processes are directly controlled by negative feedback?

- | | |
|--------------------|---------------------|
| A I and II | B I and III |
| C II and IV | D III and IV |

25 Two organs secrete substances that affect the body.

Organ 1 → Product 1

Organ 2 → Product 2

Negative feedback control of product 2 would be achieved if _____.

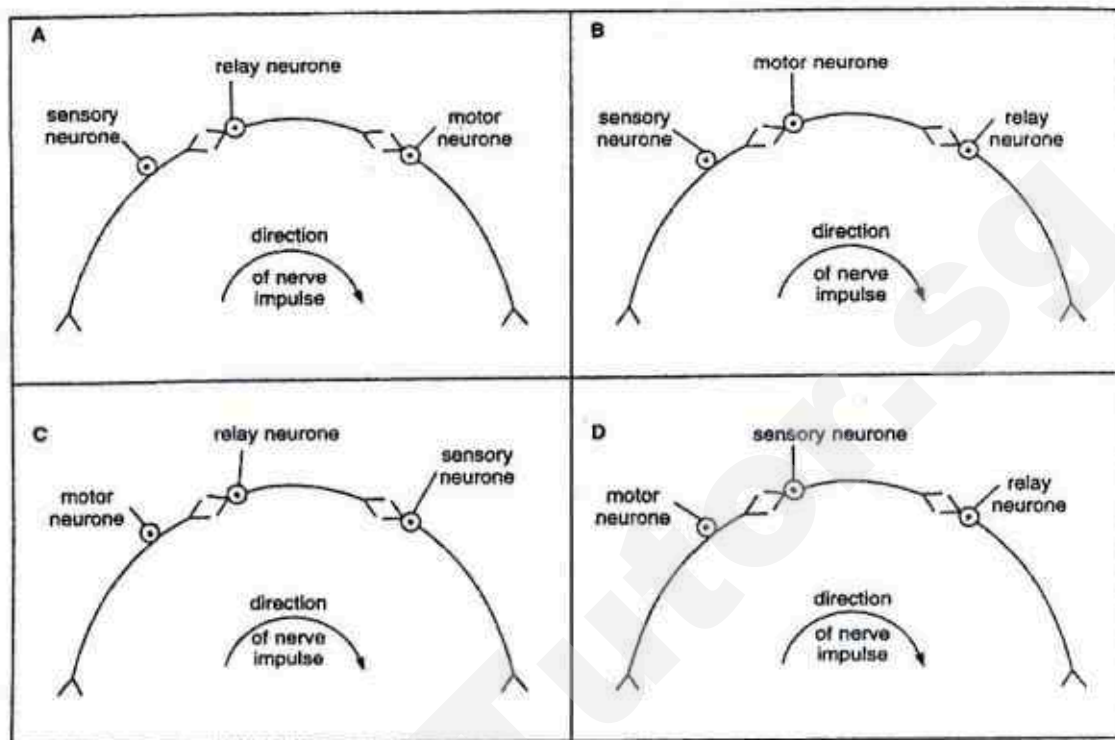
- A** Product 1 counteracts product 2
- B** Product 1 reinforces the effect of product 2
- C** Product 2 inhibits organ 1 and product 1 stimulates organ 2
- D** Product 2 stimulates organ 1 and product 1 stimulates organ 2

26 Mark was on the street in the middle of the night when a robber came up to him and demanded him for money at knifepoint. Which of the following are likely to take place in Mark's body immediately following that moment?

- 1 relaxation of the radial muscle of the iris.
- 2 dilation of arterioles supplying the gastro-intestinal tract.
- 3 dilation of arterioles supplying skeletal muscle.

- | | |
|------------------|------------------|
| A 1 and 3 | B 2 and 3 |
| C 1 | D 3 |

- 27 Which of the following diagrams, A, B, C or D, shows the correct sequence of neurons in a reflex arc?

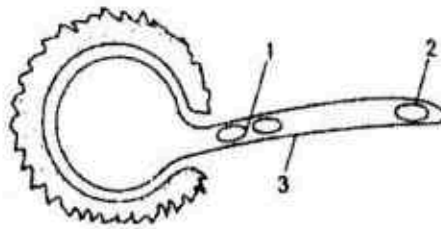


- 28 When the eye is focused on far objects, which of the following sequences gives the correct state of the lens, the ciliary muscles and the suspensory ligaments?

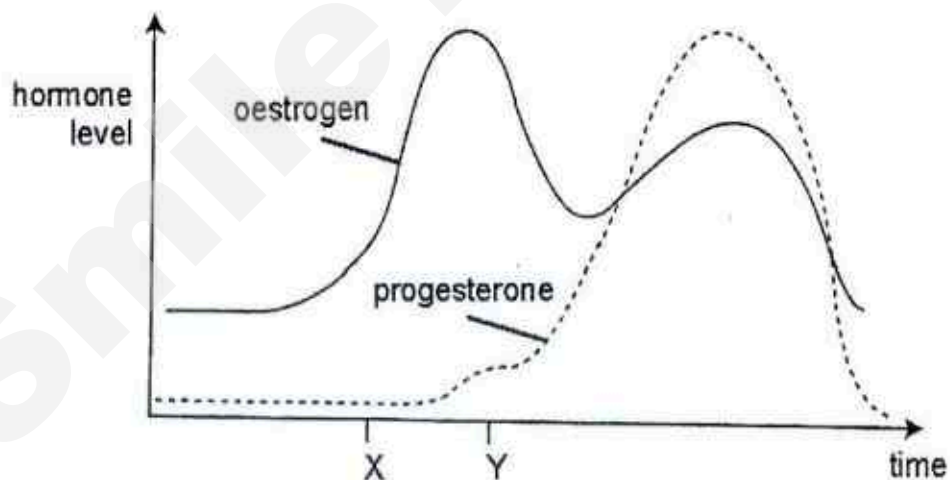
	lens	muscle	ligament
A	most convex	relaxed	relaxed
B	least convex	contracted	relaxed
C	least convex	relaxed	taut
D	most convex	contracted	taut

- 29 An elderly man found he could no longer see to read clearly. His optician prescribed spectacles with converging lenses. This was because his
- A corneas were losing their transparency.
 - B eyeballs had become longer from back to front.
 - C ciliary muscles were weakened.
 - D lenses were losing their elasticity.

Q30-31 refer to figure below.



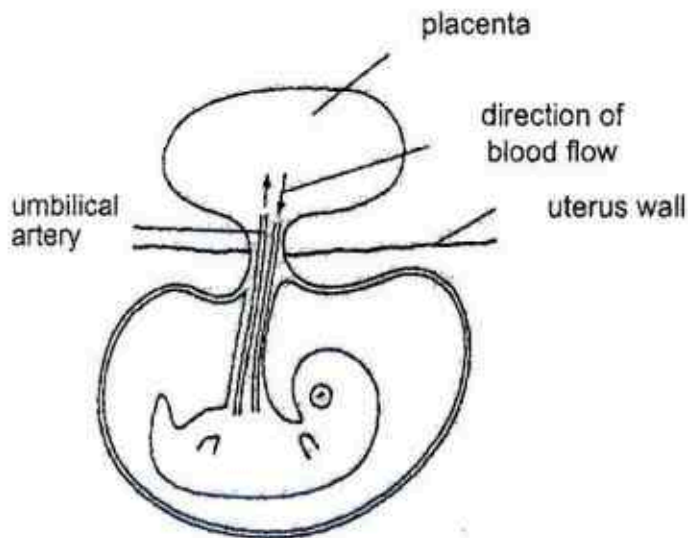
- 30 The two nuclei, the parts labelled 1, are called
- A spermatozoa B male gametes
C tube nuclei D ovules
- 31 The part labelled 3 is called a
- A filament B pollen tube
C conjugation canal D sporangia
- 32 The diagram shows the relationship between oestrogen and progesterone levels in the blood of a human female over a period of time.



