

2019

Secondary 4 Pure Biology

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**ASSUMPTION ENGLISH SCHOOL
PRELIMINARY EXAMINATION 2019**

**BIOLOGY
6093 / 01**



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LEVEL: Sec 4 Express

DATE: 2 September 2019

CLASS: Sec 4/2

DURATION: 1 hour

Additional Materials provided: 1 sheet of OAS paper

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.

Write your NAME and INDEX NUMBER at the top of this page and on the OAS paper.
Shade your index number on the OAS paper.

PAPER 1 (40 marks)

MULTIPLE CHOICE QUESTIONS

There are 40 questions in this paper. Answer **all** questions. For each question, there are four possible answers **A, B, C** and **D**.

At the end of the examination, hand in your OAS paper and question booklet separately.

This Question Paper consists of 17 printed pages including this page.

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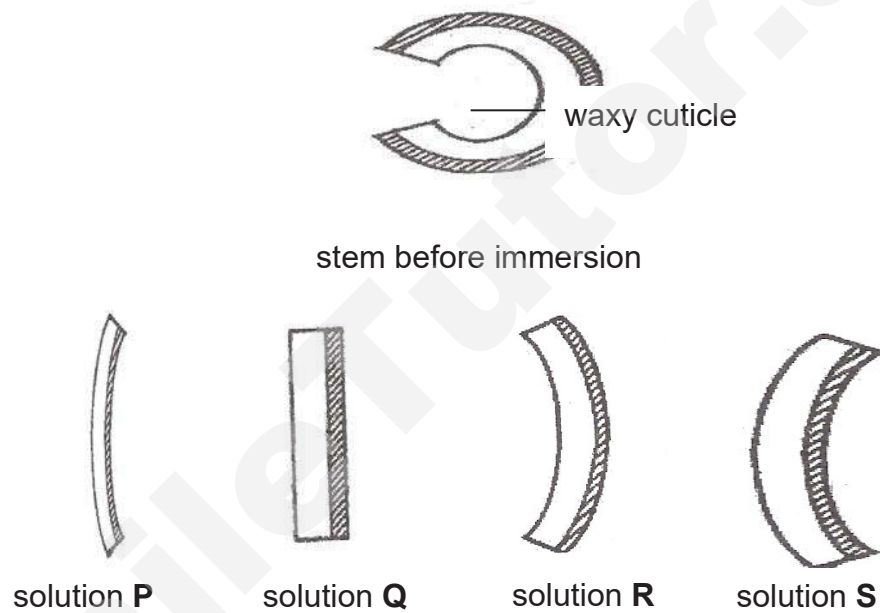
MULTIPLE-CHOICE QUESTIONS [40 marks]

For each question, **there are four** possible answers **A, B, C** and **D**.

Choose the one you consider correct and record your choice in the OAS paper provided.

- 1 Four statements about mitochondria are listed as shown. Which statements are correct?
- 1 Detoxification of metabolic waste takes place in the mitochondria.
 - 2 The main function of mitochondria is to synthesise proteins.
 - 3 There is a high concentration of mitochondria in root hair cells to assist the roots to take in water.
 - 4 There is a lower concentration of oxygen in the mitochondria as compared to the cytoplasm near the cell membrane.
- A 1 and 2 only
B 1, 3 and 4 only
C 3 and 4 only
D 4 only
- 2 Which sequence shows the correct order of increasing size and complexity?
- A cells → organelles → organs → tissues → systems
B cells → tissues → organelles → organs → systems
C organelles → cells → tissues → organs → systems
D tissues → cells → organs → organelles → systems
- 3 What can be found in a mature red blood cell?
- A antibodies and mitochondria
B carbonic anhydrase and cell membrane
C cell membrane and nucleus
D haemoglobin and fibrinogen

- 4 Which is an example of diffusion in a plant?
- A carbon dioxide from the air moving into a photosynthesising leaf
 - B minerals in xylem moving up the stem to leaves
 - C sugars in phloem moving from leaves to roots
 - D water in xylem moving from roots to leaves
- 5 The figure shows four sections of the mustard green stem before and after immersion in solutions **P**, **Q**, **R** and **S** of different sugar concentrations.



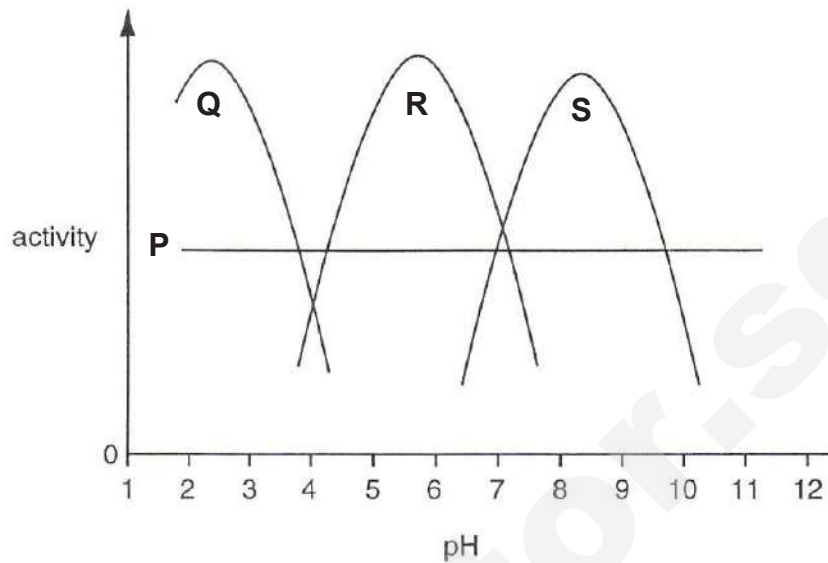
Which sequence shows the correct concentrations of the four solutions?

	highest concentration → lowest concentration			
A	P	S	R	Q
B	Q	P	S	R
C	Q	R	S	P
D	R	S	P	Q

- 6 Which element in the molecule of urea shows that it is formed from amino acids and not from glucose?
- A carbon
 - B hydrogen
 - C nitrogen
 - D oxygen
- 7 Potato contains a nutrient which is broken down by amylase when inside the human alimentary canal. Which test would detect this nutrient?
- A Benedict's test
 - B biuret test
 - C ethanol emulsion test
 - D iodine test
- 8 In an experiment, 15 g of boiled egg white was mixed with protease solution. After 1 hour at 15 °C, 5 g of protein was digested. The experiment was repeated at 25 °C and again at 60 °C. How much protein was broken down in the second and third experiments respectively?

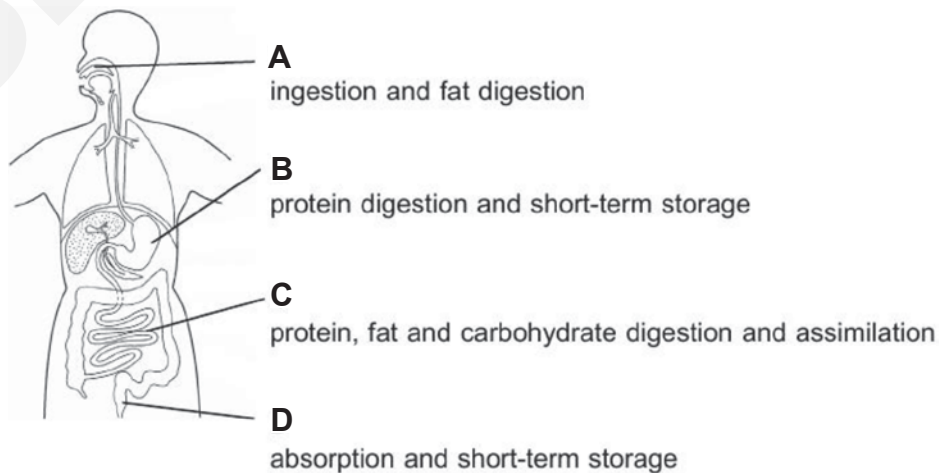
	experiment 2 (at 25 °C)	experiment 3 (at 60 °C)
A	5 g	0 g
B	5 g	10 g
C	10 g	0 g
D	10 g	15 g

- 9 The diagram below shows the effect of pH on the activity of four different enzymes.

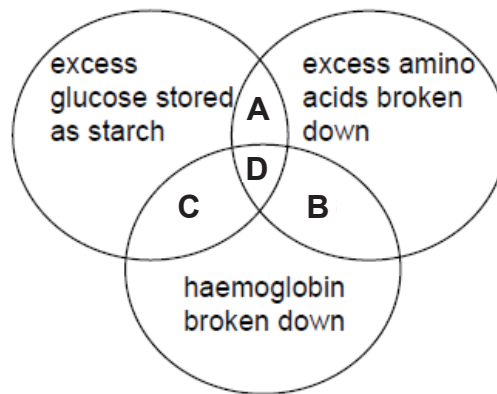


Which pair of enzymes includes one that is not affected by pH and one that is from the stomach?

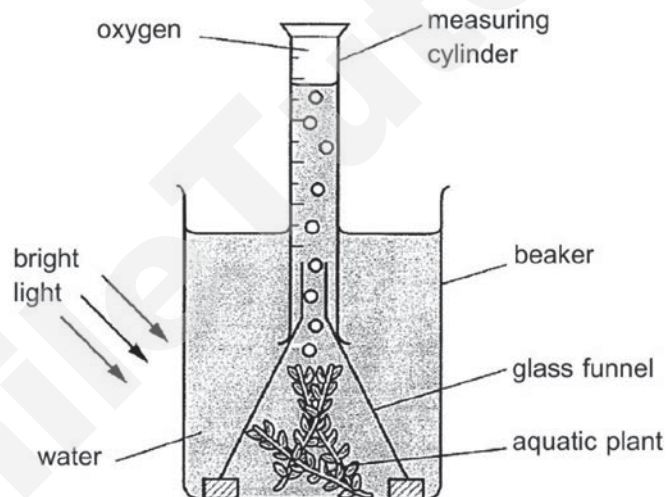
- A P and Q
 - B P and S
 - C Q and R
 - D R and S
- 10 The diagram shows the human alimentary canal with labels for the functions of some of its parts. Which label is correct?



- 11 Which section of the diagram represents the function of the liver?



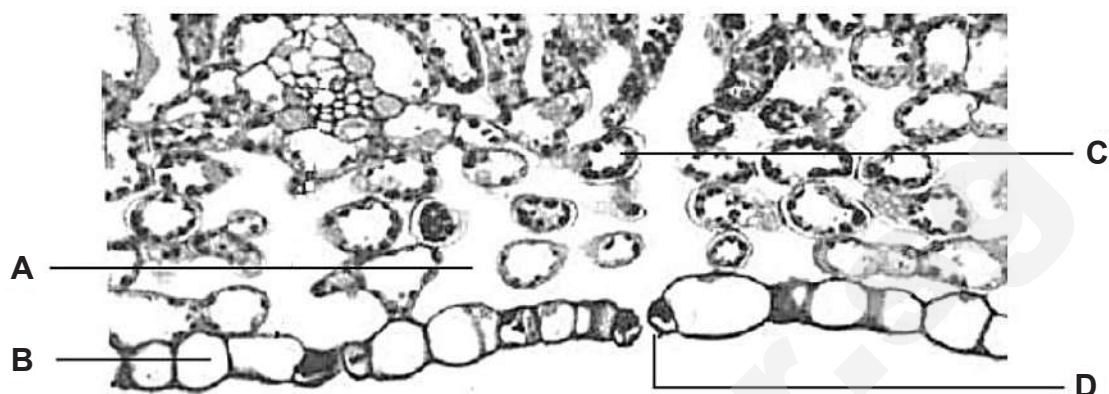
- 12 The diagram shows the apparatus used to investigate oxygen production from an aquatic plant.



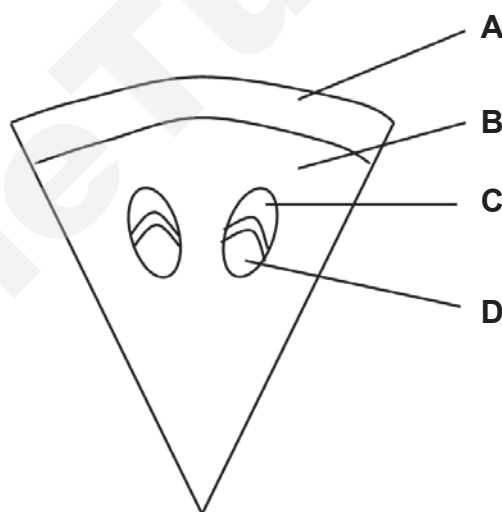
The experiment was repeated several times to calculate the volume of oxygen produced. Which two factors must be kept constant in each repeat experiment?

- A the size of aquatic plant and the amount of oxygen in the measuring cylinder
- B the size of aquatic plant and time exposed to the light
- C the size of the beaker and the size of the funnel
- D the volume of water in the beaker and the height of the measuring cylinder

- 13 The photomicrograph shows a section through the lower half of the leaf. Which region will have the lowest carbon dioxide concentration when the plant is exposed to light?



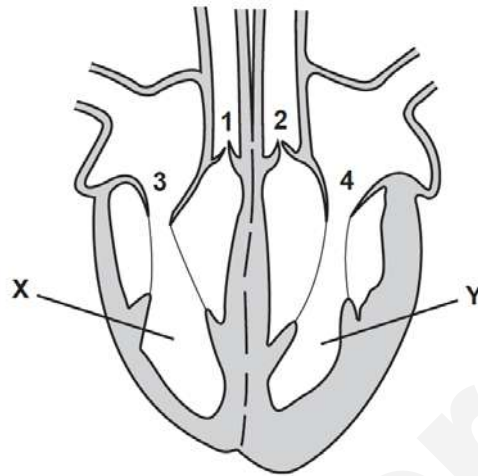
- 14 The diagram shows part of a transverse section of the stem of a plant. Which region is the xylem tissue?



- 15 A plant is exposed to different temperatures and humidities. Which set of conditions causes the plant to lose the least water?

	temperature / °C	humidity / %
A	15	30
B	15	60
C	25	30
D	25	60

- 16** The diagram shows a section through the heart. When X and Y are undergoing systole, which valves are opened and which are closed?

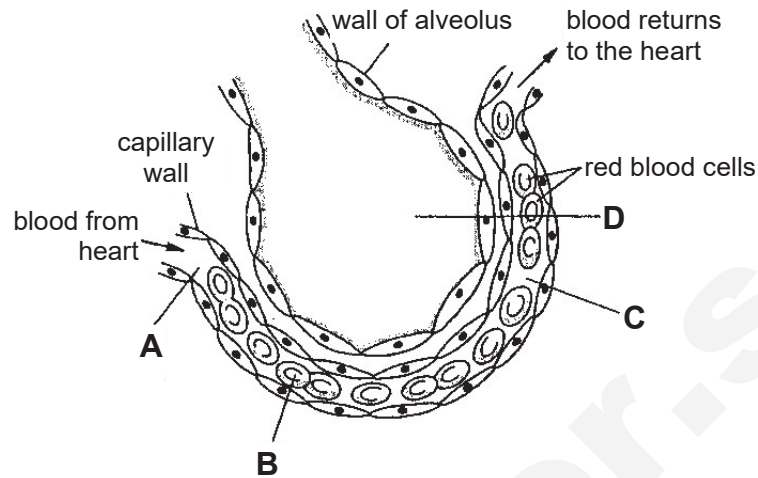


	valves 1 and 2	valves 3 and 4
A	closed	closed
B	closed	opened
C	opened	closed
D	opened	opened

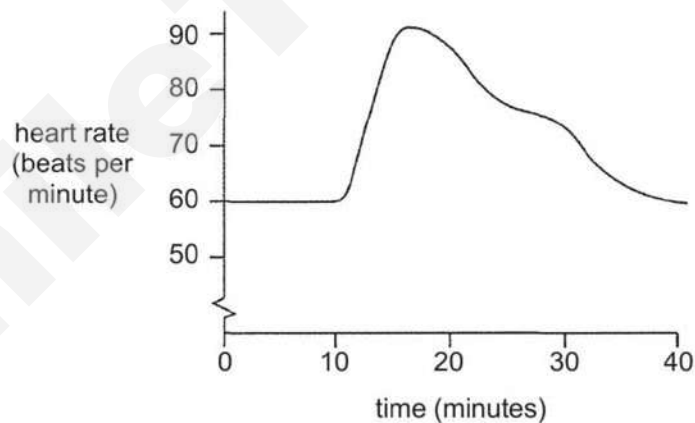
- 17** Which is the shortest route that can be taken by blood travelling from a leg to an arm in the body?

- A** leg → heart → lungs → heart → arm
- B** leg → liver → heart → lungs → arm
- C** leg → lungs → heart → liver → arm
- D** leg → lungs → heart → lungs → arm

- 18 The diagram shows a section through an alveolus and a blood capillary. In which region is the concentration of oxygen highest?



- 19 The diagram shows the short-term effect of smoking on heart rate. Which substance in cigarette smoke is the main cause of the change in heart rate between 10 and 18 minutes?



- A carbon dioxide
- B carbon monoxide
- C nicotine
- D tar

- 20** The table shows the flow rate and concentration of protein and urea in the blood vessel leading into a kidney glomerulus in a healthy person.

Total flow rate / $\text{cm}^3 \text{ min}^{-1}$	Concentration / g per 100 cm^3	
	Protein	Urea
1000	7.40	0.03

What are the correct figures for the fluid in the collecting duct?

	Total flow rate / $\text{cm}^3 \text{ min}^{-1}$	Concentration / g per 100 cm^3	
		Protein	Urea
A	10	0.00	1.75
B	10	7.40	0.03
C	1000	0.00	1.75
D	1000	7.40	0.03

- 21** Which response is not due to homeostasis?

- A** enlargement of iris
- B** increase in glucose production when blood glucose level is low
- C** increase in permeability of collecting duct of kidney tubules
- D** shivering in cold weather

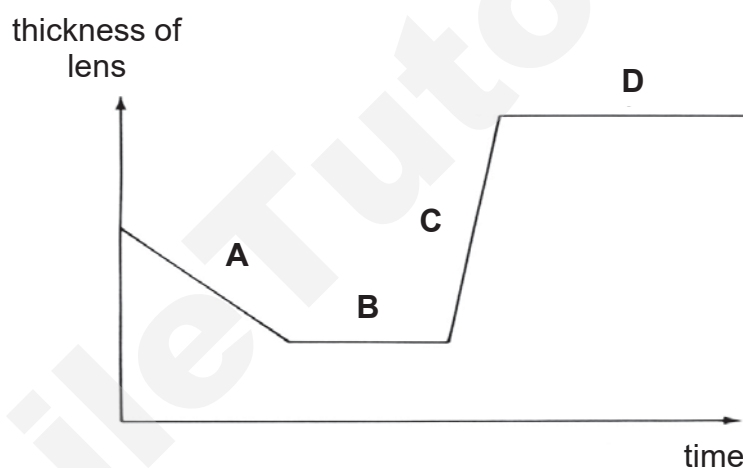
- 22** Which statement about voluntary actions is not true?

- A** Motor neurones are always involved in transmitting impulses to effectors.
- B** Relay neurones will transmit nerve impulses to the motor neurones.
- C** Sensory neurones will always send nerve impulses to the brain.
- D** Voluntary actions are always coordinated by the brain.

- 23 When the eye of the pupil dilates in response to low light intensity, which is the receptor and which is the effector?

	receptor	effector
A	pupil	ciliary body
B	pupil	iris
C	retina	ciliary body
D	retina	iris

- 24 The graph below shows the changes in the thickness of the lens in the eye when a man looked at an object which either moved towards him, away from him or remained stationary. At which stage was the object moving towards the man?



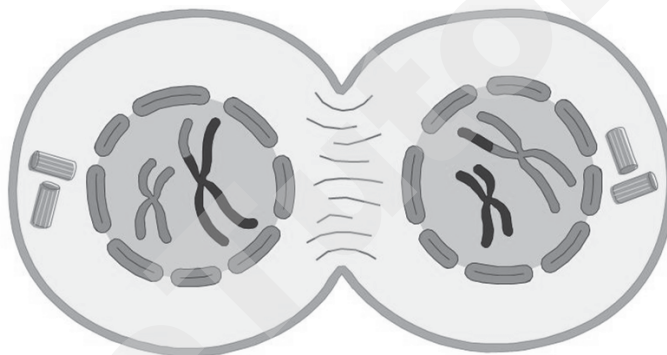
- 25 Hormones are chemicals involved in co-ordination in the body. Which combination in the table is correct?

	hormones are carried by	hormones are destroyed by
A	blood plasma	kidney
B	blood plasma	liver
C	red blood cells	kidney
D	red blood cells	liver

- 26 What effects would an increase in adrenaline have on the body?

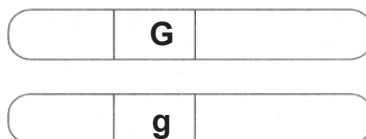
	blood flow to the gut	concentration of glucose in blood
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

- 27 The diagram shows a cell that is undergoing cell division. What type and stage of cell division does the diagram show?



	type of cell division	stage of cell division
A	meiosis	anaphase 1
B	meiosis	telophase 1
C	meiosis	telophase 2
D	mitosis	telophase

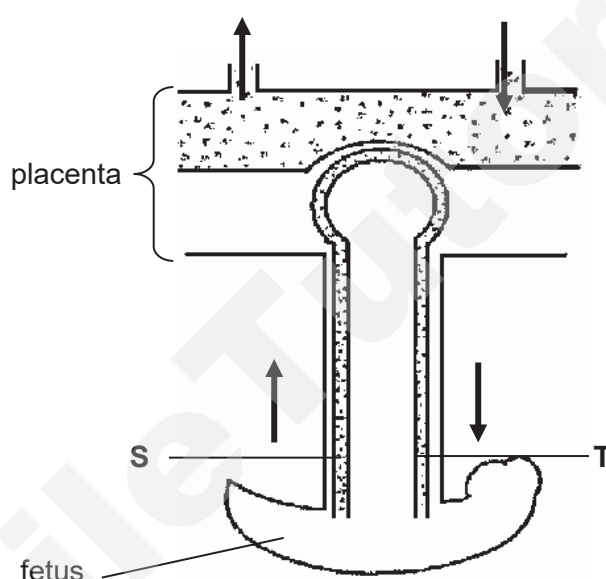
- 28 The diagram shows a pair of homologous chromosomes.



Which term best describes **Gg**?

- A** alleles **B** gametes
C genotype **D** phenotype

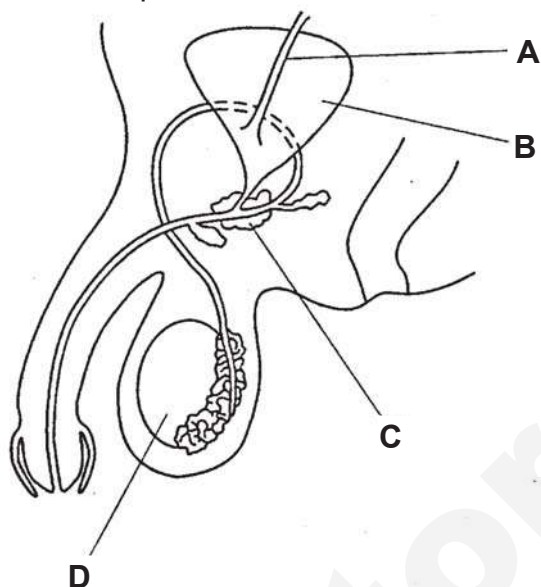
- 29 Which statement is characteristic of asexual reproduction?
- A Asexual reproduction only occurs in unicellular organisms.
 - B Meiosis takes place to form gametes.
 - C The offspring have the same genotype for all genes as their parents.
 - D The offspring will have the same height as their parents.
- 30 The diagram below shows the relationship between the blood systems of the foetus and that of the mother. The arrows indicate the direction of blood flow.



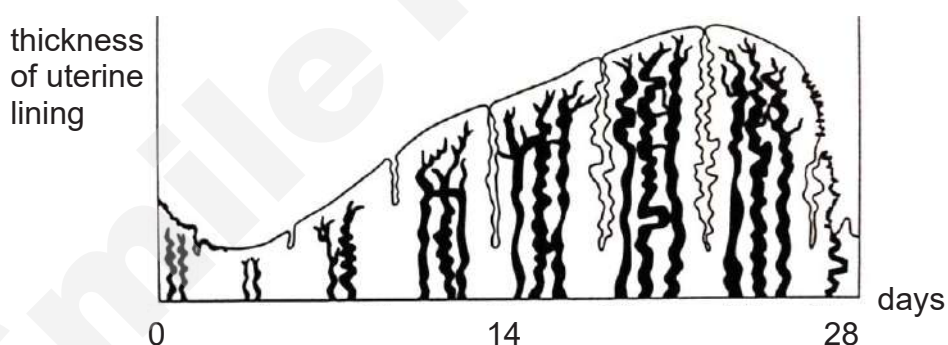
What are the identities of **S** and **T** and the nature of their contents?

	umbilical artery	umbilical vein	higher percentage of nutrients	higher percentage of waste
A	S	T	S	T
B	S	T	T	S
C	T	S	S	T
D	T	S	T	S

- 31 The diagram shows the male reproductive and urinary systems. Which structure produces the fluid part of semen?



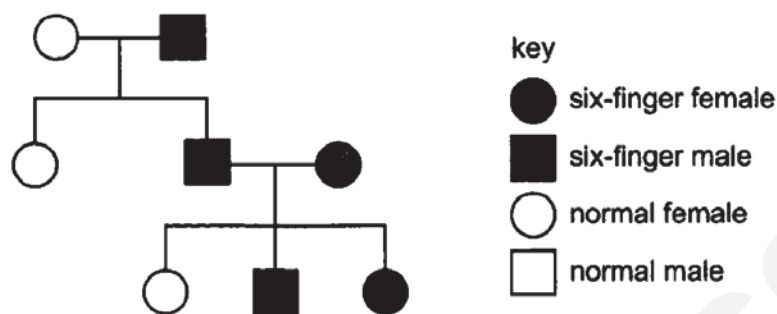
- 32 The diagram shows the variation in thickness of the uterine lining throughout a menstrual cycle of a healthy female.



During which days of the menstrual cycle does the level of oestrogen and progesterone rise?

	oestrogen	progesterone
A	1 to 5	15 to 20
B	5 to 10	15 to 25
C	15 to 20	5 to 10
D	20 to 25	1 to 10

- 33** A mutation sometimes occur in humans which causes each hand to have six fingers. The diagram shows how this condition is inherited in a family.



What does the family tree show about the mutated allele?

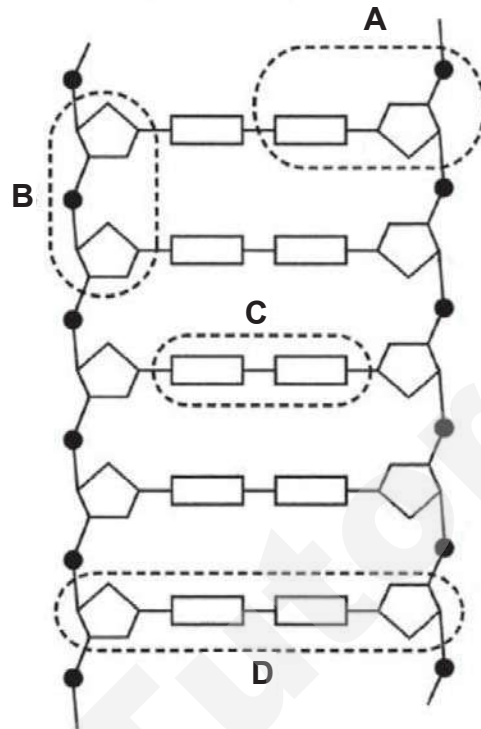
- A** It could be dominant or recessive.
 - B** It is co-dominant.
 - C** It is dominant.
 - D** It is recessive.
- 34** Which fertilisation would result in a male child with Down syndrome?

	chromosomes in ovum	chromosomes in sperm
A	22 + 1 X	22 + 1 Y
B	22 + 1 X	23 + 1 Y
C	23 + 1 Y	22 + 1 X
D	23 + 1 Y	23 + 1 X

- 35** Which phrase describes a gene?

- A** a pair of alleles
- B** a sequence of nucleotides
- C** a whole DNA molecule
- D** the chain of alleles on a chromosome

- 36 The diagram shows a section of a DNA molecule. Which segment is part of the sugar-phosphate backbone?

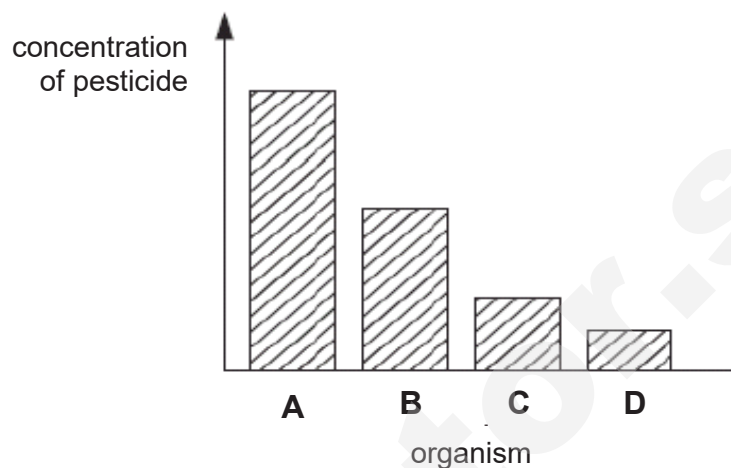


- 37 What happens to energy after it has flowed through a food chain?
- A It is lost as heat.
 - B It is recycled.
 - C It is stored as carbohydrate.
 - D It is used in respiration.
- 38 Which substance is produced by anaerobic bacteria during sewage treatment?
- A carbon monoxide
 - B carbon dioxide
 - C lactic acid
 - D methane

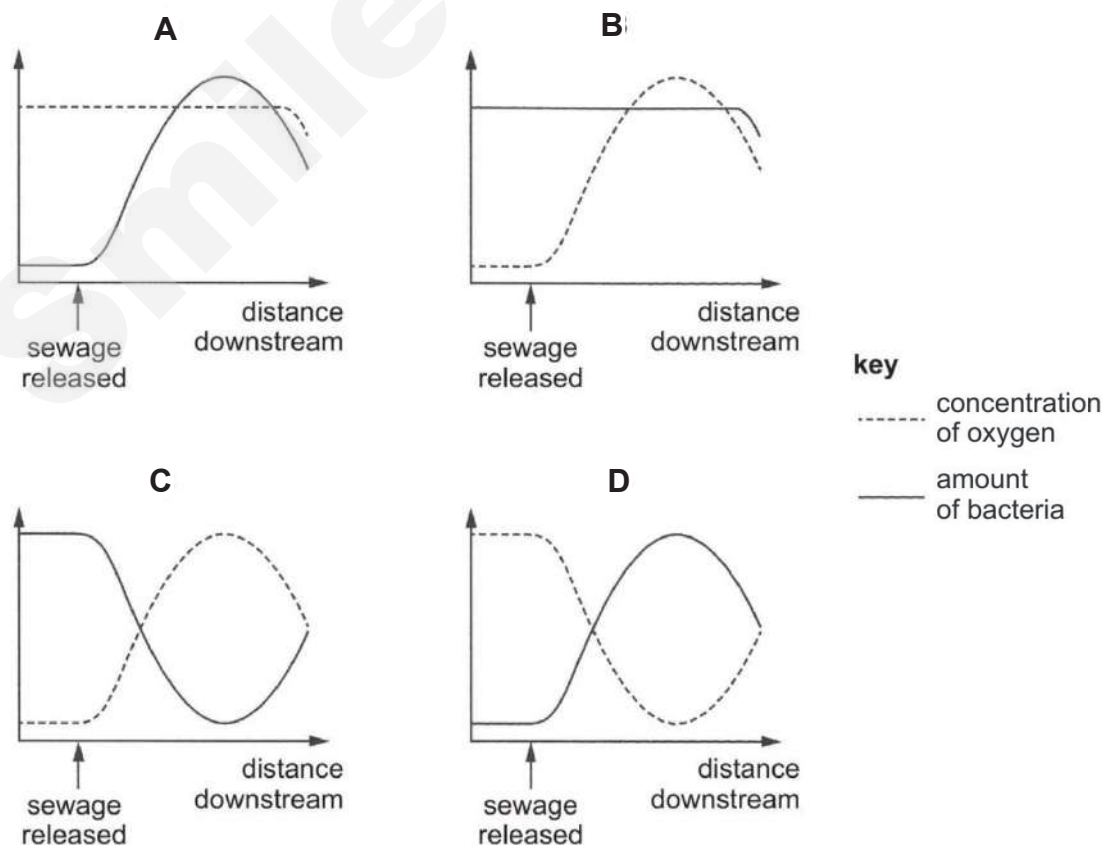
- 39 A food chain is listed as shown.

phytoplankton → small crustacean → frog → carnivorous bird

The chart below shows the concentration of pesticide in the bodies of the different organisms in the food chain. Which organism represents the small crustacean?



- 40 Untreated sewage is released into a river. This causes the amount of bacteria and the concentration of oxygen in the river water downstream to change. Which graph shows these changes?



- End of Paper -

Name: ()

**ASSUMPTION ENGLISH SCHOOL
PRELIMINARY EXAMINATION 2019**

**BIOLOGY
6093 / 02**



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LEVEL: Sec 4 Express

DATE: 3 September 2019

CLASS: Sec 4/2

DURATION: 1 hour 45 minutes

Additional Materials provided: NIL

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.

Write your NAME and INDEX NUMBER at the top of this page.

SECTION A (50 marks)

STRUCTURED QUESTIONS

Answer all questions in the spaces provided.

SECTION B (30 marks)

FREE RESPONSE QUESTIONS

Answer three questions in this section in the spaces provided.

Question 3 is in the form of an Either / Or question.

Only one of the alternatives should be answered.

For Examiner's Use	
Paper 1	/40
Paper 2 Section A	/50
Paper 2 Section B	/30
Paper 3	/40
Total	/160
Overall	/100

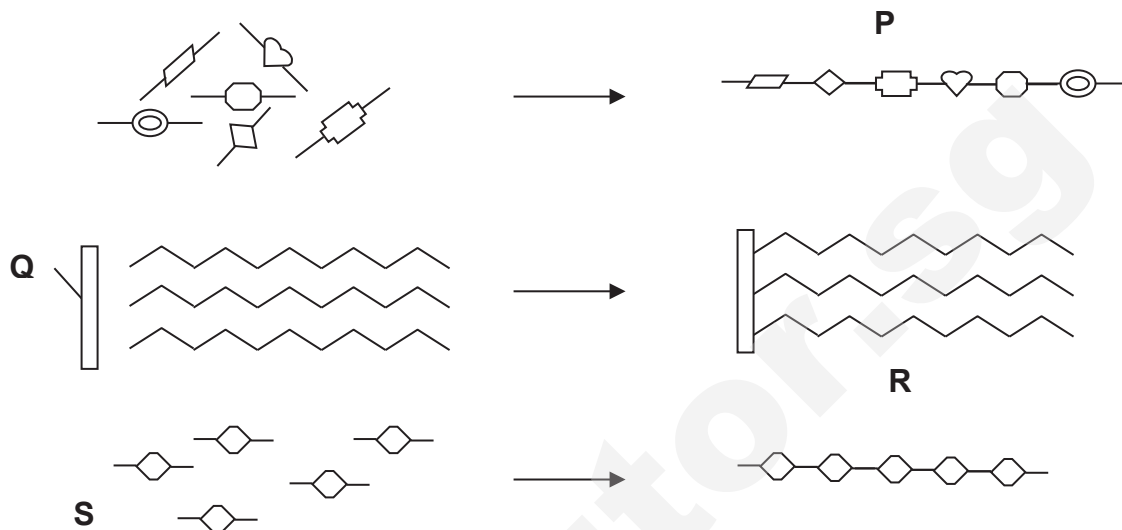
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SECTION A – STRUCTURED QUESTIONS (50 marks)

Answer **ALL** the questions in the spaces provided.

- 1 The figure below shows some chemical molecules found in the human body and how they are joined to form larger molecules.



- (a) Identify molecules **P**, **Q**, **R** and **S**.

P: **Q:**

R: **S:** [2]

- (b) (i) State a test that a student can use to test for the presence of **S** in a liquid sample of food.

..... [1]

- (ii) Describe how this test is carried out and the observations that can confirm the presence of **S** in the food.

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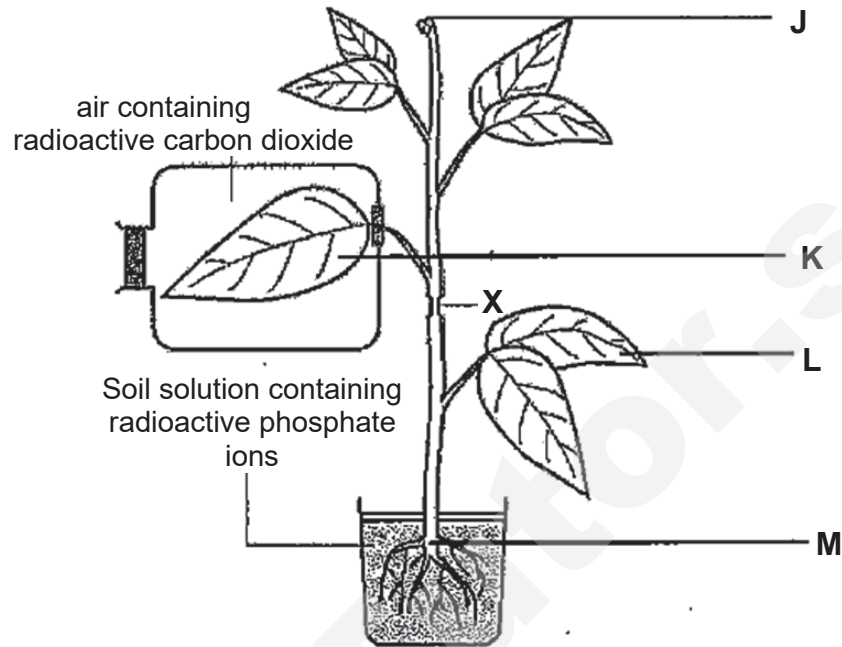
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..... [2]

- 2 The figure shows a potted plant with an outer ring of bark removed at point **X**. Leaf **K** is enclosed within a bottle containing carbon dioxide with radioactive carbon. The soil was watered with a solution containing radioactive phosphate ions. The entire plant was exposed to sunlight for 6 hours.



- (a) Which tissue of the vascular bundle is removed at point **X**?

..... [1]

- (b) Which labelled part(s) **J**, **K**, **L** and / or **M** will be tested positive for radioactive sugar? Explain your answer.

.....

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..... [4]

- (c) Which labelled part(s) **J**, **K**, **L** and / or **M** will be tested positive for radioactive phosphate ions? Explain your answer.

.....

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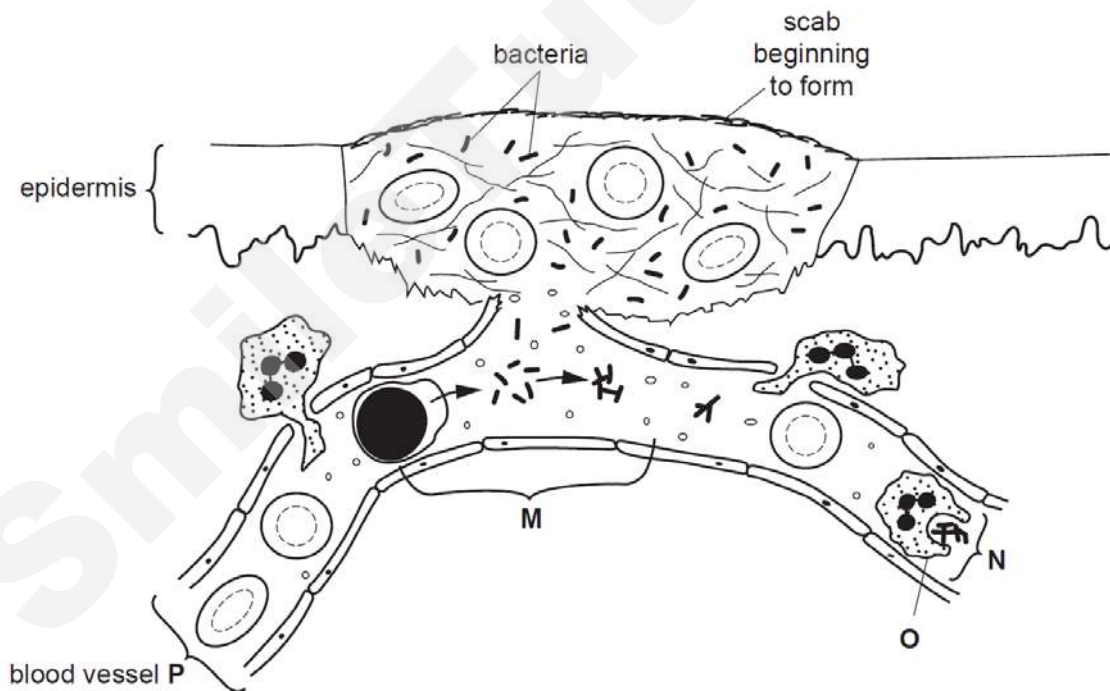
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..... [3]

- 3 The diagram shows a section through a small surface wound to the skin.



- (a) Name cell **O** and the type of blood vessel **P** shown in the diagram.

O: **P:** [2]

- (b) Explain what is happening to the bacteria at **M** and **N**.

M:

.....

N:

.....

[2]

- (c) Explain how the wound is being sealed in the region under the scab.

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.....

[2]

- (d) (i) Complete the table by circling the changes in concentration of glucose and oxygen after passing through blood vessel **P**.

substance	concentration after passing through P
glucose	higher / lower / remain the same
oxygen	higher / lower / remain the same

[1]

- (ii) Explain the changes in the concentration of oxygen and glucose, if any, in part (d)(i).

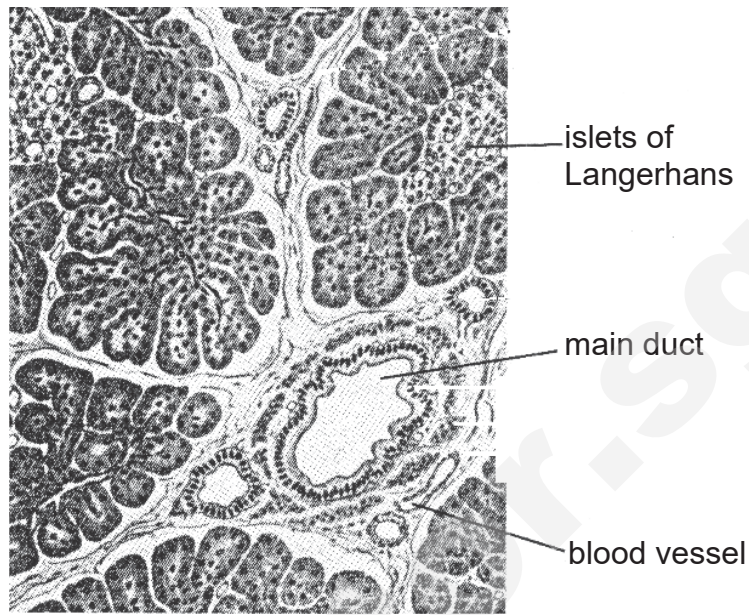
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[2]

- 4 The figure shows a section of a pancreas, as seen using a light microscope.



- (a) (i) Name one soluble protein which can be found in the main duct after a meal.

..... [1]

- (ii) State the organ in which the main duct empties its contents into.

..... [1]

- (b) (i) State the substance that will be released by the islets of Langerhans into the blood vessel after a meal.

..... [1]

- (ii) Explain how the substance identified in (b)(i) helps to regulate blood glucose concentration.

.....

 [3]

- 5 Four girls, who were adopted and brought up by different sets of foster parents, were brought together after their step-parents realised that they may be long lost siblings and had the same biological parents. The following data were recorded after they met up with each other.

	Amy	Bernadette	Christie	Diane
height / cm	168	168	160	165
weight / kg	52	57	67	57
blood type	O	AB	O	A

- (a) Group the characteristics (height, weight, and blood type) into the table below.

continuous variation	discontinuous variation

[1]

- (b) Two of the girls are identical twins. Identify the girls and give a reason for your answer.

.....

.....

[1]

- (c) The girls got together to search for their biological parents. They narrowed the search to 4 couples. The blood types of the couples are as shown.

	father	mother
couple 1	A	B
couple 2	AB	AB
couple 3	A	AB
couple 4	O	AB

- (i) Which couple do you think are the biological parents of the four girls? Explain your answer.

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[3]

- (ii) All the couples listed in (c)(i) had brown eyes. Bernadette and Diane had brown eyes as well while Christie was found to have blue eyes. The allele for brown eyes is a dominant allele over the allele for blue eyes. What is the probability that Amy has blue eyes?

.....

[1]

- 6 The diagram shows parts of an insect-pollinated and a wind-pollinated flower.

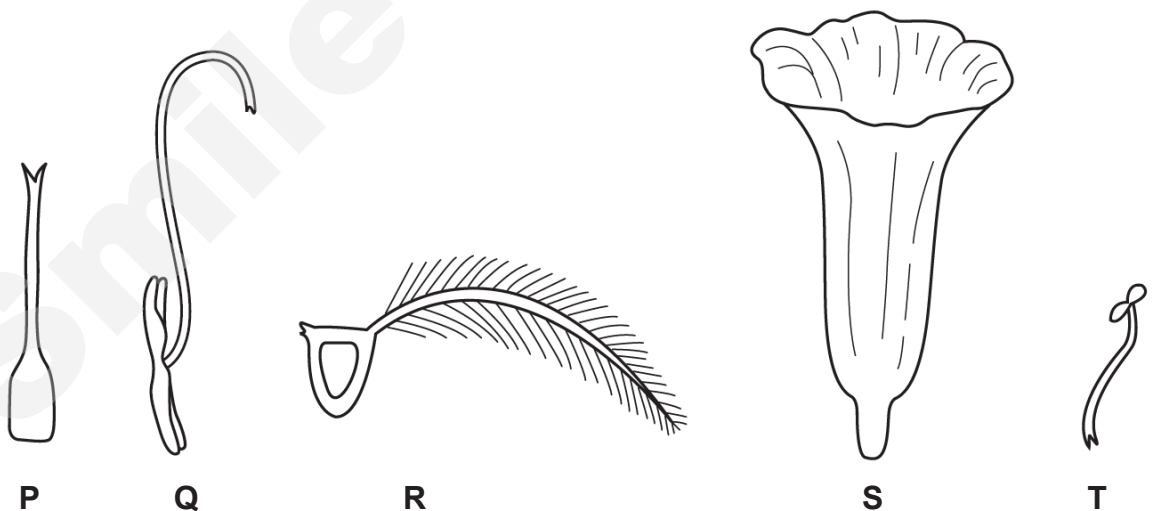


Fig. 6.1

- (a) Using the letters **P**, **Q**, **R**, **S** and **T**, list the parts that are from

the insect-pollinated flower:

the wind-pollinated flower: [2]

- (b) Explain how the structure of **R** helps it to carry out its function.

.....

.....

..... [2]

- (c) The diagram shows a pollen grain with its pollen tube.



- (i) On Fig. 6.1, use a line labelled **L** to show exactly where the pollen grain as shown is found. [1]

- (ii) Explain how the pollen tube shown in the diagram is formed.

.....

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..... [2]

- (d) State and explain the difference between a nucleus in a pollen grain and a nucleus in a cell in structure **S**.

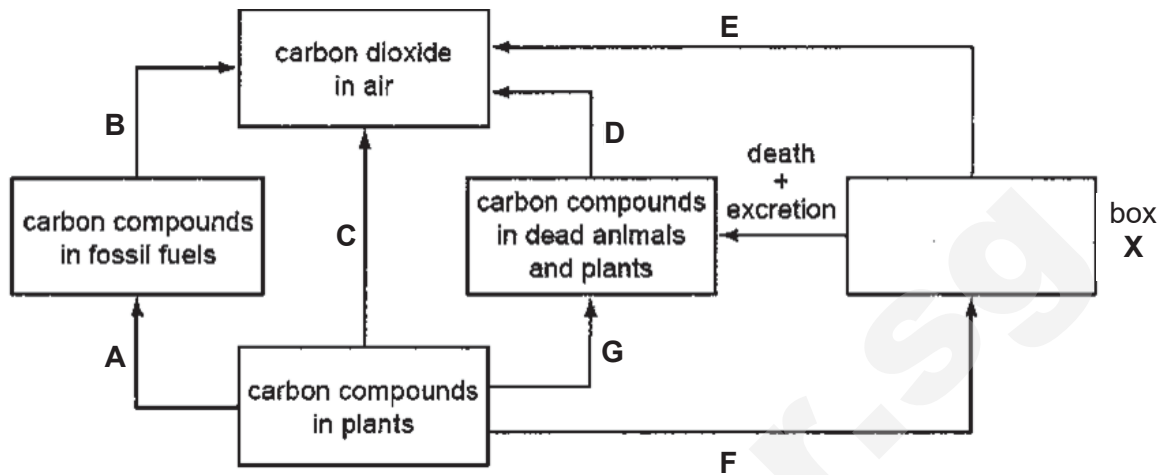
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..... [2]

- 7 The figure shows the carbon cycle. The arrows represent the various processes that take place in the cycle.



- (a) Complete the diagram by filling in 'box X'. [1]

- (b) Which two letters represent respiration?

..... [1]

- (c) (i) Draw an arrow in the diagram to indicate another process that can occur in the carbon cycle. [1]

- (ii) State the process indicated by the arrow drawn in (c) (i).

..... [1]

- (d) Describe how oceans can also be part of the carbon cycle and acts as carbon sinks.

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[3]

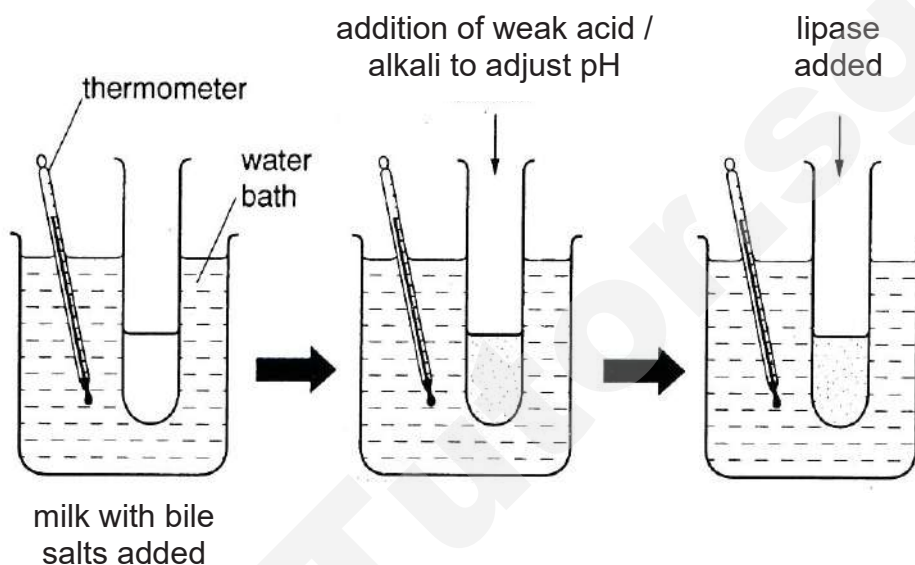
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SECTION B – FREE-RESPONSE QUESTIONS (30 marks)

Answer **three** questions in the spaces provided. Question 3 is in the form of an Either / Or question. Only one of the alternatives should be answered.

- 1 An experiment was carried out on digestion of fat using a sample of milk. Bile salt was added to 5 cm³ of milk. The pH of the mixture was adjusted to pH 8.0 and lipase was then added to the mixture.



The pH of the mixture was recorded at ten minute intervals for 60 minutes using a pH meter. The table shows the results of the investigation.

time / min	pH
0	8.0
10	7.1
20	6.8
30	6.6
40	6.5
50	6.4
60	6.4

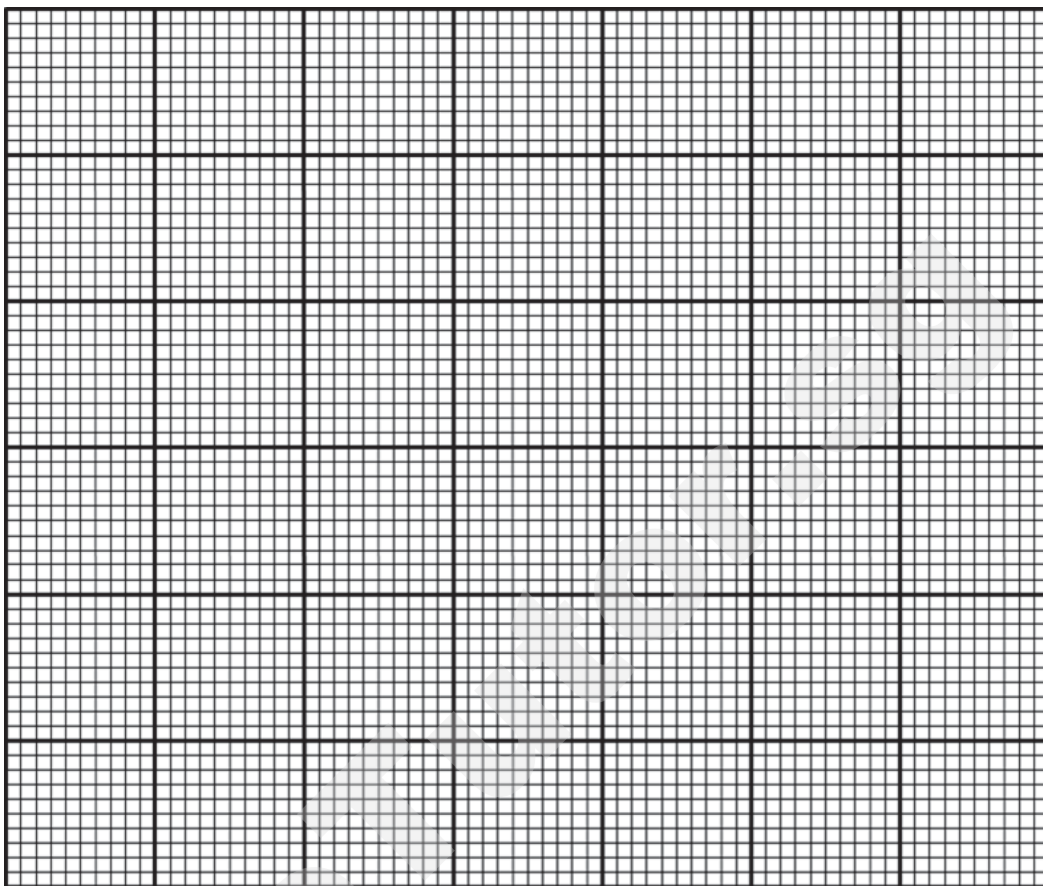
- (a) Suggest why the pH of the milk was adjusted to 8.0 before the lipase was added.

.....

.....

[1]

- (b) (i) Plot a graph to show the results of the experiment.



[3]

- (ii) Using the graph, state the pH of the mixture after 5 minutes.

..... [1]

- (c) Using the 'lock and key' hypothesis, explain the results of the experiment.

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..... [3]

- (d) Describe and explain how the experiment results will change if no bile salts were added.

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[2]

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- 2 (a) Describe what is meant by the term *mutation*.

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[2]

- (b) The familiar orange-pink colour of salmon (a type of fish) flesh is due to a gene that allows salmon to process carotene, a type of protein, found in its diet. In the wild, about 1 in 20 salmon are white fleshed. White flesh in salmon is a recessive trait. A salmon breeder wanted to find out the genotype of his orange-pink colour salmon. Suggest how he could determine the genotype with the help of clearly labelled genetic diagram(s).

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[4]

- (c) Scientists have genetically modified salmon to grow faster. They have taken a gene from the ocean pout (another type of fish) and inserted it into salmon. The pout gene permanently 'switches on' the salmon gene to make growth hormone, allowing the salmon to grow all year round instead of only in spring and summer. The resulting genetically modified (GM) salmon grows to maturity in 18 months instead of 3 years and appears to be larger than its wild-type counterparts.

Outline the procedure by which scientists combine the ocean pout gene with a bacterial plasmid to form a recombinant DNA which is reintroduced into bacterial cells. (The recombinant DNA is eventually inserted into salmon DNA to create GM salmon).

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[4]

EITHER**3 (a)** Define *homeostasis*.

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..... [1]

(b) Explain what is meant by *negative feedback*.

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..... [2]

(c) Describe how the various parts of the human skin work together to prevent the body from overheating when a person is under the sun.

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- End of Paper -

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ASSUMPTION ENGLISH SCHOOL
Sec 4 Biology 6093 Marking Scheme
Preliminary Examination 2019

Paper 1 (40 m)

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
D	C	B	A	B	C	D	C	A	B
Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
B	B	C	D	B	C	A	D	C	A
Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30
A	C	D	C	B	B	B	C	C	B
Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40
C	B	C	B	B	B	A	D	C	D

Paper 2 Section A (50 m)

	a	P – protein/polypeptide R – fat/lipid Q- glycerol S – glucose/monosaccharide every 2 correct – 1 m	2
	b i	Benedict's test	1
	b ii	Add an equal volume of Benedict's solution into the sample; Shake the mixture and place the test tube into a boiling water bath for 3 minutes; If glucose is present, a brick-red precipitate will be formed; 3 points – 2 marks, 2 points – 1 mark, 0 to 1 point – no marks	2
2	a	phloem	1
	b	J and K; K is a leaf which takes in radioactive carbon dioxide for photosynthesis; The radioactive sugars formed in leaf K (through photosynthesis) can be translocated / transported up to J; Radioactive sugars cannot move down to the roots M or leaf L as the phloem at X is removed;	4
	c	All parts/ J, K, L and M; The phosphorus will be present in the roots M as water is absorbed by the root / plant roots absorbed radioactive phosphate ions; The radioactive phosphate ions can be transport up the xylem to the J, K and L as it remains intact;	3
3	a	O: phagocyte/white blood cell P: capillary	1 1

	b	M: the lymphocyte produces antibodies that causes the bacteria to clump together; N: The bacteria is being engulfed and ingested by phagocytes /phagocytosis of bacteria;	1 1
	c	The platelets are activated; Causing soluble fibrinogen to be converted into insoluble fibrin ; The fibrin forms a mesh ; to trap red blood cells ; to form a clot ; 5 points – 2 marks, 3 to 4 points – 1 mark;	2
	d i	lower for both	1
	d ii	Glucose and oxygen diffused through the capillary into the skin cells; for the cells to perform aerobic respiration ;	1 1
4	a i	pancreatic trypsin/amylase/lipase	1
	a ii	small intestines / duodenum	1
	b i	insulin	1
	b ii	Insulin helps to decrease blood glucose concentration when it increases after absorption of glucose after a meal; Insulin helps to decrease blood glucose concentration by <ul style="list-style-type: none"> increasing permeability of cell membrane to glucose, increasing rate of glucose uptake; stimulating the liver to convert glucose into glycogen for storage; increasing oxidation of glucose during tissue respiration; (any 2 of 3 points)	1 2
5	a	Continuous Variation	1
		height weight	
	b	Amy and Christie. They are the only ones with identical blood groups;	1
	c	Couple 1.; They are the only ones with possibility of having <u>allele I^O</u> . I ^O is a recessive allele and must be present in both the paternal and maternal genes in order for Amy and Christie to have blood group O.	1 1 1
	d	100%	1
6	a	insect: P, S, T wind: Q, R 5 correct – 2 marks, 3 or 4 correct – 1 mark	2
	b	The stigma is feathery ; to provide a larger surface area ; to capture more ; pollen grains ; every 2 correct – 1 mark	2
	c i	line + label L on stigma of P or R	1
	c ii	After pollination ; the pollen grain germinates ; The pollen tube grows as it secretes enzymes to digest; the tissue of the stigma/style; Every 2 points – 1 mark	2

	d	The nucleus in the pollen grain is haploid while the nucleus in a cell in structure S is diploid ; The nucleus in the pollen grain is formed by meiosis while that of structure S is formed by mitosis .	1 1
7	a	carbon compounds in animals	1
	b	C & E	1
	c i	Draw from air to plants	1
	c ii	Photosynthesis	1
	d	Oceans can absorb carbon dioxide when the carbon dioxide dissolves in the water; The dissolved carbon dioxide is used by phytoplankton and algae during photosynthesis ; Carbon compounds found in oceans can also be buried in the seabed and be converted into fossil fuels ;	1 1 1

Paper 2 Section B (30 marks)

1	a	It is the optimum pH for lipase action;	1
	b i	correct axis with units; appropriate scale; correct plots; best-fit curve; 4 points – 3 marks, 3 points – 2 marks, 2 points – 1 mark, 0 to 1 point – no marks	3
	b ii	mark based on student's graph	1
	c	The milk molecule is complementary to the active site of the lipase; The lipase catalyses the breakdown of the fat molecule into fatty acids and glycerol; The fatty acids lowers the pH of the mixture;	1 1 1
	d	The pH will decrease less rapidly ; The bile salts causes the emulsification of the fats; The surface area to volume ratio is increased when the fats are emulsified; Thus, allowing the lipase to digest the fats more rapidly ; every 2 points – 1 mark	2
2	a	Mutation is a spontaneous / sudden and random change; in the structure of the gene; or in chromosome number; 3 points – 2 marks, 2 points – 1 mark, 0 to 1 point – no marks	2
	b	Method; How results are interpreted; correct genetic diagrams;; Perform a test cross with a homozygous recessive salmon to determine if the orange-pink salmon is homozygous dominant or heterozygous; If the orange-pink salmon is homozygous, all the offspring will be orange-pink. If the salmon is heterozygous, only half the offspring will be orange-pink; Let P the the allele for orange-pink and p be the allele for white	1 1

		<p>are reabsorbed through the tubule into the bloodstream by diffusion and active transport; Most of the mineral salts are reabsorbed as well (by diffusion and active transport) Water is also reabsorbed by osmosis along the nephron; Every 2 points – 1 mark</p> <p>(Composition) Excess water, excess salts and metabolic waste such as urea are passed on to the renal pelvis/bladder as urine;</p>	1
	b	<p>The water potential of blood increases; The hypothalamus is stimulated ; and the pituitary gland releases less anti-diuretic hormone (ADH) into bloodstream; Cells in walls of collecting duct become less permeable to water; Less water is reabsorbed from collecting ducts into blood capillaries; The body will release more water as urine, maintaining water potential of blood;</p> <p>6 points – 4 marks, 4 to 5 points – 3 marks, 3 points – 2 marks, 1 to 2 points – 1 mark</p>	4

Class	Register Number	Name
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BARTLEY SECONDARY SCHOOL

O-LEVEL PRELIMINARY EXAMINATIONS

BIOLOGY

6093/01

Sec 4 Express

Paper 1 Multiple Choice

23 Sep 2019

1 hour

Candidates answer on the Multiple Choice Answer Sheet.

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

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

Write in soft pencil on the Multiple Choice Answer Sheet.

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

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

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 Multiple Choice 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.

At the end of the examination, submit the Multiple Choice Answer Sheet.

This document consists of **20** printed pages.

Set by: LMY

[Turn over

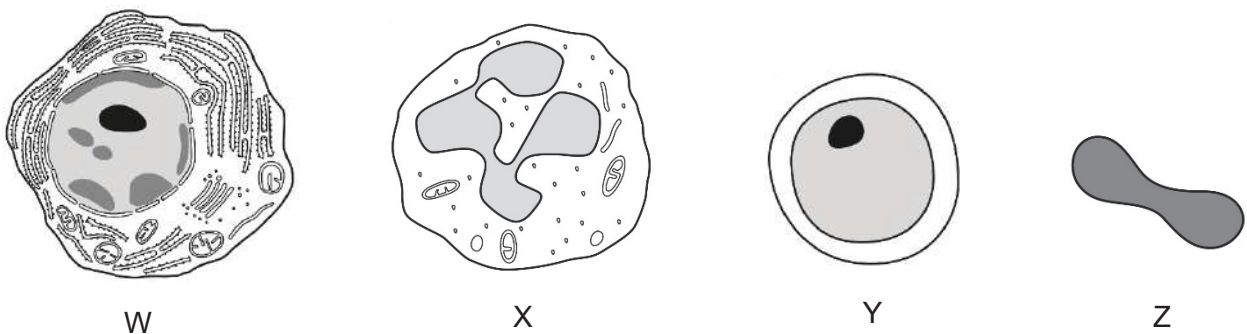
- 1 Specialised cells from the human gut produce lipases.

What are the most likely features of this cell?

- 1 It has less mitochondria than RER.
- 2 It has less RER than SER.
- 3 It has more Golgi bodies compared to a human cheek cell.
- 4 It requires a high supply of amino acids.

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

- 2 The diagram below shows four human cells W, X, Y and Z observed from electron micrographs.

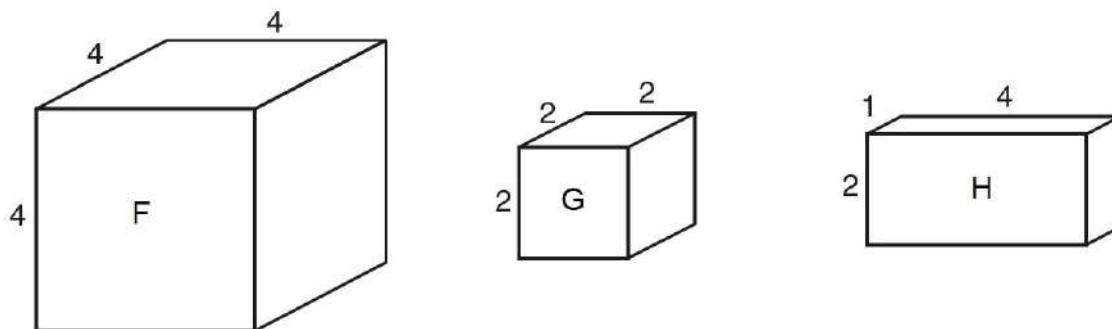


Which row matches the cells to their correct functions?

	carry oxygen	phagocytosis	produce antibodies	secrete enzymes
A	W	Y	X	Z
B	X	W	Z	Y
C	Y	Z	W	X
D	Z	X	Y	W

- 3 An experiment was carried out to investigate the effect of surface area to volume ratio on diffusion.

A block of agar containing sodium hydroxide solution and Universal Indicator solution was cut into three smaller blocks of different sizes, as shown in the diagrams below. All dimensions are in centimetres.

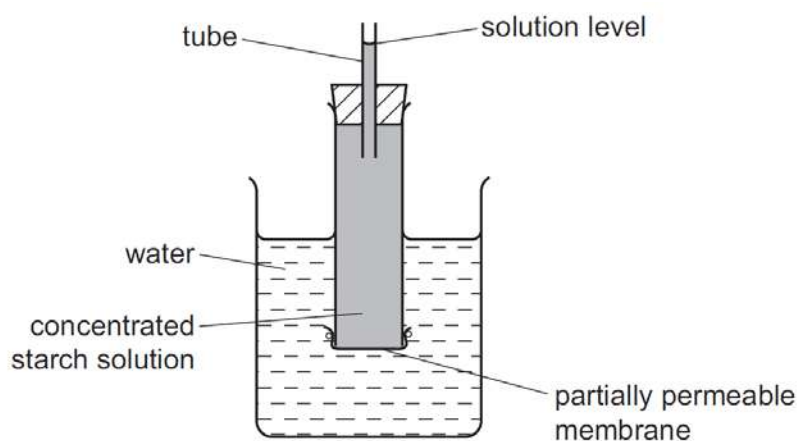


The blocks were placed in a solution of 0.1 mol / dm^3 hydrochloric acid. As the hydrochloric acid diffused into each block, a colour change was observed. The time taken for each block to change its colour completely was recorded.

Which statement is correct?

- A Although H and G have equal volumes, it will take less time for G to change colour completely.
- B H will take more time than G to change colour completely, as H has a larger surface area for each unit of volume.
- C The length, width and breadth of F are double that of G. Compared to G, this halves the surface area to volume ratio and increases the time taken for F to change colour completely.
- D The smaller the surface area of a block, the longer the time taken to change colour completely.

- 4 The diagram represents apparatus 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

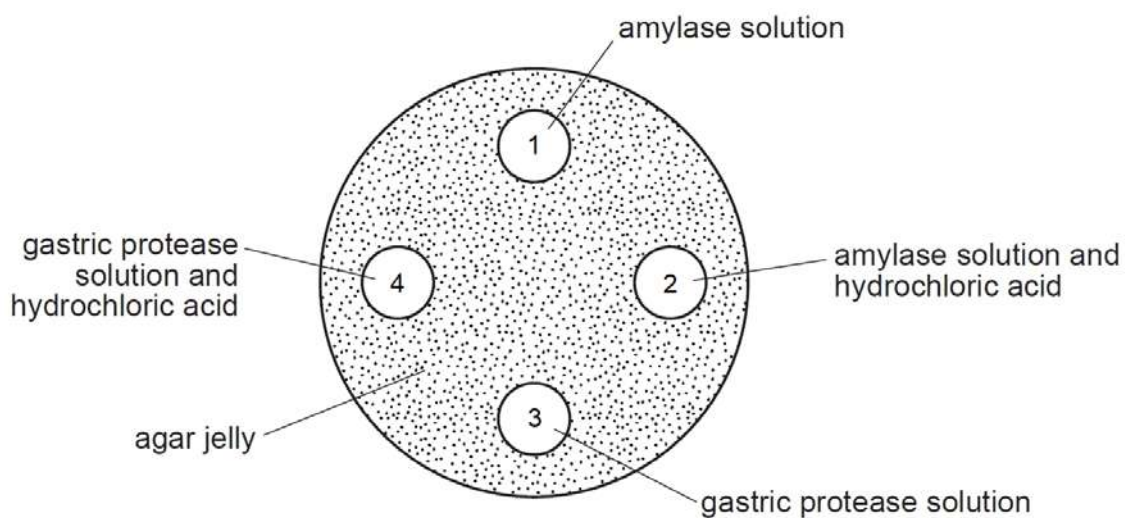
- 5 A mixture of glucose and amylase solution is tested with Benedict's solution, biuret solution and iodine solution.

Which colours are obtained?

	Benedict's solution	biuret solution	iodine solution
A	blue	blue	blue-black
B	blue	blue	brown
C	red	purple	brown
D	red	purple	blue-black

- 6 A dish is filled with agar jelly containing starch. Four holes are cut in the jelly and each hole is filled as shown.

After 30 minutes, the wells are tested with iodine solution.



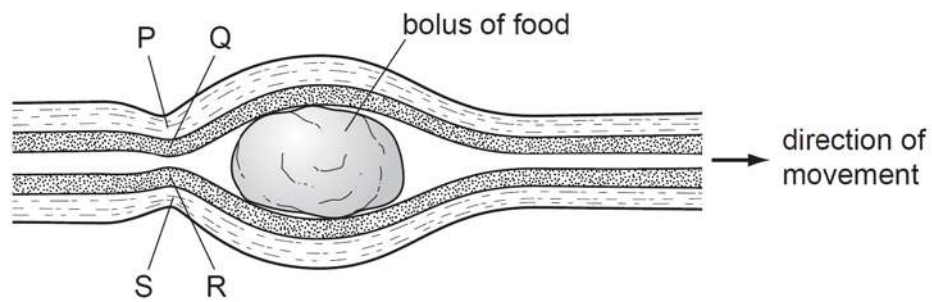
Which statement is correct?

- A All wells will be surrounded by an area of blue-black stain except well 1.
 B Wells 1 and 4 will have the largest area with yellow stain.
 C Well 2 will have a larger area with blue-black stain than well 3.
 D Well 4 will have a larger area with yellow stain than well 3.
- 7 What are the advantages of chewing food at the start of digestion?

	increasing surface area	lubricating food	making food soluble
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✗	✓

key
 ✓ = yes
 ✗ = no

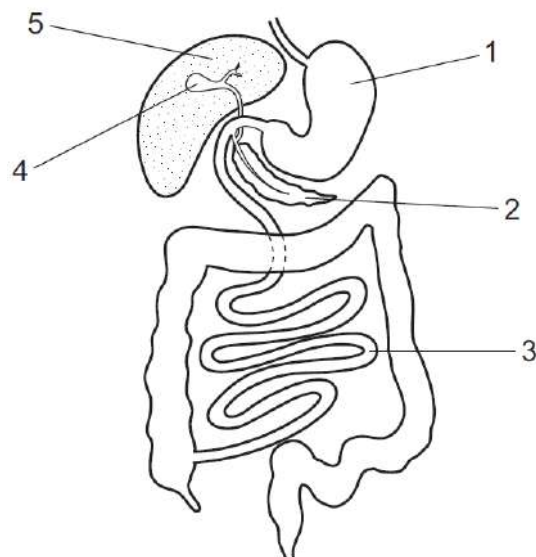
- 8 The diagram shows a bolus of food moving along the oesophagus.



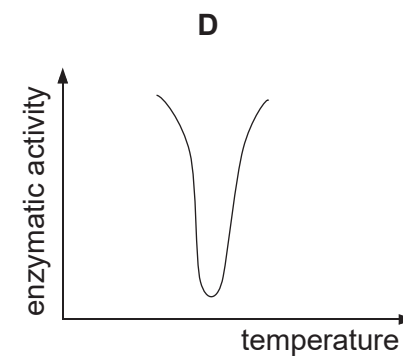
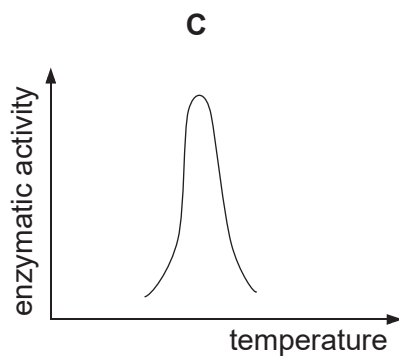
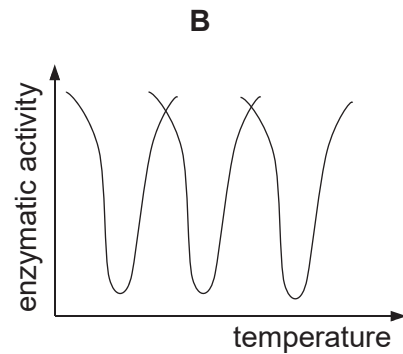
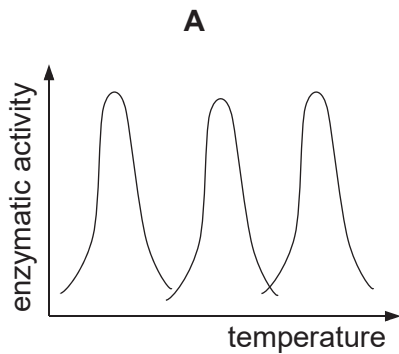
Which row describes the condition of the muscles at P, Q, R and S?

	P	Q	R	S
A	contracted	relaxed	contracted	relaxed
B	contracted	relaxed	relaxed	contracted
C	relaxed	contracted	contracted	relaxed
D	relaxed	contracted	relaxed	contracted

The figure below shows the human digestive system. Study the diagram carefully and answer questions 9 and 10.



- 9 Which graph shows the effect of temperature on the rate of enzymatic activity of the enzymes found in parts 1, 2 and 3?



- 10 Which row matches the functions to the correct structures?

	activate pepsin	produce alkaline secretions	produce bile
A	1	2	5
B	2	3	4
C	3	1	3
D	5	4	2

- 11 Which features apply to both sieve tube elements and xylem vessel elements?

- 1 no cytoplasm
- 2 no end walls
- 3 no nucleus

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

Use the graph below to answer Questions 13 and 14.

The graph shows the blood pressure recorded by three catheters (X, Y, and Z) over a 0.9-second interval. The y-axis represents blood pressure in kPa, ranging from 0 to 16. The x-axis represents time in seconds, ranging from 0.0 to 0.9.

- Catheter X (dotted line):** Shows a high systolic pressure of approximately 15.5 kPa. It has a small initial pressure of about 13 kPa at 0.0 s, which drops to 10 kPa by 0.3 s before the main pulse. The pulse peaks at 15.5 kPa at 0.5 s and returns to the baseline by 0.8 s.
- Catheter Y (dashed line):** Shows a low systolic pressure of approximately 2 kPa. It remains relatively flat, with a slight rise to 2 kPa at 0.4 s and a small peak of 2.5 kPa at 0.8 s.
- Catheter Z (solid line):** Shows a high systolic pressure of approximately 15 kPa. It has a small initial pressure of about 0.5 kPa at 0.0 s, which rises to 1 kPa by 0.3 s before the main pulse. The pulse peaks at 15 kPa at 0.5 s and returns to the baseline by 0.8 s.

Key points on the graph are labeled with numbers 1 through 4:

- 1:** Point on the solid line (Z) at approximately 0.25 s, where the pressure is about 1 kPa.
- 2:** Point on the dotted line (X) at approximately 0.3 s, where the pressure is about 10 kPa.
- 3:** Point on the dotted line (X) at approximately 0.65 s, where the pressure is about 12 kPa.
- 4:** Point on the dashed line (Y) at approximately 0.75 s, where the pressure is about 2 kPa.

13 Which structures are represented by the pressure curves X, Y and Z ?

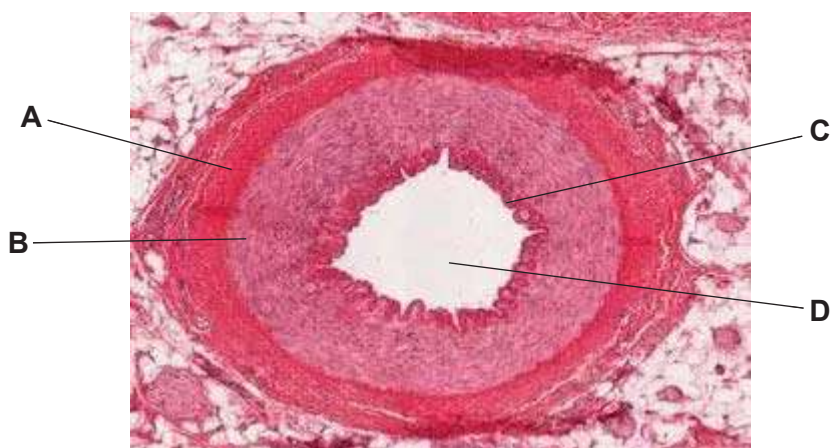
	X	Y	Z
A	aorta	vena cava	left atrium
B	aorta	left atrium	left ventricle
C	left atrium	vena cava	left ventricle
D	left ventricle	left atrium	aorta

14 Which set of labels is correct?

	valves close	valves open	bicuspid valve closes	bicuspid valve opens	semi-lunar valve opens
A	1 and 3	2 and 4	-	-	-
B	1 and 4	2 and 3	-	-	-
C	-	-	1	-	3
D	-	-	3	2	-

15 The photograph shows a cross-section of an artery.

Which labelled part would be of the same thickness in a vein?

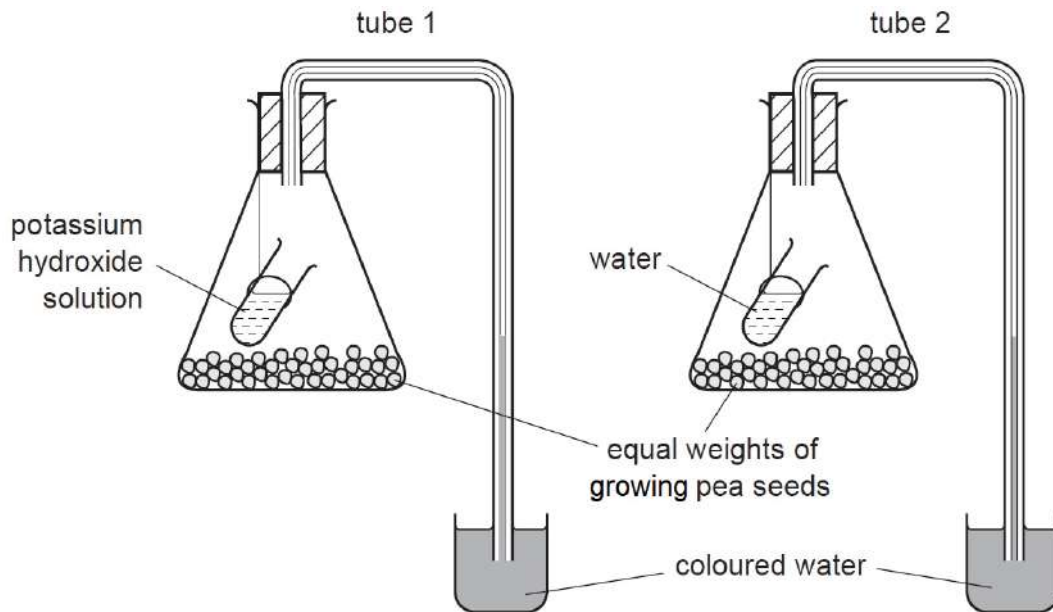


Source: <https://qph.fs.quoracdn.net/main-qimg-edb2174af10d54f34d9d4089951bdcd4.webp>
last accessed August 2019

16 In a muscle, which two substances show net movement from the tissue fluid into the plasma?

- A** carbon dioxide and glucose
- B** carbon dioxide and lactic acid
- C** glucose and oxygen
- D** lactic acid and oxygen

17 An experiment is set up as shown.



After four hours, the coloured water will

- A** be higher in tube 1 than in tube 2.
- B** be higher in tube 2 than in tube 1.
- C** have gone down by the same amount in both tubes.
- D** have gone up by the same amount in both tubes.

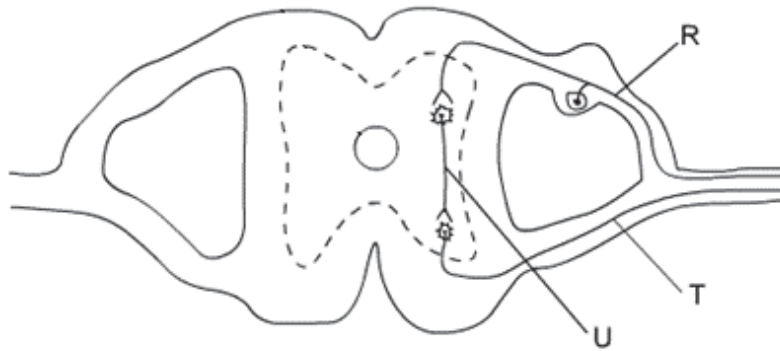
18 In the human breathing system, which features maintain the carbon dioxide gradient between the alveoli and the outside air?

- 1 blood 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

- 19** 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 oxidised
 - D** too little glucose is absorbed by the Loop of Henle
- 20** Where does most reabsorption of water occur in the kidney in humans?
- A** collecting ducts
 - B** distal convoluted tubules
 - C** loops of Henle
 - D** proximal convoluted tubules
- 21** Which process is not a result of negative feedback?
- A** A decrease in the surrounding temperature leads to a decrease in blood flow through the skin surface.
 - B** A decrease in the surrounding temperature leads to a decrease in respiration rate.
 - C** A decrease in the surrounding temperature leads to a decrease in sweating.
 - D** A decrease in the surrounding temperature leads to shivering.

22 The diagram below shows a transverse section of the spinal cord with spinal nerves.



Nerve impulses in neurones can travel in the following directions.

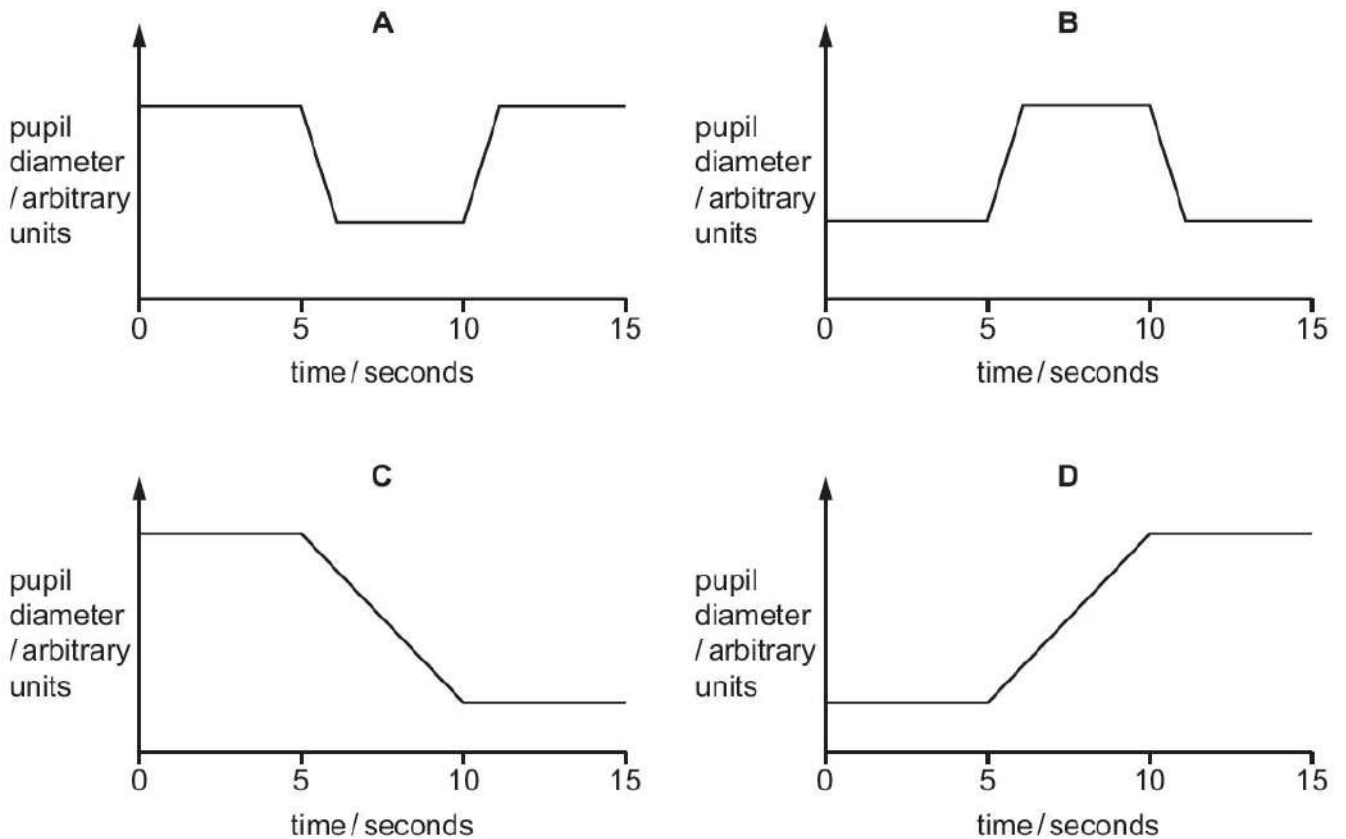
- 1 away from the central nervous system
- 2 towards the central nervous system
- 3 within the central nervous system

In which direction do impulses in neurones R, T and U travel?

	R	T	U
A	1	2	3
B	1	3	2
C	2	3	1
D	2	1	3

- 23** A person is sitting in a darkened room. After five seconds, a light is turned on. Five seconds after that, the light is turned off again.

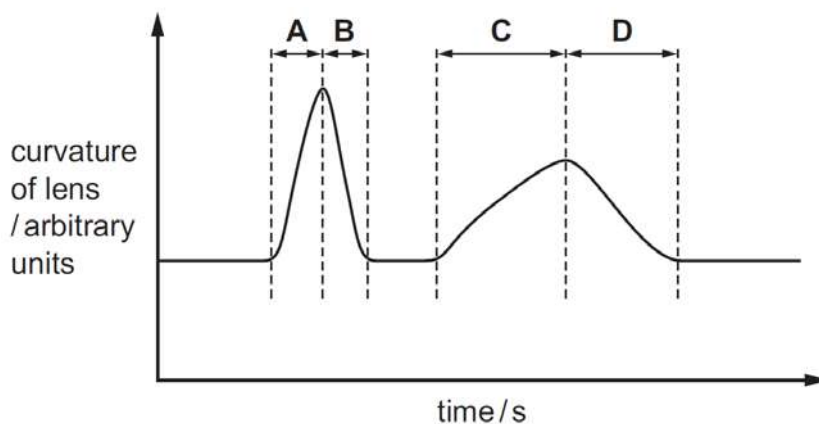
Which graph shows the changes in the diameters of the pupils?



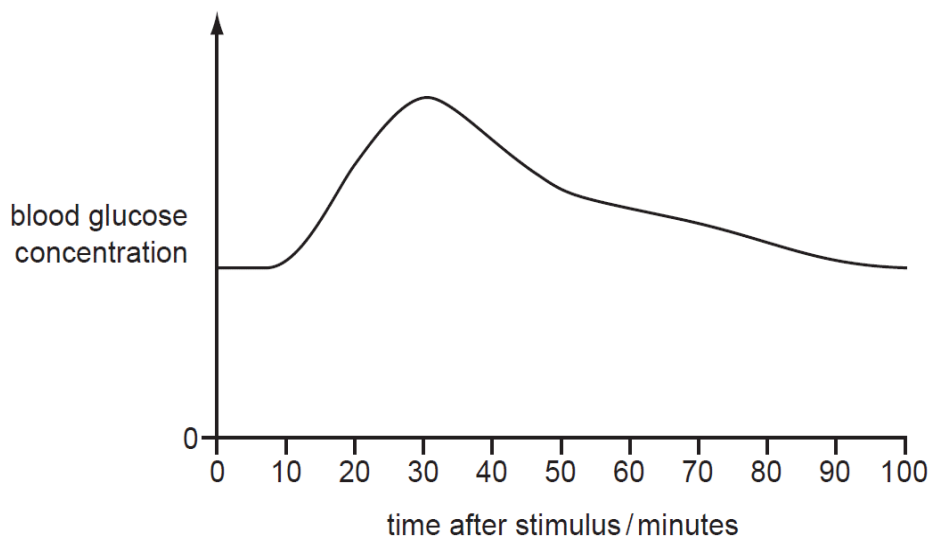
- 24** The diagram shows the curvature of the lens in a person's eye.

The shape of the lens changes as the person watches two motorbikes go past at different speeds.

During which period was a motorbike moving towards the person at the higher speed?



- 25** The graph shows changes in blood glucose concentration when a body responds to an external stimulus.



A student considers the following hormones.

- 1 adrenaline
- 2 glucagon
- 3 insulin

Which option shows the correct substance(s) responsible for the change in blood glucose concentration in the first 30 minutes?

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

- 26** Some plant species have evolved flowers suited to pollination by certain hawk moths, which are fluid-feeders. These moths have a high energy demand, feed at night and hover in front of the flowers while they feed.

Which flower characteristic is most likely to be possessed by a plant species that is pollinated by these hawk moths?

- A** brightly coloured petals and high pollen production
B flower parts shaped to resemble the female hawk moth
C production of odours during the day that mimic rotting flesh
D white petals with high nectar production

27 The first day of menstrual loss in a woman was 1 February.

Which statements are most likely true?

- 1 Ovulation will occur on 14 February.
- 2 Progesterone levels will spike on 12 February.
- 3 Menstrual loss will cease on 5 February.
- 4 Oestrogen levels will remain high on 28 February.

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

28 Which disease can be cured by antibiotics?

- A** HIV / AIDS
- B** diabetes
- C** emphysema
- D** syphilis

29 What are the conditions in a human cell just before the cell enters prophase?

	number of chromatids	nuclear envelope present
A	46	no
B	46	yes
C	92	no
D	92	yes

30 Each of the following events takes place during mitosis.

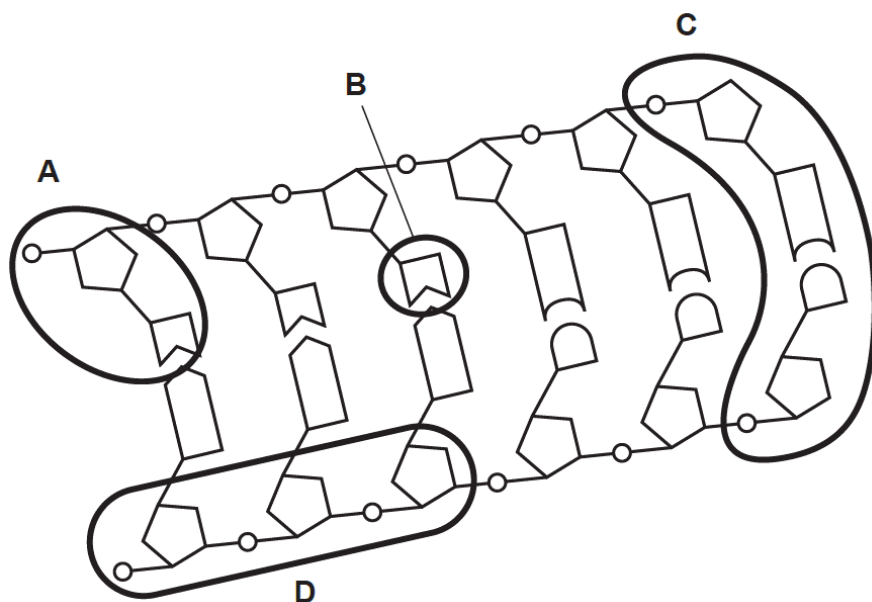
- 1 centromeres divide
- 2 chromatids move to opposite poles of the cell
- 3 chromosomes line up along the equator of the spindle
- 4 chromosomes uncoil
- 5 two chromatids are joined by a centromere

In which order do the events take place?

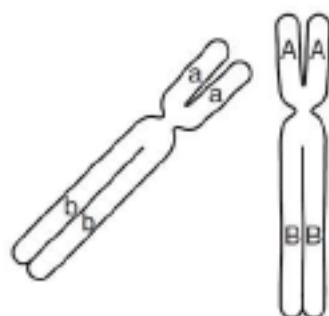
	first → last				
A	1	2	4	5	3
B	3	1	2	4	5
C	4	5	3	1	2
D	5	3	1	2	4

31 The figure shows part of a DNA molecule.

Which part is a nucleotide?



- 32 The diagram shows two homologous chromosomes in early prophase I of meiosis in a human cell. The position of two genes, A/a and B/b, on the homologous chromosomes are also shown.



Which row of diagrams is a possible representation of these chromosomes as they progress from anaphase I to prophase II?

	anaphase I	prophase II
A		
B		
C		
D		

33 The following statements describe the events that take place during DNA transcription.

Which statements are not correct?

- 1 adenine pairs with thymine
- 2 one DNA polynucleotide chain act as template
- 3 the original DNA molecule is changed after the process
- 4 uracil pairs with adenine

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

34 Which statements about genetic engineering to produce human insulin are correct?

- 1 The human insulin gene is cut out of human DNA.
- 2 The insulin gene is inserted into bacterial DNA.
- 3 The genetically engineered bacteria are cultured in large numbers.
- 4 These cultured bacteria are used in injections for diabetics.

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

35 A number of new plants are growing from pieces of a plant that have become detached and have rooted in soil.

Which statement is correct about these new plants when they mature?

- A** The fruit they produce will all ripen at the same time.
B They will all grow to the same size.
C They will all have the same colour flowers.
D They will all produce the same number of fruit.

36 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.

- 37** Flower colour is controlled by a single pair of alleles. The allele for red flowers is dominant to the allele for white flowers.

A plant homozygous for red flowers is crossed with a plant homozygous for white flowers. All the resulting plants have red flowers (F_1 generation).

When the F_1 generation are crossed with each other, 18 plants are obtained. 12 plants have red flowers and 6 have white flowers (F_2 generation).

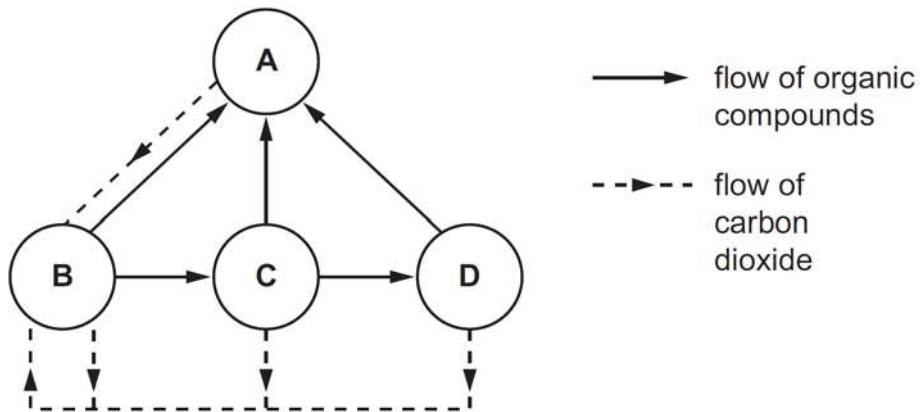
What ratio is expected in the F_2 generation and what ratio has been obtained?

	expected ratio red to white	obtained ratio red to white
A	1 : 1	2 : 1
B	1 : 1	3 : 1
C	3 : 1	2 : 1
D	3 : 1	3 : 1

- 38** The diagram shows the flow of substances within an ecosystem.

The circles represent trophic levels.

Which circle represents herbivores?



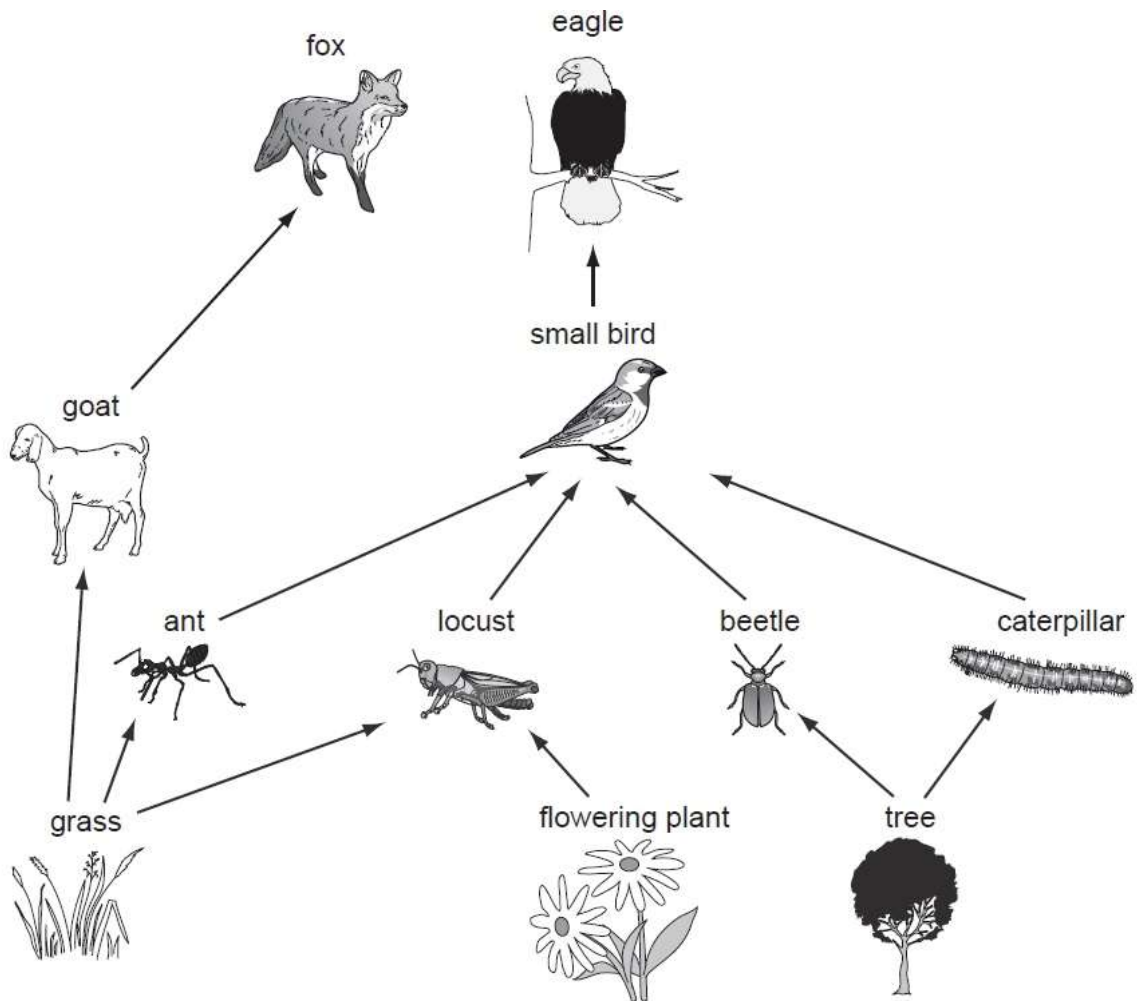
- 39** The diagram shows a food chain.

mahogany tree → caterpillar → songbird → hawk

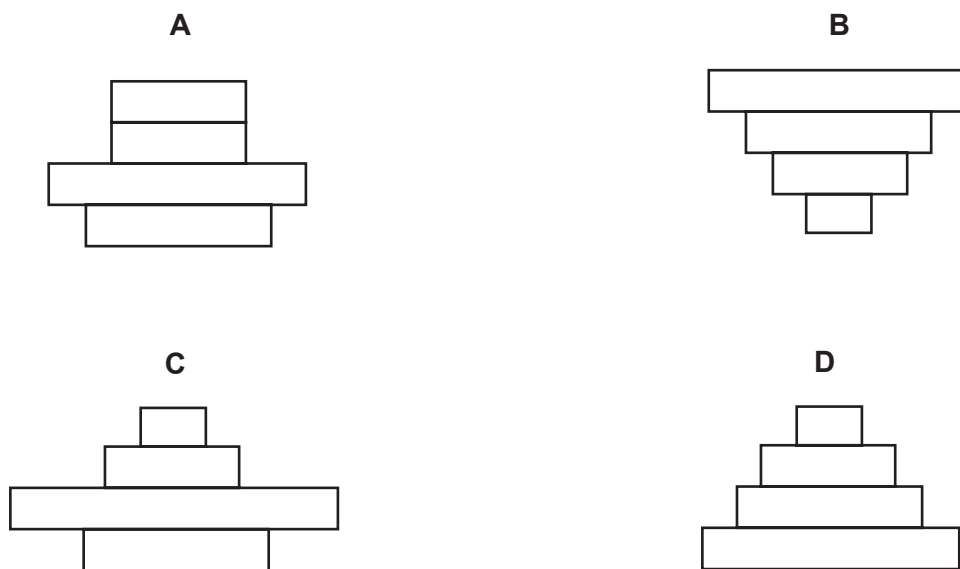
What is not recycled from the hawk to the mahogany tree?