What happens at point X and point Y?

	X	Y
A	menstruation	ovulation
B	menstruation	repair of endometrium
C	repair of endometrium	menstruation
D	repair of endometrium	ovulation

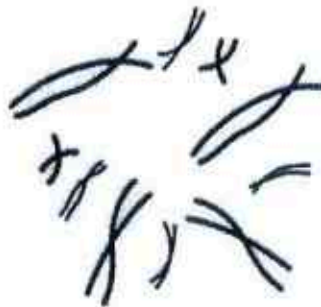
- 33 The following diagram shows a developing foetus in the uterus.



Which of the following shows the composition of blood in the umbilical artery?

	glucose concentration	oxygen concentration	carbon dioxide concentration
A	high	high	high
B	high	low	low
C	low	low	low
D	low	low	high

- 34 The figure shows the chromosomes of one cell during meiosis.



Which phase of meiosis is shown and what is the number of chromosomes in the gamete of this species?

	phase of meiosis	number of chromosomes
A	I	5
B	I	10
C	II	5
D	II	10

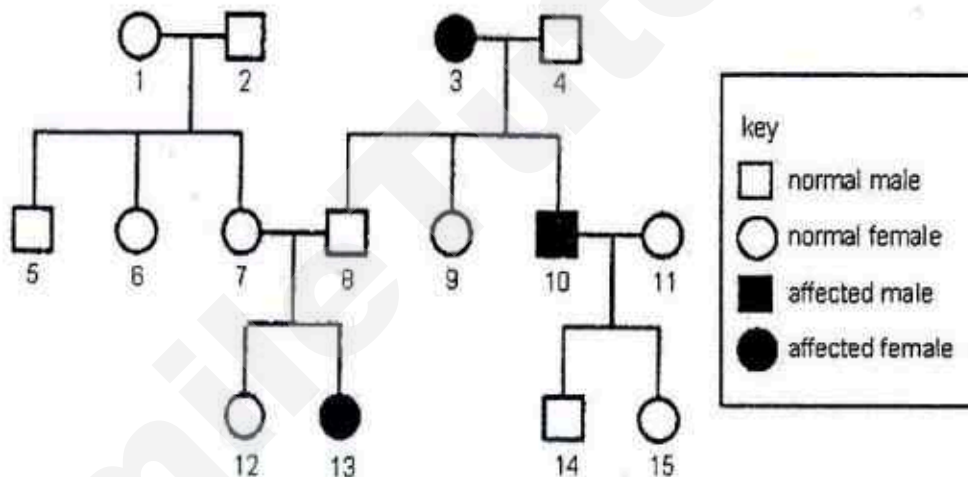
35 Homologous chromosomes contain the same _____.

- A DNA sequences
- B number of guanine and adenine
- C alleles
- D genes

36 Which of the following is true of a mutation that produces an allele that is dominant?

- A It would be expected to cause death.
- B It would be expected to spread more quickly through a population than a recessive mutation.
- C It could give an observable phenotype in a heterozygous genotype.
- D It could give an observable phenotype only in a homozygous genotype.

37 The chart shows the inheritance of a genetic disease, caused by a recessive allele ~~4, 9~~.



Which females are certain to have the genotype Qq?

- A 1, 6, and 7 only
- B 1, 7, and 12 only
- C 7, 9, and 15 only
- D 9, 12, and 15 only

38 A DNA molecule contains 20% of thymine. What is the percentage of guanine and phosphate in the DNA molecule?

	percentage of	
	guanine	phosphate
A	30	100
B	20	30
C	60	100
D	30	50

39 In a DNA molecule, the base sequence AGT codes for the amino acid serine. What is the

base sequence of the anti-codon on the tRNA to which serine becomes attached?

- A UGU B GAU C AGU D UCA

- 40 Sickle cell anemia is caused by the mutation of one base pair in the gene controlling the formation of haemoglobin.

If the original code 'GAA' mutated to 'GUA', deduce the resultant substitution of amino acids by referring to the chart below.

		Second letter				
		U	C	A	G	
First letter	U	UUU } Phe UUC } UUA } Leu UUG }	UCU } UCC } Ser UCA } UCG }	UAU } Tyr UAC } UAA Stop UAG Stop	UGU } Cys UGC } UGA Stop UGG Trp	U C A G
	C	CUU } CUC } Leu CUA } CUG }	CCU } CCC } Pro CCA } CCG }	CAU } His CAC } CAA } Gln CAG }	CGU } CGC } Arg CGA } CGG }	U C A G
	A	AUU } AUC } Ile AUA } AUG Met	ACU } ACC } Thr ACA } ACG }	AAU } Asn AAC } AAA } Lys AAG }	AGU } Ser AGC } AGA } Arg AGG }	U C A G
	G	GUU } GUC } Val GUA } GUG }	GCU } GCC } Ala GCA } GCG }	GAU } Asp GAC } GAA } Glu GAG }	GGU } GGC } Gly GGA } GGG }	U C A G

	original amino acid	substituted amino acid (after mutation)
A	Asp	Gly
B	Glu	Val
C	Val	Asp
D	Ala	Glu

----- End of Paper -----

Maris Stella High 2017 Prelim Paper 1 Ans

1	2	3	4	5	6	7	8	9	10
C	A	B	C	B	C	D	D	C	B
11	12	13	14	15	16	17	18	19	20
C	A	A	C	A	D	A	A	C	B
21	22	23	24	25	26	27	28	29	30
D	A	C	D	C	D	A	C	D	B
31	32	33	34	35	36	37	38	39	40
B	D	D	A	D	C	C	A	C	B

Qns 2 Blood is a complex tissue (RBC, WBC, platelets, plasma)

Qns 8 If a part of liver is removed, breakdown of Hb is slowed down. Formation of bile salts ↓.

↓
Less bile salt reabsorbed into stool
↓
Faeces become light coloured.

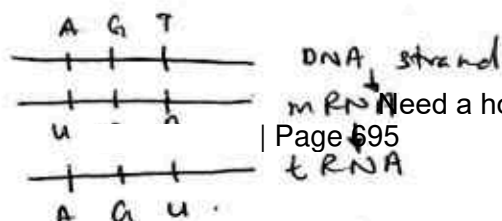
Qns 17 Root pressure, Pg 182 of Textbook.

Qns 19 "Diaphragm starting to contract".
(Look at the exhalation state) → High pressure & Low volume of lungs.

Qns 21 I → greater Surface Area for diffusion
II → conc. gradient
III → forces small molecule out at high pressure.

Qns 34. meiosis I (separation of homologous chromosomes)
→ At pairs of homologous chromosomes can still be seen in cell.

Qns 40.



Name:

Register Number:

Class:



南橋中學

NAN CHIAU HIGH SCHOOL

PRELIMINARY EXAMINATION TWO 2017
SECONDARY FOUR EXPRESS

For Marker's Use

BIOLOGY PAPER 1

5158/1

28 August 2017, Monday

1 hour

Candidates answer on the OTAS.

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number in the spaces provided on the question paper.
Use a 2B pencil to shade the answers on the OTAS. Erase any mistakes cleanly. Do not use staples, paper clips, highlighters or correction fluid.