- A** carbon dioxide
- B** energy
- C** nitrogen atoms
- D** water

40 The diagram shows part of a food web.



Which diagram shows the pyramid of biomass for this food web?



Class	Register Number	Name
-------	-----------------	------



BARTLEY SECONDARY SCHOOL

O-LEVEL PRELIMINARY EXAMINATIONS

BIOLOGY

6093/02

Sec 4 Express

Paper 2

18 Sep 2019

1 hour 45 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

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

Write in dark blue or black pen.

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 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.

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.

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

This document consists of **19** printed pages and **1** blank page.

Set by: LMY

[Turn over

Section A

Answer **all** questions.

Write your answers in the spaces provided.

- 1 Fig. 1.1 shows cells from a plant tissue which have been mounted on a slide with distilled water and viewed using a microscope.

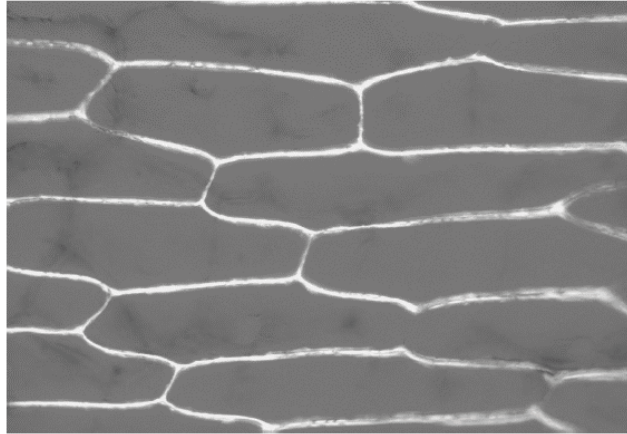


Fig. 1.1

Fig. 1.2 shows cells taken from the same plant tissue when mounted on a slide with concentrated salt solution.

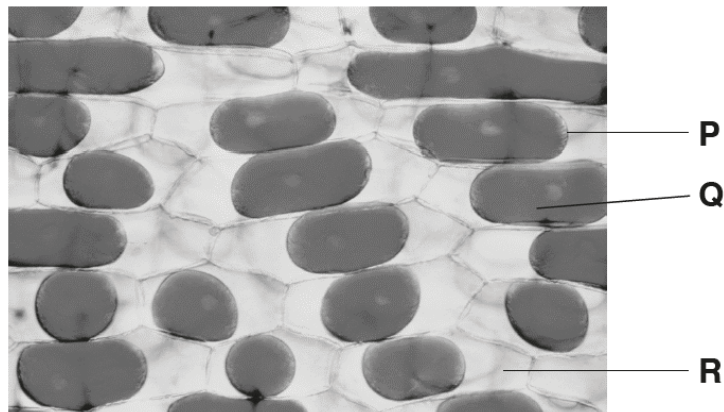


Fig. 1.2

(a) In Fig. 1.2,

- (i) identify structures **P** and **Q**.

P

Q [2]

- (ii) state the contents of location **R**.

..... [1]

- (b) The concentrations of substances in structure **Q** are different from those in location **R**.

Explain how the properties of structure **P** result in differences in concentrations of substances in **Q** and **R**.

.....

.....

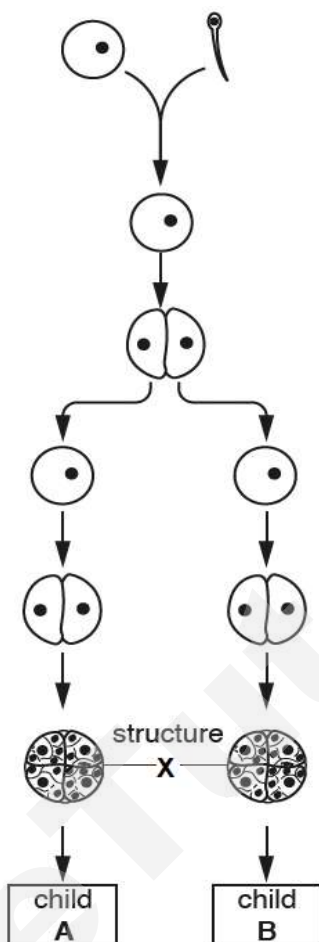
.....

.....

.....[3]

[Total:6]

2 The figure shows stages in the development of human twins.



- (a)** On the figure, label and name each of the following:

- a gamete,
- a zygote.

[2]

- (b)** Name the part of the female reproductive system that structure **X** enters.

- (c) If the sex chromosome in the sperm is a Y chromosome, and in the ovum (egg) is an X chromosome, state the sex of child **A** and of child **B**. Explain your answer.

child **A**

child **B**

explanation

.....

.....

.....

[2]

[3]

- (d) Explain how a woman's body prevents further ova (eggs) from being released until the end of her pregnancy.

.....

.....

.....

.....

.....[4]

[Total: 10]

- 3 The rate of carbon dioxide uptake at a range of carbon dioxide concentrations by two types of plants, X and Y, were compared at two temperatures using the apparatus shown in Fig. 3.1.

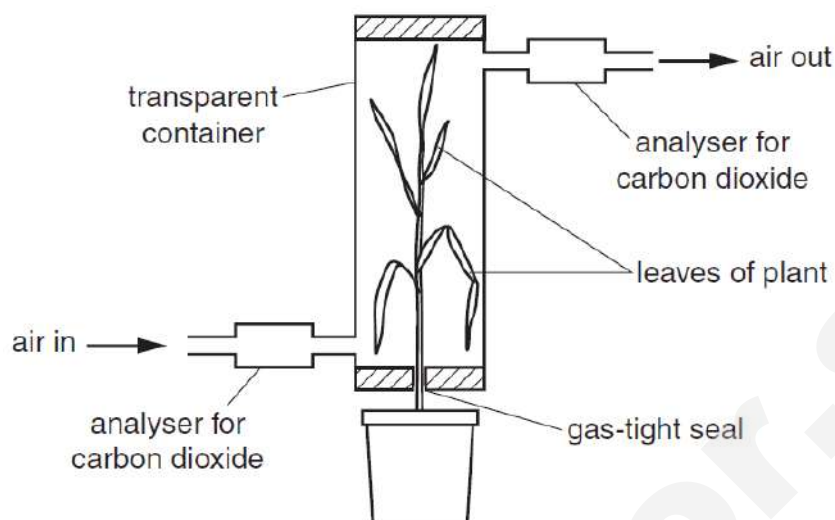


Fig. 3.1

The results of the experiment are presented in Fig. 3.2.

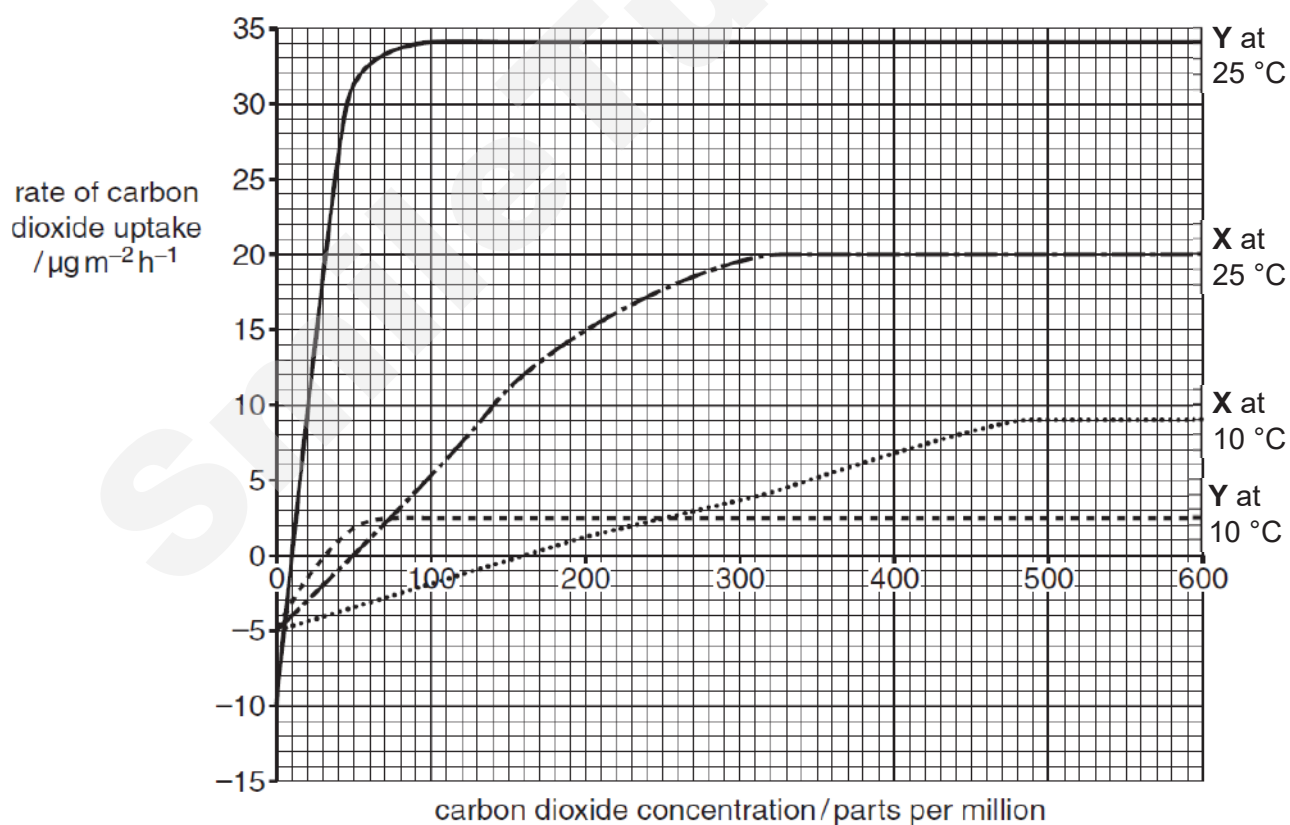


Fig. 3.2

(a) With reference to Fig. 3.2,

(i) give three conclusions for the results of the experiment.

- 1
-
-
- 2
-
-
- 3
-
-
- [3]

(ii) for plant Y at 25 °C, state

- the rate of carbon dioxide uptake at atmospheric carbon dioxide concentration.
Atmospheric carbon dioxide concentration is approximately 400 parts per million.
.....[1]
- the concentration of carbon dioxide at which the rates of photosynthesis and
respiration are the same.
.....[1]

(b) Both temperature and carbon dioxide concentrations can be limiting factors of photosynthesis.

With reference to the graph for plant X at 25 °C in Fig. 3.2, explain the term *limiting factor*.

-
-
-
-
-[2]

[Total:7]

- 4 The rates of transpiration of plants of two species, **A** and **B**, were measured over a period of seven hours. The results are shown in Fig. 4.1.

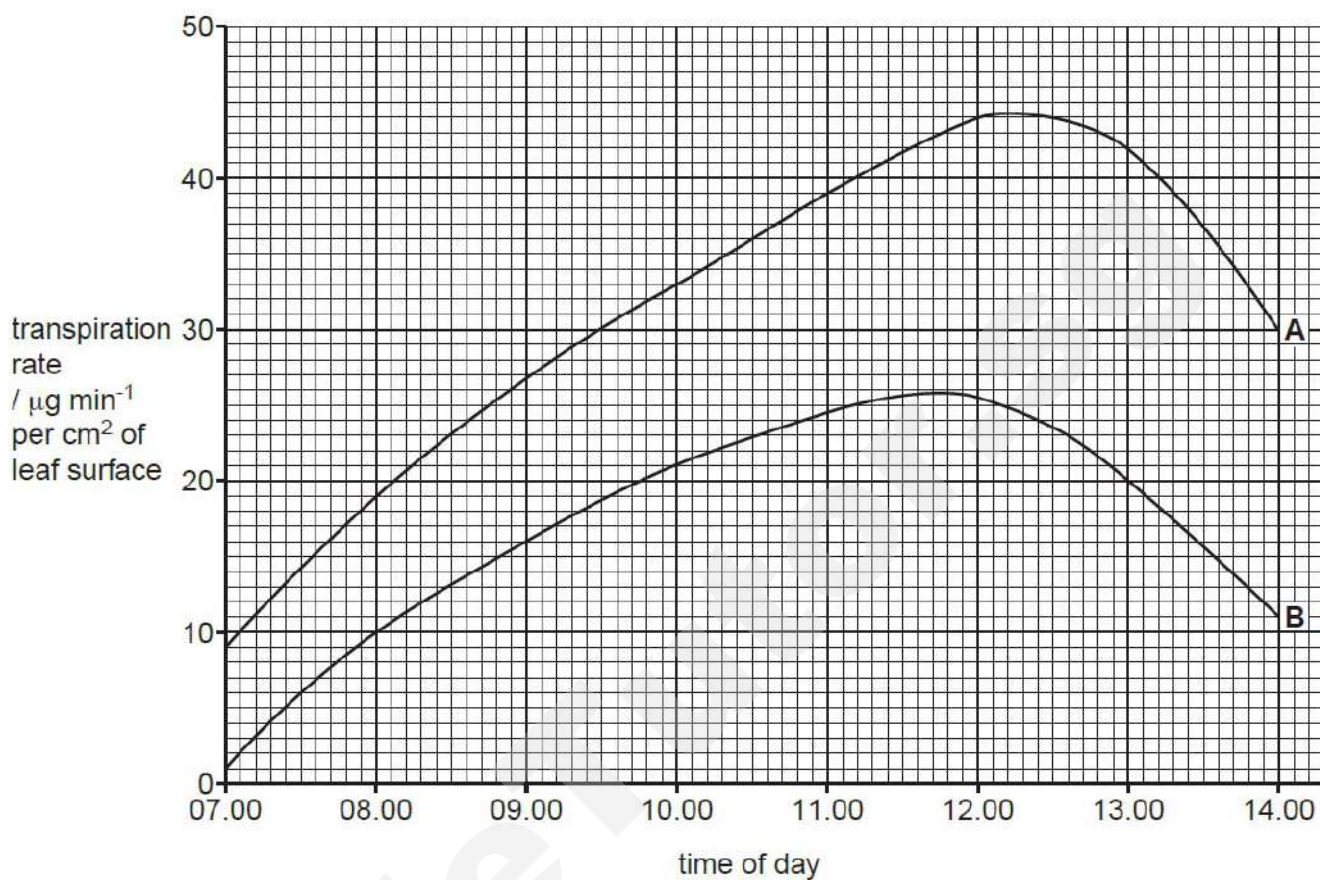


Fig. 4.1

Cacti are plants that grow in desert conditions. Fig. 4.2a shows a type of cactus. Fig. 4.2b shows the surface of the stem of the cactus seen using a microscope.

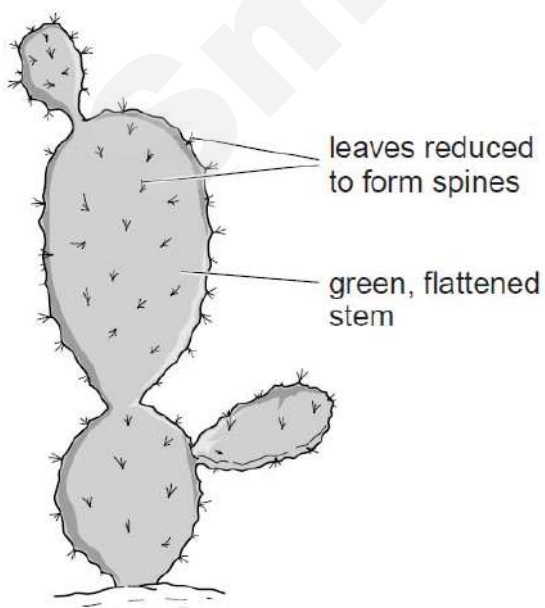


Fig. 4.2a

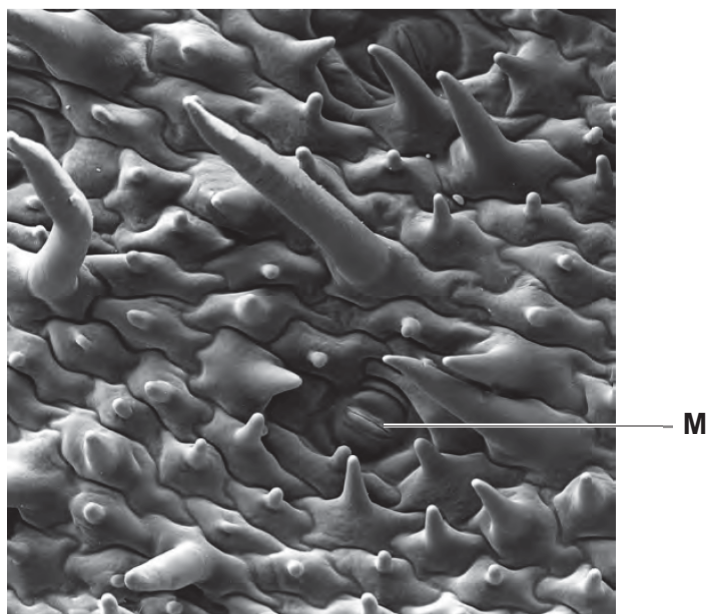


Fig. 4.2b

- (a) With reference to Fig. 4.1, calculate the maximum change in the rate of transpiration for plant **B**.

..... $\mu\text{g} / \text{min} / \text{cm}^2$ leaf surface [1]

- (b) State which plant, **A** or **B**, is likely cactus. Give a reason for your answer.

.....
[1]

- (c) Suggest why it is advantageous for the cacti to have its leaves reduced to spines.

.....

[3]

- (d) With reference to Fig. 4.2b,

- (i) name the part labelled **M**,

.....[1]

- (ii) suggest why there are many of these structures on the stems of a cactus.

.....

[2]

[Total:8]

- 5 Fig. 5.1 shows the structures connected to the human kidney.

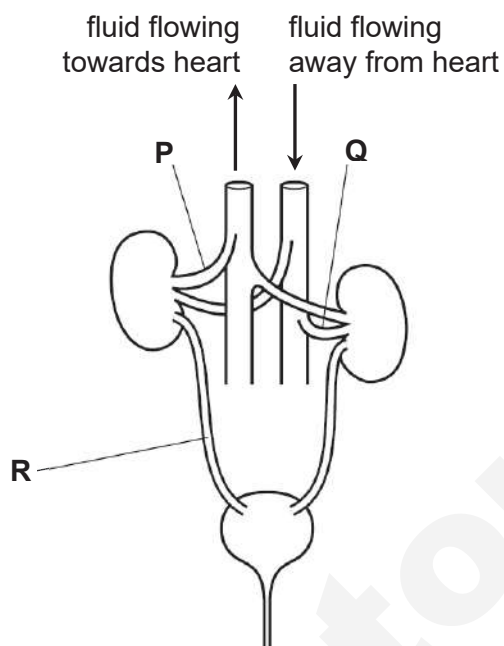


Fig 5.1

Fig. 5.2 shows the apparatus used by a student to compare the amount of urea in three samples of artificial body fluids. The three artificial body fluids are fluids obtained from structures **P**, **Q** and **R**.

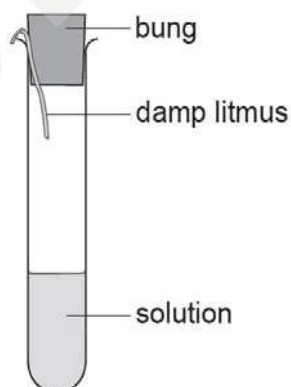


Fig. 5.2

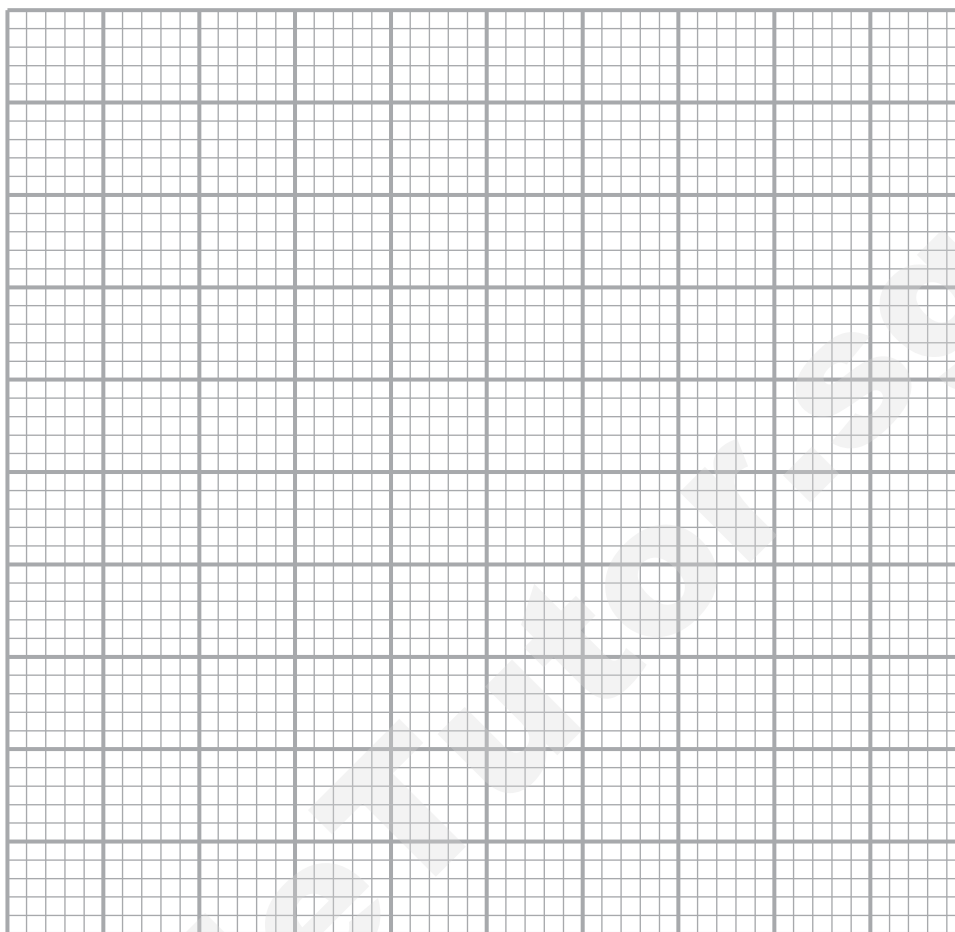
Urease is an enzyme that breaks down urea to produce ammonia. Ammonia turns red litmus paper blue.

The time taken for the litmus paper to begin to change colour is shown in Table 5.1.

Table 5.1

test tube	time taken for litmus to turn blue / min
T1	8
T2	20
T3	1

- (a) Construct a bar chart to show the results of the investigation.



[2]

- (b) (i) Using the letters **P**, **Q** and **R**, state the structure from which the artificial fluid is obtained for each test tube.

test tube	T1	T2	T3
structure			

[2]

- (ii) Describe the function of structure **R**.

.....
[1]

- (c) Explain the presence of urea in body fluid **Q**.

.....

[2]

[Total:7]

- 6 (a) The table shows the mean distance that molecules must travel during gas exchange between air in the lungs and blood in the circulatory system in birds and mammals. This distance is known as the thickness of the blood-gas barrier.

animal	mean thickness of blood-gas barrier / μm
birds	0.2
mammals	0.5

- (i) A gas that passes through the blood-gas barrier is carbon dioxide.

Explain why the movement of carbon dioxide across the blood-gas barrier is considered to be a form of excretion.

.....

.....

.....

.....[2]

- (ii) Explain how the difference in thickness of the blood-gas barrier suggests that movement of a bird by flying requires more energy than movement by a mammal on land.

.....

.....

.....

.....

.....[3]

- (iii) In mammals, lactic acid may accumulate in the muscle tissues.

Suggest how the presence of lactic acid indicates an oxygen debt even though the rate of oxygen absorption across the blood-gas barrier is at its maximum.

.....

.....

.....

.....

.....[3]

- (b) Describe how the relatively low blood pressure in the lungs is brought about by both the structure of the heart and the blood vessels in the lungs.

.....

.....

.....

.....

.....[4]

[Total: 12]

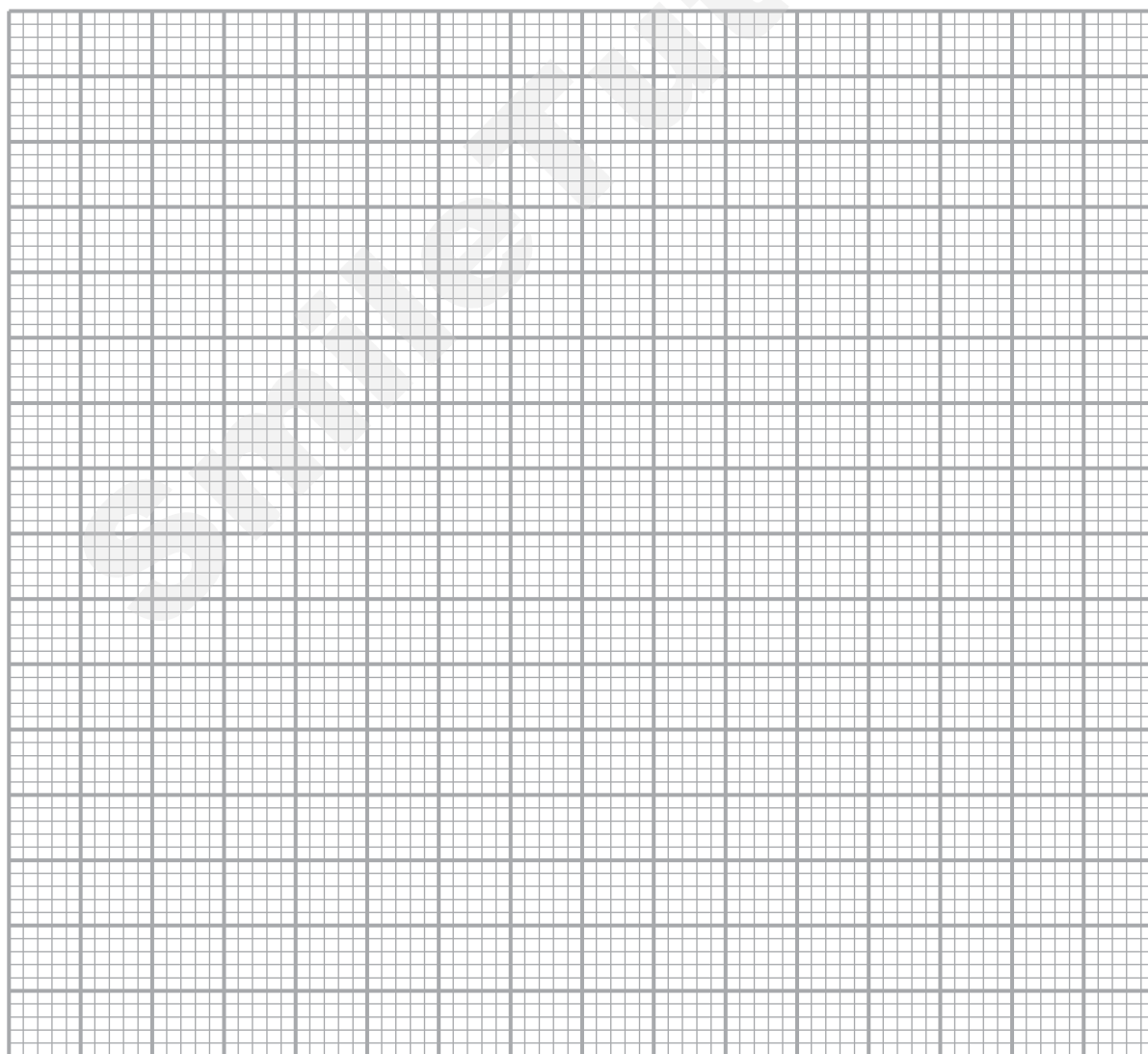
Section B

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

- 7** The table shows the concentration of glucose and insulin in blood plasma before and after a glucose drink. The time at which the glucose drink is taken is recorded as 0 minutes.

time / min	– 60	– 30	0	30	60	90	120	150	180	210	240	270	300
plasma glucose / mmol per dm ³	4.5	4.5	4.5	7.0	7.5	6.5	5.5	5.0	4.8	3.8	3.5	4.0	4.5
plasma insulin / pmol per dm ³	60	60	60	330	350	260		120	80	50	40	50	50

- (a) (i)** Plot a graph to show how plasma insulin changes with time.



[4]

- (ii) Calculate the rate of change in blood glucose from 60 minutes to 240 minutes after the glucose drink.

[2]

- (iii) Describe the relationship between the changes in blood glucose and the concentration of insulin in the blood plasma.

.....

[2]

- (iv) Data for the plasma insulin at 120 minutes is missing.

Use your graph to estimate the plasma insulin at 120 minutes. Mark this point on your graph and rewrite the value here.

plasma insulin at 120 minutes = pmol per dm^3 [1]

- (b) Insulin must be excreted from the body after it has carried out its function.

Explain how this is done.

.....

[2]

[Total: 11]

- 8** The figure shows bacteria growing on the surface of a dish containing nutrient jelly. Paper discs, such as **W** and **X**, were soaked in solutions of different antibiotics and placed on top of the growing bacteria. A clear area on the jelly indicates that bacteria in that area have been killed.



Source: https://en.wikipedia.org/wiki/Antimicrobial_resistance
last accessed August 2019

- (a) Use the information above, and your knowledge of the process of natural selection, to describe and explain the difference in appearance of the jelly surrounding discs **W** and **X**.

.....[5]

- (b) With reference to the production of one named economically important plant or animal in your answer, describe how the process of artificial selection differs from that of natural selection.

.....

.....

.....

.....

.....

.....

.....

.....

.....[4]

[Total:9]

-[6]

-[4

BSS/2019/Preliminary Examinations/4E Biology P2

9 OR

(a) Explain the differences between mitosis and meiosis. Your explanation should include references to where the processes occur and why they occur.

Tutorix

[5]

(b) Insulin is a hormone made up of two polypeptides.

Describe how insulin is produced from DNA.

.....[5]

[Total:10]

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SmileTutor.sg

Suggested Answers for 4E BIOLOGY PRELIM 2019

Paper 1

¹DDCDC

⁶ABCCA

¹¹DDBAC

¹⁶BAABA

²¹BDAAA

²⁶DBDDD

³¹ADABC

³⁶ACCBD

Paper 2

- 1 a i** P – plasma membrane
Q – (large/central) vacuole
ii R - salt solution
- b** partially permeable (membrane) ;
water molecules can pass through ;
other substances (e.g. salt) + cannot pass through ;
- 2 a** gamete / egg / ovum / sperm correctly named and labelled ;
zygote correctly named and labelled ;
- b** uterus / womb / endometrium ;
- c** both child A and B are sons/boys ;
any 2 of:
zygote has X and Y sex chromosomes ;
undergoes mitosis (to form two embryos) ;
embryos / cells / twins are identical ;
- d** progesterone levels increase ;
oestrogen levels remain low ;
growth / development of placenta / uterus lining ;
production / maturation of ovum / egg inhibited ;
- 3 a i** any 3 of:
at both temperatures Y reaches maximum uptake at lower carbon dioxide concentration ;
comparisons for rate of uptake at one temperature + data quoted ;
e.g. maximum for Y at 90–100 ppm + X at 310–320 ppm at 25 °C
e.g. maximum for Y at 60–70 ppm + X at 480–500 ppm at 10 °C
gradient for uptake of Y is higher than for X ;
rate of / gradient, for uptake by Y is higher than for X at 25 °C (at all carbon concentrations) ;
rate of uptake by Y at 10 °C is higher than for X up to 250 ppm ;
rate of uptake by X at 10 °C is higher than Y above 250 ppm ;
any other valid point ;

- ii $34 \mu\text{g} / \text{m}^2 / \text{h}$ at atmospheric CO_2 concentration ;
10 parts per million ;
 - b rate of CO_2 uptake corresponds/proportionate to rate of photosynthesis ;
(data quoted) increasing CO_2 concentration until 330ppm increases rate of uptake of CO_2 ;
 CO_2 is limiting factor because P/s rate changes with varying CO_2 conc **OR** CO_2 conc is not limiting factor above 330ppm because p/s rate remains the same ; max2
- 4
- a $26 - 1 = 25 \mu\text{g} / \text{min} / \text{cm}^2$ leaf surface
 - b B + lower rate of transpiration throughout the day
 - c lack of (available) water (in environment) ;
(spines) reduce surface area ;
reduce transpiration / evaporation / water loss ;
 - d i stoma(ta) / guard cell(s) ;
ii none / fewer on leaves ;
(serves as) passage of O_2 / CO_2 / water vapour / gas exchange ;
for respiration / photosynthesis / transpiration ; max2
- 5
- a axes labels + appropriate scales ;
correct bar representation + labels ;
 - b i **T1 – Q , T2 – P , T3 – R** 1 correct – 1m, 3 correct – 2m
ii transports / carries urine + from kidneys to (urinary) bladder ;
 - c (protein in diet) digestion of protein to form amino acids ;
deamination of amino acids in liver ;
- 6
- a CO_2 + is a (waste) product of aerobic respiration ;
removed from blood / body + lost / removed / exhaled from lungs ;
 - b (thinner barrier) results in faster/greater gas exchange / diffusion ;
more oxygen supplied / more carbon dioxide removed ;
 O_2 for / CO_2 produced from (aerobic) respiration ;
increased (rate of) respiration (to release more energy) ;
muscles (for flying) ; max3

c insufficient supply of O_2 + for aerobic respiration / (increased) rate of uptake of O_2 in muscles ;

glucose + converted to lactic acid ;

(to continue) release energy (for movement) ;

d (walls of) right ventricle ;

(have) thinner muscle ;

(results in) less forceful contractions ;

extensive branching of capillary network (in the lungs) ;

7 a i axes + labels ;

appropriate scale + graph more than 50% of grid ;

correct points plotted ;

smooth curve / point to point graph ;

ii $3.5 - 7.5 = -4.0$ mmol per dm^3 ;

-4.0 mmol per dm^3 / $(240 - 60)$ min = 0.0222 mmol per dm^3 / min ;

iii increased blood glucose results in / brings about increased blood insulin / AW ;

decreased blood glucose results in / brings about decreased blood insulin / AW ;

[reject increase(decrease) in blood insulin results in increase(decrease) in blood glucose]

iv 190 (approximate, must fit trend of candidate's graph)

b destroyed / broken down / AW + by liver;

products removed / reabsorbed; max2

8 a W has clear area + X no clear area ;

(for disc W)

(bacteria) killed around W / not killed around X ;

(bacteria has) gene ;

(or) mutation ;

(that is) resistant (to antibiotic) ;

(resistant bacteria) survive ;

(resistant bacteria) reproduce ;

(and) pass on resistance to next generation / offspring ;

(for disc X)

antibiotic (solution) not strong / concentrated enough

OR incorrect antibiotic (for the bacteria) ; max 5

- b** named example of (artificially selected) animal / plant e.g. golden rice / sheep / cow ;
reason named e.g. is economically important ;
human / farmer (selects plant / animal) (vs natural forces) ;
to breed together / cross breed ;
over several generations / repeated ; max 4

9E

- a** plants / leaves / producers ;
trap / absorb light ;
(convert light energy) into chemical energy OR make carbohydrate / glucose / sugar / starch ;
(plants) are eaten / is food + by/for herbivores / carnivores / consumer ;
(plants / photosynthesis) uses + carbon dioxide ;
(plants / photosynthesis) produces + oxygen ;
respiration + uses glucose / uses oxygen / produces carbon dioxide ;
provide a habitat for other living organisms / use of plants by humans ; max 6
- b** in palisade mesophyll layer / cells / tissue ;
spongy mesophyll layer / cells / tissue ;
more chloroplasts in palisade ;
none in epidermis / xylem / phloem / vein ;
(palisade cells) near leaf surface / (sun)light / to absorb more or most sunlight ;
rapid rate of photosynthesis ;
(chloroplasts present in) guard cells ;
(involved in) controlling stomata ; max 4

a

(mitosis)	(meiosis)
chromosome number maintained / diploid	chromosome number halved / haploid ;
identical offspring / clones	non-identical offspring ;
e.g. of where it occurs – plant or animal / in bacteria;	in gonads / testes / ovaries / anthers ;
(for) growth / repair	to produce gametes / sex cells ; correctly named gamete e.g. egg / sperm ;
(involved in) asexual reproduction	sexual reproduction ;
2 new cells produced	4 new cells produced ;

max 5

b two genes involved / one gene per polypeptide ;

(for each gene) one DNA strand in the DNA molecule + is template ;

(for the) synthesis of mRNA ;

transcription ;

mRNA moves (from the nucleus) to cytoplasm ;

(mRNA) attaches to a ribosome ;

ribosome moves along mRNA ;

translation ;

amino acids are linked ;

to form a polypeptide or protein molecule ;

max 5

PAPER 3

- 1 a table with correct headings and units;
correct surface total surface areas;
correct time taken calculated;
at least 2 timings for each test tube + 3 calculated values for time taken;
- b i labelled axes + appropriate scale + graph more than 50% of given grid;
correct points plotted;
line of best-fit + no extrapolation beyond plotted points;
- ii bigger s/a vol. ratio – faster diffusion rate
- c i determination of end point subject to colour judgement;
accuracy of block size ;
clumping effect of blocks on surface area etc. ;
any other valid point; e.g. active transport, etc. any 2
- ii use a mould to cut agar
stir contents of test tube
any other valid point
- d living cell has cell membrane ;
cytoplasm present ;
uneven shape ;
accept any other valid point
- e correct apparatus (can be indicated in diagram) ;
same size blocks of agar ;
different temperatures ;
range of temperatures stated e.g. 10 °C, 20 °C, 30 °C, 40 °C, 50 °C;
record data / plot graphs ;
at least one other variable stated e.g. better method of block production ;
repeat experiment ;
any other valid point ; max 6

- 2 a leaves of shoot D at an angle +
leaves of shoot E dropped near to stem/wilting/facing down;
leaves of shoot D firm to touch +
leaves of shoot E limp/withered/shriveled/dried up/crinkly;
- b More blue sections in shoot D than shoot E ;
correct calculations ;
- c transpiration/evaporation/capillary action;
- d water lost at faster rate in D;
greater leaf surface area in D than E;
guard cells flaccid/stomata closed in E;
- e cut end of E may be dried up / damaged xylem on cut surface;
blue dye absorbed by both shoots + same treatment for both shoots;
- f length of shoot;
size of leaves;
number of leaves;
same mass; max 3
- 3 a measurement of length of stoma
working;
answer;
- b clear outline + realistic shape + no shading;
larger than specimen;
chloroplasts;
thicker inner walls;

SUPERVISOR'S RESULTS

	T1	T2	T3
surface area / cm ²	1x1x6 = 6	0.5x0.5x6x8 = 12	[(0.5x1x4)+(1x1x2)] x 2 = 8
start time	0:07	0:12	0:19
end time	6:34	1:55	2:30
time taken / s	387	103	131

Name _____

Register No.	Class



BENDEMEER SECONDARY SCHOOL
2019 PRELIMINARY EXAMINATION
SECONDARY 4 EXPRESS
BIOLOGY
6093/01

DATE : 3 September 2019

DURATION : 1 hour

Write in 2B pencil.

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

Do not use paper clips, glue or correction fluid.

There are **forty** questions on this paper. Answer **all** questions.

For each question, there are four possible answers **A, B, C** and **D**.

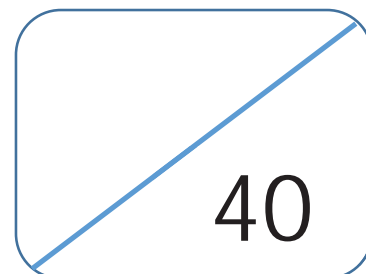
Choose the **one** you consider correct and record your choice in 2B pencil on the OTAS sheet.

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 on the question paper.

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

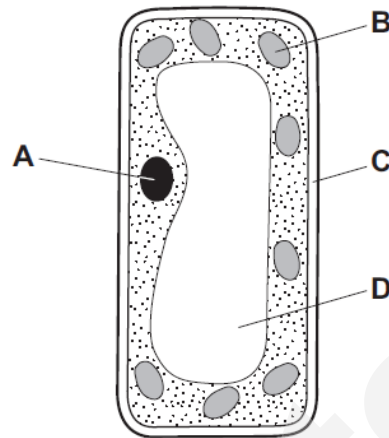


This document consists of **21** printed pages.

[Turn over

- 1 The diagram shows a palisade cell.

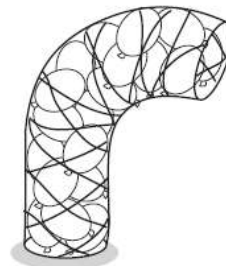
Which structure is the site of photosynthesis?



- 2 The diagrams show a cylindrical net packed with rubber balloons full of air. The structure is used by a teacher to explain wilting.



all the balloons
fully inflated



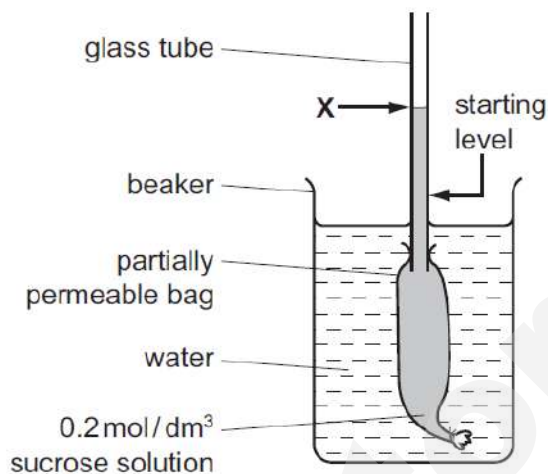
the same number of balloons
with some of the air let out

What is represented by the parts of the structure shown?

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

[Turn over

- 3 The diagram shows the result of an experiment. The liquid in the glass tube had risen to point X after three hours.

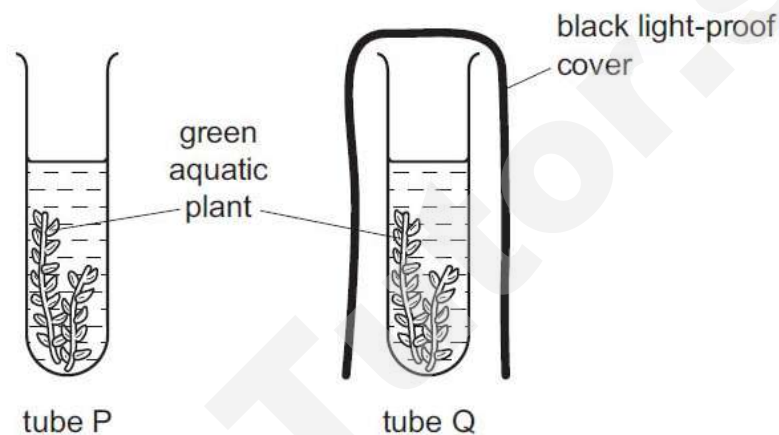


- In a second experiment, which change could be made to cause the liquid to rise higher than X?
- A a larger beaker
 - B a smaller bag
 - C water in the bag
 - D 0.4 mol / dm³ sucrose solution in the bag
- 4 Which process needs energy from respiration?
- A movement of carbon dioxide into the alveoli
 - B movement of oxygen into red blood cells
 - C uptake of glucose by cells in the villi
 - D uptake of water by root hair cells
- 5 Which substance is built up from amino acids?
- A glucose
 - B glycogen
 - C protein
 - D urea

- 6 Which property of enzymes is explained by the lock and key hypothesis?
- A All enzymes are proteins.
 - B Enzymes are inactive at very low temperatures.
 - C Human enzymes are most active just below 40 °C.
 - D Most enzymes can only catalyse one reaction.
- 7 Which is not a function of the liver?
- A conversion of glucose to glycogen
 - B storage of glycogen
 - C secretion of insulin
 - D synthesis of proteins from amino acids
- 8 The surface area of the small intestine is increased by the villi in the intestine wall.
- How does the increased surface area help absorption of digested materials?
- A It makes peristalsis more efficient.
 - B More mucus is produced for lubrication.
 - C More starch and protein can be absorbed.
 - D There is a greater chance of food molecules diffusing into the blood.

- 9 Two test-tubes, P and Q, were set up, each containing a solution of red hydrogencarbonate indicator. Hydrogencarbonate indicator turns yellow when the carbon dioxide concentration increases and turns purple when the carbon dioxide concentration decreases.

Similar pieces of the same aquatic plant were placed into tubes P and Q. Tube P was uncovered, and tube Q had a black light-proof cover. The tubes were left in a warm room in sunlight for four hours.



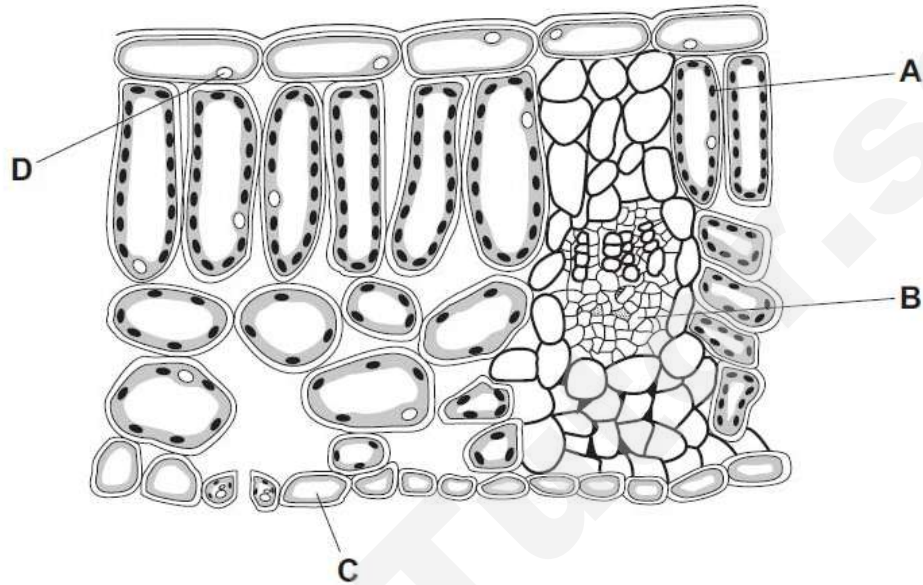
What is the colour of the hydrogencarbonate indicator in the two tubes after four hours?

	tube P	tube Q
A	purple	red
B	purple	yellow
C	red	yellow
D	yellow	red

[Turn over

- 10 The diagram represents a cross-section of part of a leaf as seen using a microscope.

Where does translocation (movement of sucrose and amino acids) occur?



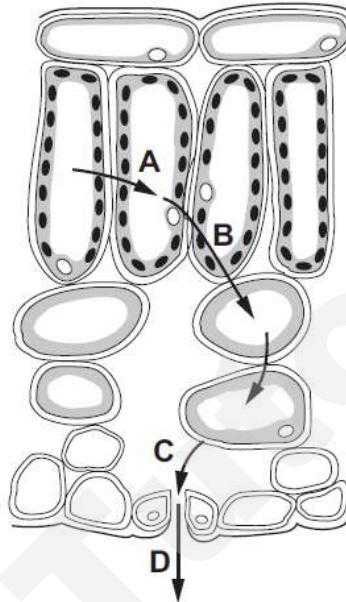
- 11 Water and ions can reach the xylem of a plant root through cell walls, without passing through a cell membrane.

How do these substances move through the cell walls?

	water	ions
A	diffusion	diffusion
B	diffusion	osmosis
C	osmosis	diffusion
D	osmosis	osmosis

- 12** The diagram shows the pathway of water molecules through part of a leaf, seen under a microscope, in transverse section.

Where does water evaporate?



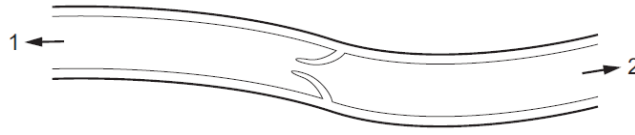
- 13** Which blood vessel transports blood into the liver?

- A** hepatic portal vein
- B** hepatic vein
- C** pulmonary vein
- D** renal vein

- 14** What is a difference between plasma and tissue fluid?

	plasma	tissue
A	dissolved glucose	no dissolved glucose
B	less dissolved glucose	more dissolved glucose
C	more protein molecules	fewer protein molecules
D	no white blood cells	white blood cells

- 15 The diagram shows a section through part of a vein.



What could be the first organs found in directions 1 and 2?

	1	2
A	heart	brain
B	intestine	liver
C	kidney	heart
D	lung	heart

- 16 The table shows the effect of exercise on the rate and depth of breathing.

	breathing rate / breaths per minute	volume of each breath / cm ³
at rest	12	500
after exercise	24	1000

What is the increase in the volume of air exchanged per minute after exercise, compared to at rest?

- A** 1000 cm³ **B** 6000 cm³ **C** 18 000 cm³ **D** 24 000 cm³

- 17** Two people of equal body mass do the same amount of exercise.

One person is in good health. The other person has emphysema.

The rate of oxygen entering each person's blood in the lungs is measured.

The results are shown in the table.

	healthy person	person with emphysema
oxygen entering blood in cm ³ per minute	22	12

Which statement explains these results?

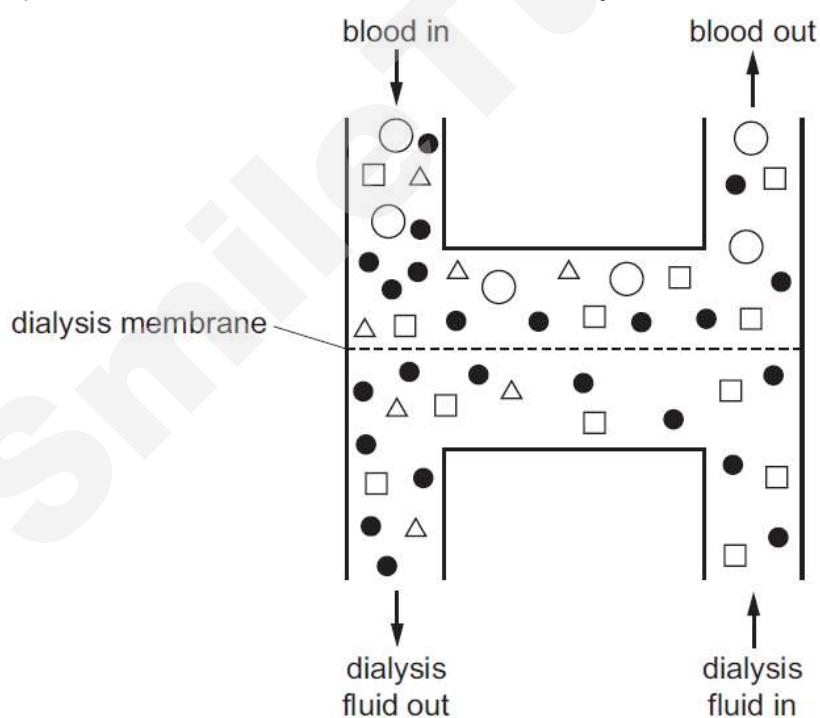
- A** The healthy person has a faster breathing rate.
 - B** The healthy person has a smaller lung volume.
 - C** The person with emphysema has damaged alveoli.
 - D** The person with emphysema has larger alveoli.
- 18** Which is produced during anaerobic respiration in muscles?
- A** carbon dioxide and water
 - B** carbon dioxide and lactic acid
 - C** carbon dioxide only
 - D** lactic acid only

- 19 An analysis of the composition of expired air is shown.

gas in expired air	% of expired air
carbon dioxide	4.1
oxygen	16.4
nitrogen and other gases	79.5

Using only data from the table, what percentage of the expired air is excreted material?

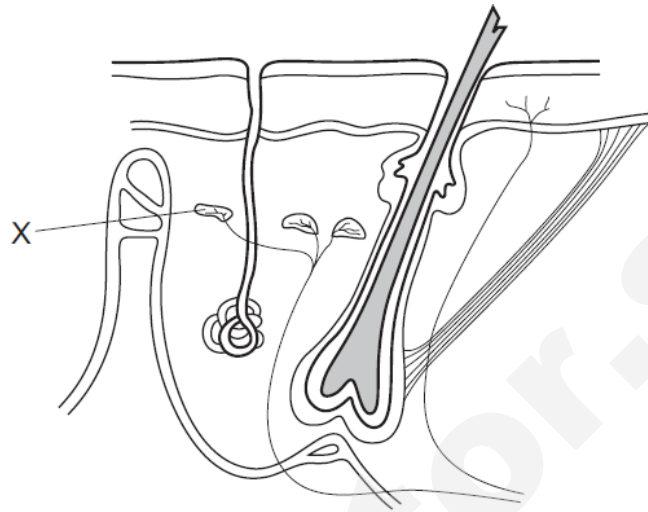
- A 0% B 4.1% C 83.6% D 100%
- 20 The diagram shows how a kidney dialysis machine works. Each shape represents a molecule found in blood or dialysis fluid.



Which shape represents urea?

- A ○ B ● C □ D △

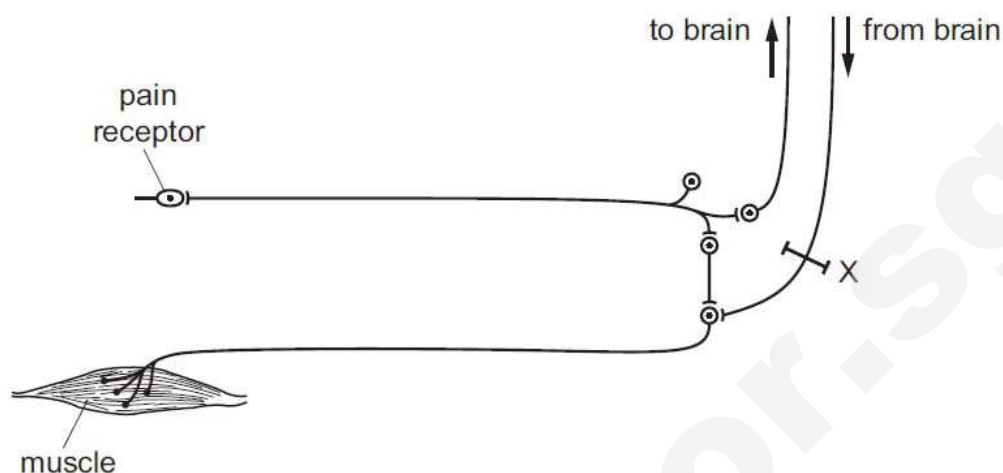
- 21 The diagram shows some of the structures seen in a section through human skin.



What is the function of structure X?

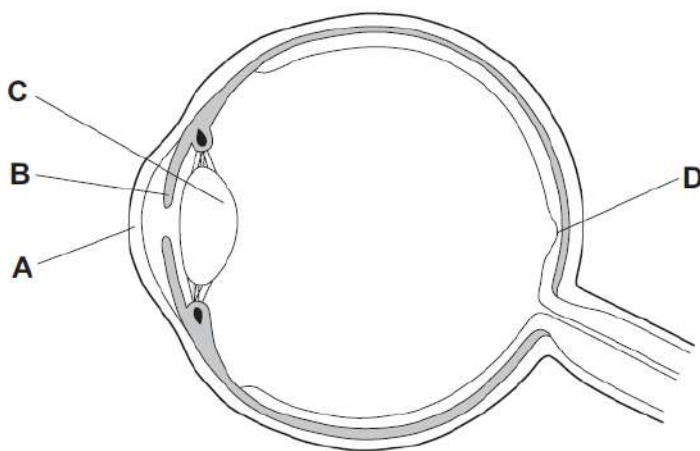
- A to cause capillaries to constrict
 - B to detect changes in temperature
 - C to receive impulses from the central nervous system
 - D to stimulate sweat glands to release sweat
- 22 Which of these is a reflex action?
- A increasing the blood glucose level by eating rice
 - B lifting a book off the table by contracting your arm muscles
 - C preventing an insect from flying into your eye by blinking
 - D using your brain to work out the answer to a problem

- 23 The diagram shows some of the nerve pathways associated with a reflex action.



If the pathway at X is damaged, how does this affect the reflex?

- A The person will not be aware that the reflex is occurring.
 - B The reflex cannot be controlled consciously.
 - C The response will occur without any stimulus.
 - D There is no response to the stimulus.
- 24 The diagram shows a section through an eye.
- Which part is the receptor for the stimulus that results in a change in the size of the pupil?



- 25** A person looks at some hills far away.

Which row shows the state of the lenses, ciliary muscles and suspensory ligaments in her eyes?

	thick lenses	contracted ciliary muscles	suspensory ligaments under tension
A	✓	✓	✓
B	✓	X	X
C	X	✓	X
D	X	X	✓

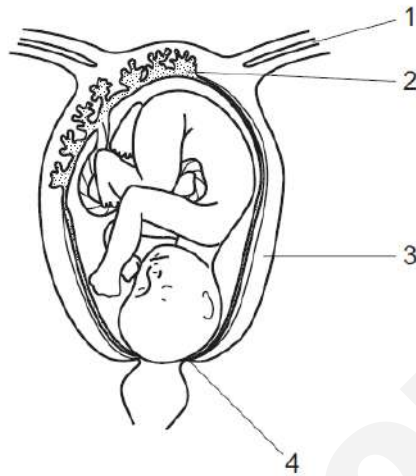
- 26** What are characteristics of hormones?

	affect target organs	carried by the blood	produced by glands
A	✓	✓	✓
B	✓	✓	X
C	✓	X	✓
D	X	✓	✓

- 27** In which part of the human female reproductive system does a zygote start to divide to form a ball of cells?

- A** cervix
- B** ovary
- C** oviduct
- D** uterus

- 28 The diagram shows a baby about to be born.



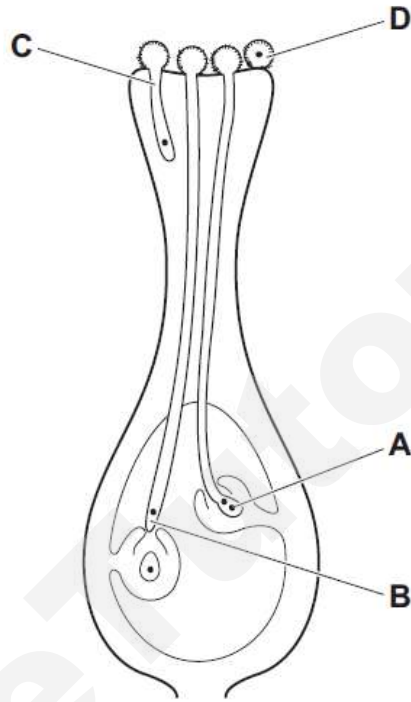
Which labelled structures are the cervix and uterus?

	cervix	uterus
A	1	2
B	2	1
C	3	4
D	4	3

- 29 Which plants are most likely to adapt successfully to a climate change in their environment?

- A** plants that are cross-pollinated
- B** plants that do not rely on wind-pollination
- C** plants that grow rapidly
- D** plants that reproduce asexually

- 30 The diagram shows the stigma, style and ovary of a flower.
Where does fertilisation take place?

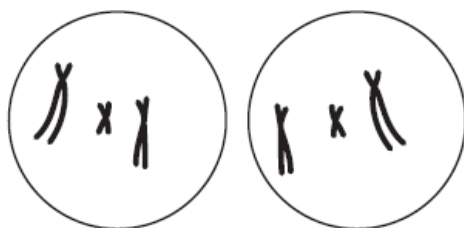


- 31 The diagram shows the chromosomes in a cell.



Which diagram shows the product of one division of the cell by mitosis?

A



B



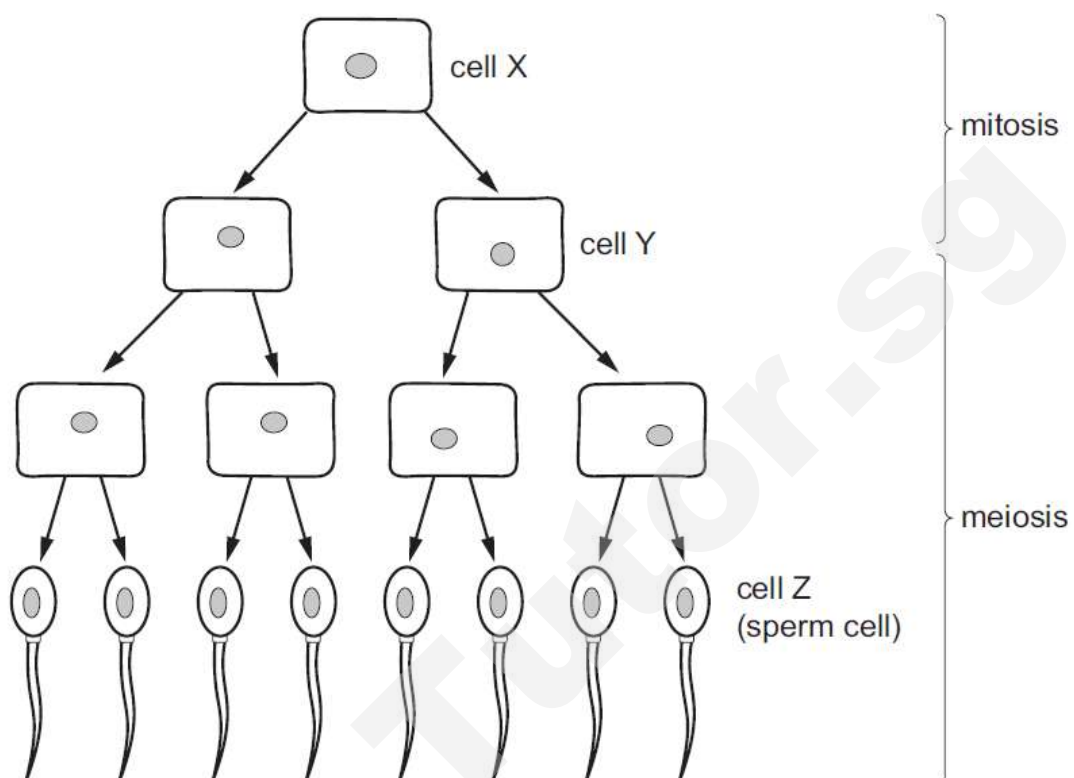
C



D



32 The diagram shows some stages in cell division in a fruit fly.



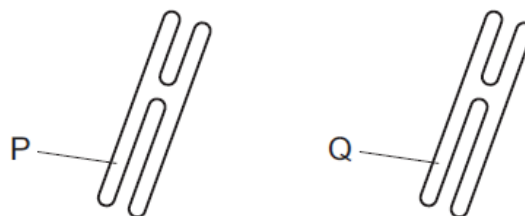
Cell X contains 8 chromosomes.

How many chromosomes are in cell Y and in cell Z?

	cell Y	cell Z
A	4	4
B	4	8
C	8	4
D	8	8

[Turn over

- 33** The diagram shows a pair of chromosomes from the same cell.



A gene is found at the point labelled P.

In a heterozygous individual, what will be found at the equivalent position labelled Q?

- A** a different allele of a different gene
 - B** a different allele of the same gene
 - C** a different gene of the same allele
 - D** the same gene of the same allele
- 34** Which statements about genes and chromosomes are correct?

	A chromosome carries a molecule of DNA.	A gene is a section of DNA.
A	true	true
B	true	false
C	false	true
D	false	false

- 35** The table shows the variation in foot length in a number of students.

foot length/ cm	number of students
20.0–20.9	0
21.0–21.9	5
22.0–22.9	12
23.0–23.9	15
24.0–24.9	17
25.0–25.9	8
26.0–26.9	0

Which row identifies this type of variation and states its cause?

	type of variation	cause
A	continuous	genes and the environment
B	continuous	genes only
C	discontinuous	environment only
D	discontinuous	genes and the environment

- 36** The colour of the fruit of tomato plants is determined by alleles of the same gene. A tomato plant with red fruit was crossed with a tomato plant with yellow fruit. Of the offspring, 26 plants had red fruit and 24 had yellow fruit.

Three explanations were suggested.

- 1 Both parents were homozygous.
- 2 One parent had two recessive alleles.
- 3 One parent was heterozygous.

Which explanations are correct?

- A** 1 only **B** 3 only **C** 1 and 2 **D** 2 and 3
- 37** Diabetes may be treated using insulin from genetic engineering.

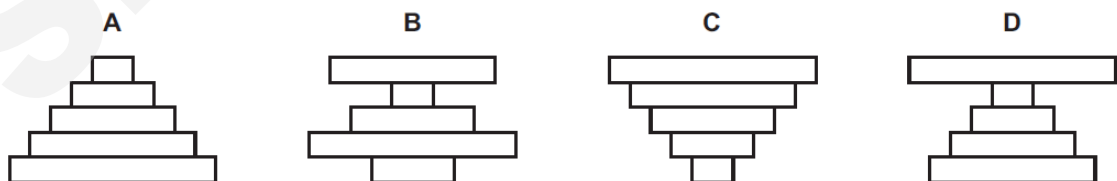
Where is this insulin produced?

- A** bacterial cytoplasm
B bacterial nucleus
C human liver
D human pancreas

- 38** A food chain is shown.

grain → insects → small birds → owls → lice

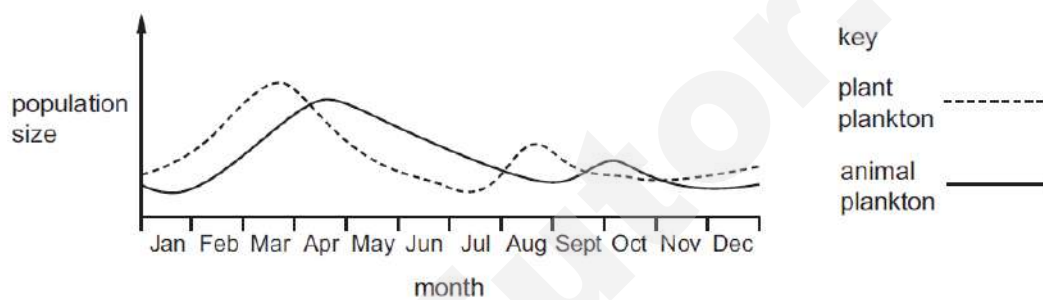
What is the pyramid of numbers for this food chain?



39 In the carbon cycle, which process returns carbon to a food chain?

- A combustion
- B decomposition
- C photosynthesis
- D respiration

40 The graph shows changes in the populations of plant and animal plankton in a lake.



Consider the following statement in relation to the data provided by the graph.

‘Population changes in animal plankton lag behind similar changes in plant plankton because the animals feed on the plants.’

Into which category does the statement fall?

- A It is a reasonable interpretation of the data.
- B It is a restatement of the data, not an interpretation.
- C It is contradicted or not supported by the data.
- D More data is required in order for this interpretation to be made.

END OF PAPER



Name _____

Register No.	Class

BENDEMEER SECONDARY SCHOOL
2019 PRELIMINARY EXAMINATION
SECONDARY 4 EXPRESS
BIOLOGY
6093/02

Date : 28 August 2019

Duration: 1 h 45 min

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on the work handed in.

Write in dark blue or black pen.

You may use a 2B pencil for any diagrams or graphs.

Do not use paper clips, glue or correction fluid.

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 (50 marks)

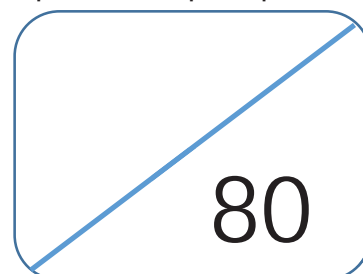
Answer **all** questions. Write your answers in the spaces provided on the question paper.

Section B (30 marks)

Answer **all** questions. Write your answers in the spaces provided on the question paper.

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

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



Section A

Answer **all** questions.

Write your answer in the spaces provided.

- 1 Fig. 1.1 shows the bud of an insect-pollinated flower and a magnified transverse section through the same flower bud. The transverse section was taken at the position shown by the dotted line.

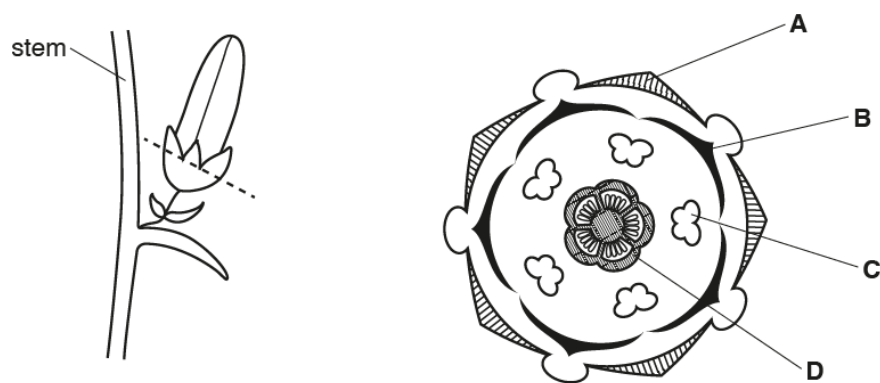


Fig. 1.1

- (a) Write the name of each of the structures **A** to **D**.

A:

B:

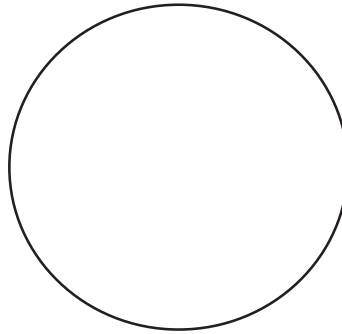
C:

D:

[4]

[Turn over

- (b) The diagram shows an incomplete transverse section through the stem of this plant.



- (i) Complete the diagram by drawing and labelling the positions of each of the following tissues:

- xylem,
- phloem.

[2]

- (ii) State one function of xylem tissue.

.....

..... [1]

[Total: 7]

[Turn over

- 2 Fig. 2.1 shows a person about to lift the handle of a bucket from position **A** to position **B**.

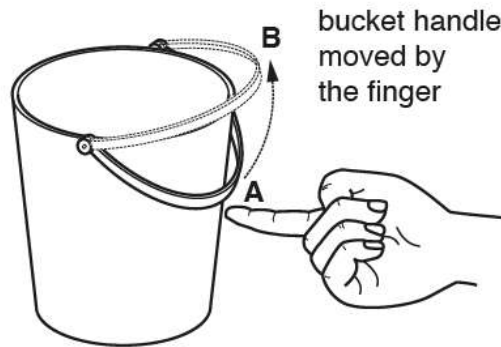


Fig. 2.1

The movement of the bucket handle, as shown, illustrates some features of the movement of a person's chest while breathing in.

- (a) State two similarities between the movement of a person's chest while breathing in and the movement of the handle.

1

2

[2]

- (b) Explain the differences between the movement of a person's chest and the movement of the handle.

.....

.....

.....

.....

.....

.....

.....

..... [5]

[Total: 7]

[Turn over

- 3 Fig. 3.1 shows a Bengal tiger.



Fig. 3.1

Fur colour in the Bengal tiger is controlled by a single gene. The dominant allele of the gene results in orange fur. A single change in this gene produces a recessive allele, which results in white fur in tigers with the homozygous recessive genotype.

- (a) Define the term *gene*.

.....

 [3]

- (b) Using the letters **T** (orange) and **t** (white) to represent the alleles that control fur colour, draw a labelled genetic diagram to show how two tigers with orange fur may give rise to offspring with white fur.

[4]

[Total: 7]

[Turn over

- 4 Fig. 4.1 shows cells from a plant tissue which have been mounted on a slide with distilled water and viewed using a microscope.

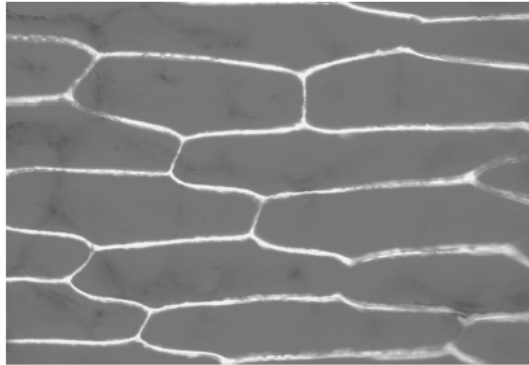


Fig. 4.1

Fig. 4.2 shows cells taken from the same plant tissue when mounted on a slide with concentrated salt solution.

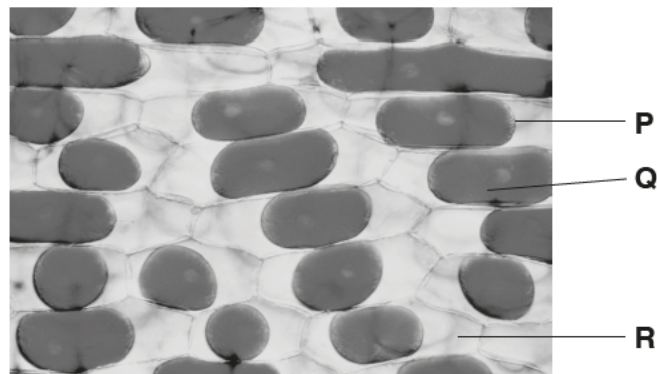


Fig. 4.2

- (a) Explain the appearance of the cells in Fig. 4.2.

.....

 [3]

- (b) Identify structures **P** and **Q** in Fig. 4.2.

P **Q** [2]

- (c) State the contents of location **R** in Fig. 4.2.

..... [1]
 [Total: 6]

[Turn over

- 5 Ivy is a plant with green leaves that vary in size. A student noticed that ivy leaves were different in width on plants growing in shady positions compared with plants growing in bright, sunny positions.

To investigate this further, she collected a sample of 10 leaves from plants growing in shady positions and 10 leaves from plants growing in sunny positions.

Some of these leaves are shown in Fig. 5.1.

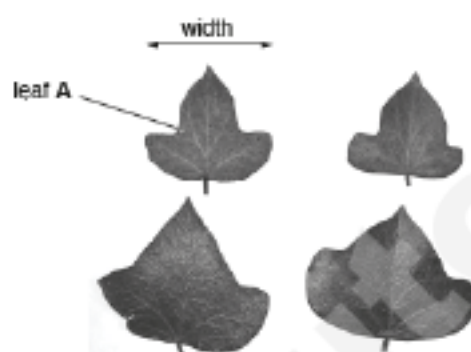


Fig. 5.1

The student measured the maximum width of the 20 leaves she collected. The results are shown in Table 5.1.

Table 5.1

leaf number	maximum width of leaf from shady position/ mm	maximum width of leaf from sunny position/ mm
1	38	43
2	48	35
3	49	29
4	54	39
5	43	34
6	46	30
7	40	29
8	47	35
9	43	31
10	54	22
mean maximum width/ mm		

[Turn over

(a) Complete Table 5.1 by calculating the mean maximum width of leaves from a shady and sunny position respectively. [2]

(b) State two conclusions that can be made from the results in Table 5.1.

- 1
.....
- 2
..... [2]

(c) Suggest how having different sized leaves in shady and sunny positions might be an advantage to the ivy plant.

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

[Total: 7]

[Turn over

6 Fig. 6.1 shows the human male reproductive organs and associated structures.

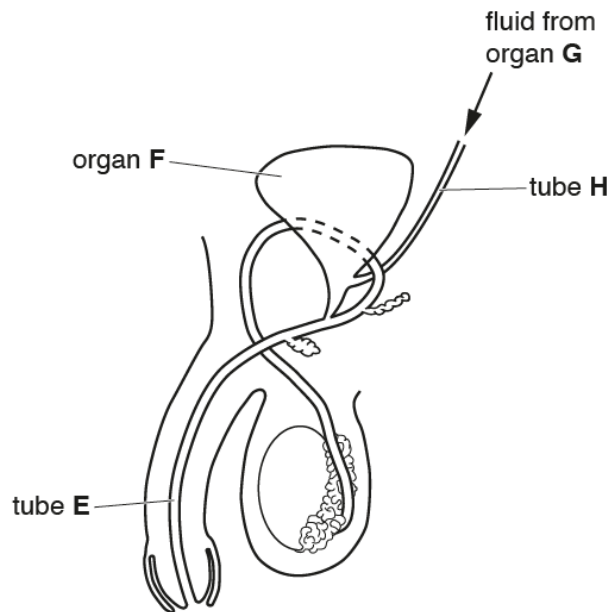


Fig. 6.1

(a) Identify each of the following:

- (i) tube E
- (ii) organ F
- (iii) organ G
- (iv) tube H

[4]

(b) State one difference between the fluids carried by tube E and tube H.

.....
 [1]

(c) State one way in which the fluid from organ G may be different in a person with diabetes compared to a person without diabetes.

.....
 [1]

[Total: 6]

[Turn over

- 7 Fig. 7.1 shows the relationships between a number of organisms living together in a South American rainforest.

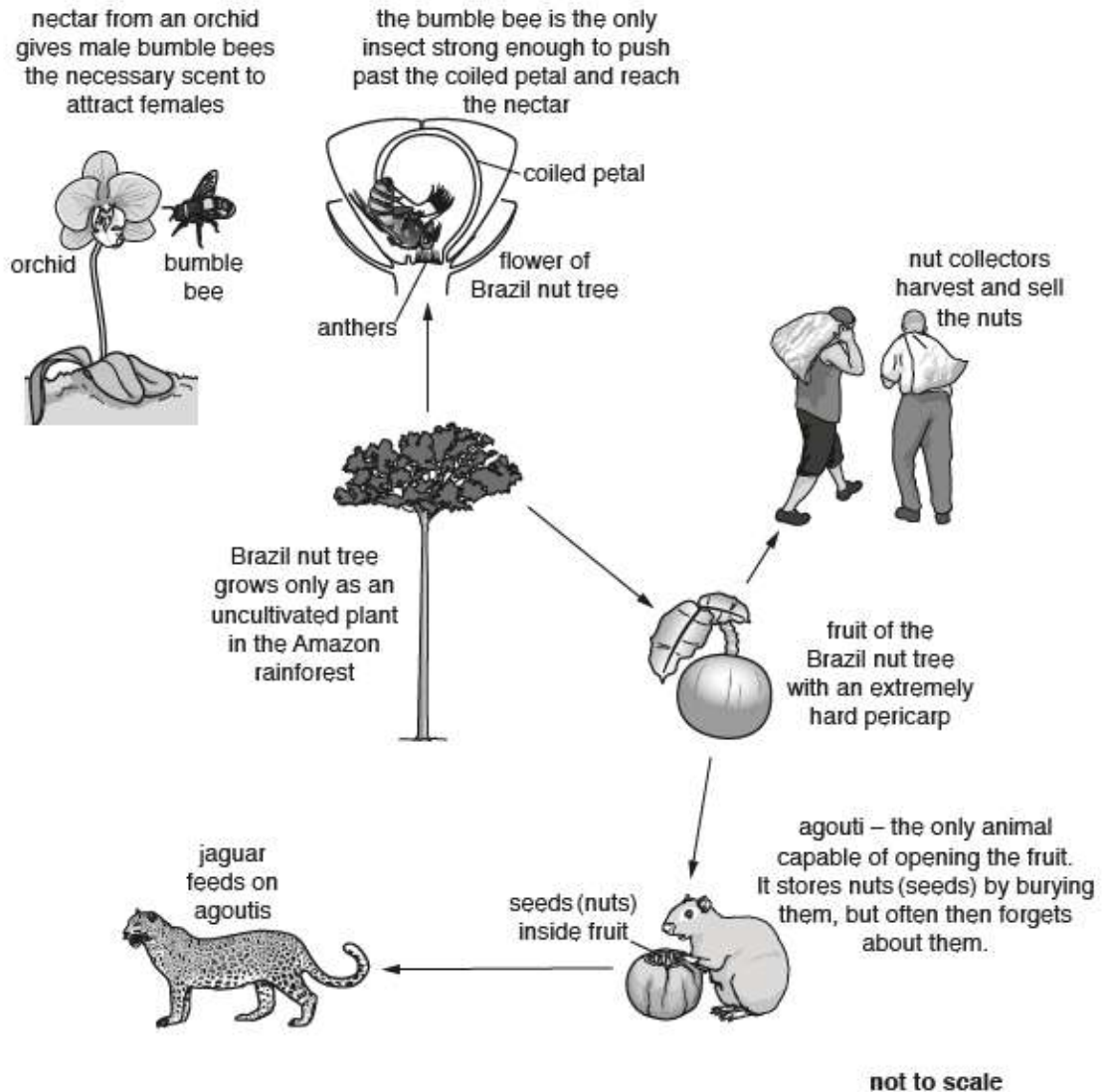
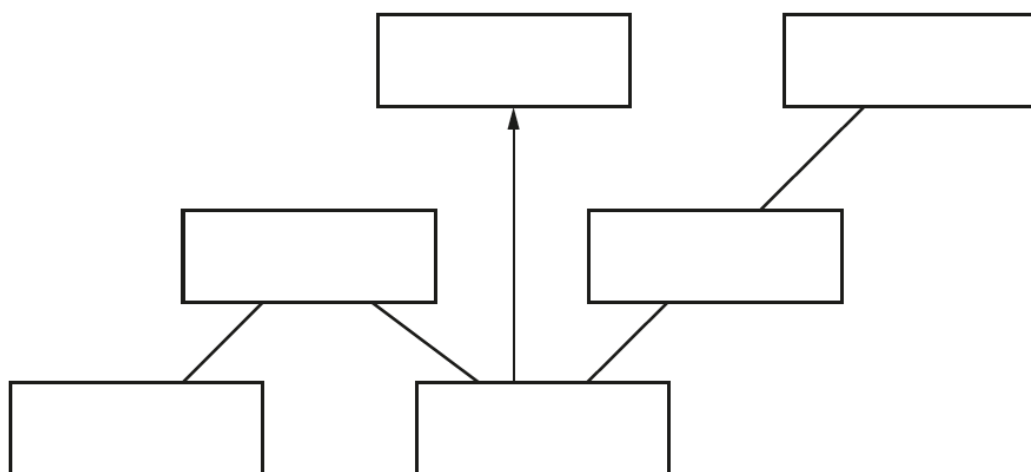


Fig. 7.1

(a) Fig. 7.2 is an incomplete food web for these organisms.

Complete Fig. 7.2 by:

- writing the name of an organism in each box,
- completing the arrows to show the flow of energy.



[4]

Fig. 7.2

(b) Suggest the possible effects on the community in the rainforest if the orchids were killed by disease.

.....

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.....

.....

..... [6]

[Total: 10]

[Turn over

Section B

Answer **three** questions.

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

- 8** Catalase is an enzyme found in many tissues. Catalase breaks down hydrogen peroxide, forming water and oxygen.

Fig. 8.1 shows the apparatus used by a student to investigate the effect of pH on the activity of catalase. The gas syringe was used to measure the volume of oxygen produced at each pH.

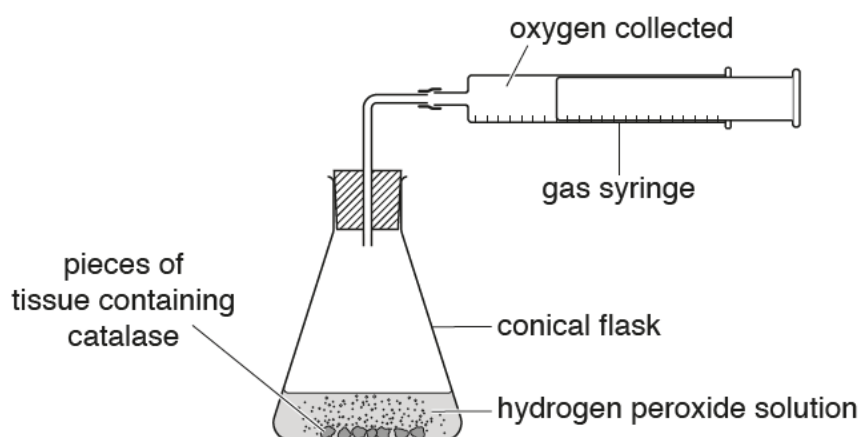


Fig. 8.1

The student carried out the experiment at a pH of 7.0 and measured the volume of oxygen produced during a period of five minutes.

He then mixed fresh samples of tissue containing catalase, and hydrogen peroxide solution at pH values of 5.0, 6.0, 8.0 and 9.0 and measured the volume of oxygen produced during the five minutes for each pH.

The results are shown in Table 8.1.

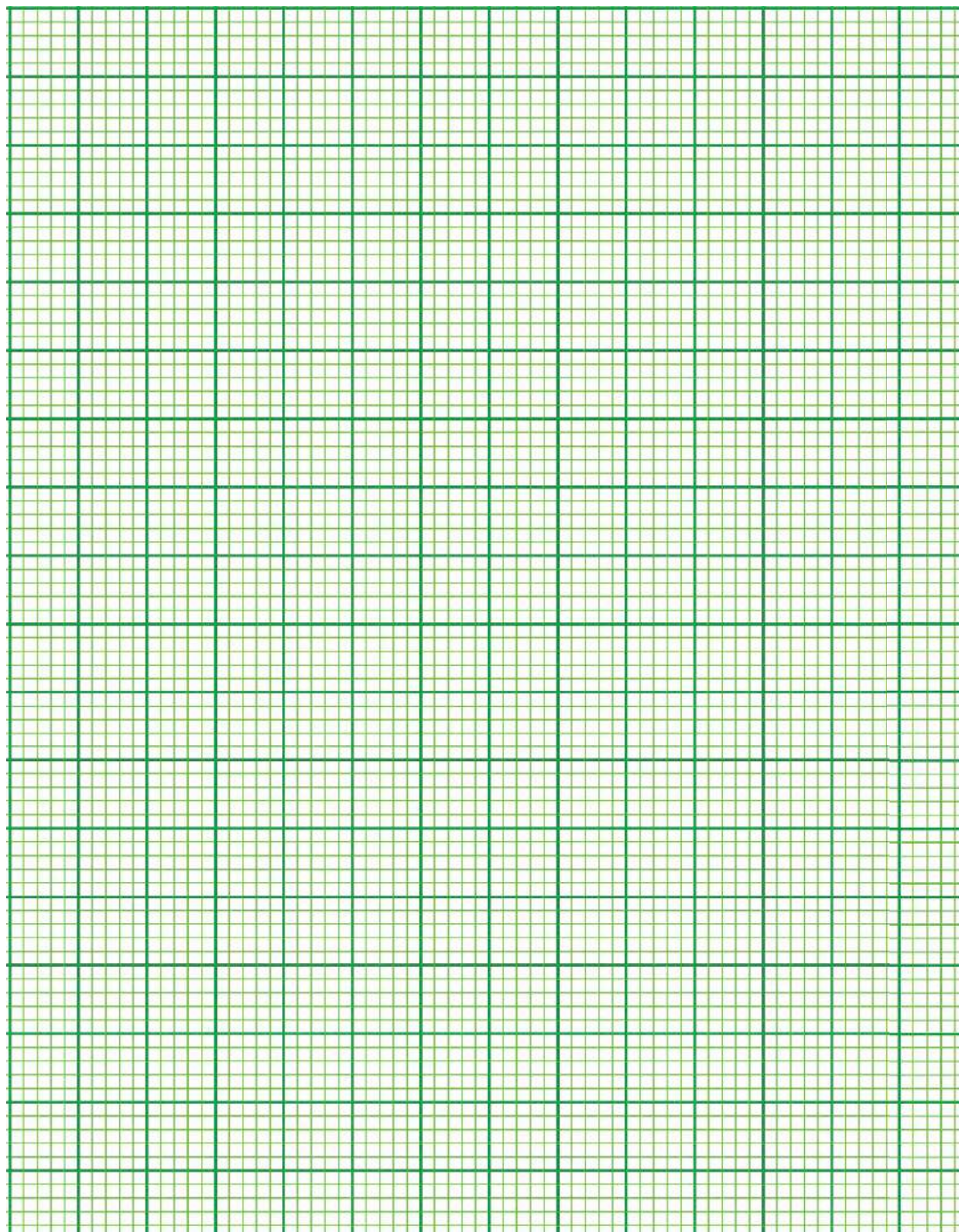
Table 8.1

pH	volume of oxygen produced during five minutes/ cm ³
5.0	12
6.0	45
7.0	88
8.0	57
9.0	8

[Turn over

- (a) Using the data in Table 8.1, plot a line graph to show the effect of pH on the activity of catalase.

Join the points on your graph with ruled, straight lines.



[4]

[Turn over

- (b) Using the information in Table 8.1 and your graph, describe the effect of pH on the activity of catalase.

.....

.....

.....

.....

..... [3]

- (c) The enzyme Savinase® is a protease used in many biological detergents. Biological detergents are used to wash clothes. Fig. 8.2 shows the effect of temperature on the activity of Savinase®.

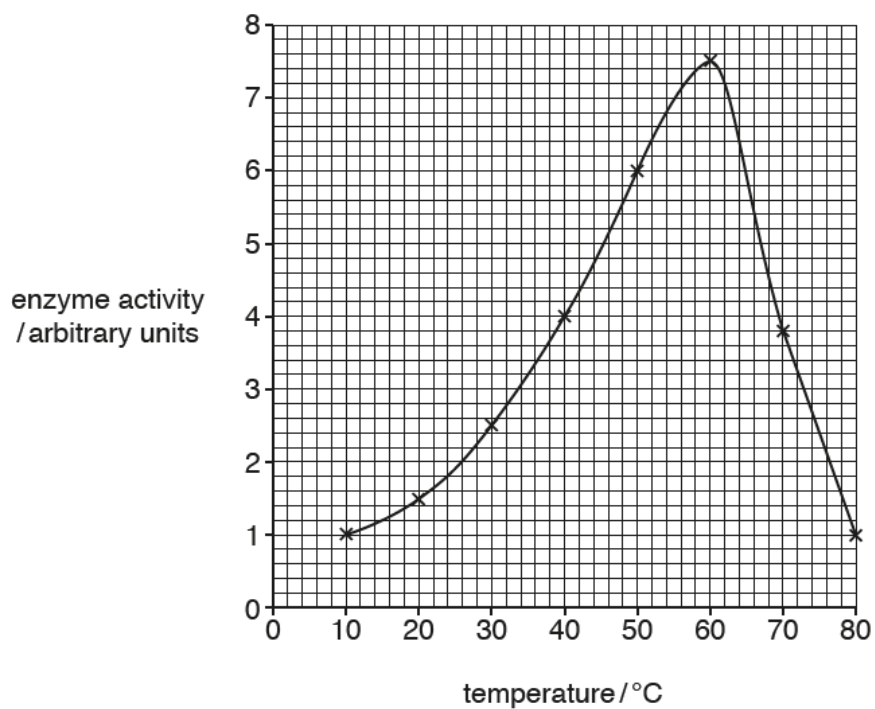


Fig. 8.2

- (i) Use Fig. 8.2 to find the optimum temperature for Savinase® activity.
..... [1]
- (ii) Suggest why Savinase® is added to biological detergents.
.....
.....
..... [2]

[Total: 10]

[Turn over

- 9 Fig. 9.1 shows the stages in the process of genetic engineering to produce the hormone insulin.

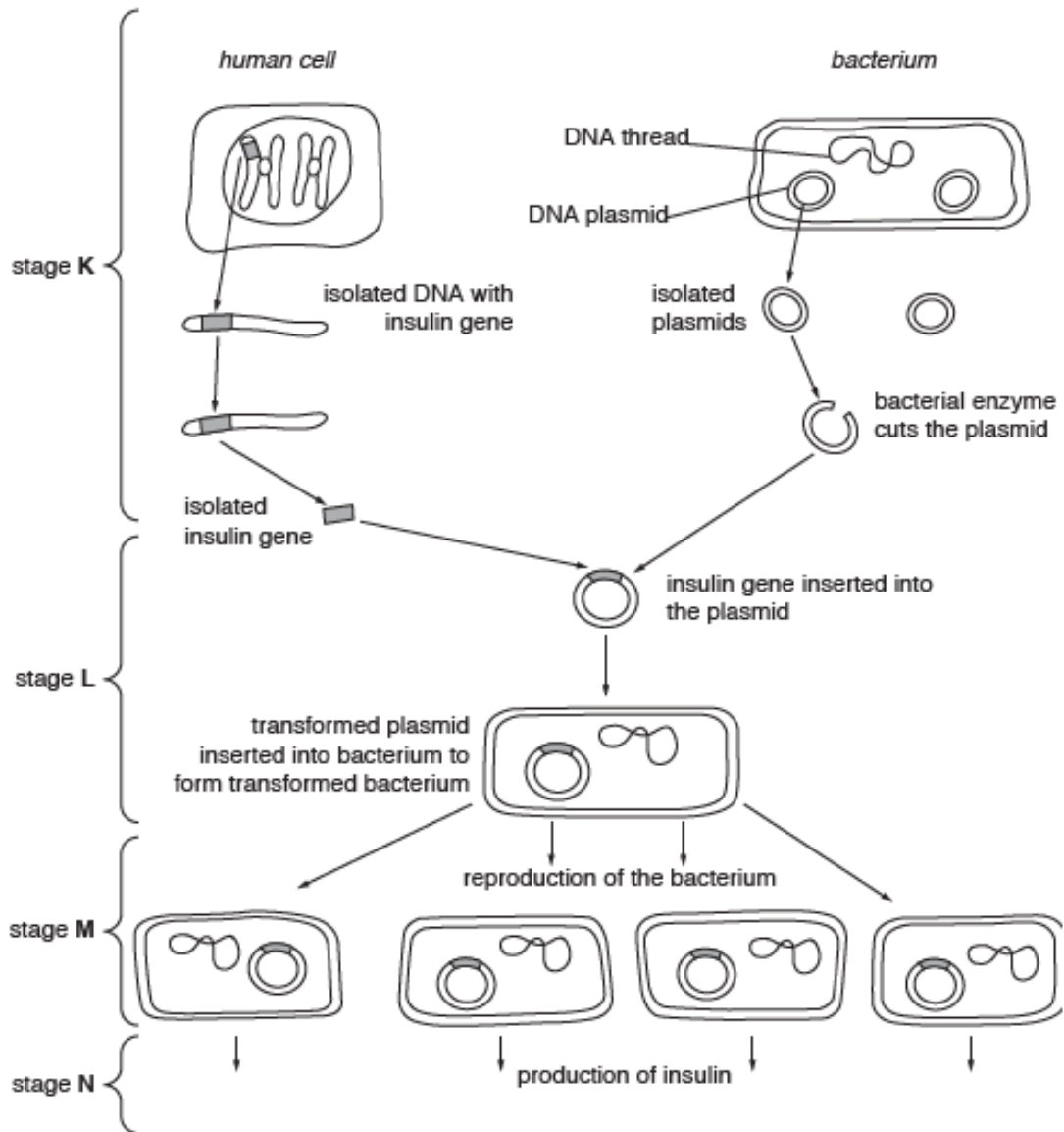


Fig. 9.1

- (a) Describe how the location and organisation of genetic material in the human cell shown in stage **K** of Fig. 9.1 is different from that in the bacterial cell shown.

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

- (b) Use your knowledge of bacterial cells to name two structures that the transformed plasmid must pass through to form a transformed bacterium in stage **L** of Fig. 9.1.

..... and [2]

- (c) State the type of reproduction that takes place in stage **M** of Fig. 9.1. Use your knowledge of the process of cell division to explain why it is important that this type of reproduction occurs.

type of reproduction
explanation
.....
..... [2]

- (d) Genetic engineering can also be used to produce crop plants for humans to eat.

Discuss the potential advantages and dangers of using genetic engineering to produce crop plants for humans to eat.

advantages

.....

.....

.....

dangers

.....

.....

..... [4]

[Total: 10]

[Turn over

10 Either

Although skin is a waterproof structure, a few chemicals are able to pass through the tissues of the skin. When a person places a finger in a solution of one of these chemicals, it is possible for that chemical to enter the circulatory system and be carried to the tongue. The person then experiences the sensation of taste.

- (a) Describe the pathway followed by this particular chemical from the finger until it reaches the tongue.

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..... [7]

- (b) Describe the part played by the nervous system to enable the person to experience the sensation of taste.

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..... [3]

[Total: 10]

[Turn over

10 Or

(a) Explain the importance of haemoglobin to a human being.

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..... [4]

(b) Explain the importance of villi to a human being.

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..... [6]

[Total: 10]

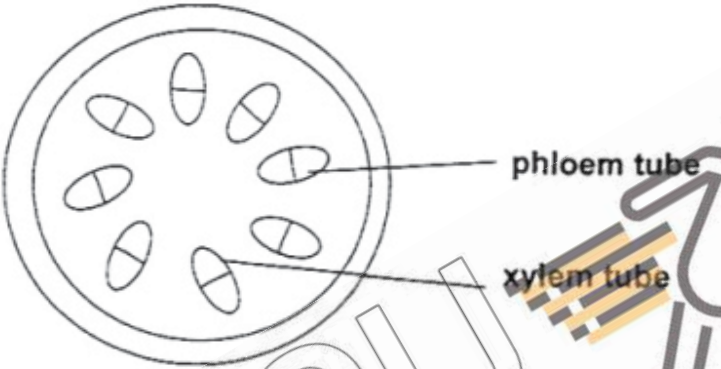
END OF PAPER

2019 Pure Biology 4E Preliminary Examination Mark Scheme

Paper 1 (40 marks)

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

Paper 2 Section A (50 marks)

1(a)	A: Sepal; B: Petal; C: Stamen/ anther/ filament; D: Ovary/ carpel/ pistil	1 1 1 1
(b) (i)	<p>1 one or more vascular bundles + each oval shaped + location correct ;</p> <p>2 'xylem' labelled on inside + 'phloem' labelled separately on outside of at least one oval vascular bundle ;</p> 	1 1
(ii)	<p>1 transports / carries AW + water / ions / minerals ;</p> <p>or</p> <p>2 support ;</p>	Any 1
		Total: 7
2(a)	<p>1 any reference to up / rises / raised ;</p> <p>2 out / forwards ;</p> <p>3 reference to muscle ;</p> <p>4 (muscle) contract(ion) ;</p> <p>5 reference to (requires) energy ;</p>	Max 2
(b)	<p>movement of person's chest)</p> <p>1 involuntary AW ;</p> <p>2 intercostal (muscles) ;</p> <p>3 (muscles) between the ribs / in the chest (wall) ;</p> <p>4 (move) bone / ribs / ribcage ;</p> <p>5 attached / hinged + to vertebrae / backbone / at back ;</p> <p>6 *leads to increase in volume / decrease in pressure ;</p> <p>(movement of bucket handle)</p> <p>7 voluntary AW ;</p> <p>8 muscle in arm / finger OR reference to bicep(s) ;</p> <p>9 external to / not part of + the bucket / handle ;</p> <p>10 (move) metal / plastic OR reference to a single handle ;</p> <p>11 attached / hinged + to bucket / at side ;</p> <p>12 *does not lead to change in volume / pressure ;</p> <p>*accept once for either chest muscle or handle</p>	Max 5
		Total: 7

3(a)	section of / made of / piece of + DNA / chromosome ; controls production of one protein ; may be copied ; unit of inheritance / passed on to next generation ;	Max 3
(b)	Parental genotype: Tt + Tt ; Gametes: t + t ; Offspring genotype: tt ; Offspring phenotype: tt offspring clearly indicated as white ; * At least 3 labels on genetic diagram correct	1 1 1 1
		Total: 7
4(a)	membrane or P / cytoplasm or Q / pulling away from wall/ plasmolysed / plasmolysis / flaccid ; water potential / concentration + lower outside than inside cells ORA ; water molecules + out of cells by osmosis ; through + partially AW permeable membrane ;	Max 3
(b)	(P) membrane ; (Q) cytoplasm ;	1 1
(c)	Salt solution	1
		Total: 6
5(a)	mean width of leaves from shady position = 46.2 (mm) ; mean width of leaves from sunny position = 32.7 (mm) ;	1 1
(b)	leaves from a shady position have a higher mean width ; leaves from a sunny position have more variable widths ;	1 1
(c)	leaves from shady place have a larger surface / area ; to trap more / available light ; for photosynthesis ; OR leaves from sunny position have smaller surface / area ; lose less water/ less evaporation ; due to transpiration ;	Max 3
		Total: 7
6(a)	(i) urethra (ii) bladder (iii) kidney (iv) ureter	1 1 1 1
(b)	semen / seminal fluid / sperm / gametes + carried by E / not carried by H ;	1
(c)	(contains) glucose ;	1
		Total: 6
7(a)	Top line (LHS) humans AW / nut collectors + (RHS) jaguars ; Middle line (LHS) bees + (RHS) agoutis ; Lower line (LHS) orchids + (RHS) (brazil nut) tree ; 4 four arrow heads drawn + all pointing upwards ;	1 1 1 1
(b)	1 less nectar ; 2 male bees + lack scent ;	Max 6

	3 female bees + not attracted ; 4 less reproduction of bees ; 5 less pollination + of trees ; 6 less trees ; 7 less nut / fruit production ; 8 loss of jobs (for humans) / negative economic impact AW ; 9 less food for agoutis ; 10 death / reduced population + of agoutis OR agoutis seek other food ; 11 less food for jaguars ; 12 death / reduced population + of jaguars OR jaguars seek other food ;	
		Total: 10

Paper 2 Section B (40 marks)

8(a)	axes correct orientation and both axes labelled fully ; linear scale for both axes ; all 5 points visibly plotted correctly ; plotted points joined with ruled lines and no extrapolation ;	1 1 1 1
(b)	activity / volume of oxygen produced increases as pH increases ; reaches a peak / AW at pH 7 ; then decreases ;	1 1 1
(c)(i)	60 (°C) ;	1
	breaks down protein (stains) ; named protein stain e.g. blood / food / milk ; not denatured / deactivated by hot water / AW ;	Max 2
		Total: 10
9(a)	in nucleus (human) / within nuclear membrane ORA ; in cytoplasm (bacteria) ; thread + plasmid(s) (bacteria) ; correct reference to chromosomes AW ; genes / chromosomes paired (human) ;	Max 2
(b)	(cell) wall ; (cell) membrane ;	1 1
(c)	type: asexual / binary fission / mitosis ; explanation: genetically + identical (cells produced) OR clones ; all capable of producing insulin / same product ; Accept: to produce insulin in large quantities / to produce a large number of bacteria / produce bacteria quickly	Max 2

(d)	<p>potential advantages: increased yield / more profitable / grow quicker / reduce famine AW ; able to grow in environmental extremes / grow in new areas ; more predictable results than selective breeding / more certain; able to transfer (beneficial) genes / features between species; nutritionally improved / visually improved / desirable outcome e.g. uniform shape ; disease / pest resistance ;</p> <p>potential dangers: risk of genetic spread to other species ; may be patented / costs too much ; possible (unknown) risk to health of other species ; possible (unknown) risk</p>	<p>Max 4</p> <p>Max 3 marks for each of advantages / dangers.</p>
		Total: 10
EITHER 10 (a)	<p>#diffusion ; epidermis / any layer of correctly named ; dermis ; #tissue fluid / plasma ; #capillary ; ----- venule / vein / vena cava ; A → *R.A + R.V. ; → correct ref. pulmonary circulation (either artery or vein) ; B → lungs ; → *L.A. + L.V. ; C → aorta / artery / arteriole ; (marks for A, B and C can be awarded if individually correct within an otherwise confused account) (* or one for heart – also available within a confused account) (# mark available anywhere so long as in correct context)</p>	Max 7
(b)	<p>stimulus / stimulates (R detects) ; receptor / taste bud / sensor / nerve or sensory endings ; sensory neurone (R nerve) ; impulses (R messages) ; brain / C.N.S. (ignore refs to spinal cord) ;</p>	Max 3
		Total: 10
OR 10 (a)	<p>absorbs + quickly ; and carries ; oxygen ; as oxyhaemoglobin ; in red blood cells ;</p>	Max 4
(b)	<p>large surface area ; uptake from ileum/small intestine ;</p>	Max 6

	*of amino acids ; *of glucose ; into blood capillaries ; *fats/fatty acids/glycerol ; into lacteals ; (* allow one for digested foods)	
		Total: 10

Name

Class			
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Index Number		
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BROADRICK SECONDARY SCHOOL

SECONDARY 4 EXPRESS

PRELIMINARY EXAMINATION 2019

BIOLOGY

6093/01

Paper 1 Multiple Choice

Sep 2019

Additional Materials: Multiple Choice Answer Sheet

1 hour

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your name, index number and class on the OTAS answer sheet.

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 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 question paper consists of **20** printed pages including this page.

[Turn over

1. Which of the following is found in all living cells?

- A centrioles and nucleus
- B chloroplast and protoplasm
- C golgi apparatus and cell membrane
- D vacuole and cell wall

2. The diagram below shows a general animal cell.

Which of the structures would be involved in the final secretion of digestive enzymes from this cell?



3. A few leaves of purple cabbage were placed in a beaker of water for 10 minutes. The water remained colourless after the 10 minutes. The beaker was then heated to 100°C for 5 minutes. After boiling, the water turned purple.

Which of the following best explains this observation?

- A The pigments gained more kinetic energy upon heating and were able to diffuse out of the leaves quickly, hence the coloured water in just 5 minutes.
- B The cell walls were denatured upon heating, allowing the pigment to diffuse into the water.
- C During the boiling, the cell membranes were damaged, hence allowing the pigment to diffuse into the water.
- D Heating increases the solubility of the pigment, thus colouring the water purple.

4. Which of these processes require energy from respiration?

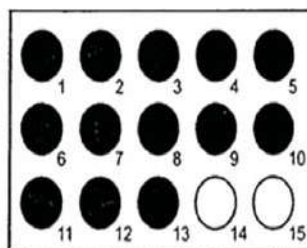
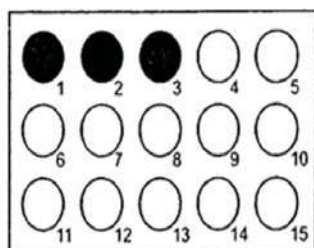
	Diffusion	Osmosis
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

Key:
 ✓ energy required
 ✗ energy not required

5. An experiment was carried out to investigate the digestion of starch using amylase at two different temperatures, 10°C and 40°C. A sample is taken every 15 seconds and placed into each well as shown below.

Each well contains 2 drops of iodine solution and 15 samples were taken from each temperature condition.

The results are shown below.



Key:

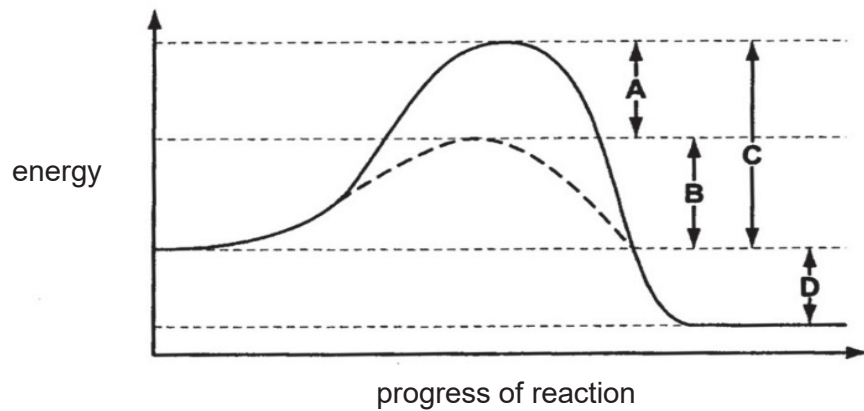
● blue-black
 ○ yellow- brown

Which of the following shows the correct temperatures and times for the complete digestion of starch?

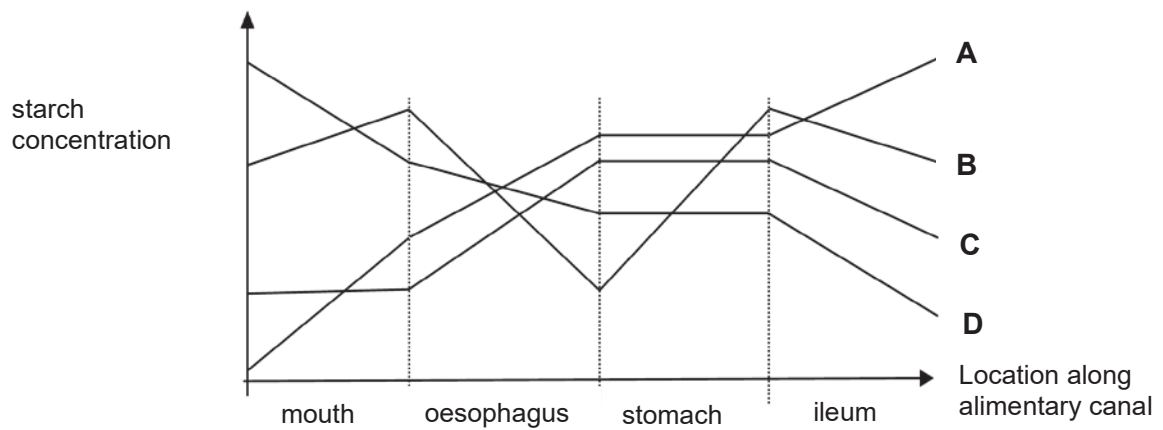
	Temperature / °C	time/s
A	10	60
	40	210
B	10	210
	40	60
C	40	45
	10	195
D	40	195
	10	45

6. The graph shows changing energy levels during a reaction, with and without the presence of the enzyme specific to this reaction.

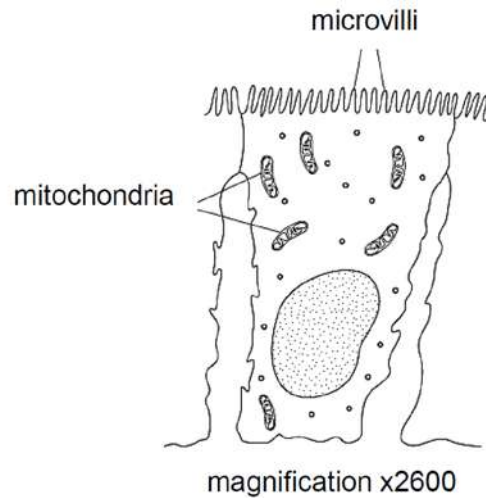
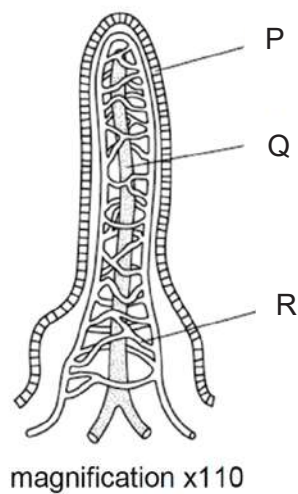
What is the activation energy of the reaction without the presence of the enzyme?



7. Which graph represents the activity of amylase in starch digestion?



8. The diagrams show a villus from the small intestine and an enlarged view of a cell from region P.

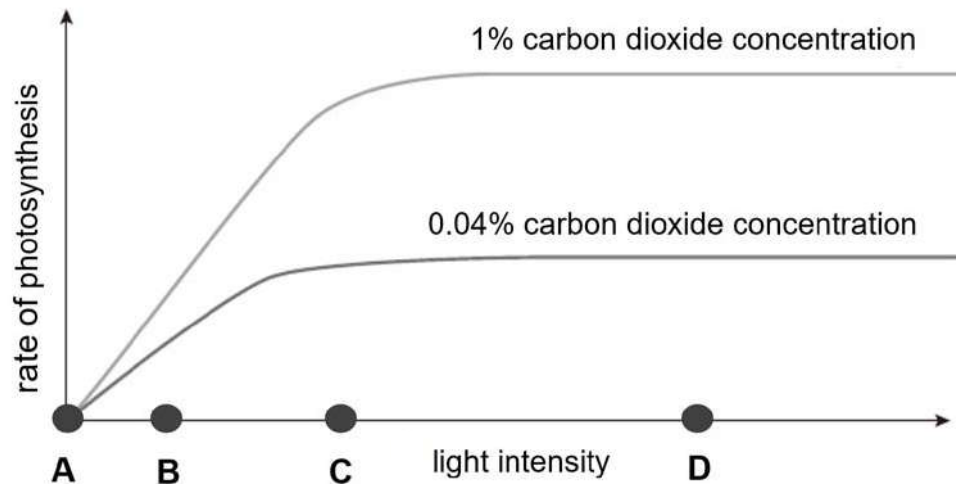


Which statement is correct?

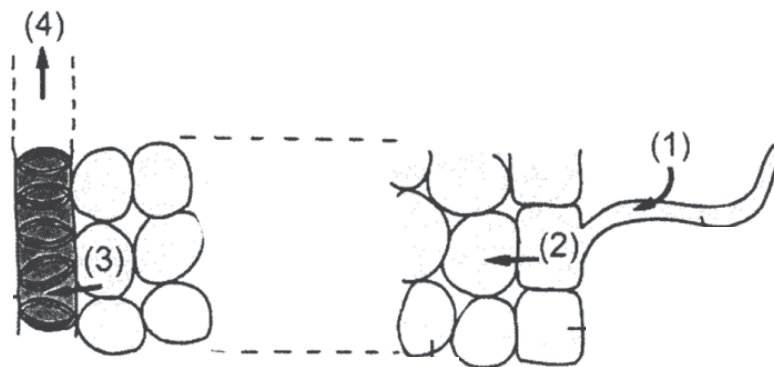
- A** Amino acids are absorbed through the microvilli and used by the cell for aerobic respiration.
 - B** Fats diffuse into P and enter Q to be distributed.
 - C** Mitochondria releases energy for the active transport of proteins into R.
 - D** Microvilli increases surface area to volume ratio of P for the absorption of glucose into R.
9. A photosynthetic plant was given the radioactive isotope of oxygen, O^{18} . Where would this isotope be eventually located?
- A** the starch grains in the mesophyll cells
 - B** the oxygen gas given out by photosynthesis
 - C** the carbon dioxide formed in respiration
 - D** the glucose made from photosynthesis

10. The graph below shows how the rate of photosynthesis in a plant varies with light intensity at two different carbon dioxide concentrations. The temperature is kept constant at 20°C.

At which light intensity is light **not** a limiting factor at both 0.04% and 1% carbon dioxide concentration?



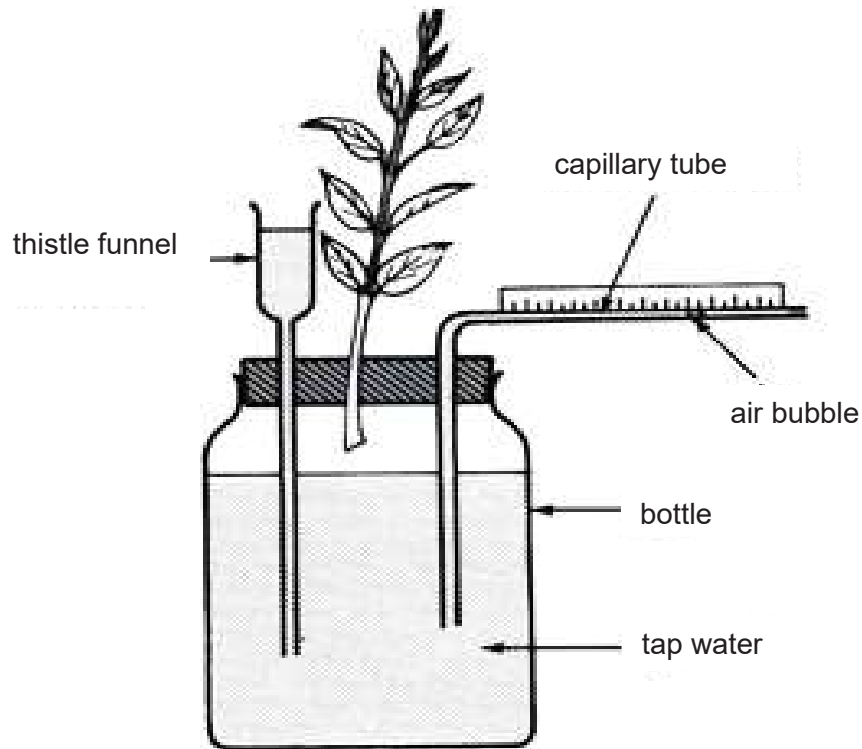
11. The diagram below shows the pathway of water movement from the soil into the root of a plant.



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)

12. The diagram below shows an experiment set-up to measure the rate of transpiration of a shoot.

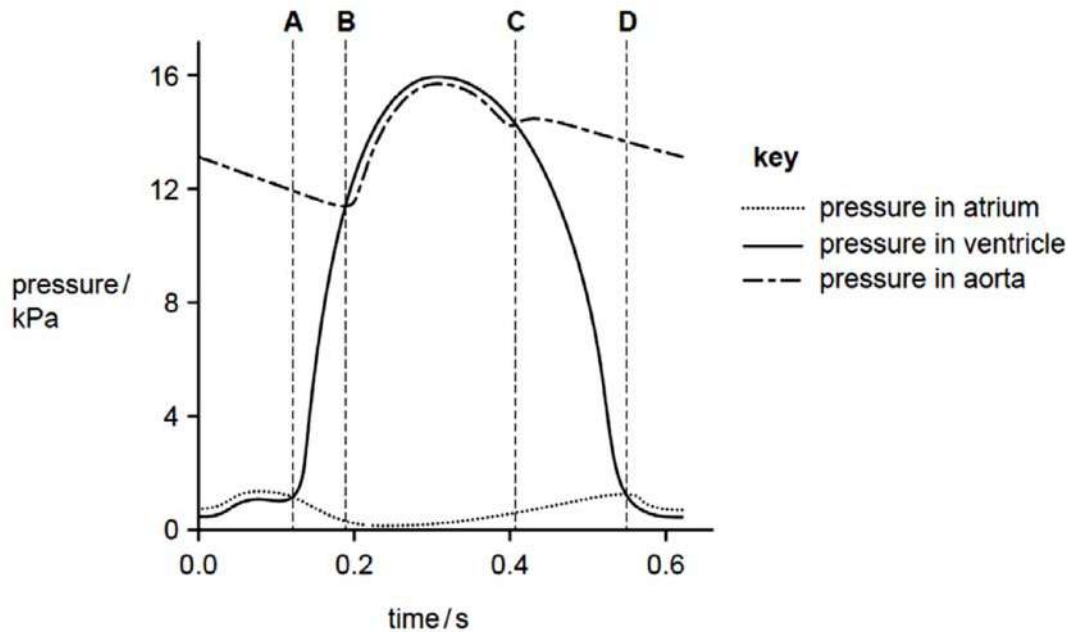


There were several mistakes in the above experimental set-up. Which of the following are the corrections that have to be made?

- I The bottle should be completely filled with water.
 - II A tap funnel should be used instead of a thistle funnel.
 - III The end of the shoot should be completely immersed in water.
 - IV Dilute hydrogencarbonate solution should be used instead of tap water to provide a source of carbon dioxide to the shoot.
- A** I and III
B II and III
C I, II and IV
D II, III, IV

13. The graph below shows the pressure changes in the left side of the heart during a single heartbeat.

At which point A to D, is the atrioventricular/bicuspid valve pushed close?



14. A certain genetic disease results in the inability to produce prothrombin. Which symptoms will the patients suffering from this disease most likely have?
- A aching muscles and insomnia
 - B fatigue and breathlessness
 - C headaches and chronic diarrhoea
 - D nosebleeds and blood in urine
15. Which reaction is catalyzed by carbonic anhydrase when red blood cells pass through the lungs?
- A $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{CO}_3$
 - B $\text{HCO}_3^- + \text{H}^+ \rightarrow \text{H}_2\text{CO}_3$
 - C $\text{H}_2\text{CO}_3 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
 - D $\text{H}_2\text{CO}_3 \rightarrow \text{HCO}_3^- + \text{H}^+$

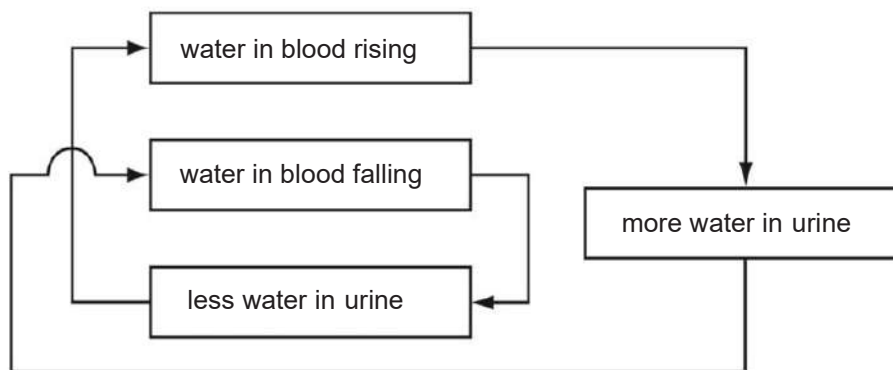
16. Some effects of tobacco smoking are listed below.

- 1 Bronchitis
- 2 Uncontrolled division in some cells
- 3 Increase in alertness
- 4 Increase in heart rate
- 5 Increase in mucus production
- 6 Increase in blood pressure

Which effects are caused by nicotine and tar respectively?

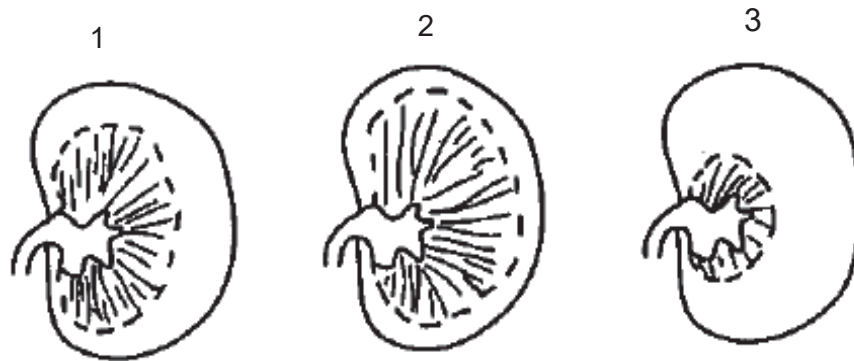
	nicotine	tar
A	1, 2 and 5	4 and 6
B	3 and 6	1 and 5
C	3, 4 and 6	1, 2 and 5
D	1, 2 and 4	3, 5 and 6

17. The diagram refers to the control of water potential in blood.
Which statement best explains why this is a negative feedback system?



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

18. The diagrams show vertical sections of kidneys of coypu, brown rat and kangaroo rat, showing 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 some days without drinking. Kangaroo rats are able to live in deserts without drinking at all.

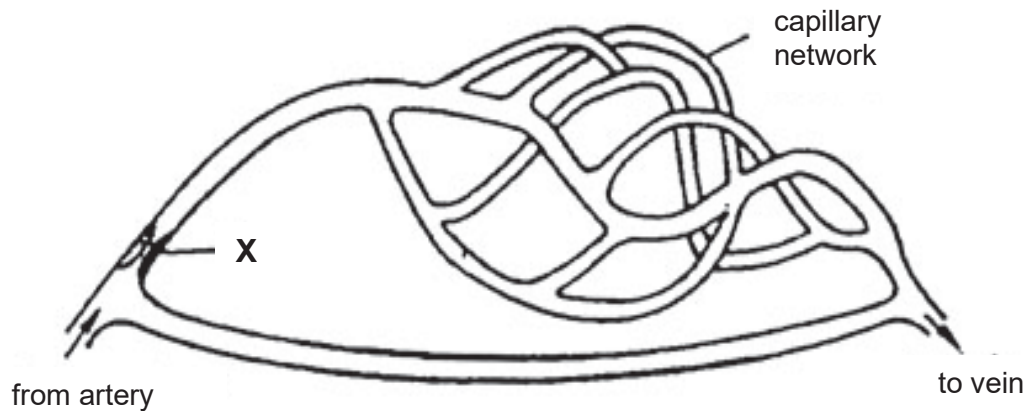
Which kidney 1, 2 or 3 is suitable for coypu, brown rats and kangaroo rats in order for them to adapt to their living environment?

	1	2	3
A	brown rat	coypu	kangaroo rat
B	brown rat	kangaroo rat	coypu
C	kangaroo rat	brown rat	coypu
D	kangaroo rat	coypu	brown rat

19. Which factors are controlled by homeostasis?

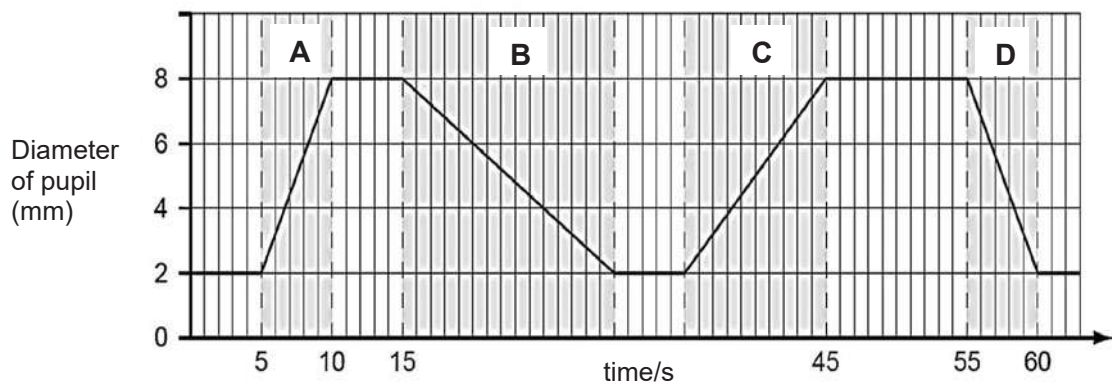
	Temperature in the stomach	pH in the duodenum	Glucose concentration in blood	Water content in the ileum
A	√	×	√	×
B	√	×	×	√
C	×	√	√	√
D	×	×	√	×

20. The diagram below shows a capillary network in the dermis of the skin.

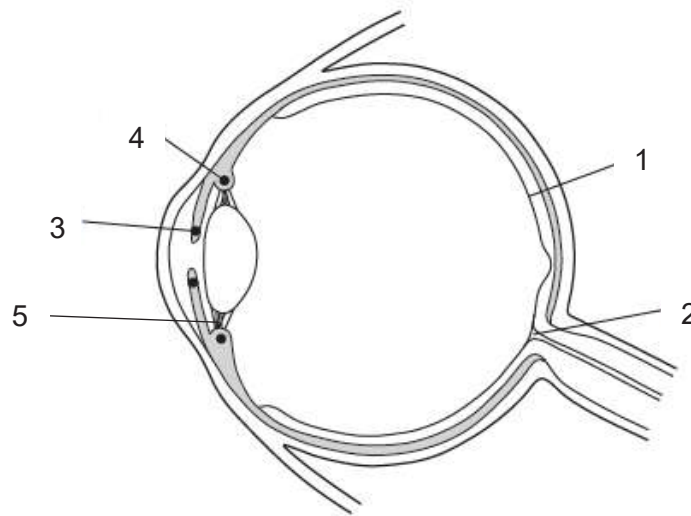


Which one of the following would be the direct result of the relaxation of the muscle labelled **X**?

- A greater heat loss
 - B shivering
 - C raising of skin hair
 - D raising the body temperature
21. The diameter of a person's pupil is measured as the light intensity is varied. During which time period does the light intensity increase fastest?



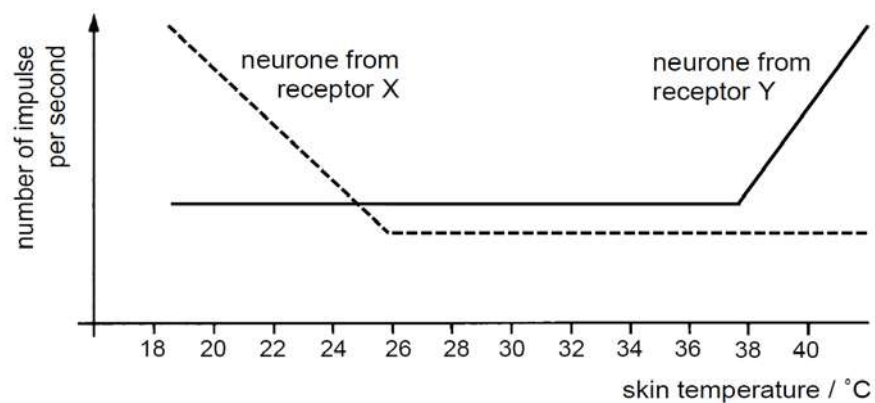
22. The diagram shows a section through the eye.



Which labelled structures are effectors and which are receptors?

	effectors	receptors
A	1	4
B	3	2
C	5	3
D	4	1

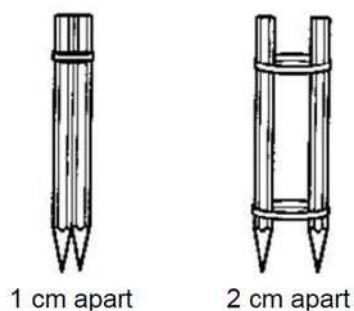
23. The graph shows the number of nerve impulses per second travelling along two sensory neurones from the skin to the brain, labelled as receptors X and Y, at different skin temperatures.



Which of the following statements best illustrates the graph?

- A** Receptor X responds most strongly to temperatures above 18°C.
- B** Receptor Y responds most strongly to temperatures above 38°C.
- C** Receptor X and Y respond most strongly outside the range of 26°C to 38°C.
- D** Receptor X and Y respond most strongly at temperatures between 26°C to 38°C.

- 24.** During an experiment, a student was blindfolded. The skin on his fingertip, the palm of his hand and his forearm were then touched several times by two pencil points, either one centimeter or two centimetres apart.



During the record of results, there were instances when he inaccurately said he had only been touched by one point.

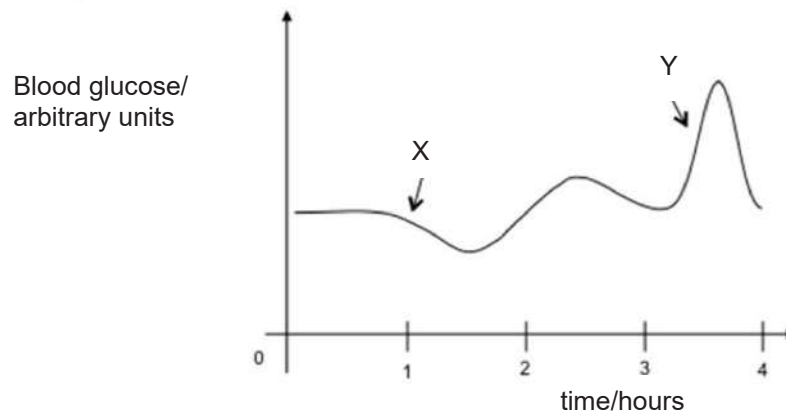
The table below shows the number of times he accurately said that he had been touched by two points.

distance between pencil points / cm	% number of times he felt two pencil points		
	fingertip	palm	forearm
1	100	5	20
2	100	75	30

Which of the following conclusions could be made from the above results?

- A** Only a few touch receptors were present in the skin of the palm.
- B** No touch receptors were present on the skin of the forearm.
- C** Touch receptors were the furthest apart in the skin of the forearm.
- D** Touch receptors were closest together in the skin of the fingertip.

25. The graph below shows changes in a person's blood glucose concentration over a four-hour period.



What causes 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

26. Dentists inject the drug procaine into gums so that they can drill into teeth without causing pain.

What is the most probable reason for procaine preventing pain?

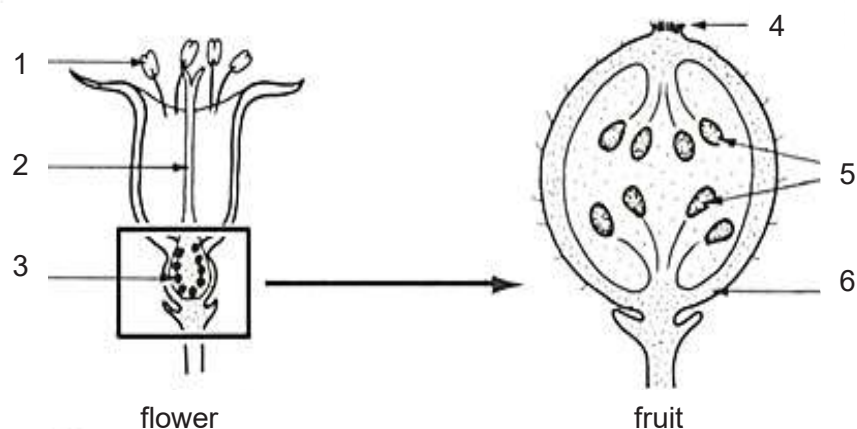
- A** It prevents the brain from interpreting impulses from the teeth.
- B** It prevents impulses passing along the sensory neurones to the brain.
- C** It blocks the synapses between the sensory neurones and motor neurones.
- D** It makes the tissues of the gums numb.

27. Which of the following statements about a hormone is correct?

- I It is transported in the blood.
- II It is secreted by an endocrine gland.
- III It is under both voluntary and involuntary control.

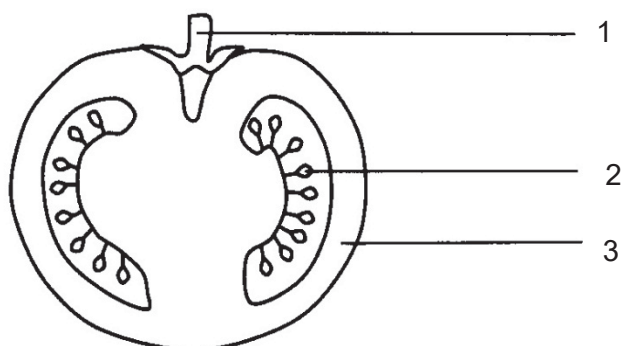
- A** I and II only
- B** II and III only
- C** I and III only
- D** I, II and III

28. The diagram shows the development of a flower into a fruit.



Where does meiosis occur?

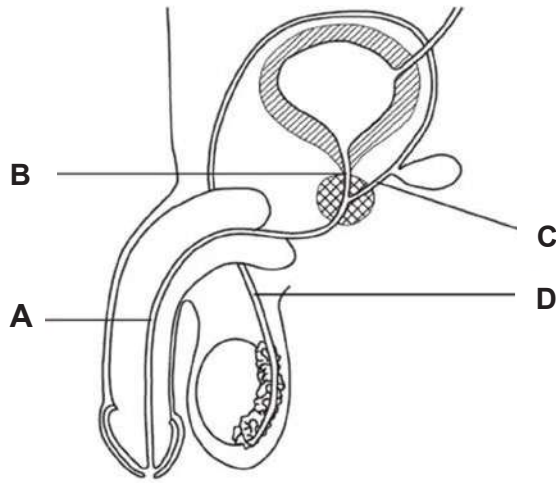
- A 5 only
 B 1 and 3 only
 C 2 and 4 only
 D 5 and 6 only
29. The diagram shows a vertical section of a tomato fruit.



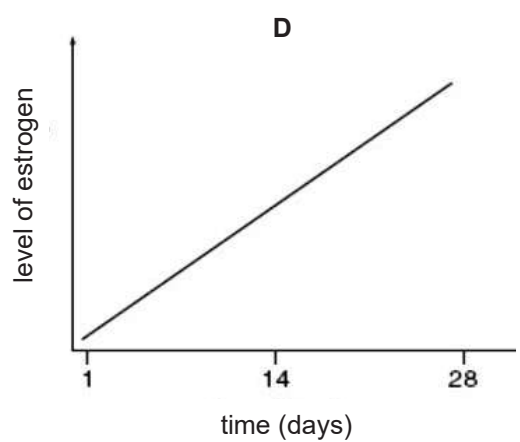
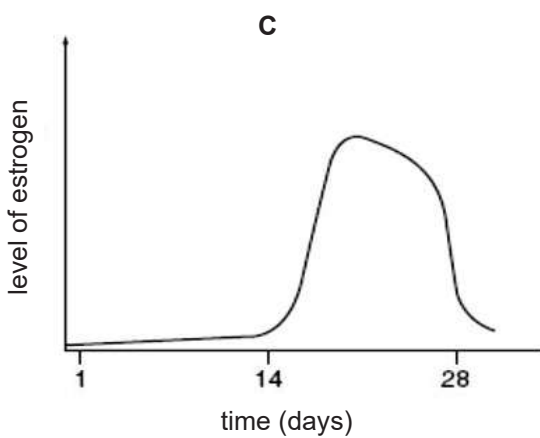
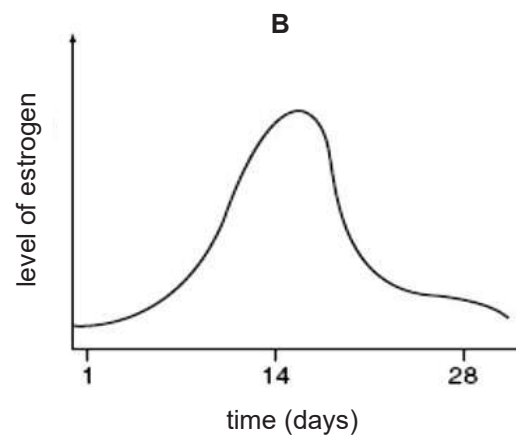
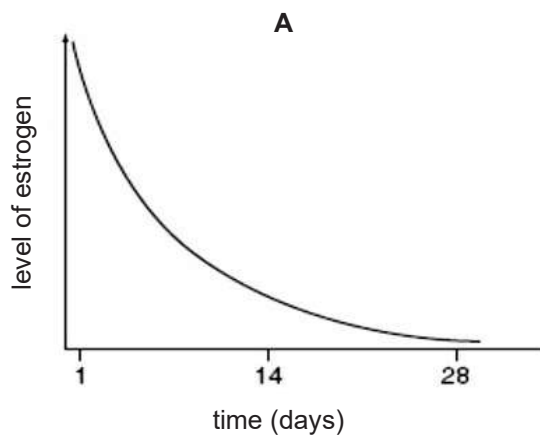
Which of the following correctly identifies the floral parts from which structures 1, 2 and 3 have developed?

	1	2	3
A	style	ovary	ovule
B	style	ovule	ovary
C	pedicel	ovule	ovary
D	pedicel	ovary	ovule

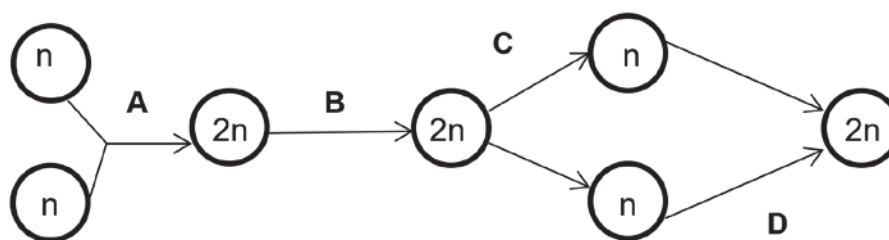
30. A surgical method of birth control involves cutting some of the tubes through which sperm pass.
At which point does the surgeon make the cuts?



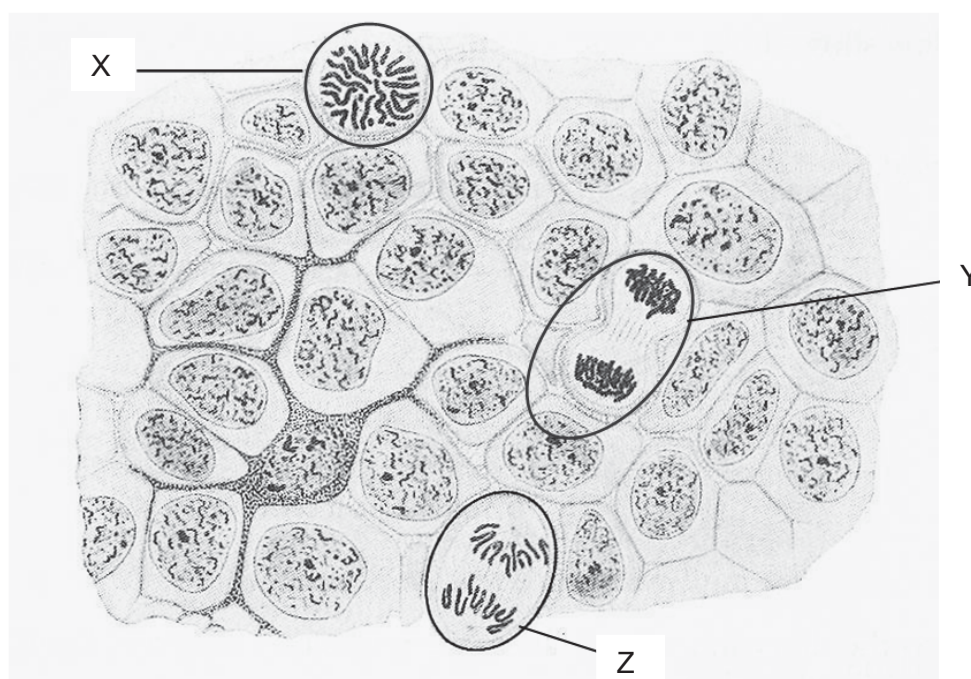
31. The level of estrogen in the blood of a woman changes during a normal menstrual cycle. Which graph shows these changes?



32. The diagram below shows the life cycle of an animal. At which stage in the life cycle does mitosis occur?



33. The diagram shows some animal cells undergoing various stages of mitosis.



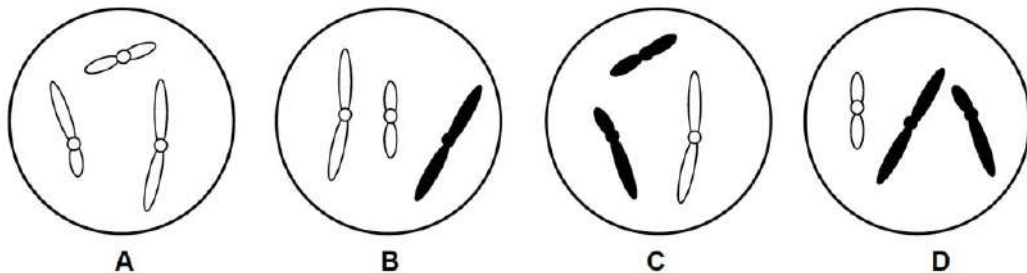
Which stages of mitosis are occurring in the cells X, Y and Z?

	X	Y	Z
A	anaphase	metaphase	interphase
B	interphase	telophase	anaphase
C	metaphase	anaphase	prophase
D	prophase	telophase	anaphase

34. The diagram below represents the nucleus of a body cell from an organism.

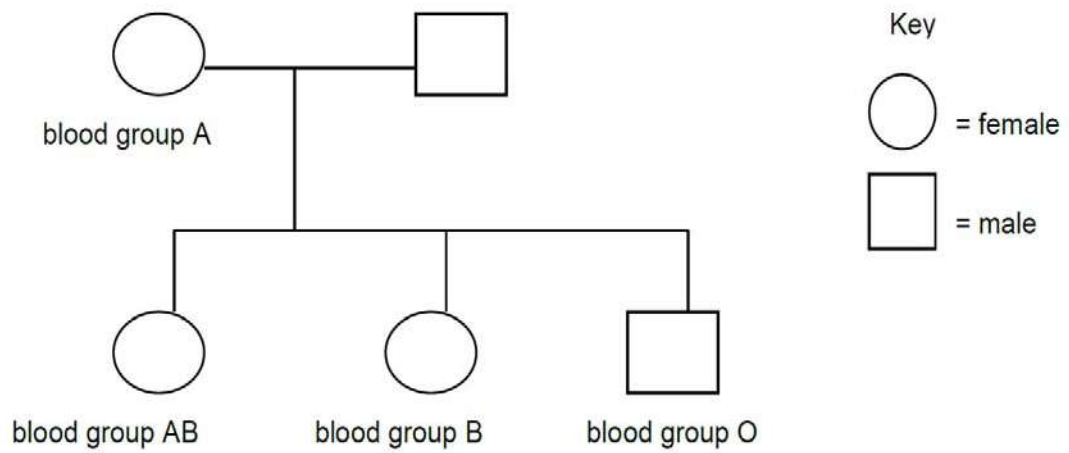


Which diagram does **not** represent a possible gamete nucleus produced by the organism?



35. A DNA molecule consists of 4000 nucleotides, of which 20% contain the base adenine.
How many of the nucleotides in this DNA molecule will contain guanine?
- A 800
B 1000
C 1200
D 1600
36. Bacteria are used in genetic engineering. A plasmid is used to transfer the required DNA into the bacterium.
What is the term used to describe the role of plasmid in this technology?
- A recombinant
B transgenic
C host
D vector
37. Huntington's Disease is an inherited condition in humans caused by a dominant allele. A woman's father is heterozygous for the condition. Her mother is not affected by the condition.
What is the chance of the woman being affected by the condition?
- A 100%
B 75%
C 50%
D 25%

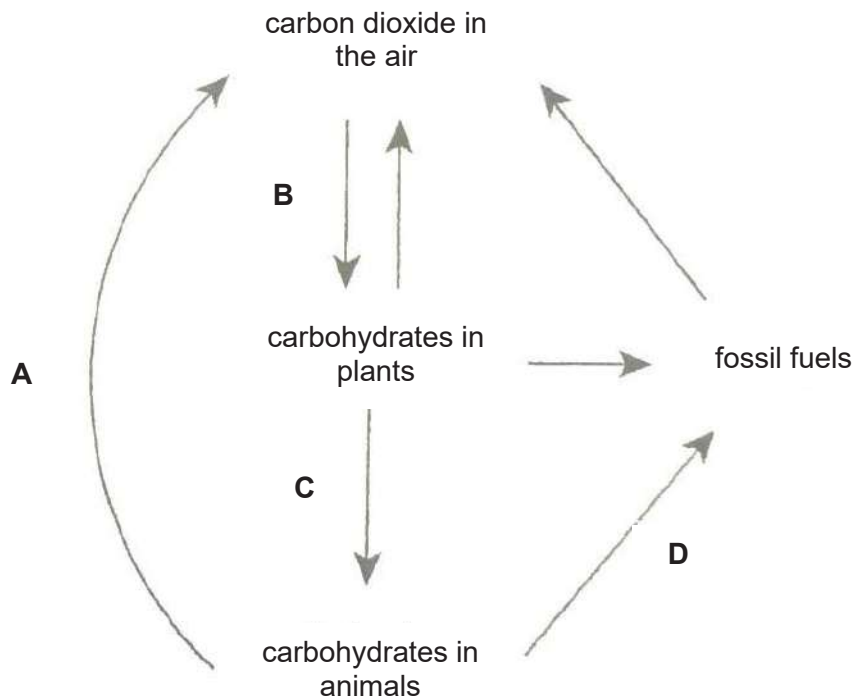
38. The diagram below shows the blood group phenotypes of some members of a family.



What are the blood group genotypes of the parents?

	father's genotype	mother's genotype
A	$I^B I^B$	$I^A I^B$
B	$I^B I^O$	$I^A I^A$
C	$I^B I^O$	$I^A I^B$
D	$I^B I^O$	$I^A I^O$

39. The diagram shows some of the processes which take place during the carbon cycle.
Which labelled part of the cycle may involve bacteria and fungi?



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

species	number of individuals	biomass of one individual (arbitrary units)
R	10,000	0.1
S	5	10.0
T	500	0.002
U	5	300 000.0

What is the energy flow in the chain?

- A** $R \rightarrow T \rightarrow S \rightarrow U$
B $R \rightarrow T \rightarrow U \rightarrow S$
C $U \rightarrow S \rightarrow R \rightarrow T$
D $U \rightarrow R \rightarrow S \rightarrow T$

End of Paper 1

Name	Class				Index Number		
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BROADRICK SECONDARY SCHOOL

SECONDARY 4 EXPRESS

PRELIMINARY EXAMINATION 2019

BIOLOGY

6093/02

Paper 2 Theory

Sep 2019

Candidates answer on the Question Paper

1 hour 45 minutes

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

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

You may use an HB pencil for any diagrams, graphs, tables or rough working.

Write in dark blue or black pen.

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

Section A

Answer **all** questions.

Section B

Answer all the questions. Question 9 is an Either/Or question.

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

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

Candidates are reminded that **all** quantitative answers should include appropriate units.

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

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

For examiner's use	
P2	/ 80

This question paper consists of **19** printed pages including this page.

[Turn over

Section A (50 marks)

Answer **all** the questions in the space provided.

- 1 (a) Define the term *translocation*. [2]

.....

.....

.....

.....

- (b) The figure below shows a scanning electron micrograph of a type of vascular tissue found in plants.

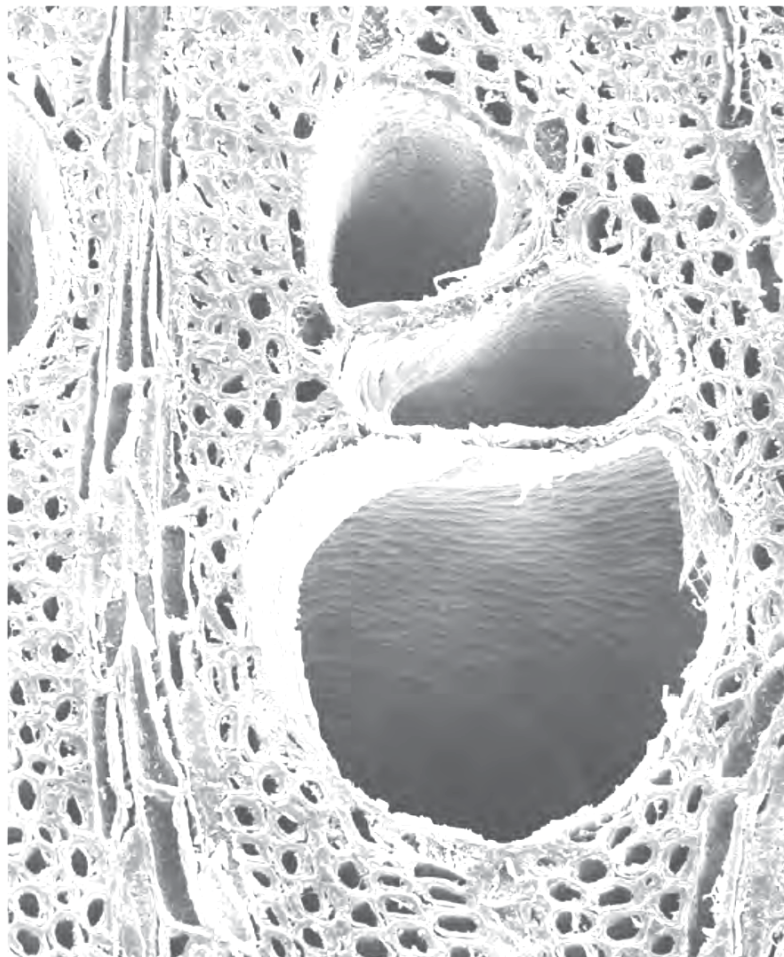


Fig 1.1

- (i) Name the vascular tissue. [1]

.....

- (ii) With reference to **Fig. 1.1**, describe two ways that these vascular tissues are adapted to their functions. [2]

.....

.....

.....

.....

- (c) Some weedkillers stop the plant from photosynthesising. These are often applied to the soil where the weeds are growing. [4]

Explain how the weedkiller reaches its site of action in the leaves.

.....

.....

.....

.....

.....

.....

.....

.....

[Total:9m]

- 2 (a) State what is meant by the term 'activation energy'. [1]

.....

.....

(b) Fig 2.1 shows a section of photographic film.

The top layer is made of silver particles embedded in a layer of gelatine which is a type of protein.

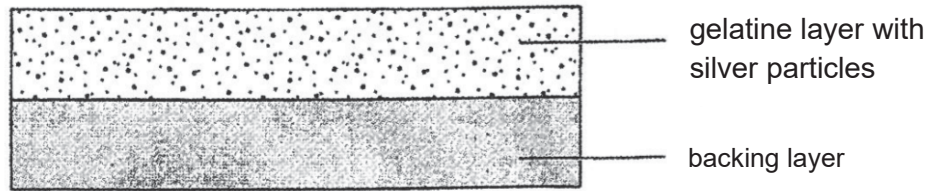


Fig 2.1

In an investigation, a 20 mm length of photographic film was placed in each of three boiling tubes.

- The film was immersed in 20cm³ water.
- 1 cm³ of liquid at different pH values was added to the boiling tubes.
- 1 cm³ of protease solution was added to each boiling tube.
- Each boiling tube was shaken gently to mix the contents.
- Each boiling tube was kept at 37°C for 1 hour.

Fig 2.2 shows the apparatus and the results of the investigation.

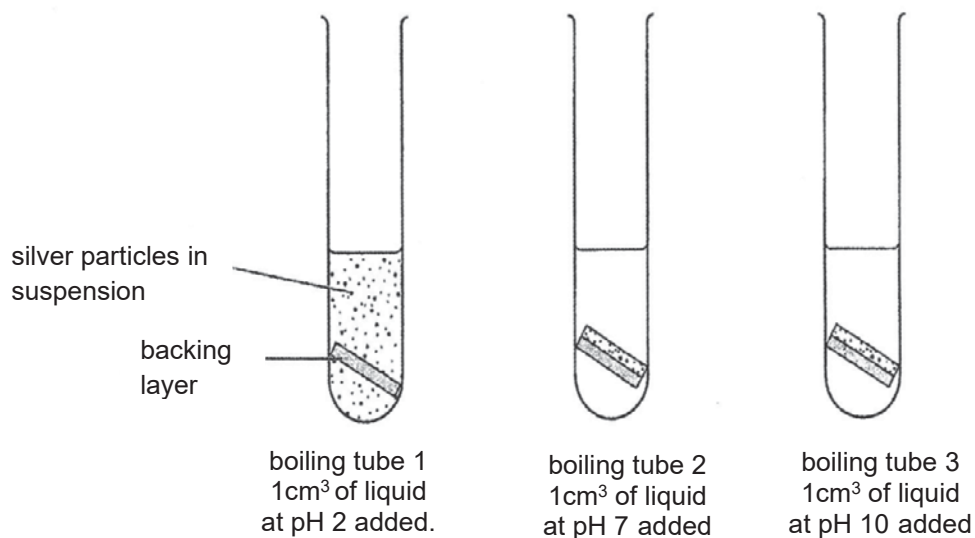


Fig 2.2

- (i) Explain the difference in results obtained between boiling tube 1 and boiling tubes 2 and 3. [3]

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- (c) Carbon dioxide is released during respiration in all living cells in the human body. [3]
Describe the role of carbonic anhydrase in the excretion of carbon dioxide from the lungs.

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[Total:7m]

- 3 The figure below shows the relationship between air temperature and the body temperature of an insect.

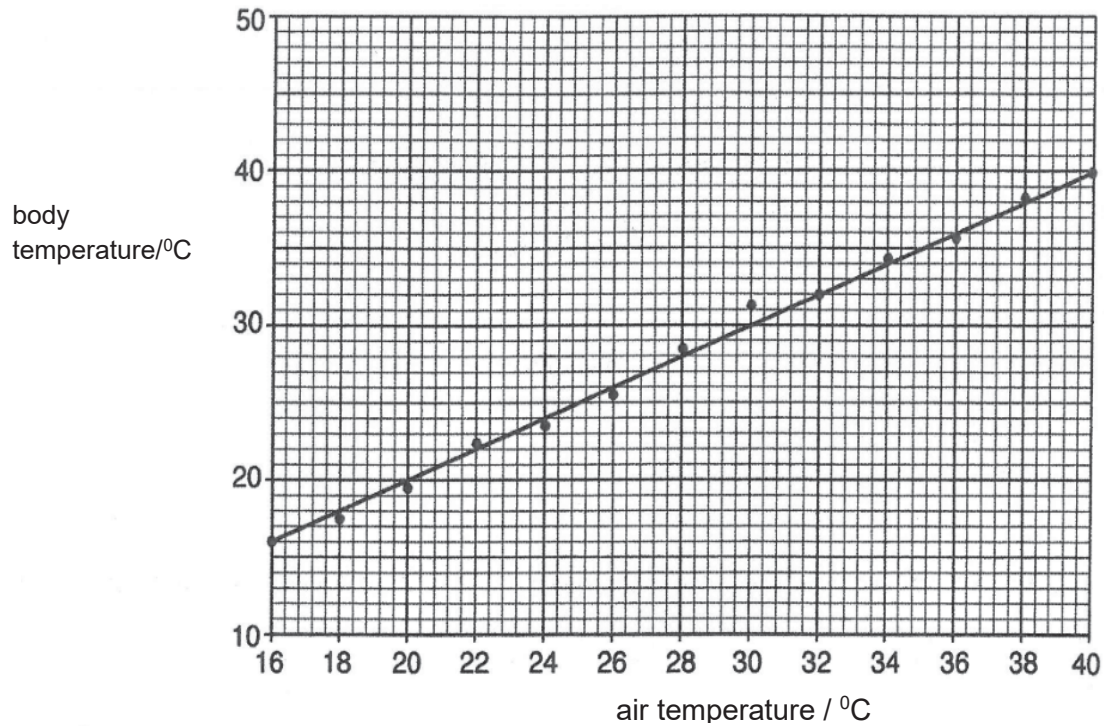


Fig. 3.1

- (a) State the change in the body temperature of the insect as air temperature changes from 16°C to 40°C, as shown in Fig 3.1 [1]

.....

- (b) State two conclusions which may be drawn from Fig 3.1. [2]

1 :

.....

2 :

.....

- (c) Sketch a line on Fig 3.1 to show the body temperature of an adult human between air temperatures of 20°C and 36°C. [2]

Show answer on the graph of Fig. 3.1.

- (d) Describe the role of insulin in regulating blood glucose concentration in the human body. [3]

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[Total:8m]

- 4 (a) Define the term *excretion* and explain its importance. [2]

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- (b) Fig 4.1 shows a kidney tubule and its blood supply.

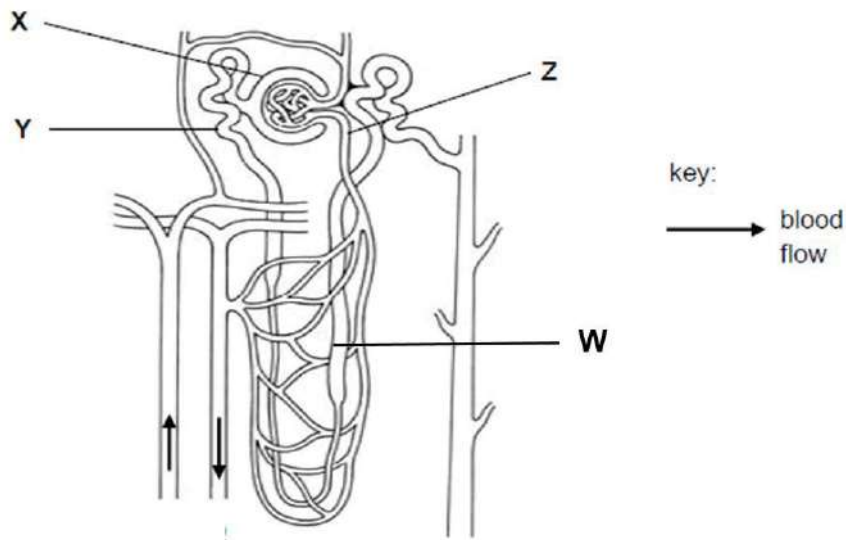


Fig 4.1

- (i) Name the structure labelled Z on Fig 4.1. [1]

.....

- (ii) Using an 'A', indicate on the structure(s) in Fig 4.1, where the anti-diuretic hormone (ADH) act(s) on during homeostasis. [1]
- (c) Table 4.1 below shows the composition of a liquid taken from part X and W of the kidney nephron above.

substance	composition/ g per 100cm ³	
	X	W
glucose	0.100	
urea	0.100	0.500

Table 4.1

- (i) Complete Table 4.1 to show the glucose content at region W. [1]
- (ii) Explain your answer to c(i). [2]

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- (iii) Explain the difference in the urea concentration between regions X and W. [2]

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- (d) Anti-diuretic hormone (ADH) is involved in the prevention of dehydration. Explain how ADH reduces water loss from the body. [3]

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[Total:12m]

- 5 Fig 5.1. shows the transfer of energy through a food web in a pond ecosystem.

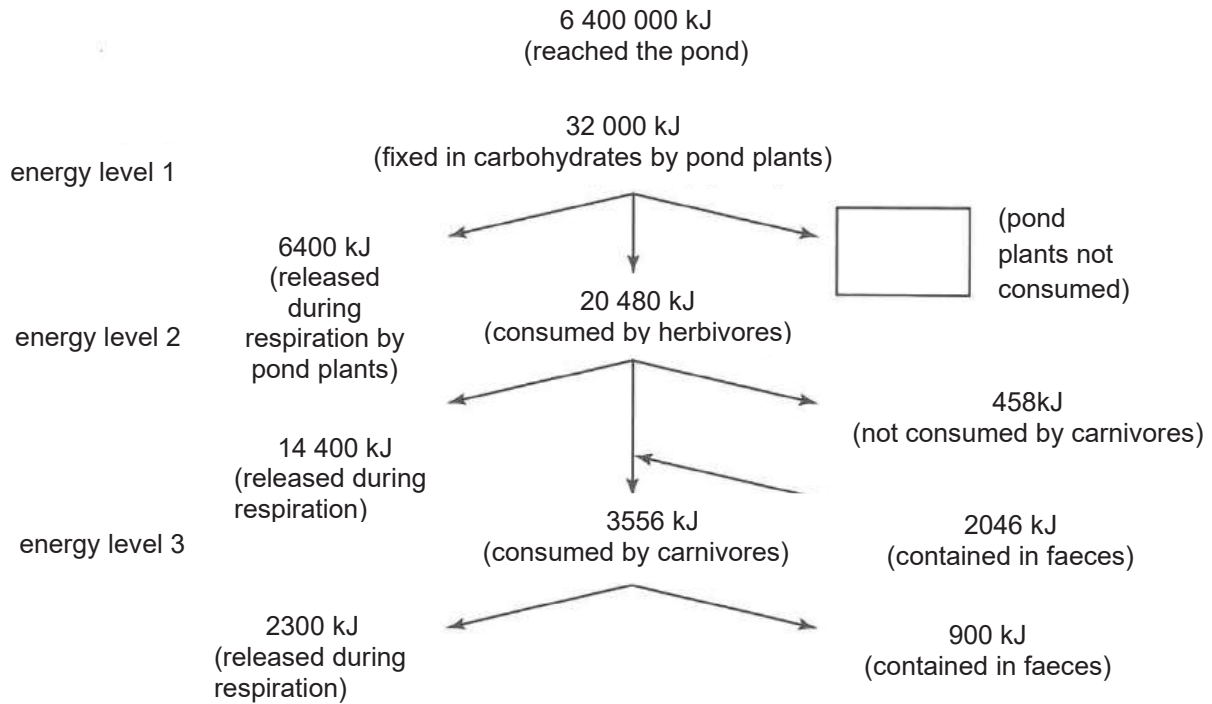


Fig. 5.1

- (a) State the process that converts the energy from sunlight into carbohydrates. [1]

.....

- (b) Calculate the percentage of energy from sunlight that was eventually fixed into carbohydrates. Show your working. [2]

..... %

- (c) Calculate the amount of energy in the pond plants that remained unconsumed by herbivores. Show your working. [2]

..... kJ

- (d) Explain why food chains and food webs rarely exceed five trophic levels. [3]

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[Total: 8]

- 6 (a) The diagram below shows a pair of homologous chromosomes during meiosis. P and Q show points where crossing over **may** occur. The other letters show the positions of the alleles of four genes.

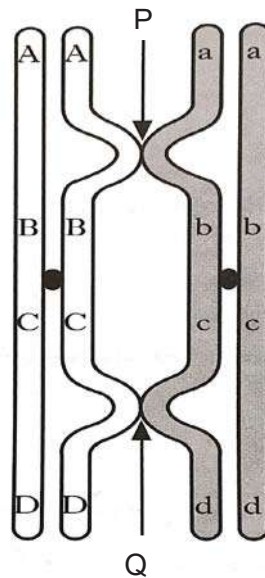


Fig 6.1

- (i) What evidence confirms that these chromosomes are homologous? [2]

.....

.....

.....

.....

(ii) What name is given to points P and Q? [1]

.....

(iii) State the importance of crossing over in meiosis. [1]

.....

.....

(b) State two places in plants where meiosis takes place. [2]

1.

2.

[Total:6m]

-End of Section A

Section B (30 marks)

Question 7 and 8 are compulsory questions.
Question 9 is in the form of an **Either/Or** question.
Only one part should be answered.

- 7 Germination is the process by which the plant grows from a seed. It results in the formation of a seedling. Germination of seeds requires both external and internal conditions such as temperature, water, light and air. Cells of germinating seeds were found to have high levels of enzymatic activity.

The experiment in Fig. 7.1 is used to measure the changes in the volume of gases confined inside a flask of seeds that are germinating.

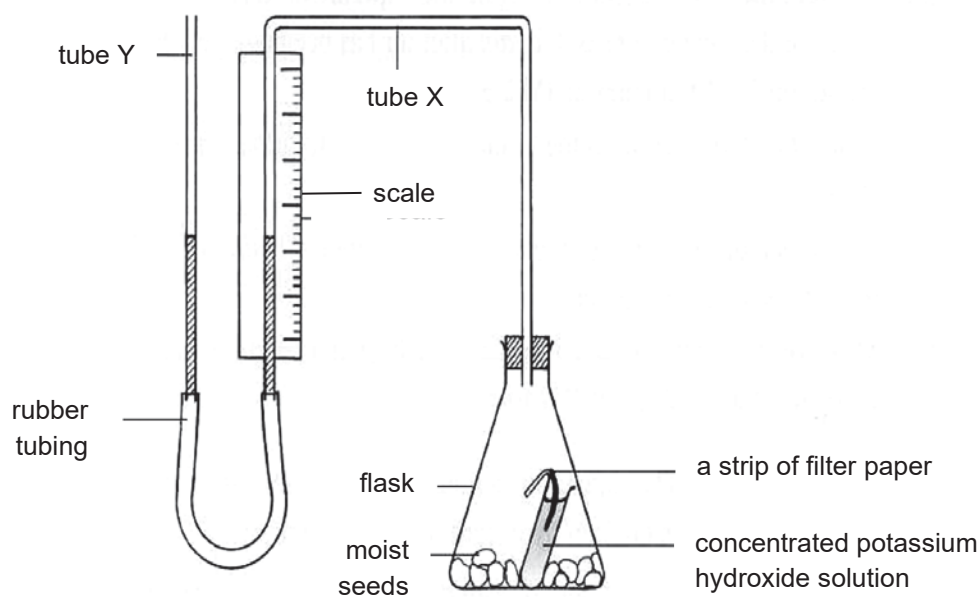


Fig 7.1

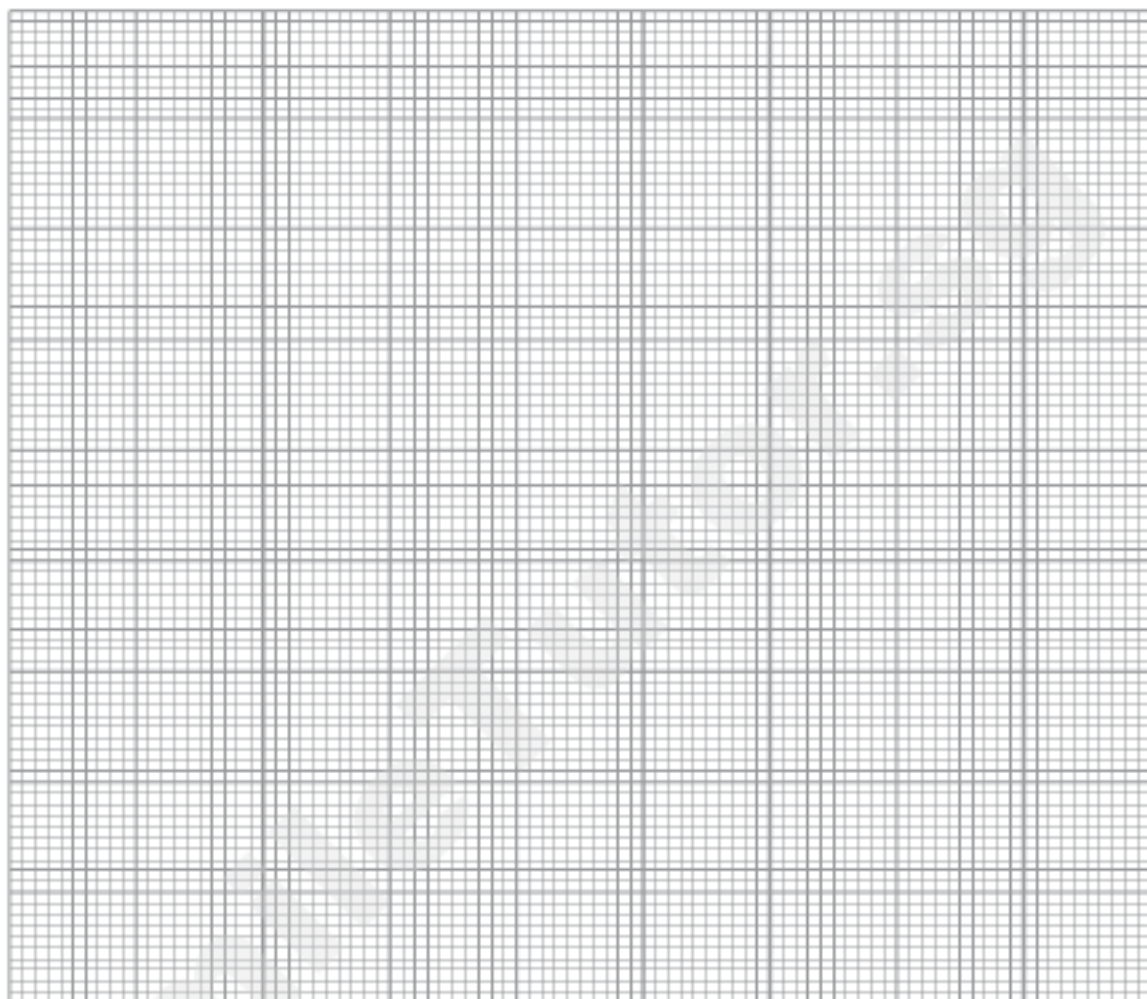
At half hour intervals, the liquid level in tube X is measured on the scale.

The result is recorded in Table 7.2.

Table 7.2

time (h)	reading on scale that shows liquid level in tube X/ cm	volume changes of gases in flask/ arbitrary units
0	2.3	0
0.5	3.1	-0.8
1.0	3.9	-1.6
1.5	4.8	-2.5
2.0	5.6	-3.3
2.5	6.4	-4.1
3.0	7.0	-4.7
3.5	7.3	-5.0
4.0	7.3	-5.0

- (a) Plot and draw a graph to show the volume changes of gases in flask against time taken. [4]



- (b) Describe the relationship between the reading on the scale and the volume changes of gases in the flask. [1]

.....
.....

- (c) Describe and explain the volume changes occurring in the flask. [2]

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- (d) Describe and explain the changes in the graph from the 3rd to 4th hour. [2]

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- (e) A control is set up to show that the seeds undergoing germination cause the volume changes of gases in the flask. [1]

Suggest what could be done to stop the seeds from germinating.

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[Total:10m]

- 8 (a) Describe the events that occur after a human egg cell is fertilised which enable it to develop and survive in the uterus. [5]

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- (b) In humans, the ability to taste PTC paper, (paper impregnated with phenylthiocarbamide), is controlled by a dominant allele (T) and the inability to taste it is controlled by the recessive allele (t). [5]

Using a fully labelled genetic diagram, explain how, in a family with three children, only the mother and one child are unable to taste PTC.

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[Total:10m]

9 Either

- 9 (a)** Outline the relationship between gene, DNA and chromosome. [6]

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- (b)** Explain how meiosis and reproduction gives rise to new variations in offsprings. [4]

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[Total : 10m]

9 Or

- (a) Fig 9.1 shows a vertical section of the human heart.

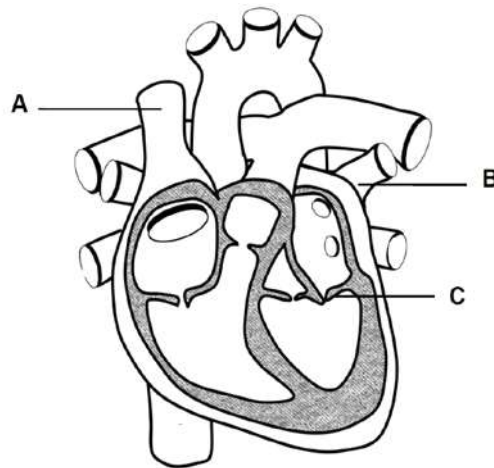


Fig 9.1

- (i) Name the blood vessels: [2]

A: B:

- (ii) Describe the function of the part labelled C. [1]

.....

- (iii) Describe and explain how blood entering the heart from the body organs reaches the lungs. [5]

.....

- (b) Explain, using a named example, what is meant by an endocrine gland. [2]

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[Total : 10m]

-End of Paper-

Name	Class				Index Number		
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BROADRICK SECONDARY SCHOOL

SECONDARY 4 EXPRESS

PRELIMINARY EXAMINATION 2019

BIOLOGY

6093/02

Paper 2 Theory

Sep 2019

Candidates answer on the Question Paper

1 hour 45 minutes

No Additional Materials are required.

ANSWERS

Section A (50 marks)

Answer **all** the questions in the space provided.

Paper 1(mcq)

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

- 1 (a) Translocation is the **transport** of food, such as **sugars and amino acids**(1m). [2]
synthesised by plants

Food is transported from leaves to **all parts of the plant**, in the **phloem tubes**.

(1m)

(bi) Xylem [1]

(ii) 1. lack of cross walls - allows continuous flow of water and mineral salts [2]

2. empty with no cytoplasm - allows continuous flow of water and mineral salts

3. lignin deposited on inner walls of xylem walls - provides mechanical support /strengthens wall to prevent collapse

award one mark for each feature plus its adaptation. (max 2 points)

(c) -weedkiller dissolves in water found in soil solution. [4]

-The root hair cells of the plant absorb water and the dissolved weedkiller by osmosis and diffusion respectively.

-Water and dissolved weedkiller move into xylem vessels in the roots down a concentration gradient.

-Xylem vessels transport water and weedkiller to all parts of plant, including leaf.

-In the leaf cells, weedkiller move from cell to cell by diffusion and exerts its effect. Plant stops photosynthesising.

(maximum 4 points)

[Total:9m]

2 (a) The energy needed to start a chemical reaction [1]

bi In boiling tube 1, pH 2 is the optimum pH for protease to digest protease. (1m) [3]
This releases silver particles into suspension.(1m)

In boiling tubes 2 and 3, protease denatured at higher temperatures, pH 7 and pH 10, Protease does not digest gelatine (type of protein) (1m)

(c) Carbon dioxide produced by respiration diffuses into the blood. [4]

Carbonic anhydrase in red blood cells catalyse reaction between carbon dioxide and water to form carbonic acid.(1m)

The carbonic acid dissociates to form hydrogencarbonate ions which diffuse out of red blood cells into plasma.(1m)

In the lungs, hydrogencarbonate ions diffuse back into red blood cells.(1m)

They are converted to carbon dioxide and water by carbonic anhydrase.(1m)

Carbon dioxide produced diffuses into alveoli and is excreted.(1m)

Max 3 points.

[Total:7m]

3 (a) (40-16=24°C) [1]

(b) 1 : When the air temperature increases, the body temperature of the insect [2]

increases linearly

2 :The insect is cold-blooded as the body temperature changes with the surrounding temperature/ Insect unable to maintain constant body temperature.

(c) To draw a straight horizontal line at 37 °C. [1]

(d) Increasing permeability of cell membranes to glucose thereby increasing the rate of glucose uptake by cells (1m) [3]

Increase tissue respiration so that glucose is broken down faster(1m)

Stimulating the liver and muscle cells to convert excess glucose into glycogen (1m)

Insulin thus helps to decrease blood glucose concentration back to normal.

[Total:7m]

4 (a) Processes by which metabolic waste products and toxic substances are removed from the body(1m) [2]

It prevents accumulation of waste products which can damage the body by interfering in important metabolic processes. (1m)

(b) (i) Efferent Arteriole [1]

(ii) -label collecting duct [2]

(ci) 0 [1]

(ii) [2]

Glucose is present in structure X (Bowman's capsule) Glucose is small enough(1m) to be forced out into the Bowman's capsule during ultrafiltration.

All glucose molecules are selectively reabsorbed (1m) at the proximal convulated tubule into the surrounding blood capillaries . Thus glucose is absent in structure W (distal convulated tubule).

(iii) [2]

Water has been selectively reabsorbed at the proximal convulsed tubule, loop of Henle, distal convoluted tubule and collecting duct. (1m)
Urea a waste product is not reabsorbed. Hence concentration of urea increase.(1m)

- (d) When the pituitary gland secretes more ADH. [3]

Cells of the collecting duct (R) become more permeable to water.(1m)

More water is reabsorbed from the collecting duct into the blood capillaries.
(1m)

The volume of urine passing through the collecting duct decreases.(1m)

Urine becomes more concentrated.(1m)

Max – 3m

[Total:12m]

- 5 (a) Photosynthesis [1]

- (b) Total energy = 6400000kJ [2]
Total energy fixed by pond plants = 32000kJ

$(32000/6400000) \times 100\%$ (1m)
= 0.5% (1m)

- (c) [2]
 $(32000 - 6400 - 20480)$ [1]
= 5120kJ(1m)

- (d) Any 3 of the following: [3]

-At each trophic level, 90% of energy is lost through heat in respiration, undigested food, uneaten body parts and excretory waste products.

-Energy is also used for growth and movement.

-Only 10% of energy is passed from one trophic level to the next.

-As a result, in a food chain with 5 trophic levels, the energy passed along from the third and fourth trophic levels will not be sufficient to sustain the last trophic level for survival.

Take note: students must make reference to 'trophic levels' and 'energy passed from one level to the next'.

Max 3 points

[Total: 8]

- 6 (ai) -same shape and size of chromosomes (1m) [2]
-same gene loci (1m)

- (ii) chiasmata [1]
- (iii) -increases variation / allows for new combinations of alleles to form [1]
- (b) Pollen grain(1m) and egg(1m) [2]

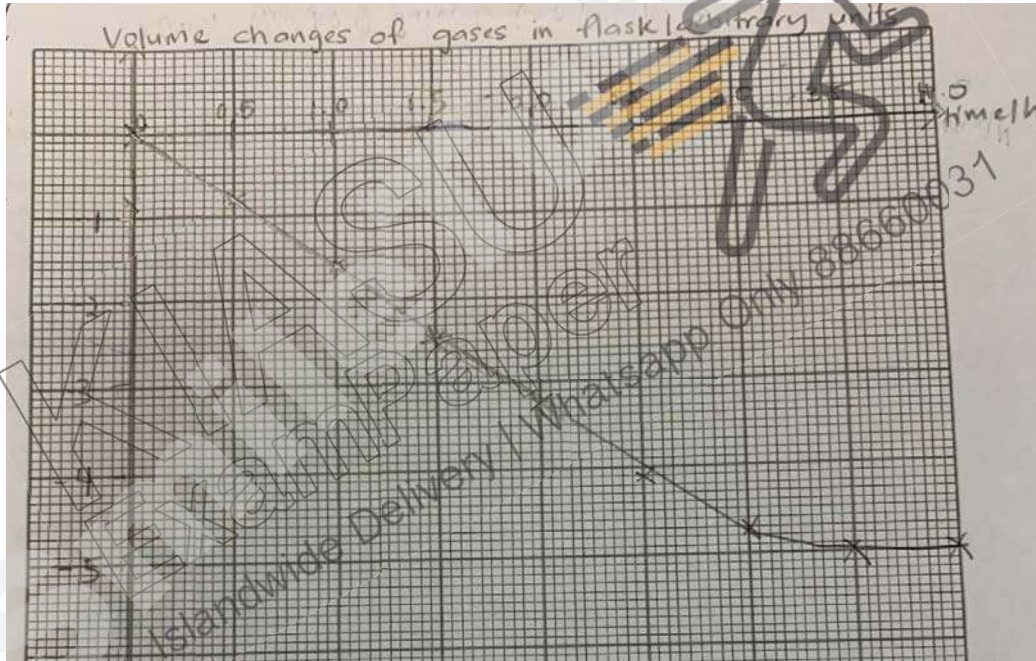
[Total:6m]

-End of Section A-

Section B (30 marks)

Question 7 and 8 are compulsory questions.
Question 9 is in the form of an **Either/Or** question.
Only one part should be answered.

- 7 (a) [4]



axes labelled with correct units;(1m)

suitable linear scales using more than half the graph paper;(1m)

accurate plotting of points on a single set of axes;(1m)

best fit line connecting all points;(1m)

- (b) As the reading on the scale increases, the volume changes of the gases in the flask also increases; [1]
- (c) Oxygen is used up when the seeds undergo germination, carrying out aerobic respiration;(1m) [2]

Carbon dioxide released during respiration is absorbed by potassium hydroxide, thus lowering the volume of gases;(1m)

- (d) The decrease in the volume of gases in the flask slows down and becomes constant; (1m) [2]

Aerobic respiration has stopped since oxygen is completely used up;(1m)

- (e) Boiling, adding strong acid/ alkali (any 1) [1]

[Total:10m]

- 8 (a) After a human egg cell is fertilised, it takes 5-7 days to reach the uterus.(1m) [5]
-The cilia on the oviduct helps to push the fertilised egg towards the oviduct.(1m)
-Peristalsis of oviduct walls also help to move the fertilised egg towards the uterus.(1m)
-The fertilised egg divides, by mitosis.(1m)
-It forms a ball of cells which implant into the uterine lining.(1m)
-Placenta provides oxygen and nutrients to the growing embryo and remove carbon dioxide and waste products from the embryo. (1m)

Any 5 points

- (b) Mother and child unable to taste PTC are homozygous recessive ie. genotype 'tt' [5]

	Father		Mother	
<u>Parental phenotype</u>	Taster		Non-taster (1m)	
<u>Parental genotype</u>	Tt		tt (1m)	
<u>Gametes</u>	T	t	t	t
<u>F1 genotype</u>	Tt	Tt	tt	tt
<u>F1 phenotype</u>	Tasters		Non-tasters (1m)	
<u>F1 phenotypic ratio</u>	1 Taster : 1 Non-taster (1m)			

Thus, the father must be heterozygous for this case to occur. (1m)

9 Either

- 9 (a) -DNA molecule is a macromolecule that is made up of two polynucleotide strands t(1m)wisted together to form a double helix structure. (1m)] [6]

-A gene is a small segment of DNA (1m)which contains a specific sequence of

nucleotides (1m) that controls the production of a polypeptide. [1]

-Chromosome is made of DNA and proteins(1m). It is condensed and coiled tightly (1m)

- (b) Independent arrangement and assortment of homologous chromosomes during metaphase I and anaphase I (1m) [4]

Pairing and Crossing over of non sister chromatids of homologous chromosomes during Prophase 1 of meiosis to form new combinations of alleles.(1m)

Independent arrangement and assortment of chromatids during metaphase II and anaphase II(1m)

Random fertilization (fusion of gametes) leads to new combinations of zygotes(1m)

- Any 4 points

[Total : 10m]

9 Or

- 9 a(i) A: vena cava B: pulmonary vein [2]

- (ii) Prevent backflow of blood from left ventricle into left atrium, when the muscles of the left ventricle contract. [1]

- (iii) -deoxygenated blood returns from the body organs through the vena cava into the right atrium. [5]

- as blood is returning, blood pressure within the right atrium increases.

-when pressure in right atrium is greater than right ventricle, tricuspid valve pushes open and blood flows into right ventricle

-muscles of right atrium contract and push blood into right ventricle

-muscles of right ventricle contract and push blood into pulmonary artery

-increase in pressure in right ventricle pushes the tricuspid valve closed

Pressure in right ventricle is greater than pulmonary artery, This causes semilunar valves to push open

-Semilunar valves push open and blood leaves right ventricle to the lungs.

(max 5 points)

[Total : 10m]

-End of Paper-

SmileTutor.sg

Name: _____ ()

Class: _____



CHIJ KATONG CONVENT
PRELIMINARY EXAMINATIONS 2019
Secondary Four Express

BIOLOGY

Paper 1

6093/01

Duration: 1 hour

Classes: 405 and 406

Additional Materials: Optical Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

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

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 Optical Answer Sheet.

Read the instructions on the Optical 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 on the question paper.

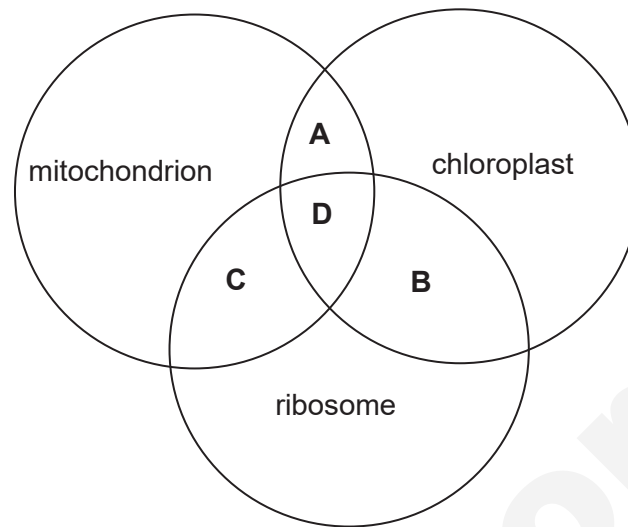
The use of an approved scientific calculator is expected, where appropriate.

At the end of the examination, hand in:

(a) Optical Answer Sheet; and

(b) Question paper **separately**.

- 1 Which section of the diagram represents the structures that are typically found in both plant and animal cells?



- 2 Which structures are found in a human male gamete?

	diploid nucleus	enzymes	mitochondria	nuclear membrane
A	✓	x	✓	✓
B	x	x	✓	✓
C	x	✓	✓	✓
D	x	✓	x	x

- 3 Which chemical element is present in fats but **not** in water?

- A carbon
B hydrogen
C nitrogen
D oxygen

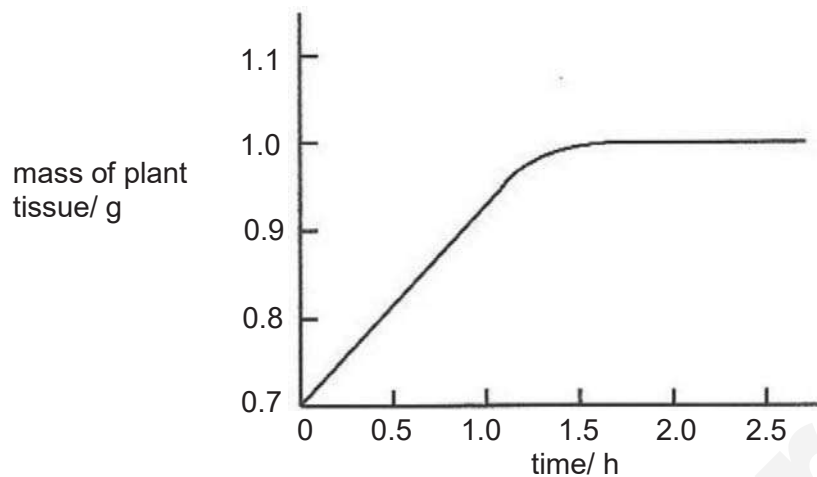
- 4 A student conducted an investigation to determine the type of nutrients in a food sample.

food sample	Benedict's test	biuret test	ethanol emulsion test
Y	blue	purple	white emulsion
Z	brick-red	blue	clear

Which row shows the nutrients present in each food sample?

	Y	Z
A	proteins	fats and glucose
B	fats and proteins	maltose
C	fats and sucrose	proteins
D	proteins and sucrose	maltose

- 5 The graph shows the changes in the mass of a piece of plant tissue in distilled water at 30 °C.

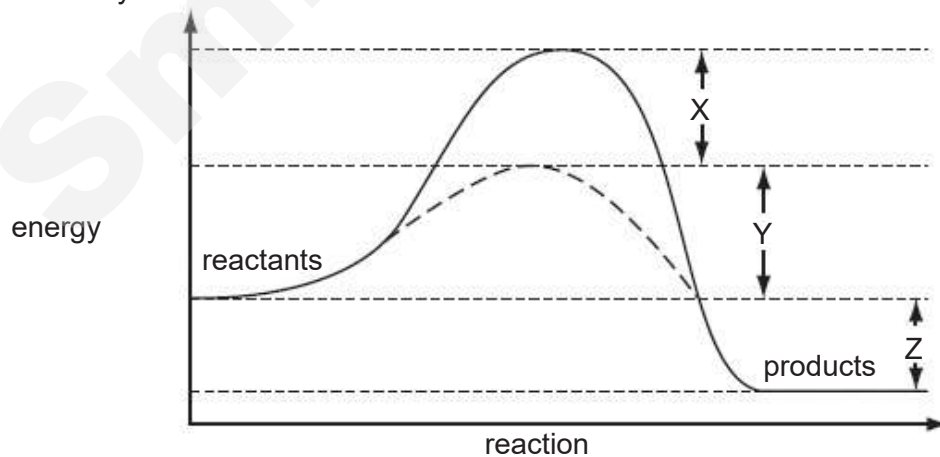


The following conclusions were made:

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



Which working shows the activation energy of the uncatalysed reaction?

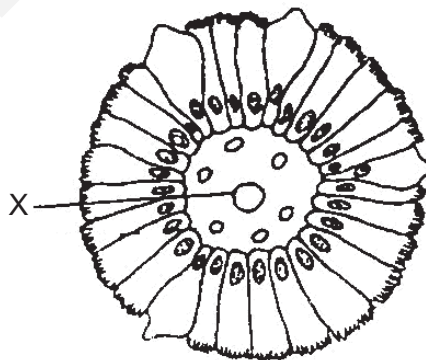
- A $X + Y - Z$
 B $X + Z - Y$
 C $X + Y$
 D $Y + Z$

- 7 Cubes of hard-boiled egg white are placed in test-tubes containing different combinations of chemicals are added to 7 tubes.

tube	chemical(s) 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?

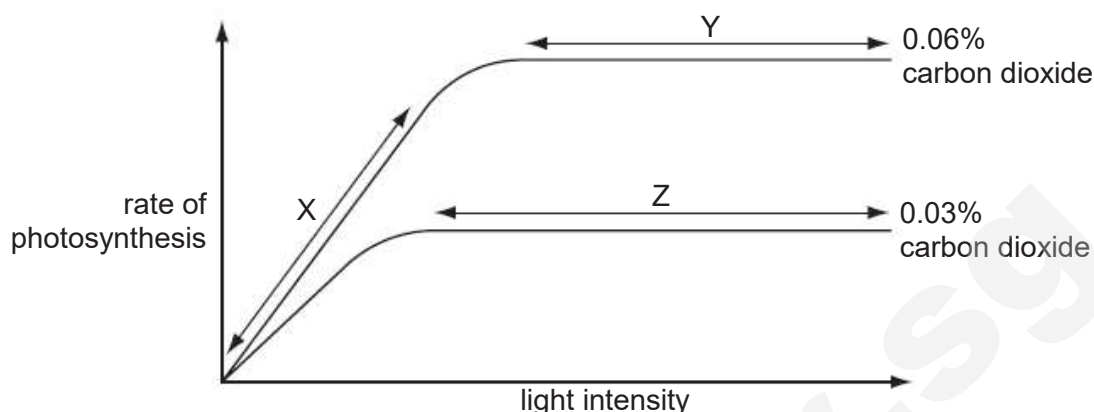
- A 1 and 6
 B 2 and 7
 C 4 and 5
 D 5 and 6
- 8 Which blood vessel contains the highest concentration of glucose after a period of fasting?
- A hepatic artery
 B hepatic vein
 C hepatic portal vein
 D inferior vena cava
- 9 The diagram shows a transverse section of an intestinal villus.



Which food substance is absorbed by structure X?

- A amino acids
 B fatty acids
 C glycogen
 D lipids

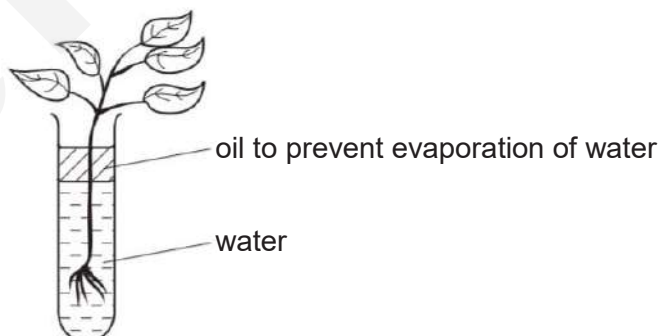
- 10 The graph shows the rate of photosynthesis of a plant at increasing light intensities at two carbon dioxide (CO_2) concentrations. The temperature is kept constant.



What may be limiting the rate of photosynthesis at X, Y and Z?

	X	Y	Z
A	CO_2 concentration	light intensity	CO_2 concentration
B	CO_2 concentration	light intensity	light intensity
C	light intensity	CO_2 concentration	CO_2 concentration
D	light intensity	CO_2 concentration	light intensity

- 11 In an investigation into rate of transpiration, 5 of the following set-ups were used.



Some of the plants had all their leaves coated with grease to reduce transpiration. Each plant is weighed in its own test-tube at the start of the experiment and after 2 days.

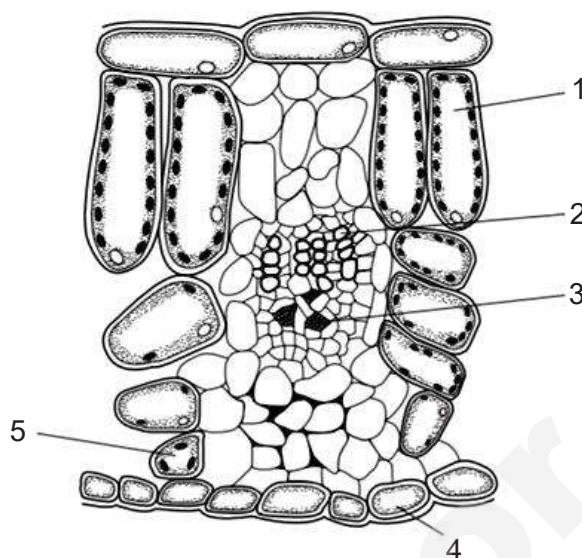
The results are shown in the table.

	mass of plant/ g				
	plant 1	plant 2	plant 3	plant 4	plant 5
t = 0	105	121	107	111	119
t = 2 days	103	97	84	110	93

Which plants had their leaves coated with grease?

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

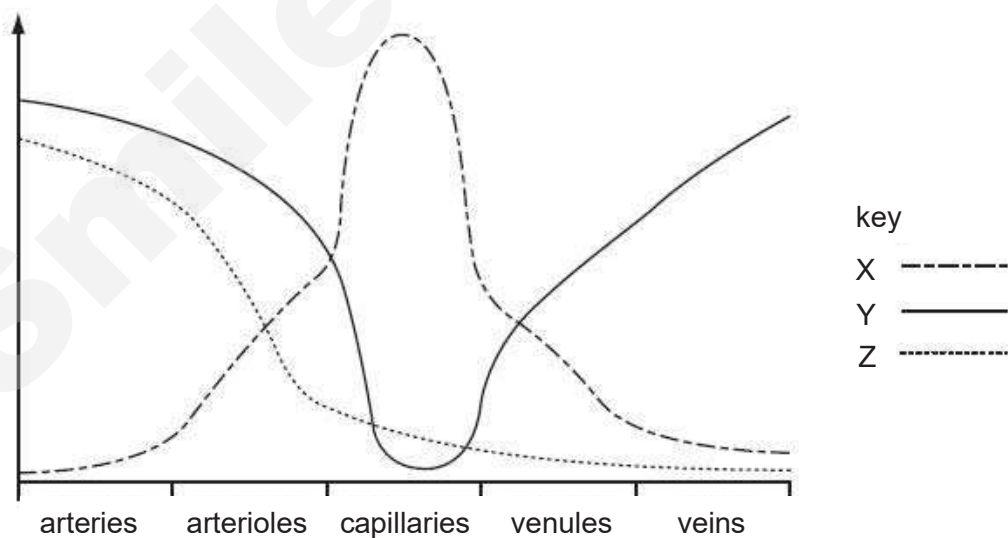
12 The diagram shows a section through a leaf.



Which option matches the cells to their respective functions?

	photosynthesis	transport
A	1 and 5	2 and 3
B	2 and 4	1 and 4
C	3 and 4	2 and 5
D	4 and 5	3 and 4

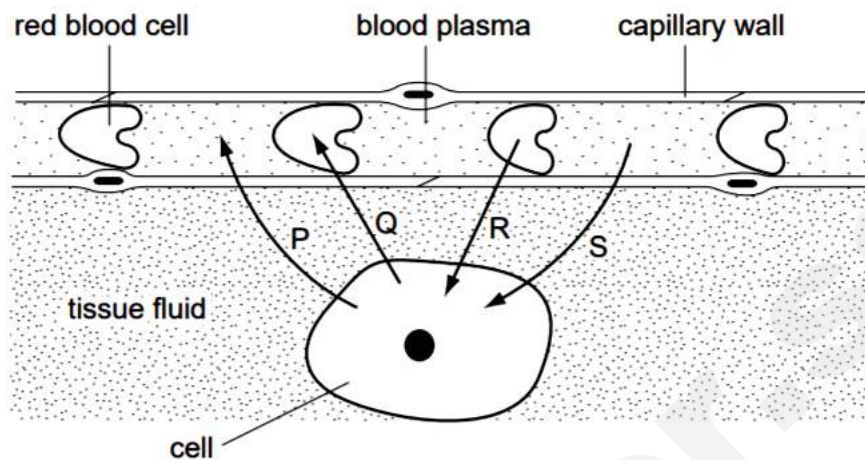
13 The graph represents data on blood vessels and blood flow.



Which row correctly identifies the curves?

	pressure of blood	total cross sectional area	velocity of blood flow
A	Y	Z	X
B	Z	Y	X
C	Z	X	Y
D	X	Y	Z

- 14** The diagram represents a blood capillary with an adjacent cell. The arrows represent the directions of movement of substances between the capillary and the cell.

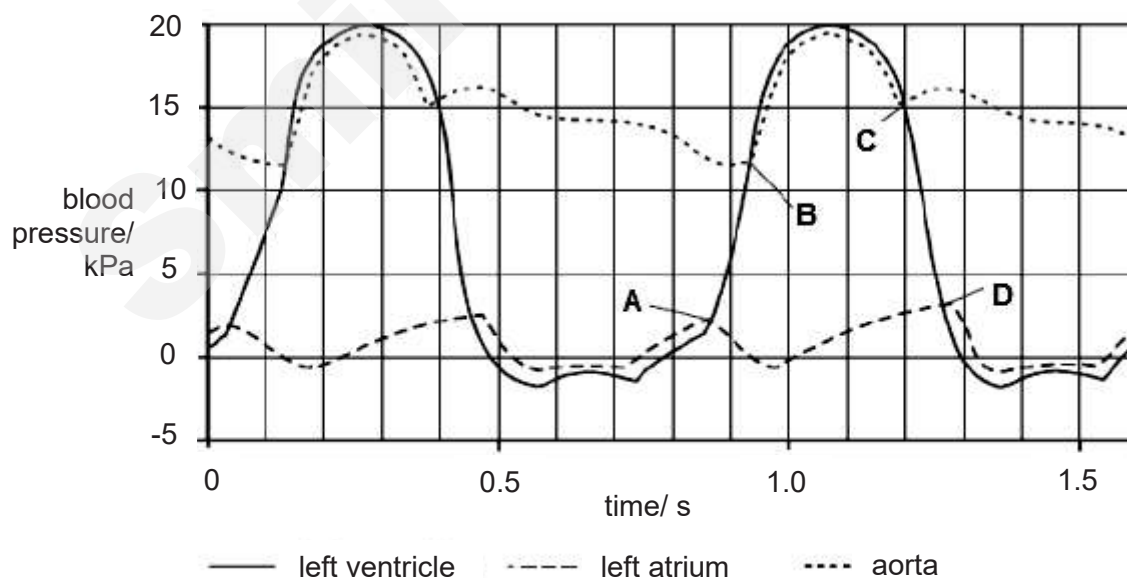


Which arrows represent glucose, carbon dioxide and oxygen?