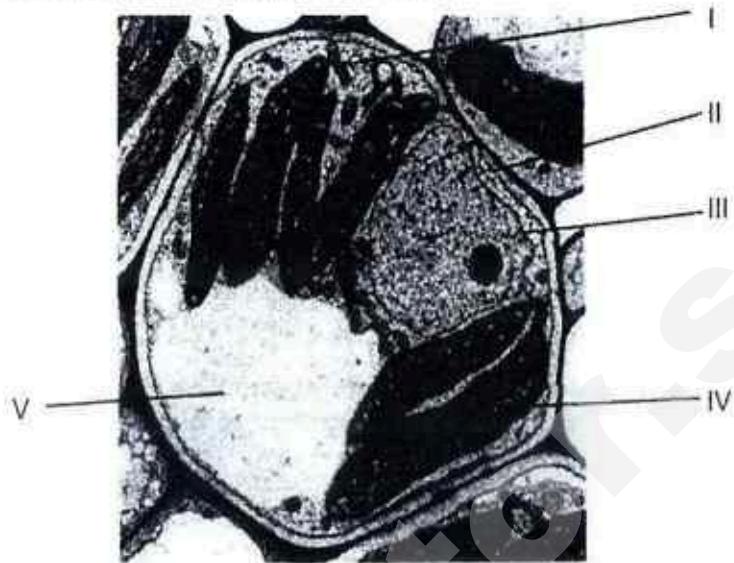
There are **forty** questions in this section. Answer **all** questions. Choose the option you consider correct and shade the corresponding letter, A, B, C or D on the OTAS.

The total marks for this paper is 40.

This paper consists of **21** printed pages including the cover page.

Choose the option you consider **correct** and shade the corresponding letter, **A, B, C** or **D** on the OTAS. [40m]

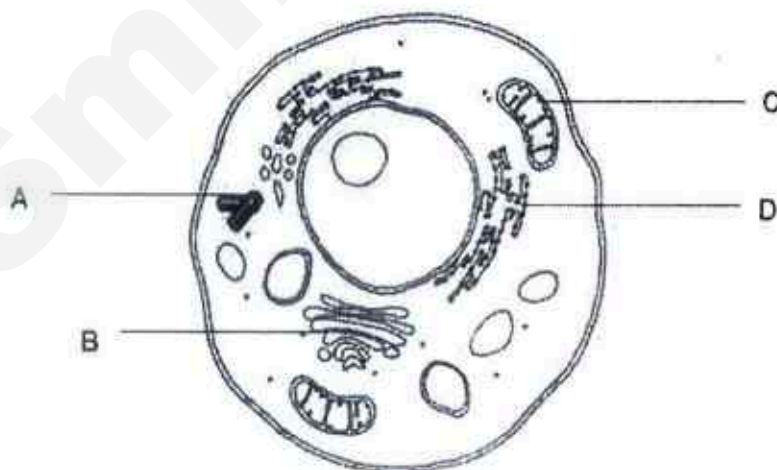
1. The diagram shows the electron micrograph of a plant cell.



Which row correctly identifies the organelles?

	I	II	III	IV	V
A	chloroplast	cell surface membrane	nucleus	Golgi apparatus	central vacuole
B	chloroplast	cellulose cell wall	nucleolus	chloroplast	ribosome
C	mitochondrion	cell surface membrane	nucleus	chloroplast	central vacuole
D	mitochondrion	cellulose cell wall	nucleolus	Golgi apparatus	ribosome

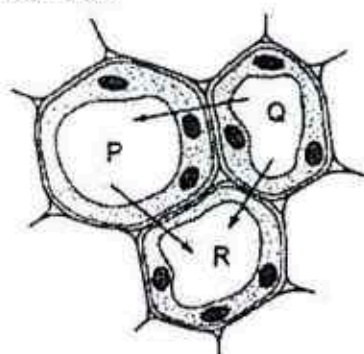
2. The diagram shows the structure of a typical animal cell as seen using an electron microscope.



Which label links an organelle to its function correctly?

Organelle	Function
A	Control protein synthesis
B	Formation of spindle fibers
C	Release of energy
D	Synthesis of fats

3. The diagram shows three plant cells, P, Q and R. The arrows indicate the movement of water molecules between the cells by osmosis.



Which of the following shows the correct order of the water potential in the cells?

	Highest	→	Lowest
A	P	Q	R
B	P	R	Q
C	Q	P	R
D	R	Q	P

4. While preparing an omelette, Julia cracked open an egg into a bowl. She accidentally spilled vinegar into the bowl with the uncooked egg and after 10 minutes, she noticed that parts of the egg had begun to solidify.

What is the most likely explanation?

- A The addition of vinegar resulted in a drop in temperature that caused the egg to solidify.
 B Vinegar has a low pH that caused the proteins in the egg to denature.
 C Vinegar contains pepsin which curdled the protein in the egg.
 D Water left the egg by osmosis because the vinegar has a low water potential.
5. Cubes of hard-boiled egg white are placed in test-tubes containing 5 cm³ of water. Other substances are added to each tube as shown in the chart. The tubes are left for eight hours and then tested for amino acids.

tube	solution added	results of test for amino acids
1	pepsin	absent
2	pepsin + alkali	absent
3	none	absent
4	pepsin + acid	large amounts
5	boiled pepsin + acid	traces
6	acid	traces
7	alkali	absent

Which tubes show that pepsin is an enzyme?

- A 1 and 6
 B 2 and 7
 C 4 and 5
 D 5 and 6

6. A food sample gives the following results on testing:

A violet colouration with Biuret's solution;
 A blue colour when heated with Benedict's solution;
 A yellow colour with iodine solution;
 A white emulsion with ethanol.

Which nutrients does the food contain?

- A Fat and protein
 B Protein and reducing sugar
 C Reducing sugar and starch
 D Starch and fat
7. If the pancreatic duct of a person becomes blocked, which symptom would be observed?
- A Decrease in the release of bile
 B Decrease in the release of insulin
 C Decrease in the rate of digestion of fats
 D Increase in blood glucose concentration
8. The table shows the conditions set up in an experiment.

test-tube 1	1 ml of oil	5 ml of lipase	0.05 g of bile salts	5 ml of pH 9 buffer
test-tube 2	1 ml of oil	5 ml of water	0.05 g of bile salts	5 ml of pH 9 buffer
test-tube 3	1 ml of oil	5 ml of lipase	-	5 ml of pH 9 buffer

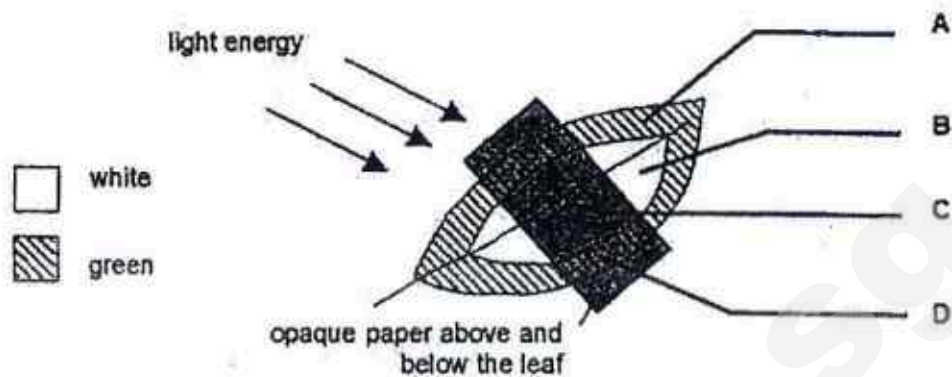
Three drops of pH indicator were added to each tube. The colour changes for the pH indicator are as follows.

pH 3	pH 5	pH 7	pH 9
red	pink	orange	yellow

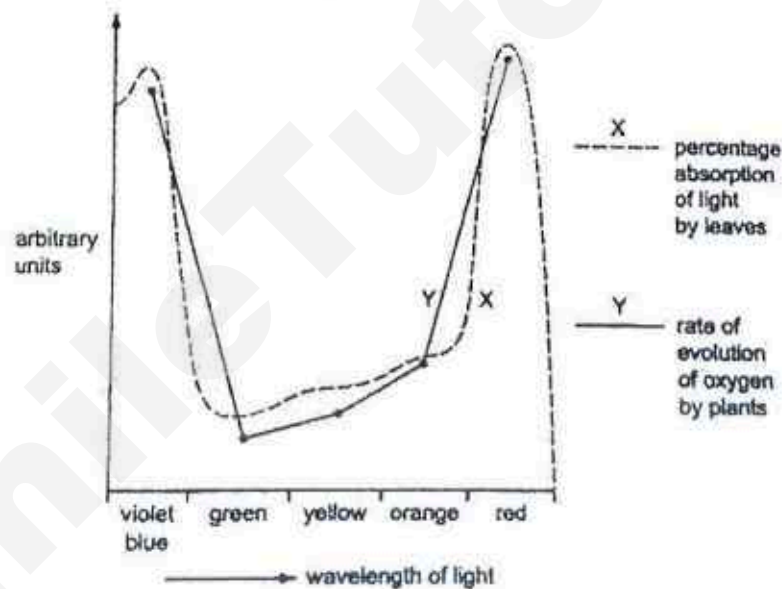
What colour would you expect to see in the test tubes after 30 minutes?

	Test tube 1	Test tube 2	Test tube 3
A	red	red	yellow
B	orange	yellow	pink
C	pink	yellow	red
D	red	yellow	pink

9. The diagram below shows an experiment to investigate photosynthesis in a variegated leaf. Which portion of the leaf is missing two factors required for photosynthesis?



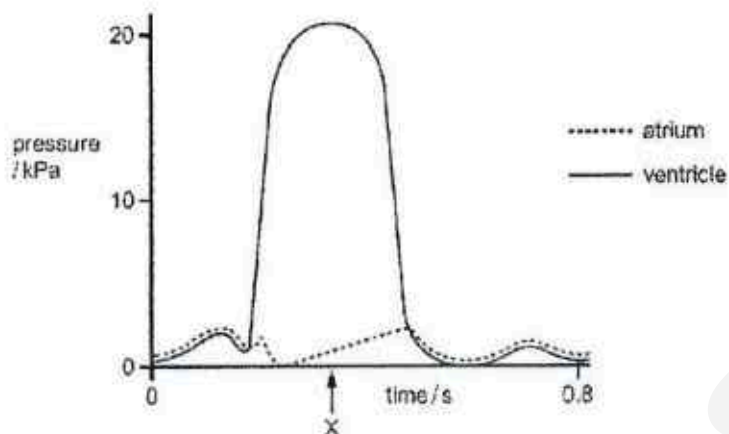
10. The graph shows the effect of different wavelengths of light on processes taking place in green plants.



What can be deduced from the solid line Y?

- A Photosynthesis is least active in green light and most active in blue and red light.
- B Photosynthesis is most active in green light and less active in blue and red light.
- C Respiration is least active in green light and most active in blue and red light.
- D Respiration is most active in green light and less active in blue and red light.

11. The graph shows the pressure changes in the left atrium and the left ventricle during one heartbeat.



What is the state of the valves in the heart at time X?

	Bicuspid valve	Aortic valve
A	closed	closed
B	closed	open
C	open	closed
D	open	open

12. The blood of three patients, X, Y and Z were tested to determine their respective blood groups. Their blood was tested with the serum samples from blood groups A and B respectively.

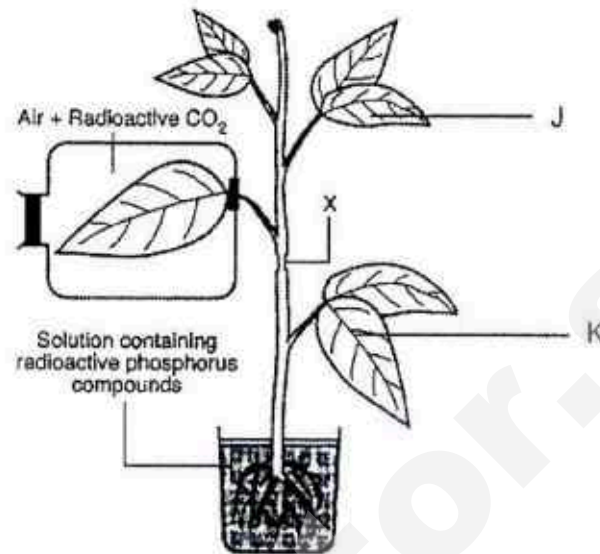
The results are shown below.

patient	serum from blood group A	serum from blood group B
X		
Y		
Z		

Which of the following shows the correct blood group matching for all the patients?

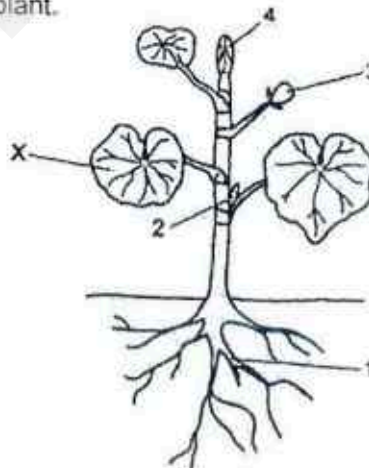
	Patient X	Patient Y	Patient Z
A	B	AB	O
B	A	O	AB
C	O	A	B
D	AB	B	A

13. An experiment was set up as shown below, to study the movement of substances in a plant. A ring of tissues was removed at X, leaving only the woody inner part exposed. After several hours, the relative amounts of radioactive carbon and phosphorus compounds in different parts of the plant were measured.



Which of the following statements is true?

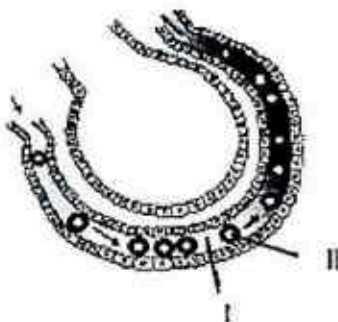
- A Radioactive carbon compounds were found in both leaves J and K.
 - B Radioactive carbon compounds can only be found in the roots and radioactive phosphorus compounds were found in the both leaves J and K.
 - C Radioactive phosphorus compounds were found in both leaves J and K and radioactive carbon compounds were found in leaf J but not in leaf K.
 - D Radioactive phosphorus compounds were found in leaf K but not in leaf J.
14. The diagram shows a green plant.



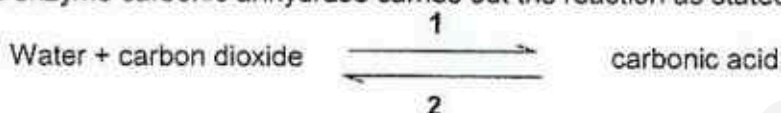
Where will food made by leaf X be found after translocation?

- A 1 only
- B 1 and 2 only
- C 1, 2 and 3 only
- D 1, 2, 3 and 4

15. The diagram below illustrates an alveolus and its associated blood supply.



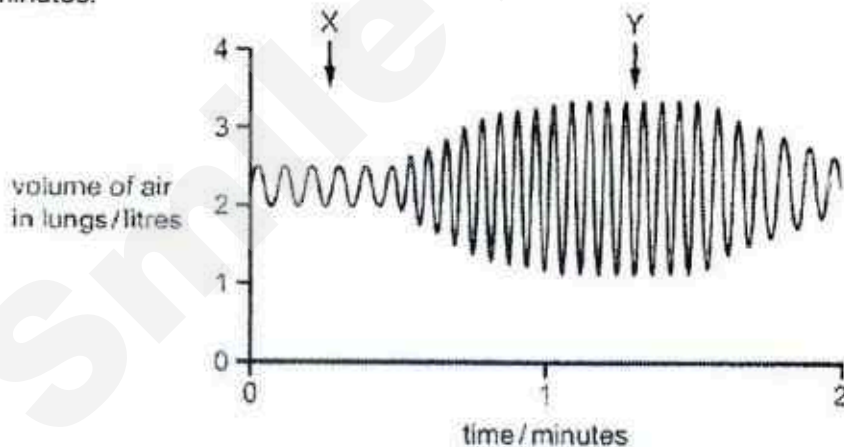
The enzyme carbonic anhydrase carries out the reaction as stated below.