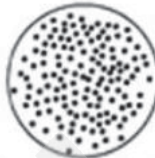



	glucose	carbon dioxide	oxygen
A	P	R	Q
B	Q	S	P
C	R	Q	S
D	S	P	R

- 15** The graph shows pressure changes in the left ventricle, left atrium and aorta.

At which point, **A**, **B**, **C** or **D** is the aortic valve open?



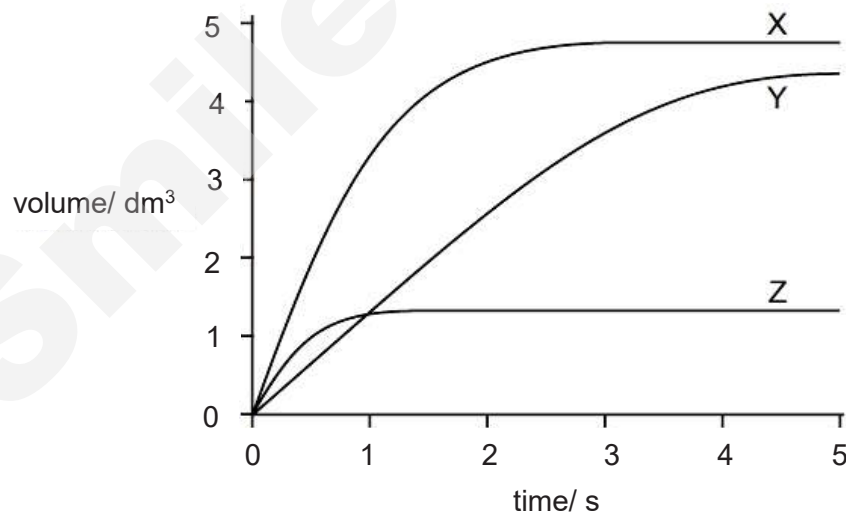
- 16** The diagram shows the results of blood group testing of three people.

blood extracted from person	X	Y	Z
serum from blood group A	 clumps	 clumps	 no clumping
serum from blood group B	 no clumping	 clumps	 no clumping

Which blood group does X, Y and Z belong to?

	X	Y	Z
A	A	AB	O
B	B	AB	O
C	AB	A	B
D	O	AB	A

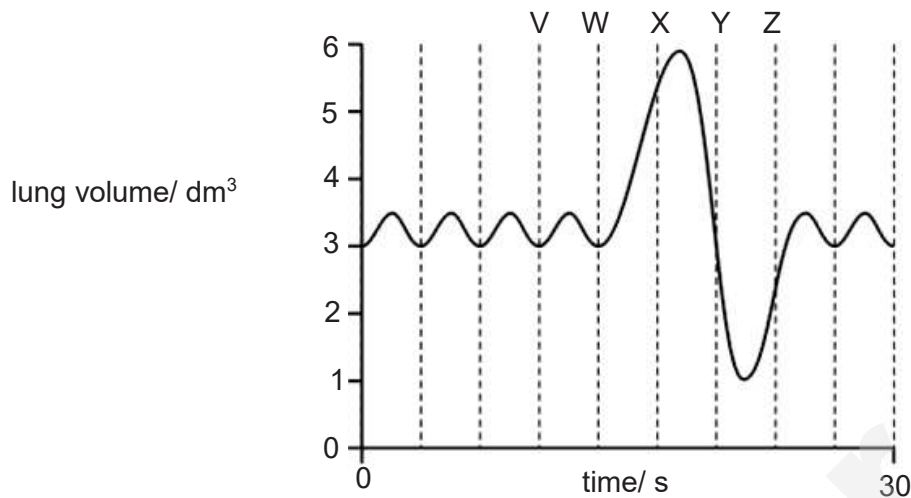
- 17** The graph shows the volume of air breathed out quickly and with force, following a deep breath in, for three different people, X, Y and Z.



What is an explanation for the differences shown?

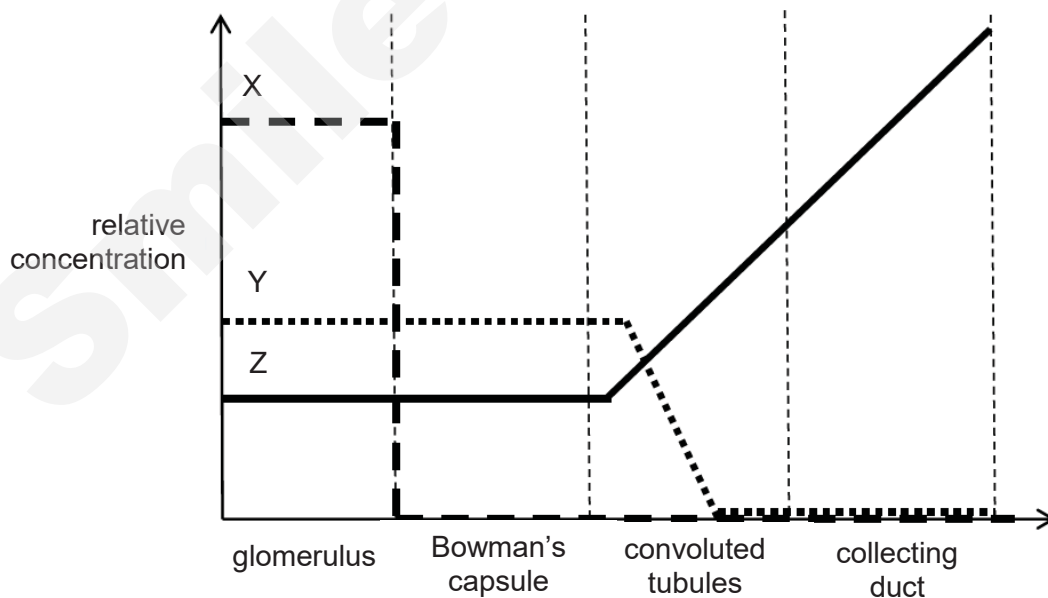
	chronic bronchitis	emphysema	healthy lung function
A	X	Y	Z
B	X	Z	Y
C	Y	Z	X
D	Z	Y	X

- 18 The graph shows changes in the amount of air in a person's lungs over a period of 30 seconds.



During which period is the rate of breathing the highest?

- A V to W
 - B W to X
 - C X to Y
 - D Y to Z
- 19 The line graphs show the relative concentration of glucose, protein and urea in the fluids obtained from various parts of the mammalian kidney.



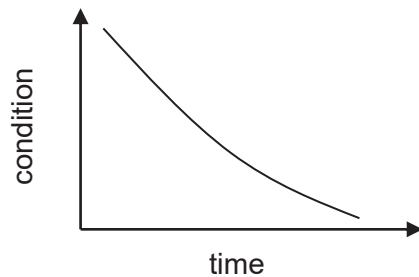
Which option correctly matches the three line graphs?

	X	Y	Z
A	glucose	urea	protein
B	glucose	protein	urea
C	protein	urea	glucose
D	protein	glucose	urea

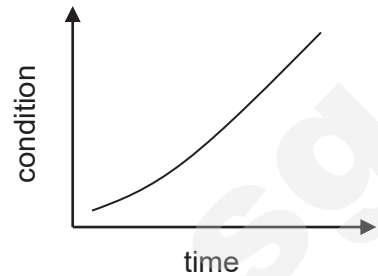
20 The graphs show how four different conditions in the body may change with time.

In which graph is the condition being controlled by negative feedback?

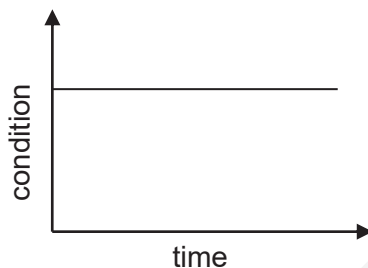
A



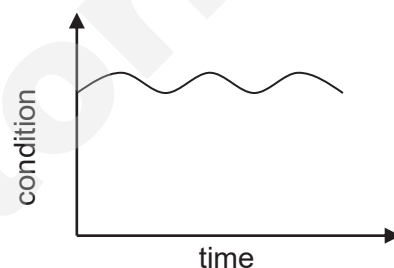
B



C



D



21 The table gives information about endocrine glands.

Which row shows the correct information?

	gland	hormone produced	target organ	effect
A	adrenal	adrenaline	liver	decreases blood glucose concentration
B	ovaries	progesterone	uterus	ovulation occurs
C	pancreas	insulin	liver	conversion of excess glucose to glycogen
D	testes	testosterone	penis	erection occurs for sexual intercourse

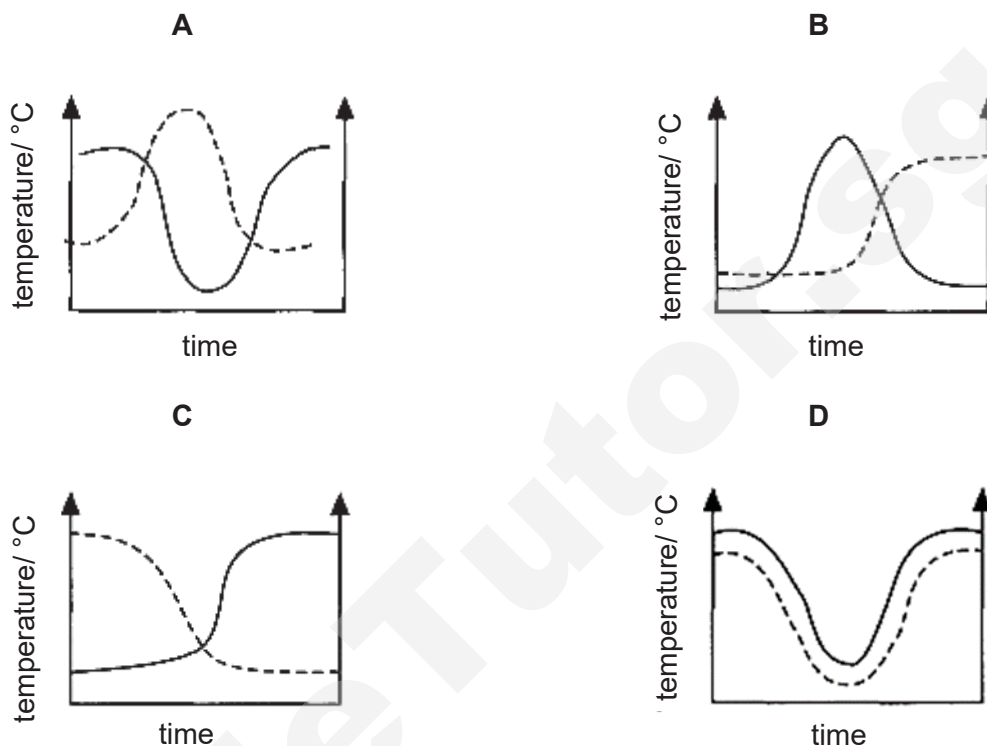
22 Which statement describes a role of the anti-diuretic hormone?

- A** It controls the rate of water secretion in the sweat.
- B** It is antagonistic to insulin.
- C** It regulates osmotic concentration of body fluids.
- D** Its absence causes diabetes mellitus.

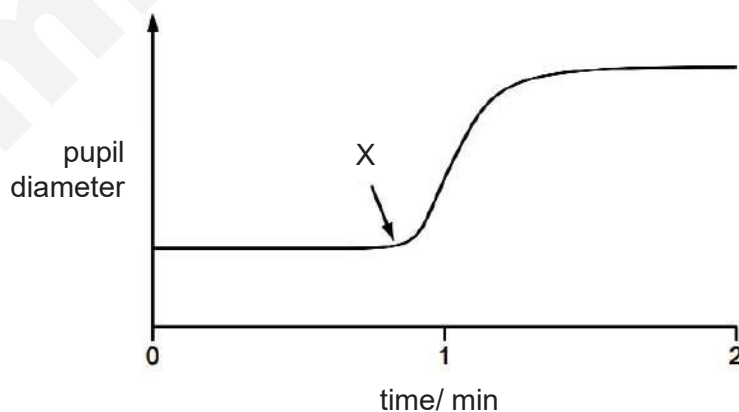
- 23** A man is placed in a room where the temperature is controlled at 40 °C. Measurements of his skin temperature and rate of sweating are recorded over a period of time.

Which graph would most accurately represent the above situation?

Key — skin temperature ---- rate of sweating



- 24** The graph shows how the diameter of a pupil of the human eye changed during the period of two minutes.



What happens to the light intensity at X, and which muscles begin to contract?

	light intensity	iris muscles
A	decrease	circular
B	decrease	radial
C	increase	circular
D	increase	radial

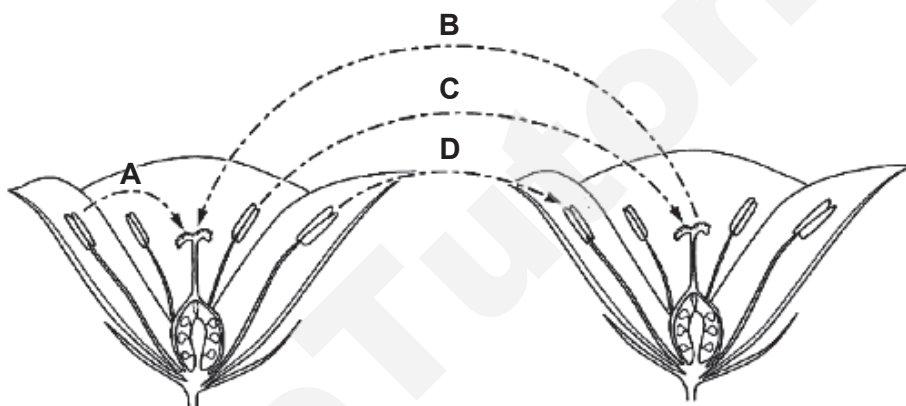
- 25** An experiment was set up using four groups of insect pollinated flowers, all of the same species, in a field. In each group, different parts of the flowers were removed and insects were allowed to visit all the flowers freely.

Which group of flowers would produce the most number of seeds?

	stigma	anthers	petals
A	left	left	removed
B	left	removed	left
C	removed	left	removed
D	removed	removed	left

- 26** The diagram shows two different flowers from two different plants of the same species.

Which letter represents cross-pollination?



- 27** Which row shows the effects of estrogen and progesterone?

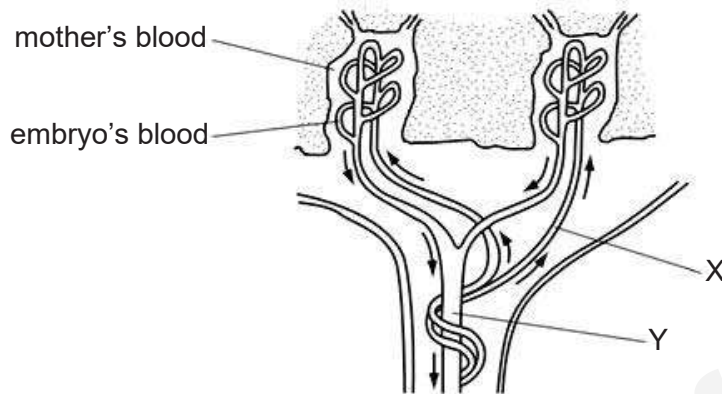
	high levels required for ovulation	high levels needed to stop development of more ova	maintains uterine lining thickness	repairs the uterine lining
A	estrogen	progesterone	estrogen	progesterone
B	estrogen	progesterone	progesterone	estrogen
C	progesterone	estrogen	estrogen	progesterone
D	progesterone	estrogen	progesterone	estrogen

- 28** After sexual intercourse, sperms can survive up to 3 days in the uterus and oviducts. Ovulation can occur any time between day 13 and 15 of the menstrual cycle. An ovum can survive for 2 days after ovulation.

How long is the longest possible fertile period?

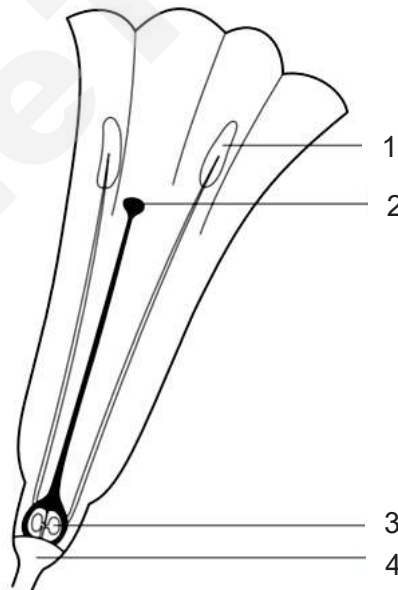
- A** 2 days
- B** 3 days
- C** 5 days
- D** 7 days

- 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 in X at higher concentrations than in Y?

- A** carbon dioxide and glucose
 - B** carbon dioxide and urea
 - C** glucose and oxygen
 - D** glucose and urea
- 30** The diagram shows a section through a flower.



In which structures are haploid nuclei formed by reduction division?

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

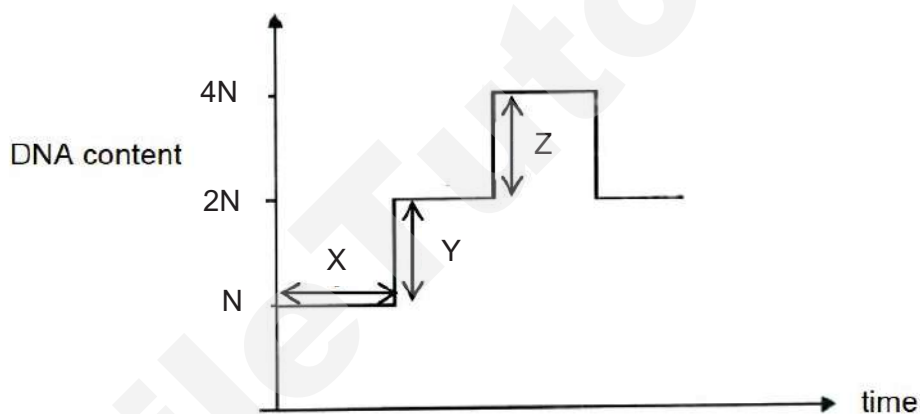
31 The list gives some of the stages involved in gamete and zygote formation.

- 1 prophase I of meiosis
- 2 prophase II of meiosis
- 3 metaphase I of meiosis
- 4 fertilisation

During which stages do events occur that increase genetic variation in the zygote?

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

32 The diagram shows changes in the amount of DNA content of a cell. The amount of DNA content in a normal body cell is $2N$.



What is represented by X, Y and Z?

	X	Y	Z
A	telophase	gametes	fertilisation
B	fertilisation	interphase	gametes
C	gamete	fertilisation	interphase
D	anaphase I	metaphase I	gametes

33 Within a group of humans, which is an example of a continuous variation?

- A** blood group
B eye colour
C height
D tongue rolling

34 Which statement about human blood group is correct?

- A A person with the blood group A cannot have an I^O allele.
- B A person with the blood group B may have either the genotype $I^B I^B$ or $I^B I^O$.
- C In a person with the blood group AB, the I^B allele is recessive to the I^A allele.
- D The alleles I^B and I^O are co-dominant and have an equal effect on the phenotype.

35 Bacteria can be genetically modified to produce human insulin.

What is a possible risk of this procedure?

- A Bacterial insulin is less effective in treating diabetes than animal insulin.
- B The genetically modified bacteria may become insulin resistant.
- C The genetically modified bacteria may produce too much insulin.
- D The presence of a new gene in the bacteria may alter the way existing gene work.

36 Which statement about chromosomes is correct?

- A Chromosomes are long DNA molecules called genes which are divided into sections.
- B Chromosomes include a long molecule of DNA divided into sections called genes.
- C Chromosomes include genes which are divided into sections called DNA molecules.
- D Genes include long DNA molecules called chromosomes.

37 In maize, one allele of a particular gene allows chlorophyll production while the other allele prevents this, giving plants with cream-coloured leaves.

Half the seeds from a cross between two green-leaved plants were sown in trays kept in the dark. The other half was sown in similar conditions except that they received optimum light intensity.

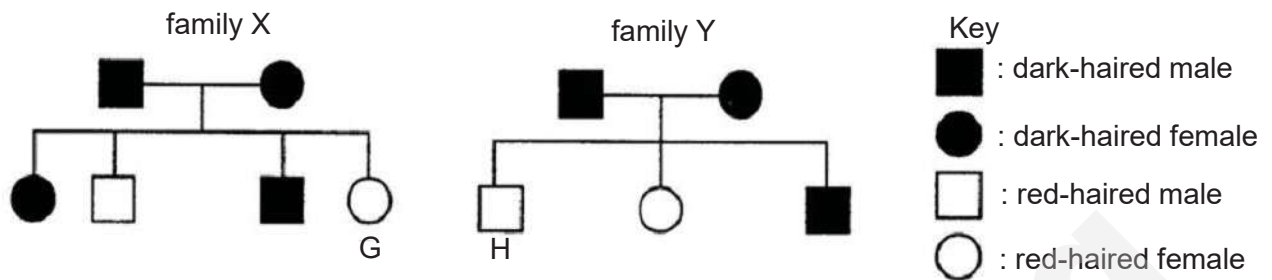
The table shows the results obtained.

number of seedlings			
kept in the dark		kept in optimum light intensity	
green leaves	cream leaves	green leaves	cream leaves
X	400	320	110

What is the most possible number of green-leaved plants formed from seeds germinating in the dark?

- A 0
- B 110
- C 320
- D 400

- 38 The diagram shows the pattern of inheritance of dark hair and red hair in two families.



If individuals G and H marry each other, what prediction can be made about the hair colour of their children?

- A All their children will have red hair.
 B Half of their children will have dark hair.
 C Only the boys will have dark hair.
 D 75% of their children will have dark hair.
- 39 A single plant provides food for many herbivores. The herbivores supply food for a few carnivores.

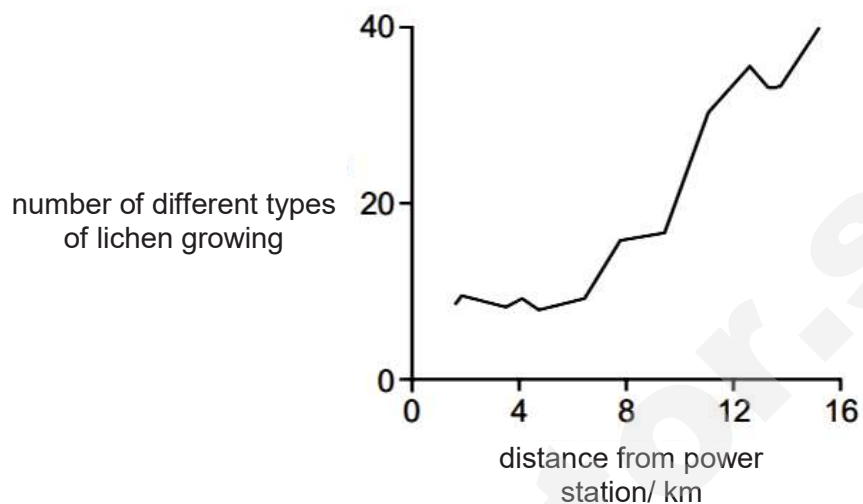


Which pyramids of numbers and biomass represent this information accurately?

	pyramid of numbers	pyramid of biomass
A	W	Y
B	W	Z
C	X	Y
D	X	Z

40 Lichens are organisms which are very sensitive to air pollution.

The graph shows how the distance from a coal-fired power station affects the number of different types of lichen growing.



Which conclusion can be drawn from this information?

- A** Lichens grow faster near the power station.
- B** Lichens grow more slowly near the power station.
- C** Sulfur dioxide from the power station inhibits the growth of lichens.
- D** There are fewer different types of lichen growing near the power station.

Name: _____ ()

Class: _____



CHIJ KATONG CONVENT
PRELIMINARY EXAMINATIONS 2019
Secondary Four Express

BIOLOGY

Paper 2

6093/02

Duration: 1 hour 45 minutes

Classes: 405 and 406

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name, registration number and class 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, tables or rough working.

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 **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 on Section B.

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

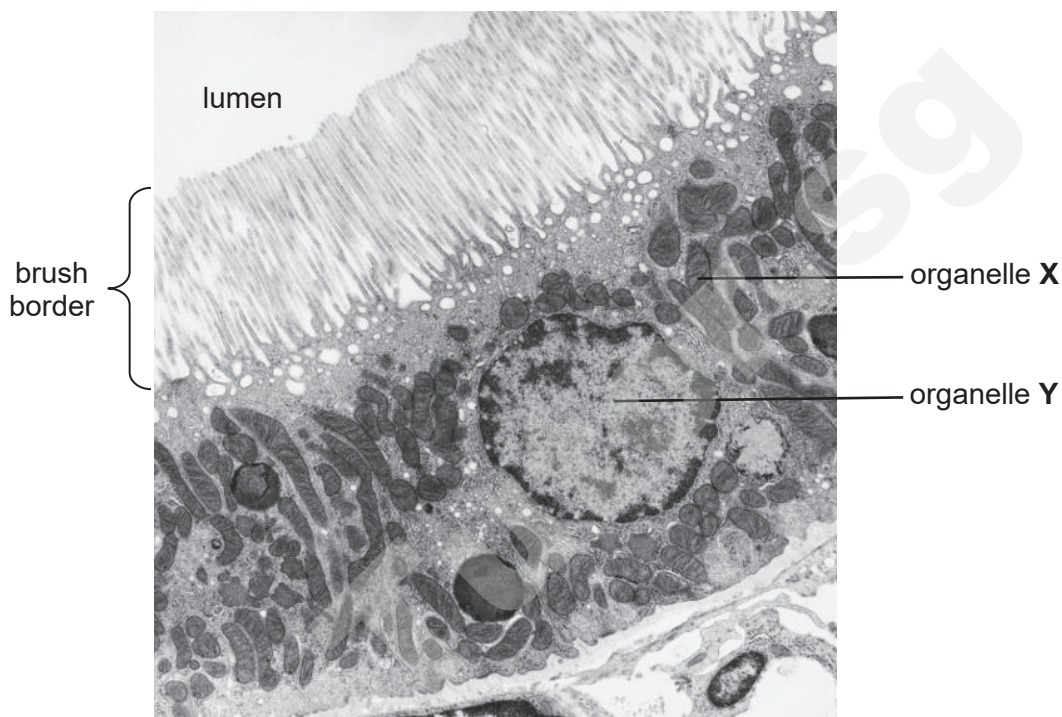
The number of marks is given in brackets [] at the end of each question or part question.

FOR EXAMINER'S USE	
Paper 1	/ 40
Paper 2	
Section A	/ 50
Section B	/ 30
TOTAL	/ 120

Section AAnswer **all** the questions.

Write your answers in the spaces provided.

- 1** The diagram shows an electron micrograph of a segment of a proximal convoluted tubule cell of a kidney.

**Fig. 1.1**

- (a)** Identify organelles **X** and **Y**.

X **Y** [2]

- (b)** Suggest the importance of the numerous numbers of organelle **X** in the cell.

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

- 1 (c) Glomerular filtrate flows through the lumen of the proximal convoluted tubule which is surrounded by a tall brush border. The brush border is formed by the numerous folding of the cell membrane of the tubule cell.

Suggest and explain the importance of the brush border to the tubule cell.

.....

.....

.....

.....[2]

- (d) Almost all humans have one functioning liver. In cases of liver transplantation, it is possible for a donor to donate a portion of his liver to a patient in need.

Suggest why it is possible for the donor to do so.

.....

.....[1]

[Total: 7]

- 2 Fig. 2.1 shows a human heart and its associated blood vessels.

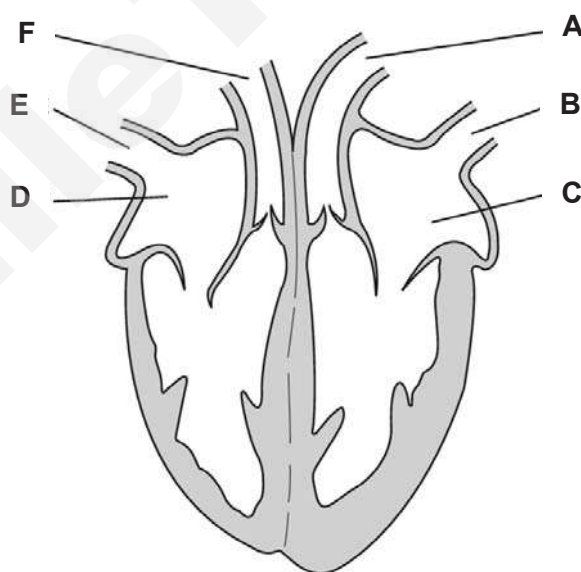


Fig. 2.1

- (a) Complete the table below to show which structures **A** to **F** are involved in the circulation of blood to or from the lungs and body tissues.

blood to or from lungs	blood to or from body tissues

[2]

- 2 (b) Compare the pressure of blood in the circulation to the body tissues and the pressure of blood in the circulation to the lungs.

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

- (c) Explain how the structure of the heart produces this difference in blood pressure.

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

- (d) In humans, there are three types of blood circulation:

- 1 Systemic circulation which circulates blood through various body tissues.
- 2 Pulmonary circulation which allows for oxygenation of blood in the lungs.
- 3 Portal circulation which is part of systemic circulation, with blood passing through two sets of capillaries before draining into a larger systemic vein.

Name one vein involved in portal circulation.

.....[1]

[Total: 7]

- 3 (a) Write the word equation for photosynthesis in the given space below.

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

- 3 (b) A young, green and leafy stem was placed in a clear glass beaker of water in bright light. Fig. 3.1 shows the stem 12 hours later.

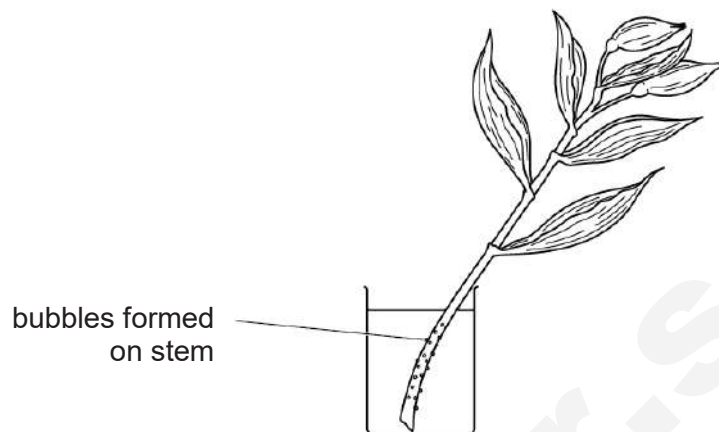


Fig. 3.1

Tests proved that the bubbles contain oxygen gas.

Explain how the bubbles of oxygen gas appeared on the sides of the green stem.

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.....

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.....

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.....[3]

- (c) Explain the benefits to other aquatic organisms of having submerged water plants in the ecosystem.

.....

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.....

.....

.....[3]

[Total: 8]

- 4 Fig. 4.1 shows part of the flowering head of a small tree that grows in tropical rainforests.

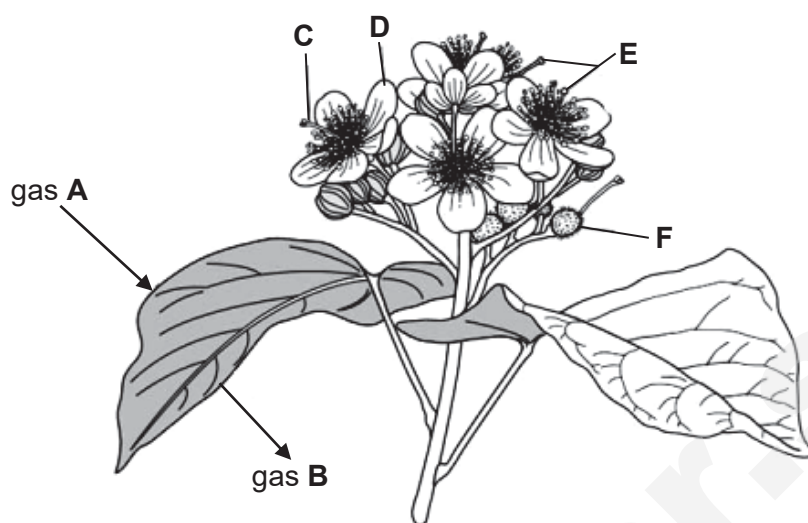


Fig. 4.1

- (a) Identify structures **C**, **D** and **E**.

C

D

E [3]

- (b) Gases **A** and **B** represent gases that pass into and out of the leaves in the absence of light energy.

Write the equation to show the relationship between gas **A** and gas **B**.

.....

.....[1]

- (c) Structure **F** is the fruit of this plant. It has low mass and density, and is covered with hair.

Suggest how this fruit can be dispersed to other parts of the tropical rainforests.

.....

.....[1]

- 4 (d)** Extracts from the tree have many uses in medicine. Some of the extracts are alkaline and have anti-bacterial properties.

Suggest why these tree extracts are sometimes used to treat medical conditions in the human stomach.

.....

.....

.....

.....[2]

[Total: 7]

- 5** Table 5.1 shows the concentration of glucose and hormone **A** in the blood over a period of 8 hours in a person.

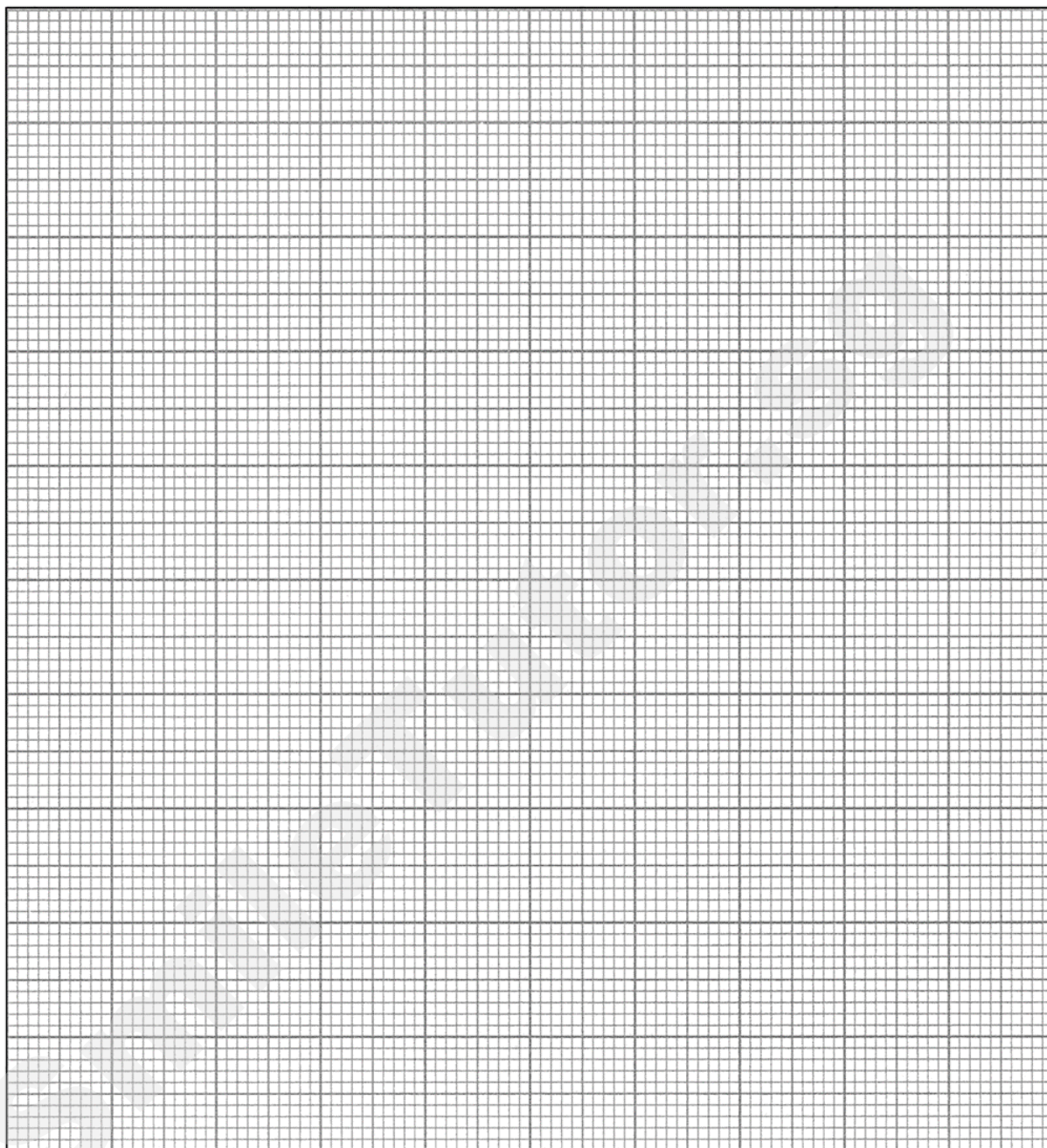
Table 5.1

time/ h	blood glucose concentration/ x 10 mg/ dl	blood hormone A concentration/ $\mu\text{g}/\text{mg}$
0	5	4
1	5	4
2	7	20
3	15	19
4	16	15
5	13	8
6	9	5
7	6	4
8	5	4

- (a)** In the grid provided on the next page, plot the graphs of the concentration of glucose and hormone **A** in blood against time.

Both graphs must share the given space and you may have one y-axis on each side of the space.

5 (a)



[5]

(b) Identify hormone **A**, and provide an explanation for your answer.

.....

.....

.....

.....[2]

[Total: 7]

6 Fig. 6.1 shows an animal cell during cell division.

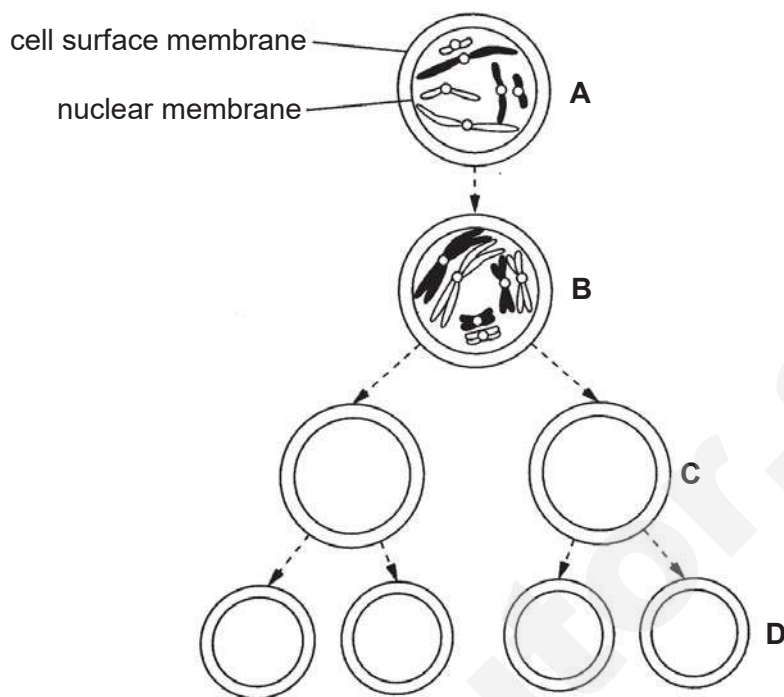


Fig. 6.1

- (a) Identify the type of cell division shown.
[1]
- (b) Complete the diagram on Fig. 6.1, for C and D. [2]
- (c) Gene coding for Bt-toxin is found in soil bacterium *Bacillus thuringiensis*. Cabbage plants with in-built Bt-toxin gene against the diamondback moths can be produced by genetic engineering i.e. the farmer no longer has to eliminate the insects with insecticides.

Explain how these transgenic cabbage plants can be produced.

.....

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.....[4]

[Total: 7]

- 7 Fig. 7.1 shows the relationships between a number of organisms living together in a South American rainforest.

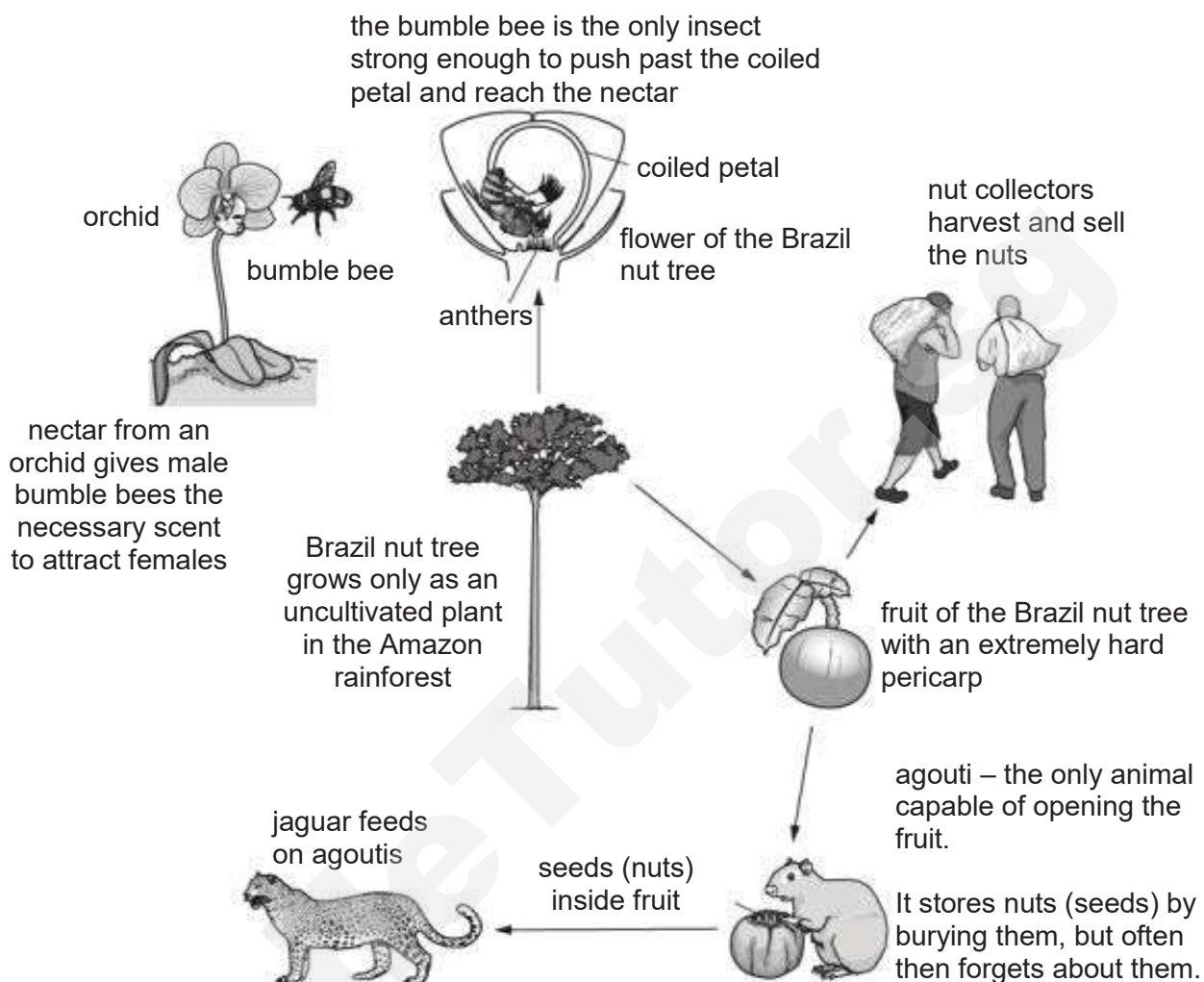


Fig. 7.1

- (a) Complete Fig. 7.2 by:

- writing the name of an organism in each box,
- completing the arrows to show the flow of energy.

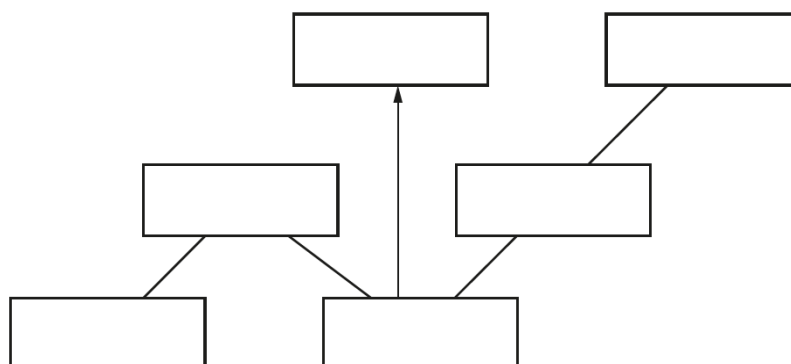


Fig. 7.2

[4]

-
- 7 (b) Suggest the possible effects on the community in the rainforest if the orchids were killed by a disease.

.....

.....

.....

.....

.....

.....[3]

[Total: 7]

Section BAnswer **three** questions.Question **10** is in the form of an **Either/ Or** question. Only one part should be answered.

- 8 (a)** Describe the structure of the DNA.

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.....

.....

.....

.....

.....

.....

.....

.....[4]

- (b)** Haemophilia is a genetic disorder where blood clotting does not occur, and the affected person may bleed to death from a minor cut. The gene for haemophilia is recessive, and is inherited only from the X-chromosome of the mother. This means that a son who inherits the recessive gene in the X-chromosome from the mother, and a healthy Y-chromosome from the dad, will inherit haemophilia.

A healthy man marries a woman who does not have the condition. They have a son who is haemophiliac. Explain with the aid of a genetic diagram how this is possible, and suggest the probability of this occurrence in the offspring.

You may use X^h for the recessive allele on X-chromosome.

[6]

[Total: 10]

- 9 (a)** Describe how a developing fetus in the uterus obtains and uses its metabolic requirements and gets rid of its waste products.

.....[6

- 9 (b)** Describe how water and sugars are transported to a developing fruit.

.....[4]

[Total: 10]

10 Either

- (a)** Describe three different ways substances move into and out of animal cells.

Use an example to illustrate each process.

etTutor

[6]

- 10 (b)** Some muscles in our body work as antagonistic pairs. 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 movement of food bolus in the esophagus after swallowing.

[4]

[Total: 10]

ANSWERS

1	2	3	4	5	6	7	8	9	10
C	C	A	B	B	C	C	B	D	C

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

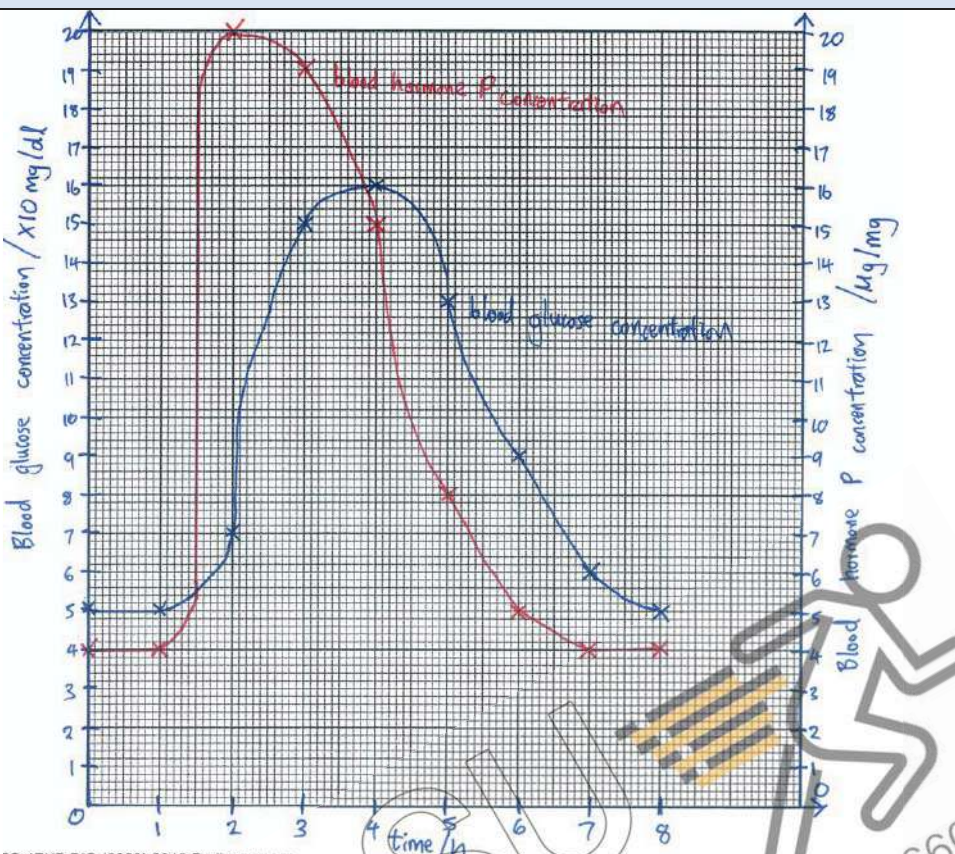
21	22	23	24	25	26	27	28	29	30
C	A	B	B	B	C	B	D	B	A

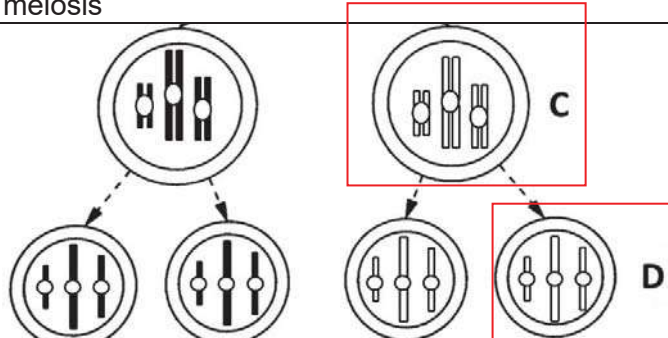
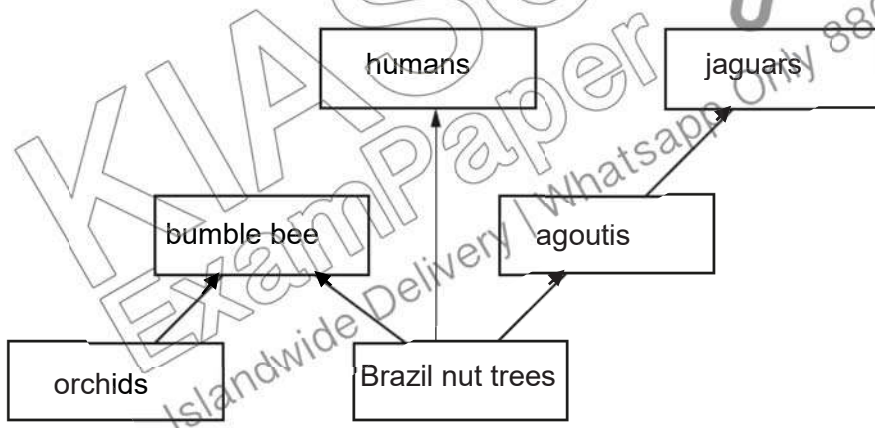
31	32	33	34	35	36	37	38	39	40
C	C	C	B	D	B	A	A	C	D

Marking Scheme

Qn no	suggested marking points		marks				
Section A							
1(a)	X: mitochondrion Y: nucleus		1 1				
1(b)	The mitochondrion releases energy + for active transport/ aerobic respiration; of the glucose and amino acids; (from the lumen of the proximal convoluted tubule back into the bloodstream;) Common errors: <ul style="list-style-type: none">not reading 'ORGANELLES' as requested in qn stem;plural VS singular		1 1				
1(c)	<ul style="list-style-type: none">The brush border increases the surface area to volume ratio of the cell;to increase rate of selective reabsorption/ diffusion of useful substances;		1 1				
1(d)	The liver can regenerate itself/ the other portion is still functioning Common errors: <ul style="list-style-type: none">not using ideas/ keywords close enough to 'regeneration' i.e. (biology) the process of growing again;using "grow again quickly" + "grow again slowly". The rate of regeneration is relative, so why mention the speed? It actually takes about 30 days + this is relatively fast.R: answers related to patients e.g. the donated portion of the liver can still carry out the functions. Qn is on donor.		1				
			7				
2(a)	<table><tr><td>blood to or from lungs</td><td>blood to or from body tissues</td></tr><tr><td>B, C, F</td><td>A, D, E</td></tr></table> 1 m for each correct side. No 0.5m Common errors: <ul style="list-style-type: none">not practicing careful reading – the blood can be TO or FROM, not necessarily oxygenated or deoxygenated only	blood to or from lungs	blood to or from body tissues	B, C, F	A, D, E		2 m
blood to or from lungs	blood to or from body tissues						
B, C, F	A, D, E						
(b)	higher to body tissues; OR lower to lungs		1				
(c)	left ventricle; [correct identification of side] has thicker muscular walls ; greater + contraction / force (applied to blood) AW ; Common errors: <ul style="list-style-type: none">the thicker muscular ventricular walls GENERATE higher blood pressure, not simply withstandexert ≠generate high blood pressure *BUT* muscular contraction of thicker left ventricular walls exerts higher pressure on the blood → sentence phrasing/ C+E		1 1 1				

	<ul style="list-style-type: none"> - Students who explained double circulation are not awarded marks as NATQ + IRR. - Ventricles cannot contract; ventricular walls contract 	
(d)	hepatic portal vein/ renal portal vein	1
		7
3 (a)	<p>light energy carbon dioxide + water → glucose + oxygen + water chlorophyll</p> <p>1m for all conditions 1m for all correct reactants + products</p> <p>Common errors:</p> <ul style="list-style-type: none"> - Missing out water as product - Using 'sunlight' instead of 'light energy' 	2
(b)	<ul style="list-style-type: none"> - photosynthesis occurs - oxygen gas released via intercellular spaces - diffuses through opening/ spaces/ stomata/ lenticels 	1 1 1
(c)	<ul style="list-style-type: none"> - increases oxygen concentration in water via photosynthesis - Oxygen is required for respiration - reduce competition for oxygen - use plants/ leaves of plants for food/ - use plants/ leaves of plants for home/ shelter from predators <p>Common errors:</p> <ul style="list-style-type: none"> - Benefit to the water plants; qn requested benefits to other aquatic organisms 	max 3
		8
4(a)	<p>C: style D: petal E: anthers</p> <p>Common errors: not observing closely – E is anther, not stigma. Compare with the other anther structures. If F is fruit, thus C is the style, the stigma is found above C. E would be anthers, above the filament.</p> <p>NB marking points are strictly followed as this was a previous O level qn with the exact same diagram.</p>	1 1 1
(b)	<p>glucose + oxygen (gas A) → carbon dioxide (gas B) + water + large amount of energy $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + \text{Energy/ ATP/ 38 ATP}$</p>	
(c)	<ul style="list-style-type: none"> - wind dispersal OR - hooks onto insects <p>Common errors: R: dispersed by animals → how so?; water – assumption there's a body of water in the tropical rainforests</p>	1
(d)	<ul style="list-style-type: none"> - alkaline: to neutralise HCl - anti-bacteria: to kill/ destroy bacteria in stomach/ reduce chance of infections <p>Common errors:</p> <ul style="list-style-type: none"> - Not answering the quality of 'anti-bacterial properties' - R: "extracts remove/ eliminate the bacteria" → remove/ eliminate, how? 	1 1

5(a)	 <p>SS 4EXP BIO (6093) 2018 Prelim P2 LYT</p>	7
	<ol style="list-style-type: none"> 1. Scale 2. Points 3. Line for hormone A 4. Line for BGC 5. Axes – blood glucose and hormone A; both must be the same scale due to relationship between the 2 <p>smooth curve, not straight line + differentiated/ different plot symbols simply labelling won't suffice as there is a cross/ overlap of lines</p> <p>Common errors: straight line – relationship between hormone concentration in blood + time is usually a curve</p> <p>Use “SPLAT” as a reminder – even if the markers’ points are different, these SPLAT points would help you cover all grounds! Write it down as a reminder to yourself.</p>	<p>1 1 1 1 1</p>
(b)	<p>Adrenalin.</p> <p>The increase in hormone causes increase in BGC + with no prior decrease.</p> <p>A: Although glucagon increases in blood glucose level, there is no trigger/stimulus eg drop in blood glucose level which causes release of glucagon/ sudden increase in concentration of hormone A which usually happens when a person faces/ suffers from a shock.</p> <p>Common errors: not differentiation why it is caused by adrenaline as opposed to glucagon.</p>	<p>1 1</p>

		7
6(a)	meiosis	1
(b)	 <p>*A: student drawing for the circle closes to letter C and D.</p>	1
(c)	<ol style="list-style-type: none"> 1. The Bt-toxin gene is cut from the DNA of the soil bacterium, Bacillus thuringiensis using restriction enzymes. Using the same restriction enzyme, bacterial plasmid is cut. 2. Bt-toxin gene is inserted into plasmid to form a recombinant plasmid using ligase. 3. Recombinant plasmid then introduced into bacterial cells using heat / electric shock. Bacterial cells are cloned. 4. Cabbage plant cells infected with bacteria, thus introducing the recombinant plasmid into the cabbage plant cells. <p>Common errors: poorly done – not using keywords or understanding process.</p>	max 4
7(a)	 <p>3 m: all 6 correct boxes, 2m: 4 correct boxes, 1m: 2 correct boxes// no 0.5 m awarded 1m: all correct arrow heads.</p> <p>Common errors: not understanding the sequence. the fruit, the flower, belongs to the same brazil nut tree → we do not differentiate them into different trophic level. It is one trophic level i.e. brazil nut tree.</p>	4
(b)	<ol style="list-style-type: none"> 1 less nectar ; 2 male bees + lack scent ; 3 female bees + not attracted ; 4 less reproduction of bees ; 5 less pollination + of trees ; 	any 3

	6 less trees ; 7 less nut / fruit production ; 8 loss of jobs (for humans) / negative economic impact AW ; 9 less food for agoutis ; 10 death / reduced population + of agoutis OR agoutis seek other food ; 11 less food for jaguars ; 12 death / reduced population + of jaguars OR jaguars seek other food ; Common errors: hyperbolic assumptions reduced/ decreased \neq 0 less \neq lesser decreased rate \neq cannot	
		7
Section B		
8a	<ul style="list-style-type: none"> - Nucleotides: 1 deoxyribose sugar + phosphate group + nitrogenous base - 4 bases: adenine, thymine, guanine, cytosine - 2 strands of DNA joined together by complementary base pairing; double helix + complementary base pairing - Anti-parallel strands 	1 1 1 1
8b	<ul style="list-style-type: none"> - This is possible as the mother is a carrier of the recessive gene, and the father is a healthy male. 	1
	<p>Handwritten genetic cross diagram for hemophilia. It shows a carrier mother (Xx) and a healthy father (XY). The diagram includes parental phenotypes, genotypes, random segregation of gametes (X, x and X, Y), and the resulting F1 generation with their genotypes and phenotypes: healthy daughter (XX), healthy son (XY), carrier daughter (Xx), and haemophiliac son (Xy). It concludes with the probability of a haemophiliac son being 25%.</p>	5
		10
9(a)	exchange of substances at the placenta; oxygen and nutrients diffuse from maternal blood space into fetal blood; waste products e.g urea and carbon dioxide diffuse out of fetal blood into maternal blood space; umbilical cord transports the dissolved substances in the blood to and fro fetus and mother; oxygen and glucose are used for cellular respiration to release energy for cell growth; amino acids and fatty acids used for building new protoplasm, new cells for the fetus;	1 1 1 1 1 1

9(b)	water transported via osmosis in xylem vessels from roots to stem to the transport tissues in the developing fruit; water move up through transpiration pull; glucose produced in the leaves are converted to sucrose; transported as sucrose in the phloem to the developing fruit;	1 1 1 1
		10
Either 10(a)	diffusion + describing the process; diffusion example; osmosis + describing the process; osmosis example; active transport + describing the process; active transport example; R: any explanation wrt plant cells	1 1 1 1 1 1
10(b)	<ul style="list-style-type: none"> - Circular muscles relax + Longitudinal muscles contract - Widening the lumen, allowing entrance/ to pass through - Circular muscles contract + longitudinal muscles relax - Constricting the lumen behind the bolus, pushing it through 	1 1 1 1
		10
Or 10(a)	<ul style="list-style-type: none"> - Pollen grain germinates / pollen tube develops upon stimulation by sugary sticky fluid + secreted by the stigma - Growth of pollen tube by secreting enzymes to digest tissues of style - transports the male gamete - The tip of pollen tube enters the ovule via the micropyle - The tip of pollen tube absorbs sap and swell/burst - Releasing the male gamete into the ovule + fertilise/ fuse with the female gamete 	1 1 1 1 1 1
10(b)	<p>Advantages of cross pollination to self-pollination:</p> <ul style="list-style-type: none"> - Greater genetic variation in the offspring compared to the parents + more adapted to changes in the environment - Beneficial genes/traits of both parents may be passed to the offspring / less possibility for recessive alleles to offspring <p>R: if answers stop at "greater genetic variation" – so what? How does this benefit the offspring?</p> <p>Disadvantages of cross pollination to self-pollination:</p> <ul style="list-style-type: none"> - Dependent on external agent of pollination + may not always be available - requires two parents + they may not be always available - More abundant pollen grains need to be produced compared to self pollination process as there is greater risk of loss during the transfer between two plants / more energy loss/ - Not all beneficial traits / genes of a plant may be passed down to the offspring 	1 1 1 1
		10

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2019 PRELIMINARY EXAMINATIONS SECONDARY 4 EXPRESS

BIOLOGY

6093/01

Paper 1 Multiple Choice

18 September 2019

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 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.

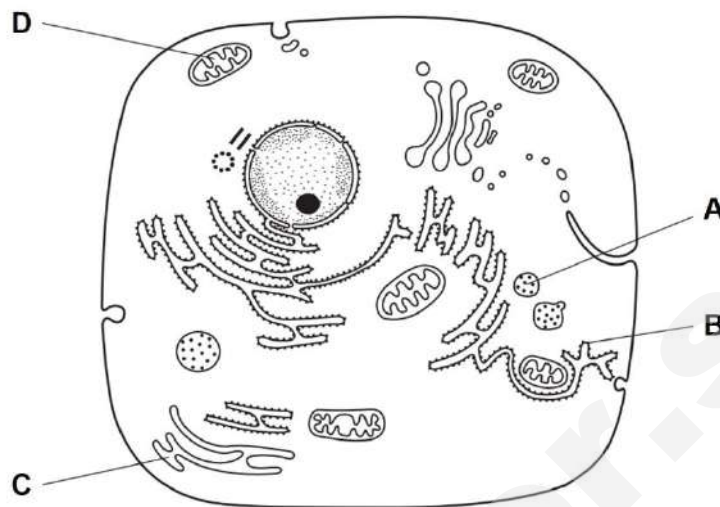
Read the instructions on the Answer Sheet very carefully.

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

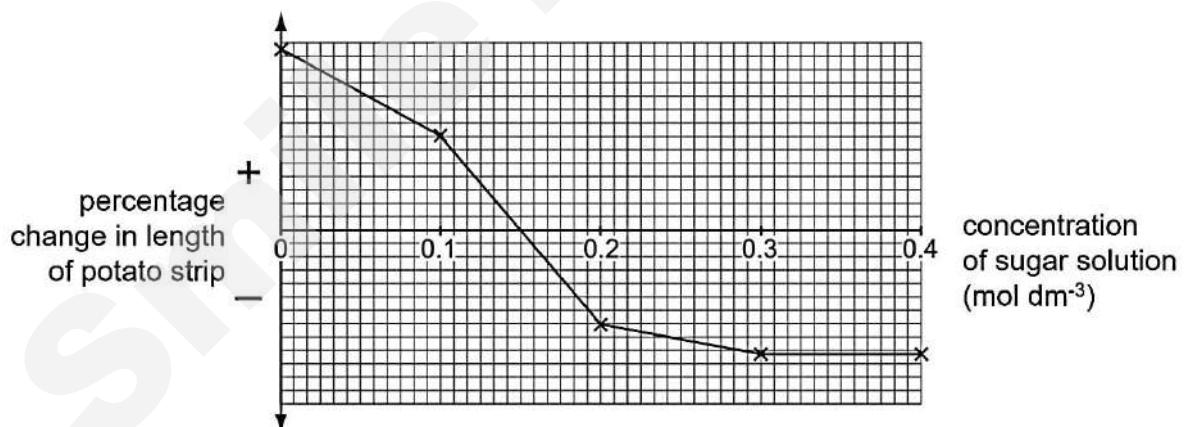
Any rough working should be done in this booklet.

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

- 1 The diagram shows an electron micrograph of an animal cell.
Which structure synthesises and transport proteins?



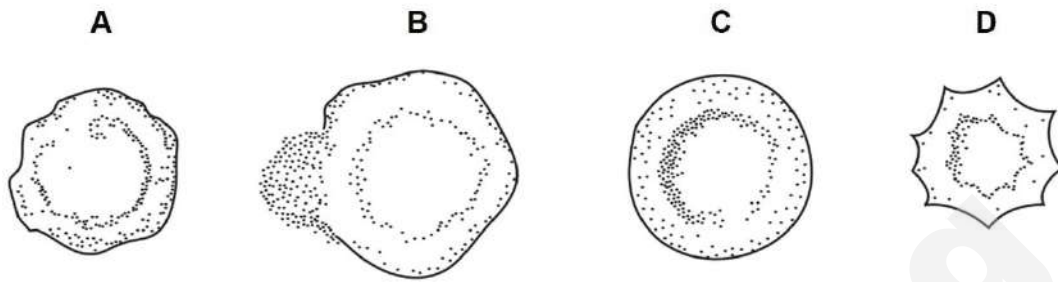
- 2 Five pieces of potato strips, of equal size and shape, are cut from the same potato tuber. The strips are then placed in sugar solutions of different concentrations. After four hours, the change in length of each potato strip is measured.
The results are shown in the graph.



Which concentration of sugar solution has approximately the same water potential as the potato tuber?

- A 0.00 mol dm⁻³
 B 0.15 mol dm⁻³
 C 0.30 mol dm⁻³
 D 0.40 mol dm⁻³

- 3 Some red blood cells were placed in distilled water and salt solutions of different concentrations. Which diagram shows the appearance of the cell that has been placed in distilled water?



- 4 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
- 5 What may take place during hydrolysis reaction?

- 1 a molecule of water is produced
- 2 a sucrose molecule is split into fructose and glucose
- 3 digestion of complex molecules into simpler ones using enzymes

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

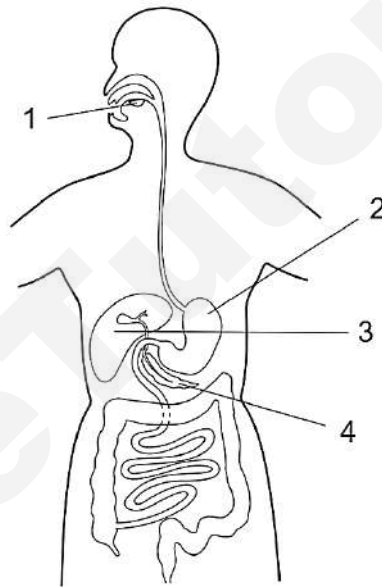
6 Some of the molecules found in animal tissues are grouped into three lists.

- 1 glucose, lipids, water, deoxyribose
- 2 glycogen, antibodies, adenine, fatty acids
- 3 haemoglobin, carbon dioxide, mRNA, disaccharides

Which lists include one or more molecules that always contain nitrogen atoms?

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

7 The diagram shows some organs of the digestive system.



Where are proteases made?

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

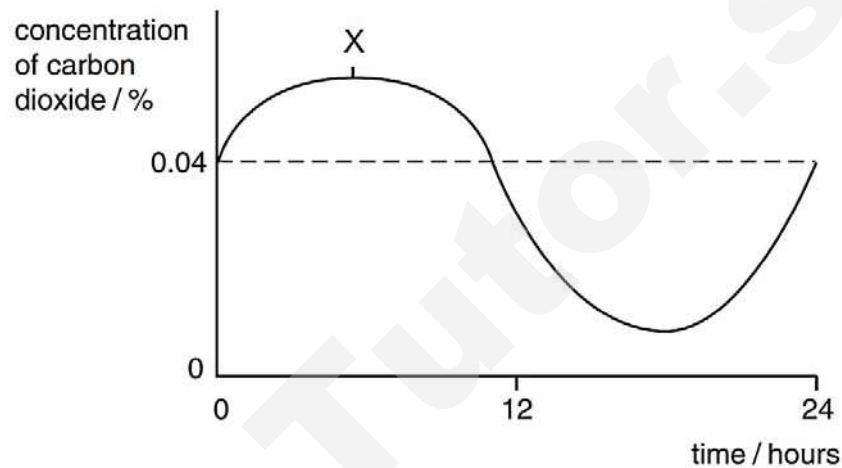
8 Starch is digested by amylase in the mouth, but it is not digested in the stomach.
What is the reason for this?

- A** All starch digestion is completed in the mouth.
- B** The pH in the stomach is not suitable for the amylase to work.
- C** The starch does not stay in the stomach long enough to be digested.
- D** The temperature in the stomach is not suitable for the amylase to work.

9 In which part of the body does the breakdown of drugs occur?

- A brain
- B heart
- C kidneys
- D liver

10 The graph shows the concentration of carbon dioxide in the air surrounding a plant measured over 24 hours.



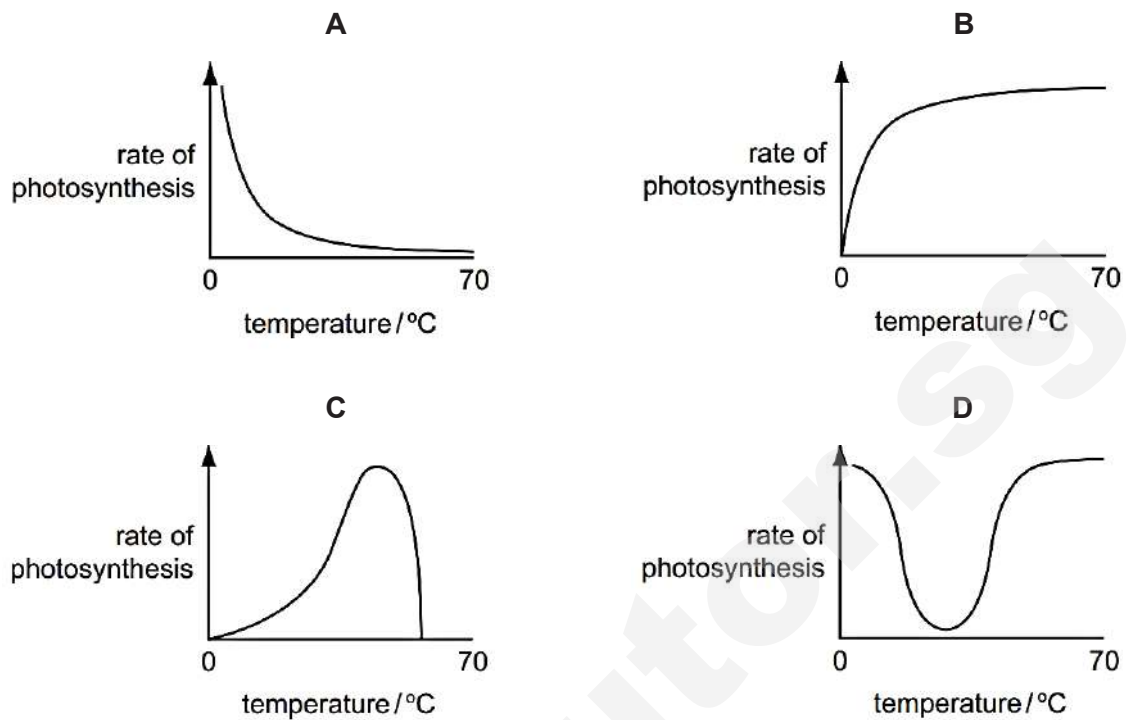
Which explains the carbon dioxide concentration at time X?

	light intensity	plant process
A	darkness	respiration
B	darkness	transpiration
C	daylight	photosynthesis
D	daylight	respiration

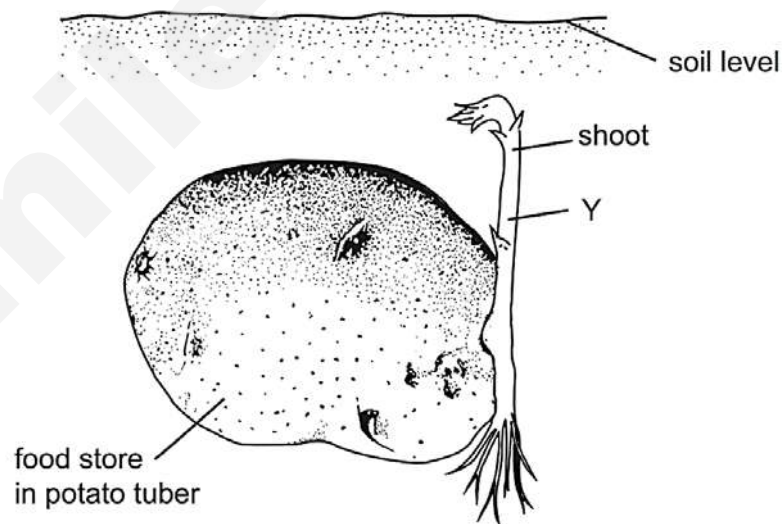
11 Why is sunlight necessary for photosynthesis?

- A It is a catalyst.
- B It is required to activate enzymes.
- C It is required to break down water molecules.
- D It is required to form chlorophyll.

12 Which graph shows the effect of temperature on the rate of photosynthesis?



13 The diagram shows a shoot growing from a potato tuber.



What is being transported in the phloem cells at Y?

- A starch downwards
- B starch upwards
- C sugars downwards
- D sugars upwards

- 14 Which row correctly identifies xylem vessel and sieve tube element?

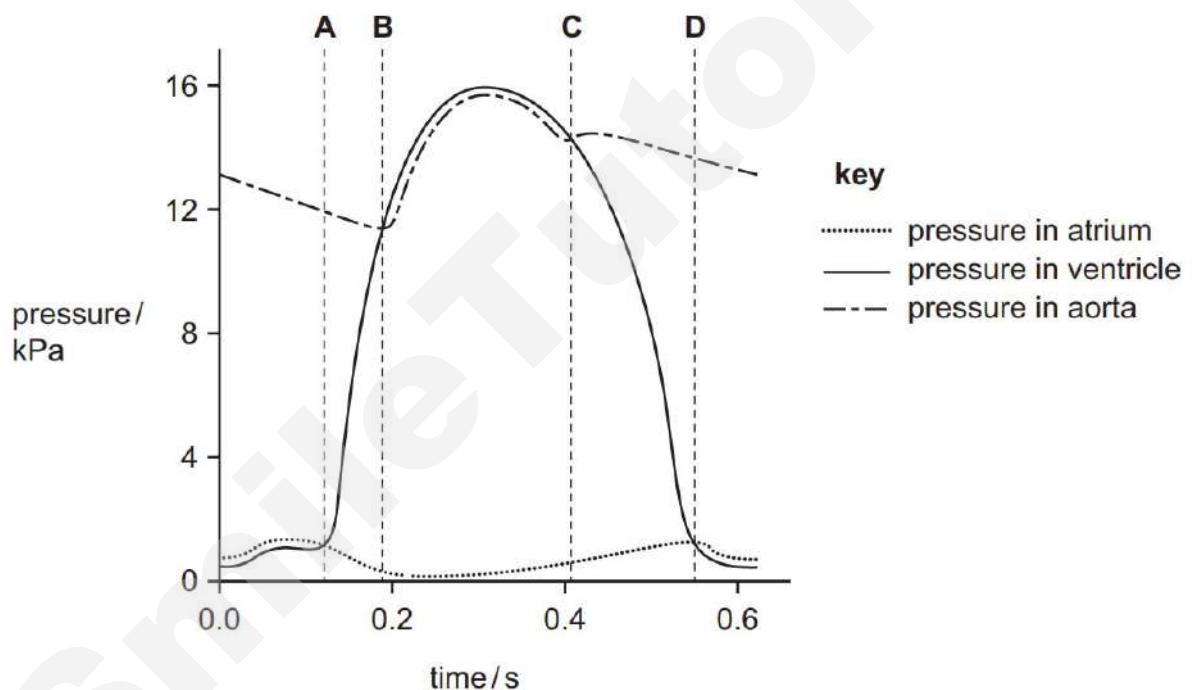
	xylem vessel		sieve tube element	
	cytoplasm	nucleus	cytoplasm	nucleus
A	✓	✓	X	X
B	X	✓	X	X
C	X	X	✓	✓
D	X	X	✓	X

key

✓ = present

X = absent

- 15 The graph shows pressure changes in the left side of the heart, during a single heart beat. At which point does the semi-lunar valve open?

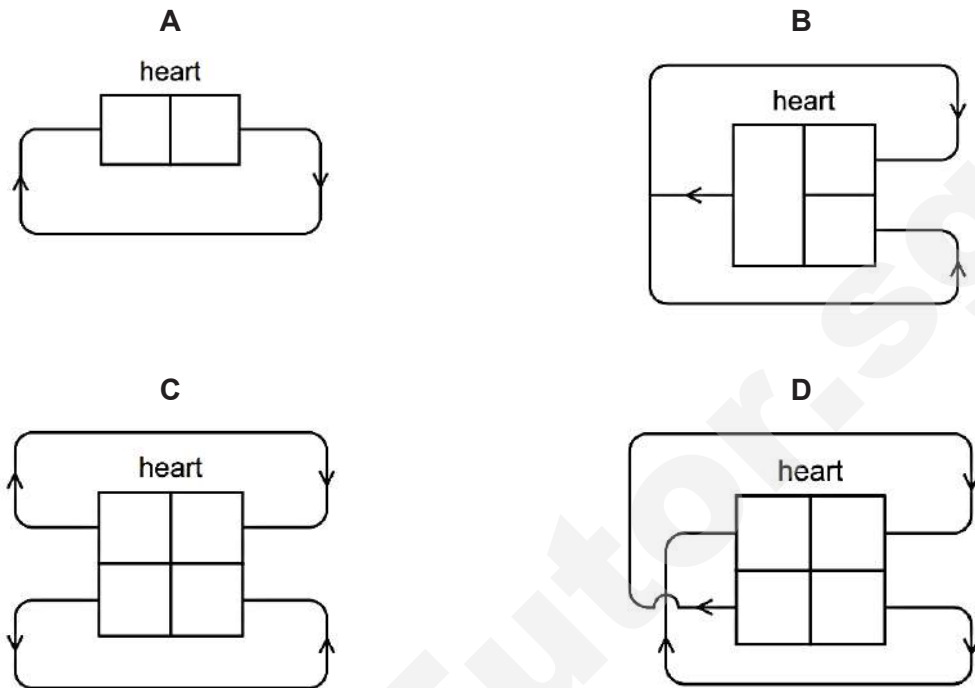


- 16 What causes the transfer of materials between capillaries and tissue fluid?

- A** active transport
- B** blood pressure
- C** capillary action
- D** osmosis

17 Which diagram shows the human double circulatory system?

key: → direction of blood flow

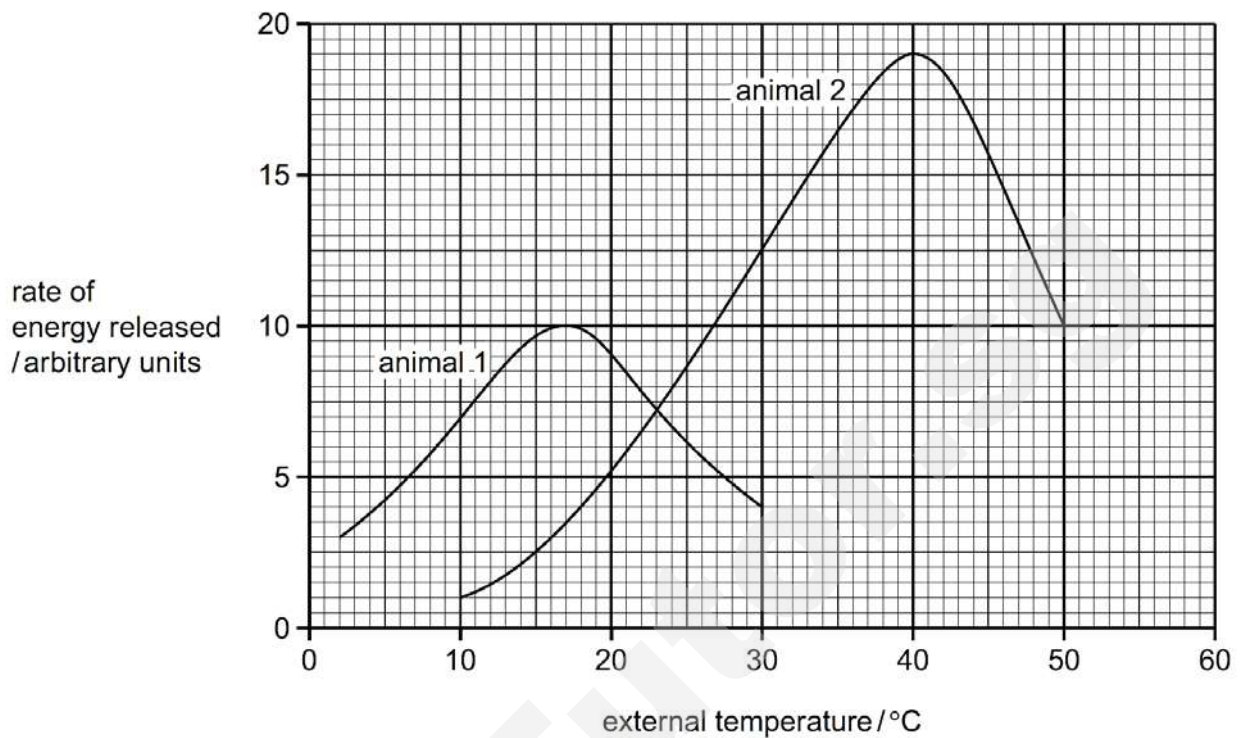


18 Fitness training increases the concentration of lactic acid that runners can build up in their muscles before pain stops them from running.

What is a consequence of this increase?

- A Aerobic respiration in muscles can be more rapid.
- B Blood flow to the muscles is increased.
- C More anaerobic respiration can take place in the muscles.
- D More energy is needed by the muscles to work.

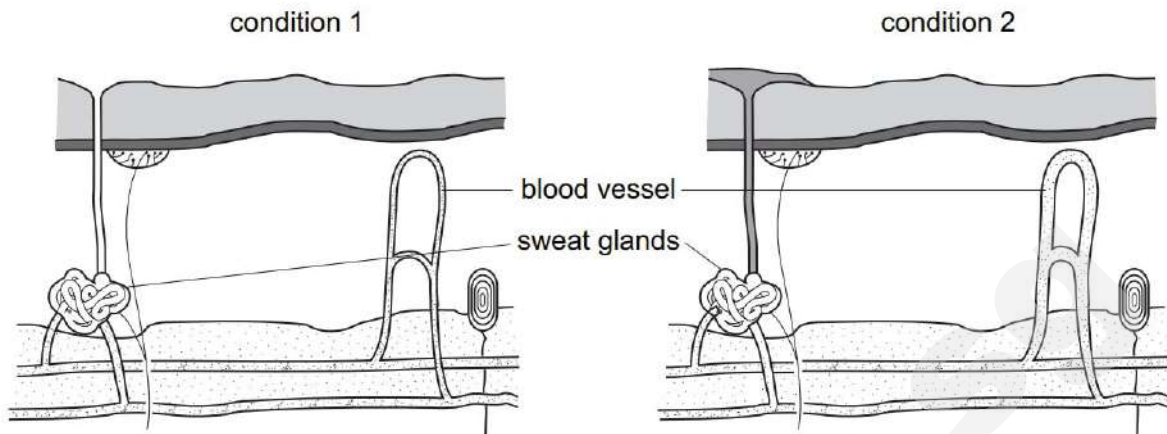
- 19 The graph shows the energy released by two animals through respiration as the external temperature changes.



Which conclusion can be drawn from the graph

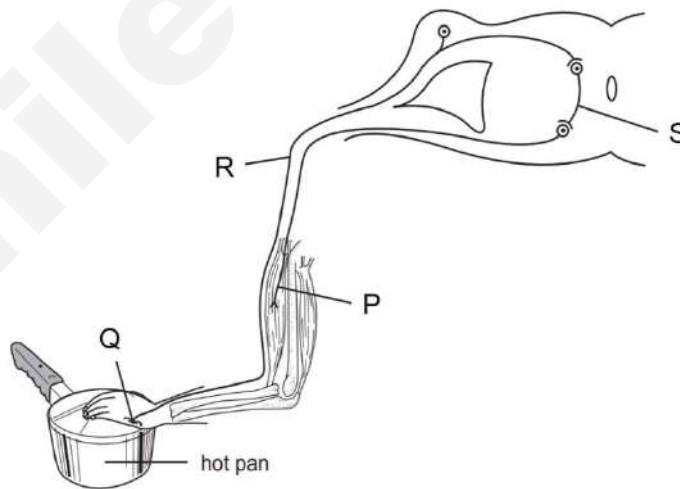
- A Animals 1 and 2 release the least energy at 23°C.
 - B Animal 2 always respire faster than animal 1.
 - C As the temperature rises, respiration always increases.
 - D The rate of respiration is the same for both animals at 23°C.
- 20 Which organs remove excretory products from the blood?
- A bladder and liver
 - B bladder and lungs
 - C kidneys and bladder
 - D lungs and kidneys

- 21 The diagram shows structures within human skin under two different conditions.



Which statement accounts for the change from condition 1 to 2?

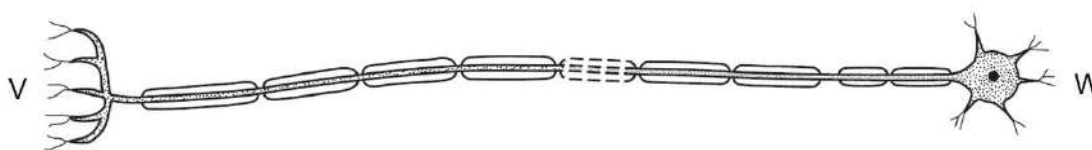
- A A person enters a cold room to store fresh food products.
 - B A person leaves an air-conditioned room to go to the washroom.
 - C A person stands stationary in the field on a sunny day.
 - D A person walks under a sheltered walkway from the office to the canteen.
- 22 The diagram shows the structures involved in a reflex action.



Which sequence shows the structures involved in the reflex action?

- A $P \rightarrow Q \rightarrow R \rightarrow S$
- B $P \rightarrow S \rightarrow R \rightarrow Q$
- C $Q \rightarrow R \rightarrow S \rightarrow P$
- D $Q \rightarrow S \rightarrow P \rightarrow R$

- 23 The diagram shows a neurone.

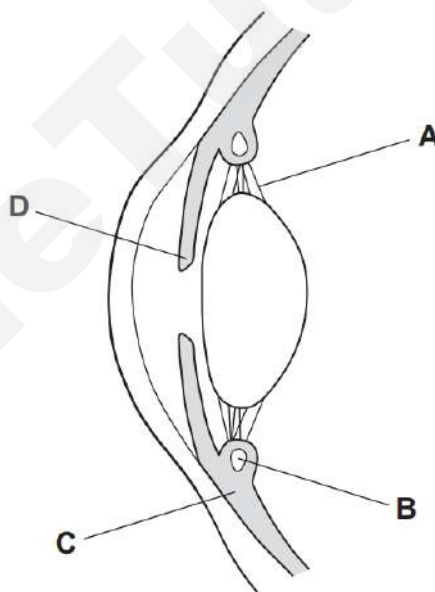


Which structures could be found at V and W?

	V	W
A	brain	intestine
B	brain	leg
C	eye	hand
D	ovary	spinal cord

- 24 The diagram shows a section through a human eye.

Which structure contains muscles which contract to produce a focused image on the retina?



- 25 The following shows some hormones produced by the body.

- | | | | |
|---|------------|---|--------------|
| 1 | adrenaline | 3 | insulin |
| 2 | glucagon | 4 | testosterone |

Which hormone(s) is/are involved in the conversion of glycogen to glucose?

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

- 26** Nocodazole is a chemical used in the study of mitosis. It causes all mitotic cells to stop dividing at metaphase. The following statements show the effect that the chemical may have on the process of mitosis.

- 1 inhibits chromatin condensing in the nucleus
- 2 prevents replication of centrioles
- 3 stops sister chromatids migrating to opposite poles

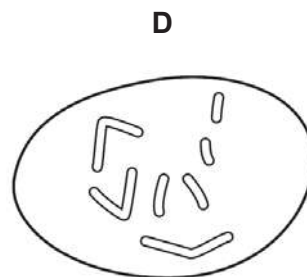
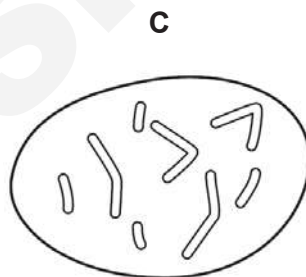
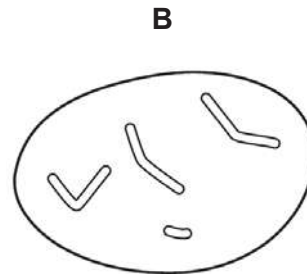
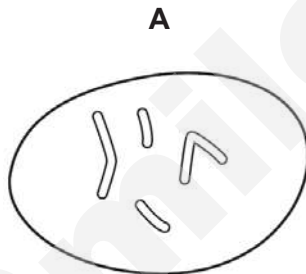
Which statement(s) correctly identify how this chemical might work?

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

- 27** The diagram shows the chromosomes in the nucleus of a cell that divides by mitosis.



Which diagram shows the chromosomes in the nucleus of one of the daughter cells produced?



- 28** Male bees are haploid. They develop from unfertilised eggs. Female bees are diploid. The following statements are on male and female bees.

- 1 All male bees are genetically identical.
- 2 Male bee sperm cells are produced by mitosis.
- 3 Female bees do not need fertilisation to be produced.

Which statement(s) are correct?

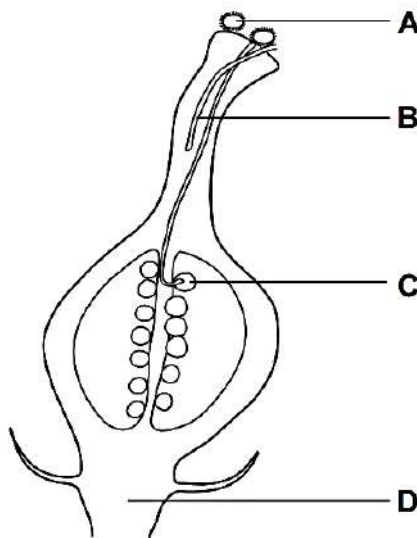
- A** 1 and 2 **B** 1 and 3 **C** 2 only **D** 2 and 3

- 29** Which row on the male reproductive system in a human, is correct?

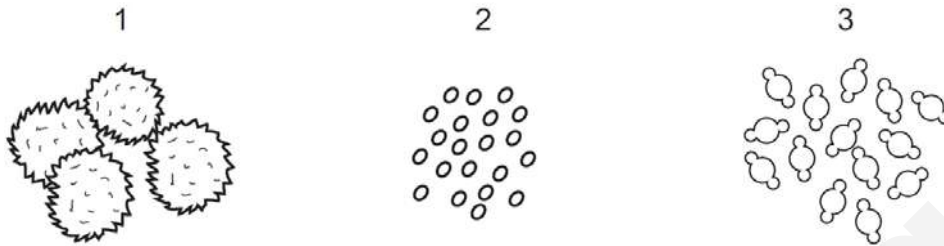
	produces sperm	secretes sex hormones	secretes enzymes to nourish sperm	stores inactive sperm
A	testes	scrotum	ureter	urethra
B	epididymis	testes	prostate gland	ureter
C	testes	testes	prostate gland	epididymis
D	scrotum	prostate gland	epididymis	testes

- 30** The diagram shows a flower from a plant.

Which part of the flower, when cell samples are taken, can produce offspring that are genetically identical to the plant?



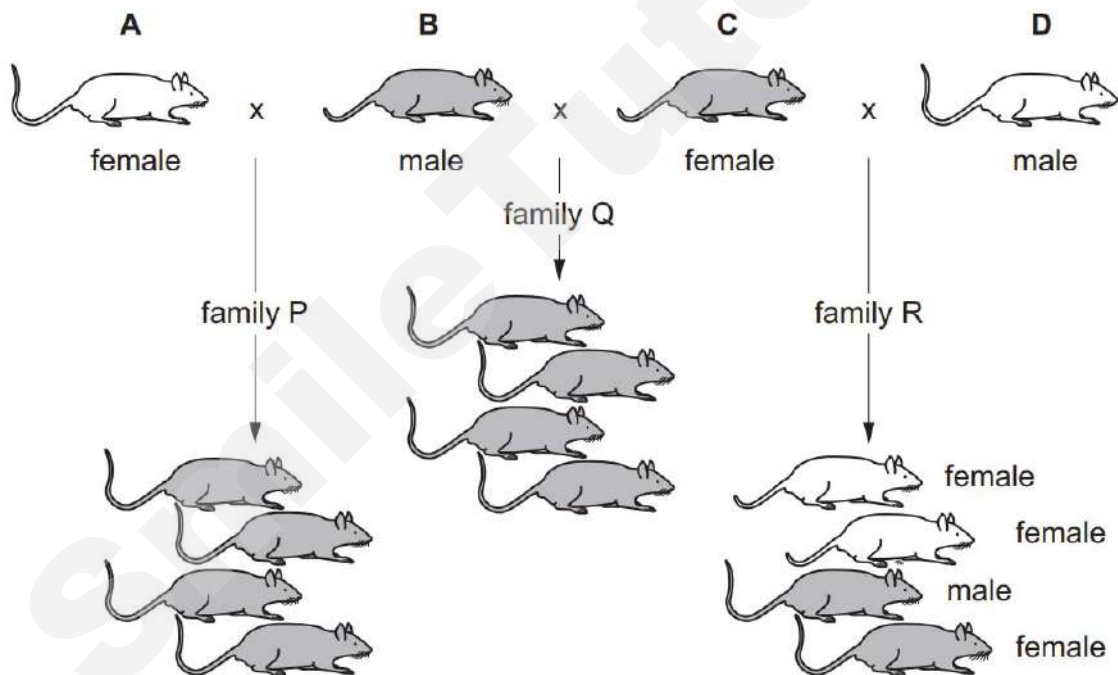
- 31 The diagrams show pollen grains from three different species of plant as they appear under the microscope. The diagrams are all drawn to the same scale.



Which pollen grains are involved in insect-pollination?

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

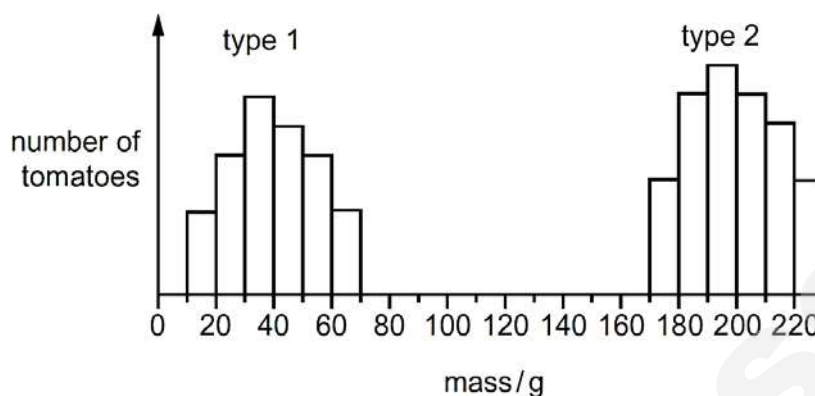
- 32 The diagram shows the inheritance of coat colour in mice.
Which mouse is heterozygous for coat colour?



- 33 Which is not a feature of natural selection?

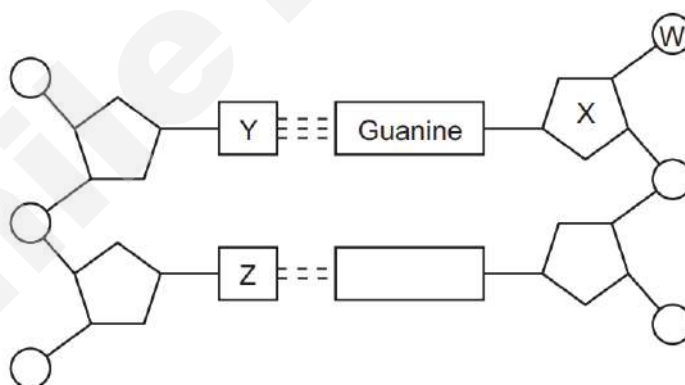
- A** genetic engineering
B random mutation
C reproduction of new offspring
D survival of the fittest

- 34 The graph shows the masses of two different types of tomato.



What can be concluded from the graph?

- A Genes do not affect the mass of tomatoes.
 - B Type 1 tomatoes show continuous variation.
 - C Type 2 tomatoes are sometimes smaller than type 1 tomatoes.
 - D Type 2 tomatoes show discontinuous variation.
- 35 The diagram shows part of a DNA molecule.



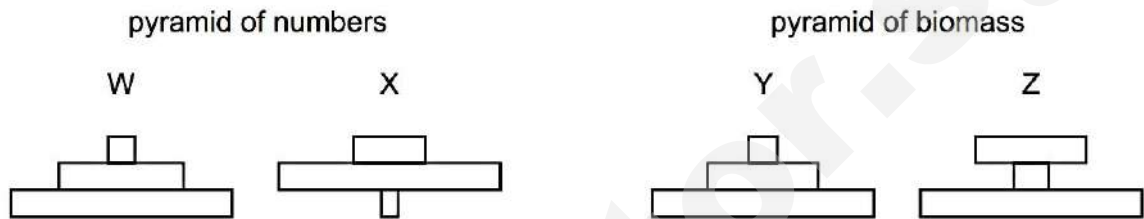
Which letters indicate cytosine, deoxyribose, phosphate and thymine?

	cytosine	deoxyribose	phosphate	thymine
A	W	X	Y	Z
B	Y	X	W	Z
C	Y	Z	X	W
D	Z	W	X	Y

36 Which molecule has its synthesis directly controlled by DNA?

- A amylase
- B glycerol
- C glycogen
- D iron

37 A single plant provides food for many herbivores. The herbivores supply food for a few carnivores.



Which pyramid of numbers and which pyramid of biomass show this information?

	pyramid of numbers	pyramid of biomass
A	W	Y
B	W	Z
C	X	Y
D	X	Z

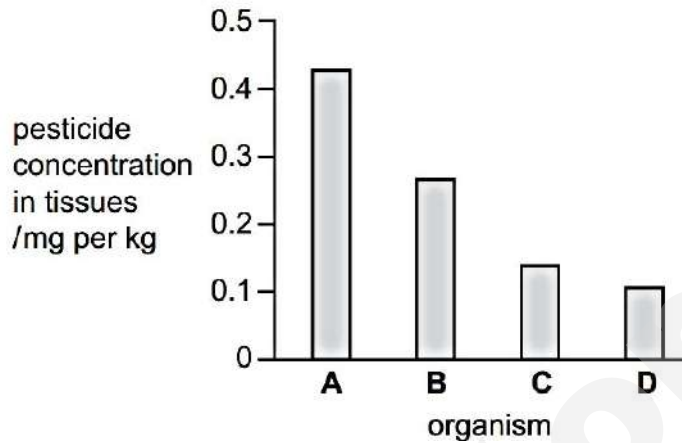
38 Within an ecosystem, the top consumers in a food chain are few in number. Which statement explains this?

- A Energy losses occur at each trophic level.
- B Energy losses occur within the consumers' digestive system.
- C Top consumers are large in size.
- D Top consumers have a low reproductive rate.

- 39 The concentration of a pesticide in the tissues of the organisms in the following food chain was measured.

plants → small fish → large fish → birds of prey

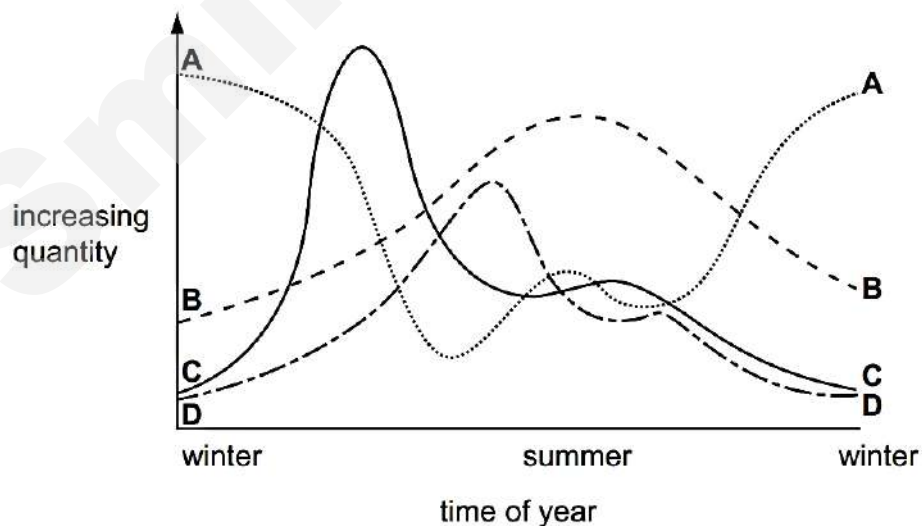
Which bar on the chart represents the large fish?