Which of the following states the site of enzyme activity and its catalytic reaction when blood passes through the lungs?

	Site of enzyme activity	Catalytic reaction
A	I	1
B	II	2
C	II	1
D	I	2

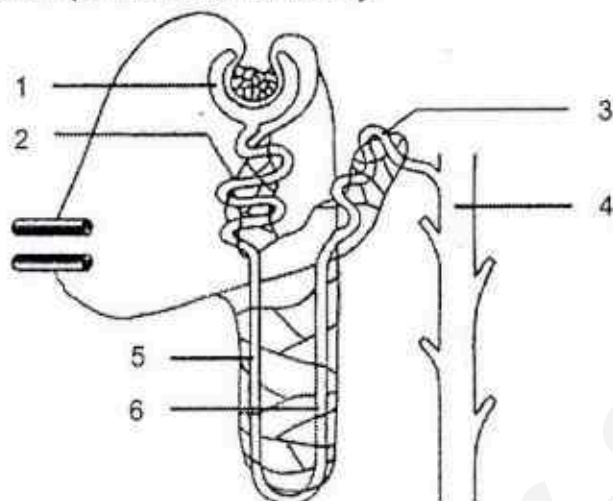
16. The graph shows the changes in the volume of air in a person's lungs over a period of two minutes.



What would cause the change in pattern of the graph between points X and Y?

- A Changing from running to walking
- B Changing from walking to running
- C Increasing frequency of contractions of the internal intercostal muscles
- D Increasing strength of contractions of the internal intercostal muscles

17. The diagram below shows a part of the human kidney.



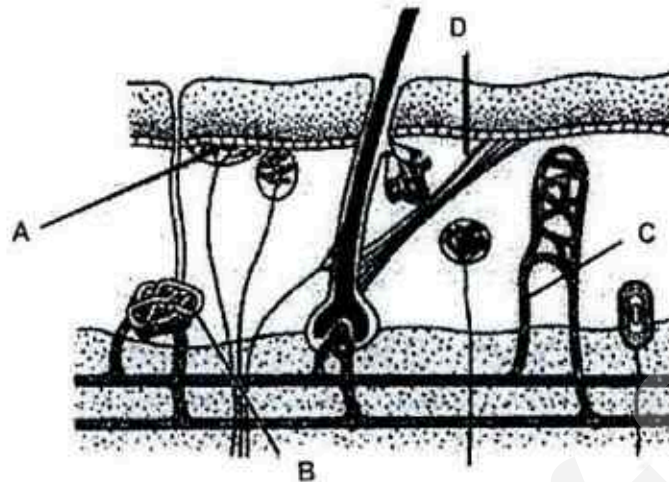
In which regions would you expect to find cells with the largest number of mitochondria?

- A 1 and 2
 - B 2 and 3
 - C 3 and 4
 - D 5 and 6
18. The kidney is involved in osmoregulation of the blood.

What happens in the body when there is excessive sweating during a hot day?

	anti-diuretic hormone released by pituitary gland	volume of water reabsorbed by the kidney tubule
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

19. The diagram below shows the cross section of human skin.



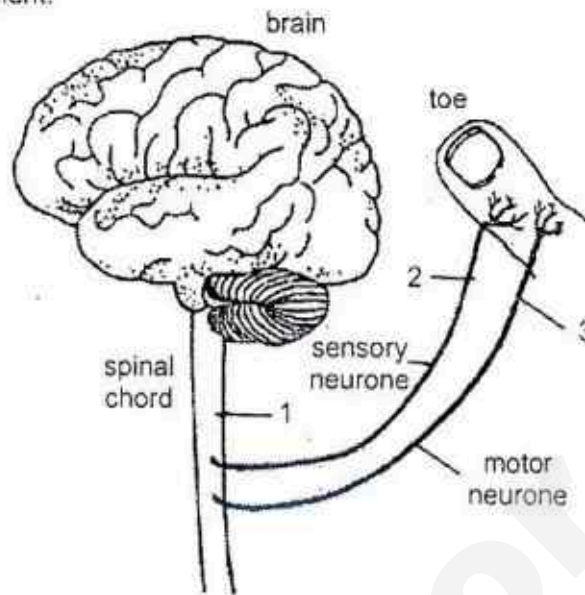
Which of the following correctly states the function of each structure?

- A Structure A sends feedback to the receptor.
 - B Structure B produces a fluid to help the body lose heat.
 - C Structure C dilates when body temperature drops.
 - D Structure D contracts when the body temperature rises.
20. When a class of neurotransmitters (e.g. endorphins) are produced at specific synapses, a feeling of euphoria results. Drugs such as heroin can also mimic the effect of endorphins.

Which of the following is a possible mechanism of action of heroin?

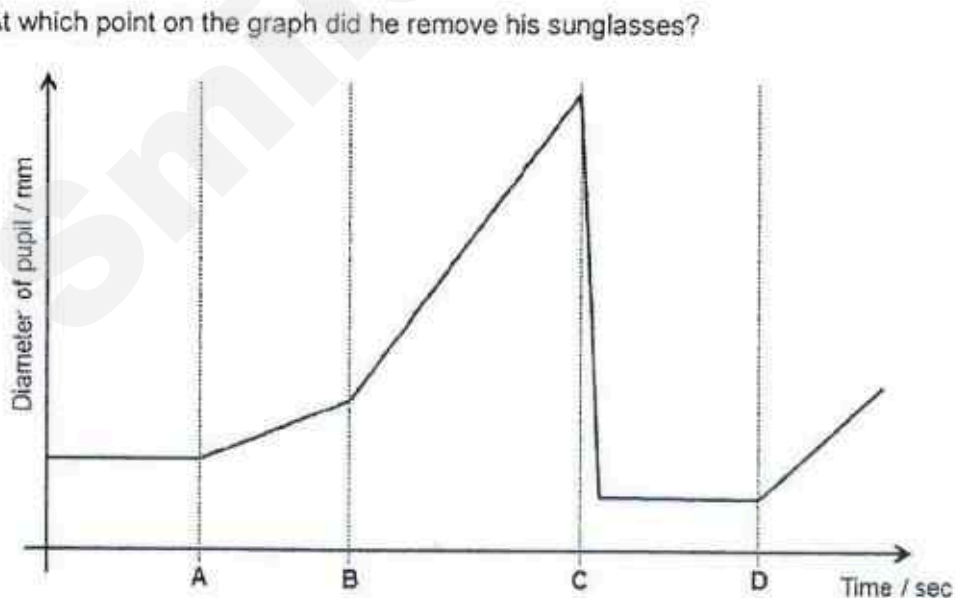
- A It inhibits the binding of endorphins to their receptors.
- B It is able to bind to the same receptors as endorphins.
- C It is able to decrease the breakdown of endorphins at the synapse.
- D It is able to increase the breakdown of endorphins at the synapse.

21. A woman was given an anaesthetic to block either region 1, 2 or 3. She can move her toe but cannot feel the movement.



Which region(s) is/are blocked?

- A 1 only
 - B 2 only
 - C 1 and 3
 - D 2 and 3
22. A man was wearing sunglasses on a sunny day and removed them as he prepared to enter the swimming pool. The following graph shows the diameter of his pupil against time.