- 40 The graph shows the annual changes of the following factors in a lake.

intensity of light per day
 numbers of producers
 numbers of primary consumers
 quantity of nutrients

Which curve represents the numbers of primary consumers?





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PRELIMINARY EXAMINATION 2019 SECONDARY 4 EXPRESS

BIOLOGY

6093/02

Paper 2

2 September 2019

1 hour 45 minutes

Candidates answer on Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

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

Write in dark blue or black pen on both sides of the paper.

You may use an HB pencil for any diagrams or graphs.

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

Section A

Answer **all** questions.

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

Section B

Answer **all** the questions, the last question is in the form either/or.

Write your answers on 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.

	Marks
Section A	
Section B	
Total	

Section A

Answer **all** questions.

Write your answers in the spaces provided.

- 1 Fig. 1.1 shows part of a cell taken from the pancreas, which is involved in the production of digestive enzymes.

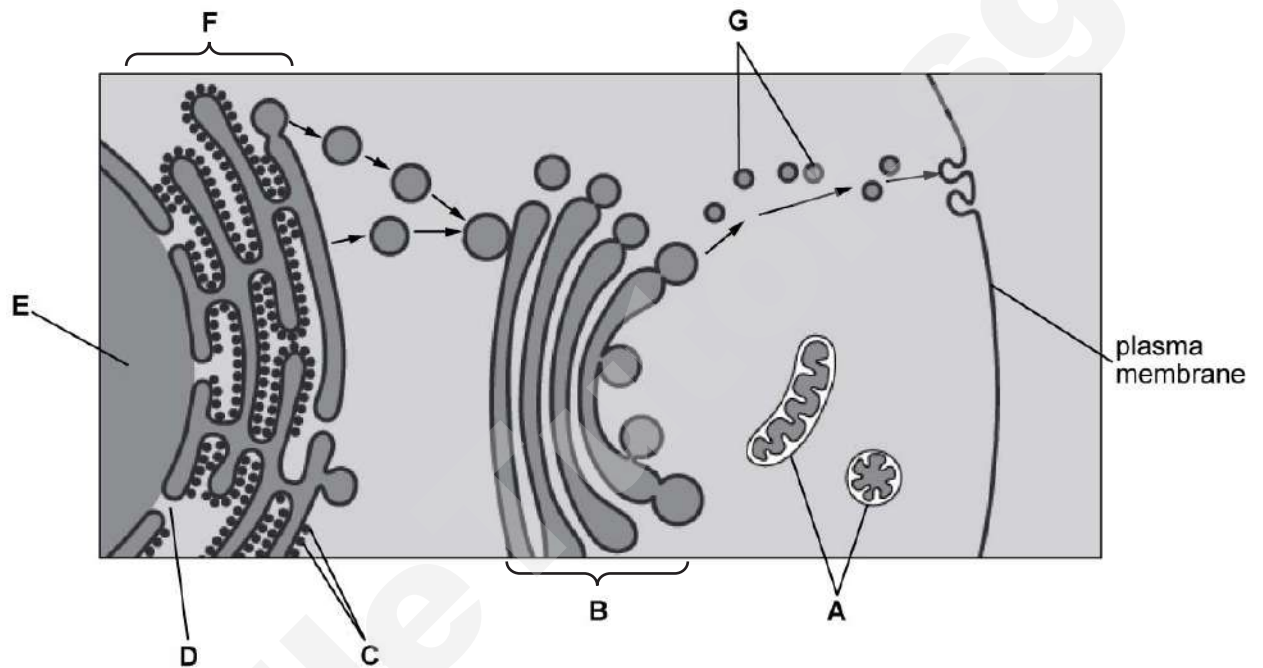


Fig. 1.1

- (a) Identify the structures labelled **A** and **B**.

A

B

[2]

- (b) With reference to the structures labelled **C**, **D** and **E**, describe the sequence of events that lead to the production of digestive enzymes in this cell.

.....

.....

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..... [4]

[Total: 6]

- 2 Fig. 2.1 summarises a technique used to measure the water potential of beetroot cells.

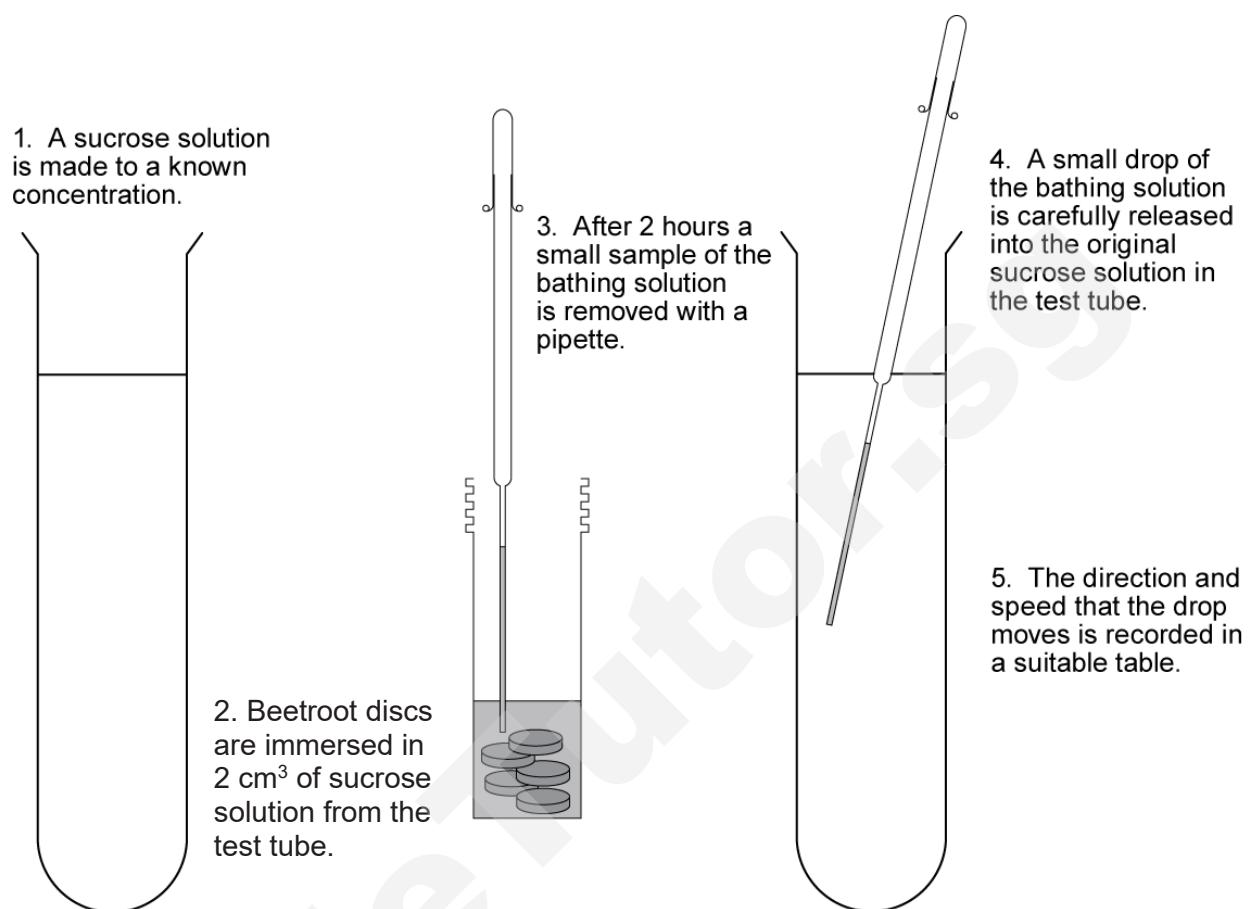


Fig. 2.1

Table 2.1 shows the results of an experiment carried out by some students.

Table 2.1

concentration of sucrose solution (M)	direction droplet moved (number of arrows indicates speed of movement)
0.1	↓↓↓
0.2	↓↓
0.3	↓
0.4	↔
0.5	↑
0.6	↑↑
0.7	↑↑↑

- (a) According to these results which concentration of sucrose has the same water potential as the beetroot cells?

..... [1]

- (b) Explain why the drop of bathing solution rose in the 0.6 M solution.

.....
.....
.....
.....
.....
.....
.....
..... [4]

- (c) In the space below, draw a labelled diagram of a single beetroot cell from the 0.7 M sucrose bathing solution, to show how it would have appeared under a light microscope.

[3]

[Total: 8]

- 3 The photomicrographs in Fig. 3.1 show some stages of cell division in a flower of a lily, *Lilium candidum*.

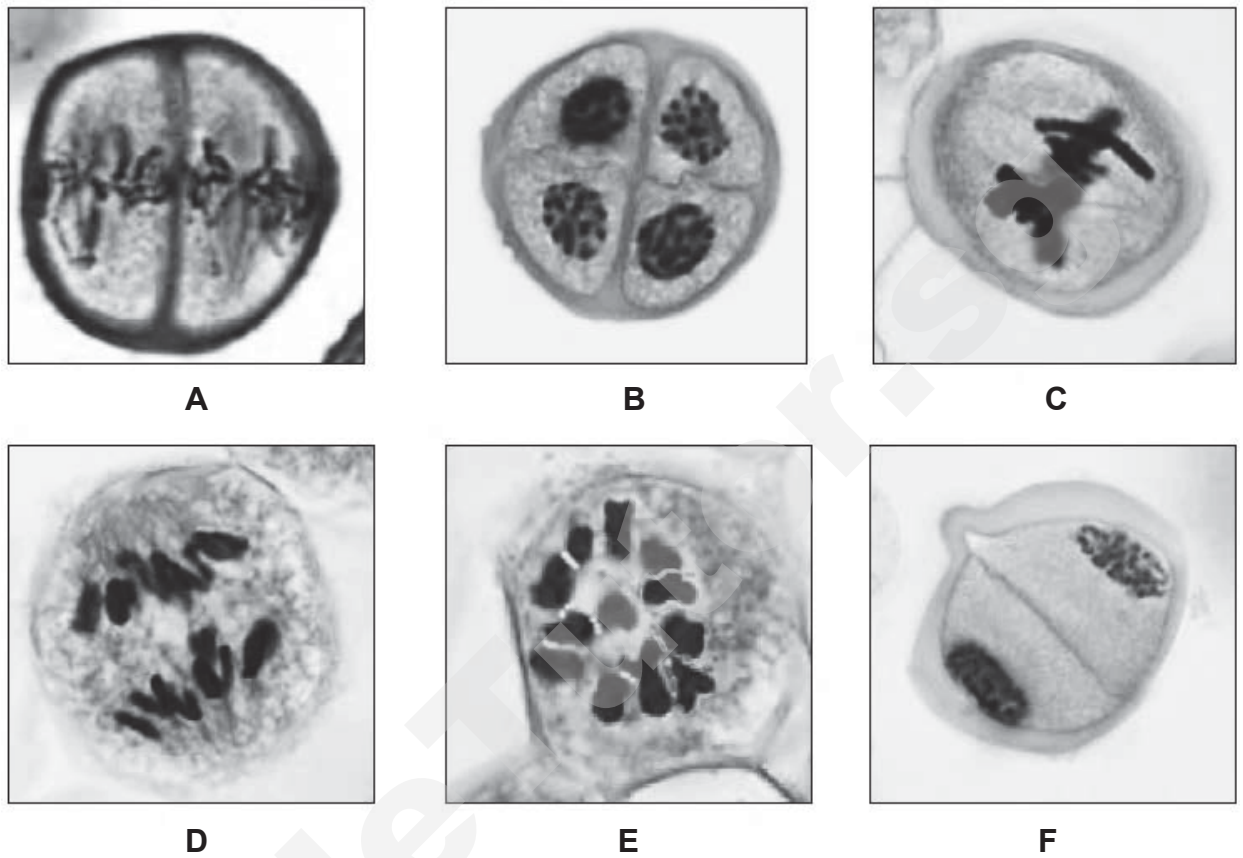


Fig. 3.1

- (a) (i) Identify the type of cell division shown.

.....

[1]

- (ii) State a part of the flower that could have been used to produce the photomicrographs.

.....

[1]

- (iii) Write the letters in the order the stages would occur.

1 **E** 2 3 4 5 6

[1]

- (ii) Use photomicrograph **E** to find the haploid number of the lily, *Lilium candidum*.

haploid number.....

[1]

- (b) Use your knowledge of cell division to describe two differences between the arrangements of chromosomes in stages **A** and **C**.

.....

.....

.....

.....

.....

..... [3]

- (c) State how the type of cell division involving stages **A** to **F** can result in variation in the lily, *Lilium candidum*.

.....

.....

.....

..... [2]

[Total: 9]

- 4 *Nerium oleander* is a xerophytic plant. A photomicrograph of a section through the leaf of *N. oleander* is shown in Fig. 4.1.

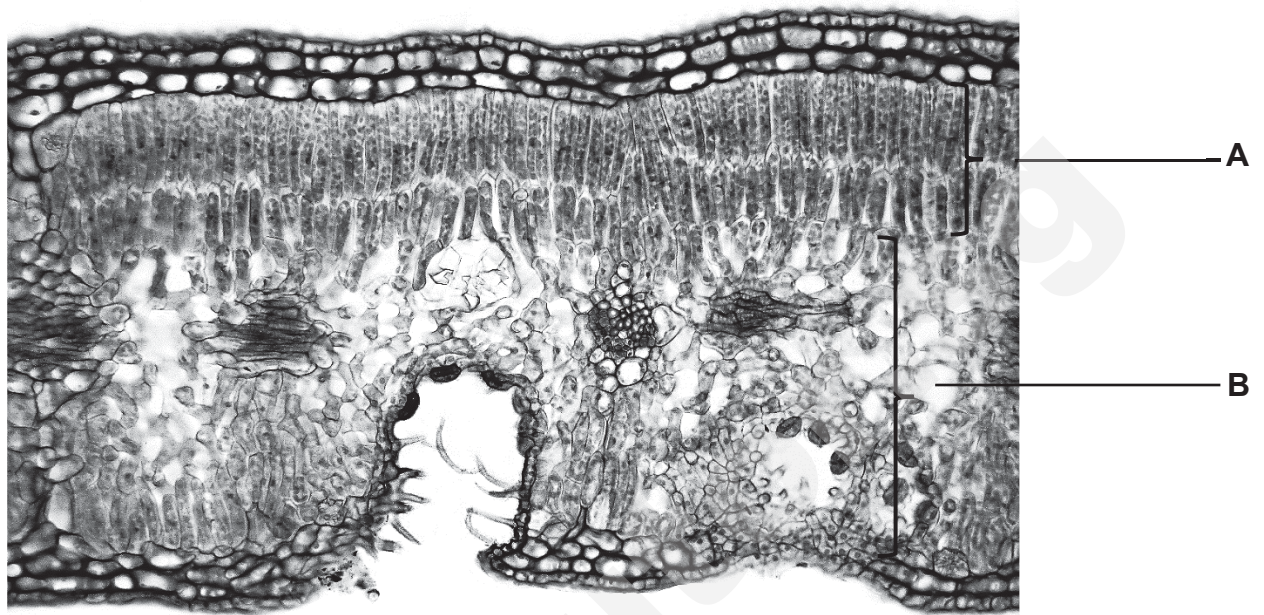


Fig. 4.1

- (a) Identify the tissues labelled **A** and **B**.

A

B

[2]

(b) The leaf shown in Fig. 4.1 has a number of adaptations to reduce water loss by transpiration. Two of the adaptations are:

- a multilayered epidermis
- stomata only found in depressions, known as stomatal crypts, on the lower surface of the leaf.

Explain how the two adaptations will help to reduce water loss in *N. oleander*.

multilayered epidermis

.....

.....

stomatal crypts

.....

.....

.....

..... [3]

[Total: 5]

- 5 (a) Hydrogen peroxide has a harmful effect on cells. One effect is to damage DNA.
Describe the structure of DNA.

.....

.....

.....

.....

.....

.....[3]

- (b) The cell has mechanisms to repair the damage to DNA caused by hydrogen peroxide. Errors in repair may cause a change to the structure of DNA.
Explain why hydrogen peroxide can be considered a mutagen.

.....

.....[1]

- (c) Scientists have created transgenic bacteria that glow. The glowing bacteria have a jellyfish gene for the production of a protein which causes them to glow.
Describe how the transgenic bacteria were produced.

.....

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.....

.....

.....[4]

[Total: 8]

- 6 Fig. 6.1 shows the body temperature of a person.

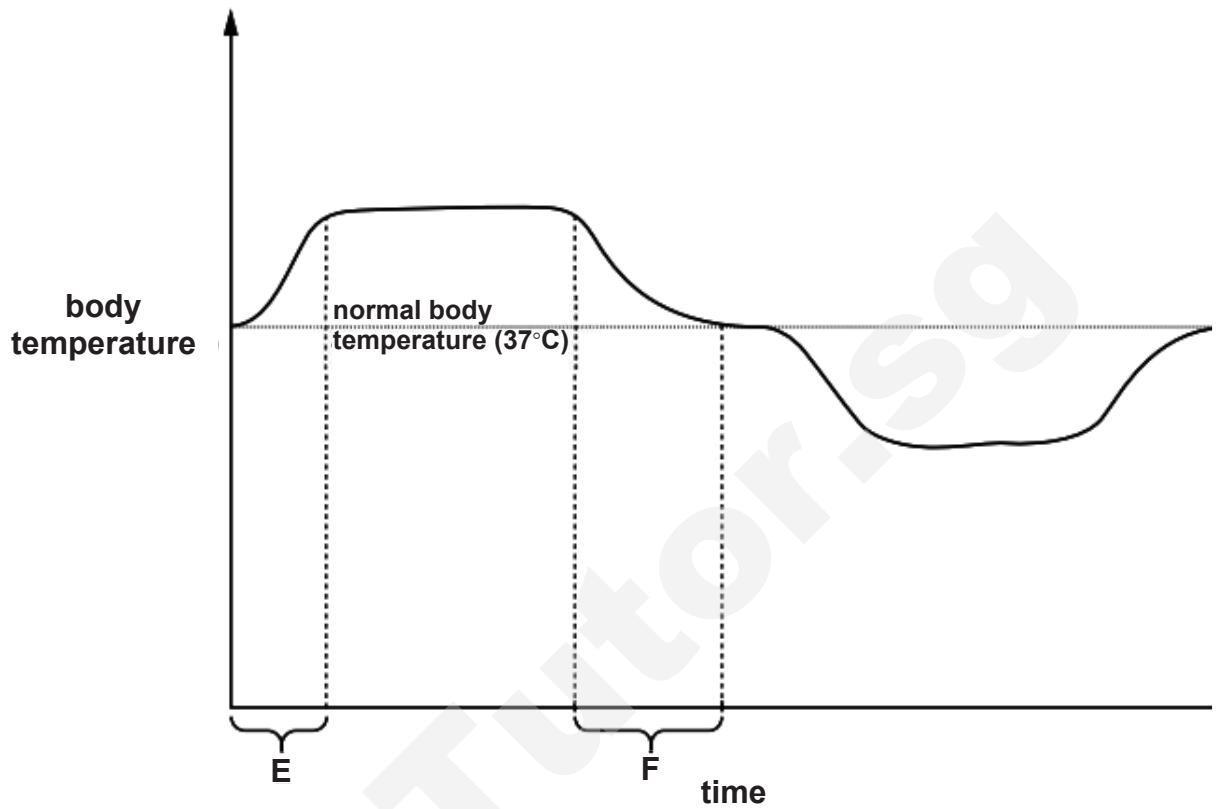


Fig. 6.1

- (a) Suggest three things that could happen to account for the graph during period **E**.

- 1.....
- 2.....
- 3.....

[2]

- (b) Explain two body responses that can cause the change in body temperature at period **F**.

-
-
-
-
-[4]

[Total: 6]

- 7 (a) Fig. 7.1 shows a pyramid of energy and part of the carbon cycle.

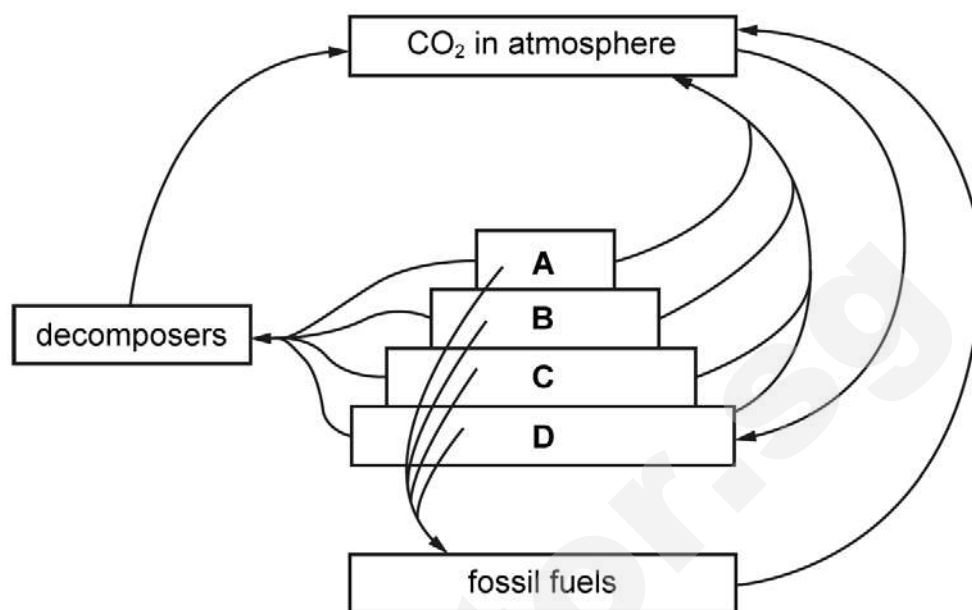


Fig. 7.1

- (i) Explain why trophic level **A** is smaller than trophic level **B** in the pyramid of energy in Fig. 7.1.

.....

 [2]

- (ii) In Fig. 7.1, using the letter **P**, label the line that represents photosynthesis. [1]

- (b) Define the term *bioaccumulation*.

.....

 [2]

- (c) Describe how human activities are affecting the carbon cycle.

.....

.....

.....

.....

.....

.....[3]

[Total: 8]

Candidate Name:	Class:	Index No:
------------------------	---------------	------------------

Section B

Answer **three** questions.

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

- 8** A protein is used to hold other chemicals onto the clear plastic backing of photographic film, as shown in Fig. 8.1.



Fig. 8.1

Trypsin is an enzyme which will digest the protein so that the coating on the photographic film is removed and the film becomes clear.

Table 8.1 shows the results obtained by two students who investigated the effect of pH on the activity of this enzyme. They made up the solutions, set up the experiment and timed how long the enzyme took to digest the protein and clear the film.

Table 8.1

pH	time for the protein to be digested / min		average time for the protein to be digested / min
	student 1	student 2	
2	12.0	14.0	
4	8.0	9.0	
6	2.0	3.0	
8	0.5	1.0	
10	8.0	9.0	

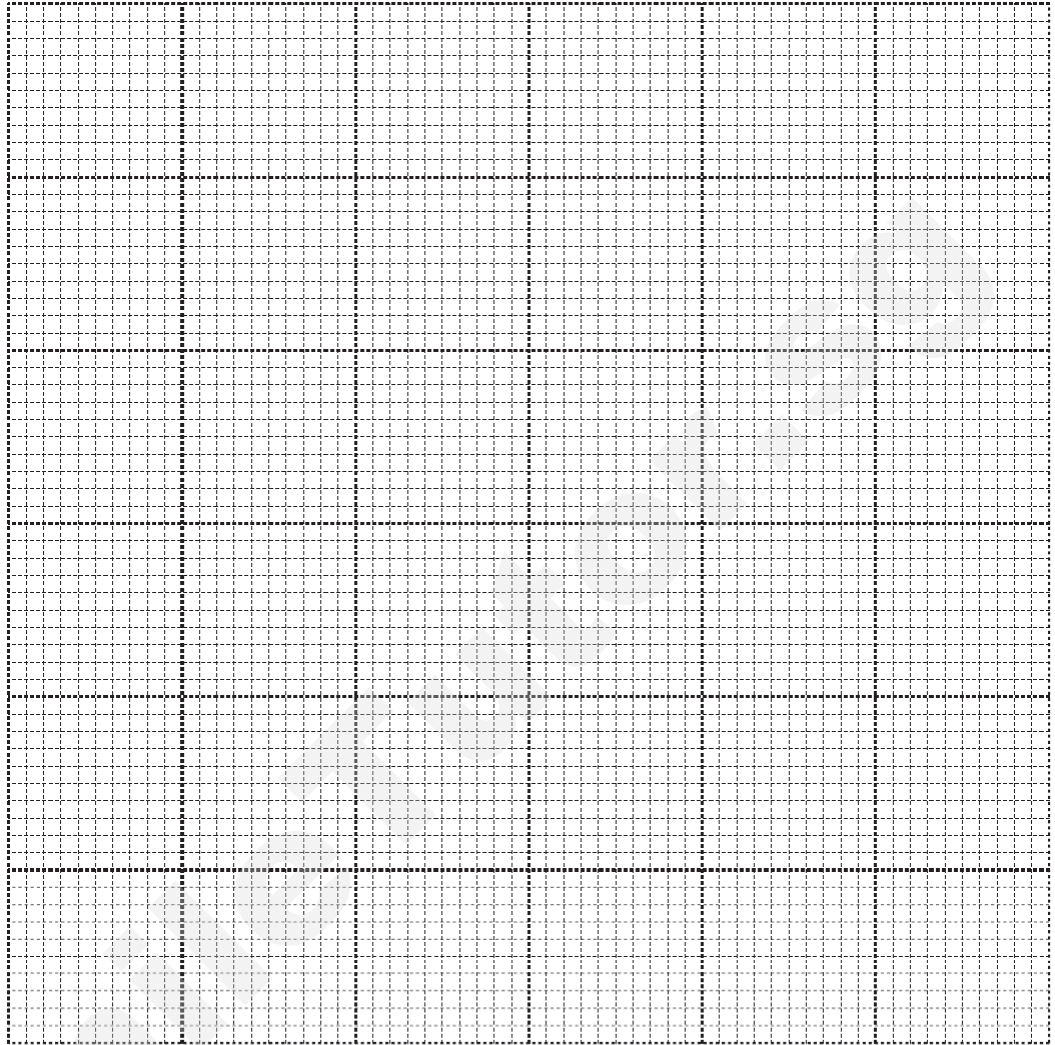
- (a) Calculate the average time for the proteins to be digested and complete Table 8.1. [1]

- (b) State two variables that should be kept constant in the experiment.

1.....

2.[1]

- (c) Plot a graph of the average time for the protein digestion at each pH in the grid provided.



[4]

- (d) Describe and explain the effect of pH on the activity of the enzyme.

.....

.....

.....

.....

.....

.....

.....

.....

[4]

[Total: 10]

- 9 (a) Cockroaches are pests which damage food and spread diseases. They have a gene which makes them attracted to sugar. In the 1980s, a mixture of insecticides and sugar was used as a means of pest control. The sugar attracted the cockroaches and the insecticide killed them. In the 1990s, certain populations of cockroaches were no longer attracted to sugar. The insecticide was still lethal but the cockroaches avoided eating it when it was mixed with sugar.

Explain how the cockroaches evolved to survive the pest control used in the 1980s.

.....

.....

.....

.....

.....

.....

.....

.....

.....[4]

- (b) Describe one difference between the process of artificial selection and natural selection. Include reference to the production of one named economically important plant or animal in your answer.

.....

.....

.....

.....[2]

(c) What are the advantages of genetic engineering over selective breeding?

.....

.....

.....

.....

.....

.....

.....

.....

.....[4]

[Total: 10]

10 Either

- (a)** Describe the double circulation of blood in the human circulatory system and the different functions of the two circuits.

.....[6]

- (b)** Explain how the structure of capillaries is adapted for the transport of a named material to tissue fluid.

.....[4]

[Total: 10]

10 Or

(a) Explain why most living organisms depend on photosynthesis.

.....[6]

(b) Explain why increasing the light intensity in which a plant is growing does not necessarily increase its rate of photosynthesis.

[4]

[Total: 10]

SmileTutor.sg

Dunman Secondary School

Subject code: 6093

Level and Stream: Secondary 4 Express

Marking scheme

Exam series: Prelims

Paper 1

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

Paper 2

Section A

1 (a) A mitochondria

B Golgi apparatus/Golgi body

2 correct [1]. All correct [2]

[1]

(b) With reference to the structures labelled C, D and E, describe the sequence of events that lead to the production of digestive enzymes in this cell.

The nucleus, E contains DNA/gene which codes for the production of proteins/enzymes. [1]

Transcription of the genes occurs in the nucleus to produce messenger ribonucleic acids (mRNAs). [1]

mRNA leaves the nucleus via the nuclear pore, D. [1]

Ribosomes, C carry out translation in the cytoplasm to synthesise the polypeptide chains that will fold into digestive enzymes. [1]

[4]

[Total: 6]

2 (a) 0.4 M

[1]

(b) The water potential of the cell sap in the beet root cells was higher than the 0.6 M sucrose solution. [1]

Water moves out of the beet root cells into the 0.6 M bathing sucrose solution across the partially permeable cell membrane [1] by osmosis. [1]

The bathing solution becomes less dense than the 0.6 M sucrose solution and floats [1]

[4]

(c) Marking points:

Plant cell with no chloroplasts [1]

Plasmolysed cell [1]

Correct labels of cell wall, cell membrane, vacuole [1]

[3]

[Total: 8]

- 3 (a) (i) **meiosis** [1]
- (ii) **ovule / anther / ovary** [1]
- (iii) 1 **E** 2 **C** 3 **D** 4 **F** 5 **A** 6 **B**

[1]

- (ii) **6** [1]

(b)	C / metaphase I	A / metaphase II
[1]	1. Chromosomes are one either side of the equator.	Chromosomes are on the equator.
[1]	2. Chromosomes are paired.	Chromosomes are not paired.
[1]	3. Centromere are not on the equator.	Centromeres are on the equator.

Correct identification of stages A and C. [1]

Any two marking points [2]

[3]

- (c) **Crossing over occurs during prophase I.** [1]

Random assortment occurs during metaphase I and II and anaphase I and II. [1]

[Total: 9]

- 4 (a) **A palisade mesophyll**
- B spongy mesophyll** [1]

- (b) multilayered epidermis reduces loss of water vapour /evaporation through the cuticle [1]

stomatal crypts **The leaf has sunken stomata that lie in the grooves of the leaf on the**

lower surface of the leaf / has hairs that trap water vapour diffusing out of the stomata. [1]

This increases the humidity around the stomata and so reduces the rate of transpiration. [1]

[3]

- (c) Describe how sucrose is transported from the leaves to the roots of plants for storage.

Sucrose is transported to the roots of plants via the phloem/sieve tubes [1] [1]

[Total: 5]

- 5 (a)
1. The basic unit of DNA is the nucleotide made up of a deoxyribose sugar, phosphate group and nitrogenous base.
 2. DNA is made of two polynucleotide strands.
 3. The two polynucleotides are twisted to form a double helix.
 4. There is complementary base pairing of Adenine with Thymine and Guanine with Cytosine [1] Reject A-T and C-G if there is no elaboration on what the letters represent.
 5. DNA strands are held together by hydrogen bonds.
 6. Each polynucleotide strand has a sugar phosphate backbone.

Any three marking points. 1 mark for each marking point. [3]

- (b) Since hydrogen peroxide can result in incorrect changes in the nucleotide or sequence of the bases. / Formation of a new allele. [1] [1]

- (c) The gene for the glowing protein is cut out from the jellyfish chromosome with the gene using a restriction enzyme. [1]

The same restriction enzyme is used to cut the plasmid from a bacterium. [1]

The plasmid is mixed with the DNA fragment containing the gene for the glowing protein and the enzyme DNA ligase. [1]

The recombinant DNA is mixed with the bacteria and heat / electric shock is applied causing pores to appear in the cell surface membrane for the recombinant plasmid to enter. [1] [4]

[Total: 8]

- 6 (a) Any three of the following marking points. [1] for each point

- exercise
- increase in temperature of the surroundings
- increase in metabolism/ increase in respiration
- fever
- ovulation
- wearing more or thicker clothes

All correct [2] Two correct [1] [2]

- (b)
- The sweat glands become more active to increase in the production of sweat [1] the evaporation of the sweat removes latent heat of vaporization. [1]
 - Increased vasodilation in the arterioles increases the blood flow to the capillaries near the surface of the skin [1] which increases the heat loss to the surroundings by radiation, conduction and convection. [1]
 - There is reduced metabolism/respiration [1] to reduce the release of heat. [1]

Any two correct responses and explanations. [4]

- 7 (a) 90% of the energy at each trophic level is lost to the surroundings when energy is transferred from one trophic to another. [1] Energy is lost to the surroundings in the form of heat/undigested materials/excretory products/uneaten body parts [1]

Any two ways of energy loss for 1 mark. [2]

- (ii) Label the arrow from CO₂ in the atmosphere to D with P. [1]

- (b) Define the term *bioaccumulation*.

Bioaccumulation is the process by which certain chemicals are not excreted from the bodies of organisms but accumulate in their bodies. [1]

The chemicals are then passed along the food chains and become concentrated in the bodies of the final consumers. [1] [2]

- (c) Describe how human activities are affecting the carbon cycle.

The burning of fossil fuels releases carbon dioxide into the environment [1]

Deforestation reduces the removal of carbon dioxide from the atmosphere [1].

The decrease in the amount of carbon stored in carbon sinks increases the amount of carbon dioxide in the atmosphere [1]

[3]

[Total: 8]

Section B

- 8 (a)

Table 8.1

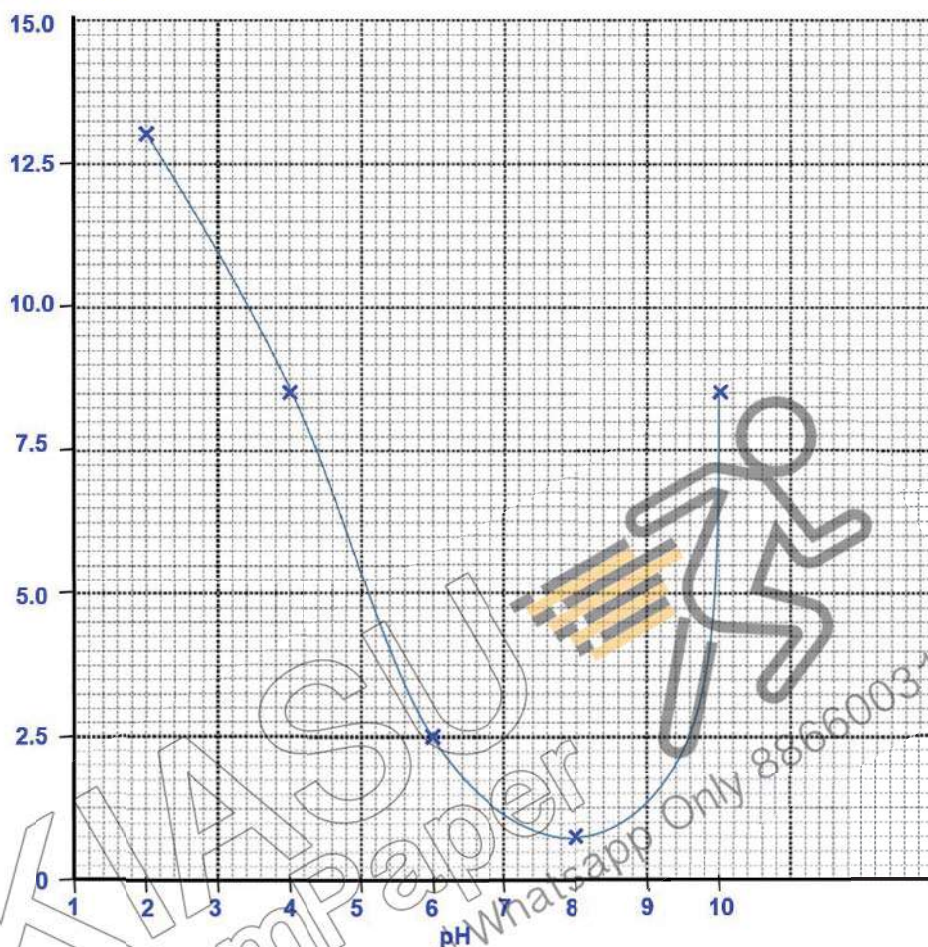
pH	time for the protein to be digested / min		average time for the protein to be digested / min
	student 1	student 2	
2	12.0	14.0	13.00
4	8.0	9.0	8.50
6	2.0	3.0	2.50
8	0.5	1.0	0.75
10	8.0	9.0	8.50

(b) Length of the photographic film/volume of enzyme/ concentration of enzyme/
type of enzyme Any two variables [1]

[1]

(c) Scale [1] Plot [1] Axes [1] Best fit line [1]

Time taken to digest
the protein/min



[4]

(d) As pH increases from pH 2 to pH 8, the time taken to digest proteins decreases from 13.00 min to 0.75 min. [1]

As pH increase from pH 8 to pH 10, the time taken to digest proteins increases from 0.75 min to 8.50 min. [1]

At extreme pH 2 and pH 10, the time taken is longer as the enzyme/trypsin starts to denature and loses the specific three-dimensional shape of its active site [1]

At pH 8, the time taken to digest the protein is the shortest, as it is the optimum pH for the enzyme/trypsin. [1]

[4]

[Total: 10]

- 9 (a) The gene for sugar attraction was mutated [1] and led to variation/ populations/ individuals that are not attracted to sugar. [1]

Those that are not attracted to sugar did not eat the poison and survived. [1]

Those that survive have a higher chance of reproduction to pass on the genes to the next generation. [1] [4]

(b)

In natural selection, nature selects for the varieties that are better adapted to changes in the environment but in artificial selection humans select the varieties of organisms that suit their needs. [1]

In natural selection, the varieties are produced by mutations but in artificial selection, the varieties are produced by selective breeding. [1]

Example, good meat-producing and milk-producing cattle (accept any suitable example of an economically important plant or animal).

Any difference [1]

One example [1]

[2]

- (c) Genes from any plant or animal can be inserted into non-related species or different species. [1]

Genes are carefully selected before transfer into an organism. This reduces the risk of genetic defects being passed on to the offspring. [1]

Genetic engineering uses individual cells which reproduce rapidly in the laboratory in a small container. [1]

More efficient. For example, transgenic salmon grow faster and require less food than ordinary salmon. [1]

[4]

[Total: 10]

10 Either

- (a) In the double circulation of blood, the blood passes through the heart twice in one complete circuit. [1]

Double circulation in humans consists of the pulmonary circulation and systemic circulation. [1]

In the pulmonary circulation the blood flows between the lungs and the heart [1]

Pulmonary arteries carry deoxygenated blood from the heart to the lungs to be oxygenated [1]

Pulmonary veins carry oxygenated blood from the lungs back to the heart [1]

In the systemic circulation the blood is pumped/flows from the heart to the rest of the body and then back to the heart [1]

Oxygenated blood leaves the aorta and is distributed by arteries to all parts of the body except the lungs. [1]

Veins carry blood from all parts of the body back to the right side of the heart. [1]

Any 6 of the marking points

- (b) Structural adaptation of capillary:

The walls of a capillaries is one cell thick. [1]

The endothelium is partially permeable which enables certain substances to diffuse quickly through the capillary walls. [1]

The narrow lumen of capillaries allows red blood cells to move through in a single file [1] lowering the rate of blood flow and increasing the efficiency of exchange of materials between the blood and the tissue cells. [1]

The dense network/repeated branching of capillaries increases the total cross-sectional area. [1] The increase in total cross-sectional area lowers the blood pressure in capillaries, giving more time for the exchange of substances. [1]

Transfer of a named material:

- Dissolved food substances/ oxygen [1] transported from the blood in the capillary across the capillary wall into the tissue fluid by diffusion. [1]
- Metabolic/excretory waste products from cells [1] diffuse into the tissue fluid and then through the capillary walls into the blood. [1]
-

Any 2 marks from structure of capillary and 2 marks from transfer of the named material.

[4]

[Total: 10]

10 Or

- (a) Explain why most living organisms depend on photosynthesis.

Plants are producers/ autotrophs unlike other living organisms [1]

Or

Plants convert light energy in the presence of carbon dioxide and chlorophyll into chemical energy in the form of glucose during photosynthesis [1]

Excess glucose produced is converted into sucrose and transported to the storage organs whereby the sucrose is converted to starch [1].

The glucose produced during photosynthesis can react with nitrates brought to the leaves to form amino acids which will be stored in the plants as proteins [1]

The glucose produced can be converted to fats for storage. [1]

Primary consumers or herbivores obtain their energy/ nutrients by consuming plants [1]

Secondary consumers feed on the primary consumers for food thus depending indirectly on plants for food [1]

Photosynthesis produces oxygen which organisms use when they undergo respiration to breakdown glucose in food to release energy [1]

Any 6 points

[6]

- (b) Explain why increasing the light intensity in which a plant is growing does not necessarily increase its rate of photosynthesis.

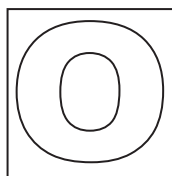
There are other limiting factors such as temperature [1] and concentration of carbon dioxide [1]

Temperature above and below the optimum temperature can affect the rate of photosynthesis as enzymes are involved [1]

Insufficient carbon dioxide can affect the rate of photosynthesis as it is a raw material for photosynthesis [1]

[4]

[Total: 10]



JURONGVILLE SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2019
Secondary 4 Express



STUDENT
NAME

CLASS

INDEX
NUMBER

Biology

6093/01

Paper 1

4 September 2019

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.

White your name, index number and class 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.

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

DO NOT OPEN THE BOOKLET UNTIL YOU ARE TOLD TO DO SO

For Examiner's Use

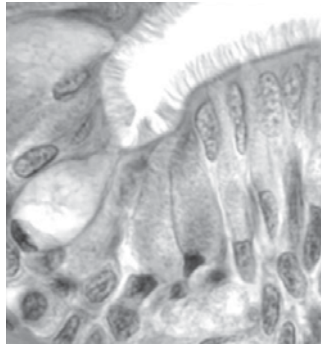
40

Setter: Ms Jo-Ann Lee Hui

This document consists of **17** printed pages.

[Turn over

- 1 The photomicrograph below shows a row of cells that line a particular tract in the human body.



Which of the following is visible in the photomicrograph?

- A chloroplasts
- B cilia
- C mitochondria
- D ribosomes

- 2 Some processes which occur in flowering plants are listed.

- 1 ion uptake by root hairs
- 2 ion movement up the xylem in the stem
- 3 water 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 3 only
- C 2 only
- D 3 and 4 only

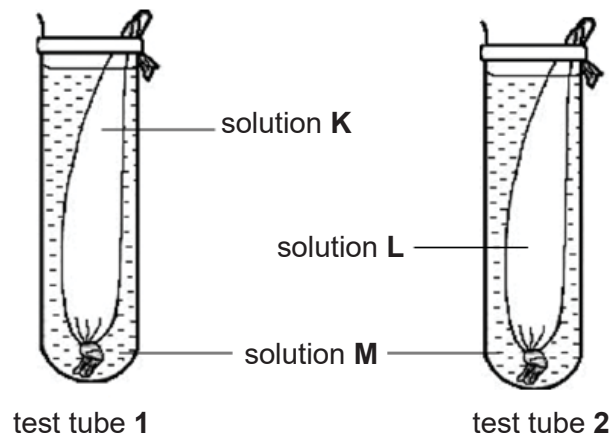
- 3 The table below shows the relative amount of mitochondria, chloroplasts and endoplasmic reticulum in four types of cells.

cell type	relative amount of organelles		
	mitochondria	chloroplasts	endoplasmic reticulum
A	+	+	+
B	+++	-	+
C	+++	-	+++
D	+	-	+

Key: number of '+' indicates the relative amount of organelles
 '-' indicates the absence of the organelle

Which cell type is found in the lining of the alveoli in the lungs?

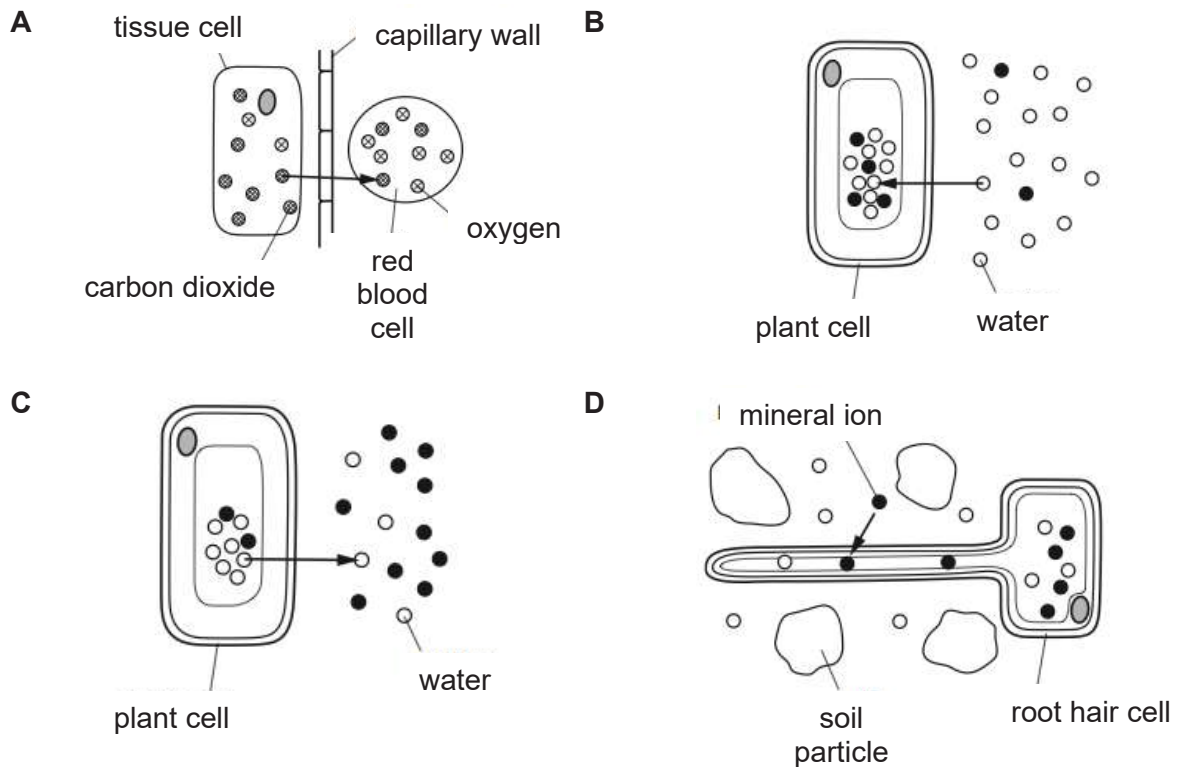
- 4 The diagram shows an experimental setup.



At the end of the experiment, the Visking tubing in test tube **1** expands while the Visking tubing in test tube **2** shrinks. What could solutions **K**, **L** and **M** be?

	solution K	solution L	solution M
A	10 % sucrose solution	20 % sucrose solution	5 % sucrose solution
B	20 % sucrose solution	10 % sucrose solution	5 % sucrose solution
C	25 % sucrose solution	15 % sucrose solution	35 % sucrose solution
D	35 % sucrose solution	15 % sucrose solution	25 % sucrose solution

- 5 Which diagram illustrates the process of active transport?



- 6 The table below shows the results of an analysis of the cell sap from an aquatic plant and the surrounding seawater.

substance analysed	concentration of ions (arbitrary units)		
	sodium ions (Na^+)	potassium ions (K^+)	chloride ions (Cl^-)
cell sap	0.13	0.56	0.72
seawater	0.57	0.04	0.59

A student makes the following deductions.

- 1 The cells remove chloride ions by diffusion.
- 2 The cells remove sodium ions by active transport.
- 3 The cells accumulate sodium ions by active transport.
- 4 The cells accumulate potassium ions by active transport.

Which of the following statements are correct?

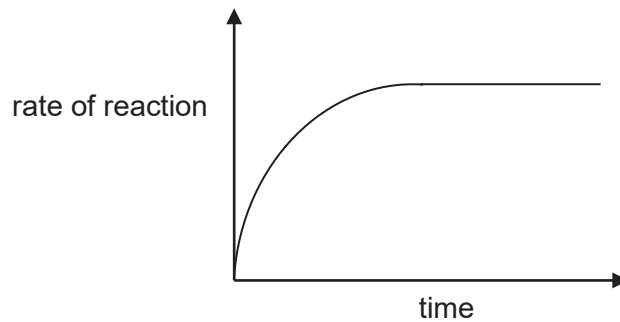
- A** 1, 2 and 3 only
B 1, 2 and 4 only
C 1, 3 and 4 only
D 2, 3 and 4 only
- 7 Which conversion does **not** take place in a plant?
- A** amino acids into polypeptides
B glucose into glycogen
C nucleotides into DNA
D starch into maltose
- 8 The Benedict's test can determine the amount of reducing sugar present in any mixture. Three samples, **P** containing 10 % glucose, **Q** containing 5 % sucrose and **R** containing 1 % glucose are tested.

Which option shows the expected results for the three samples?

	solution P	solution Q	solution R
A	blue solution	green precipitate	brick-red precipitate
B	green precipitate	blue solution	blue solution
C	brick-red precipitate	blue solution	green precipitate
D	brick-red precipitate	brick-red precipitate	green precipitate

- 9 A fixed volume of enzyme catalase was added to a fixed volume of hydrogen peroxide solution.

The diagram shows how the rate of the reaction changed over time.



Why did the rate of reaction become constant over time?

- A The active sites of enzymes become saturated.
 - B The enzymes have been denatured.
 - C The products have already been formed.
 - D The substrate molecules were used up.
- 10 Fruits, such as papaya, can be used to tenderize meats before cooking because they contain enzymes, which break down the proteins present in meats.

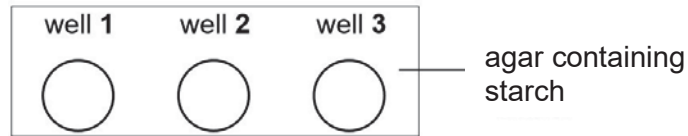
Using papaya as a natural meat tenderizer, Albany conducted experiments to investigate the conditions at which the softest meat would result. The conditions used are summarised in the following table.

Which experiment would result in the softest meat?

experiment	condition of papaya	
	boiled / raw	cubes / juice
A	boiled	cubes
B	boiled	juice
C	raw	cubes
D	raw	juice

- 11 Which of the following would **not** be a likely outcome of the removal of the pancreas?
- A decrease in the amount of glycogen production in liver and muscle cells
 - B decrease in the amount of protein being digested in the body
 - C increase in the pH of the duodenum
 - D increased risk of diabetes mellitus

- 12 Digestive juices were collected from three regions of the human alimentary canal. Drops of these juices were added to wells made in an agar of starch as shown below.



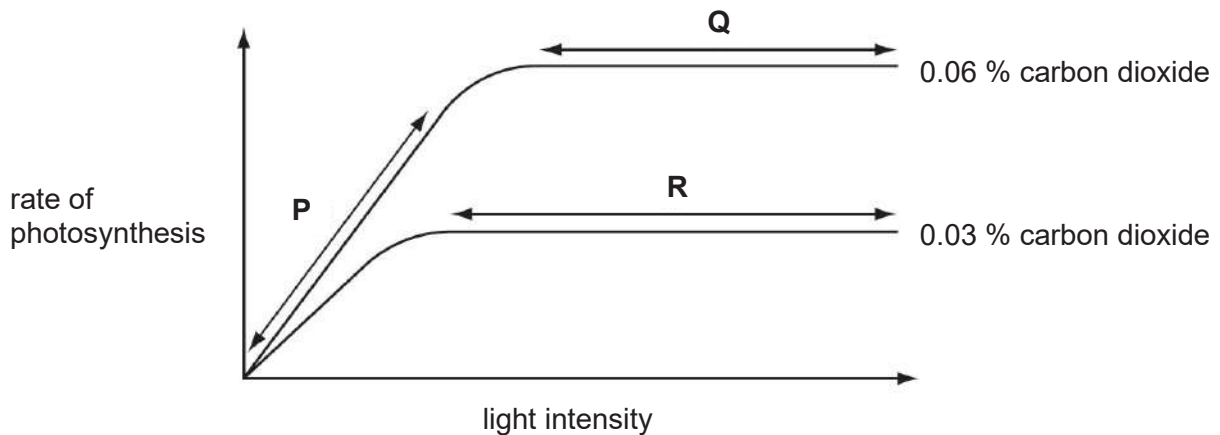
After an hour, the wells were rinsed with distilled water and flooded with iodine solution. The results are summarized in the following table.

	well 1	well 2	well 3
colour of iodine solution	blue-black	brown	brown

Which one of the following correctly identifies the regions of the alimentary canal from which the three digestive juices were obtained?

	well 1	well 2	well 3
A	oral cavity	small intestine	stomach
B	oral cavity	stomach	small intestine
C	small intestine	oral cavity	stomach
D	stomach	small intestine	oral cavity

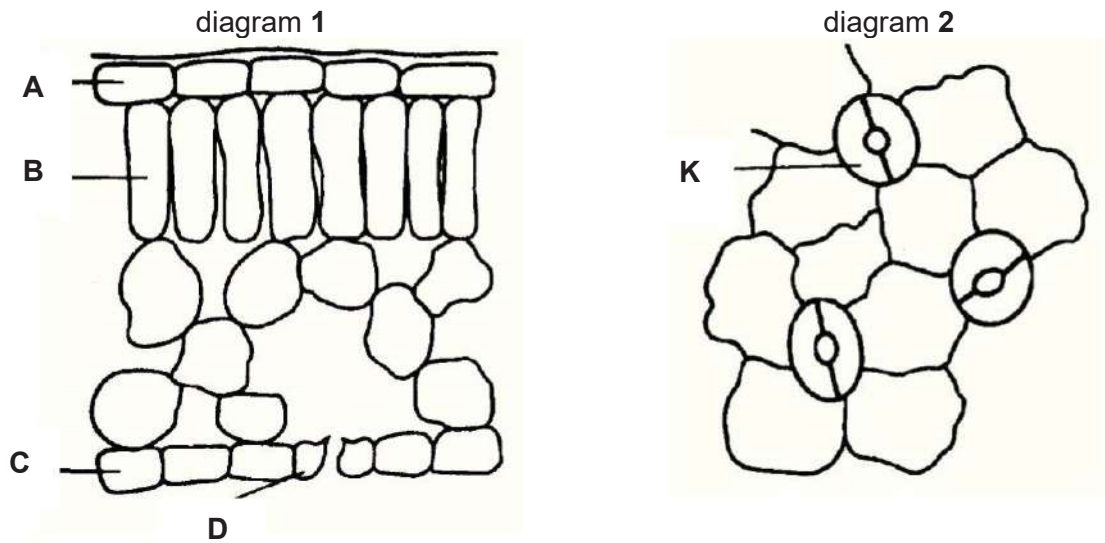
- 13 The graph shows the rate of photosynthesis of a plant with increasing light intensities at two different carbon dioxide concentrations. The temperature is kept constant.



Which of the following accurately identifies the limiting factors at P, Q and R?

	P	Q	R
A	carbon dioxide concentration	light intensity	carbon dioxide concentration
B	carbon dioxide concentration	light intensity	light intensity
C	light intensity	carbon dioxide concentration	carbon dioxide concentration
D	light intensity	carbon dioxide concentration	light intensity

- 14 The diagrams show the outline of cells in two different views of a leaf.



Which cell in diagram 1 is the same as cell K in diagram 2?

- 15 In an experiment with a potometer, the leafy shoot was subjected to four different environmental conditions. The table below shows the results obtained.

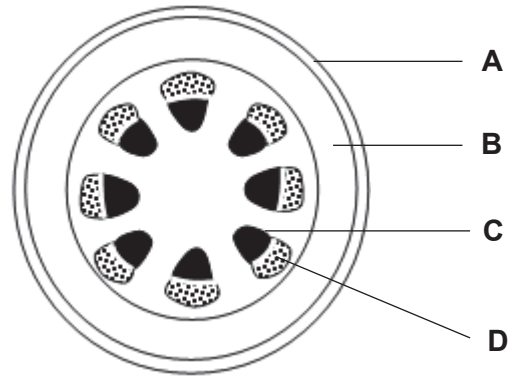
conditions	distance travelled by the bubble (mm)	time taken (min)
P	8	1
Q	12	2
R	8	2
S	9	1.5

Which of the following is the best conclusion drawn from the results above?

- A** The rate of transpiration is the highest in condition **Q**.
- B** The rate of transpiration is the same under condition **Q** and condition **S**.
- C** The temperature at condition **P** is lower than that in condition **R**.
- D** The temperatures at condition **Q** and condition **S** are the same.

- 16 The diagram shows a section of a young stem.

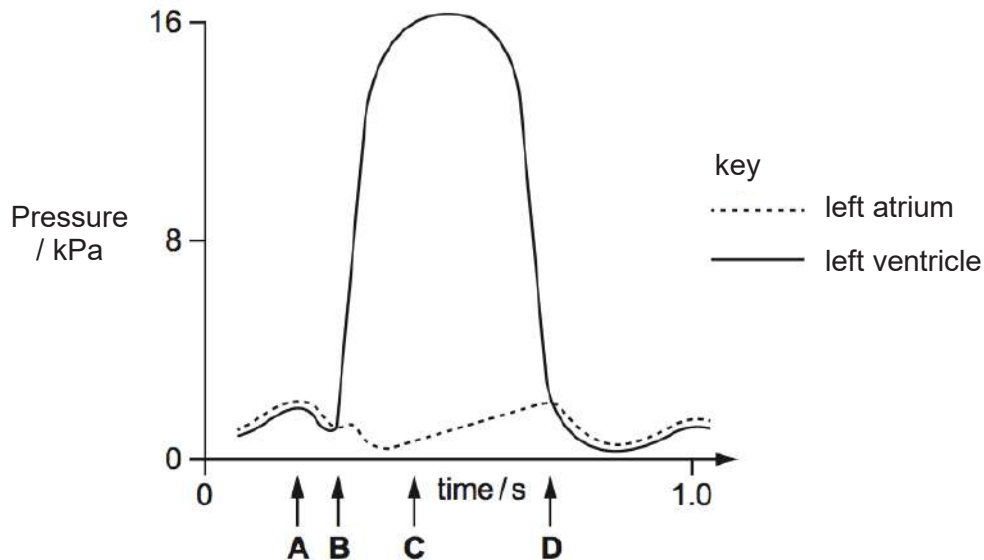
Which cells do **not** respire?



- 17 Leaves were taken from four different plants and the number of stomata were counted. Which plant would wilt the slowest when grown in a very dry region?

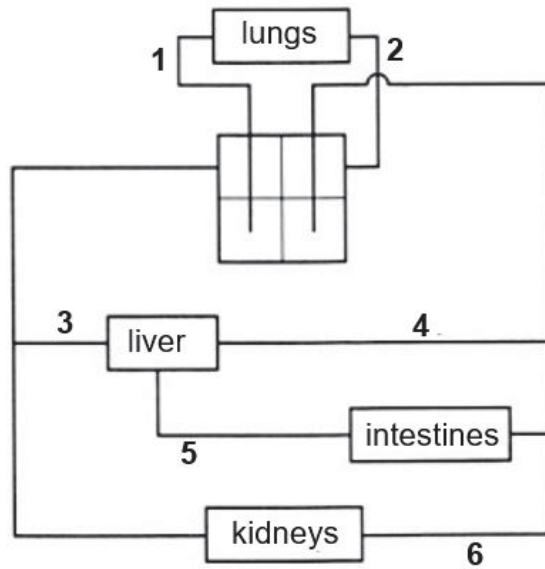
plant	mean number of stomata per cm ²	
	upper leaf surface	lower leaf surface
A	0	800
B	4000	6000
C	8000	26000
D	8500	15000

- 18 The graph shows the pressure changes in the left atrium and the left ventricle while the heart is still beating.



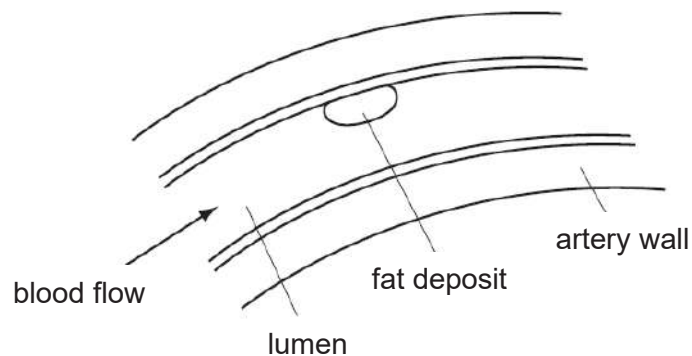
When does the bicuspid valve start to open?

- 19 The diagram shows a simple illustration of the human circulatory system. The parts labelled 1 to 6 represent blood vessels



After a heavy meal, which of the following statements would be correct?

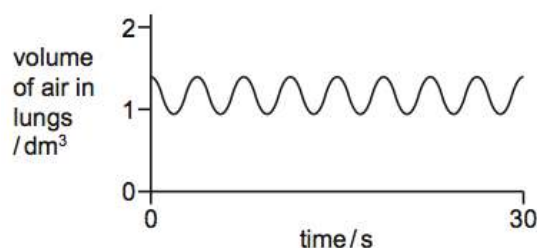
- A 1 contains more urea than 2
 - B 3 contains more glucose than 5
 - C 4 contains more oxygen than 5
 - D 6 contains more carbon dioxide than 3
- 20 The following diagram shows a section of the coronary artery with deposition of fats that may result in a heart attack.



Which of the following best describes the events that could lead to a heart attack?

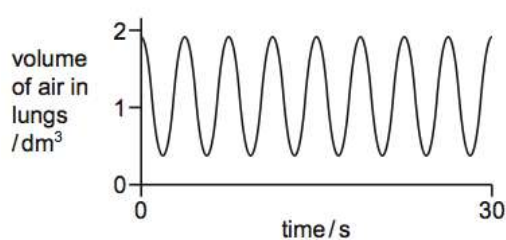
- A blockage of the artery's lumen to the heart muscles
- B further fat deposits followed by platelet destruction
- C further fat deposits followed by red blood cell destruction
- D hardening the artery wall, preventing diffusion across the wall

- 21 The graph shows changes in the volume of air in the lungs of a person at rest, over a period of 30 seconds.

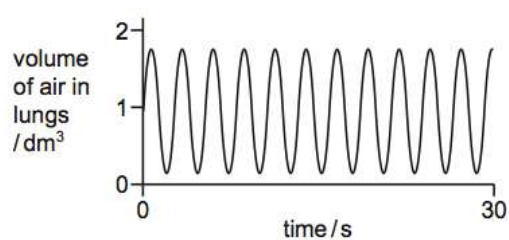


Which graph shows changes in the volume of air in the lungs of the same person immediately after he has done five minutes of vigorous exercise?

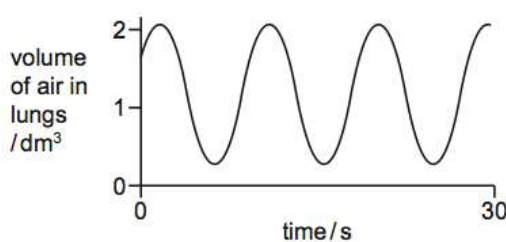
A



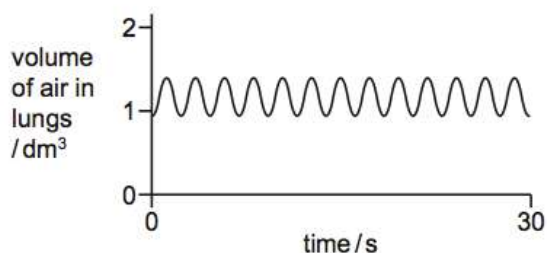
B



C



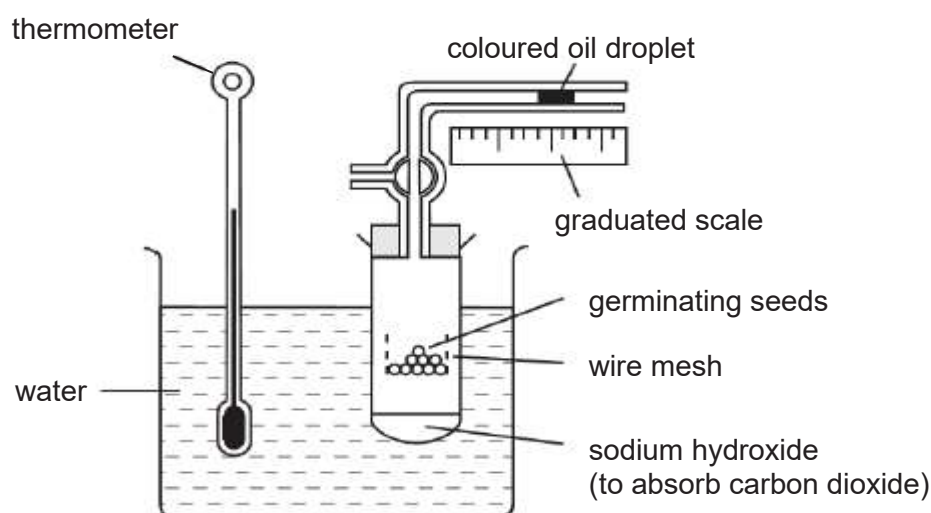
D



- 22 Which of the following describes the diaphragm, the external intercostal muscles and the movement of the ribcage during inhalation?

	diaphragm movement	ribcage	external intercostal muscles
A	downwards	upwards and outwards	contract
B	downwards	upwards and inwards	relax
C	upwards	downwards and inwards	contract
D	upwards	downwards and outwards	relax

- 23 The diagram shows the apparatus used to investigate respiration.



Which quantity is being measured to determine the rate of respiration?

- A carbon dioxide released
 B heat absorbed
 C oxygen absorbed
 D water vapour released
- 24 Gestational diabetes insipidus is a condition that occurs in women during pregnancy. Pregnant mothers produce vasopressinase in the placenta. Vasopressinase breaks down anti-diuretic hormone.

Which option shows the effect of gestational diabetes on a pregnant woman?

	amount of water reabsorbed by kidney tubule	effect on urine produced	
		quantity	concentration
A	decreased	decreased	concentrated
B	decreased	increased	diluted
C	increased	decreased	concentrated
D	increased	increased	diluted

- 25 Which option best illustrates the principle of homeostasis?

- A increasing the blood glucose level after a meal rich in carbohydrates
 B reddening of the face after a man drank a large amount of beer
 C secreting a large amount of tears when watching a sad movie
 D shivering of the body in response to the external cold environment

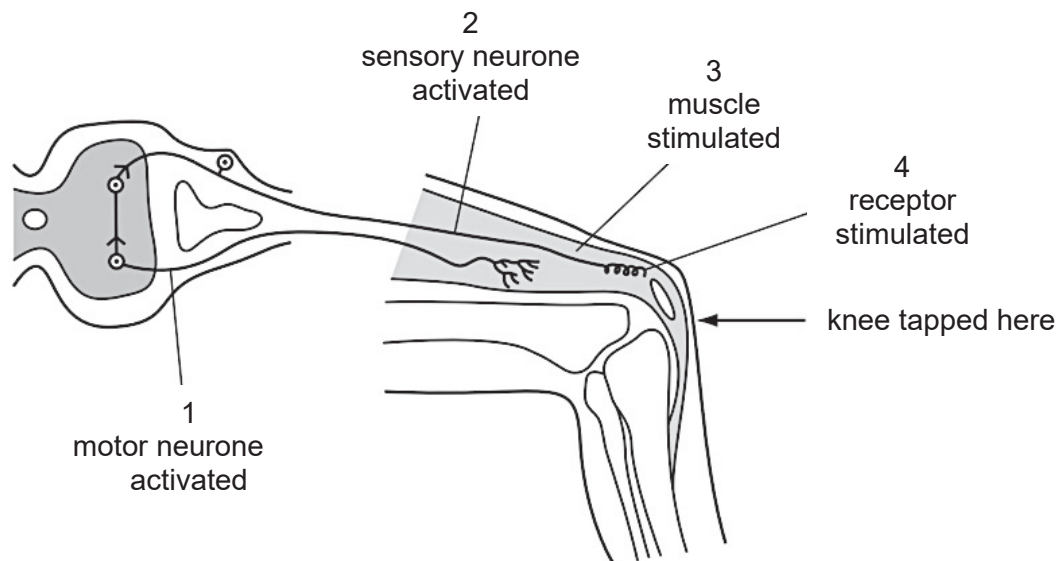
- 26 Which option best describes what happens to the pupil and the iris immediately after the lights in a dark room are switched on?

	size of pupil	radial muscles	circular muscles
A	decreases	contract	relax
B	decreases	relax	contract
C	increases	contract	relax
D	increases	relax	contract

- 27 Which option shows the effect of adrenaline?

	heart rate	rate and depth of breathing	blood glucose concentration
A	no change	no change	increases
B	increases	no change	no change
C	increases	increases	increases
D	no change	decreases	decreases

- 28 The diagram shows a simple reflex arc.



What is the correct order of events after the knee is tapped?

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

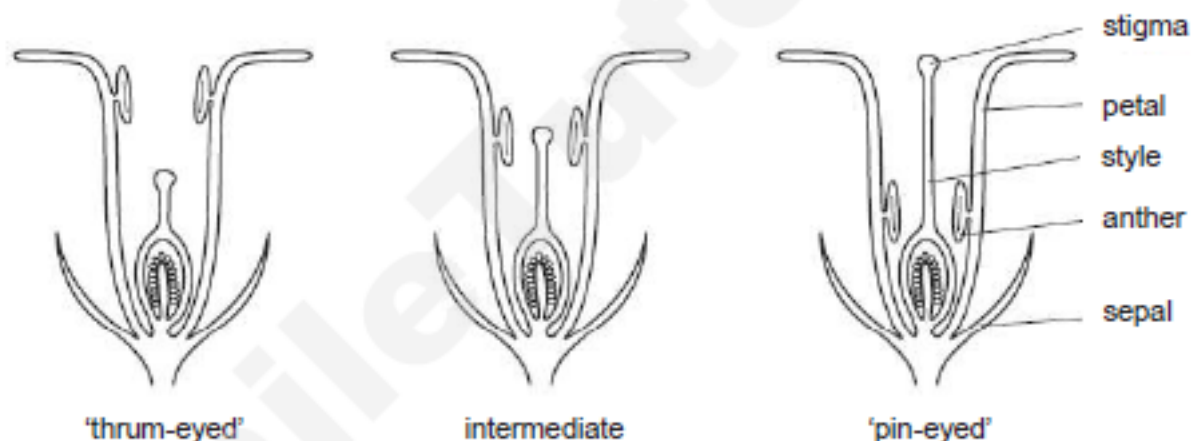
- 29 Male bees are haploid. They develop from unfertilised eggs. Female bees are diploid. They develop from fertilised eggs.

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

- 1 All male bees are genetically identical.
- 2 Male bee sperm cells are produced by mitosis.
- 3 New combinations of genes only occur in female bees.

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

- 30 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.

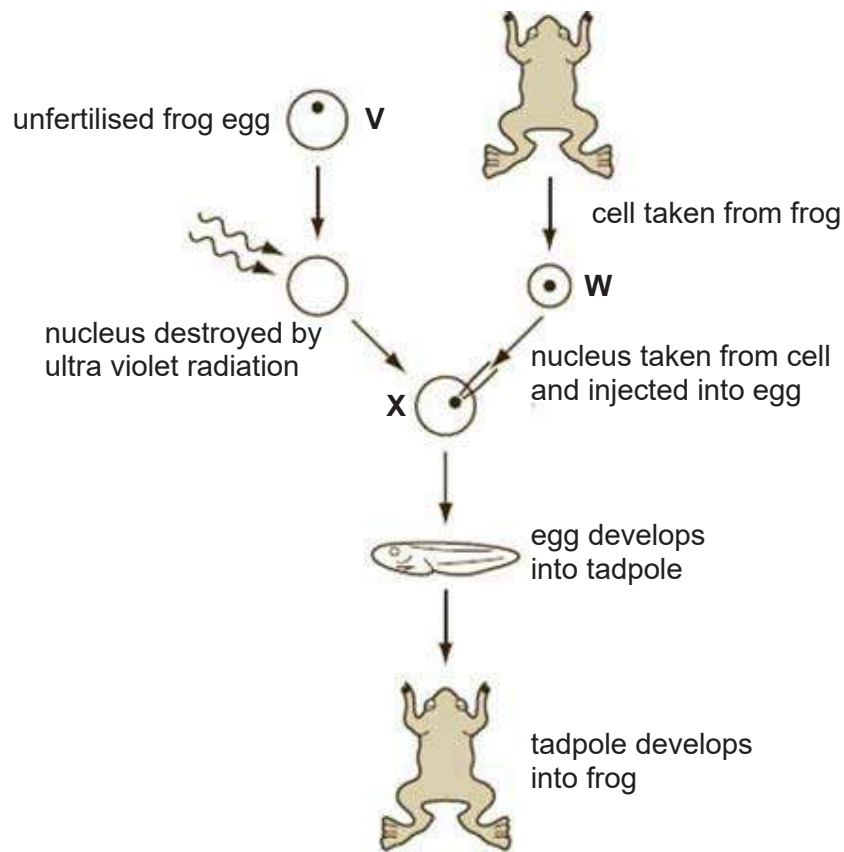


Which of the following statements are correct?

- 1 Cross-pollination will be favoured for primroses with 'pin-eyed' flowers.
- 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

- 31** The diagram shows how genetically identical frogs can be developed from unfertilised frog eggs. The diploid number in frogs is 26.



Which option correctly identifies the number of chromosomes in each of the type of cells in the diagram?

	V	W	X
A	13	13	26
B	13	26	13
C	13	26	26
D	26	26	13

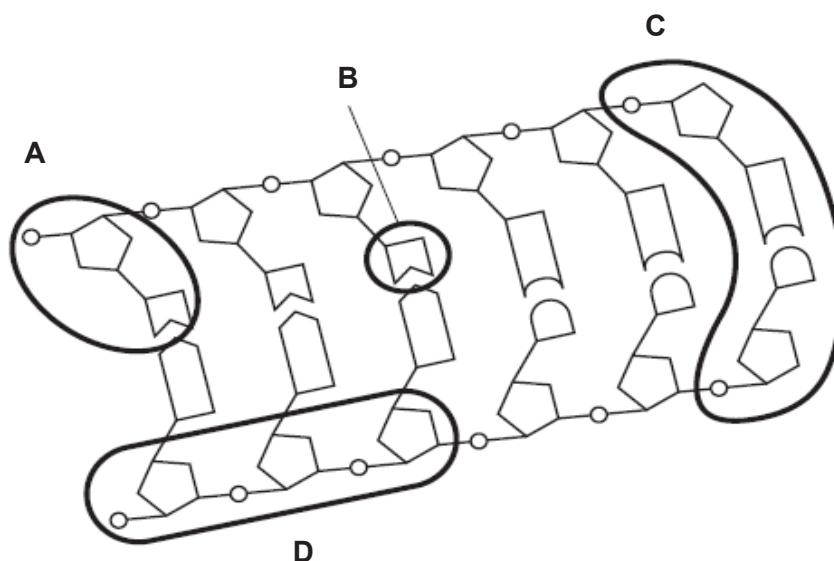
- 32** The DNA of a particular cell contains 30 % adenine bases.

What is the percentage of cytosine bases in this strand of DNA?

- A** 20 %
- B** 30 %
- C** 40 %
- D** 60 %

- 33** The diagram shows part of a DNA molecule.

Which part of the DNA molecule shows a nucleotide?



- 34** Colchicine is a well-known mitotic poison that inhibits the formation of spindle fibres. What might be observed in cells exposed to colchicine?

- A** Centrioles cannot move to opposite poles of the cell.
- B** Centrioles will not be present in the cells.
- C** Chromosomes are randomly distributed throughout the cell during metaphase.
- D** Chromosomes remain as loose chromatin threads.

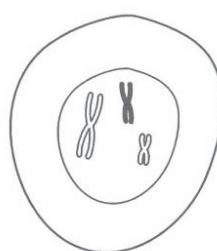
- 35** A cell containing three pairs of chromosomes divides by meiosis.

Which diagram shows one of the daughter cells after telophase II?

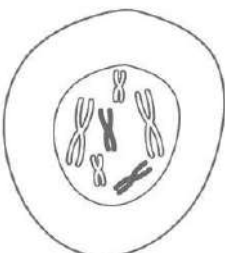
A



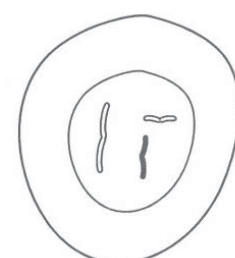
B



C

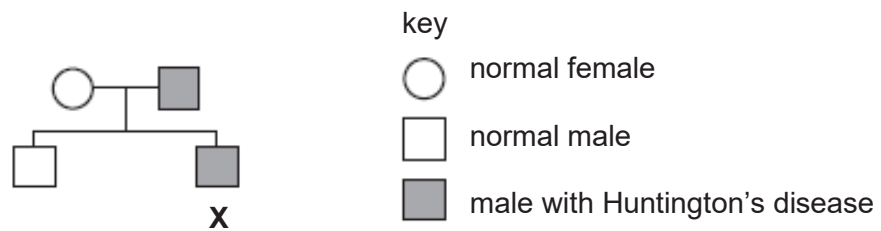


D



- 36** Huntington's disease is an inherited condition caused by a dominant allele.

The diagram below shows how this condition is passed on in a family.



Person **X** marries someone who does not have Huntington's disease.

What is the chance that their first child will suffer from Huntington's disease?

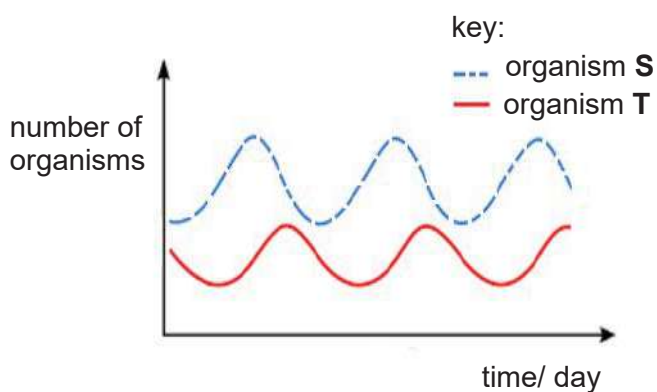
- A** 0 %
- B** 50 %
- C** 75 %
- D** 100 %
- 37** Which of the following is **not** a valid example of evolution by means of natural selection?
- A** development of antibiotic-resistant bacteria
- B** development of orchids with different flower shapes to attract pollinators
- C** cross-breeding of cows to obtain better quality milk
- D** growth of birds with different kinds of beak for different food sources
- 38** A scientist tested the level of pesticides in the following food chain:

plankton → clams → flounder → white-bellied sea eagle

Which option shows the likely results? (ppm = parts per million)

	plankton/ ppm	clam/ ppm	flounder/ ppm	white-bellied sea eagle/ ppm
A	0.03	0.23	2.05	18.45
B	0.03	0.06	0.09	1.00
C	0.03	0.03	0.56	6.30
D	0.03	0.005	0.00024	0.00001

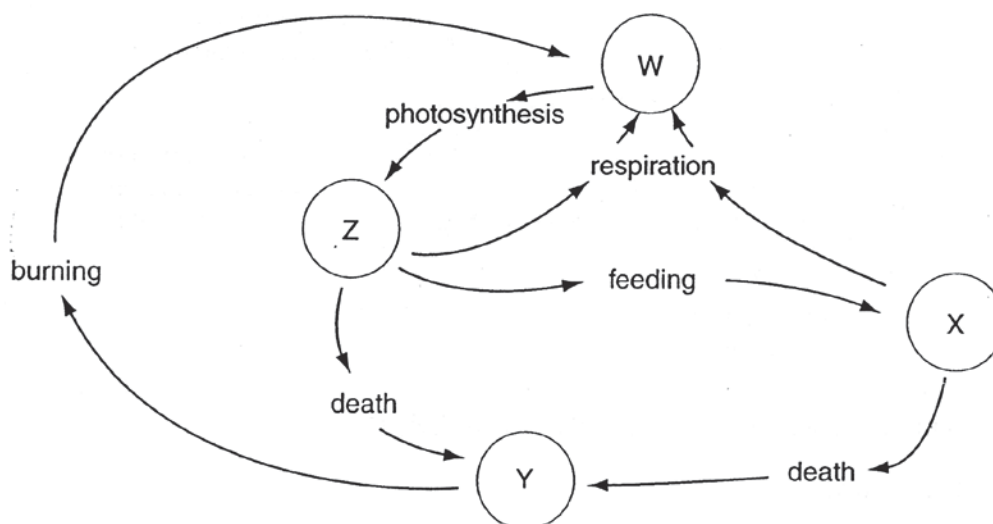
- 39 The diagram shows a graph of the number of organisms over time.



What could organism **S** and **T** be?

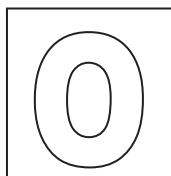
	S	T
A	duck	plant
B	eagle	rabbit
C	lion	lamb
D	worm	chicken

- 40 The diagram shows some stages in the carbon cycle. **W**, **X**, **Y** and **Z** are carbon compounds.



What is **Y**?

- A** carbon compounds found in dead animals only
- B** carbon compounds found in dead animals and dead plants
- C** carbon dioxide in the air
- D** coal and oil



JURONGVILLE SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2019
Secondary 4 Express



STUDENT
NAME

CLASS

INDEX
NUMBER

Biology

6093/02

Paper 2

4 September 2019

1 hour 45 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

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

Write in dark blue or black pen.

You may use pencil for drawing diagrams or graphs.

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

Answer **ALL** questions.

If working is needed for any question it must be shown with the answer.

Omission of essential working will result in loss of marks.

All working must be written step-wise and shown clearly in **INK**.

CAUTION: Any working or answer not written in ink will NOT be marked.

The total marks for this paper is 80.

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

DO NOT OPEN THE BOOKLET UNTIL YOU ARE TOLD TO DO SO

For Examiner's Use	
Section A	50
Section B	
Q10	10
Q11	10
Q12 EITHER/OR	10
Total	80

Setter: Ms Jo-Ann Lee Hui

Section A: Structured Questions [50 marks]

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

- 1 Fig. 1.1 is an experimental model which represents a simplified plant system. The plastic tube represents the stem of a plant. The red ink represents the soil solution.

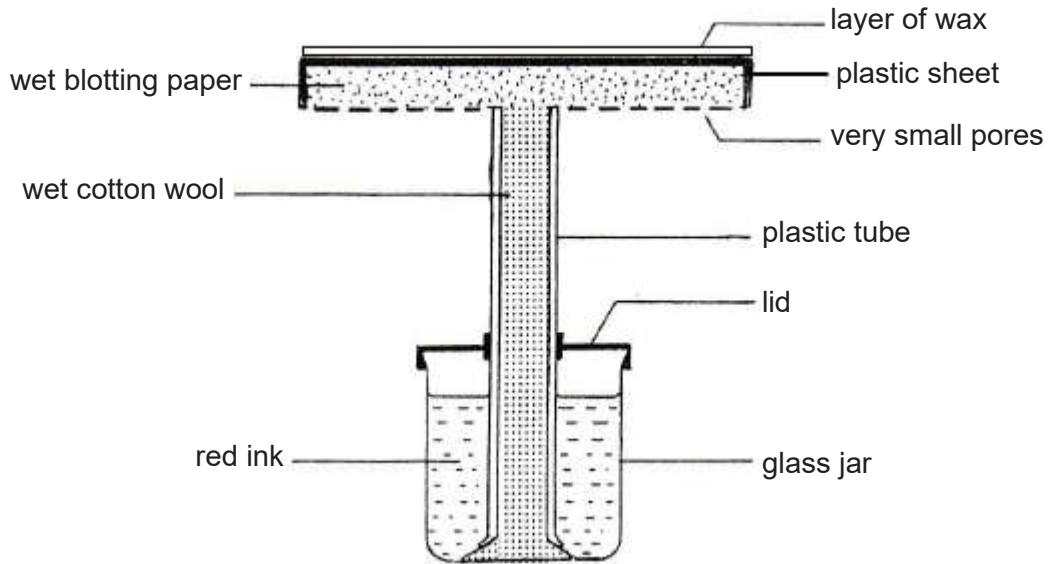


Fig. 1.1

The experimental model was placed in three different locations each for 12-hour periods. Table 1.2 shows the amount of mass lost at the different locations.

Table 1.2

experiment	location of the model	loss of mass / g
I	on the laboratory bench	1.0
II	under an electric fan	1.8
III	inside a plastic bag	0.1

- (a) State what the following parts of the model represent in an actual leaf.

- (i) blotting paper :[1]
 (ii) layer of wax :[1]
 (iii) pores in plastic sheet :[1]

- (b) The colour of the cotton wool changes during the process of the experiment. The model also experiences a loss in mass for all three experiments.

Name the process in plants that are demonstrated by the

- (i) colour change :[1]
 (ii) loss in mass :[1]

- (c) Compare and explain the differences in the loss of mass in experiment I with the other two experiments.

.....

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.....

.....

.....[4]

[Total: 9]

- 2 (a) Table 2.1 shows the response of three unknown blood types (**X**, **Y** and **Z**) to two serums containing antibodies a and b respectively.

Table 2.1

blood type	antibody a serum	antibody b serum
X	no agglutination	no agglutination
Y	agglutination occurs	no agglutination
Z	no agglutination	agglutination occurs

- (i) State the identity of blood type **X**, **Y** and **Z**.

X:

Y:

Z:

[3]

- (ii) Explain your answer in **2(a)(i)**.

.....

.....

.....

.....

.....

.....[3]

[Turn Over

- (b) Fig. 2.2 shows the surface view of a mammalian heart where one of the blood vessels of **C** is clogged with fats. This clogged area is shaded in black.

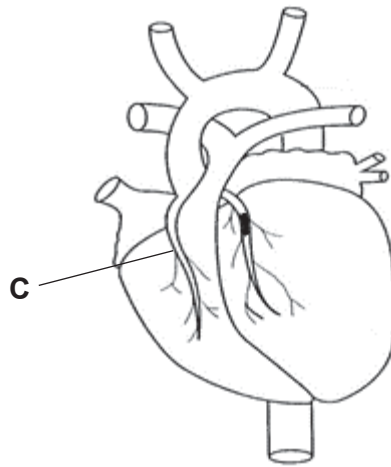


Fig. 2.2

- (i) Identify blood vessel **C** and state its function.

.....

[2]

In a procedure known as a coronary bypass surgery, doctors make use of a part of a vein from a patient's leg and transplants it onto the blood vessels to redirect the blood flow.

- (ii) Suggest one precaution the doctors need to take when using a vein for this surgery.

.....
[1]

- (iii) State a lifestyle change that would help reduce the risk of coronary heart disease.

.....
[1]

[Total: 10]

3 Read the following extract and answer the questions that follow:

It has been reported that Singapore has the second highest proportion of diabetics among developed nations. Diabetes mellitus can be prevented at the pre-diabetes stage. Pre-diabetics have a blood glucose level of between 7.8 and 11 mmol / l, two hours after an Oral Glucose Tolerance Test.

- (a)** State one other sign of diabetes mellitus.

.....
[1]

- (b)** Doctors recommend avoiding soft drinks and spacing out meals to prevent the onset of diabetes mellitus.

Explain how these measures prevent the onset of diabetes mellitus.

.....

[3]

- (c)** With regular exercise and weight-loss, the blood glucose for some patients at the pre-diabetes stage can be brought back to normal levels.

Suggest how regular exercise can help reduce blood sugar levels.

.....

[2]

- (d)** Suggest a reason why alcoholism promotes the development of diabetes mellitus.

.....

[2]

- (e)** Some diabetic patients require insulin therapy, where insulin is injected directly into the bloodstream as it cannot be consumed orally.

Suggest a reason why this is so.

.....
[1]

[Total: 9]

[Turn Over

- 4** In mammalian kidneys, the kidney is closely associated with the process of excretion.

- (a)** Define excretion in the human body.

.....[1]

An athlete ate some salty food. This food contained high concentrations of sodium ions. Table 4.1 shows the concentrations of some of the substances in this person's blood plasma, in the kidney filtrate and the urine. These values were measured shortly after eating the food.

Table 4.1

substance	concentration / g / dm ³		
	plasma	filtrate	urine
water	900.0	970.0	950.0
protein	80.0	0.0	0.0
glucose	1.0	1.0	0.0
amino acids	0.5	0.5	0.0
urea	0.3	0.3	20.0
sodium ions	3.2	3.2	6.0

- (b)** Using your knowledge of filtration and reabsorption in the kidney, describe and explain why neither protein nor glucose was found in the urine but urea was found in high concentrations.

.....[6]

[Total: 7]

5 Fig. 5.1 shows the cross-section of human sweat glands.

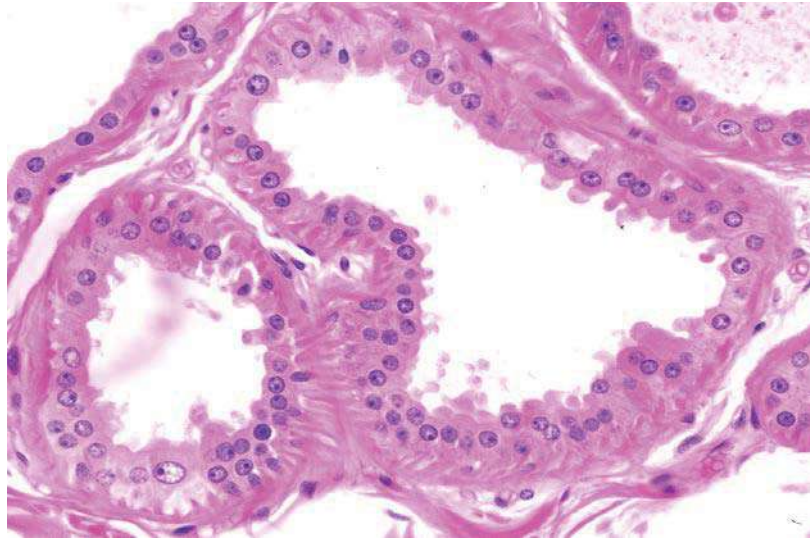


Fig 5.1

- (a) (i) On Fig. 5.1, label the region that leads to the sweat duct as **W**. [1]
- (ii) Describe two differences between the homeostatic control of urine and sweat production.

.....

.....

.....

.....[2]

The graph illustrates the relationship between time and sweat production. The y-axis represents sweat production in arbitrary units, ranging from 0 to 12. The x-axis represents time in minutes, ranging from 0 to 40. The curve shows a baseline of 0.5 units, a rise to a peak of 12 units at 23 minutes, and a return to the baseline by 34 minutes.

time / minutes	sweat production / arbitrary units
0	0.5
5	0.5
10	1.5
15	6.0
20	11.0
23	12.0
25	11.0
30	8.0
34	0.5
40	0.5

(i) With reference to Fig. 5.2, state the time at which the male starts sweating.

(ii) Describe and explain the shape of the curve in Fig. 5.2.

[4]

- 6 Each food chain contains a number of trophic levels. Energy is lost from a food chain between each trophic level.

Fig. 6.1 shows how energy is passed from one trophic level to another.

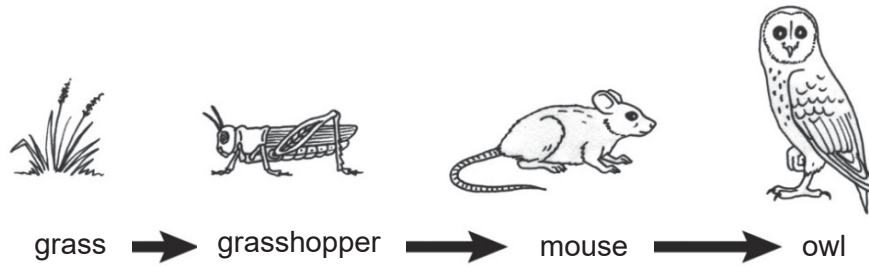


Fig 6.1

- (a) Construct a fully labelled pyramid of biomass for the food chain seen in Fig. 6.1.

[1]

- (b) Explain why there are no more than four trophic levels in the food chain shown in Fig. 6.1.

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.....[3]

- (c) Fish such as salmon can be reared intensively in fish farms. They are fed high protein food from other animals. When eating this food, the fish are feeding as secondary consumers.

Describe the disadvantages of intensive farming, such as salmon farming, for producing human food.

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.....

.....[3]

[Total:7]

[Turn Over

Section B (30 marks)

Answer **three** questions.

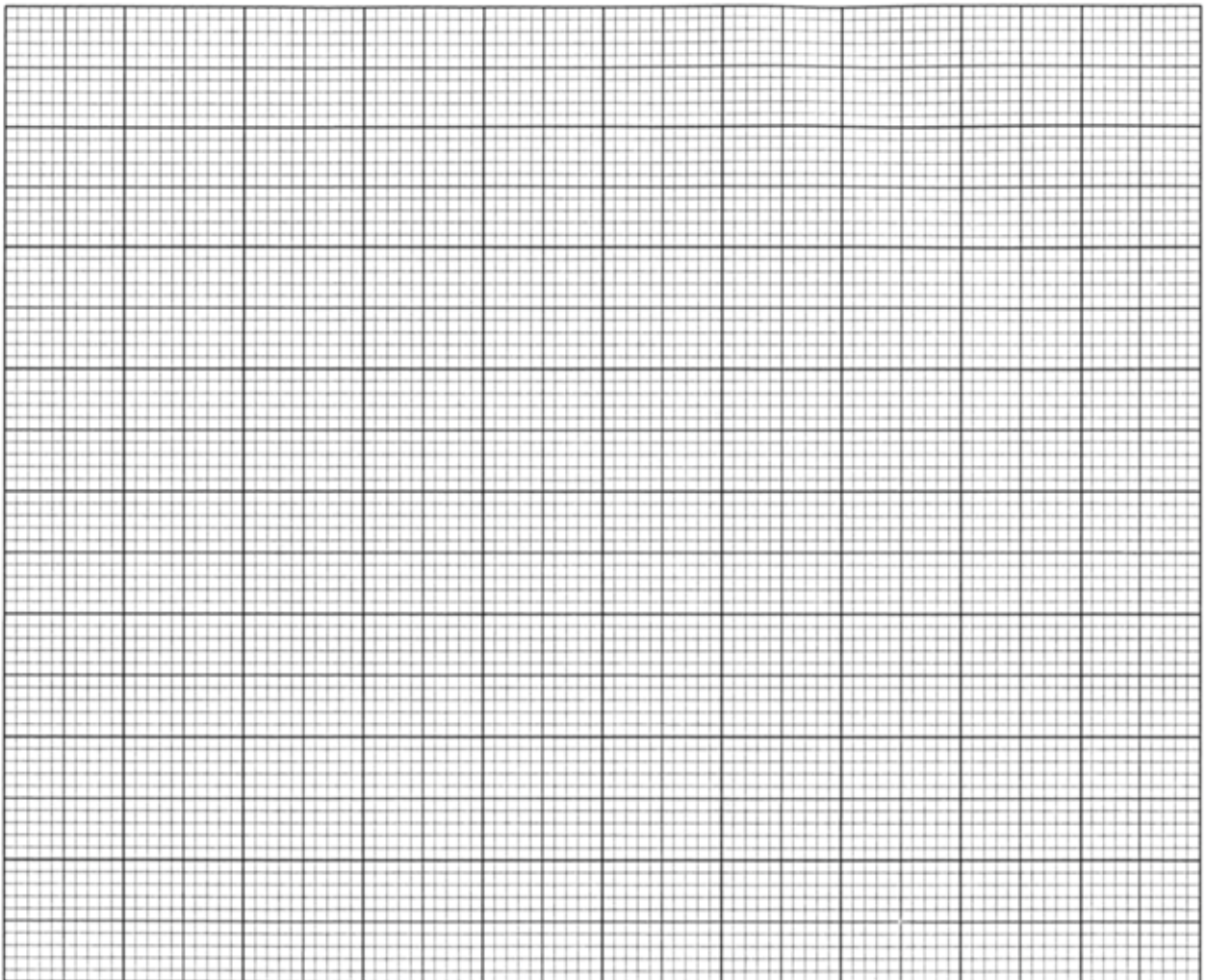
Question 9 is in the form of **Either/Or**. Answer only one part.

- 7 A survey to investigate the impact of smoking on the live birth weight of babies was conducted. It was administered to fifty females aged between 25 and 30 years. All participants of the survey were habitual smokers who continued to smoke during pregnancy. Table 7.1 shows the results.

Table 7.1

average number of cigarettes smoked each day	average live birth weight of baby born/ kg
0	2.78
1 – 2	2.60
3 – 4	2.45
5 – 6	2.33
7 – 8	2.20
9 – 10	2.12

- (a) (i) On the grid below, plot a bar chart of average live birth weight of baby born against average number of cigarettes smoked each day.



- 7 (a) (ii) Describe and explain the results shown in Table 7.1.

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.....

.....[4]

- (b) State the source and outline the role of a named hormone in maintaining pregnancy.

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.....

.....[3]

[Total: 10]

- 8 (a)** Night blindness is a genetic disorder controlled by a dominant allele. Those who have this disorder cannot see well in dim light. A man suffering from night blindness married a woman whose sight is normal. The couple has four children; two of whom have normal vision and the other two have night blindness.

Draw a genetic diagram indicating the genotypes and phenotypes for each generation.

[5]

- (b)** Explain, using examples, how continuous variation differs from discontinuous variation.

.....

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.....[5]

[Total:10]

EITHER

- 9 (a)** Compare and contrast the structure of a polypeptide and a protein.

[3]

- (b)** Distinguish between glycogen, glucagon and glycerol.

[7]

[Total: 10]

[6]

[4]

End of paper



Jurongville Secondary School
Science Department 2019
Marking Scheme & Marker's Report

Assessment: Prelim Examination 4E Biology (6093)

Level: 4 Express

Qn	Marking Scheme	Remarks	Marks	Marker's Report
1	B		[1]	
2	A		[1]	
3	D		[1]	
4	D		[1]	
5	D		[1]	
6	B		[1]	
7	B		[1]	
8	C		[1]	
9	A		[1]	
10	D		[1]	
11	C		[1]	
12	D		[1]	
13	C		[1]	
14	D		[1]	
15	B		[1]	
16	C		[1]	
17	A		[1]	
18	B		[1]	
19	C		[1]	
20	A		[1]	
21	B		[1]	
22	A		[1]	
23	C		[1]	
24	B		[1]	
25	D		[1]	
26	B		[1]	

[Turn over

Qn	Marking Scheme	Remarks	Marks	Marker's Report
27	C		[1]	
28	A		[1]	
29	D		[1]	
30	C		[1]	
31	C		[1]	
32	A		[1]	
33	A		[1]	
34	C		[1]	
35	D		[1]	
36	B		[1]	
37	C		[1]	
38	A		[1]	
39	D		[1]	
40	D		[1]	

A: 9
 B: 9
 C: 11
 D: 11

[Turn over

Jurongville Secondary School
Science Department 2019
Marking Scheme & Marker's Report

Assessment: Biology (Pure) Prelim Paper 2 2019

Level: Sec 4E

Qn	Marking Scheme	Remarks	Marks	Marker's Report
1a	i) Mesophyll layer (accept both spongy/ palisade) ii) Cuticle iii) Stomata		[1] [1] [1]	
1b	i) Transpiration pull/ diffusion ii) Transpiration/ evaporation of water		[1] [1]	
1c	The mass lost in experiment II is higher than in experiment I by 0.8 g as the rate of transpiration (accept evaporation) is higher; The wind from the fan blows away the water vapour from around the stomata, maintaining a <u>steep concentration gradient</u> of water vapour; The mass lost in experiment III is lower than in experiment I as the rate of transpiration (accept evaporation) is lower; Water vapour is trapped within the plastic bag and this <u>increases the humidity</u> around the stomata, decreasing the water vapour concentration gradient;		[1] [1] [1] [1]	
			Total: 9	
2ai	X: Blood type O Y: Blood type A Z: Blood type B		[1] [1] [1]	
2aii	X had <u>no antigens</u> on the red blood cell as no agglutination occurred; Y had <u>antigen A</u> on it as antibody a will bind to it, causing agglutination, it has no antigen B on it as no agglutination occurred in the presence of antibody b. Z had <u>antigen B</u> on it as antibody b will bind to it, causing agglutination, it has no antigen A on it as no agglutination occurred in the presence of antibody a.		[1] [1] [1]	
2bi	C: coronary artery; It carries <u>oxygenated blood</u> from the aorta to the heart/ cardiac cells/ muscles;		[1] [1]	
2bii	Ensure that the vein is fitted in the right way so the valves will allow blood to flow through/ Use a piece of vein that does not have any valves;		[1]	
2biii	Reduce smoking/ quit smoking/ consume less cholesterol and saturated fats/ exercise regularly/ manage stress well		[1]	

Qn	Marking Scheme	Remarks	Marks	Marker's Report
			Total: 10	
3a	Presence of glucose in urine;		[1]	
3b	<p>Avoiding sugary drinks</p> <ul style="list-style-type: none"> - Reduces the rapid increase in blood glucose; - Sugars in drinks are easily absorbed into the bloodstream to increase blood glucose concentration; <p>Spaced out meals</p> <ul style="list-style-type: none"> - Allows gradual absorption of sugars from digested carbohydrates; - Less rapid increases in blood glucose; - Gives more time for glucose to be absorbed by cells for use or storage; 	Any 3 points, max 2 points from each header	[3]	
3c	<p>Regular exercise:</p> <ul style="list-style-type: none"> - More glucose is used by muscle <u>cells</u> during exercise; - For respiration to release more energy; 		[1] [1]	
3d	<p>Alcohol use can cause liver cirrhosis/ damage;</p> <p>Excess glucose cannot be converted to glycogen easily for storage as the liver is the site of insulin action/ The liver is damaged and cannot convert excess glucose to glycogen;</p>		[1] [1]	
3e	Insulin might be digested by enzymes when consumed/ Acid in the stomach might react with the insulin/ insulin is too big to pass through the small intestine for absorption;		[1]	
			Total: 9	
4a	Excretion is the process by which metabolic waste products and toxic substances are removed from the <u>body of an organism/ human</u> ;		[1]	
4b	<p>Protein level in the <u>filtrate</u> and the urine is 0.0 g/dm^3/ No protein in filtrate or in urine; Protein is too big to pass through the basement membrane of the glomerulus into the nephron/ into the Bowman's capsule;</p> <p>Glucose undergoes ultrafiltration as it is small enough to pass through the basement membrane so the filtrate contains 1.0 g/dm^3 of glucose; However glucose would be reabsorbed back into the <u>bloodstream</u> at the <u>proximal convoluted tubule</u>, hence the urine would have no glucose;</p> <p>Urea is small enough to be filtered out in the filtrate 0.3 g/dm^3 in the filtrate; It is not absorbed back into the bloodstream and is concentrated in urine to 20 g/dm^3/ is removed in urine;</p>		[1] [1] [1] [1] [1] [1]	
			Total: 7	
5ai	Label space between cells as W		[1]	

Qn	Marking Scheme	Remarks	Marks	Marker's Report
5aii	Urine production regulates <u>blood</u> water potential, sweat production regulates <u>body temperature</u> ; Urine production is controlled/affected by ADH concentrations, sweat production is affected by nervous impulses;		[1] [1]	
5bi	At 8 minutes		[1]	
5bii	When the person exercises, muscle cells release a lot of <u>heat</u> (through respiration), <u>sweat production increases</u> from <u>0.6</u> to <u>12 arbitrary units</u> ; Hypothalamus detects the increase in body temperature and sends nerve impulses to sweat glands which become more active/ produce more sweat; After t=23 minutes, heat production slows down/ sweat production <u>reduces</u> from 12 to 0.6 arbitrary units; Negative feedback to the sweat glands to reduce <u>sweat production</u> / Body temperature returns back to normal by around t=23;	Must use info from the graph to get full marks	[1] [1] [1] [1]	
			Total: 8	
6a	Correct pyramid shape with producers at the bottom , organisms labelled clearly;		[1]	
6b	10% of energy is transferred to the next trophic level, 90% of energy is lost <u>between trophic levels</u> through heat in respiration/ <u>uneaten organism parts/ waste products/ undigested food (faeces)</u> ; Not enough energy in <u>fourth trophic level</u> to support another level/ <u>5th trophic level</u> will obtain very little energy;		[1] [1] [1]	
6c	Protein feed from animals is <u>expensive</u> , increasing the cost; More energy efficient to <u>feed humans crops or producers or even the animals</u> used to make the fish feed; Waste feed can cause eutrophication of the water; Diseases can pass between fish in fish farm <u>very easily</u> ; Chemicals such as antibiotics, when used to control disease can also pollute the environment; Natural habitat of organisms is removed;	Any 3 valid points	[3]	
			Total: 7	

Qn	Marking Scheme	Remarks	Marks	Marker's Report
7ai	Correctly labelled axes Reasonable scale (graph is large enough to fill 50% of the space in both directions); Correct plotting of points;		[1] [1] [1]	
7aii	As the number of cigarettes smoked increases from 0 to 10 sticks a day, the average live birth weights of a baby decreases from 2.78 to 2.12 kg; Cigarette smoke contains nicotine to constrict blood vessels, including umbilical cord vessels; Carbon monoxide binds with haemoglobin to form carboxyhaemoglobin, so the oxygen carrying capacity of red blood cells is reduced; Less blood containing oxygen / nutrients is brought to the foetus for growth and respiration OR Less oxygenated blood is brought to the foetus for growth and respiration;;		[1] [1] [1]	
7b	Progesterone; It is released by the <u>ovaries</u> / and subsequently the <u>placenta</u> ; It helps to <u>maintain/ further thicken</u> the uterine lining to ensure the lining is maintained during pregnancy;		[1] [1] [1]	
			Total: 10	
8a	Let B be the dominant allele for night blindness Let b be the recessive allele for normal sight parent phenotype male night blindness X female normal parent genotype Bb x bb gametes B b b b F1 genotype Bb Bb bb Bb F1 phenotype night blindness night blindness normal Normal		[1] [1] [1] [1] [1]	

Qn	Marking Scheme		Remarks	Marks	Marker's Report
	F1 phenotypic ratio	2 night blindness : 2 normal	Accept 1:1		
8b	Continuous variation	Discontinuous variation	2 examples per category	[2] [1] [1] [1]	
	Any 2 e.g. (Height, mass, IQ, skin tone)	Any 2 e.g. (blood type, gender)			
	Range of phenotypes/ values/ characteristics/ traits	Clear cut phenotypes, distinct from one another with no intermediates			
	Controlled by many genes, has an additive effect	Controlled by one or few genes, no additive effects			
	Affected by environment (e.g. diet)	Not affected by environment			
				Total: 10	
9 E a	<p>Similarity: Both are made up of basic units of amino acids (bonded together by peptide bonds); Contain the elements C,H, O, N;</p> <p>Differences: Polypeptides are shorter/ smaller/ less complex than proteins which are larger/ more complex;</p> <p>Polypeptides are straight chains of amino acids without a 3D folded structure that proteins have;</p>		At least 1 similarity	[3]	
9 E b	<p>Glycogen:</p> <ul style="list-style-type: none"> - A storage form of carbohydrate/glucose; - Complex structure with branched chains of glucose molecules; - Found in animal/ human cells (in particular muscle and liver cells) <p>Glucagon:</p> <ul style="list-style-type: none"> - A hormone; - Carried/ transported by the bloodstream; - Secreted by the islets of Langerhans in pancreas; - Stimulates liver cells to convert more glycogen to glucose for use; <p>Glycerol:</p> <ul style="list-style-type: none"> - A product of chemical digestion of fats, along with fatty acids; - It is absorbed from the small intestine and is recombined with fatty acids in the epithelium of the villus; 		At least 2 points for each substance, max 3 points for each substance	[7]	
				Total: 10	

Name

Reg. No

Class



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4EX

BIOLOGY

6093/01

Paper 1 Multiple Choice [40 Marks]

PRELIMINARY EXAMINATION

Additional Materials:

Approved calculator

OTAS

September 2019

1 hour

Instruction to Candidates

Do not start reading the questions 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 index number on the OTAS provided.

Information for Candidates

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 OTAS.

Read the instructions on the OTAS 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.

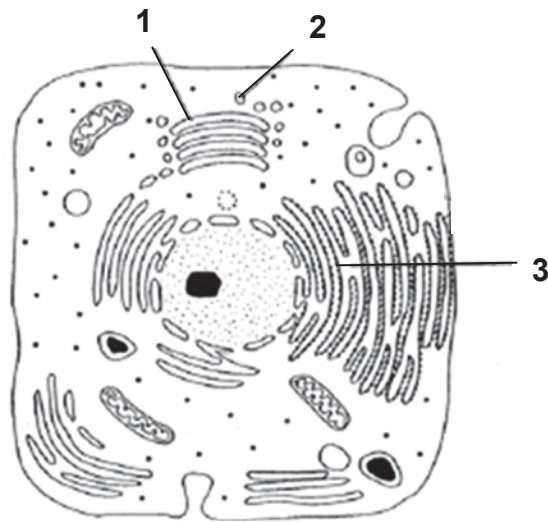
This question paper consists of **20** printed pages.

Setter: Mr Timothy Ng

Vetter: Mrs Marie Huang

[Turn Over

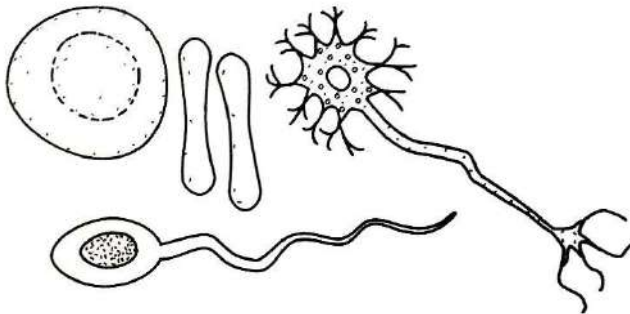
- 1 The diagram shows the magnified structure of an animal cell under an electron microscope.



What are the functions of the labelled structures?

	synthesizing protein from amino acids	exporting proteins out of the cell	modify, store and package proteins
A	1	2	3
B	1	3	2
C	3	1	2
D	3	2	1

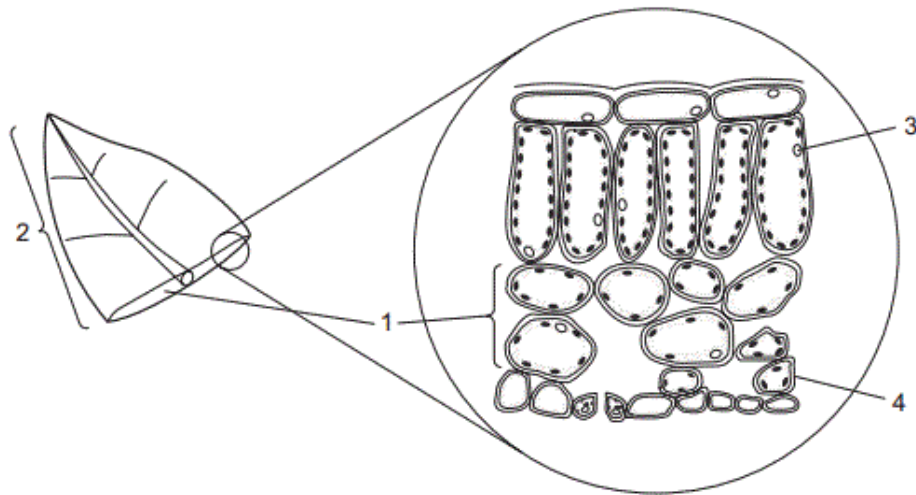
- 2 The diagrams below show several different types of human cells.



Which of the following statements is correct?

- A** All the cells can move.
- B** All the cells can undergo cell division.
- C** All the cells have a nucleus.
- D** All the cells have a plasma membrane.

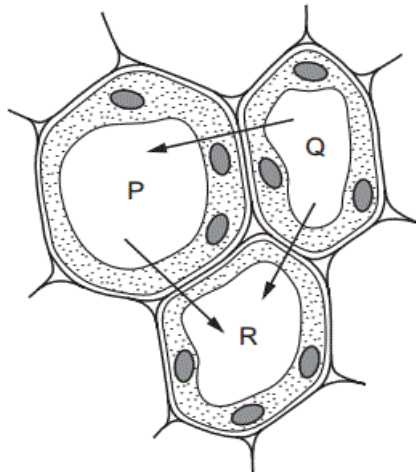
- 3 The diagram shows the structure of a leaf.



Which letter 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

- 4 The diagram shows three plant cells labelled P, Q and R. The arrow shows the movement of water by osmosis.



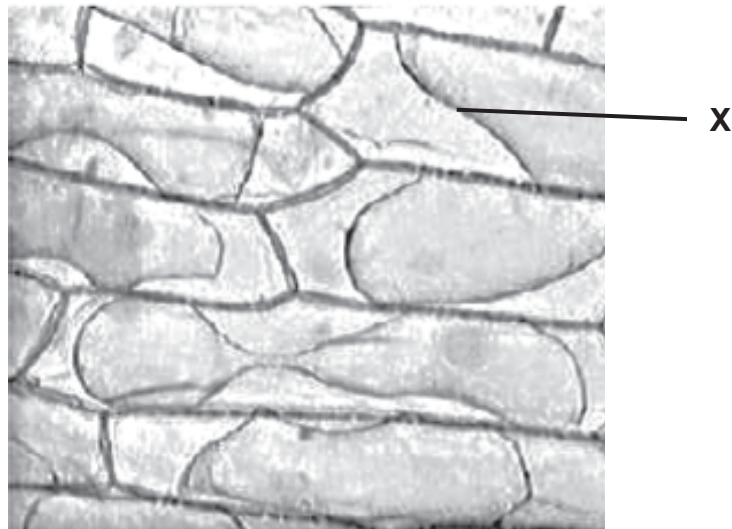
What is the correct order of water potential in the cells, from the highest to the lowest?

	Highest	Middle	Lowest
A	P	Q	R
B	P	R	Q
C	Q	P	R
D	R	P	Q

- 5 Which of the following correctly states a difference between diffusion and osmosis?

	Diffusion	Osmosis
A	against a concentration gradient	along a concentration gradient
B	does not require energy	requires energy
C	requires a partially-permeable membrane	does not require a partially-permeable membrane
D	involves all particles	involves mainly water molecules

- 6 The light micrograph below shows the appearance of some onion cells after they had been placed in a concentrated salt solution for some time.



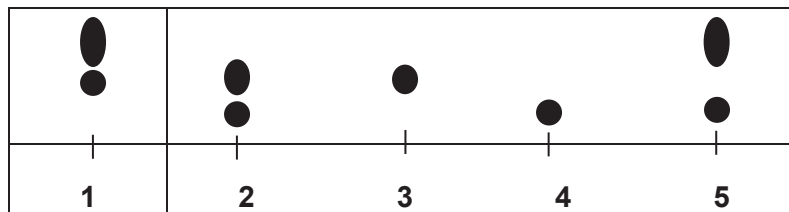
Identify X and the condition of the cells above.

	X	Condition of cells
A	cell membrane	crenated
B	cell membrane	plasmolysed
C	cell wall	crenated
D	cell wall	plasmolysed

- 7 Which of the following correctly states the digestion of sucrose?

	nutrient	enzyme	products of digestion
A	sucrose	amylase	glucose only
B	sucrose	lactase	glucose and galactose
C	sucrose	lipase	fatty acids and glycerol
D	sucrose	sucrase	glucose and fructose

- 8 Five disaccharides were each hydrolysed with dilute acid and the purified products were separated by chromatography. The results are shown in the diagram below.



Spot 1 in the diagram represents the products obtained from the hydrolysis of sucrose.

Which of the following represents the results obtained from the hydrolysis of lactose and maltose?

	lactose	maltose
A	2	3
B	2	4
C	5	2
D	5	3

- 9 A student tested his fluid lunch in the following ways and got the results as shown.

Treatment	Results
Added 1 ml of alcohol followed by water 1 ml of water to a sample of the fluid lunch.	A white emulsion was formed.
Added 1 ml of Biuret solution to a sample of the fluid lunch.	The Biuret solution turned violet.
Added 2 ml of Benedict's solution to a sample of the fluid lunch and placed it in a boiling water bath for 3 minutes.	The Benedict's solution turned into a brick-red precipitate.
Added 3 drops of iodine solution to a sample of the fluid lunch.	The iodine solution remained brown.

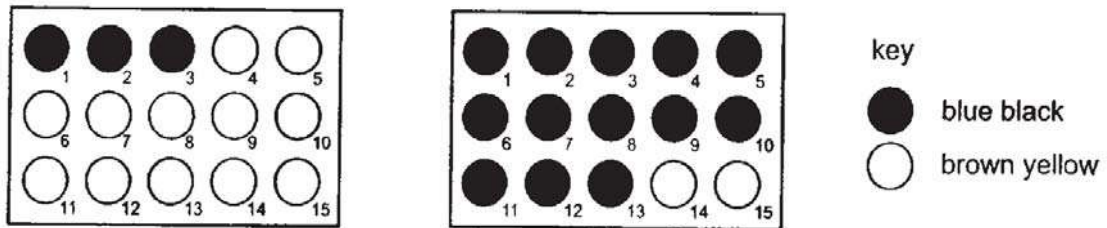
The food substances present in the lunch could contain some of the following nutrients:

1. fat
2. protein
3. reducing sugar
4. starch

From the results of the tests, which of the nutrients were present in his lunch?

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

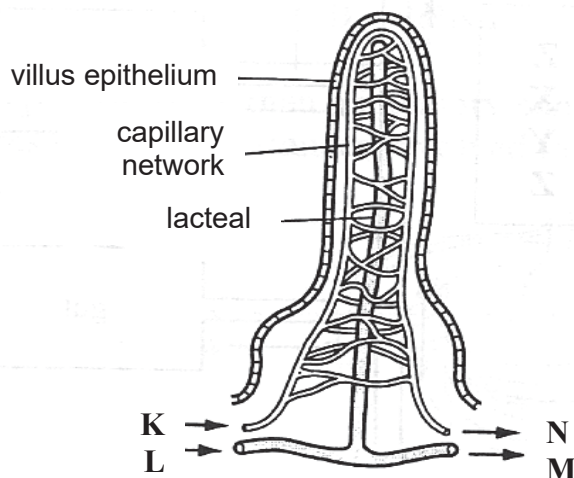
- 10 An experiment was carried out to investigate the digestion of starch using amylase at two different temperatures. A sample was removed from each mixture at 15 seconds intervals and placed into a spotting tile well containing two drops of iodine solution. The results are shown in the diagram.



Which of the following shows the correct temperatures and times for the complete digestion of starch?

	Time for digestion of starch / s	
	10°C	30°C
A	0.45	19.50
B	19.50	0.45
C	45.00	195.00
D	195.00	45.00

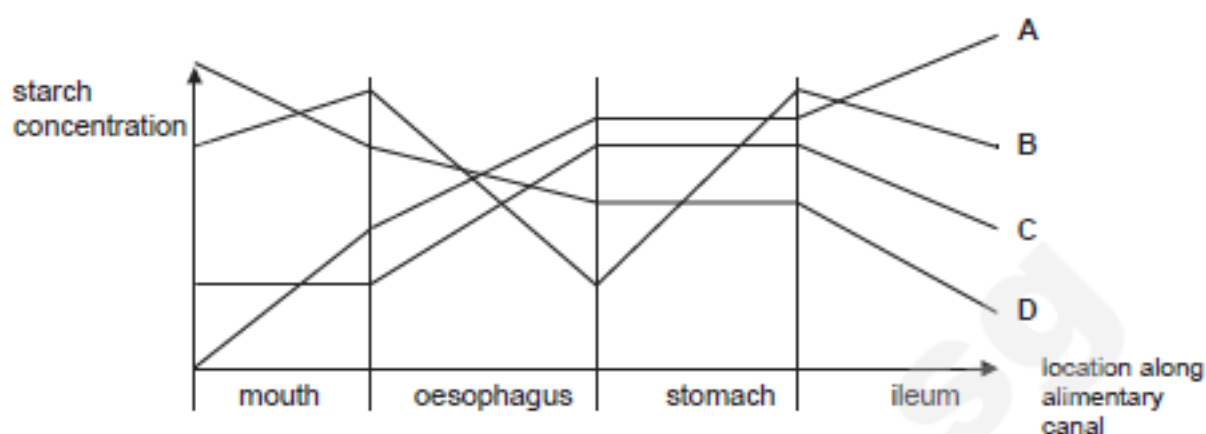
- 11 The diagram shows the structure of a villus found in the small intestine. The arrows show the direction of flow of the fluids from the products of digestion absorbed by the villus.



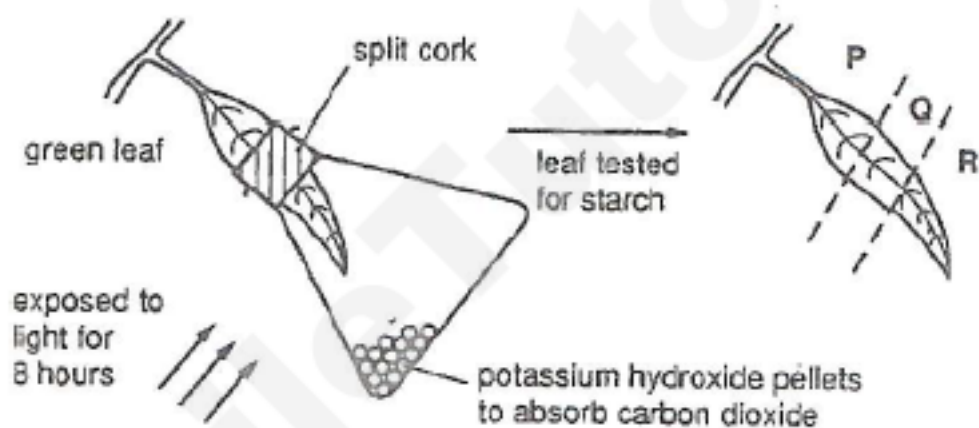
After a meal, where will you find the highest concentrations of amino acids and glucose?

	amino acids	glucose
A	K	N
B	L	M
C	M	M
D	N	N

12 Which of the graphs below represent starch digestion along the alimentary canal?



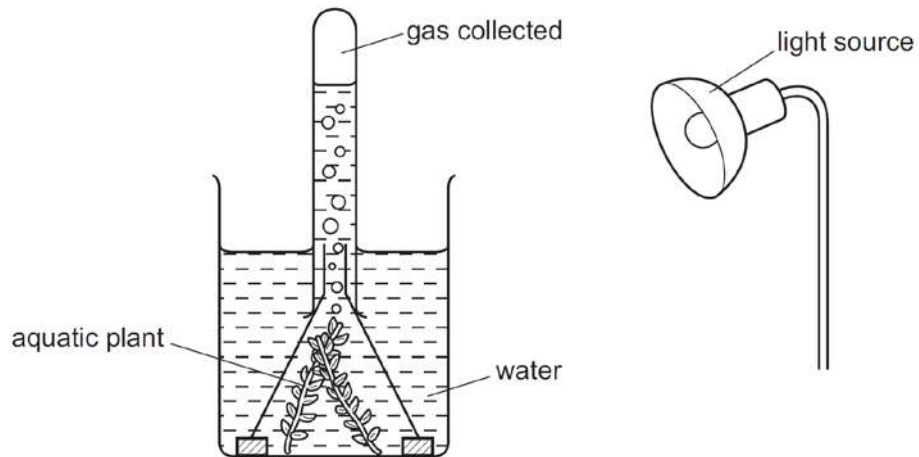
13 The diagram shows an experiment which was carried out to investigate photosynthesis.



What were the colours of regions Q, and R, after the leaf had been tested for starch using iodine solution?

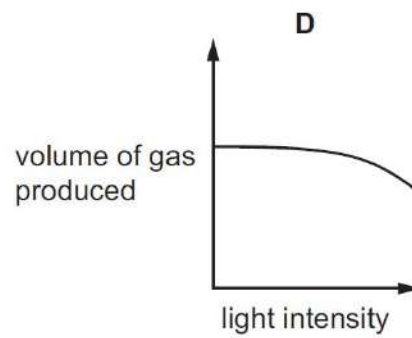
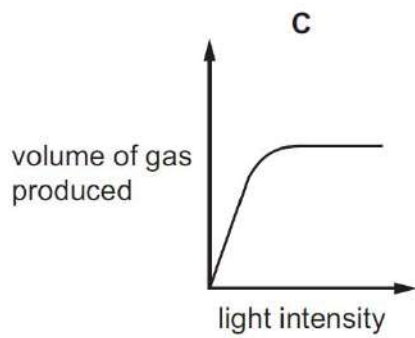
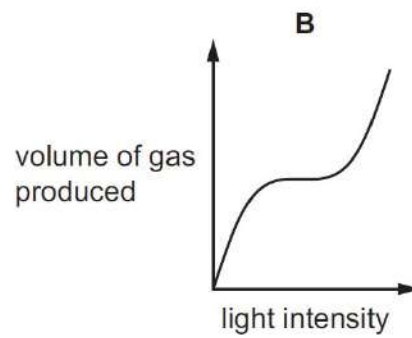
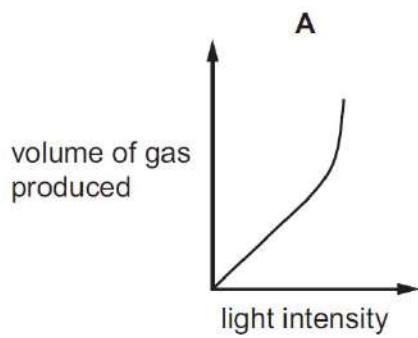
	Q	R
A	blue-black	brown
B	brown	brown
C	blue-black	blue-black
D	brown	blue-black

- 14 An experiment is set up as shown. The volume of gas collected is measured after 30 minutes.

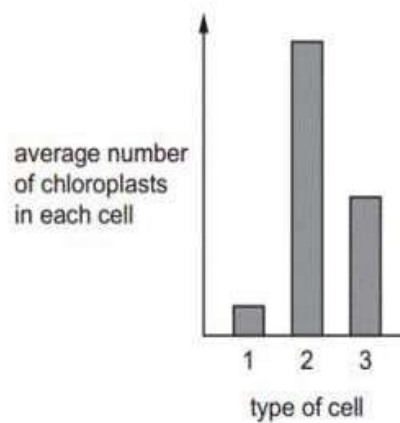


The experiment is repeated several times. Each time the light intensity is increased.

Which graph shows the results?



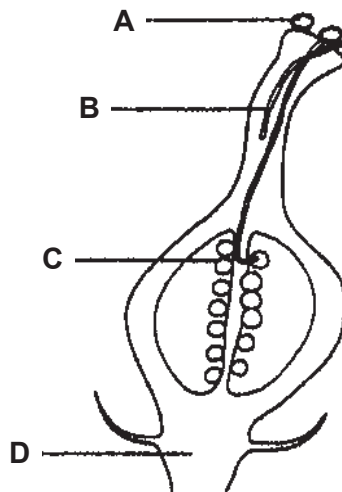
- 15** The chart shows the average number of chloroplasts in each of three different types of leaf cell.



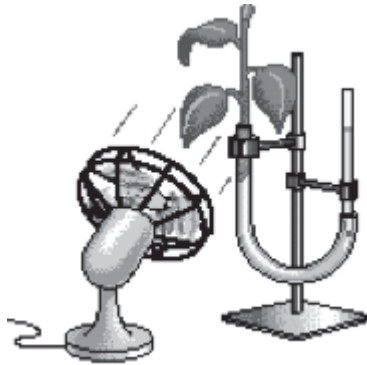
What are the three types of leaf cell?

	1	2	3
A	guard cell	palisade mesophyll cell	spongy mesophyll cell
B	palisade mesophyll cell	spongy mesophyll cell	guard cell
C	spongy mesophyll cell	guard cell	palisade mesophyll cell
D	spongy mesophyll cell	palisade mesophyll cell	guard cell

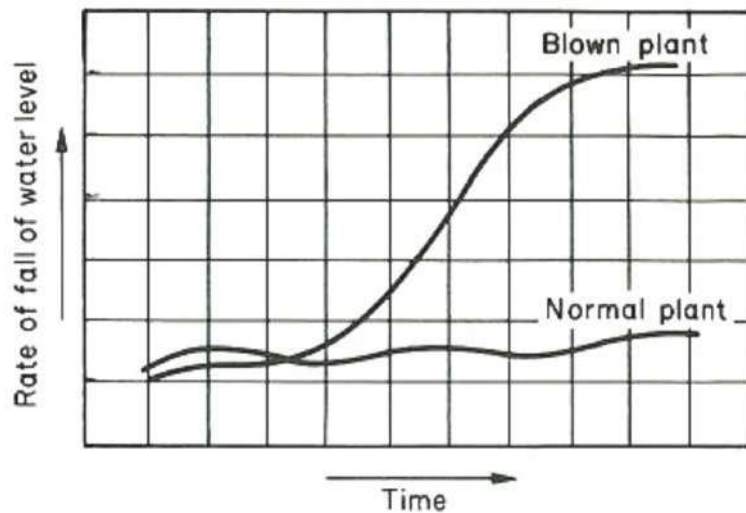
- 16** In cell tissue culture, cells are taken from the parent plant and grown in a cell culture. From which part of the plant would cell samples be taken so that the new plants would be genetically identical to the parent plant?



- 17 An experiment was conducted to investigate the effect of wind on the rate of transpiration in plants. One plant had a fan directed at it throughout the experiment.



The graphs below show the rate of fall of the water levels in two plants.

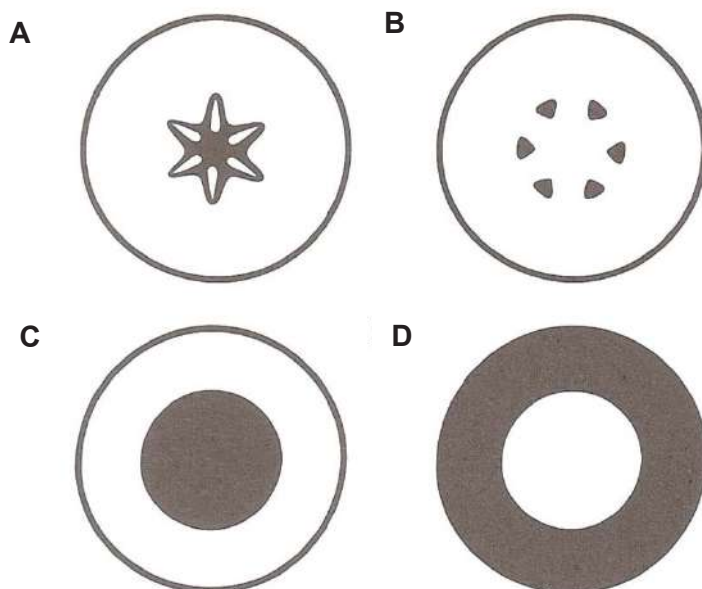


Which statement is the best explanation of the difference between the two graphs?

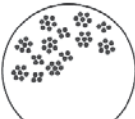
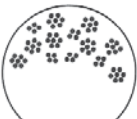
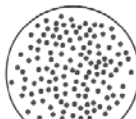
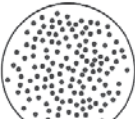

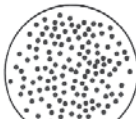
- A** The fan caused an increase in the rate of translocation, resulting in increased water uptake.
- B** The fan caused more evaporation of water from the cylinder and the leaves.
- C** The plant has a greater transpiration rate due to the increased air movement.
- D** The plant took up less water as the fan cooled the temperature.

- 18 A plant was exposed to radioactive carbon for a period of time. Six hours later, the cross-section of the stem tissue shown below was cut from the plant and dried in an oven. It was pressed against photographic plates that became black when exposed to radioactivity.

Which of the following shows the appearance of the photographic plate taken at the end of the experiment?



- 19 The test results of blood group testing of three people, John, Jacob and Jennifer are shown below.

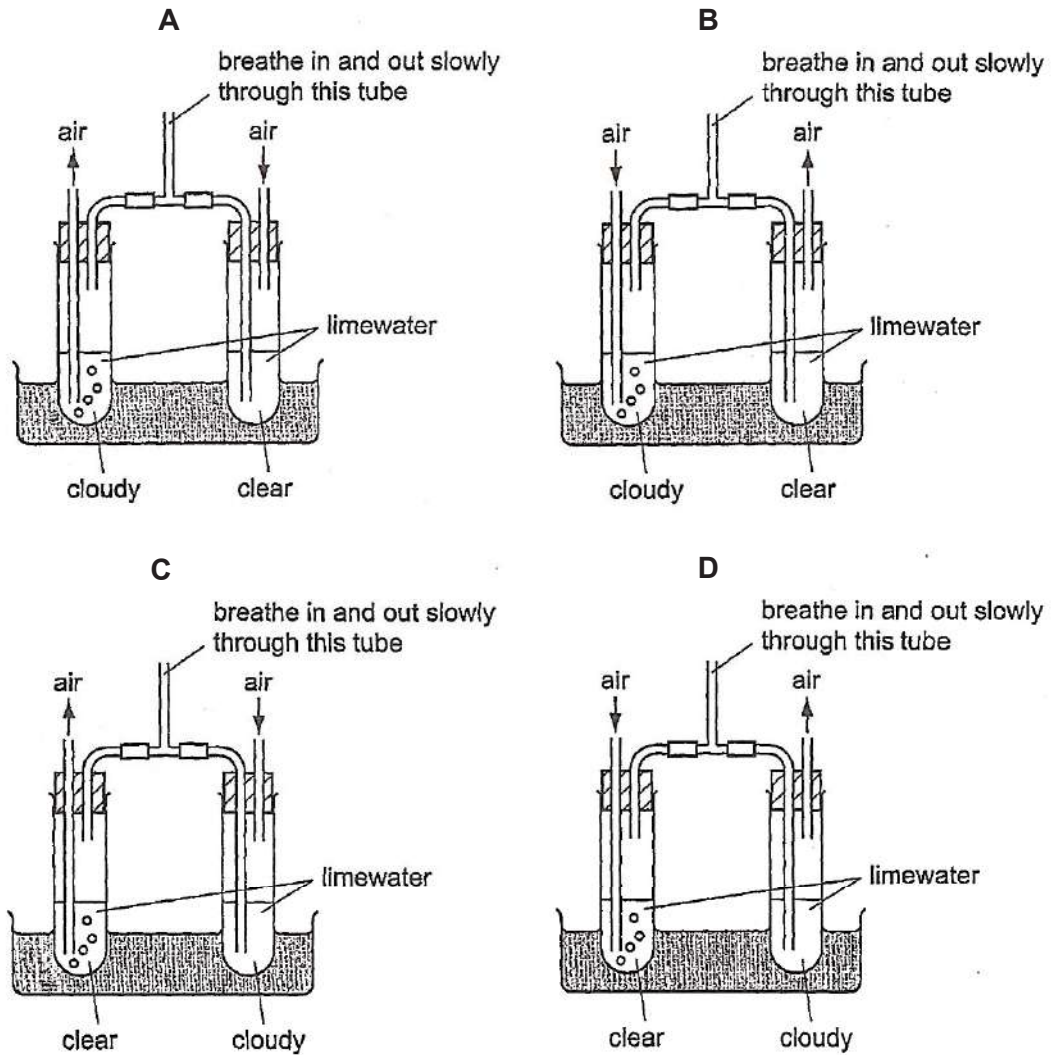
Blood of person	John	Jacob	Jennifer
Serum from blood of group A	 clumps	 clumps	 no clumping
Serum from blood of group B	 no clumping	 clumps	 no clumping

Which of the following correctly identifies their blood groups?

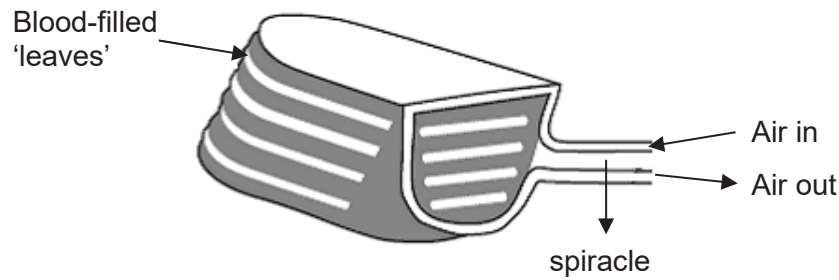
	John	Jacob	Jennifer
A	A	B	AB
B	AB	A	B
C	B	AB	O
D	O	AB	A

[Turn Over

- 20 Carbon dioxide turns limewater cloudy. Which one of the following demonstrates that expired air contains much more carbon dioxide?



- 21** Scorpions have breathing organs called 'book lungs'. These consist of blood-rich tissues arranged like the leaves of a book. Air enters the 'book lungs' through a small opening called a spiracle. Gases can be exchanged between the air and the blood.



Which of the following will speed up gas exchange between the blood in the 'leaves' and the air around them?

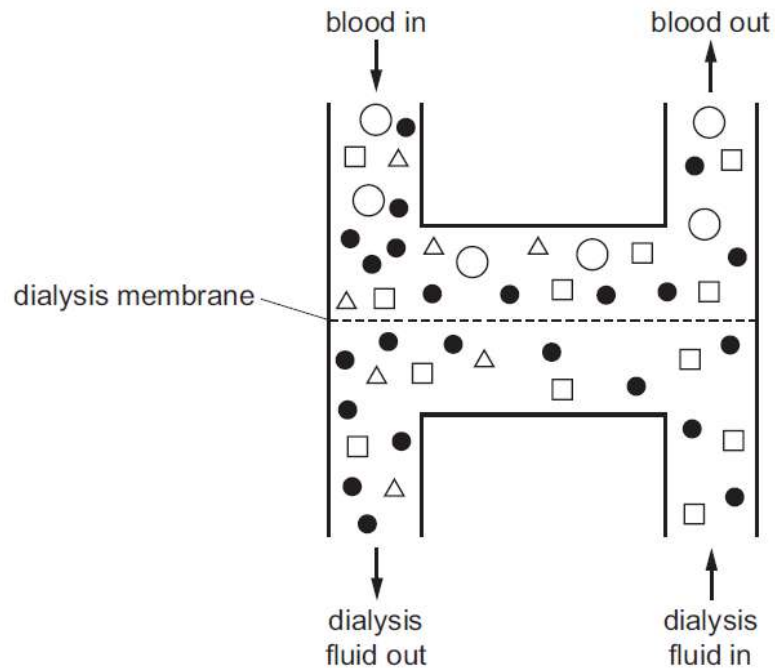
- A** Increasing the flow of blood through the 'leaves'.
 - B** Lowering the blood temperature.
 - C** Reducing the number of 'leaves'.
 - D** Reducing the size of the spiracle.
- 22** The following table gives the events involved in the secretion and action of anti-diuretic hormone (ADH).

Which row shows the correct chain of events?

Key
 + = Increased
 - = Decreased

	Water level in blood relative to normal	Amount of ADH produced relative to normal	Amount of water reabsorbed by kidneys
A	+	+	-
B	+	-	+
C	-	+	+
D	-	-	-

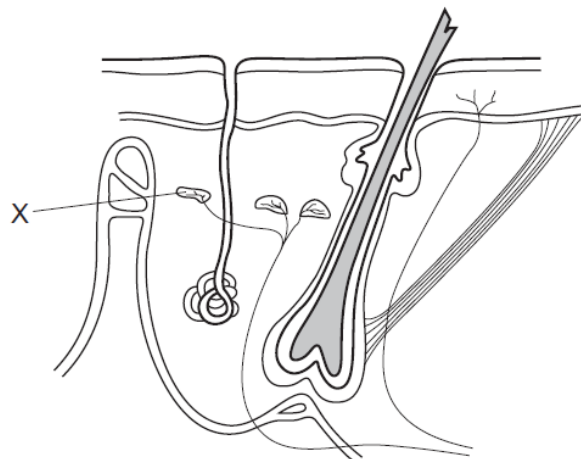
- 23 The diagram shows how a kidney dialysis machine works. Each shape represents a molecule found in blood or dialysis fluid.



Which shape represents urea?

- A ○
- B ●
- C □
- D △

- 24 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

25 Four processes that take place in the human body are listed.

1. absorption of amino acids through the villi
2. maintenance of a constant body temperature
3. production of lactic acid in muscles
4. regulation of blood glucose concentration

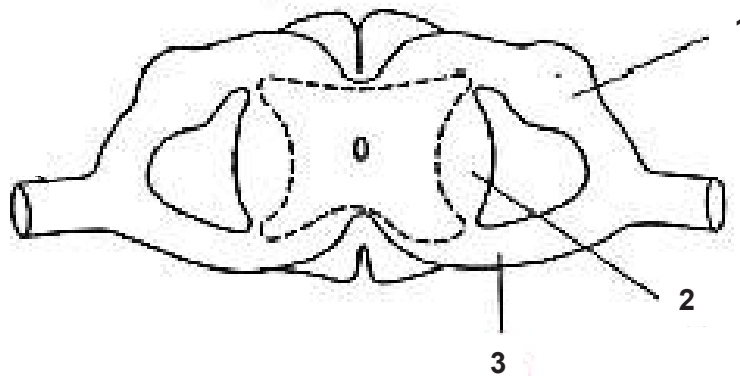
Which two processes are directly controlled by negative feedback?

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

26 How is the concentration of blood glucose regulated?

	Blood glucose concentration	Pancreas stimulated to secrete	Liver converts
A	fall	glucagon	glycogen to glucose
B	fall	insulin	glucose to glycogen
C	rise	glucagon	glucose to glycogen
D	rise	insulin	glycogen to glucose

27 Part of the spinal cord of a person was damaged. A pin prick was applied to the base of the person's foot. It was observed that the person felt the pain but was unable to jerk his foot away from the pin.



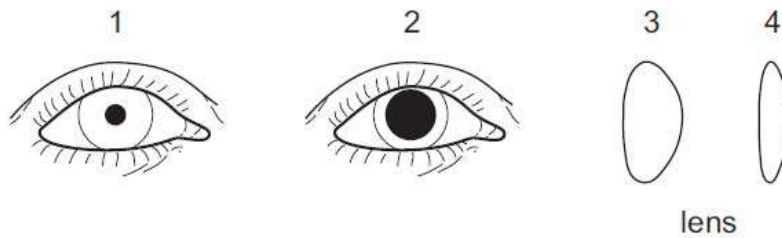
If the diagram represents the spinal cord of the person, which area(s) is/are likely to be damaged?

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

28 Which of the following actions is **not** a reflex action?

- A choking and coughing when food get stuck in your throat
- B closing your eyelids as dust particles from smoke hit your face
- C crying when you feel sad
- D pulling your hand away after touching a candle flame

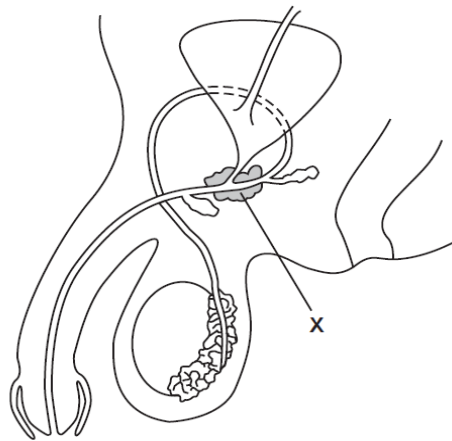
29 The diagrams show the eye viewed from the front and its lens in cross-section.



Which diagrams show the appearance of the pupil and the shape of the lens when looking up at the sky at night?

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

30 The diagram shows part of the male reproductive system.



What will be the effect of removing gland X?

- A prevention of the storage of sperm before fertilisation
- B reduction of the nutrients in the seminal fluid
- C slowing down of the production of sperm
- D stoppage of the secretion of a male hormone

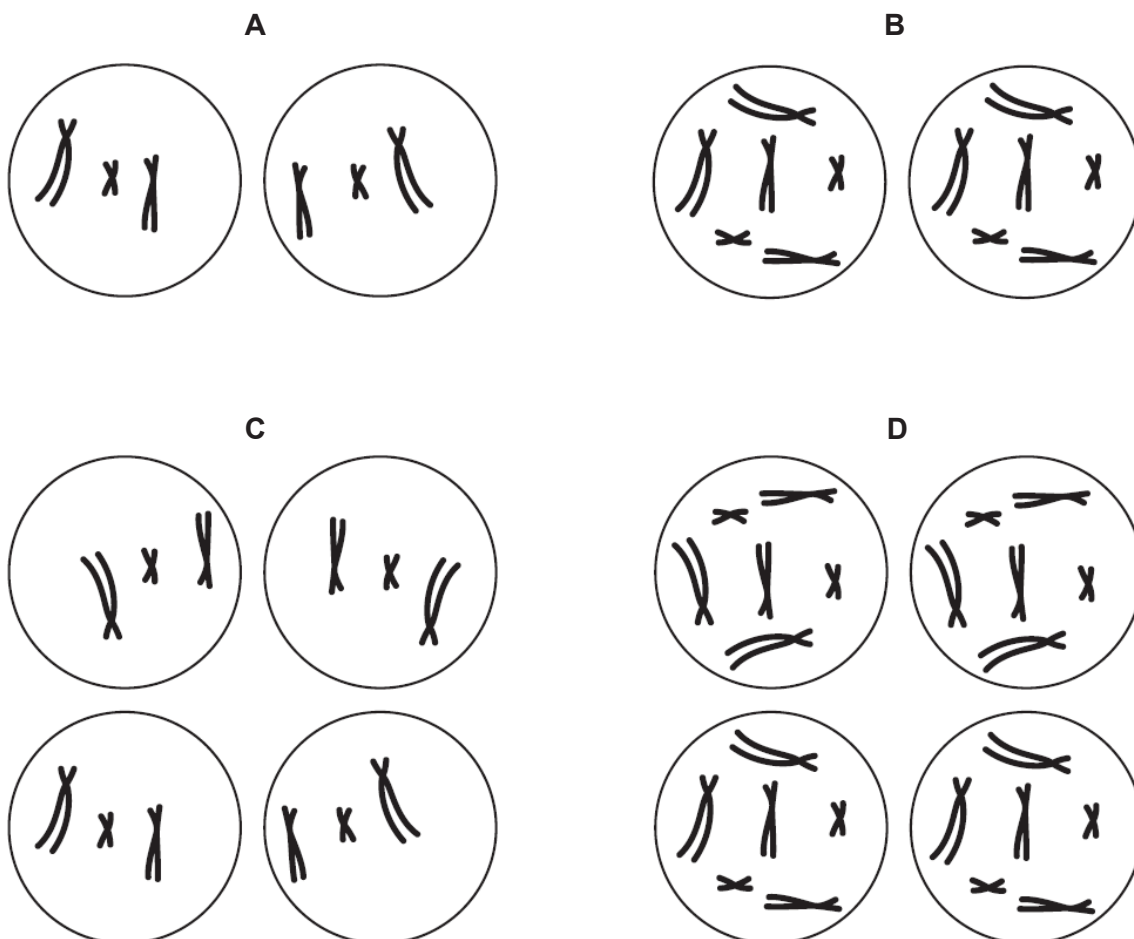
31 Which of the following occurs in mitosis but **not** in meiosis?

- A crossing over between homologous chromosomes
- B homologous chromosomes are sorted to different nuclei
- C independent assortment of chromosomes at metaphase
- D nuclear envelope reforming around a diploid number of chromosomes at telophase

32 The diagram shows the chromosomes in a cell.



Which diagram shows the product of **one** division of the cell by mitosis?



- 33** In some species of dragonflies, the females have two X chromosomes while the males have one X chromosomes and no Y chromosomes. If the normal diploid number in a dragonfly is 16, what would be the number of chromosomes in the body cells of the male and female dragonflies?

	Male dragonfly	Female dragonfly
A	7	8
B	8	16
C	15	16
D	16	16

- 34** The following table shows the base composition of the chromosome in a particular insect.

Base composition/%			
Adenine	P	Q	R
31.6	18.0	18.4	32.0

Which of the following correctly identifies the unknown bases?

	P	Q	R
A	cytosine	guanine	thymine
B	guanine	cytosine	uracil
C	guanine	uracil	cytosine
D	thymine	guanine	cytosine

- 35** The diagram shows a pair of chromosomes from the same cell.

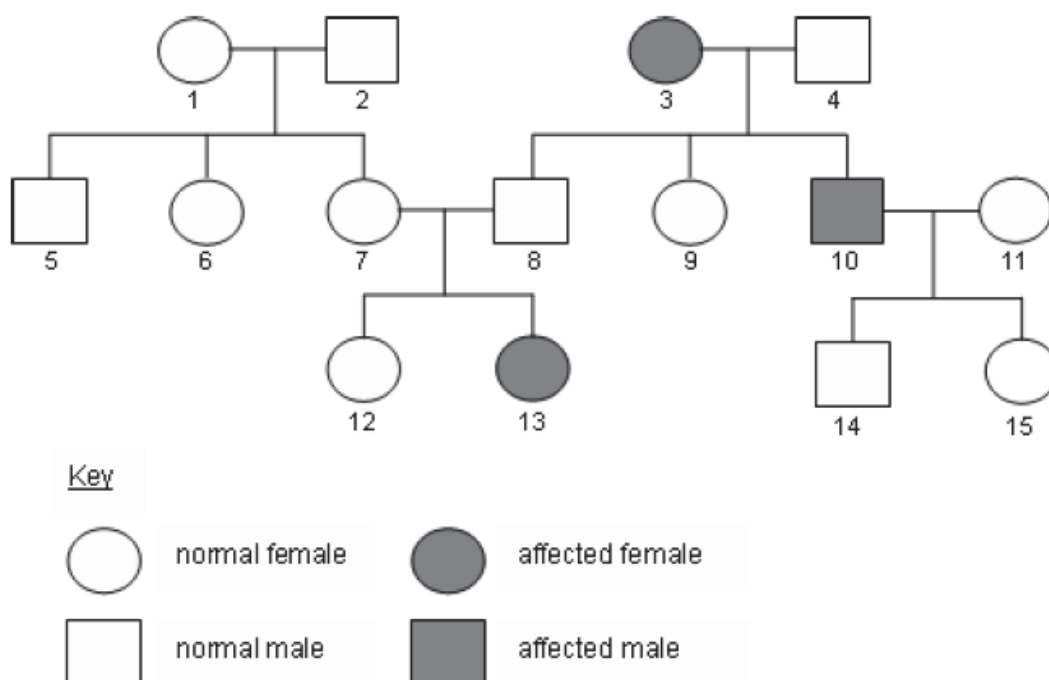


A gene is found at the point labelled P.

In a heterozygous individual, what will be found at the equivalent position labelled Q?

- A** a different allele of a different gene
- B** a different allele of the same gene
- C** a different gene of the same allele
- D** the same gene of the same allele

36 The family tree shows the inheritance of a condition caused by the recessive allele **g**.



What is/are the possible genotypes for individual 11?

- A** Gg
- B** GG
- C** GG and Gg
- D** GG, Gg and gg

37 In a species of plant, the allele for yellow flowers is dominant to the allele for white flowers.

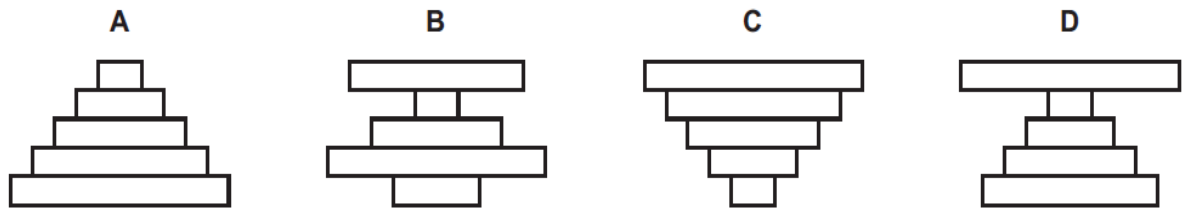
Which offspring is it possible to produce from a cross between two plants heterozygous for flower colour?

- A** heterozygous yellow and heterozygous white
- B** heterozygous yellow only
- C** heterozygous yellow, homozygous yellow and homozygous white
- D** homozygous yellow only

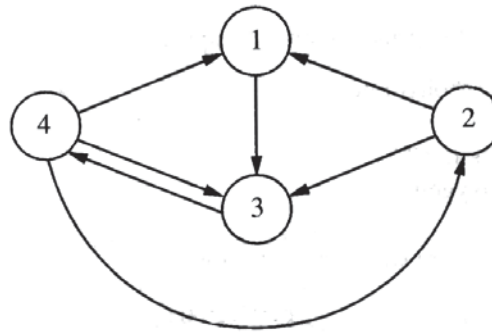
38 A food chain is shown.

wheat → insects → small birds → owls → lice

What is the pyramid of numbers for this food chain?



39 In the diagram below, arrows represent the movement of carbon compounds in the carbon cycle. The circles represent carbon compounds in animals, decomposers, plants and the atmosphere.



Which of the following options correctly identifies the four circles?

	1	2	3	4
A	atmosphere	plants	decomposers	animals
B	animals	atmosphere	Plants	decomposers
C	decomposers	animals	atmosphere	plants
D	plants	decomposers	animals	atmosphere

40 Which change would lead to an increase in biodiversity in an area?

- A building a large number of blocks of family dwellings in a city
- B increasing the number of cows in a pedigree herd
- C replacing a forest with a large palm oil plantation
- D stopping fishing in an area of sea for several years

----- End of Paper -----

Name

Reg. No

Class



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4EX

BIOLOGY**6093/02**

Paper 2 Theory [80 Marks]

PRELIMINARY EXAMINATION

September 2019

1 hour 45 minutes

Additional Materials:

Approved calculator

Instruction to Candidates

Do not start reading the questions until you are told to do so.

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

Write in dark blue or black pen.

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

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

Section AAnswer **all** questions.

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

Section BAnswer **all** questions. The last question is in the form of either/or.

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		Marks
Paper 1 (MCQ)		/ 40
Paper 2		
A		/ 50
B	6	/ 10
	7	/ 10
	8	/ 10
Total		/ 120

This question paper consists of **18** printed pages.

Setter: Mr Timothy Ng

Vetter: Mrs Marie Huang

[Turn Over

Section A

Answer **all** questions in this section.
Write your answers in the spaces provided.

- 1 **Fig. 1** shows the leaves of the same plant during a drought. **Fig. 1.1a** shows the plant before it was watered and **Fig. 1.1b** shows the plant after it was watered daily for one week.

before watering



Fig. 1.1a

after watering

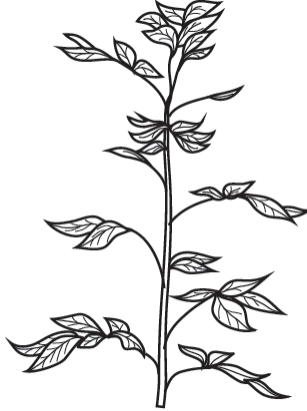


Fig. 1.1b

- (a) (i) Define the term *transpiration*.

.....
 [1]

- (ii) Describe and explain two factors that would affect the rate of transpiration of the plant in **Fig. 1.1a** during a drought.

.....

 [4]

- (iii) Suggest how wilting helps the plant to survive during a drought when water is in short supply.

.....

 [2]

- (b) Name one process that takes place in **Fig. 1.1b** only during the day.

..... [1]

- (c) **Fig. 1.2** shows the uptake and loss of oxygen by a leaf during a 24-hour period.

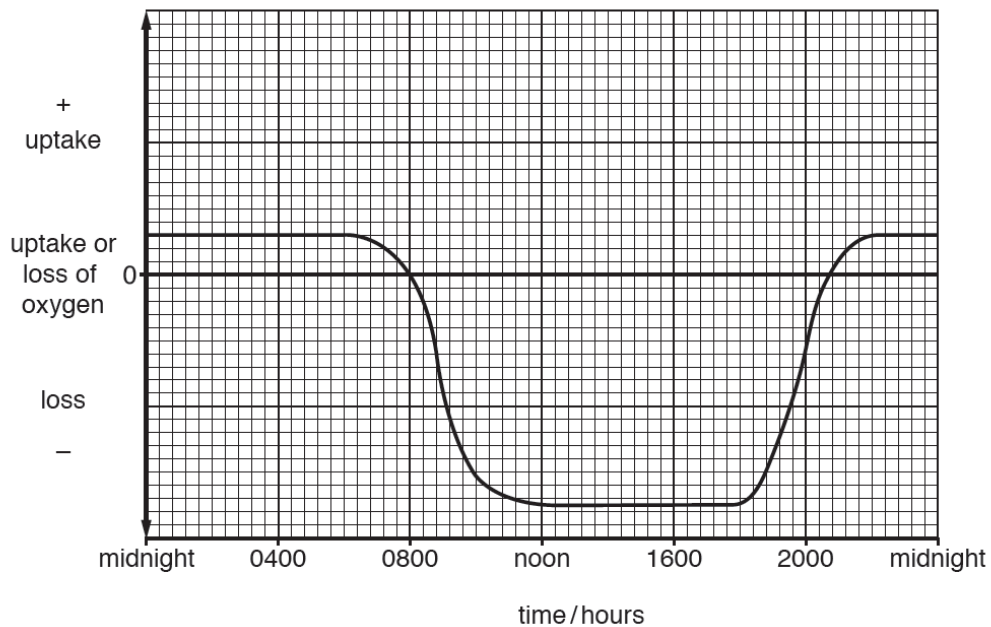


Fig. 1.2

Explain the processes taking place in the leaf between 1800 hours and 2000 hours.

.....

 [2]

[Total marks = 10]

- 2 **Fig. 2.1** below shows the changes in oxygen uptake and pH of the muscles of an athlete during a race.

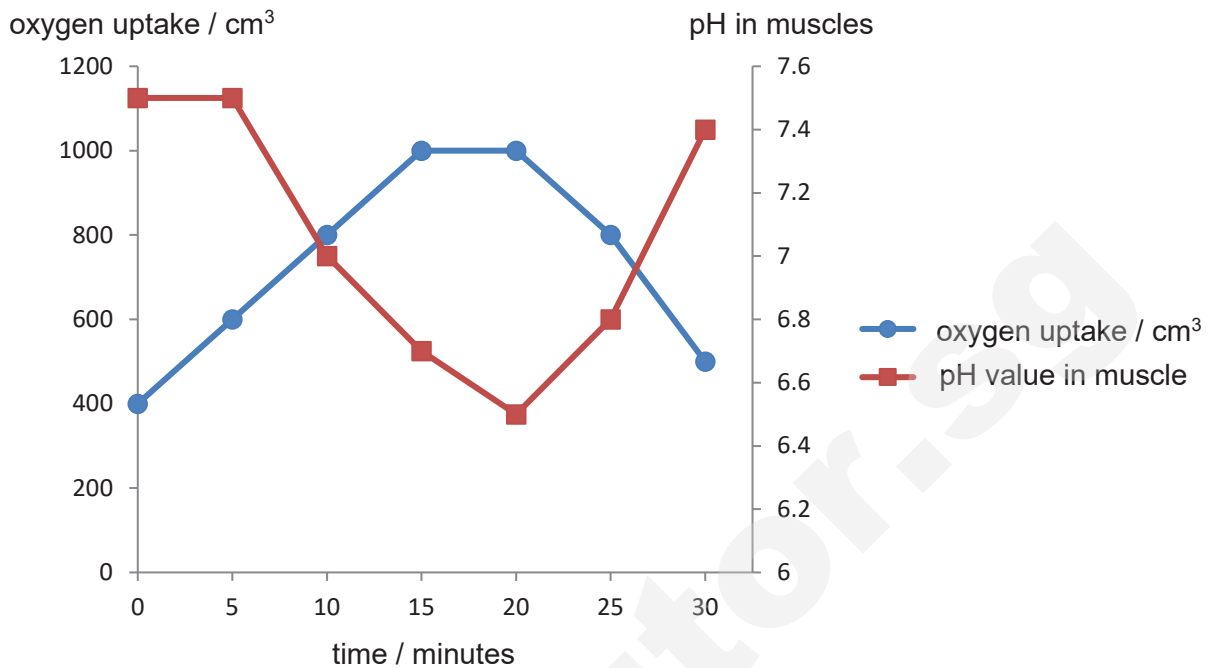


Fig. 2.1

(a) With reference to **Fig. 2.1**,

- (i) state the time that the athlete begins to incur an oxygen debt.

.....minutes

[1]

- (ii) deduce the process that caused the changes in pH in his muscles.

..... [1]

- (iii) explain how the oxygen debt results in the changes in pH in his muscles.

.....

.....

.....

.....

.....

..... [3]

- (b) The increase in oxygen demand by the athlete was due to an increase in aerobic respiration in his muscles.

State the word equation for aerobic respiration.

..... [1]

- (c) Fig. 2.2 shows a section of an alveolus.



Fig. 2.2

- (i) With reference to Fig. 2.2, describe **two** ways that the structure of the alveoli is adapted to its function in gaseous exchange.

.....

 [2]

- (ii) Describe the possible harmful effects of smoking cigarettes on the alveoli.

.....

 [2]

[Total marks = 10]

[Turn Over]

- 3 Fig. 3.1** below shows a cross section of the heart from a person suffering from a heart defect known as “hole in the heart”.

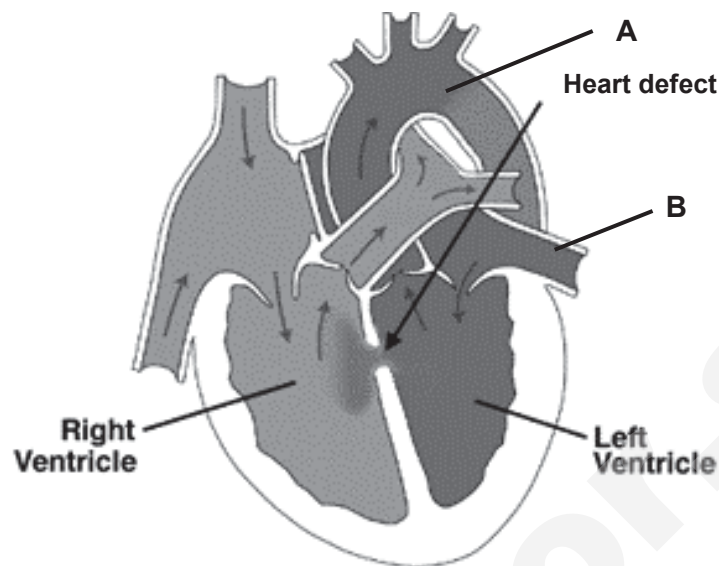


Fig. 3.1

- (a) (i)** Identify the blood vessels labelled **A** and **B** in **Fig. 3.1**.

A:

B:

[2]

- (ii) Describe how the heart works to generate a heartbeat.

Printed on 10/10/2019 10:10:10 AM. Page 4 of 4.

- (iii) Predict how the heart defect will affect the lifestyle of this person.

..... [2]

- (b) **Fig. 3.2** shows pressure changes in the left side of the heart and aorta over time. The total length of a cardiac cycle is 0.8 seconds. Points 1, 2, 3 and 4 indicate when the atrio-ventricular valves and semilunar valves are either open or close.

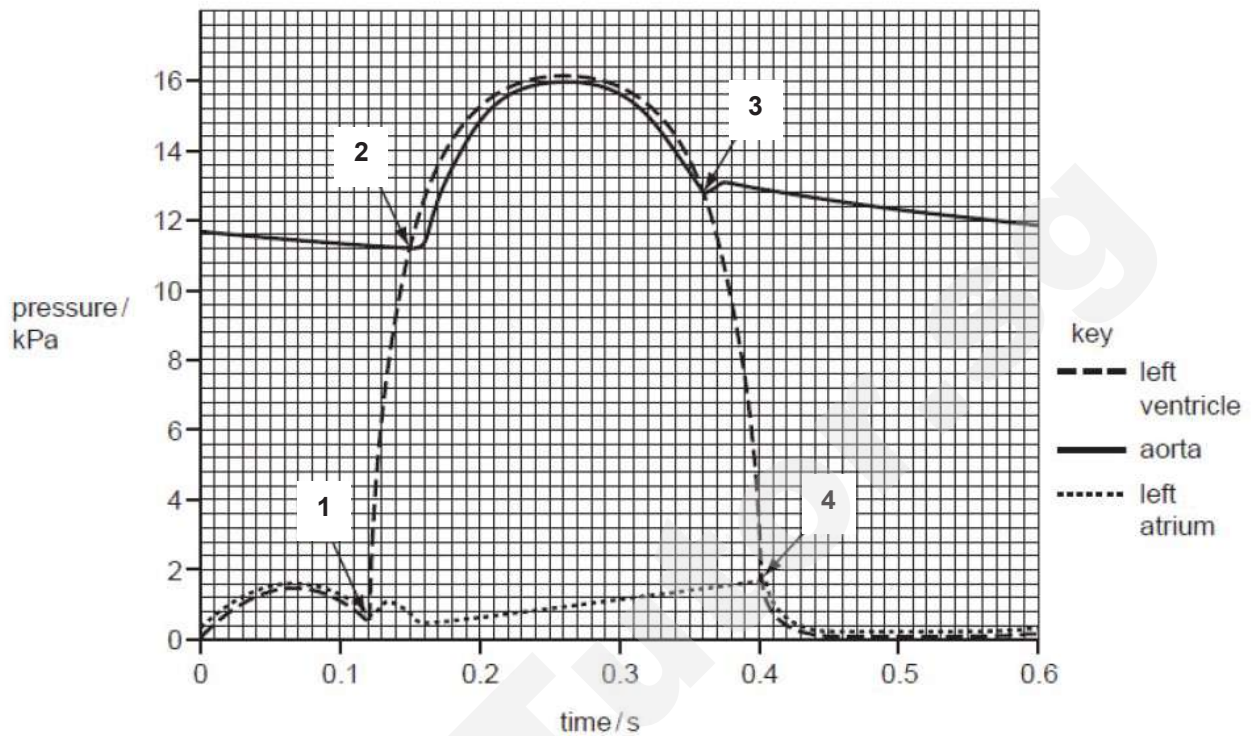


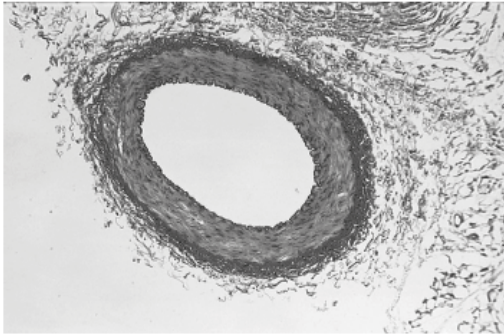
Fig. 3.2

- (i) **Circle** on **Fig. 3.2**, the area(s) of the graph where the atrio-ventricular valves and the semi-lunar valves are both closed at the same time during the cardiac cycle shown. [1]
- (ii) Calculate how many times the heart described in **Fig 3.2** will beat in **one** minute.

Number of heart beats per minute = [1]

- (c) **Fig. 3.3** shows the transverse section of two types of blood vessels found in the human circulatory system.

X



Y

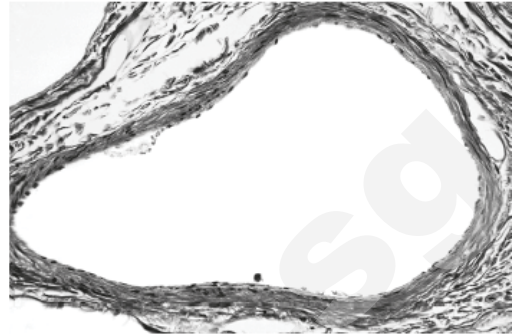


Fig. 3.3

- (i) Identify blood vessel **Y**.

..... [1]

- (ii) Describe the differences in the structures **X** and **Y** as shown in **Fig. 3.3**.

.....
 [1]

[Total marks = 12]

4 Fig. 4 shows the model of how a kidney nephron function.

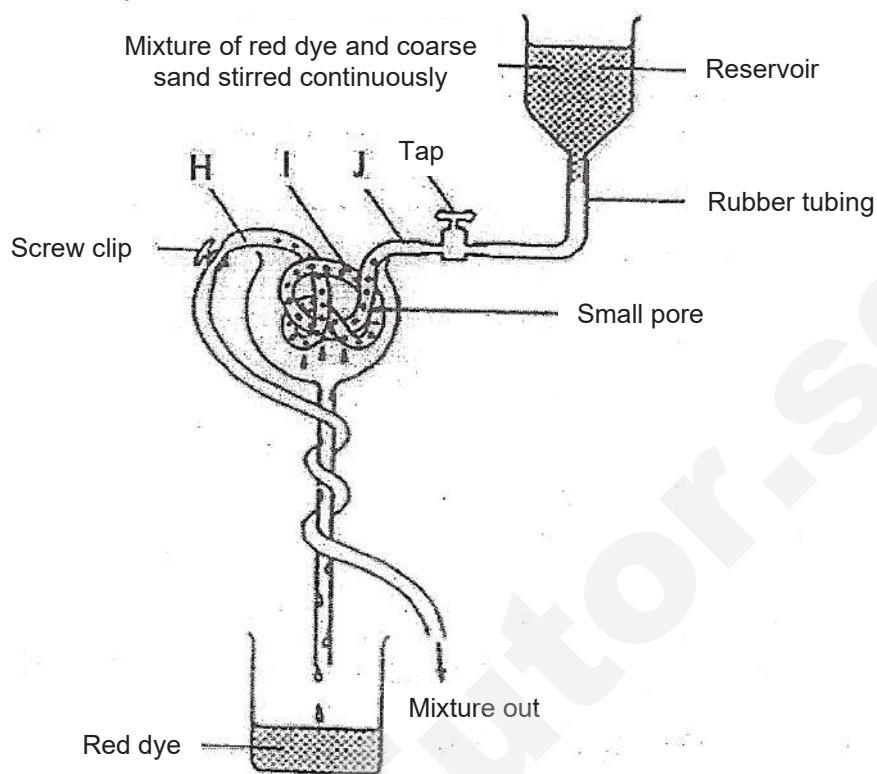


Fig. 4

(a) Identify the labelled structures H, I and J.

H:

I:

J:

[2]

(b) Name one cell type or organic compound in the mammalian body that is represented by the coarse sand in the mixture.

..... [1]

(c) Part I is involved in two key processes in the excretion of urea from the body.

(i) Define the term *excretion*.

.....

..... [1]

(ii) State the key process that part I is involved in during excretion.

..... [1]

[Turn Over]

- (d) The reabsorption of water in the kidneys is controlled by a hormone produced by an endocrine gland.

Name this hormone and state its role in the kidneys during excretion.

.....

.....

..... [2]

- (e) Describe two differences between the nervous system and the hormonal system.

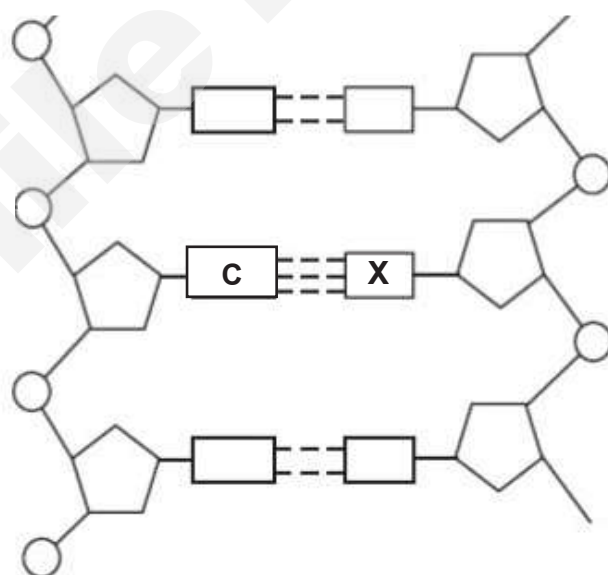
.....

.....

..... [2]

[Total marks = 9]

- 5 (a) Fig. 5.1 below shows a section of DNA.



Key:
C = Cytosine

Fig. 5.1

- (i) On Fig. 5.1, circle one nucleotide. [1]
- (ii) Identify base X.

..... [1]

(iii) Outline the relationship between DNA, genes and chromosomes.

.....

.....

.....

..... [2]

(f) A person with diabetes may be treated with insulin produced by genetically modified bacteria.

Outline how such genetically modified bacteria may be produced and used to manufacture human insulin on a commercial scale.

.....

.....

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.....

.....

..... [5]

[Total marks = 9]

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

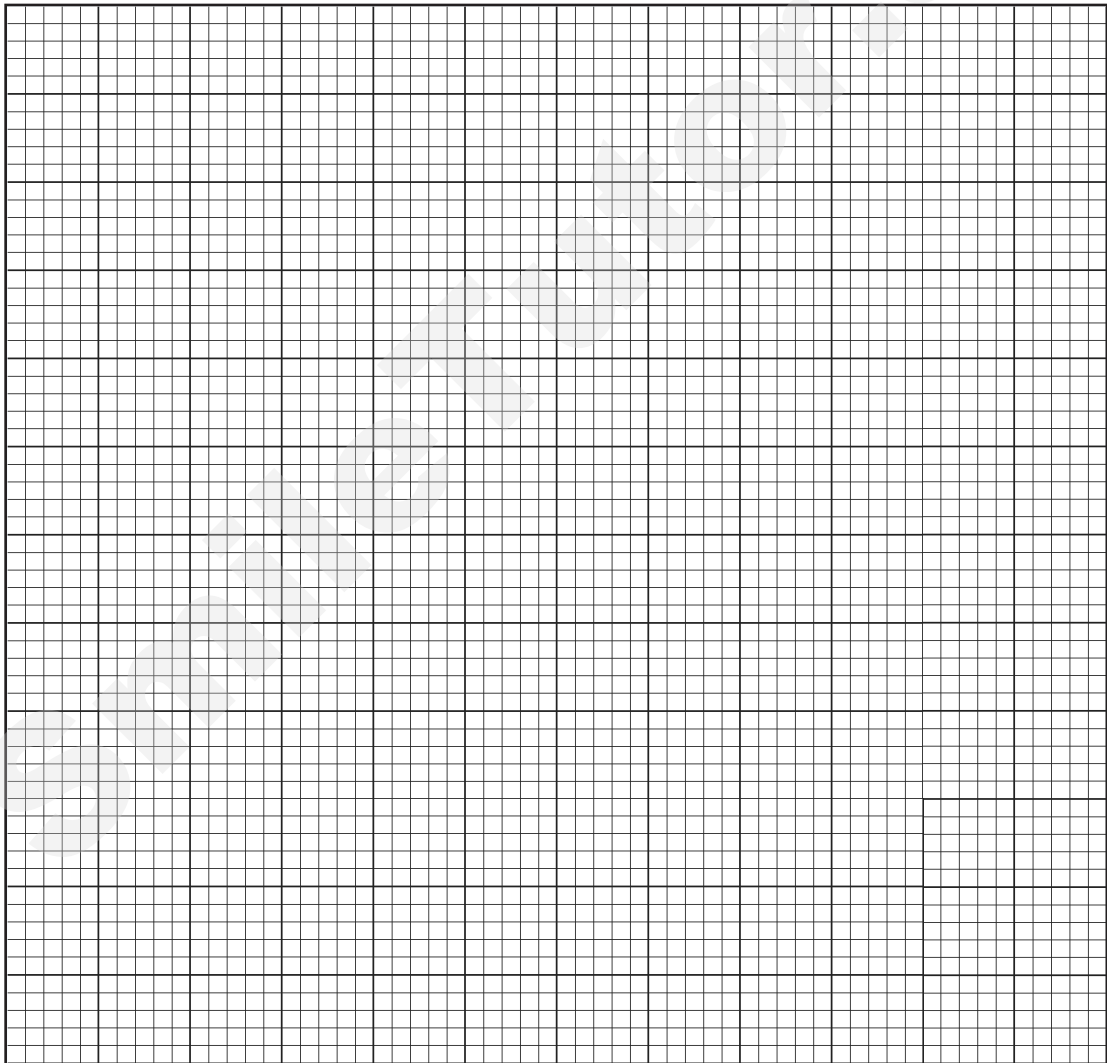
[Turn Over]

Section BAnswer **three** questions.Question **8** is in the form of an **Either / Or** question. Only one part should be answered.

- 6** The table below shows the distribution in blood group among a population of 1000 people living in a small town in Alaska.

Blood Group	Number of people
A	410
AB	30
B	90
O	470

- (a)** With reference to the data above, draw a histogram to represent the data. [3]



(b) Identify and explain the type of variation that is shown by the blood group.

.....

 [2]

(c) Blood group of individuals are inherited from their family members. **Fig. 5.1** shows a family tree.

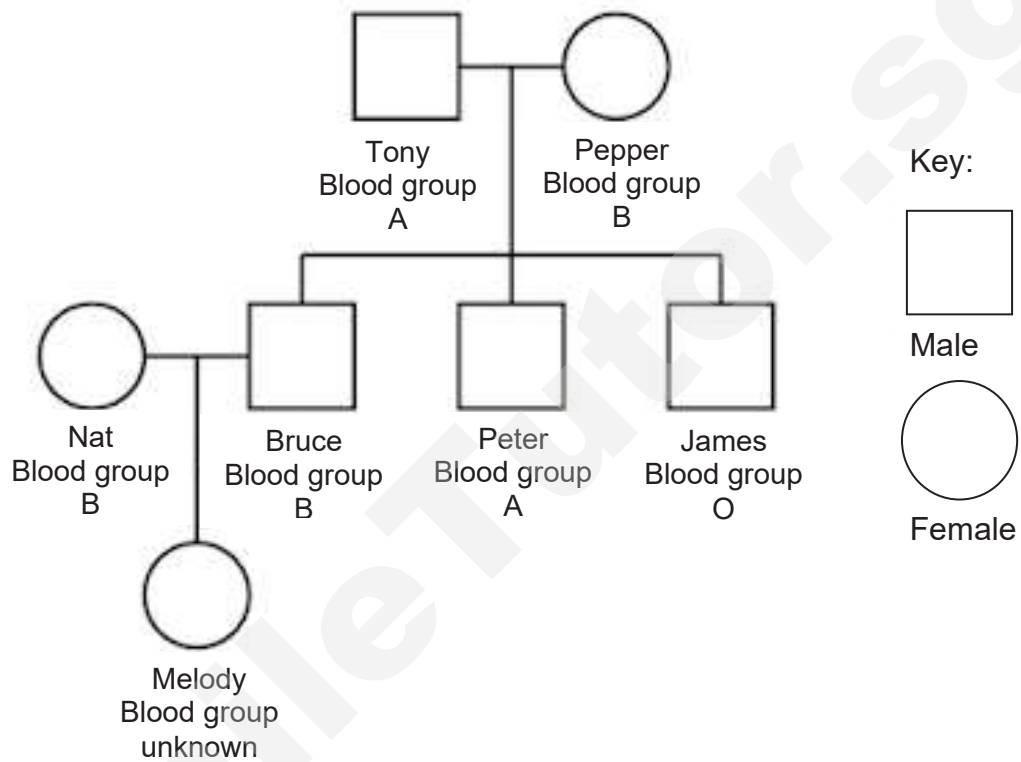


Fig. 5.1

(i) Using a genetic diagram, determine the probability that Tony and Pepper can have a child with blood group AB.

Probability = [4]

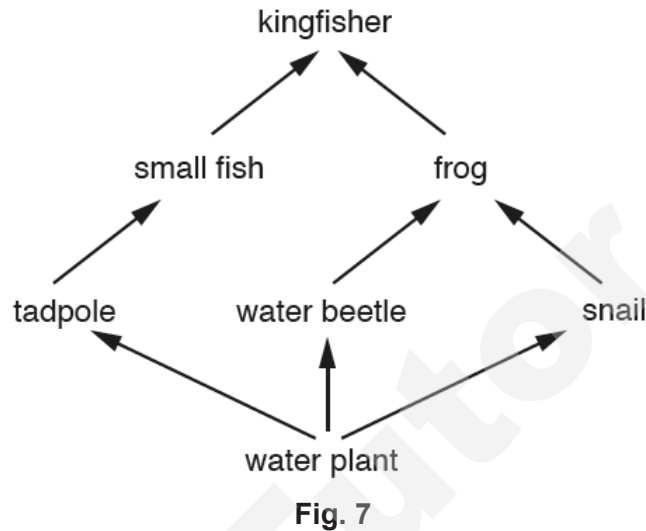
[Turn Over

(ii) Deduce using **Fig. 5.1** the possible blood group(s) that Melody could have.

..... [1]

[Total marks = 10]

7 The diagram below shows a food web of a community of organisms.



(a) Referring to the food web in **Fig. 7**,

(i) Draw a pyramid of biomass for a food chain that consists of at least **four** trophic levels.

[2]

(ii) complete the table by writing the correct number of organisms for each statement about the food web. The first number has been written for you.

statement	number
the number of producers	1
the number of consumers	
the number of food chains	

[1]

- (b) The oceans and forests help in the cycling of carbon in our ecosystem. Define the term carbon sink and describe the importance of the oceans as a carbon sink.

.....

.....

.....

.....

.....

..... [3]

- (c) Scientists observing the kingfishers did a blood test on them and discovered high levels of the pesticide, DDT accumulating in their bodies. They noticed that the kingfishers frequently preyed along the rivers near a farming community.

Explain how the excessive use of DDT by the farmers affects the survival of the kingfishers.

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

[Total marks = 10]

8 Either

- (a) Distinguish between asexual reproduction and sexual reproduction in flowering plants.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

- (b) Fig. 8.1 below shows the flower of a plant.



Fig. 8.1

Describe and explain two adaptations observed in **Fig. 8.1** that facilitate pollination of this flower.

.....

.....

.....

..... [2]

- (c) Describe the processes that takes place in a flower from **Fig. 8** after it is successfully pollinated.

[4]

[Total marks = 10]

8 Or

- (a) Describe the levels of hormone oestrogen and progesterone and its effect in the menstrual cycle.

..... [5]

[Turn Over

(b) Fig. 8.2 shows a section of a mother's uterus.

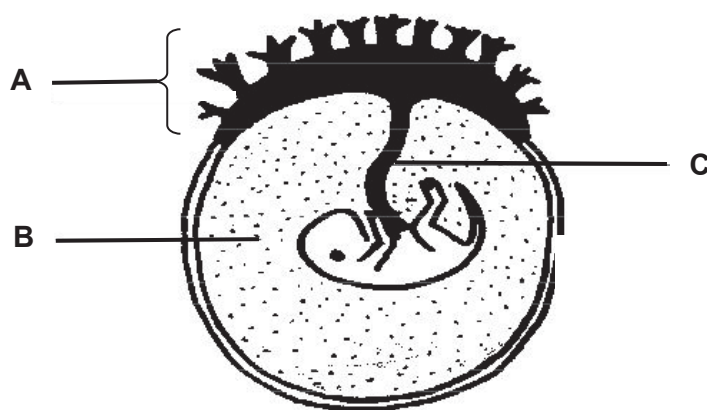


Fig. 8.2

With reference to structures **A**, **B** and **C**, describe how they help to support the growth and development of the foetus during pregnancy.

SmileTutor

[5]

[5]

[Total marks = 10]

- - - - - End of Section B - - - - -
- - - - - End of Paper - - - - -

Answer Key (Prelim 2019 – 6093/01)

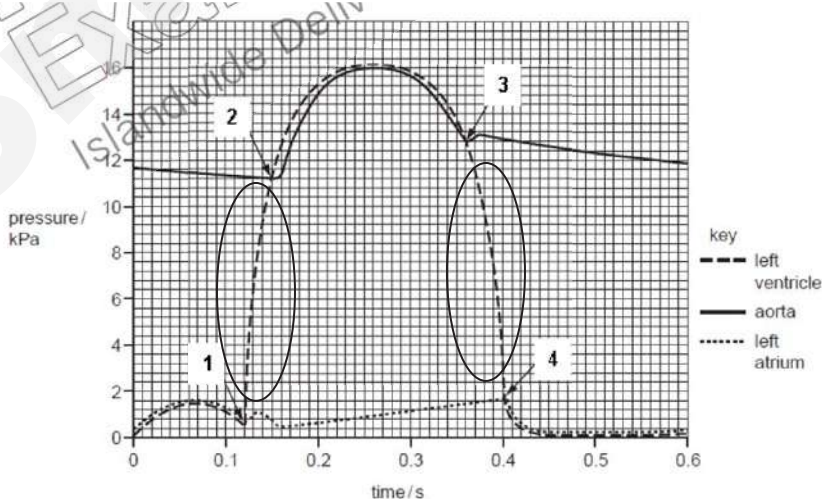
Paper 1: 40 MCQs [40 marks]

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

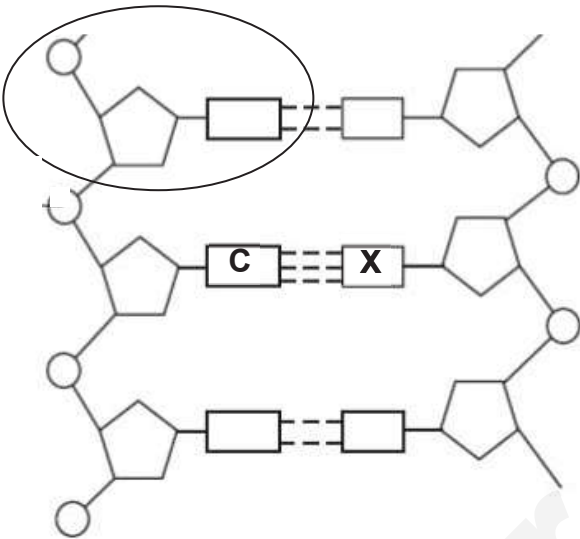
Answer Key (Prelim 2019 – 6093/02)

Paper 2 Section A: Answer all questions [50 marks]

1	(a)(i)	Transpiration is the loss of <u>water vapour</u> from the aerial parts of the plants through the <u>stomata of the leaves</u> .	[1m]
	(a)(ii)	<ul style="list-style-type: none">• Temperature As the temperature during the drought is very high, there will be an increase in the rate of evaporation of water from the surfaces of the leaf. This increases the rate of transpiration.• Humidity As the humidity is very low, the water vapour concentration gradient between the surrounding air and the intercellular air space (in the leaf) is very high. Water vapour diffuses out of the leaf increasing the rate of transpiration. <p>(light intensity and wind speed not accepted)</p>	[2m] [2m]
	(a)(iii)	<ul style="list-style-type: none">• Wilting will cause the leaves to droop/fold up, reducing the surface area exposed to sunlight.• Stomata size reduced• This helps the plant to reduce transpiration as the guard cells turn flaccid.	[2m]
	(b)	Photosynthesis	[1m]
	(c)	<ul style="list-style-type: none">• From 1800 to 2000 hours, the uptake of oxygen is increasing as the rate of respiration in the plant is now higher• than the rate of photosynthesis as the light intensity of the surrounding decreases to zero at night.	[2m] Total: 10
2	(a)(i)	5 minutes	[1m]
	(a)(ii)	Anaerobic respiration	[1m]
	(a)(iii)	<ul style="list-style-type: none">• Aerobic respiration is not able to meet the energy demands of the athlete. Muscles will respire aerobically and anaerobically to get more energy creating an <u>oxygen debt</u>.• Anaerobic respiration releases a <u>lactic acid</u> as a by-product.• The lactic acid produced caused the pH to decrease from <u>7.6 to 6.2</u> from 5 min to 20 min.	[3m]
	(b)	glucose + oxygen → carbon dioxide + water + <u>large amounts of energy</u>	[1m]
	(c)(i)	<ul style="list-style-type: none">• The oxygen enters the alveoli where it dissolves into the <u>thin film of moisture</u> lining the inner walls of the alveoli increasing the speed of diffusion.• The walls of the alveoli are <u>one-cell thick</u> which allows for rapid diffusion of dissolved oxygen into the red blood cells.	[2m]

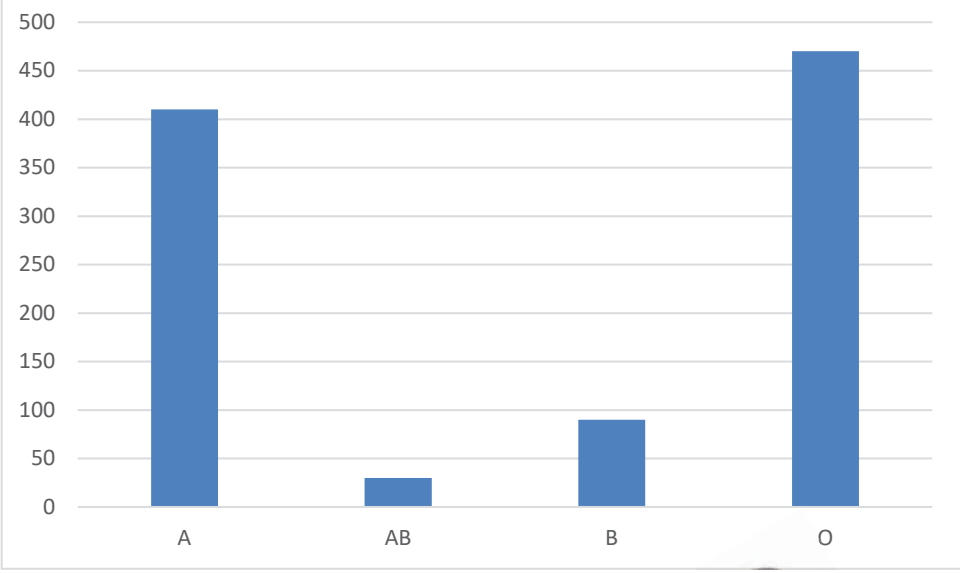
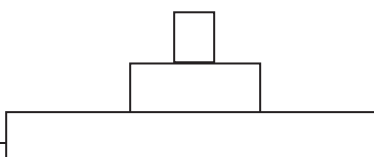
	(c)(ii)	<ul style="list-style-type: none"> • <u>Tar will paralyse the cilia</u> causing a build-up of mucus which may result in bronchitis / frequent coughing. • The frequent coughing may cause emphysema where <u>the walls of the alveoli are damaged</u> reducing the surface area for <u>gaseous exchange</u>. 	[2m] Total: 10
3	(a)(i)	A – Aorta B – Pulmonary vein	[2m]
	(a)(ii)	<p>Deoxygenated and oxygenated returns to the right and left atrium from the body and lungs respectively.</p> <ul style="list-style-type: none"> • During atrial systole, the <u>higher pressure in the atriums compared to the ventricles</u> causes the <u>atrio-ventricular valves</u> to open forcing blood into the ventricles. • During ventricular systole, the <u>higher pressure in the ventricles compared to the atrium</u> and arteries causes the <u>semi-lunar valves to open</u> and the <u>atrio-ventricular valves</u> to close creating the “lub” sound. • As the blood is pumped to the <u>lungs and rest of the body</u>, the higher pressure of the <u>aorta and pulmonary artery</u> will cause the <u>semi-lunar valves to close</u> to prevent <u>backflow</u> of blood. This will create the softer “dub” sound. <p>(1m awarded for stating when the “lub” and “dub” sound is produced)</p>	[1m] [1m] [1m] [1m]
	(a)(iii)	<ul style="list-style-type: none"> • The hole in the median septum will cause the <u>oxygenated blood in the left side of the heart</u> to <u>mix</u> with the <u>deoxygenated blood in the right side of the heart</u>. • This will result in <u>less oxygen transported in the blood</u> around the body. Hence, he will be unable to participate in any strenuous activities. 	[2m]
	(b)(i)	 <p>2 correct circles required for full marks</p>	[1m]
	(b)(ii)	$60 / 0.8 = 75$	[1m]
	(c)(i)	Vein	[1m]

	(c)(ii)	Y has thinner <u>less muscular and elastic walls</u> compared to X.	[1m]												
			Total: 12												
4	(a)	H – Efferent arteriole I – Glomerulus J – Afferent arteriole 1m for 1 correct 2m for all correct	[2m]												
	(b)	Red blood cell / Plasma proteins	[1m]												
	(c)(i)	Excretion is the process by which <u>metabolic waste products</u> and <u>toxic waste materials</u> are removed from the body.	[1m]												
	(c)(ii)	Ultrafiltration	[1m]												
	(d)	<ul style="list-style-type: none">• Anti-diuretic hormone.• It controls the <u>permeability</u> of the proximal convoluted tubule and the collecting duct to water for reabsorption.	[2m]												
	(e)	<table border="1"><tr><td>Involve nerve impulses (electrical signals)</td><td>Involve hormones (chemical substances)</td></tr><tr><td>Impulse are transmitted by neurones</td><td>Hormones are transported by the blood</td></tr><tr><td>Quick response</td><td>Slow Response</td></tr><tr><td>Reponses are short-lived</td><td>Reponses may be short-lived or long-lived</td></tr><tr><td>May be voluntary or involuntary</td><td>Always involuntary</td></tr><tr><td>Tend o affect one target organ</td><td>Tend to affect more than one target organ</td></tr></table> Any 2 suitable comparison	Involve nerve impulses (electrical signals)	Involve hormones (chemical substances)	Impulse are transmitted by neurones	Hormones are transported by the blood	Quick response	Slow Response	Reponses are short-lived	Reponses may be short-lived or long-lived	May be voluntary or involuntary	Always involuntary	Tend o affect one target organ	Tend to affect more than one target organ	[2m] Total: 9
Involve nerve impulses (electrical signals)	Involve hormones (chemical substances)														
Impulse are transmitted by neurones	Hormones are transported by the blood														
Quick response	Slow Response														
Reponses are short-lived	Reponses may be short-lived or long-lived														
May be voluntary or involuntary	Always involuntary														
Tend o affect one target organ	Tend to affect more than one target organ														

5	(a)(i)		[1m]
	(a)(ii)	Guanine	[1m]
	(a)(iii)	<ul style="list-style-type: none"> A gene is made up of a specific sequence of nucleotides that code for a particular polypeptide. A chromosome contains many genes / DNA organises into many chromosomes within the nucleus / Each molecule of DNA is a chromosome. 	[2m]
	(b)	<ul style="list-style-type: none"> Use a <u>restriction enzyme</u> to cut out the <u>insulin gene</u> from a human chromosome. Sticky ends will be produced. Using the <u>same restriction enzyme</u>, cut the <u>plasmid</u> from a bacterium to produce complementary <u>sticky ends</u>. Combine the insulin gene with the plasmid using <u>DNA ligase</u> to produce a recombinant plasmid. Use <u>heat or electric shock</u> to insert the recombinant plasmid into <i>E.coli</i> bacteria and culture the bacteria for commercial production of insulin. 	[5m] Total: 9

Paper 2 Section B: Answer all questions [30 marks]

6	(a)(i)	Number of people	[3m]
---	--------	------------------	------

		 <p style="text-align: right;">Blood Group</p> <ul style="list-style-type: none"> - Clean, clear bars drawn/point plotted correctly - Correct axis labels - Appropriate scale 	
	(b)	<ul style="list-style-type: none"> - Discontinuous variation - There are a few clear-cut phenotypes / genes do not show additive effect. 	[2m]
	(a)	B or O	[1m]
	(b)	<p>Allele of blood group A = I^A Allele of blood group B = I^B Allele of blood group O = I^O</p> <p>Parental phenotype – blood group A : blood group B Parental genotype - $I^A I^O$: $I^B I^O$ Gametes - $I^A I^O$: $I^B I^O$ (with circles) Crossing over F1 genotype - $I^A I^B$ / $I^A I^O$ / $I^B I^O$ / $I^O I^O$ F1 phenotype - AB / A / B / O Ratio - 1 : 1 : 1 : 1</p> <p>Probability = 0.25 or 1/4</p>	[1m] [1m] [1m]
	(a)	B or O	[1m]
			Total: 10
7	(a)(i)		[2m]

		<div></div> <p>1m for correct pyramid shape 1m for correct trophic levels with labels</p> <ul style="list-style-type: none">• water plant > tadpole > small fish > kingfisher• water plant > water beetle > frog > kingfisher• water plant > water beetle > snail > kingfisher <p>(any 1)</p>									
	(a)(ii)	<table><tr><th>statement</th><th>number</th></tr><tr><td>the number of producers</td><td>1</td></tr><tr><td>the number of consumers</td><td>6</td></tr><tr><td>the number of food chains</td><td>3</td></tr></table> <p>All correct for 1m</p>	statement	number	the number of producers	1	the number of consumers	6	the number of food chains	3	[1m]
statement	number										
the number of producers	1										
the number of consumers	6										
the number of food chains	3										
	(b)	<ul style="list-style-type: none">• A carbon sink is an area that stores carbon compounds for an indefinite period of time. It stores more carbon than it releases.• Carbon dioxide that dissolves in the oceans are absorbed by phytoplankton during photosynthesis.• Some of the carbon compounds found in oceans is buried under the seabed as fossil fuels.	[3m]								
	(c)	<ul style="list-style-type: none">• Excess DDT used by farmers might have washed into nearby river. DDT is <u>non-biodegradable</u> and not easily <u>excreted</u> by the cells in the body.• The microscopic algae absorb the DDT which accumulates in their bodies.• As we move up the trophic levels, bio-accumulation occurs as DDT concentration increases in the bodies of the animals• Bio-amplification occurs as the concentration of DDT in top-level predators may reach lethal levels.	[4m] Total: 10								
8	Either										
	(a)	<ul style="list-style-type: none">• Asexual reproduction does not involve the fusion of gametes while the fusion of gametes occurs in sexual reproduction.• Only one parent is need in asexual reproduction compared to one or two parents in sexual reproduction.• Offspring are genetically identical in asexual reproduction while they are genetically different in sexual reproduction.• Asexual reproduction is a quicker method of reproduction compared to sexual reproduction.• Asexual reproduction produces a larger number of offspring than sexual reproduction. <p>(any 4)</p>	[4m]								
	(b)	<ul style="list-style-type: none">• Large petals to attract insects to land• Small, compact stigma that do not protrude out of the flower.	[2m]								

		➤ Insects will help transfer pollen grains onto the stigma as they enter the flower to collect nectar.	
	(c)	<ul style="list-style-type: none"> The mature stigma secretes a <u>sugary fluid</u> that stimulates germination of the pollen grain. A pollen tube grows out of the pollen grain transporting the male gametes <u>down the style</u>. The pollen tube secretes <u>enzymes</u> to digest the tissues of the stigma and style as it grows towards the ovule. The pollen tube enters the <u>ovule through the micropyle</u>, releasing the male gametes to fuse with the female gametes for fertilisation. 	[4m] Total: 10
8	Or		
	(a)	<ul style="list-style-type: none"> During the menstrual flow stage (day 1 to day 5), the levels of oestrogen and progesterone are very low. <u>Menstruation</u> occurs. During the <u>follicle stage</u> (day 6 to day 13), the follicle cells begins to produce oestrogen which causes the repair and growth of the uterine lining. During the <u>corpus luteum stage</u> (day 16 to day 28), the corpus luteum will secrete progesterone and some oestrogen. The progesterone maintains and further thickens the uterine lining, building up more blood capillaries. If no fertilisation occurs, the corpus luteum breaks down and the levels of oestrogen and progesterone decreases causing menstruation to occur again. If fertilisation occurs, the corpus luteum will not degenerate and continue to produce both hormones until the placenta is fully developed and takes over. 	[1m] [1m] [1m] [1m] [1m]
	(b)	Placenta (A) <ul style="list-style-type: none"> Separates the maternal blood from the foetal blood to protect it from the <u>high blood pressure</u>. Prevents the <u>mixing of the mother's blood and the foetus's blood</u> as they may <u>agglutinate</u> if the blood groups are not compatible. The maternal blood allows protective <u>antibodies</u> to <u>diffuse</u> from the mother's blood to the foetus's blood <u>protecting</u> it from certain <u>diseases</u>. The placenta produces progesterone which maintains the uterine 	[5m] Total: 10

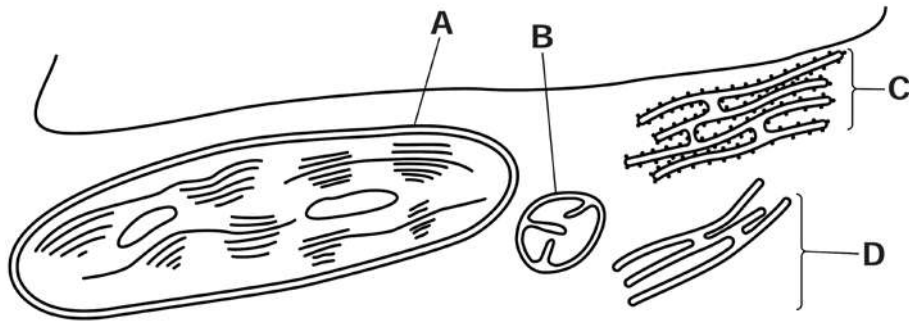
		<p>lining in a healthy state during pregnancy. (any 2)</p> <p>Amniotic Fluid (B)</p> <ul style="list-style-type: none"> • Helps to protect the foetus from physical injury / shock absorber. <p>Umbilical cord (C)</p> <ul style="list-style-type: none"> • Umbilical arteries transport deoxygenated blood and metabolic wastes from the foetus to the placenta. • Umbilical veins transport oxygenated blood and nutrients from the placenta to the foetus. 	
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Multiple Choice Questions [40m]

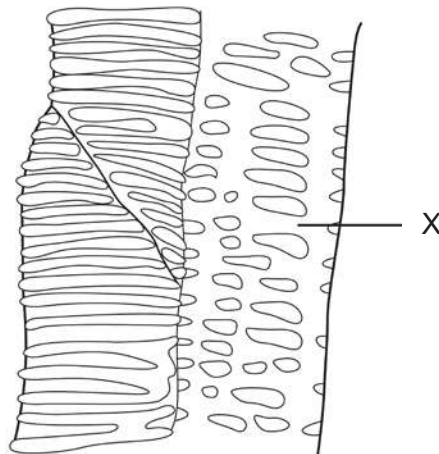
Shade your answers in the OTAS answer sheet provided

- 1 The diagram shows a drawing made from an electron micrograph of a leaf cell.