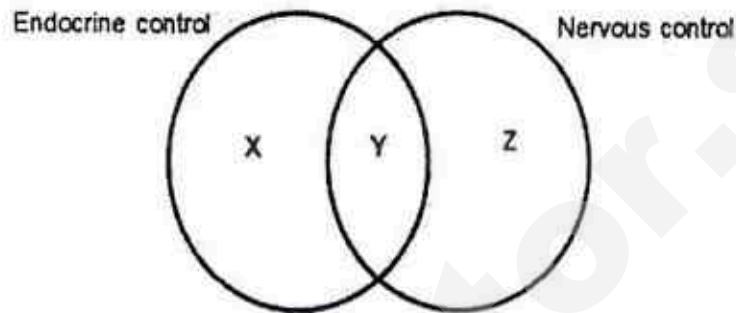


At which point on the graph did he remove his sunglasses?

23. Our eyes feel strained when we read small prints for a long period of time.
Which of the following is the correct explanation for the incident described above?

- A The suspensory ligaments become stretched.
- B The retina no longer records clear images.
- C The optic nerve no longer transmits impulses to the brain.
- D The ciliary muscles become fatigued.

24. The comparison between endocrine control and nervous control can be illustrated using the following venn diagram.



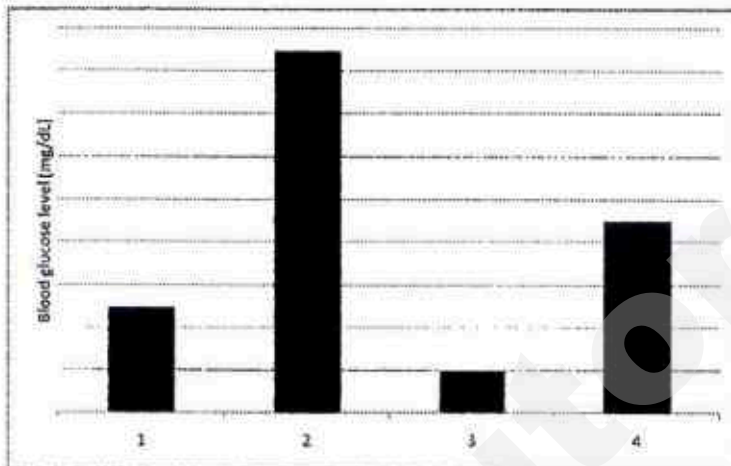
Which of the following can fit into the regions X, Y and Z?

	X	Y	Z
A	A method of coordination	Always voluntary	May be voluntary or involuntary
B	Always involuntary	A method of coordination	May be voluntary or involuntary
C	May be voluntary or involuntary	Always voluntary	A method of coordination
D	May be voluntary or involuntary	A method of coordination	Always voluntary

25. Four people had the following descriptions with regards to their body and dietary conditions:

- Normal; has not eaten for 24 h
- Normal; before lunch
- Normal; 3 h after lunch
- Diabetic; 3 h after lunch

They were then tested for their blood glucose levels. The graph below shows the blood glucose levels of the four people.



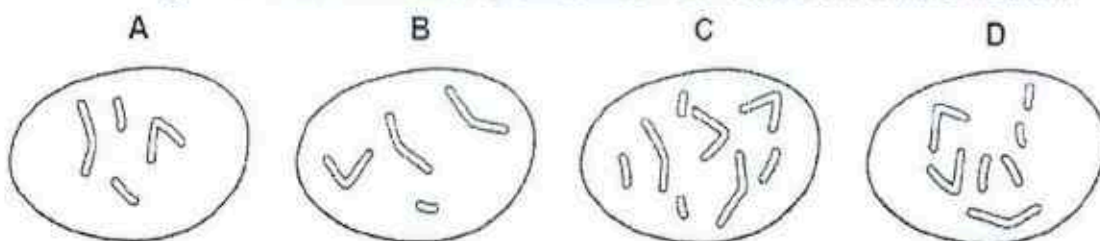
Which of the following would be accurate labels for the various columns in the graph above?

	1	2	3	4
A	Normal; before lunch	Normal; 3 h after lunch	Normal; has not eaten for 24 h	Diabetic; 3 h after lunch
B	Normal; has not eaten for 24 h	Diabetic; 3 h after lunch	Normal; before lunch	Normal; 3 h after lunch
C	Normal; before lunch	Diabetic; 3 h after lunch	Normal; has not eaten for 24 h	Normal; 3 h after lunch
D	Normal; 3 h after lunch	Diabetic; 3 h after lunch	Normal; has not eaten for 24 h	Normal; before lunch

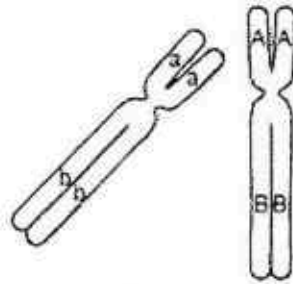
26. The diagram shows the chromosomes in the stigma cell of a flowering plant.



Which diagram shows the nucleus of chromosomes in the root hair cell of the same plant?



27. The diagram shows two homologous chromosomes in early prophase I of meiosis in an animal cell. Two genes, with alleles A/a and B/b, whose loci occur on the homologous chromosomes are also shown.



Which option is a possible representation of these chromosomes at anaphase I and prophase II?

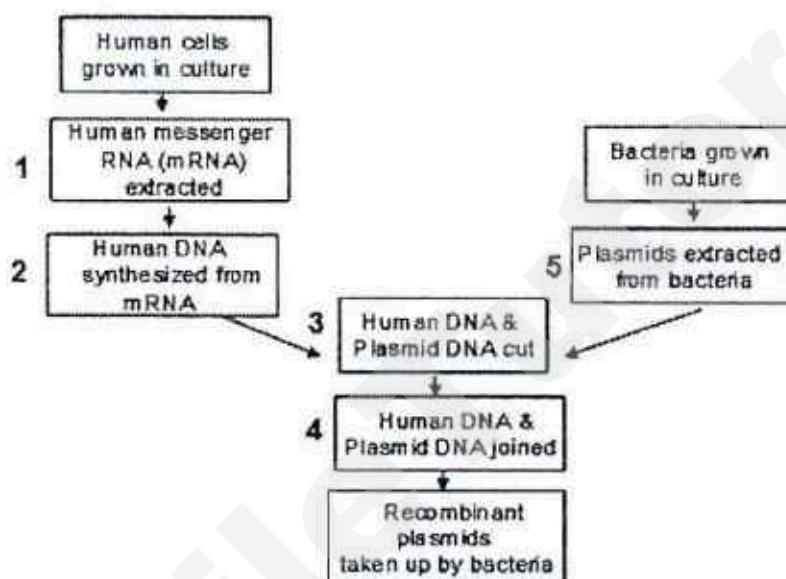
	anaphase I	prophase II
A		
B		
C		
D		

28. A gene is made up of 126 bases. 15% of the gene is identified as adenine.

Which of the following is correct about the number of amino acids in the protein after translation and percentage of thymine in the mRNA after transcription is true?

	number of amino acids in protein after translation	percentage of thymine in mRNA after transcription (%)
A	42	0
B	42	15
C	46	35
D	378	15

29. The diagram below shows stages of production of human insulin via genetic engineering.



Which of the following correctly lists the stages that involve the specific enzymes?

	Polymerase	Ligase	Restriction enzyme
A	3	4	2
B	2	3	4
C	2	4	3
D	1	3	2

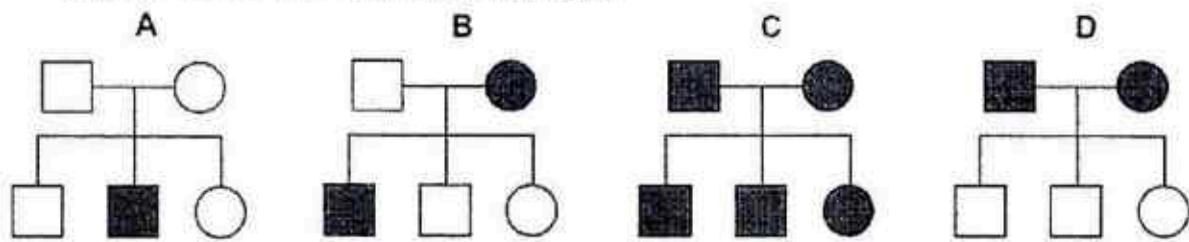
30. Genetic information for a chicken breed is shown below.

Genotype	Phenotype
FF	Normal fowl (normal feathers)
Ff	Frizzle fowl (curly feathers)
ff	Feather Shedder fowl (Loses feathers easily)

Which one of the following crosses will produce only chickens with curly feathers?

- A Normal x Frizzle
- B Frizzle x Frizzle
- C Normal x Feather Shedder
- D Feather Shedder x Feather Shedder

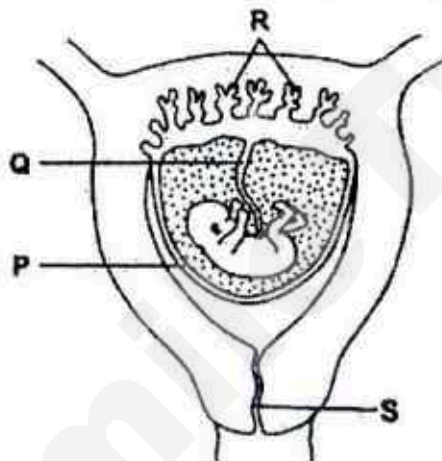
31. Which of the following pedigree diagrams may conclusively prove that the ability to roll tongue (unshaded) is controlled by a dominant allele?



32. In human reproduction, which sequence of events is correct?

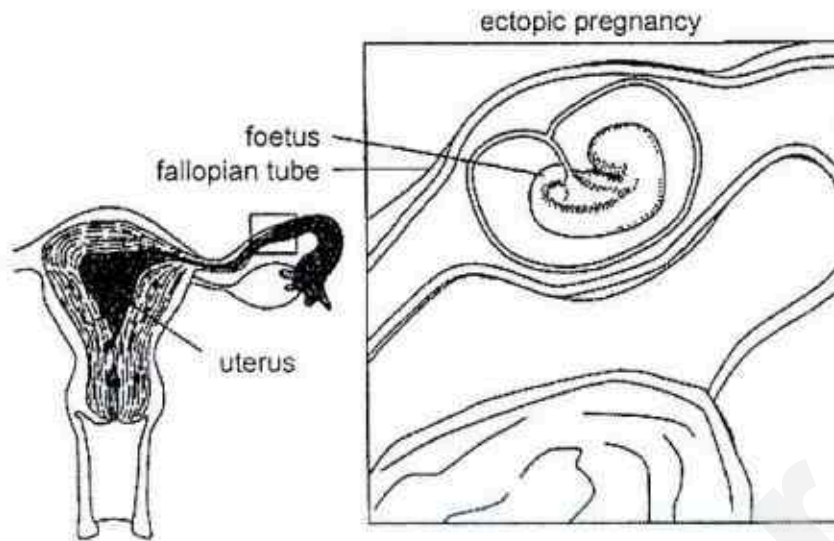
- A menstruation → ovulation → fertilisation → implantation
- B menstruation → ovulation → implantation → fertilisation
- C ovulation → menstruation → fertilisation → implantation
- D ovulation → menstruation → implantation → fertilisation

33. The diagram shows a foetus developing in a uterus. Which structures remove excretory products from the foetus?



- A P and Q
- B Q and R
- C R and S
- D S and P

34. The diagram shows a rare type of pregnancy in which the foetus develops in the fallopian tube.

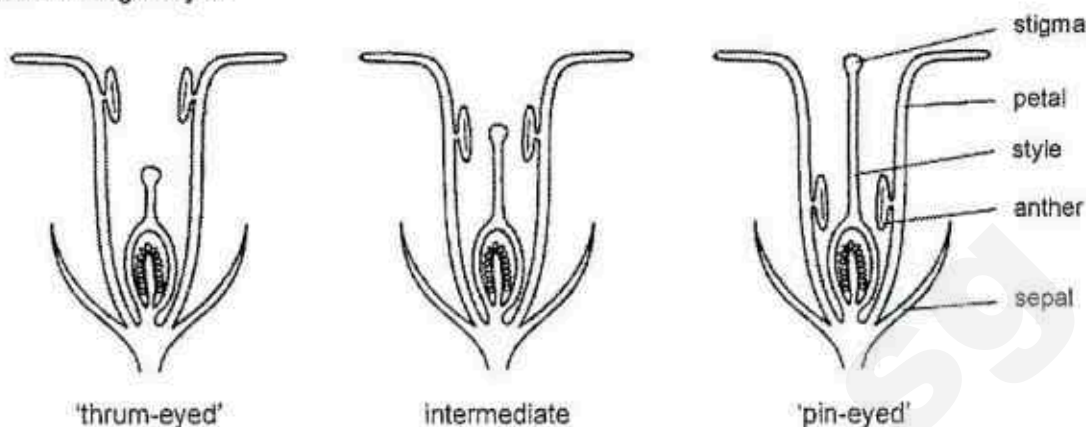


Why would the pregnancy shown in the diagram be dangerous for the mother?

- 1 The fallopian tube might rupture as the foetus enlarges.
- 2 It might result in tearing of the cervical region.
- 3 Foetal and maternal blood may mix, causing agglutination.

- A 1 only
B 2 only
C 1 and 2
D 1, 2 and 3

35. The diagram shows the different flower shapes of the primrose plant. 'Thrum-eyed' flowers have a short style, 'pin-eyed' flowers have much longer styles, whereas intermediate flowers have a medium-length style.



Which of the following statements are correct?

- 1 Cross-pollination will be favoured in 'pin-eyed' and 'thrum-eyed' primroses compared with intermediate primroses.
- 2 Primroses with 'pin-eyed' flowers are likely to show more genetic variation than primroses with intermediate flowers.
- 3 Primroses with intermediate flowers are likely to be more able to adapt to changing environmental conditions than 'pin-eyed' and 'thrum-eyed' primroses.
- 4 Self-pollination is more likely to occur in primroses with intermediate flowers.

- A 3 and 4 only
 B 1, 2 and 3 only
 C 1, 2 and 4 only
 D 1, 2, 3 and 4

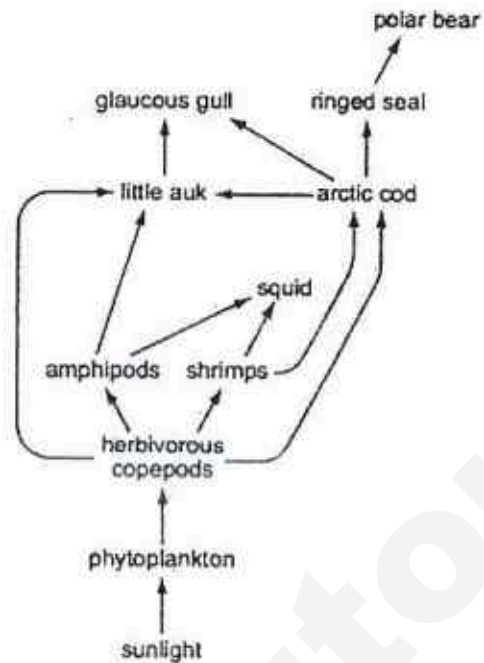
36. Some of the events which occur during sexual reproduction in a flowering plant are listed below.