Which organelle carries out detoxification?



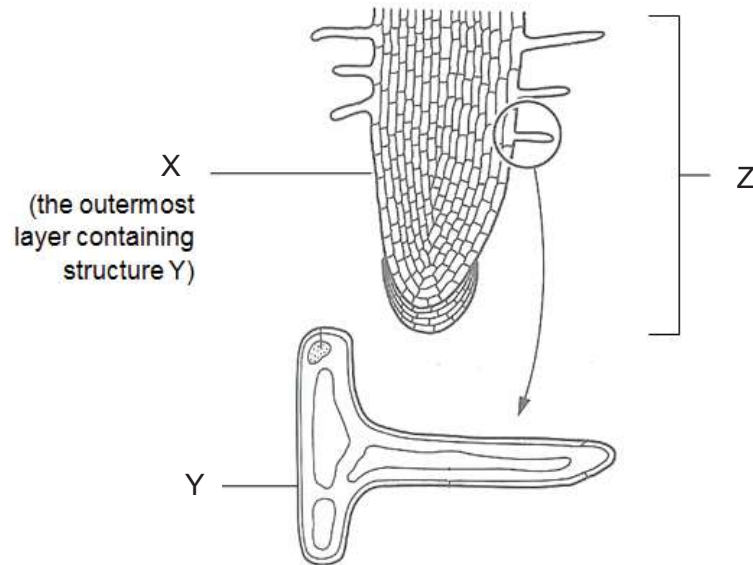
- 2 The diagram shows part of a xylem vessel.



What is the function of structure X?

- A absorption
- B photosynthesis
- C support
- D transport

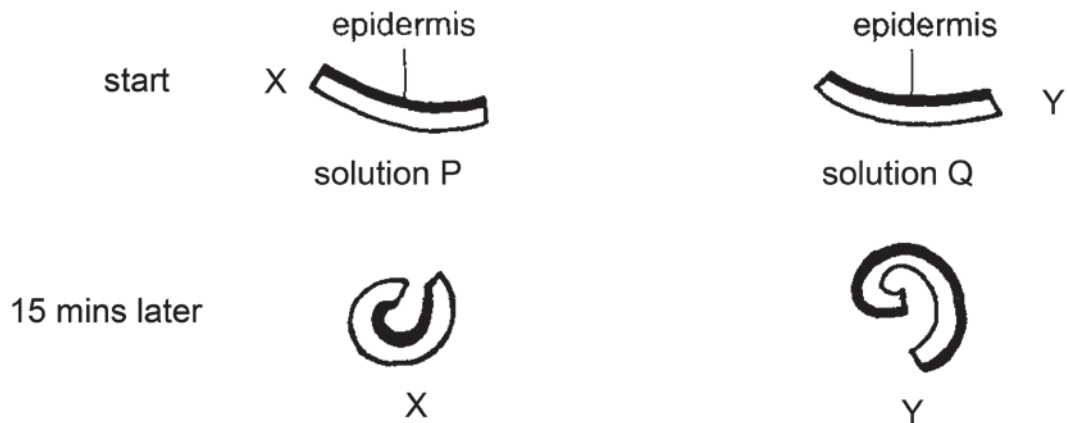
- 3 The diagram shows the structure of the root of a plant.



Which row is correct?

	X	Y	Z
A	cell	tissue	organ
B	epidermis	root hair cell	root
C	root hair	root cell	root tip
D	tissue	cell	system

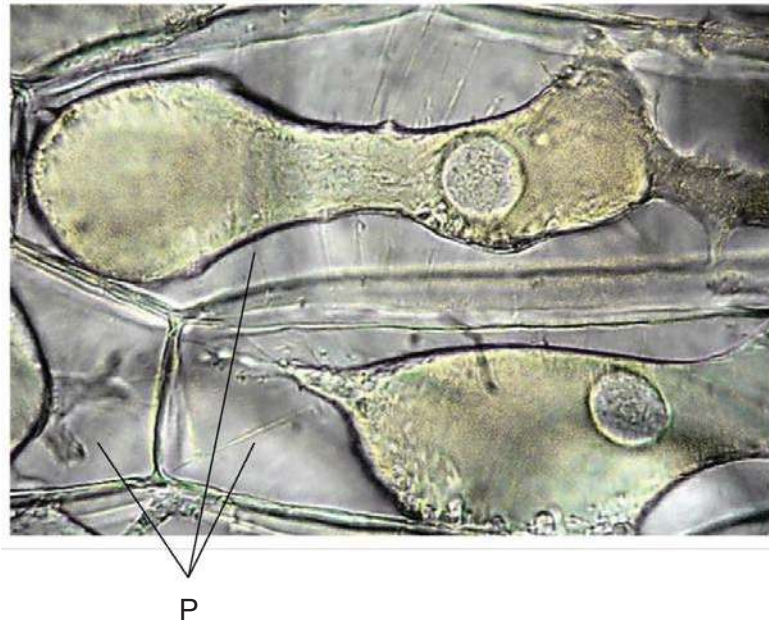
- 4 A 3 cm long balsam stem was cut into four longitudinal strips. Two of the strips, X and Y, were placed in solutions P and Q respectively. The diagram shows the appearance of X and Y at the start of the experiment and 15 minutes later.



Which of the following could be possible identities of solution P and Q?

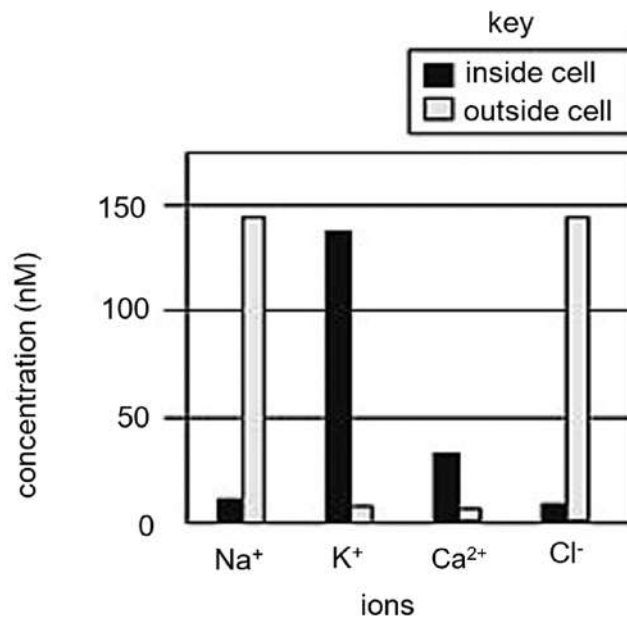
	P	Q
A	10% sucrose solution	25% sucrose solution
B	25% sucrose solution	water
C	25% sucrose solution	10% sucrose solution
D	water	25% sucrose solution

- 5 A fleshy section of an onion bulb was taken and placed in a liquid. The diagram below shows the cells from the onion bulb after half an hour.



- Which of the following is most likely to be in the regions labelled P?
- A concentrated sugar solution
 - B dilute sugar solution
 - C distilled water
 - D oil
- 6 Which of the following statements is the reason why most organisms cannot live in salt solutions more concentrated than sea water?
- A The high salt concentration increases the density of the water so the organisms float on the surface.
 - B The high salt concentration increases the rate by which they enter the cell through active transport.
 - C Water molecules from tissues of organisms are removed too rapidly.
 - D Water molecules will enter the tissues and the organisms will burst.

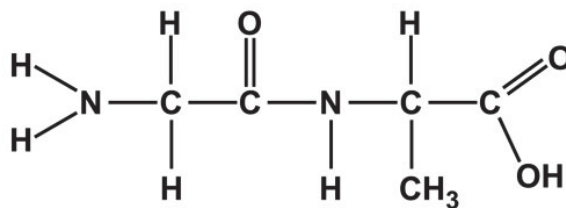
- 7 The bar graph shows the concentration of various ions on the inside and outside of an animal cell.



Which of the following ions would be taken up by the following methods into the cell?

	diffusion	active transport
A	Cl ⁻ , Ca ²⁺	Na ⁺ , K ⁺
B	K ⁺ , Ca ²⁺	Na ⁺ , Cl ⁻
C	Na ⁺ , Cl ⁻	K ⁺ , Ca ²⁺
D	Na ⁺ , K ⁺	Cl ⁻ , Ca ²⁺

- 8 The diagram shows the structure of a molecule.



Which one of the following tests would give a positive result?

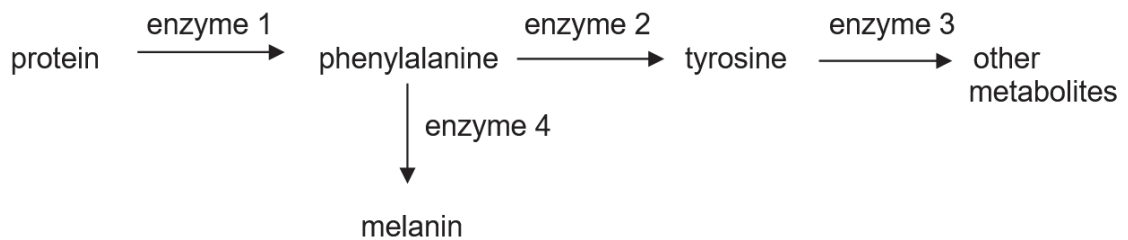
- A** adding biuret solution
- B** adding iodine in potassium iodide solution
- C** heating with Benedict's solution
- D** shaking with ethanol then pouring into water

9 Which of the following is not a function of water in our body?

- A** A medium for chemical reactions to take place.
- B** Helps to control body temperature.
- C** Helps to transport hormones.
- D** To provide energy for cell activities.

10 Phenylketonuria is an inherited disease. Individuals with the disease have high levels of the amino acid phenylalanine in the blood. They also have pale skin due to lack of melanin.

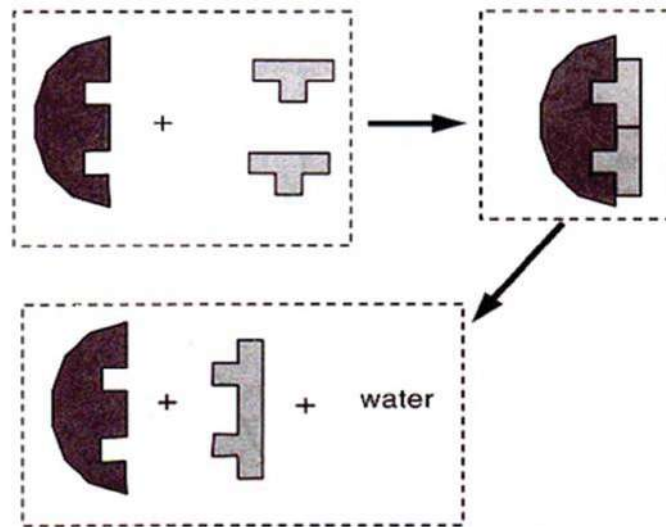
The diagram shows a series of reactions that occurs in individuals who are not affected phenylketonuria.



Which enzyme(s) is/are lacking in individuals affected by phenylketonuria?

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

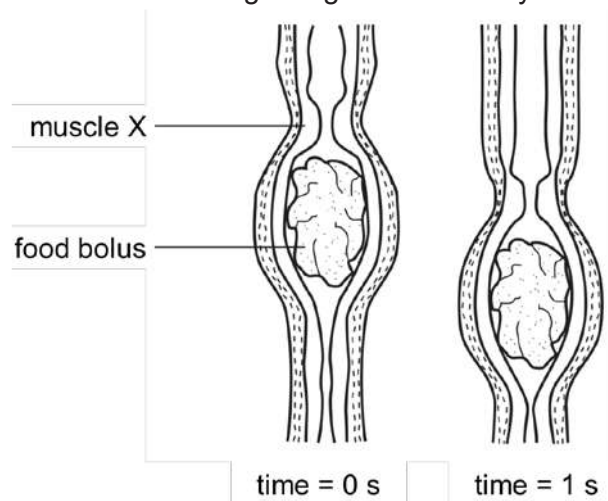
11 The following diagram represents an enzymatic reaction.



Which of the following reactions can be represented by the above diagram?

- A synthesis of fat from fatty acids and glycerol
- B synthesis of maltose from glucose
- C synthesis of polypeptide from different amino acids
- D synthesis of starch from glucose

12 The diagram shows some food moving along the alimentary canal.


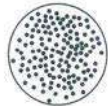


Which row identifies muscle X and its action, and the component in the food bolus that will most likely stimulate the movement shown?

	muscle X	muscle action	component in food bolus that stimulates movement
A	circular muscle	contracting	fibre (roughage)
B	circular muscle	relaxing	fibre (roughage)
C	longitudinal muscle	contracting	protein
D	longitudinal muscle	relaxing	protein

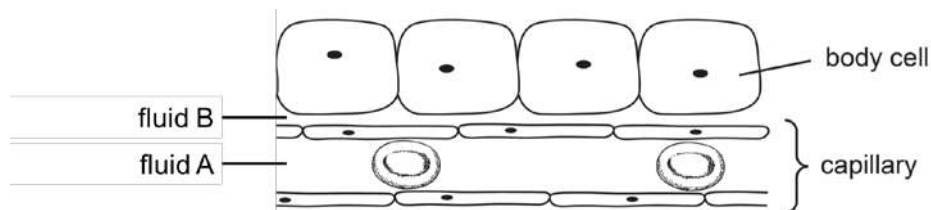
- 13** A sample of blood was taken from a patient. Two drops of blood were placed on a white tile and tested with serum containing 'antibodies a' and 'antibodies b' respectively.

The results of the test are shown.

	serum with antibodies a	serum with antibodies b
blood samples	 <p>clumping</p>	 <p>no clumping</p>

What conclusion can be made regarding the characteristics of the patient's blood type?

- A** The patient can donate blood to another person with blood type B
 - B** The patient's blood type is AB.
 - C** The patient's red blood cells contain antigen A.
 - D** The patient's red blood cells do not contain any antigens.
- 14** The diagram shows some body cells and a nearby capillary.

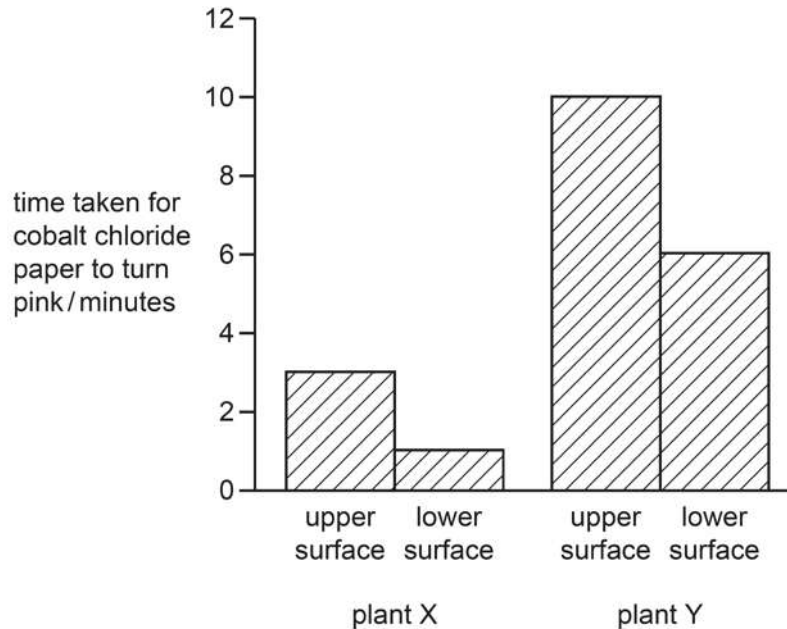


Which row is not a possible difference between fluid A and fluid B?

	fluid A	fluid B
A	less dissolved glucose	more dissolved glucose
B	more red blood cells	fewer red blood cells
C	more white blood cells	fewer white blood cells
D	some dissolved glucose	no dissolved glucose

- 15** Cobalt chloride paper is blue when dry but turns pink when wet. Some blue cobalt chloride paper was fastened to the upper and lower surfaces of a leaf on a plant X and a leaf on plant Y.

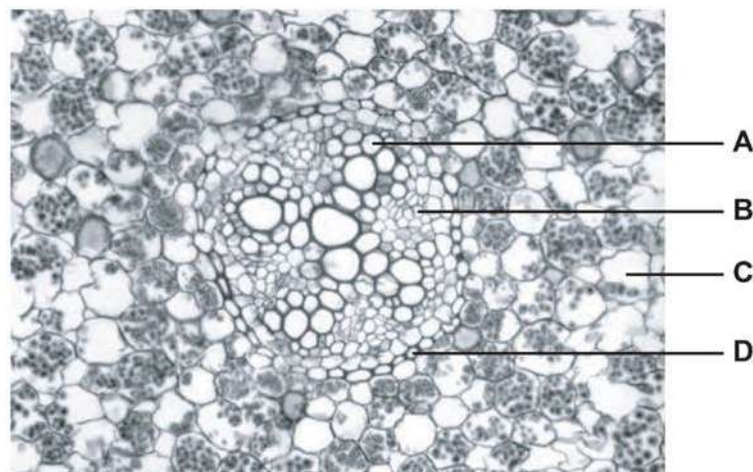
The diagram shows the results of the experiment.



Which conclusion is correct?

- A** It was an unreliable experiment as it was difficult to ascertain the colour change in cobalt chloride paper.
 - B** There are more stomata on the upper side than underside of the leaf.
 - C** There is an error in the experiment as the cobalt chloride paper on the underside of the leaf should turn pink faster.
 - D** Translocation occurred on both sides of the leaf.
- 16** The photomicrograph shows part of a section of a plant.

In which tissue are nitrates transported?



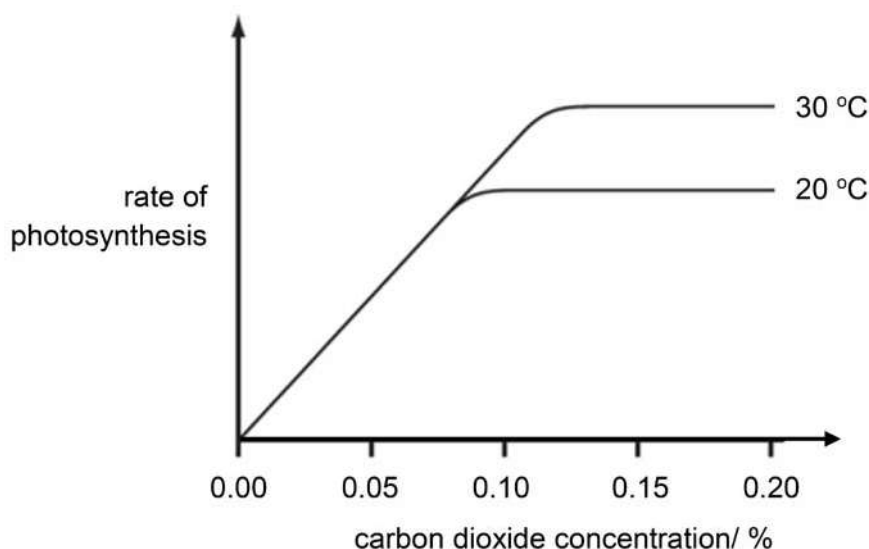
17 The table shows the rate of water flow through a tree over a 12-hour period.

time of day	rate of flow / cm per hour
7:00	100
9:00	120
11:00	140
13:00	250
15:00	300
17:00	260
19:00	180

What conclusion can be drawn from the table?

- A Between 7:00 and 17:00 hours, the rate of flow continuously increases.
- B The greatest increase in rate of flow is between 11:00 and 13:00 hours.
- C Water does not flow up through a tree in the evening.
- D Water flow is affected by humidity between 15:00 and 17:00 hours.

18 The graph shows the rate of photosynthesis in a plant in full sunlight at two different temperatures and different concentrations of carbon dioxide.



Which conclusion can be drawn from the graph?

- A At atmospheric carbon dioxide concentration, carbon dioxide concentration has no effect on photosynthesis.
- B At high carbon dioxide concentration, temperature limits the rate of photosynthesis.
- C Carbon dioxide concentration limits the rate of photosynthesis.
- D When temperature is low, the plant cannot photosynthesise.

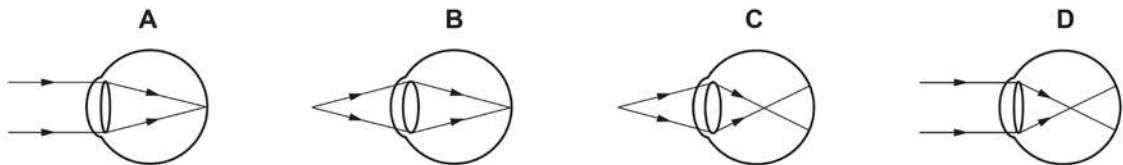
19 Which substance has the same concentration in dialysis fluid as in blood?

- A creatinine
- B glucose
- C protein
- D urea

20 What happens when the core temperature of the body increases?

	diameter of blood vessels in the skin	sweat production
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

21 Which diagram shows how light from a near object is focused on the retina to form a clear image?



22 The table shows the results of a blood and urine test of four different individuals.

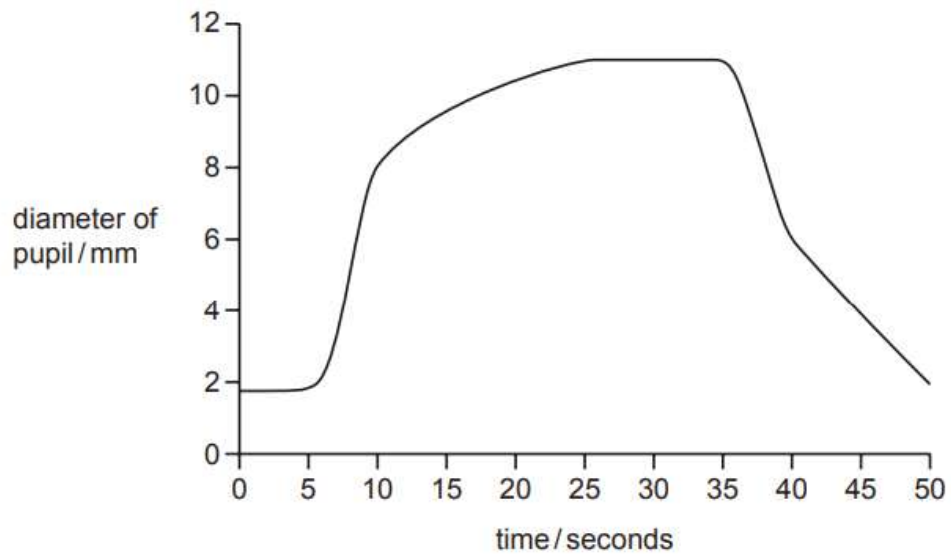
individual	concentration of glucose	
	blood	urine
1	+	+
2	+	-
3	-	+
4	-	-

key
 + = increased
 - = decreased

Which individual(s) may have diabetes?

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

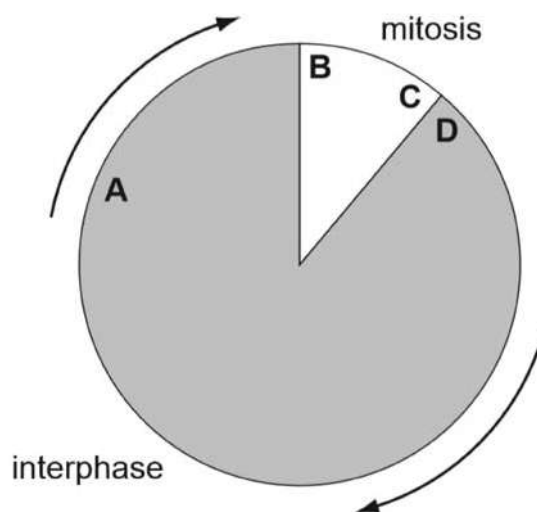
- 23** The graph shows the changes in the diameter of the pupil of the eye as the light intensity of the surroundings is changed.



Between which times is the light intensity decreasing?

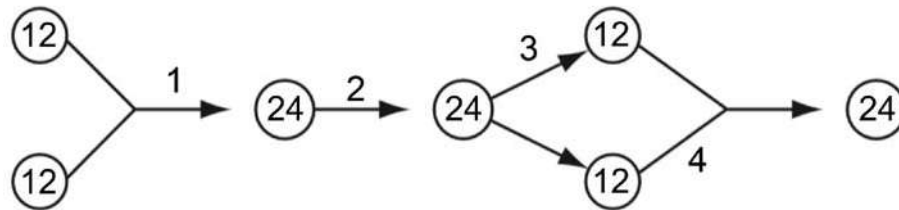
- A** 5 to 10 seconds
 - B** 25 to 35 seconds
 - C** 35 to 40 seconds
 - D** 40 to 50 seconds
- 24** The diagram shows the mitotic cell cycle.

When radioactive nucleotides are supplied to dividing cells, at which point will they be incorporated into the chromosomes?



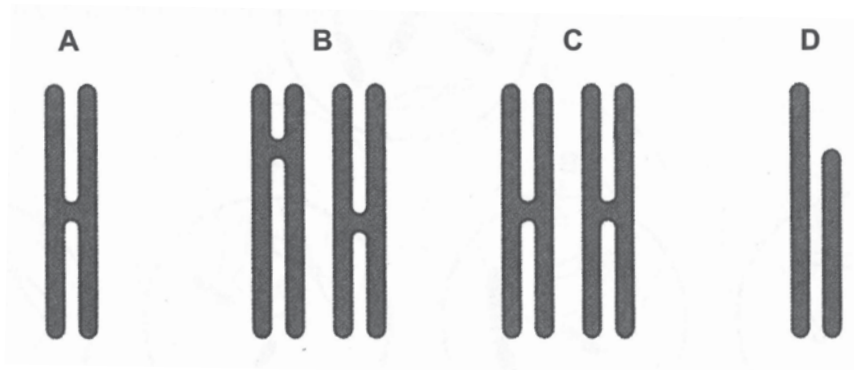
- 25** The diagram represents the life cycle of an animal. There are 24 chromosomes in the body cell of this animal.

At which stage in the life cycle does fertilisation, meiosis and mitosis occur?



	fertilisation	meiosis	mitosis
A	1	3	2
B	2	4	1
C	3	1	4
D	4	2	3

- 26** Which diagram represents a pair of homologous chromosomes after replication?

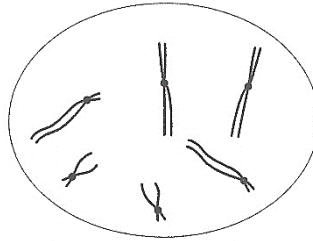


- 27** Colchicine is a well-known mitotic poison that inhibits the formation of spindle fibres.

What might be observed in cells that are exposed to colchicine?

- A** Centrioles of the cell will fail to replicate.
- B** Chromosomes are randomly distributed throughout the cell during metaphase.
- C** Chromosomes remain as loose chromatin threads.
- D** Sister chromatids are separated rather than held together at the centromere.

28 The diagram shows chromosomes during mitosis.



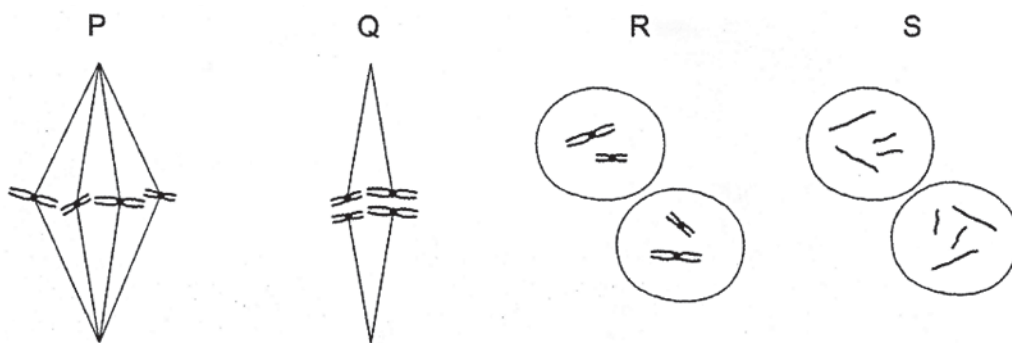
How many pairs of chromatids and homologous chromosomes are shown and which stage of mitosis is shown?

	pairs of chromatids	pairs of homologous chromosomes	stage of mitosis
A	3	6	prophase
B	3	6	telophase
C	6	3	prophase
D	6	3	telophase

29 The diagram below represents the nucleus of a body cell of an organism.



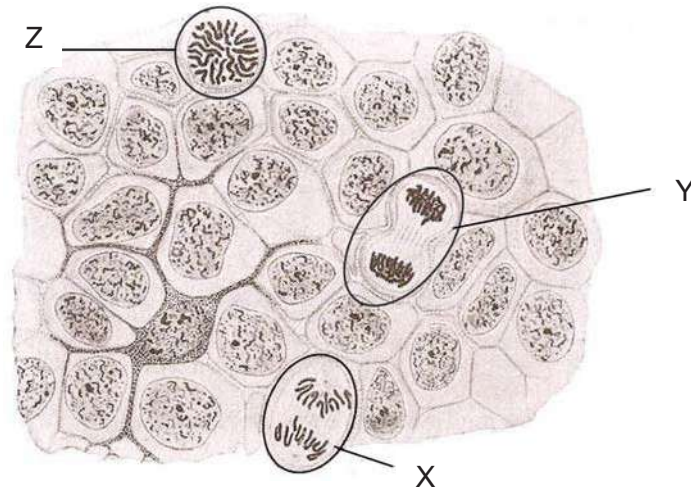
The diagrams below show the appearance of the same cell during different stages of cell division.



Which diagrams show stages of meiosis?

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

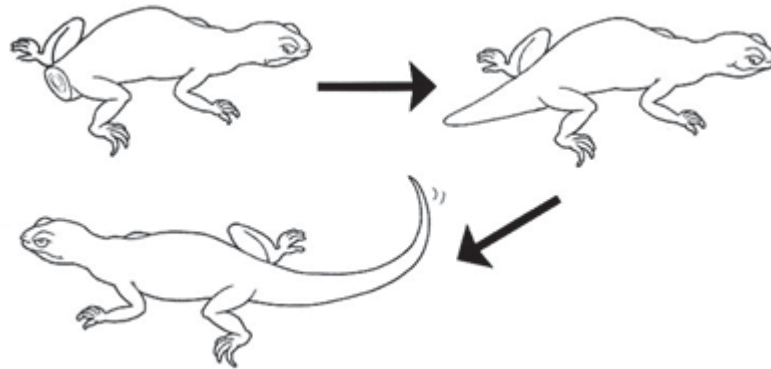
30 The diagram below shows animal cells undergoing various stages of mitosis.



Identify the stages of mitosis occurring in the cells labelled X, Y and Z.

	X	Y	Z
A	anaphase	prophase	interphase
B	anaphase	telophase	prophase
C	prophase	anaphase	telophase
D	prophase	telophase	metaphase

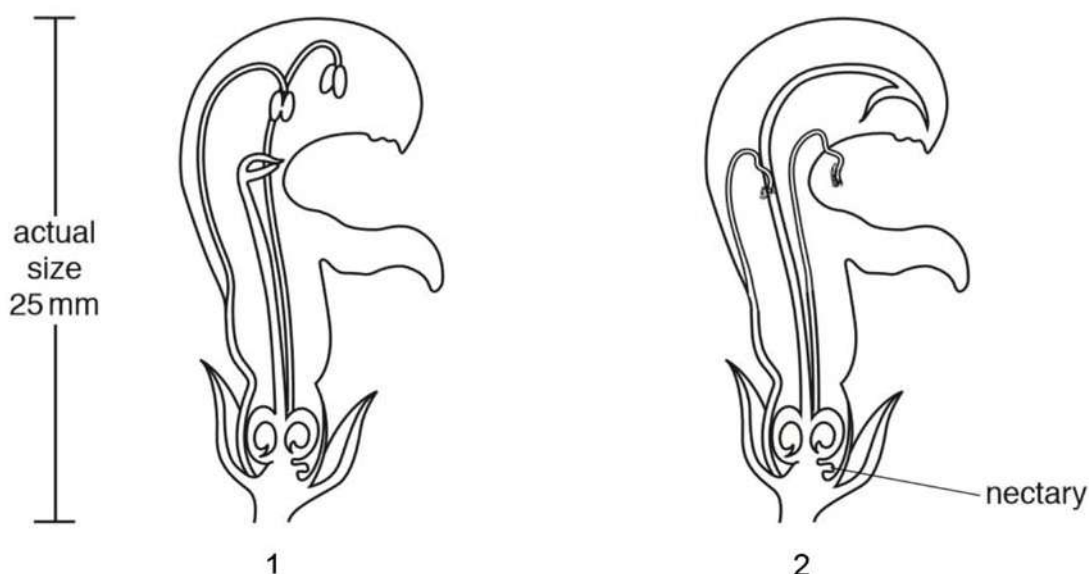
31 The diagrams show a lizard in various stages of regeneration of its tail.



Which cellular process is directly responsible for this regeneration?

- A** meiosis
- B** mitosis
- C** nutrition
- D** respiration

- 32** The diagram shows two separate flowers from the same species of plant at different stages in their development.



Which row gives the method by which these flowers can be pollinated?

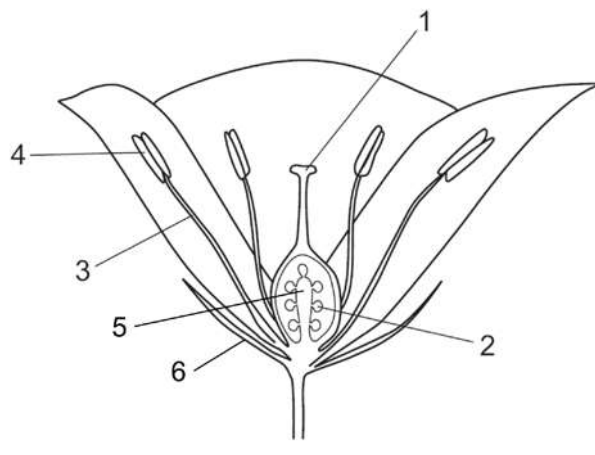
	type of pollination possible in flower 1	type of pollination possible in flower 2
A	insect	wind
B	self	insect
C	wind	insect
D	wind	wind

- 33** A number of new plants are growing from pieces of a plant that have become detached and have rooted in soil.

Which statement is correct about these new plants when they mature?

- A** The new plants are formed after self-pollination.
- B** They will all grow to the same size.
- C** They will all have the same colour flowers.
- D** They will all produce the same number of fruit.

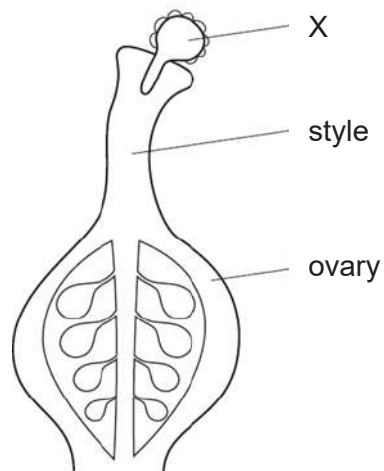
34 The diagram shows a flower cut in half.



Which parts of the flower produce haploid gametes?

- A** 1 and 2
- B** 2 and 4
- C** 3 and 6
- D** 4 and 5

35 The diagram shows part of a flower at one stage during reproduction.



What is structure X?

- A** a pollen grain after fertilisation, but before pollination
- B** a pollen grain after pollination, but before fertilisation
- C** an ovule after fertilisation, but before pollination
- D** an ovule after pollination, but before fertilisation

- 36** Flowering plants use different methods to ensure that their flowers are pollinated successfully.

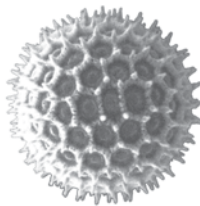
Some of these methods are listed.

- 1 Plant 1 has flowers in which the female parts ripen before the male parts.
- 2 Plant 2 has separate male and female flowers.
- 3 Plant 3 has separate male and female plants.
- 4 Plant 4 has flowers in which the male parts ripen before the female parts.
- 5 Plant 5 has flowers in which the male and female parts ripen at the same time.

Which method(s) make it more likely that self-pollination will take place?

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

- 37** The diagram shows a structure taken from the flower of Morning Glory.

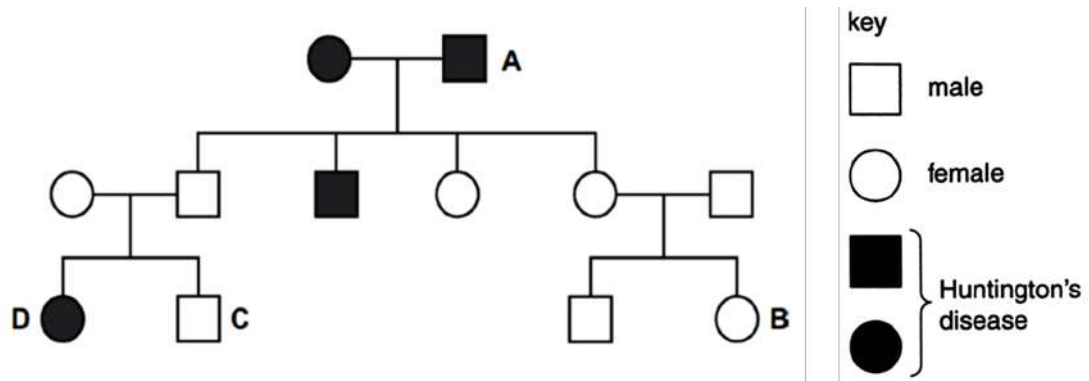


Which statement is correct?

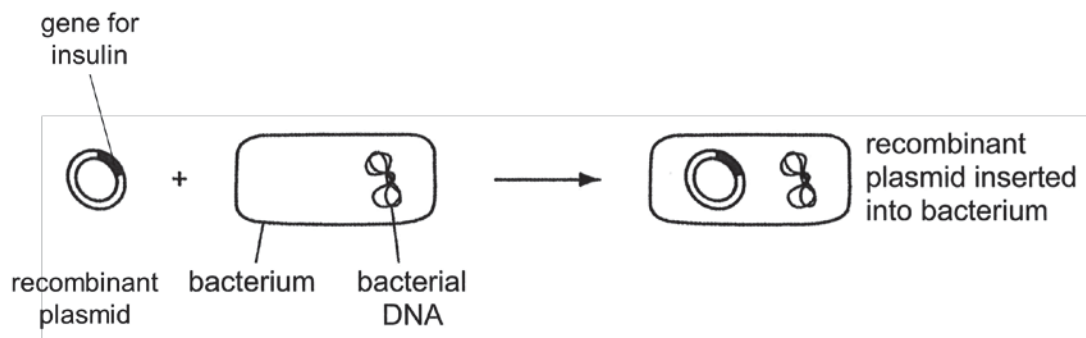
- A** An embryo is formed when the structure fuses with the female gamete.
- B** The structure can only germinate if it lands on the stigma of another flower.
- C** The structure is the male gamete of a plant.
- D** The sugary fluid of a stigma stimulates the structure to germinate.

- 38** Huntington's disease is an inherited disorder of the central nervous system. It is caused by a dominant allele. The family tree shows the inheritance of Huntington's disease.

Which individual's symbol is not correct?



- 39** The diagram shows one stage of the process to produce recombinant DNA that will synthesise human insulin for the treatment of diabetes.

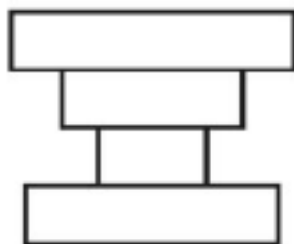


What is the next stage of this process?

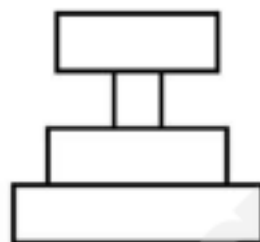
- A** Add the altered bacterium to human food.
- B** Inject the altered bacterium into the blood of a person with diabetes.
- C** Put the bacterium into a fermenter to multiply rapidly.
- D** Use the altered bacterium in a nasal spray.

40 Which pyramid of numbers has more primary consumers than producers?

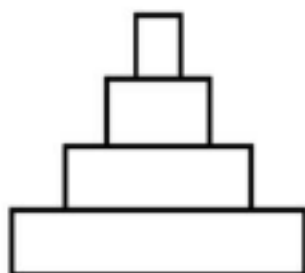
A



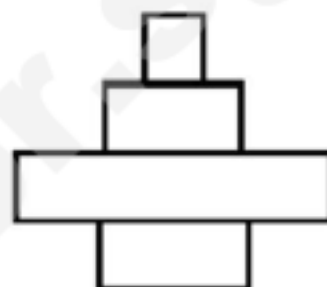
C



B



D



End of Paper 1

Section A: Structured Questions [50m]

Answer all questions in the spaces provided on the Question Paper.

- 1 Fig. 1 shows a diagram of a section through the heart.

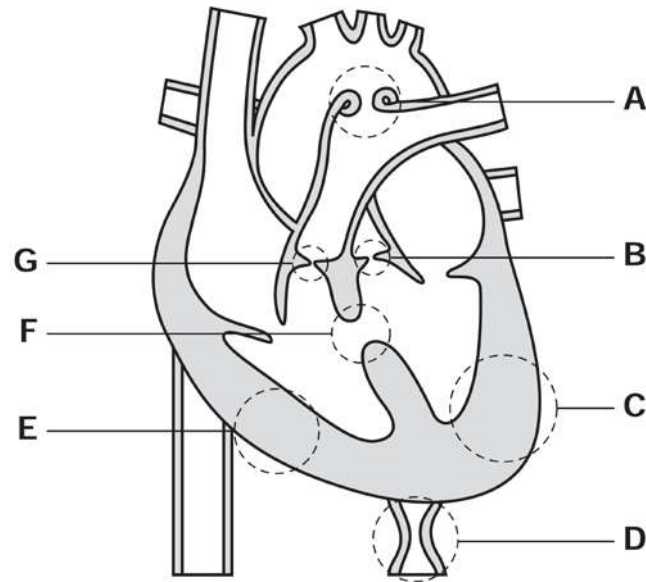


Fig. 1

- (a) One of the dotted circles shows that the area affected involves a hole in the septum between the ventricles.

Write down the label of the dotted circle that shows

- (i) a hole in the septum between the ventricles and [1]

.....

- (ii) a narrowing of the semilunar valve of the pulmonary artery. [1]

.....

- (b) Describe the structural defect shown by the dotted circle labelled **D**. [1]

.....

.....

- (c) The dotted circle labelled **A** shows the area affected in a person with the congenital heart disease called *patent ductus arteriosus*.

Suggest and explain how the flow of blood in a person with *patent ductus arteriosus* differs from that of a person with a healthy heart. [3]

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[Total: 6]

- 2 Fig. 2 is a graph of the volume of air flowing into and out of the lungs of a human while breathing at rest.

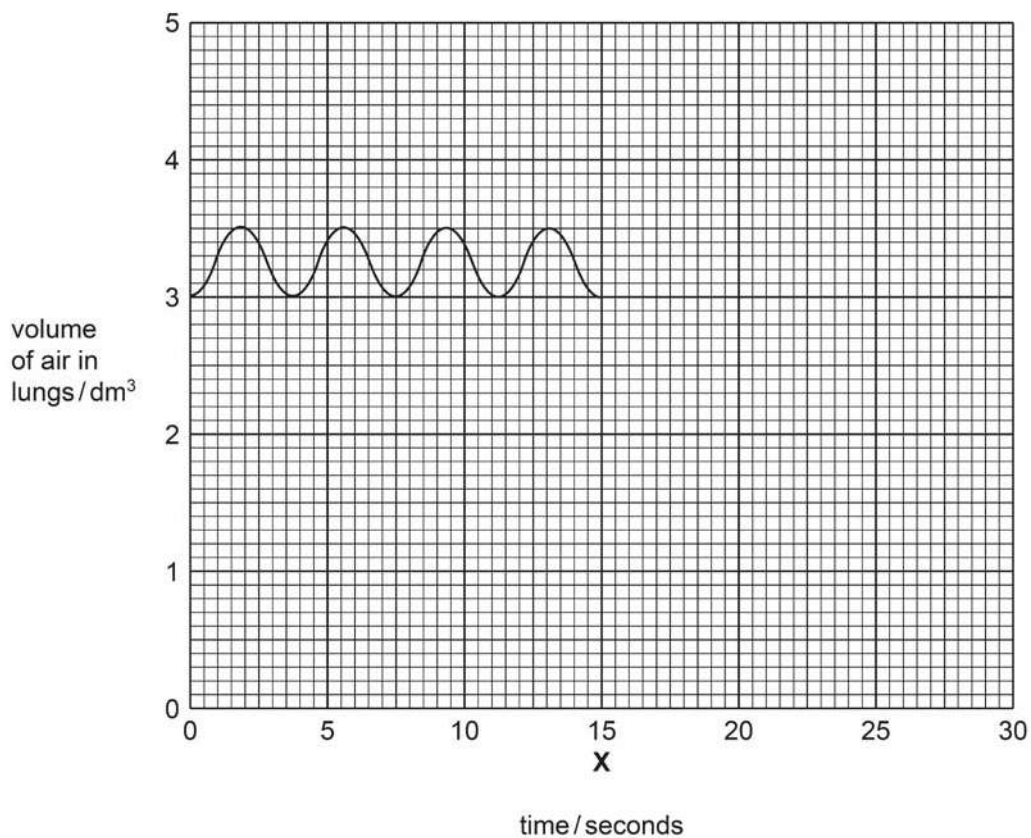


Fig. 2

- (a) (i) State how many breaths are inhaled in 15 seconds. [1]

.....

- (ii) State the volume of air breathed in during each breath. [1]

.....

- (iii) Calculate the volume of air breathed in during one minute.
Show your working. [2]

..... cm³

- (b) (i) At time **X** the person began to exercise. Sketch on the graph five more breaths for this person during this exercise. [2]

- (ii) Explain the difference in the graph before and after time **X**. [4]

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

[Total: 10]

- 3 Amniocentesis is a test that may be offered during pregnancy to find the sex of the fetus and to detect mutations.

During the test, a long, hollow needle may be used to withdraw some of the fluid into a syringe, as shown in Fig. 3.

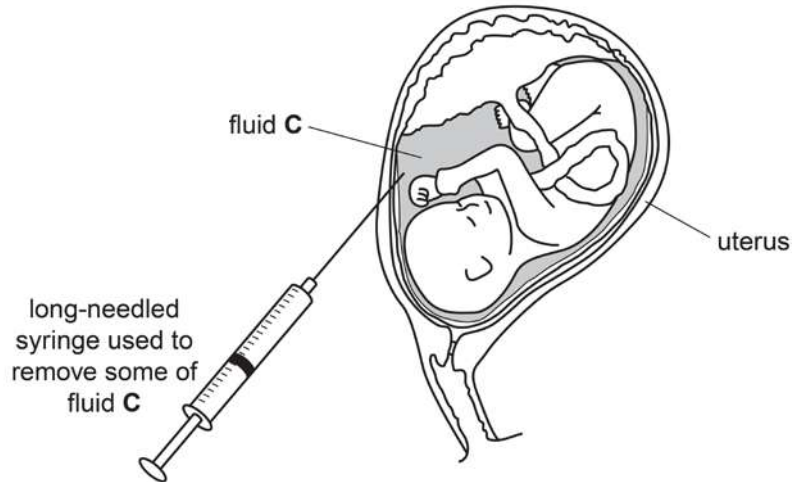


Fig. 3

- (a) Name fluid **C** and state its function. [2]

name of fluid

function

- (b) Suggest how fluid **C** is used to find the sex of the fetus and to detect mutations. [2]

.....

.....

- (c) On Fig. 3, label

(i) the placenta using a line and the letter **P**; [1]

(ii) the umbilical cord using a line and the letter **U**. [1]

- (d) Describe the functional relationship between the placenta and the umbilical cord. [3]

[Total: 9]

- 4 Fig. 4 shows some parts of the human alimentary canal and associated organs.

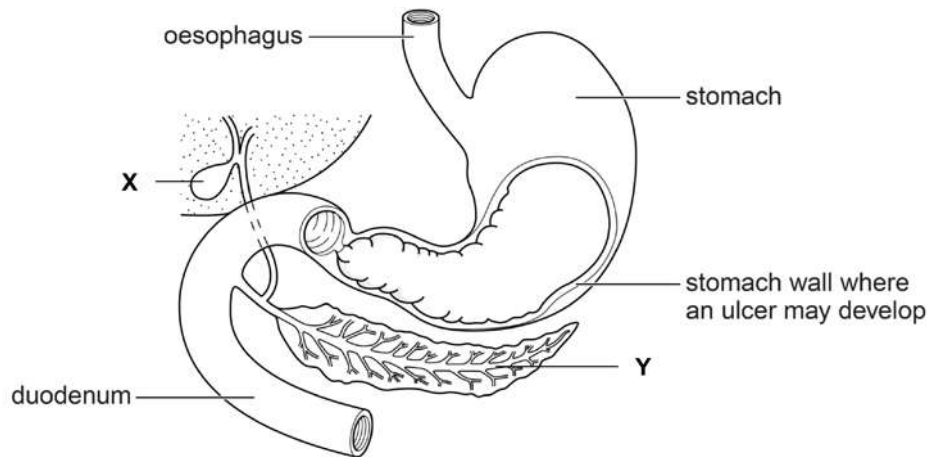


Fig. 4

- (a) An ulcer can develop on the wall of the stomach, 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. [4]

(b) Describe how **X** and **Y** work together in fat digestion. [4]

[Total: 8]

- 5 Fig. 5 shows details of DNA replication. One strand acts as a template for the synthesis of a new strand.

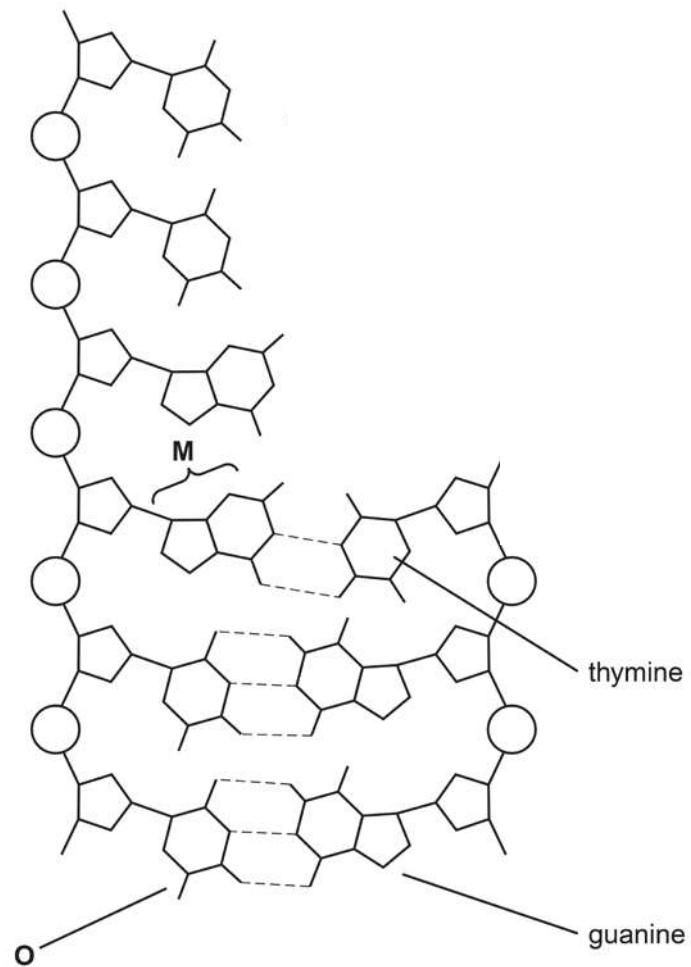


Fig. 5

- (a) On Fig. 5, circle one nucleotide. [1]
- (b) Name the nitrogenous bases, **M** and **O**. [1]
- M** **O**
- (c) Describe **two** features of a polypeptide molecule that are different from those found in a DNA molecule. [2]

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.....

.....

[Total: 4]

- 6 An investigation was carried out into the effect of diet on the rate of production of urine. Three students each took 1.5 dm^3 of a different drink **A**, **B** or **C**.

Fig. 6 shows the volume of urine released by each student over the next two and a half hours.

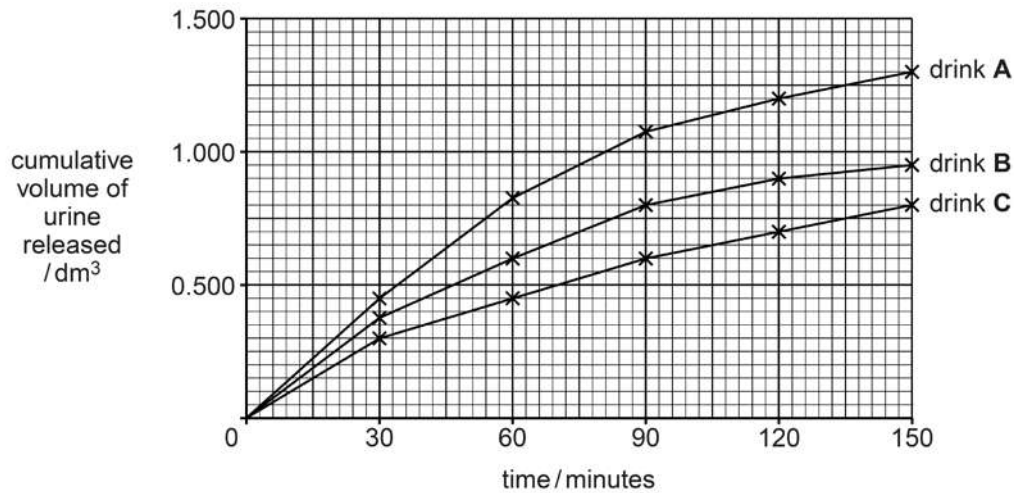


Fig. 6

- (a) Suggest which of the three drinks contained the highest amount of mineral salts.

Give an explanation for your answer.

[4]

drink with highest amount of mineral salts

explanation

.....

.....

.....

- (b) Urine released by the student who took drink **B** was found to contain high levels of urea.

[3]

Suggest a possible reason for this result.

.....

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.....

.....

[Total: 7]

7 Fig. 7 shows a section through the skin.

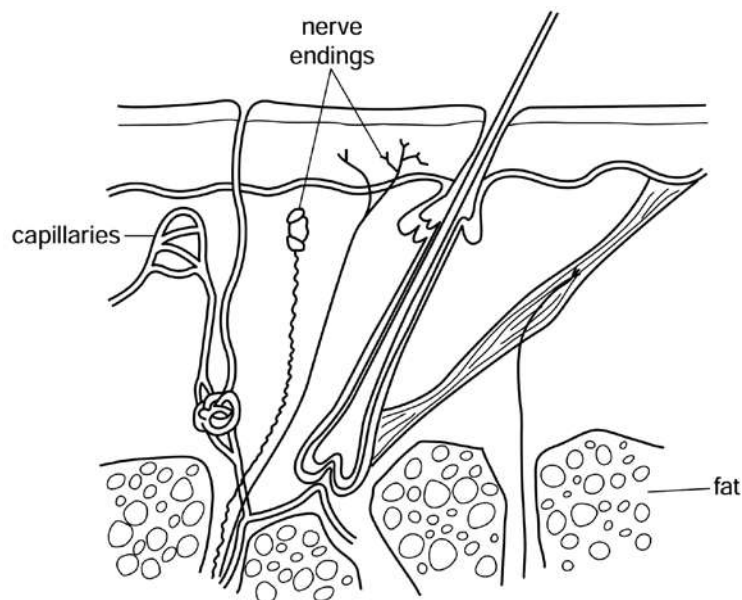


Fig. 7

(a) Suggest two possible functions of the nerve endings shown in Fig. 7. [2]

1.
2.

(b) Explain how the capillaries shown in Fig. 7 are involved in the loss of heat from the body during exercise. [3]

.....

.....

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.....

(c) A layer of fat is shown in Fig. 7.

Suggest a function for this structure in mammals living in an extremely cold climate.

[1]

[Total: 6]

Section B: Free Response Questions [30m]

Answer **three** questions.

Question **10** is in the form of an **Either/Or** question.

Only one part should be answered.

Write your answers in the space provided.

- 8 (a)** A man blames his wife for the sex of their child.

Use your knowledge of how sex is inherited to explain which parent determines the sex of a child.

[6]

- (b) Researchers at Harvard Medical School recently designed a model to show how bacteria overcome drugs meant to stop and destroy them.

Fig. 8 shows bacteria growing on the surface of a dish containing nutrient jelly (which appear black). At the start of the experiment, the bacteria (which appear white) only grew on the part of the jelly that did not contain antibiotic. After some time, a small group of bacteria is seen in the part of the jelly that contained the antibiotic.

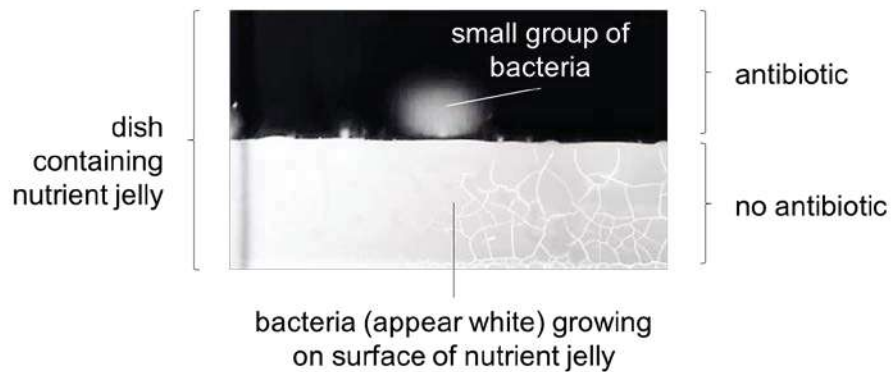


Fig. 8

Use the information above, and your knowledge of the process of natural selection, to describe and explain the observation described above.

[4]

[Total: 10]

9 The following experiment was carried out to investigate the effect of light intensity on the rate of photosynthesis of a water plant, *Elodea*.

- *Elodea* was cut into three pieces, each 10 cm long.
- Each piece of *Elodea* was placed in a glass tube, containing 0.5% sodium hydrogen carbonate solution, which was then sealed with a bung.
- Tube **A** was placed 10 cm away from a lamp.
- Tube **B** was placed 5 cm away from a lamp.
- Tube **C** was placed in a dark room.
- An oxygen sensor was used to measure the percentage of oxygen in the solutions at the start of the experiment and again at 5, 10 and 20 minutes.

The results are shown in Fig. 9.

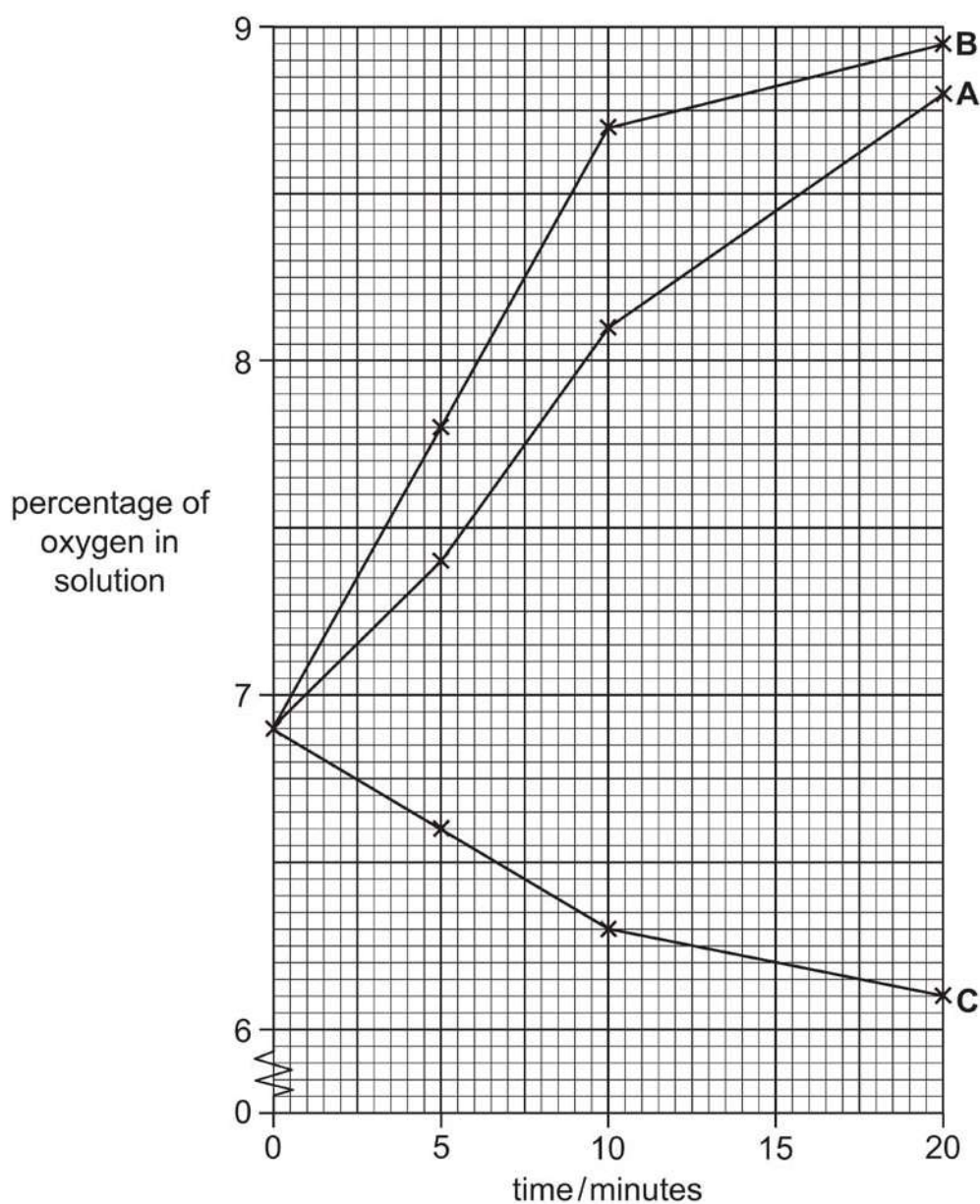


Fig. 9

- (a) Calculate the mean rate of oxygen production for tube **A** for the 20 minutes of the experiment.

Give your answer to two decimal places.
Show your working.

[1]

answer

- (b) Describe how more results can be obtained to plot a new graph that shows the effect of light intensity on the rate of photosynthesis.

[4]

.....

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.....

.....

.....

- (c) Explain the results for tube **C**.

[2]

.....

.....

- (d) The fruit of *Elodea* contain seeds that ripen underwater.

Describe how photosynthesis in *Elodea* can lead to an increase in the level of starch in its seeds.

[3]

[Total: 10]

Either

10 A child is frightened by a sudden loud noise and turns to run away from the noise.

- (a)** Explain why the child's heart beats faster immediately after hearing the sudden loud noise.

[5]

- (b)** Describe the pathway of nerve impulses in the child's act of running away.

[5]

[Total: 10]

Or

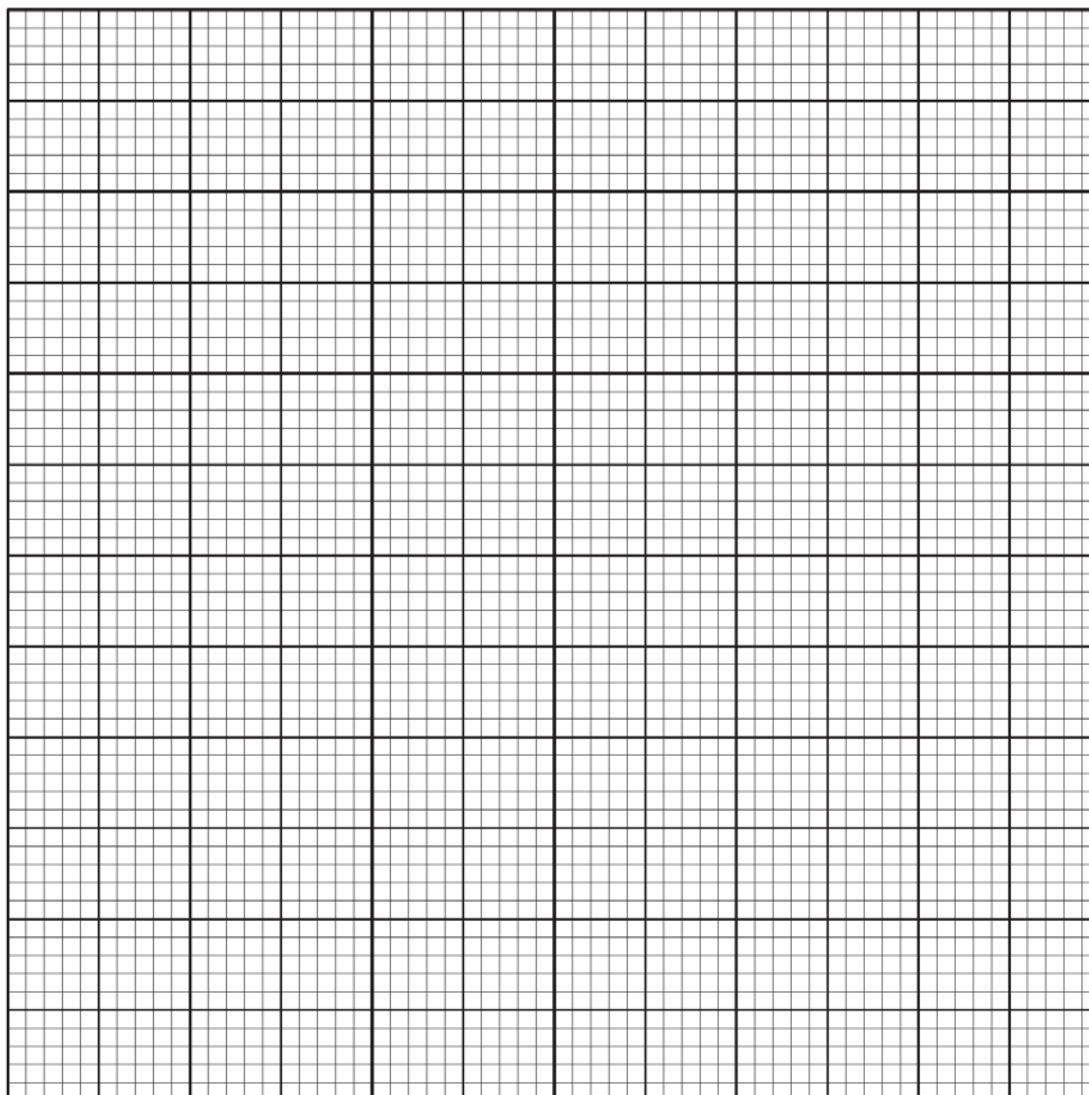
- 10** Table 10 shows the quantities of pesticides, in parts per million (ppm) that accumulate in four populations, each at different trophic levels in a food chain.

Table 10

population	A	B	C	D
quantity of pesticide accumulated/ ppm	40	400	120	2000

- (a)** Draw a bar chart of the data in Table 10.

[3]



- (b) State what is meant by the term *trophic level*. [1]

- (c) (i) Draw the food chain shown in Table 10. [1]

- (ii) Explain your answer in (c)(i). [5]

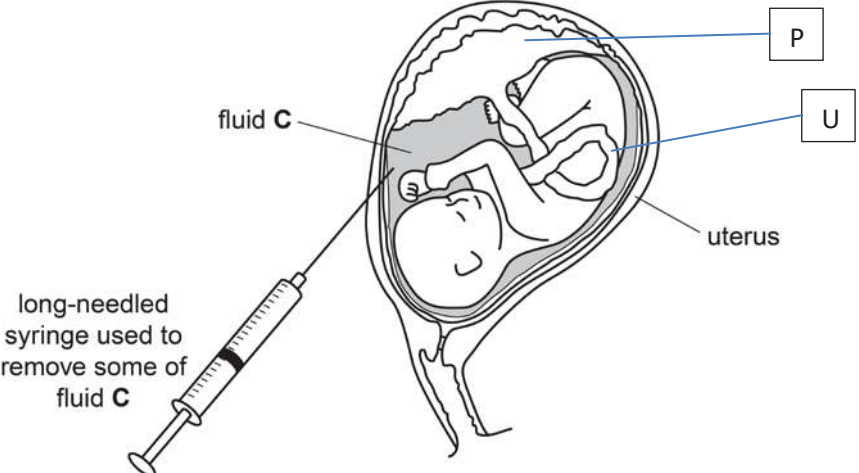
[Total: 10]

2019 Prelim 4E Biology Paper 1 6093/1

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

Section A: Structured Questions [50m]

1	ai	F ;		
	aii	G ;		
	b	narrowing of the aorta / OWTTE ;		
	c	accept ora where relevant <i>suggest</i> 1 blood flows <u>from</u> aorta <u>to</u> pulmonary artery ; 2 increased volume of / more, blood to lungs ; A blood to lungs at higher pressure 3 oxygenated and deoxygenated mix / oxygenated blood / blood from aorta, to lungs ; <i>explain (why blood flows from aorta to pulmonary artery)</i> 4 left ventricle thicker wall (than right ventricle) ; 5 (so) contraction generates greater force (than right ventricle)/AW ; 6 higher pressure in aorta (than pulmonary artery) ; [3 max] <i>max 2 for omission of suggestion or explanation</i> adapted from: 9700_s10_qp_22		
				[Total: 6]
2	a	i	4;	
		ii	0.5 dm ³ /500 cm ³ ;	
		iii	4 (breaths) x 500 (cm ³) x 4 (quarter minutes); 8000 cm ³ ; R 8 dm ³	
	b	i	single breaths occupy a shorter time; breaths have greater amplitude;	
		ii	more oxygen uptake ; <u>more</u> energy (R produced, made, manufactured, etc.) ; from aerobic respiration ; more muscular contraction;	
				[Total: 10]
3	a	amniotic fluid ; prevents physical harm / damage to fetus ;		
	b	DNA / chromosomes ; from fetal cells / nuclei ; (of fluid C is used for the analysis)		

c	i, ii		
d		<p>umbilical cord carries fetal blood to and from placenta ; <u>which then</u> ; transfers nutrients / oxygen from mother to fetus ; removes CO₂ / waste from fetus to mother ;</p> <p><i>max 2m if no ref to causal / sequential relation between umbilical cord and placenta penalize once for unclear direction of transfer / transport</i></p>	
		[Total: 9]	
4	a	<p>less digestion of protein ; protease / pepsin, no / reduced activity ; (stomach) <u>decrease</u> in pH / acidity / less acid ; R change ref. fewer microorganisms / bacteria / pathogens killed ;</p> <p>A work best in acid conditions R drug neutralises the acid adapted from: 5090_s14_ms_21</p>	
	b	<p>(X) gall bladder, stores / releases bile ; R secretes / produces (which) emulsifies fats ; (Y) pancreas, secretes pancreatic juice ; (which contains) lipase ; breaks down fat into fatty acid and glycerol ;</p>	
		[Total: 8]	
5	a	<p>Circle contains one phosphate group, one nitrogenous base, one ribose, all covalently bonded to each other ;</p>	
	b	<p>M = adenine and O = cytosine ;</p>	

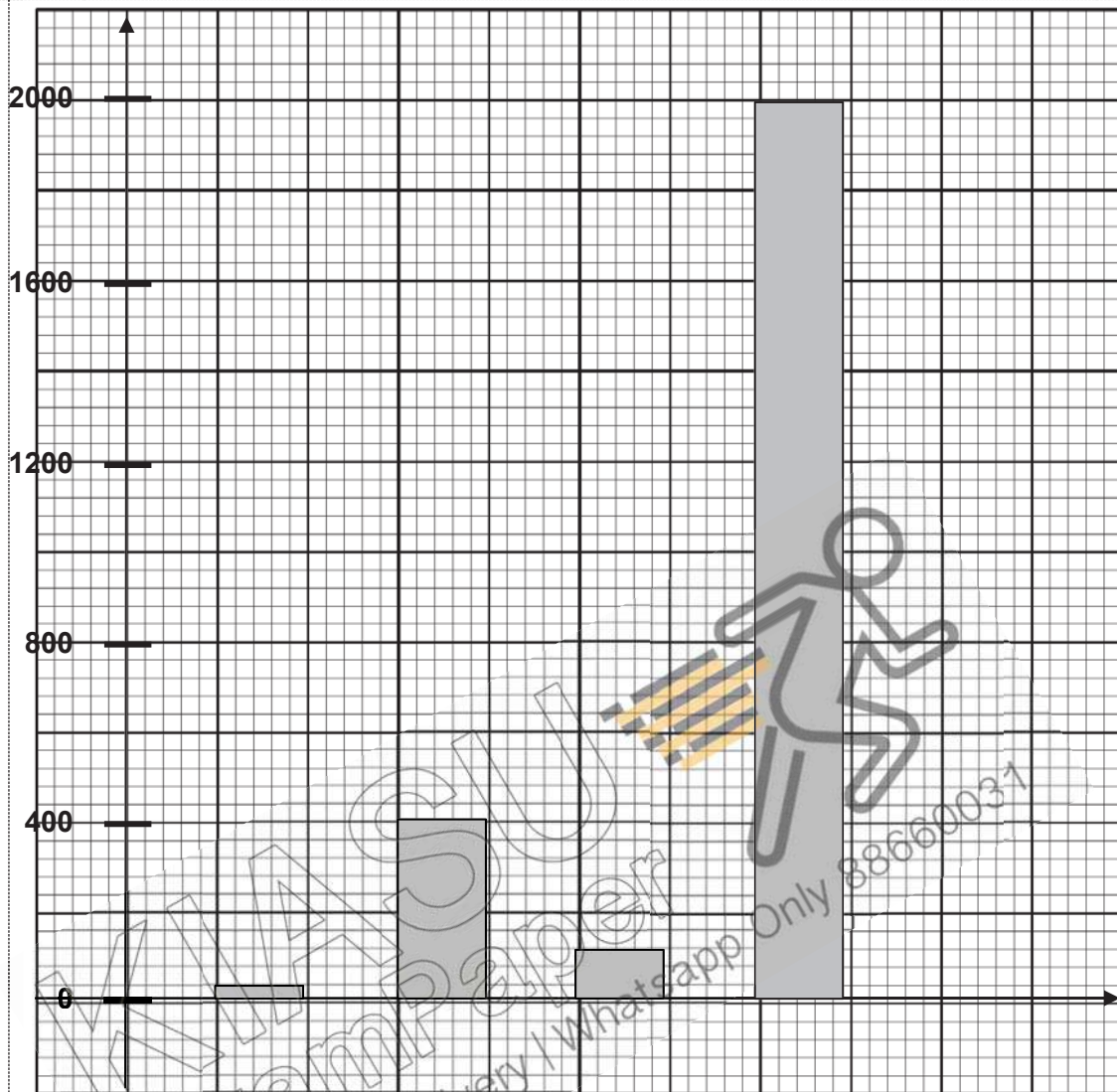
	c	<p>Assume answer is about polypeptide unless indicated otherwise. A comparison is not required. Information given below is for <u>either</u> polypeptide <u>or</u> DNA features. A ideas from either column. Do not penalise if points are not corresponding on one line / sentence. Mark all points on line. Only R if biologically incorrect.</p> <table><tr><td><i>polypeptide</i></td><td><i>DNA</i></td></tr><tr><td>amino acids</td><td>nucleotides ;</td></tr><tr><td>one / single strand / chain</td><td>two / double strand / chains ;</td></tr><tr><td>peptide bonds</td><td>phosphodiester ;</td></tr><tr><td>R between peptides / polypeptides</td><td></td></tr><tr><td>20 types of amino acids</td><td>only 4 types of bases</td></tr><tr><td>A > 4</td><td></td></tr><tr><td>no phosphate / PO₄</td><td>has phosphate / PO₄ ;</td></tr><tr><td>2° / 3° structure</td><td>double helix ; 3 max</td></tr></table> <p>adapted from: 9700_s04_ms</p>	<i>polypeptide</i>	<i>DNA</i>	amino acids	nucleotides ;	one / single strand / chain	two / double strand / chains ;	peptide bonds	phosphodiester ;	R between peptides / polypeptides		20 types of amino acids	only 4 types of bases	A > 4		no phosphate / PO ₄	has phosphate / PO ₄ ;	2° / 3° structure	double helix ; 3 max	
<i>polypeptide</i>	<i>DNA</i>																				
amino acids	nucleotides ;																				
one / single strand / chain	two / double strand / chains ;																				
peptide bonds	phosphodiester ;																				
R between peptides / polypeptides																					
20 types of amino acids	only 4 types of bases																				
A > 4																					
no phosphate / PO ₄	has phosphate / PO ₄ ;																				
2° / 3° structure	double helix ; 3 max																				
			[Total: 4]																		
6	a	<p>drink C</p> <p>(increased salt intake led to) decreased water potential in blood plasma ;</p> <p>pituitary gland released more ADH into bloodstream ;</p> <p>cells in walls of collecting ducts more permeable to water / more water reabsorbed from collecting duct into capillaries ;</p> <p>lowest increase in volume of / more water in + urine / produces least / little / less urine ;</p>																			
	b	<p>more protein ; lg ref. to specific foods</p> <p>correct ref. excess amino acids ;</p> <p>broken down in / converted by liver / deamination ;</p> <p>adapted from: 5090_s14_ms_22</p>																			
			[Total: 7]																		
7	a	<p>one per line, mark the first, any 2 from:</p> <p>detection of pressure, temperature, pain, touch;;</p> <p>(A for ONE mark max. a reference to the detection of stimuli)</p>																			
	b	<p>dilation of arterioles; R capillaries</p> <p>more blood, carries heat;</p>																			

		heat lost from + body surface/skin/named heat transfer method; capillaries supply sweat glands; [max 3]	
	c	stores energy; supplies energy/heat; insulates (against heat loss); *ref. low external temperature [max 1] adapted from: N15/1/22	
			[Total: 6]

Section B: Free Response Questions [30m]

8	a	<p>father is XY / contains Y chromosomes ; A marks in Punnett Square</p> <p>mother is XX / does not contain Y chromosomes ;</p> <p>father produces sperm with either X or Y (chromosomes) ;</p> <p>mother produces eggs only with X (chromosomes) ;</p> <p>sex depends on which sperm fertilises the egg ;</p> <p>1:1 male : female in offspring / AW ;</p>	[6]
	b	<p><i>explain (why bacteria only grew on jelly without antibiotic)</i></p> <p>reference to (bacteria) killed in region with antibiotic / ORA ;</p> <p><i>explain (why some bacteria grew on jelly with antibiotic after some time)</i></p> <p>gene, mutation ; <u>causes</u> some bacteria to be <u>resistant</u> to antibiotic ;</p> <p>(resistant bacteria) survive, reproduce ;</p> <p>pass on resistance / gene mutation to next generation / offspring ;</p> <p>information from https://news.harvard.edu/gazette/story/2016/09/a-cinematic-approach-to-drug-resistance/</p>	
		[Total: 10]	
9	a	<p>8.8 – 6.9 / 20 ;</p> <p>0.10 ;</p> <p>% per minute ; R plural</p>	
	b	<p>three more tubes, placed 15 cm, 20 cm, 25 cm away from the lamp ;</p> <p>measure percentage of oxygen in the solutions at 0 , 5, 10, 20 minutes ;</p> <p>calculate mean rate of oxygen production for all tubes for the 20 minutes of the experiment ;</p> <p>plot a graph of mean rate against light intensity / distance from lamp, draw a trend line ;</p> <p>rate will increase with light intensity then level off ;</p> <p>[max 4]</p>	[4]
	c	<p>no, photosynthesis / light dependent reaction ;</p> <p>oxygen used up in respiration ;</p>	[2]
	d	<p>glucose is converted to sucrose ;</p> <p>translocation (of) sucrose ;</p> <p>from the leaf to the seeds ;</p> <p>through phloem ;</p> <p>converted to starch ;</p>	[3]

10 a (OR)



b the position of an organism / feeding level AW;
in a food chain / food web / pyramid of biomass / pyramid of numbers
/ pyramid of energy;

c i $A \rightarrow C \rightarrow B \rightarrow D$

ii small plants/animals absorb/contain pesticide ;
eaten by small fish
(Only mark available if no ref to pesticide in the answer) ;
(pesticide) passes from small fish to large fish ;
each time many organisms eaten/higher organism gets large
dose/intensifies, increases;
is not excreted;
cannot be broken down ;
stored in body AW;
adapted from: 5090_s11_ms_21

End of Paper

Name: ()

Class: Sec 4A

Queenstown Secondary School



Preliminary Examination 2019 Secondary Four Express Biology 6093/01

2 September 2019
Monday

Time: 1130 – 1230h
Duration: 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.

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.

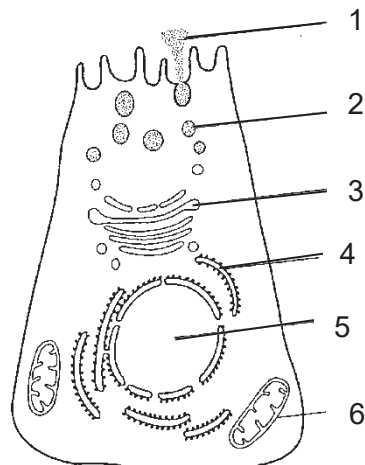
Read the instructions on the Answer Sheet very carefully.

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.

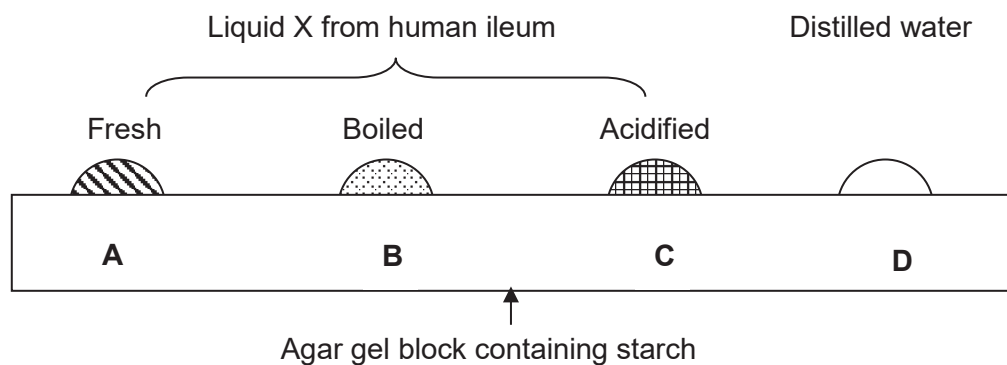
The use of an approved scientific calculator is expected, where appropriate.

- 1 The diagram below shows an animal cell.



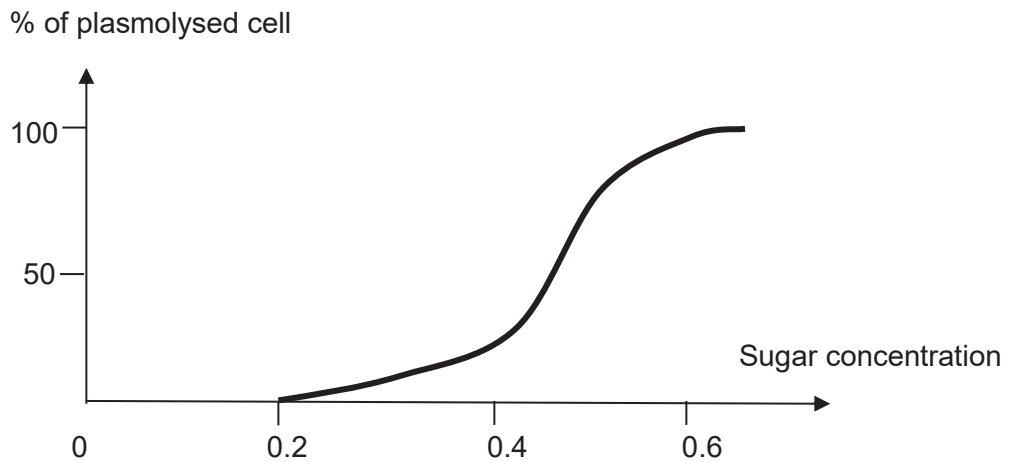
What is the functional relationship between the labelled structures?

- A 1 is synthesised by 4.
 - B 2 develops into 6.
 - C 3 contains products synthesised by 5.
 - D 4 controls the contents of 5.
- 2 The figure below shows an experiment in which four different liquids were added onto an agar gel plate on spots **A**, **B**, **C** and **D**.



The set was incubated at 37°C for 5 hours, after which the starch plate was washed with distilled water and iodine solution was added onto **A**, **B**, **C** and **D**. Which of the spots **A**, **B**, **C** and **D** will not turn blue-black?

- 3 The following graph illustrates the percentage of plasmolysed leaf cells at different concentrations of sugar solutions.



From the above results, it suggests that the leaf cells

- A are resistant to low sugar concentration.
 - B have cell saps of different concentrations.
 - C are of different sizes.
 - D are of different shapes.
- 4 The table below shows the results of an analysis of the cell sap from a marine plant and the surrounding seawater.

substance analysed	concentration of ions (arbitrary units)		
	sodium ions (Na^+)	potassium ions (K^+)	chloride ions (Cl^-)
cell sap	0.13	0.56	0.61
sea water	0.57	0.02	0.30

A student makes the following deductions that the cell

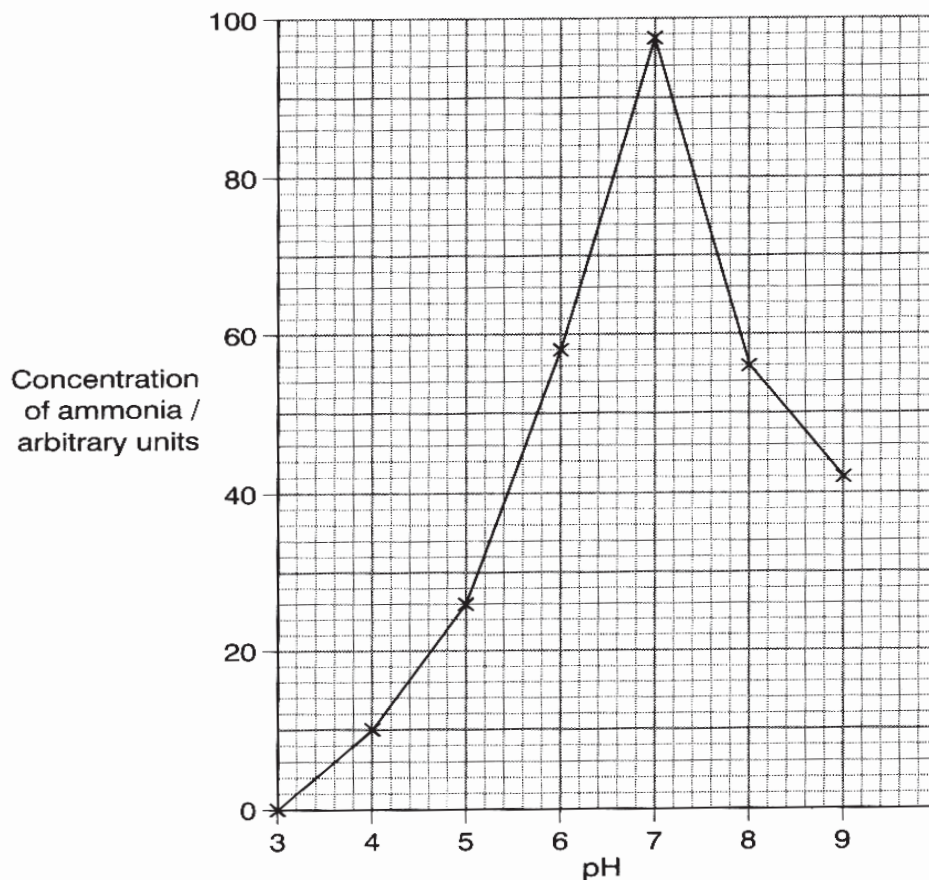
- I removes chloride ions by diffusion.
- II removes sodium ions by active transport.
- III accumulates sodium ions by active transport.
- IV accumulates potassium ions by active transport.

Which of the above statements are correct?

- A I, II and III
- B I, II and IV
- C I, III and IV
- D II, III and IV

- 5 Urease is an enzyme which catalyses the breakdown of urea to ammonia and carbon dioxide. An experiment was carried out at 30°C to investigate the effect of pH on the activity of urease. 10.0 cm³ of pH 3 buffer solution was mixed with 1 cm³ of urease solution. This mixture was then added to 10.0 cm³ of urea solution and the concentration of ammonia in the mixture was measured after 60 minutes. This procedure was repeated using buffer solutions of pH 4, 5, 6, 7, 8 and 9.

The results are shown in the graph below.



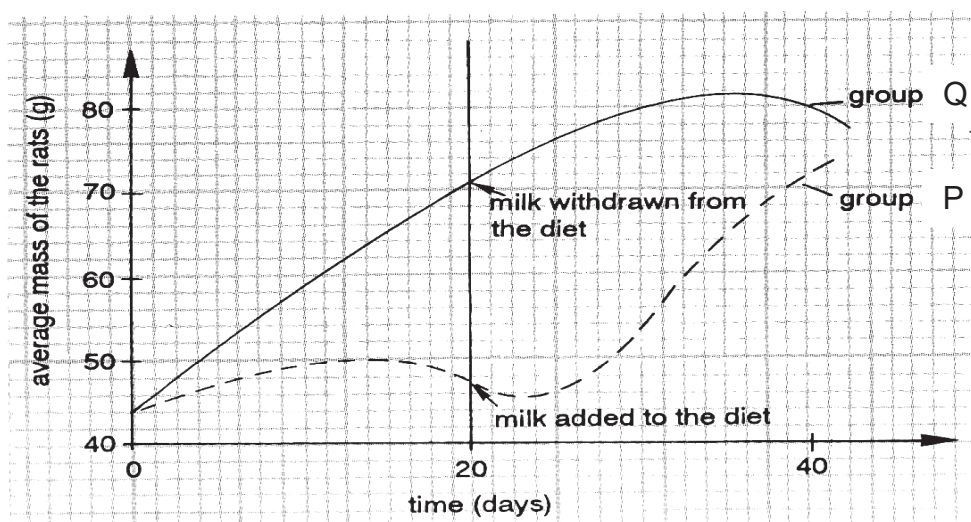
Which of the following statements are true about the activity of urease at different pH values?

- I: A curve of similar shape should be obtained if the concentration of carbon dioxide is tracked in the experiment.
- II: A curve of similar shape should be obtained if the experiment is conducted at 60°C.
- III: This enzyme works best at pH 7.
- IV: The enzyme is denatured at pH 9.

- A** I and II **B** I, II and III **C** I, III and IV **D** I, II, III and IV

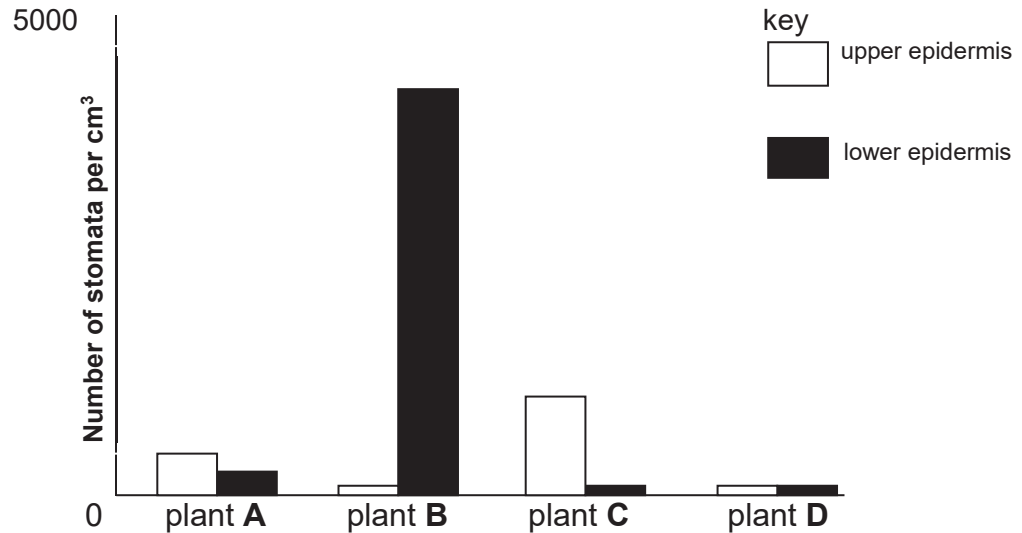
For questions 6 and 7, refer to the information and graph given below.

In this experiment, a group of rats (P) was fed on a basic diet (carbohydrates, lipids, proteins, minerals and water) and a second group of rats (Q) was given the basic diet plus milk initially. The results over 40 days were shown below.

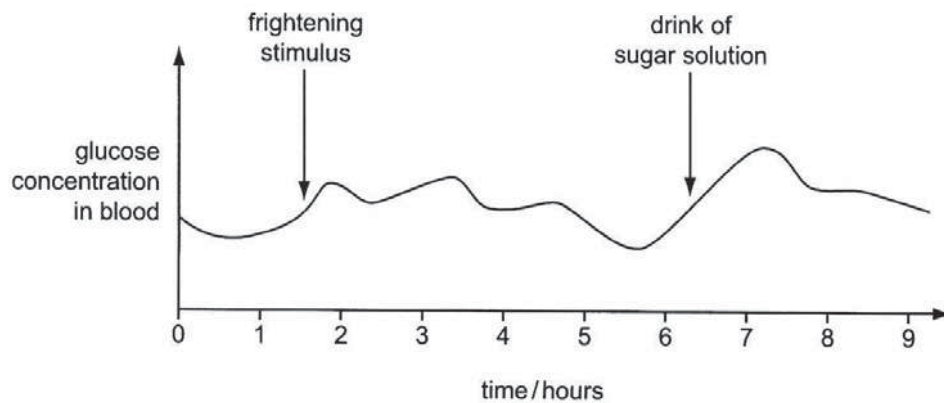


- 6 The diet given to groups P and Q was exchanged after the 20th day. What is the reason?
- A To prevent the death of the rats.
 - B To remove minerals stored in the rats.
 - C To prove that the results seen are due to the effect of milk.
 - D To investigate the interactions of different diets on the growth rate.
- 7 The rats in group P did not increase in mass immediately after milk was added to the diet because
- A milk took time to be digested and assimilated.
 - B the rat did not need the special constituents found in milk.
 - C it took time to produce the digestive enzymes.
 - D the rat did not have the right enzymes to catalyse the reaction.

- 8 The graph below shows the distribution of stomata on the upper and the lower epidermis of the leaves of four plants. Which of these plants would you find in a desert?



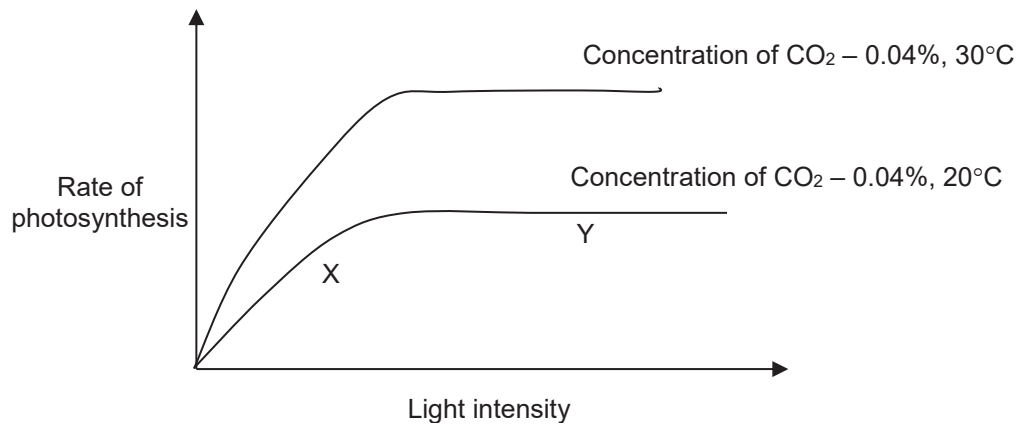
- 9 The graph shows the blood glucose concentration over a period of time.



Which statement is consistent with the blood glucose concentration at eight hours?

- A adrenaline secretion is high
- B insulin secretion is high
- C insulin secretion is low
- D the brain detects the low glucose concentration

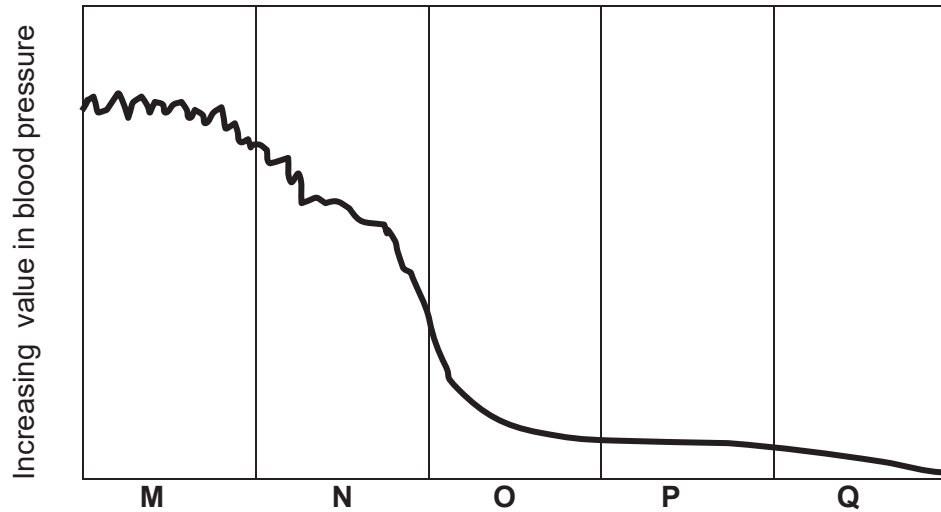
- 10 The graph below shows how the rate of photosynthesis in a plant varies with light intensity at 2 different carbon dioxide concentrations and temperatures as shown.



From the information of the graphs alone, which are the limiting factors at points X and Y?

	X	Y
A	light intensity	concentration of CO ₂
B	temperature	light intensity
C	light intensity	temperature
D	concentration of CO ₂	temperature

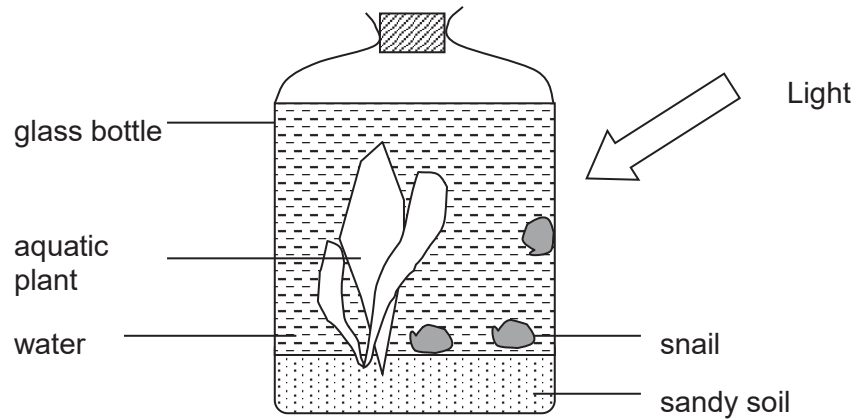
- 11 The graph below shows the variation in blood pressure of the five main types of blood vessels in the circulatory system of man.



Which of the following correctly identifies the blood vessels labelled M to Q?

	M	N	O	P	Q
A	arterioles	arteries	veins	venules	capillaries
B	arteries	arterioles	capillaries	veins	venules
C	veins	venules	capillaries	arterioles	arteries
D	arteries	arterioles	capillaries	venules	veins

- 12 The following diagram shows an aquarium placed in a bright room with temperature of about 30°C.



Which of the following factors is most important for the survival of the organisms in the aquarium?

- A the amount of carbon dioxide in the water
- B the amount of light in the room
- C the amount of oxygen in the water
- D the temperature of the water

- 13** The table below shows the changes in the dry weight of substances found in seeds before and after germination in a dark covered container.