- I anthers split open
- II growth of pollen tube
- III pollen grain sticks to stigma
- IV seed develops inside ovary
- V male gamete fuses with female gamete

In which order do these events occur?

	first	→				last
A	II	III	IV	II	III	III
B	I	III	II	V	IV	IV
C	III	V	I	II	IV	IV
D	IV	II	V	I	III	III

37. The diagram shows a food web in an arctic ecosystem.



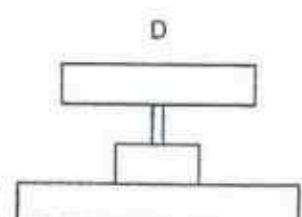
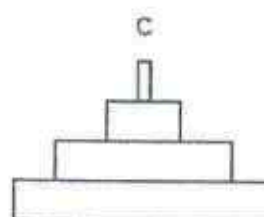
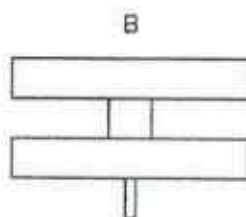
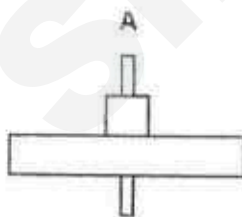
How many trophic levels are represented in the food web?

- A 6
- B 7
- C 8
- D 9

38. The diagram shows a food chain.

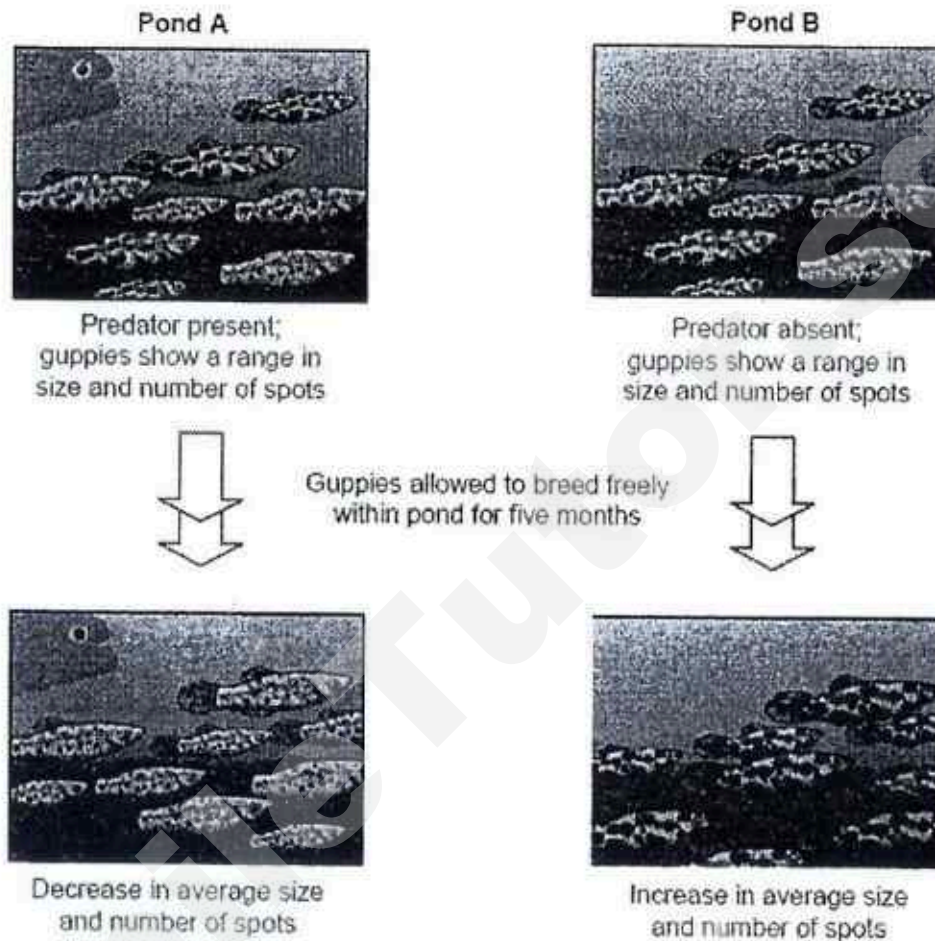
grass → rabbit → fox → flea

Which pyramid of numbers matches this food chain?



39. The body of male guppies have coloured spots that attract females to mate. The number and size of guppy spots are largely genetically controlled.

To examine the theory of evolution by natural selection, a scientist carried out an experiment with wild guppies. The following set-ups were established in two separate ponds, with observations made after five months:



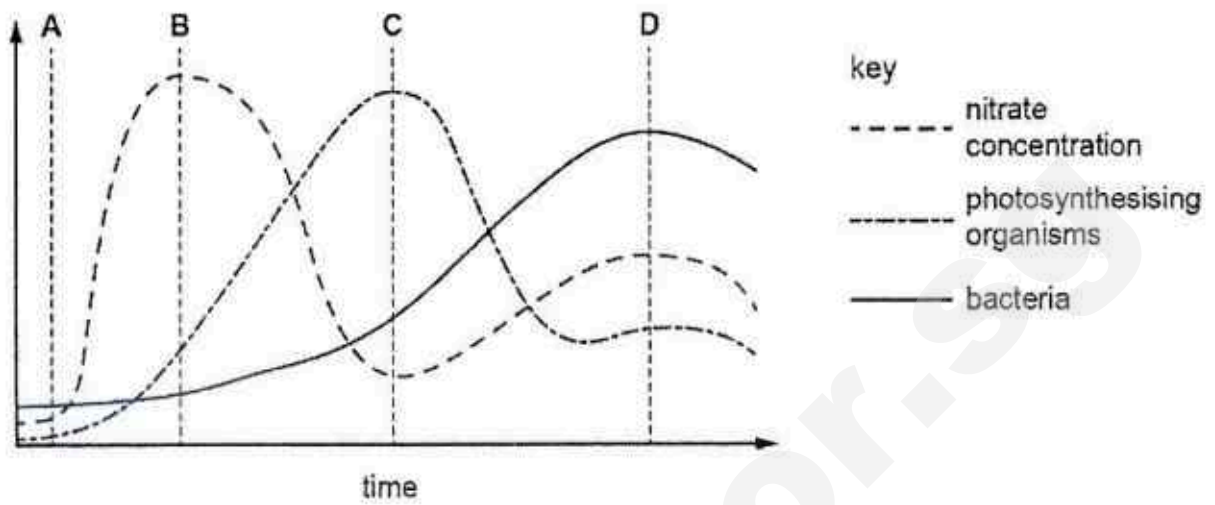
Source of pictures: <http://evolution.berkeley.edu/>

Which of the following statements does not apply to natural selection acting on the guppy populations?

- A In pond A, individual guppies develop less spots to evade predation.
- B In pond B, guppies with more and larger spots have a selective advantage.
- C In ponds A and B, competition among individuals lead to a shift in the genetic make-up of the population.
- D In ponds A and B, meiosis and mutation give rise to variations in the population.

40. The graph shows changes in a part of a lake after it has been polluted by fertilisers from a nearby farm.

At which time will the concentration of oxygen be the lowest in the water?



~~~~~ END OF PAPER ~~~~~

Nan Chiau High School

|    |   |    |   |    |   |    |   |
|----|---|----|---|----|---|----|---|
| 1  | C | 11 | B | 21 | B | 31 | A |
| 2  | C | 12 | A | 22 | C | 32 | A |
| 3  | C | 13 | C | 23 | D | 33 | B |
| 4  | B | 14 | D | 24 | B | 34 | A |
| 5  | C | 15 | B | 25 | C | 35 | C |
| 6  | A | 16 | B | 26 | C | 36 | B |
| 7  | C | 17 | B | 27 | D | 37 | A |
| 8  | D | 18 | D | 28 | A | 38 | D |
| 9  | C | 19 | B | 29 | C | 39 | A |
| 10 | A | 20 | B | 30 | C | 40 | D |