Parts of seed	Dry weight of seeds /g	Dry weight of seedlings formed after germination in darkness /g
Fats	86.2	32.2
Sugars	7.3	19.0
Cellulose	5.4	14.6
Simple proteins	21.6	11.2
Others	24.9	49.1
Total dry weight	145.4	126.1

Why is there a greater mass of cellulose in the seedlings compared to the seeds?

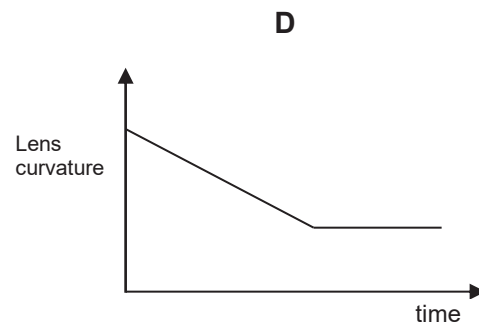
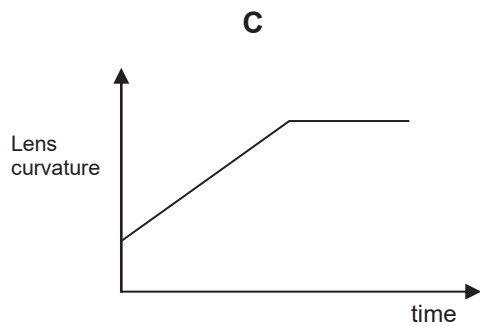
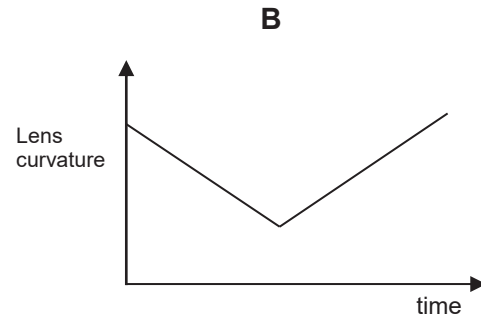
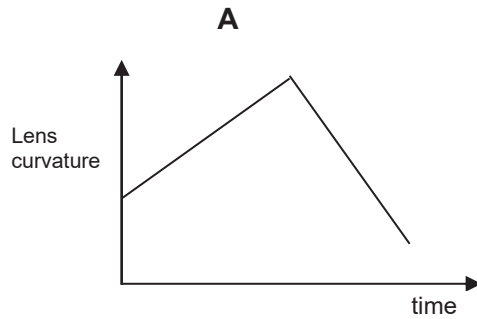
- A** Cellulose and fats are used up during respiration.
- B** Cellulose is formed as the number of cells increased.
- C** Cellulose is translocated from the seeds to the seedlings.
- D** Cellulose is formed as a storage substance in the seedling.

- 14** Which of the following are **not** the characteristics of nervous impulses?

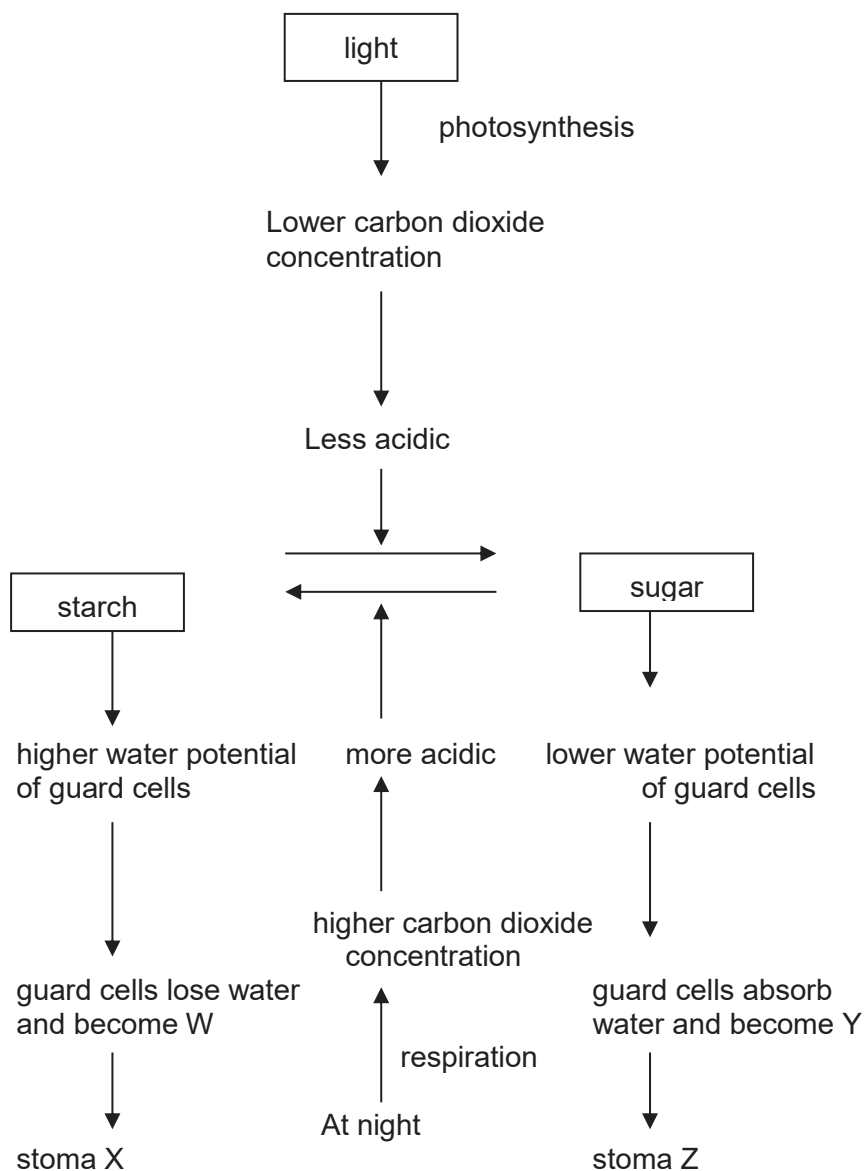
- I It can be transmitted in reverse directions.
- II Transmission along a nerve fibre are both electrical and chemical in nature.
- III The initiation of impulses always starts from the brain.

- A** I and II **B** II and III **C** I and III **D** I, II and III

- 15 A boy was watching a ladybird which was flying towards him and then landed on his nose. Which of the following graphs shows the change in curvature of the lens of his eyes?



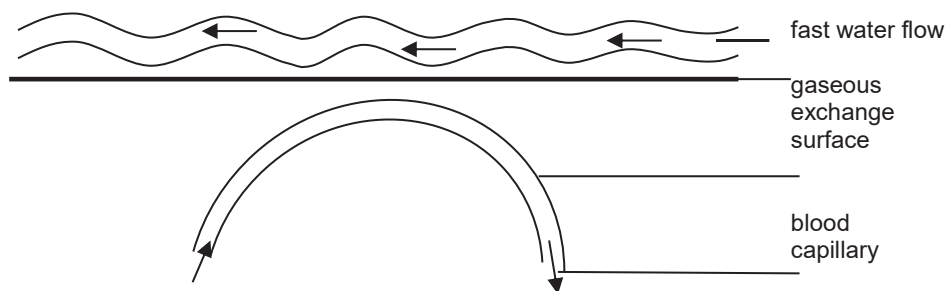
- 16 The mechanism of how stomata opens and closes is shown below.



Which of the following correctly represents W, X, Y and Z?

	W	X	Y	Z
A	flaccid	opens	turgid	closes
B	flaccid	closes	turgid	opens
C	turgid	closes	flaccid	opens
D	turgid	opens	flaccid	closes

- 17 The diagram represents the gaseous exchange surface of a fish.



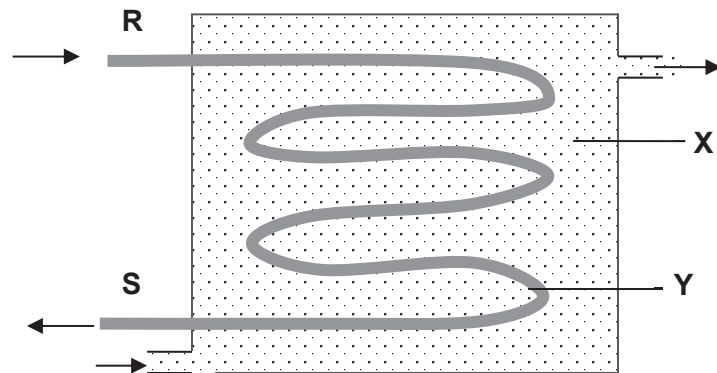
	amount of oxygen dissolved in water	amount of oxygen dissolved in blood plasma	rate of blood flow
A	small	large	fast
B	small	large	slow
C	large	small	fast
D	large	small	slow

- 18 The diagram shows a valve in a section through a blood vessel. Which statement is correct?



- A** Blood flows from X to Y, opening the valve.
- B** The elastic wall causes the valve to close between heartbeats.
- C** Muscles in the wall contract and close the valve, preventing backflow.
- D** The valve is forced open when the blood pressure at Y is greater than at X.

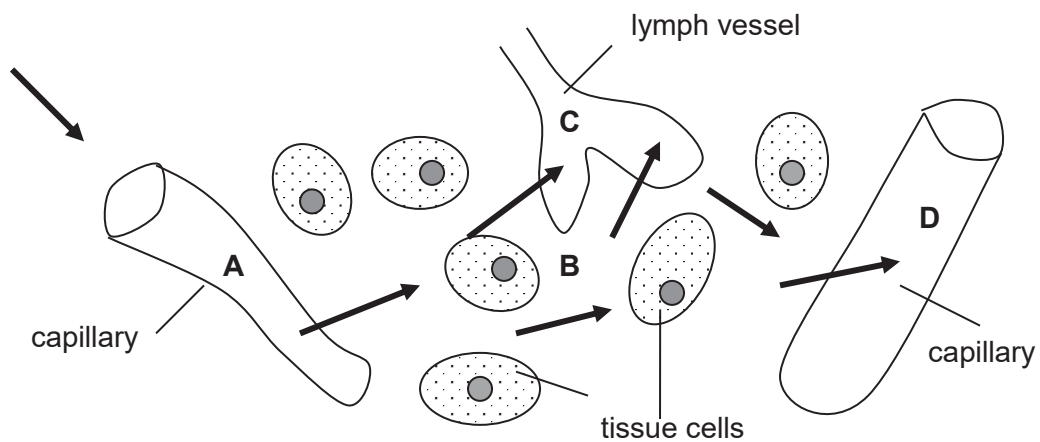
- 19 The diagram below represents a dialysis machine.



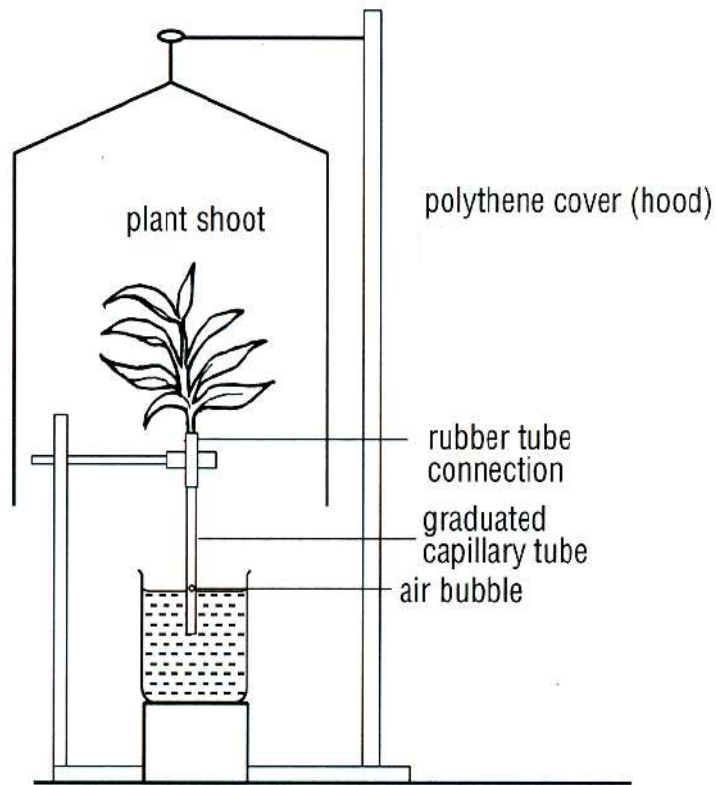
What are X and Y, and to which parts of the patient are R and S connected?

	X	Y	R	S
A	dialysis fluid	lymph	artery	vein
B	lymph	dialysis fluid	vein	artery
C	dialysis fluid	blood	artery	vein
D	blood	dialysis fluid	vein	artery

- 20 The diagram below shows part of a tissue. The arrows show movement of fluids. At which point is the pressure highest?









- 21 An experiment was set up as shown in the diagram below.



What is likely to happen to the air bubble during the experiment?

- A** Falls slightly due to no wind and no light.
- B** Rises slightly due to low humidity and no wind.
- C** Remains the same due to low humidity and no light.
- D** Remains the same due to high humidity and no wind.

For questions 22 and 23, refer to the results of blood group testing of three people, John, Jacob and Jennifer, shown below.

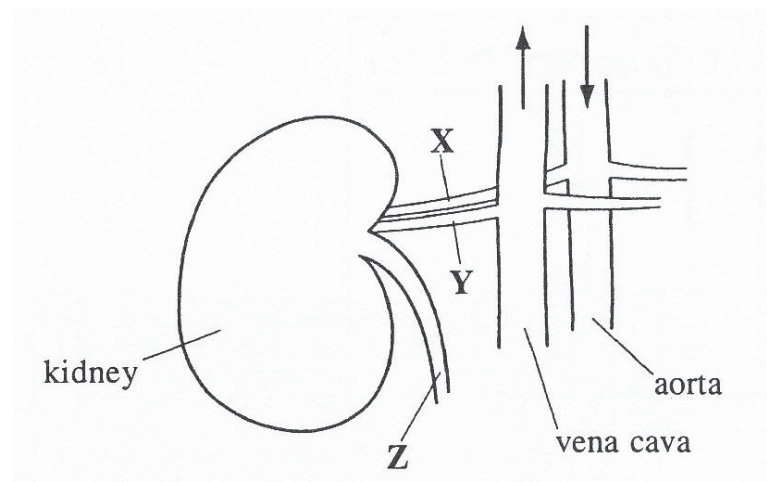
Blood of person	X	Y	Z
Serum from blood of group A	 clumps	 clumps	 no clumping
Serum from blood of group B	 no clumping	 clumps	 no clumping

- 22 To which blood group does each belong?

	John	Jacob	Jennifer
A	A	B	AB
B	B	AB	O
C	AB	A	B
D	O	AB	A

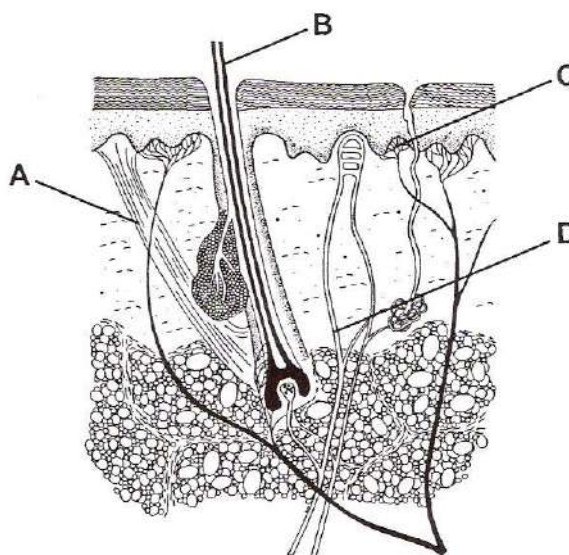
- 23 What causes the red blood cells of John to clump when his blood is mixed with serum from group A?
- A Antibody a in the serum reacts with antigen A on the red blood cells.
 B Antibody a in the serum reacts with antigen B on the red blood cells.
 C Antibody b in the serum reacts with antigen B on the red blood cells.
 D Antibody b in the serum reacts with antigen A on the red blood cells.

- 24** Long term kidney failure can be treated by introducing sterile dialysis fluid into the abdominal cavity. The fluid is drained and replaced regularly using a tube inserted surgically through the abdominal wall. Why does this method work well?
- A** It is because osmoregulation and excretion are achieved by diffusion between the blood in the abdominal capillaries and the dialysis fluid.
- B** It is because osmoregulation and excretion are achieved by the active transport of ions, water and urea between the abdominal capillaries and the dialysis fluid.
- C** It is because the fluid is in direct contact with the kidneys and urea so that excess ions can pass into it without being filtered by the glomeruli.
- D** It is because the fluid is in direct contact with the liver and the large intestine so that waste and excess ions can pass into it from these organs.
- 25** The diagram shows the structures associated with a human kidney. What are the relative concentrations of urea in X, Y and Z?

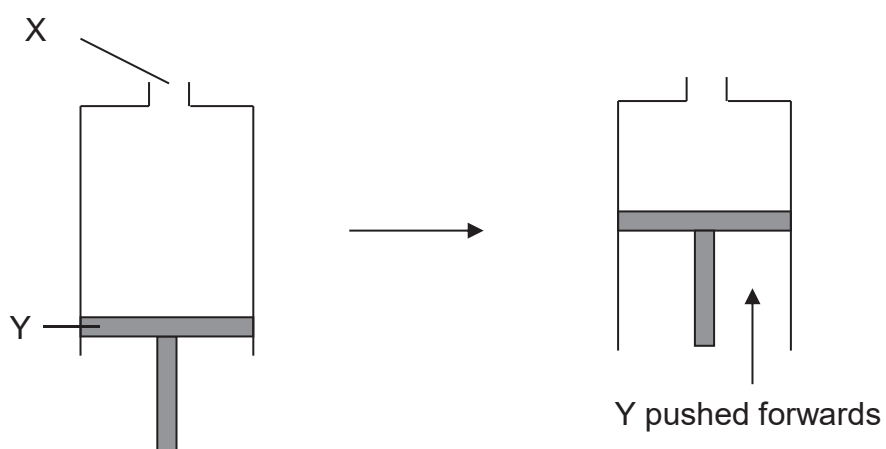


	X	Y	Z
A	high	low	high
B	high	low	low
C	low	high	high
D	low	high	low

- 26** A person walks into a very cold room. Shortly afterwards the hairs on their skin are raised. Which labelled structure is included in the first stage of this reflex?



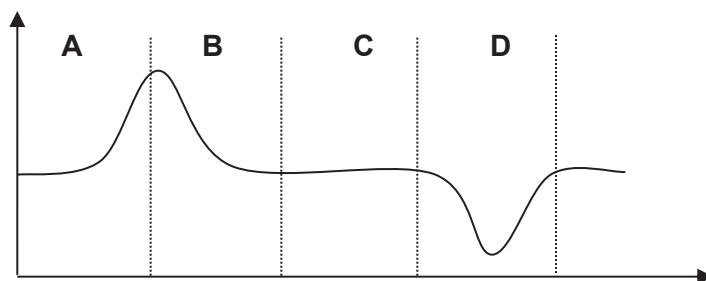
- 27** The following diagrams show models which demonstrate the actions of a set of muscles used during breathing.



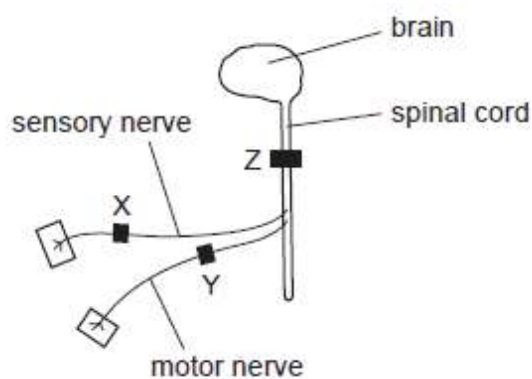
Which structures in the human thorax are represented by parts X and Y on the model and what process is exhibited as Y is pushed upwards?

	X	Y	process
A	bronchus	ribs	inhalation
B	bronchus	diaphragm	exhalation
C	trachea	ribs	inhalation
D	trachea	diaphragm	exhalation

- 28 The graph below shows changes in a person's internal body temperature over a period of time. During which period would the arterioles supplying blood to surface capillaries first become dilated?



- 29 The diagram shows part of the central nervous system where X, Y and Z indicate possible positions to apply an anesthetic block. The anaesthetics are not applied simultaneously at all locations.



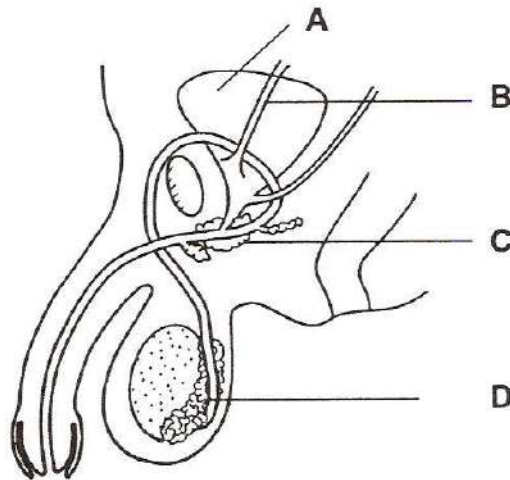
A person's hand is pricked by a pin.

Which of the following correctly describes the effects when an anesthetic block is applied at X and Y respectively?

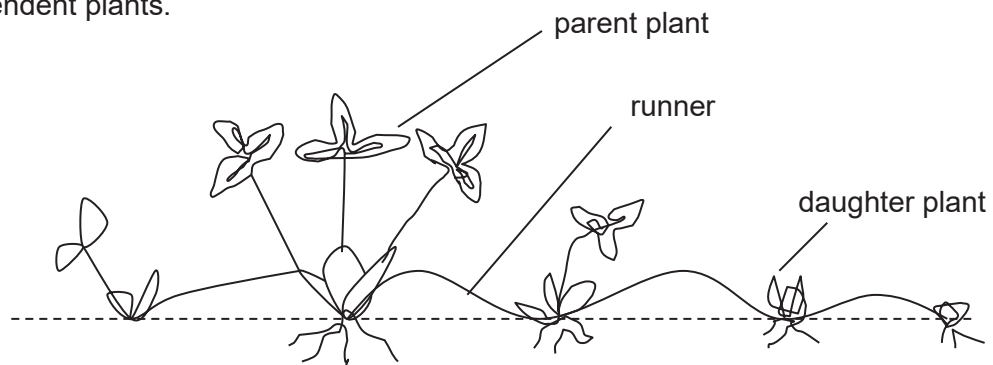
	X		Y	
	pain felt	arm moved	pain felt	arm moved
A	x	✓	✓	x
B	x	✓	x	✓
C	✓	x	✓	x
D	✓	x	x	✓

key: ✓ true x not true

- 30 The diagram shows the male reproductive system and part of the urinary system. Which labelled part stores passive sperms?



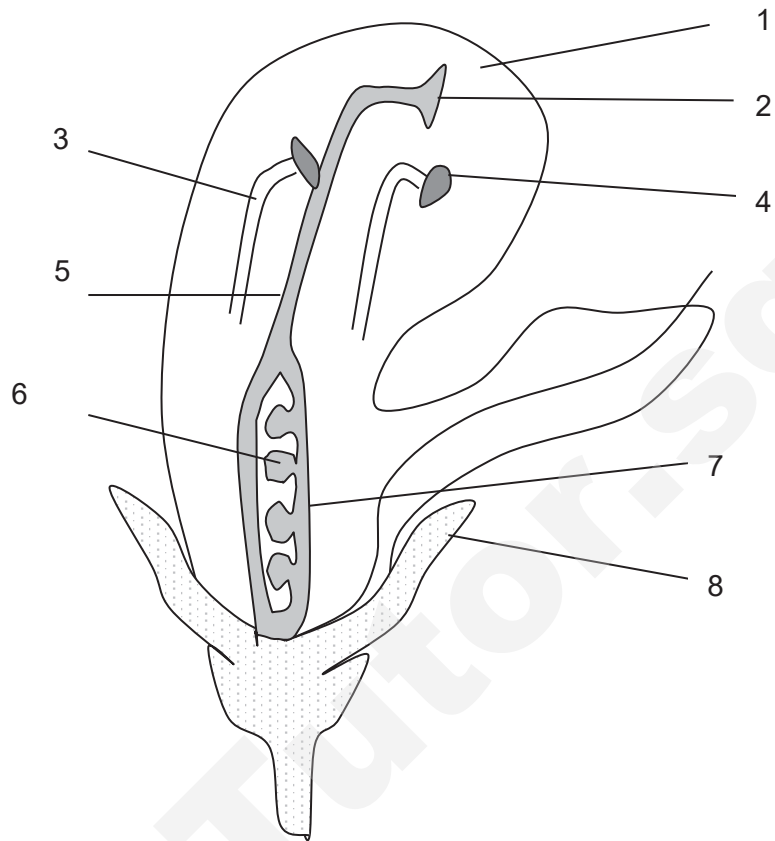
- 31 Some species of plant reproduce vegetatively by producing slender side-shoots called runners, which grow along the ground surface and roots at the nodes as shown in the diagram below. Eventually, the runner decays, leaving the rooted parts to develop as independent plants.



In which of the following ways may this method of reproduction have an advantage over reproduction by seed?

- A The offspring are identical to the parent and are able to survive well in the same environment as the parent plant.
- B Rapid growth of the runners will ensure a much wider range of dispersal.
- C There is no possibility of a mutation occurring to give offspring of a different genotype.
- D Those plants which compete with this species will have less chance of becoming established nearby.

- 32** The diagram below shows the structure of an insect-pollinated flower.



Which of the following is the adaptation of the above flower to bring about insect pollination?

- A** 5 is longer than 3.
- B** 1 is big and brightly coloured.
- C** 8 is small and green in colour.
- D** 3 is long and pendulous.

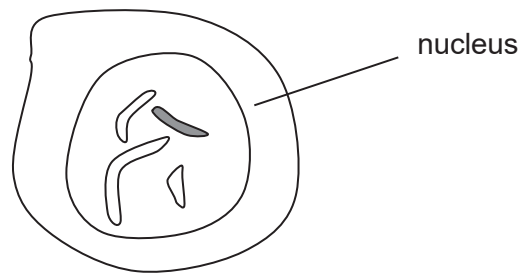
- 33 The table below shows the relative amounts of DNA found in different cells.

animal	sperm cell/arbitrary units	blood cell/arbitrary units
chicken	1.3	2.5
frog	3.7	7.3
human	3.3	7.3
trout	2.7	5.8

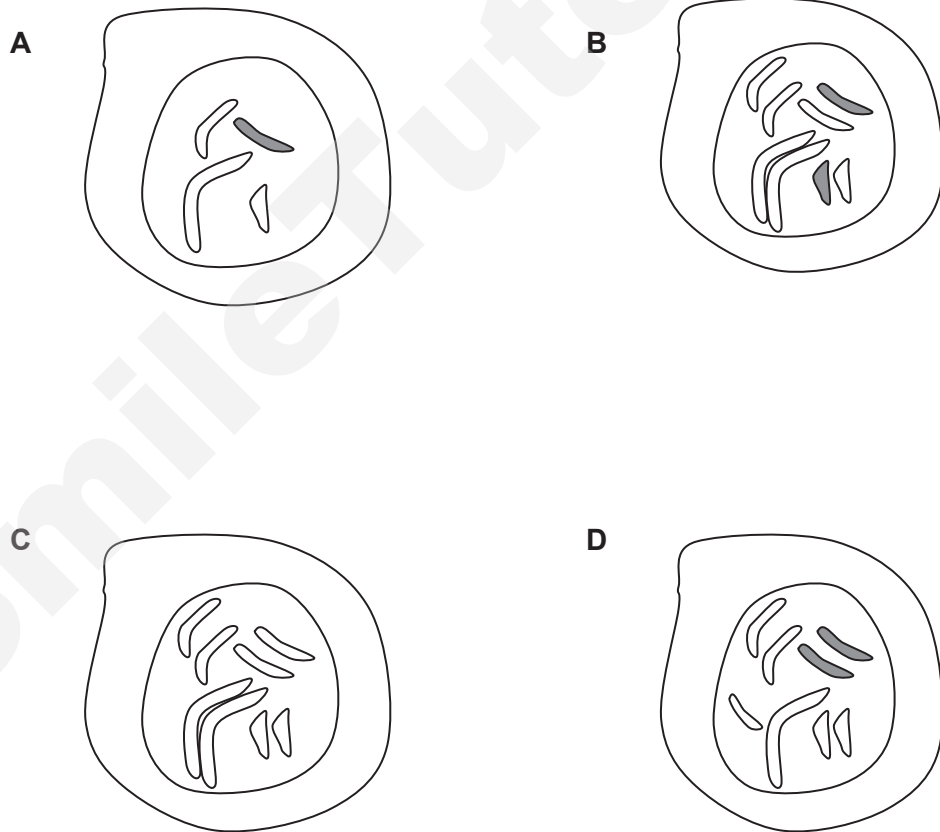
Which of these conclusions is **incorrect**?

- A The amount of DNA in each cell is in proportion to the size of the animal.
- B Not all animals have the same amount of DNA.
- C The sperm cells have roughly half the number of chromosomes found in blood cells.
- D The amount of DNA in the same type of cells varies from animal to animal.

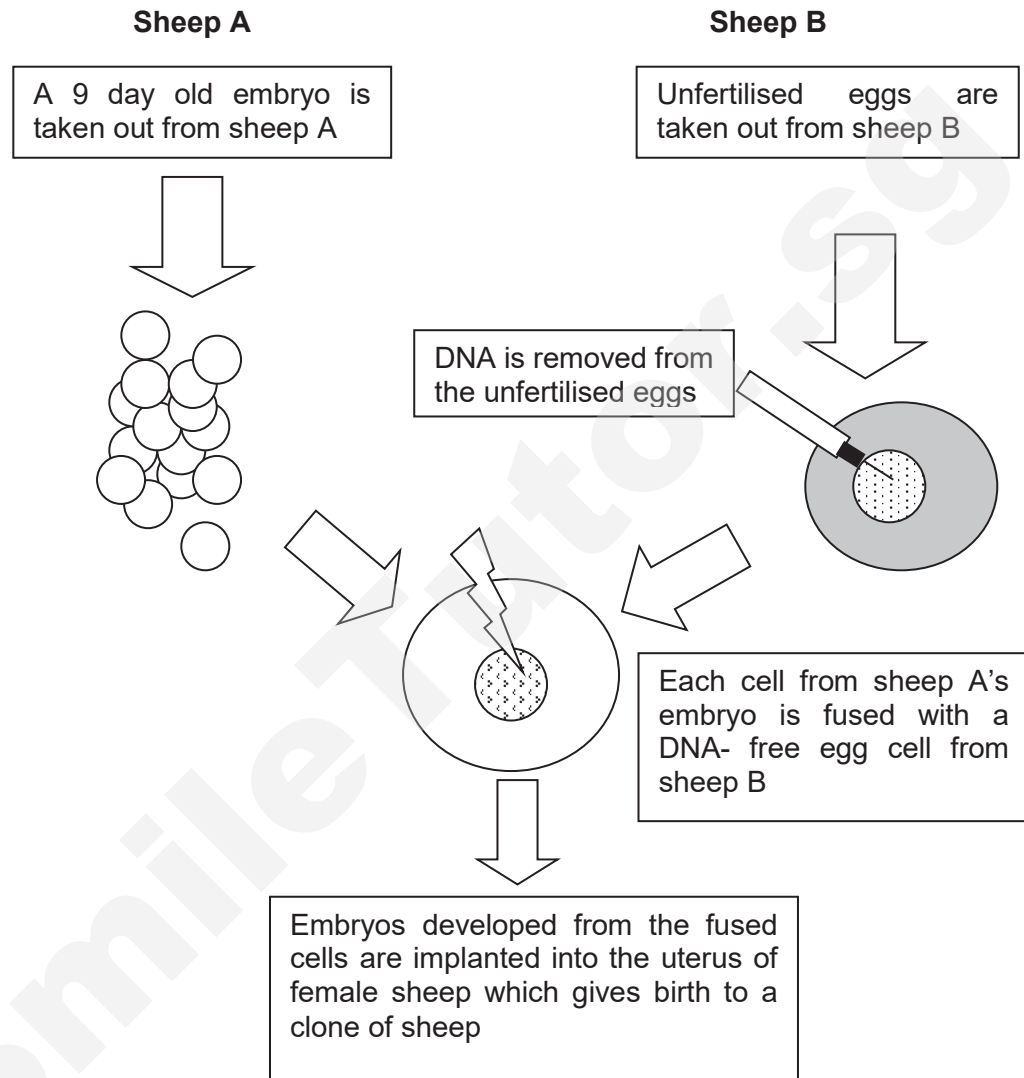
- 34 The diagram below shows the nucleus of a sex cell of an organism.



What would become of the nuclear contents after fertilisation?



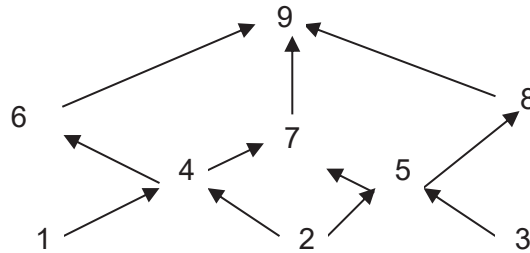
- 35 The diagram below outlines how a clone of sheep were produced from a mother sheep.



Which of the following statements states that the above process is asexual reproduction?

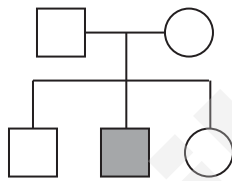
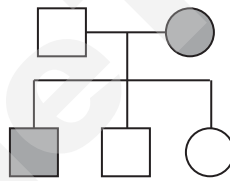
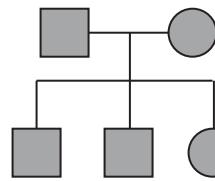
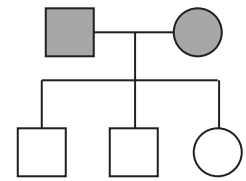
- A** No gametes are produced by sheep A.
- B** Sheep A and sheep B have not mated.
- C** The unfertilised egg obtained from sheep B contains haploid number of chromosomes.
- D** No fusion of gametes is involved in the production of the clone.

- 36 The diagram shows nine organisms forming a food web. Which of the organisms is a producer and which is a carnivore?

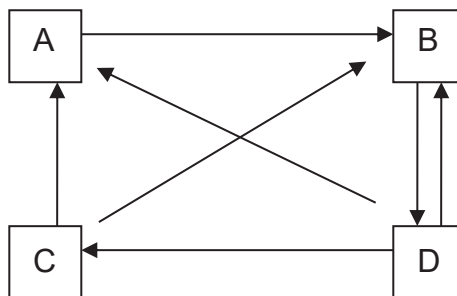


	producer	carnivore
A	1	4
B	2	6
C	5	8
D	7	9

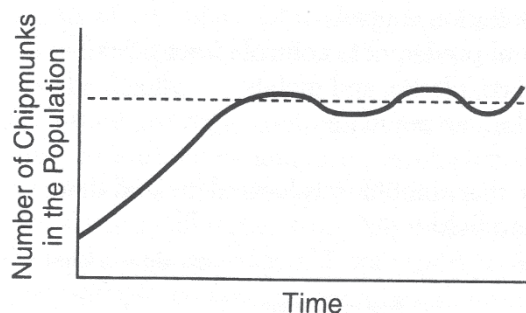
- 37 Which of the following pedigree diagrams may conclusively prove that the ability to roll the tongue (unshaded) is a dominant characteristic?

**A****B****C****D**

- 38 The diagram represents the cycling of carbon through the atmosphere, consumers, decomposers and producers in an ecosystem. Which box represents organisms whose growth rate would be increased by a rise in levels of atmospheric carbon dioxide?



- 39 A population of chipmunks migrated to an environment where they had little competition. Their population quickly increases but eventually stabilised as shown in the graph. Which statement best explains why the population stabilised?



- A A predator species came to an area and occupied the same niche as the chipmunks.
- B An increase in the chipmunks population caused an increase in the producer population.
- C Interbreeding between members of the population increased the mutation rate.
- D The population size became limited due to factors such as availability of food.
- 40 Consider the food chain below :

Tree → caterpillar → birds → protozoa

Which of the following correctly illustrates the pyramid of biomass and pyramid of numbers?

	pyramid of biomass	pyramid of numbers
A		
B		
C		
D		

SmileTutor.sg

Name: ()

Class: Sec 4A

Queenstown Secondary School



Preliminary Examination 2019 Secondary Four Express Biology 6093/02

**3 September 2019
Tuesday**

**Time: 1045 – 1230h
Duration: 1 hour 45 minutes**

Additional Materials: Question Paper
Graph paper (1 sheet)

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Section A

Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.

Section B

Answer all **three** questions, the last question is in the form either/or.
Answer all questions in the spaces provided.

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.

Examiner's Use	
Section A	/50
Section B	/30
Q8	
Q9	
Q10	
TOTAL	/80

Section A

Answer **all** questions.

Write your answers in the spaces provided.

- 1 An experiment was carried out with a plant over a period of three days to measure the rate of water uptake by the plant. The table below shows the rate of the uptake of water during the three days.

Day	Time (Hour)	Rate of Water Uptake (<i>ml</i> /hour)
Day 1	1200	10
	2400	4
Day 2	1200	16
	2400	4
Day 3	1200	9
	2400	4

- (a) Using the information obtained from the table above, account for the rate of water uptake at midnight each day.

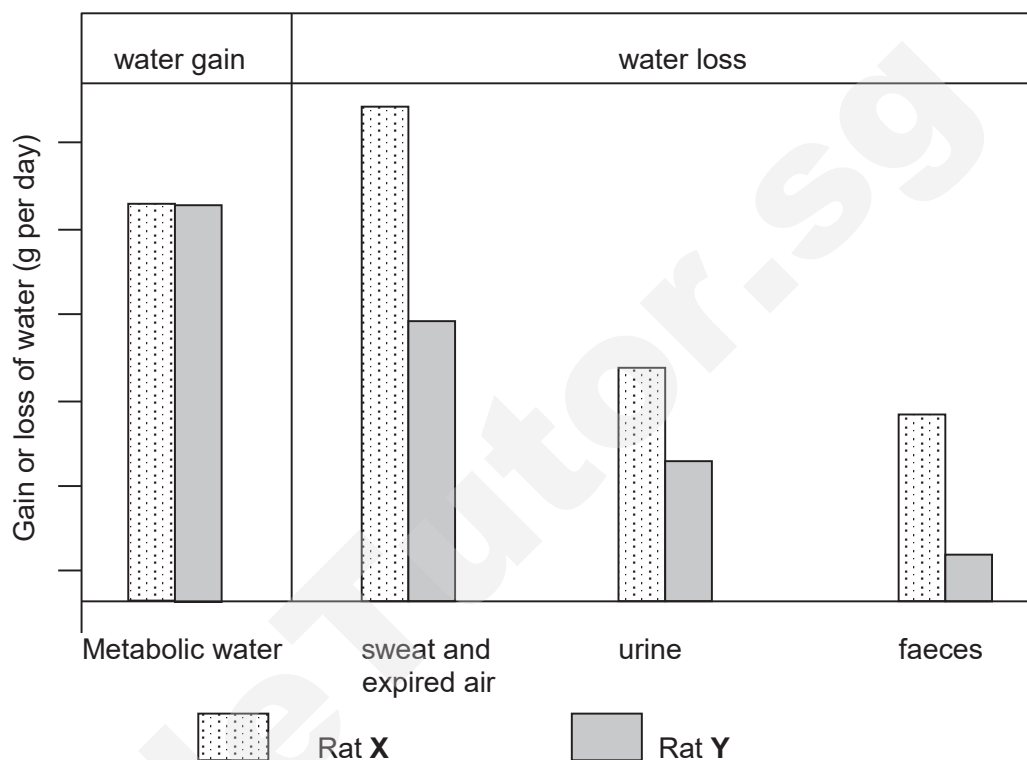
[2]

- (b) Suggest a reason for the difference in the rate of water uptake at 1200 on the three days.

[3]

[Total: 5]

- 2 Two rats **X** and **Y**, of equal weight but belonging to different species, were given the same amount of food. They were kept in the same environmental conditions inside the laboratory for three days. The average daily gain and loss of water by each rat is shown in the following chart:



- (a) State **two** environmental conditions that should be kept constant during the experimental period.

[2]

- (b) (i) Briefly describe **one** way by which the rats obtain metabolic water.

[1]

- (ii) What will be the result if the rats fail to maintain the water balance?

.....
 [1]

- (c) If rat **X** is forced to do vigorous exercise, what will be the change in the amount of water lost in each of the three waste products? Explain your suggestion.

.....

 [2]
 [Total: 6]

3 Fig. 3.1 shows a food chain and the energy flow through it.

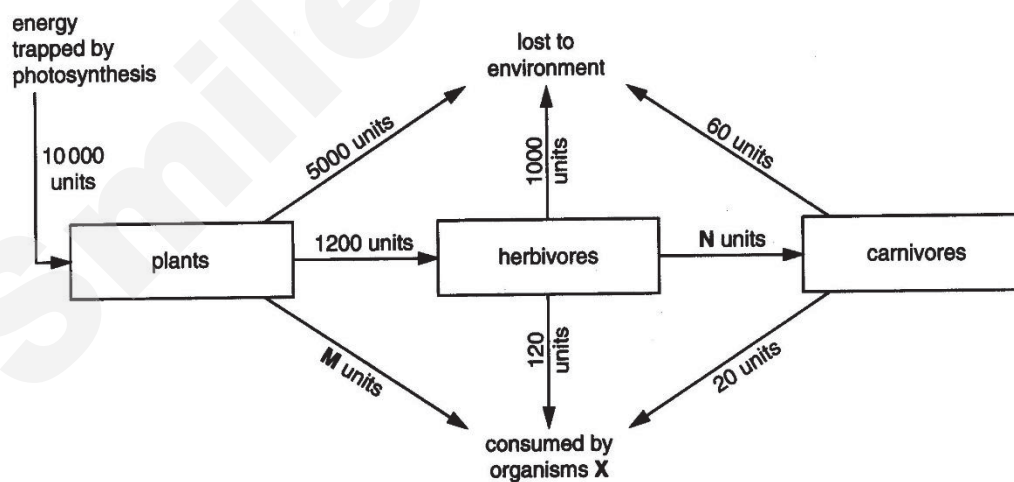


Fig. 3.1

- (a) Calculate the energy values **M** and **N**.

M: [1]

N: [1]

- (b) Which group of organisms might **X** belong to?

----- [1]

- (c) Suggest **two** processes that might account for the loss of energy from the organisms to the environment.

----- [2]

- (d) Suggest why the herbivores lose more energy to the environment than the plants.

----- [2]
[Total: 7]

- 4 Photomicrograph **X** shows the transverse section of the reproductive part of a plant. Photomicrograph **Y** shows a magnified image of the cells found in the reproductive structure.

Photomicrograph **X**Photomicrograph **Y****Fig 4.1**

- (a) Identify structures **X** and **Y**.

X: [1]

Y: [1]

- (b) (i) Name the type of cell division involved in the production of cells shown in photomicrograph **Y**.

..... [1]

- (ii) Explain the significance of the type of cell division you mentioned in (b) (i).

.....

 [3]

- (c) From the structure of **Y**, suggest how it is transferred from one reproductive structure to another. Give a reason for your answer.

----- [2]

- (d) Describe **one** similarity and difference between structure Y in plant and human.

similarity ----- [1]

difference ----- [1]

[Total: 9]

- 5 Fig. 5.1 below are two graphs showing potassium and bromide ion uptake in dandelion roots.

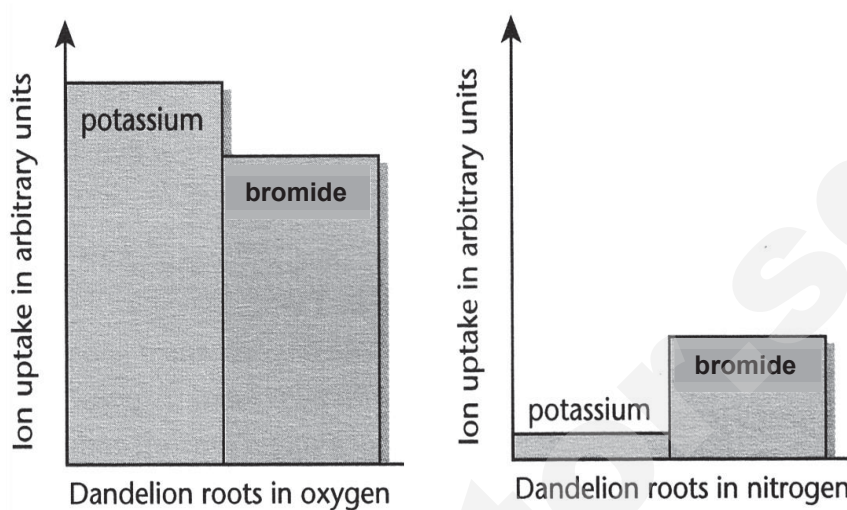


Fig. 5.1

- (a) State **two** processes in which the ions are taken up by the plants.

----- [2]

- (b) From the findings as shown in the graphs above, explain the difference in the absorption of the ions between the two processes.

----- [2]

- (c) Potassium and bromide ions are absorbed into the plants by the roots. Explain briefly the adaptations of the root hairs in order to carry out its function.

[2]

- (d) Outline the route taken by the bromide ions as it travels from the roots to the leaves.

[3]

[Total: 9]

- 6 In humans, the inherited disease, Huntington's chorea, is caused by a dominant allele. Answer the questions with reference to the following pedigree:

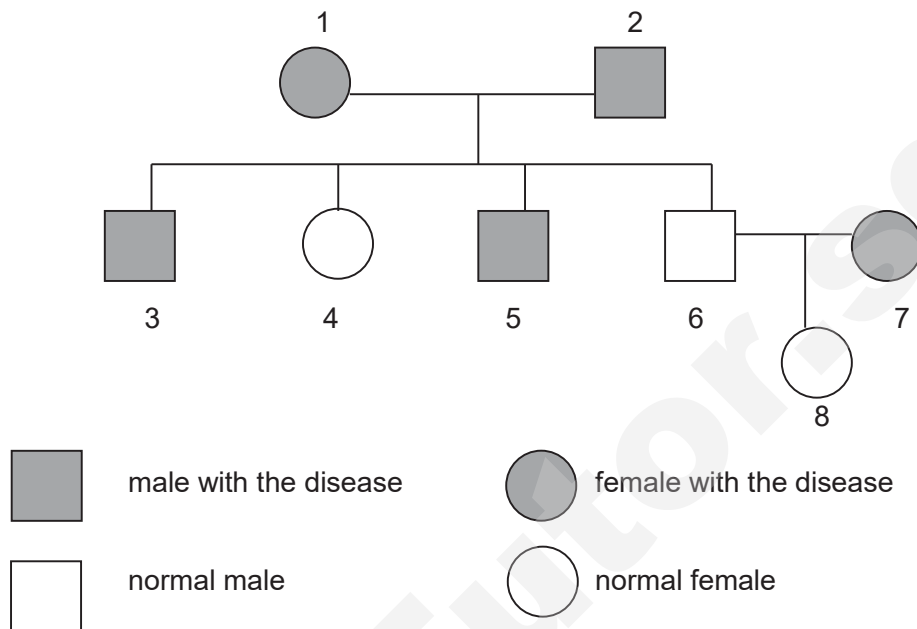


Fig. 6.1

- (a) From the information given in Fig. 6.1, deduce the genotypes of individuals 1 and 2. Explain how you arrive at your answer.

individual 1: _____ [1]

individual 2: _____ [1]

explanation:

 _____ [1]

- (b) What is the chance of a second child of the couple **6** and **7** being normal?
Explain your answer with the help of a genetic diagram.

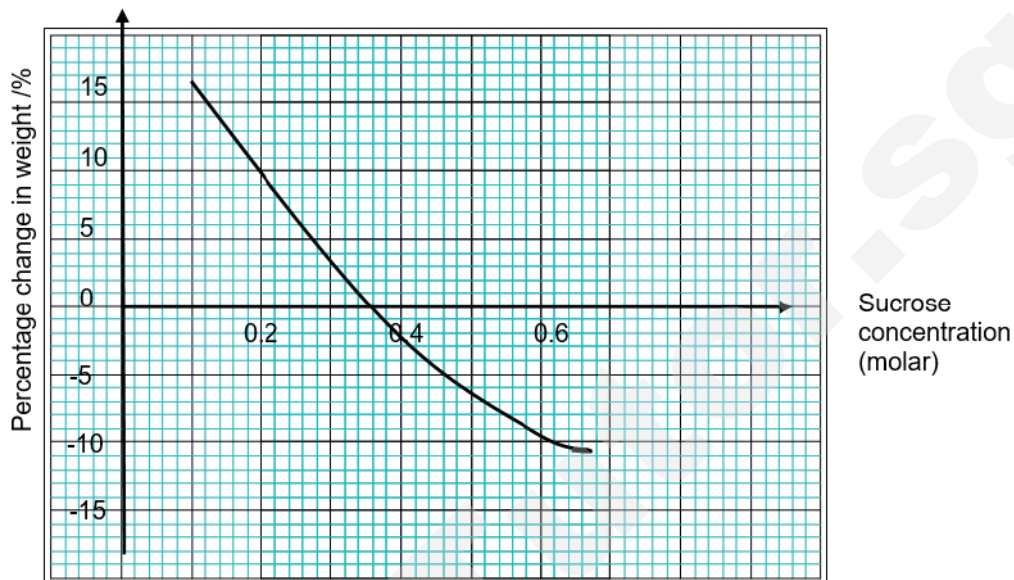
[5]

- (c) Suggest, if any, the possibility that individual **4** will have a child with the Huntington chorea if she is married to a normal man.

[2]

[Total: 10]

- 7 The following graph shows the result of an experiment where strips of potato of similar shape and size were immersed in sucrose solutions of different concentrations.



- (a) If the average initial mass of each potato strip is 3.2g, what is the average final mass of the potato strip that has been immersed in the 0.5M sucrose solution?

[2]

- (b) What is the water potential of the potato cell sap in terms of the concentration of the sucrose solution? Give a reason for your answer.

[2]

[Total: 4]

Section B

Answer **three** questions in this section.

Q10 is in the form of an ***Either / Or*** format. Only one part should be answered.

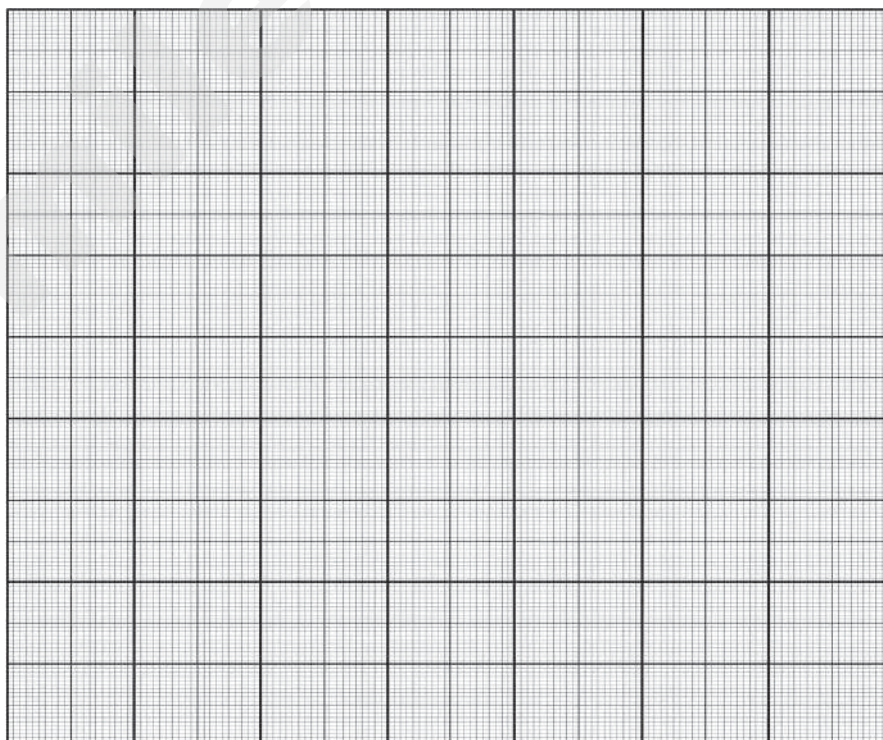
- 8 Two different types of haemoglobin were extracted from a pregnant woman. The percentage saturation of haemoglobin with oxygen is a measure of how readily the haemoglobin binds with oxygen.

Table 8.1 shows the percentage saturation of haemoglobin at different partial pressure of oxygen.

Table 8.1

Partial Pressure of oxygen / Kpa	0	2	4	6	8	10	12
% saturation of fetal haemoglobin	0	20	56	80	90	94	98
% saturation of normal haemoglobin	0	12	36	66	82	90	96

- (a) Plot the percentage saturation of fetal and normal haemoglobin at different partial pressure of oxygen on the grid.



[4]

- (b) Using the graph above, describe and explain the trend shown by the fetal haemoglobin and normal haemoglobin at different pressures of oxygen.

[3]

- (c) Describe how the fetus obtains oxygen from the mother during the development of the fetus.

[3]

[Total: 10]

- 9 (a) The disease diabetes occurs commonly among obese people. One of the symptoms is the presence of glucose in the urine. Describe a test to check for the presence of glucose in the urine of diabetics.

[2]

- (b) Diabetics are usually treated with daily insulin injections. Until recently, the insulin used to treat diabetics was extracted from animals. Nowadays, genetically engineered insulin is used widely for the treatment of diabetes.

- (i) Use your knowledge of the basic principles of genetic engineering to explain how genetically engineered insulin is produced.

[6]

- (ii) Suggest **two** advantages of using genetically engineered insulin to treat diabetes as compared to the insulin extracted from animals.

[2]

[Total: 10]

10 EITHER

- (a) Describe the main stages in the menstrual cycle of an unmarried female. Explain how hormones help in controlling this cycle.

[6]

- (b) "Upon successful fertilisation in a female mammal, the uterus plays a very important role in the development of the embryo till its birth." How true is this statement?

[4]

[Total: 10]

10 OR

- (a) 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 though thick gloves, socks and shoes are worn.

[5]

- (b) Explain why our body shiver in cold conditions and perspire in hot weather conditions.

[5]

[Total: 10]

2019 Pure Biology 6093 Preliminary Examination
Answers

Paper 1

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

Section A (50 marks)
Answer all questions in the spaces provided.

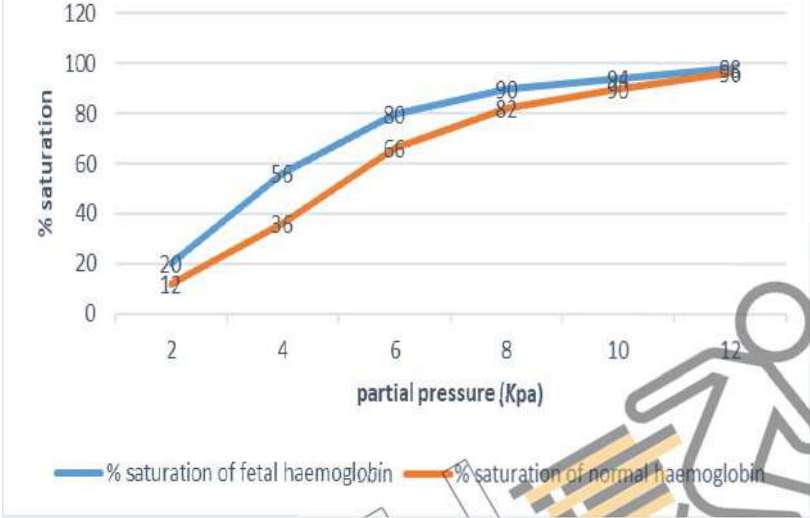
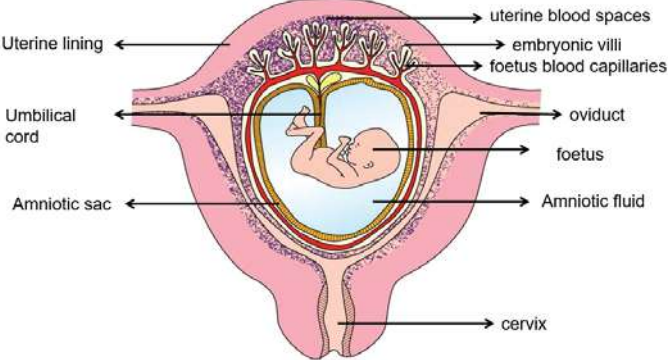
No.	Answers	Marks
1.		
a.	Rate of water uptake for all three days are same at 4ml/hr [1] Reason: Lower temperature at midnight so loss of water to the surrounding is also low [1] and therefore the plant will take in less water.[1] OR There is no light at midnight so no photosynthesis takes place, stomata closes, less water lost to the surrounding therefore plant take in less water[1]	2
b.	The rate of water uptake is higher at 1200 on day 2 compared with day 1 and day 3. [1] It could be due to the higher temperature/lower humidity/more windy on day 2 as compared to the other two days [1] As a result, the plant loses more water through transpiration leading to the increase in water uptake. [1]	3
2.		
a.	Any two environmental conditions: same habitat[1], temperature of surrounding [1], amount of water given to rat[1], humidity[1], type of food [1], amount of oxygen[1]	2
(b) (i)	from respiration – water is the byproduct <i>metabolic waste comes from metabolic reactions takes place in living cells like respiration, deamination of amino acids, digestion is not metabolic reactions</i>	1
(ii)	The cells will either crenated or burst	1
b.	Amount of sweat increase Reason: to remove heat from the body so to reduce body temperature Volume of urine decreases, concentration of urine increases, Reason: so to maintain stable water potential in blood Faeces become hard Reason: water reabsorbed from undigested waste [1 mark describe change] [1 mark to explain the reason]	2
3.		
a.	M: 3800 units[1] $(1000-(5000+1200))= 3800$ units N: 80 units [1] $(1200-(1000+120)) = 80$ units	2
b.	decomposer	1
c.	Any two points: Heat during respiration, uneaten body parts, removal of undigested waste, removal of excretory products like urea	2
d.	The greatest amount of energy is already lost during a transfer from producer to herbivore so there is less energy available to the herbivore. [1] As a result, the herbivore loses less energy to the surrounding as energy is required to carry out living processes like respiration, growth etc.[1]	[1] [1]
4.		
(a)	X: anther [1] Y: pollen grains [1]	2

(b)(i)	Meiosis[1]	1
(b) (ii)	To produce haploid gametes [1] so when gametes fuse, the diploid number is restored, this helps to maintain the normal diploid number of chromosome To produce variation in species [1] variations occur when crossing over and independent assortment of chromosomes variations increase the chance of survival of species during change in environment [1]	3
(c)	Pollinated by insects [1]; small with hairs which look like hooks to cling to legs of insects [1] OR Pollinated by wind [1]; small and numerous [1]	2
(d)	Similarity: both are sex gametes Different :male sperms have tail swim to the egg can move independently but pollen are carried by agent	1 1

5.		
a.	Diffusion [1] Active transport [1]	2
b.	Absorption of the ions are greater in the presence of oxygen [1] which means besides normal diffusion of ions, active transport increases the uptake of the ions because it requires energy to take place[1] <i>** active transport can take place simultaneously with diffusion</i>	2
c.	Roots are small and numerous which increases surface area to volume ratio [1]. This increases surface area for absorption of ions into the roots [1]	2
d.	From roots, bromine diffuses into the root cells [1] then enter the xylem vessels [1] which brings the bromine to the leaves. Transpiration pull provide pulling force to move bromide from stem to leaves [1]	3
6.		
a.	Individual 1: Hh [1] Individual 2: Hh [1] Explanation: From the crossings of heterozygous parents, 50% of the offsprings are carriers and 50% have normal genotype. [1]	3
b.	<div style="text-align: center;"> Parent Genotype [1] Hh x hh Gametes [1] (H) (h) (h) (h) F1 genotype[1] Hh Hh hh hh Phenotype ratio [1] 1(normal): 1(huntington) </div> <p>The chance of second child from couple 6 and 7 to be normal is 50%. [1]</p>	5
c.	Not possible. [1] A normal individual will have a homozygous recessive genotype so if individual 4 who is also homozygous recessive marries the normal individual, there will no gene for Huntington disease [1]	2

7		
a.	% change in mass -6.5% Change in mass $6.5/100 \times 3.2 = 0.208\text{g}$ [1] Final mass $3.2 - 0.208 = 2.299\text{g}$ [1]	2
b.	0.36M sucrose solution [1] no change in final mass as no net movement of water/ similar water pot in cell sap and solution[1]	2

Section B (30 marks)

No.	Answers	Marks																					
8																							
a.	<p>percentage saturation of fetal and normal haemoglobin at different partial pressure of oxygen</p>  <table border="1"> <thead> <tr> <th>partial pressure (Kpa)</th> <th>% saturation of fetal haemoglobin</th> <th>% saturation of normal haemoglobin</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>20</td> <td>12</td> </tr> <tr> <td>4</td> <td>56</td> <td>36</td> </tr> <tr> <td>6</td> <td>80</td> <td>66</td> </tr> <tr> <td>8</td> <td>90</td> <td>82</td> </tr> <tr> <td>10</td> <td>94</td> <td>90</td> </tr> <tr> <td>12</td> <td>96</td> <td>96</td> </tr> </tbody> </table> <p>Accuracy points plotted [1]; Best Fit line [1]; Accurate labeling of axes [1]; Correct scale [1]</p>	partial pressure (Kpa)	% saturation of fetal haemoglobin	% saturation of normal haemoglobin	2	20	12	4	56	36	6	80	66	8	90	82	10	94	90	12	96	96	4
partial pressure (Kpa)	% saturation of fetal haemoglobin	% saturation of normal haemoglobin																					
2	20	12																					
4	56	36																					
6	80	66																					
8	90	82																					
10	94	90																					
12	96	96																					
b.	<p>The fetal haemoglobin shows a higher % saturation of oxygen compared to normal haemoglobin [1]</p> <p>Fetal haemoglobin binds more readily to oxygen than normal haemoglobin[1]</p> <p>As result, fetal haemoglobin can take more oxygen from the maternal blood spaces [1]</p>	3																					
c.	<p>The fetal blood capillaries are separated from the mother's blood by maternal blood spaces / a thin layer of tissue in the placenta.[1]</p> <p>The oxygen concentration in mother's blood is higher than the fetal's blood.[1]</p> <p>Oxygen from the mother's blood diffuses into the blood spaces / layer of ten issue and then into the fetal's blood.[1]</p> 	3																					

9.		
a.	Describe Benedict's/Fehling's solution test Add a few drops of Benedict's reagent to the urine sample in a test-tube. [1] Place the test-tube in boiling water bath for about ten minutes. If reducing sugar is present in the urine sample, orange red precipitate will form otherwise the Benedict's solution remains blue. [1]	2
b.	(i) <ul style="list-style-type: none"> insulin gene is taken from human chromosome the gene is cut with restriction enzyme which produces the sticky end Obtain a plasmid in bacteria cut using same restriction enzyme, this produces the complementary sticky ends Mix the DNA fragment and the plasmid. insulin gene inserted into plasmid using DNA ligase Mix the plasmid with E.coli bacteria. Apply heat shock to open up the pores in the cell membrane for the plasmid to enter. Bacteria will use the new gene to make insulin Bacteria can be isolated and grown in fermenters to produce large amounts of insulin 	6
	(ii) any two reasons <ul style="list-style-type: none"> reduced cost of medicine so more patients have access to insulin faster production as bacteria multiply faster no life is harmed as it is obtained from bacteria 	2
10	<u>Either</u>	
a.	Day 1-5 : menstruation due to cessation of progesterone from corpus luteum, FSH secreted by pituitary gland Day 6-13 : FSH stimulates forming of follicles , Graafian follicle secretes oestrogen, effects of oestrogen: causes repair of uterine lining, inhibits FSH, stimulates pituitary gland to secrete luteinising hormone (LH) Day 13-15: LH causes ovulation and causes formation of corpus luteum. Corpus luteum ruptures and releases egg into oviduct, Corpus luteum secretes progesterone Day 16-28 : Uterine lining continues to thicken with blood capillaries, preparing for fertilised egg, inhibits ovulation, inhibits FSH production If no fertilization, progesterone continues to increase, inhibits LH, corpus luteum breakdown, progesterone level drops, uterus lining breakdown and the whole cycle repeats	6
b.	Any the four points above below: <ul style="list-style-type: none"> Wall of uterus filled with blood & nutrients for implanted embryo – providing embryo with cushion, protection & food[1] Formation of placenta in wall of uterus to provide foetus with oxygen and food & to remove carbon dioxide & waste from it;[1] Amnion & amniotic fluid in uterus space to protect foetus from physical harm & fluctuations in temperature; [1] Contractions of wall of uterus to help push foetus out of vagina during birth[1]. 	4

10	OR	
a.	<p>In cold weather, blood vessels near the skin surface constrict thus reducing blood flow to prevent heat loss to the surrounding [1] so to preserve the core body temperature;[1]</p> <p>In prolonged cold weather, prolonged vascular contraction will cut blood supply to the surface of skin. [1]</p> <p>Thus fingers and toes which are near the surface of skin may be deprived of nutrients and oxygen which may lead to further heat loss and cell death [1]</p> <p>Thick gloves, socks and shoes may not able to maintain core body temperature over prolonged cold weather because poor blood circulation, low activity rate [1]</p>	5
b.	<p><u>Cold weather:</u></p> <p>Drop in temperature of the blood detected by hypothalamus;[1]</p> <p>Impulses sent to muscles which contract violently to produce heat;[1]</p> <p>Body temperature return to normal[1/2]</p> <p><u>Hot weather:</u></p> <p>Increase blood temperature detected by hypothalamus;[1]</p> <p>Impulses sent to sweat glands to produce more sweat; Sweat evaporated, more heat loss[1]</p> <p>Body temperature return to normal [1/2]</p>	5

Name	Class	Index Number

UNITY SECONDARY SCHOOL

PRELIMINARY EXAMINATIONS 2019

SECONDARY FOUR EXPRESS



BIOLOGY 6093/01

18 SEPTEMBER 2019

PAPER 1

1 HOUR

Additional Materials : **Optical Answer Sheet**

READ THESE INSTRUCTIONS FIRST

This paper consists of **40** Multiple Choice Questions.

Answer **ALL** questions. For each question, there are four possible answers, **A**, **B**, **C** and **D**. Choose the most appropriate answer and shade on the Optical Answer Sheet (OAS) provided.

Write your name, class and shade your register number in the spaces on the OAS.

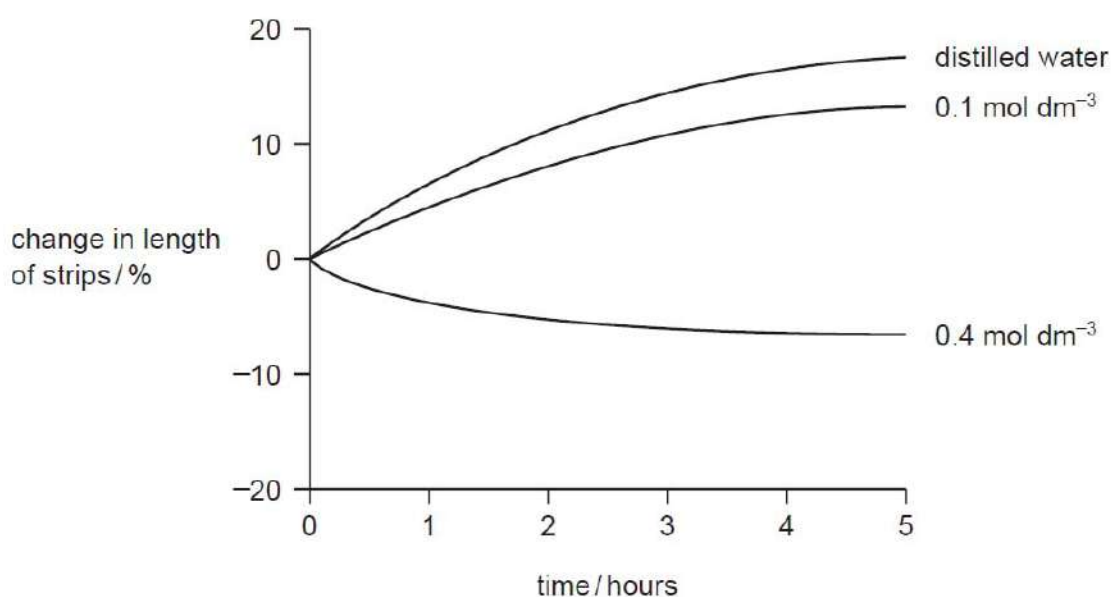
Do not fold nor use any correction fluid on the OAS. Read the instructions on the OAS carefully.

The total number of mark for this paper is 40 marks.

This paper consists of **19** printed pages, including this cover page.

Section A: Multiple Choice Questions (40 Marks)

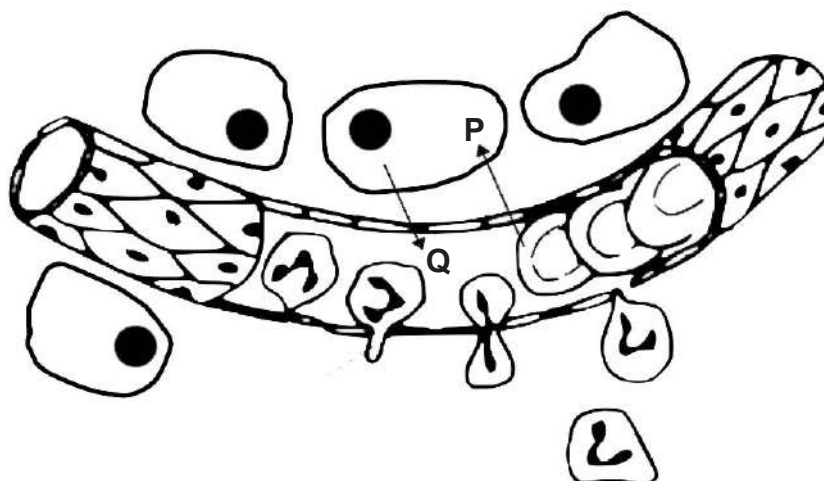
- 1 Mature red blood cells have no nucleus and no mitochondria. Which of the following processes can be carried out by a mature red blood cell?
- A** Aerobic respiration
 - B** Anaerobic respiration
 - C** Cell division
 - D** Protein synthesis
- 2 Strips of potato tuber tissue were immersed in distilled water or in sucrose solutions of different concentrations. The graph shows the percentage change in length of the strips.



Which statement best explains the change that occurred in the potato strips immersed in 0.1 mol dm⁻³ sucrose solution?

- A** Sucrose molecules diffused into the potato cells.
- B** Sucrose molecules were actively transported into the potato cells.
- C** The water potential of the sucrose solution was less than the water potential inside the cells.
- D** The water potential of the sucrose solution was higher than the water potential inside the cells.

- 3 The diagram shows a blood capillary among tissue cells.



Which of the following best describes the movement of key substances in the directions of the arrows **P** and **Q**?

	P	Q
A	CO ₂ ; through diffusion	oxygen; through diffusion
B	water; through osmosis	oxygen; through diffusion
C	oxygen; through diffusion	CO ₂ ; through diffusion
D	oxygen; through diffusion	water; through osmosis

- 4 A student carried out four food tests on a sample. The results are shown below.

test	appearance of sample after test
iodine test	blue black
biuret test	light blue
emulsion test	white emulsion
Benedict's test	green

What did the sample contain?

- A** glucose and protein
- B** glucose and sucrose
- C** starch and proteins
- D** starch and fats

- 5 The enzyme lactase, which breaks down lactose into glucose and galactose, was added to a test tube containing cow's milk.

What would be the result of food tests conducted on this mixture?

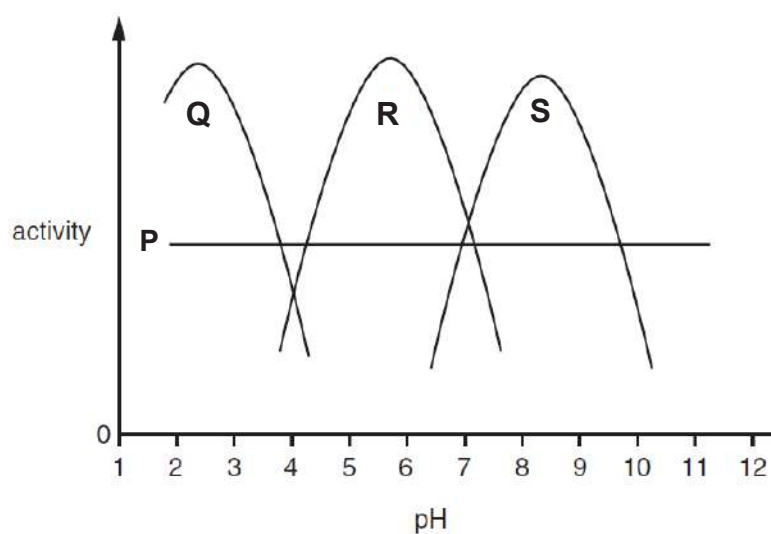
solution	Benedict's test	emulsion test	iodine test	biuret test
A	x	✓	x	✓
B	✓	x	x	✓
C	x	✓	✓	x
D	✓	x	✓	x

key

✓ = positive result

x = negative result

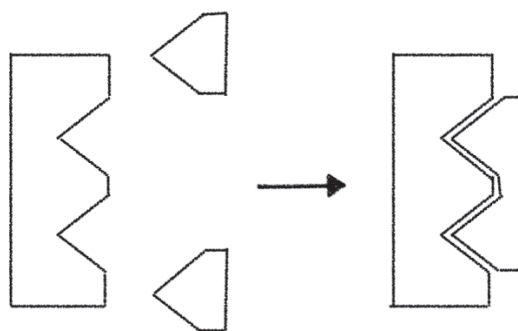
- 6 The graph shows the effect of pH on the activity of four different enzymes.



Which pair of enzymes includes one from the stomach, and one that is **not** affected by pH?

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

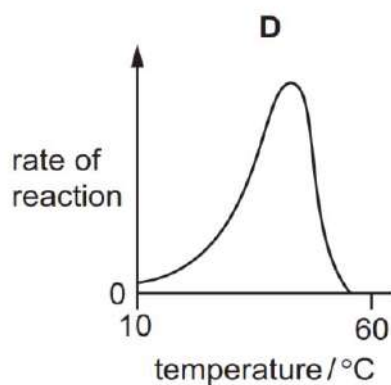
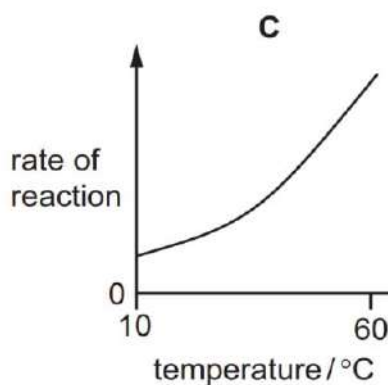
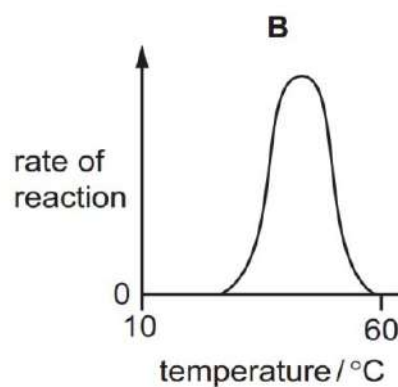
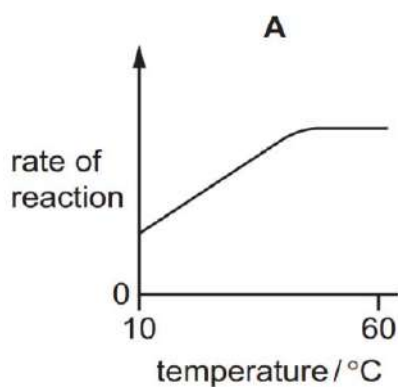
7 The diagram shows an enzymatic reaction.



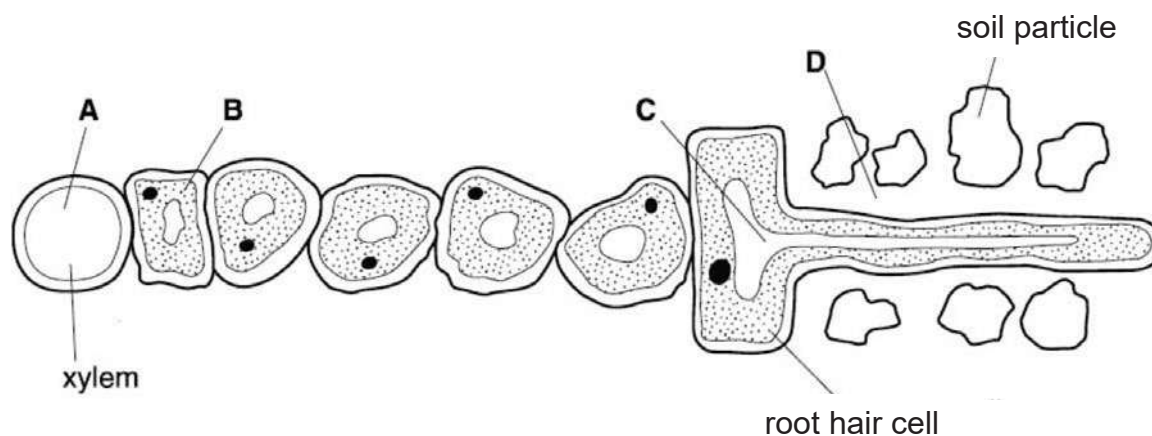
Which of the following biological processes can be illustrated by this diagram?

- A The fermentation of sugar by yeast.
- B The hydrolysis of fats by lipase.
- C The oxidation of glucose in respiration.
- D The synthesis of cellulose cell walls in a plant cell.

8 An enzyme needed for respiration was extracted from bacteria living in natural hot water springs where the water temperature is between 85°C and 95°C. Which graph would represent the relationship between temperature and the rate of bacterial respiration?

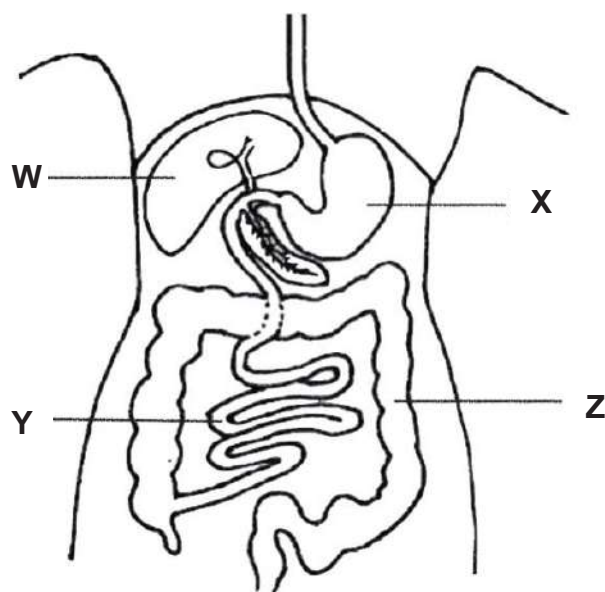


- 9 The diagram below shows part of a plant root in the soil. At which labelled point is the water potential highest?



Use the diagram below to answer questions 10 and 11.

The diagram shows part of the human alimentary canal.



- 10 Which of the following is **not** an accurate match of the organ to its function?

	Organ	Function
A	W	Regulation of blood glucose concentration
B	X	Get rid of bacteria and pathogens in food
C	Y	Absorption of water
D	Z	Absorption of fats

11 Which of the following correctly describes how Organ **Y** is adapted for its function?

	structural feature	function
A	acidic pH	provides optimum pH for intestinal enzymes to function
B	long	maximises time for absorption
C	presence of villi	decreases surface area for absorption
D	one-celled thick epithelium	increases distance between intestinal lumen and blood vessels for diffusion

12 Samples of digestive juices were obtained from 3 patients' small intestines, which were then tested for the presence of fats. The conditions faced by each patient is shown below.

	Patient 1	Patient 2	Patient 3
Pancreatic duct blocked	No	Yes	Yes
Bile duct blocked	No	No	Yes

Which of the following shows the most probable results from the test for the presence of fats?

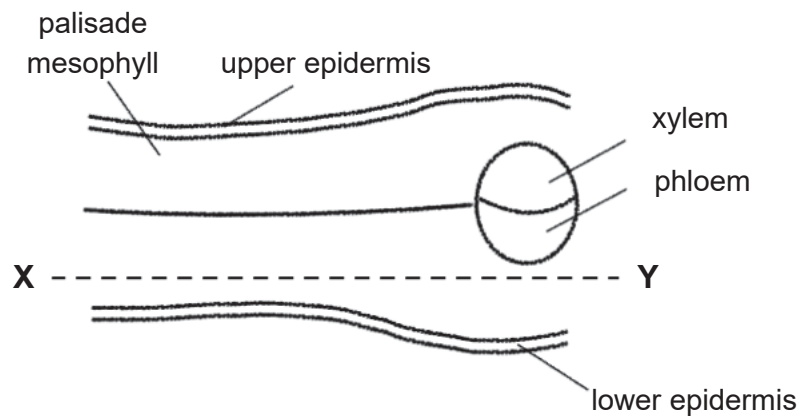
	Patient 1	Patient 2	Patient 3
A	negative	positive	positive
B	positive	positive	negative
C	positive	negative	positive
D	negative	negative	positive

13 Which of the following explains why plants have a lower rate of photosynthesis during wilting?

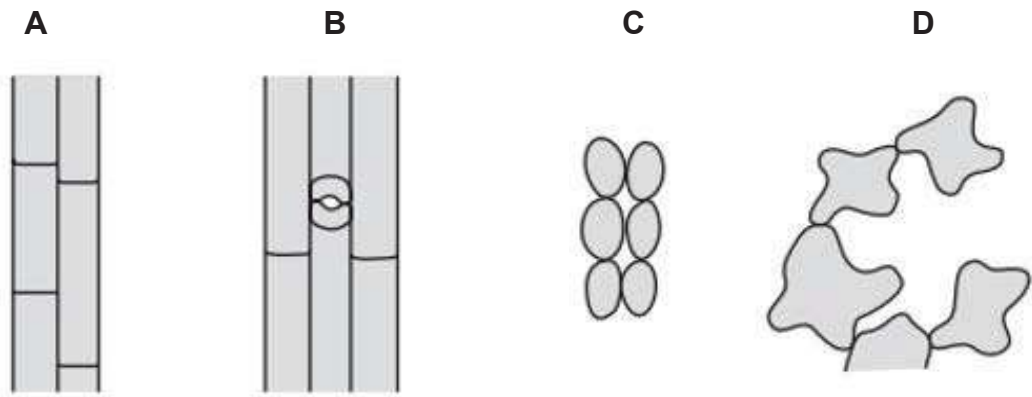
- I. Wilted leaves have less surface area exposed to sunlight
- II. Stomata size is reduced due to guard cells becoming turgid
- III. Less water is available for photosynthesis

- A** I only
- B** I and II only
- C** I and III only
- D** I, II, and III

- 14** The diagram below shows the tissues in a leaf as seen under the microscope.

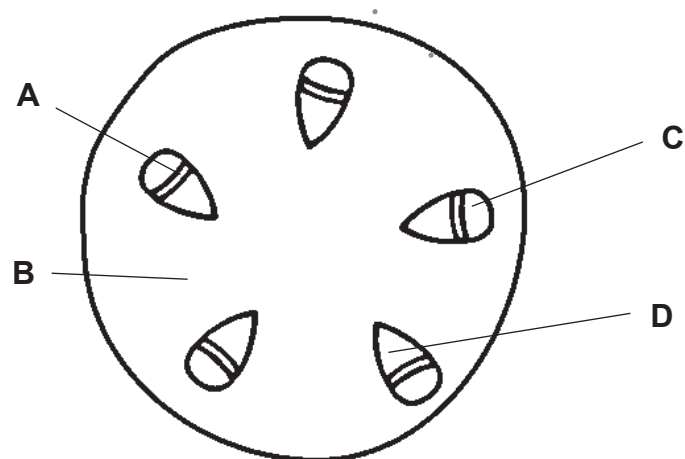


If a cut were made along the line **X—Y**, what would the arrangement of cells look like?

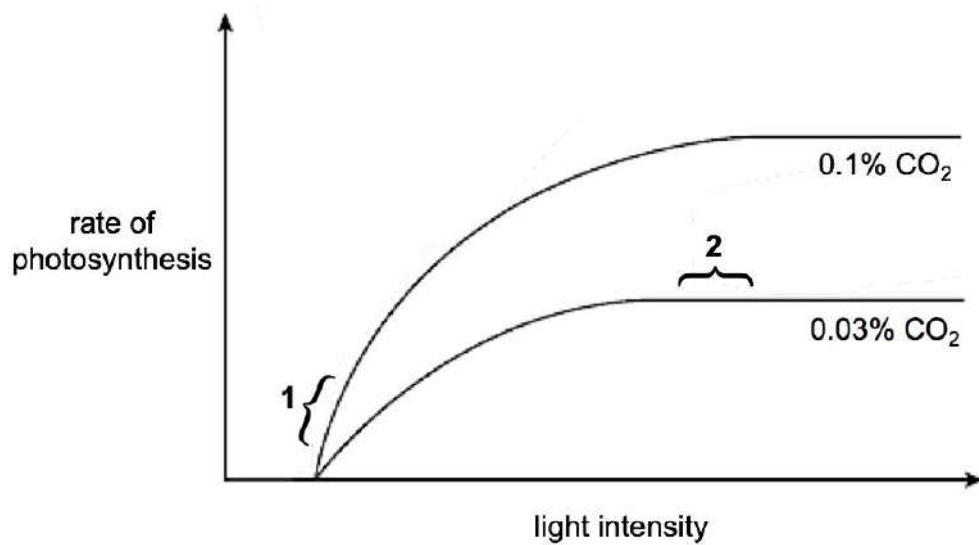


- 15** The diagram shows a section through the stem of a dicotyledonous plant.

Which tissue transports amino acids up the stem?



16 The diagram shows the graph of photosynthetic rate against light intensity.



What are the limiting factors of photosynthesis at regions 1 and 2?

	Region 1	Region 2
A	CO ₂ concentration	Light intensity
B	CO ₂ concentration	Temperature
C	Light intensity	CO ₂ concentration
D	Light intensity	Temperature

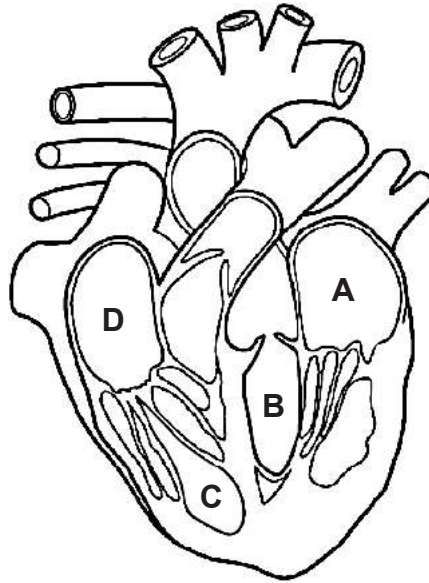
17 Which of the following features allow an artery to withstand the pressure of blood flowing through it?

- I. smooth endothelium
- II. thick elastic layer in the artery wall
- III. thick layer of muscles in the artery wall

- A** I and II only
- B** I and III only
- C** II and III only
- D** I, II, and III.

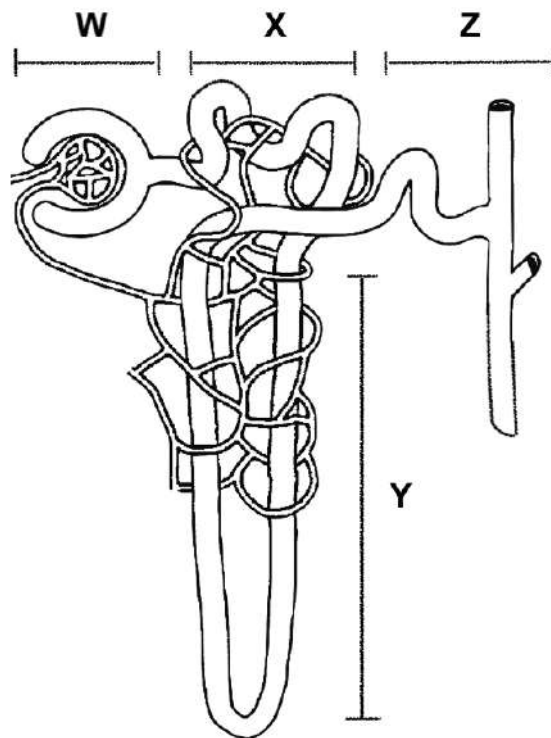
- 18 In a medical investigation, a dye was injected into the renal artery of a patient. The dye was not filtered out of the blood in the kidneys.

Which chamber of the heart would be the first to receive blood with this dye in it?

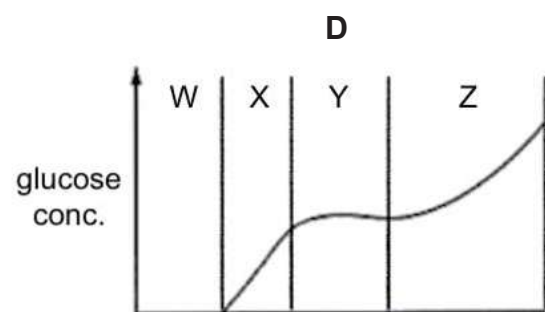
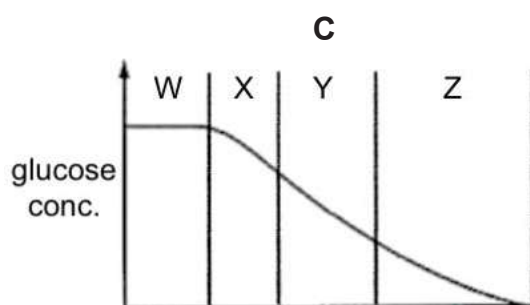
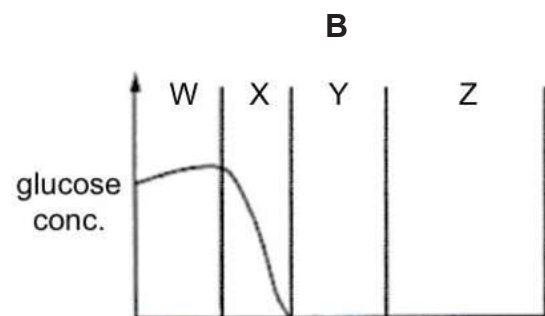
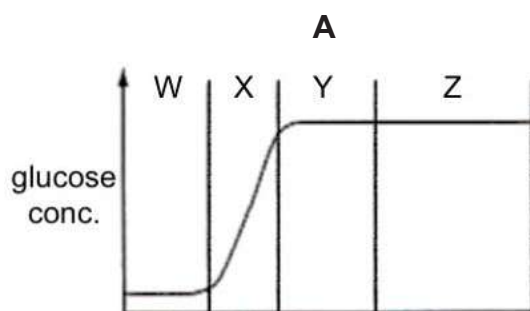


- 19 A drug has been found to **inhibit** the effects of antidiuretic hormone (ADH). What would be the consequence of administering this drug to a healthy person?
- A A smaller volume of urine would be formed.
 - B More proteins would be present in the urine.
 - C The person will become dehydrated.
 - D The urine concentration will increase.
- 20 Where does most reabsorption of water occur in the kidney?
- A collecting duct
 - B distal convoluted tubule
 - C loop of Henle
 - D proximal convoluted tubule

21 The diagram shows a nephron and its associated blood vessels.



Which graph shows the concentration of glucose present in each part of the kidney tubule in a healthy individual?



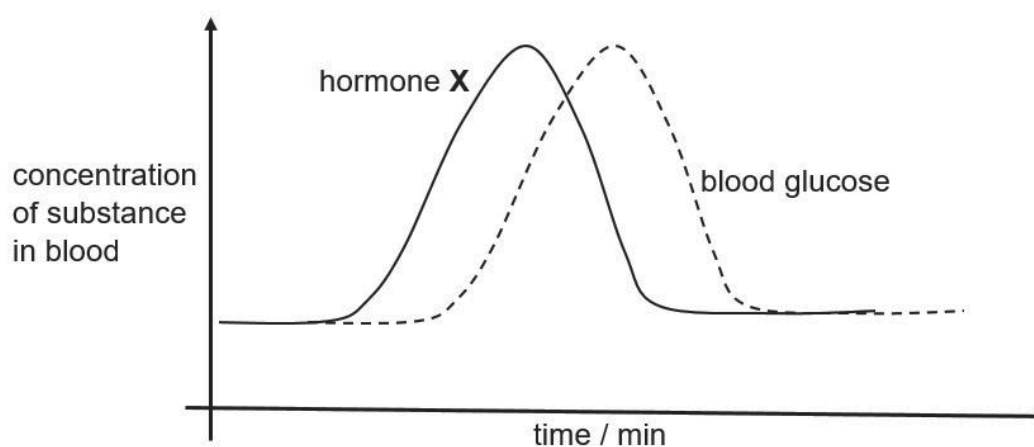
22 Four processes that take place in the human body are listed.

- I. absorption of amino acids through the villi
- II. maintenance of constant body temperature
- III. production of lactic acid in muscles
- IV. regulation of blood glucose concentration

Which two processes are directly controlled by negative feedback?

- A** I and II
- B** I and IV
- C** II and III
- D** II and IV

23 The graph shows the relationship between the level of hormone **X** and blood glucose within the human body.



Which of the following correctly identifies hormone **X** and explains its relationship to blood glucose?

	hormone X	explanation
A	insulin	stimulates conversion of glycogen into glucose
B	insulin	stimulates the conversion of glucose into glycogen
C	adrenaline	stimulates conversion of glycogen into glucose
D	adrenaline	stimulates the conversion of glucose into glycogen

24 What is the function of the iris in the mammalian eye?

- A** to alter the shape of the lens
- B** to control the amount of light entering the eye
- C** to focus light rays on the retina
- D** to protect the cornea from damage

25 The following events occur when a person is focusing on a near object.

1. lens become thicker
2. nerve impulses travel along optic nerve to the brain
3. photoreceptors are activated and nerve impulses are produced
4. nerve impulses transmitted to ciliary muscles via motor neurons
5. ciliary muscles contract and suspensory ligaments relax

What is the correct order of these events?

	first	→			last
A	3	2	5	4	1
B	3	5	2	4	1
C	3	4	5	2	1
D	3	2	4	5	1

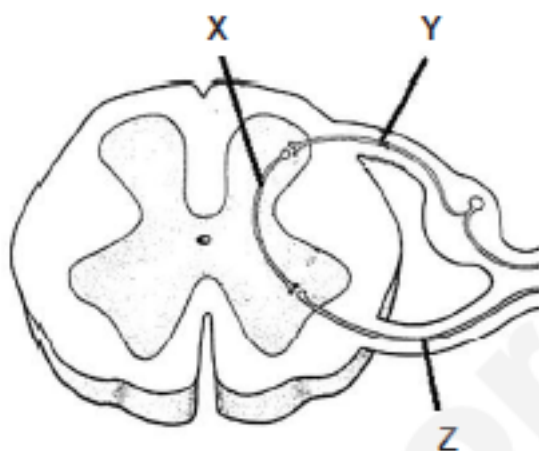
26 Last night, Jane's sister turned off the lights while the family was watching television. Jane felt that the screen got brighter even though the actual brightness had not been changed.

Which of the following accounts for Jane's perception of the increase in brightness of the screen?

- A** relaxation of the circular muscle of the iris
- B** relaxation of the radial muscle of the iris
- C** relaxation of ciliary muscles
- D** contraction of ciliary muscles

Use the diagram below to answer questions 27 and 28.

The diagram shows part of the spinal cord and some neurones which are connected to the leg of a patient.



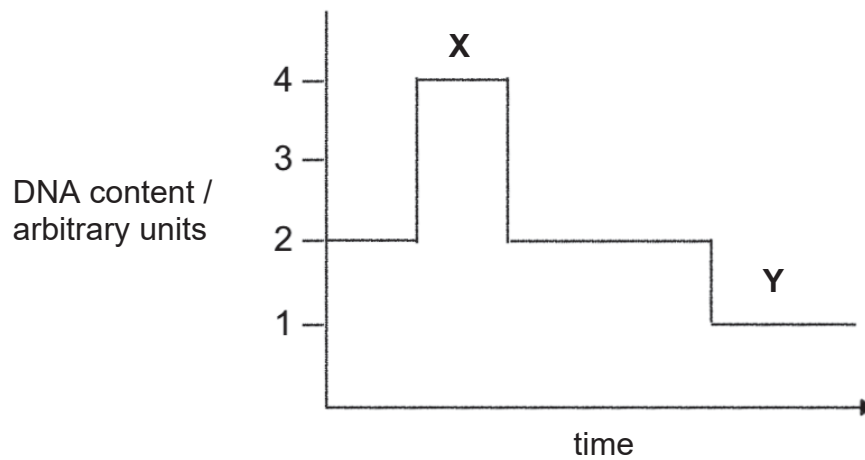
27 Which of the following correctly describes the functions of X, Y and Z?

	X	Y	Z
A	Relay impulses within the central nervous system	Transmits impulses out of the spinal cord	Connects receptor to the spinal cord
B	Connects receptor to the spinal cord	Transmits nerve impulses out of the spinal cord	Relay impulses within the central nervous system
C	Relay impulses within the central nervous system	Connects receptor to the spinal cord	Transmits nerve impulses out of the spinal cord
D	Transmits nerve impulses out of the spinal cord	Connects receptor to the spinal cord	Relay impulses within the central nervous system

28 An anaesthetic which blocks nerve impulses in neurone Z is applied on the patient. Which of the following best describes the effect on his leg?

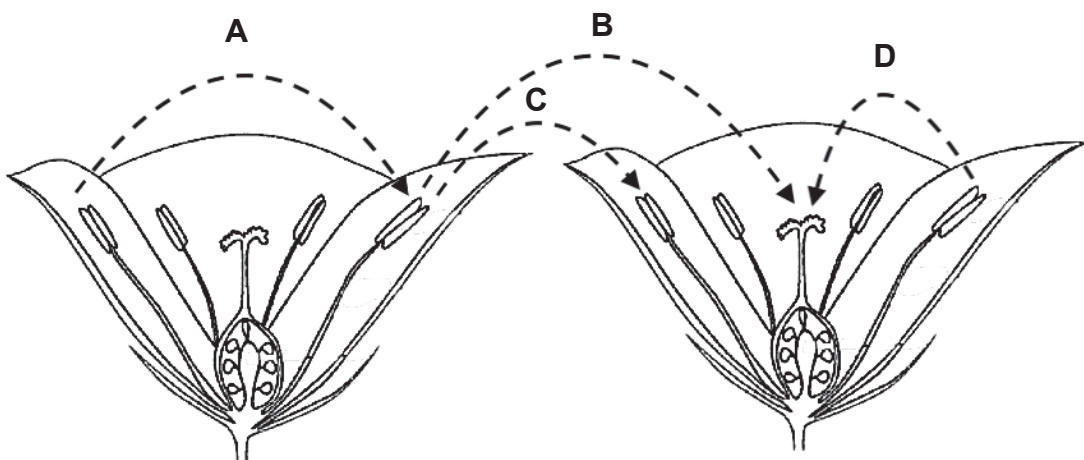
- A He cannot feel a pinprick but can move his leg.
- B He can feel a pinprick and move his leg.
- C He can feel a pinprick but cannot move his leg.
- D He cannot feel the pinprick and cannot move his leg.

- 29 The graph shows the amount of DNA in the nuclei of cells dividing via meiosis.



Which stages do **X** and **Y** represent respectively?

- A Metaphase I and Telophase I
 - B Prophase I and Telophase II
 - C Telophase I and Metaphase II
 - D Telophase I and Telophase II
- 30 The diagram below shows two flowers of the same species.
- Which arrow represents cross-pollination?



31 What is/are some of the advantage(s) of plants that undergo cross-pollination?

- I. Results in greater variation of offspring.
- II. Bisexual flowers are no longer necessary for pollination.
- III. Chances of offspring surviving changes to environment are higher.
- IV. Beneficial qualities are passed on from both parents to offspring.

- A** I only
- B** I and III only
- C** II and III only
- D** II and IV only

32 For which process is the pollen tube essential?

- A** for the cross-pollination of the flower
- B** for the dispersal of pollen grains from the anther
- C** to allow the male gamete to reach the ovule
- D** to provide a site for fertilisation to occur

33 The diagram shows a human sperm cell.

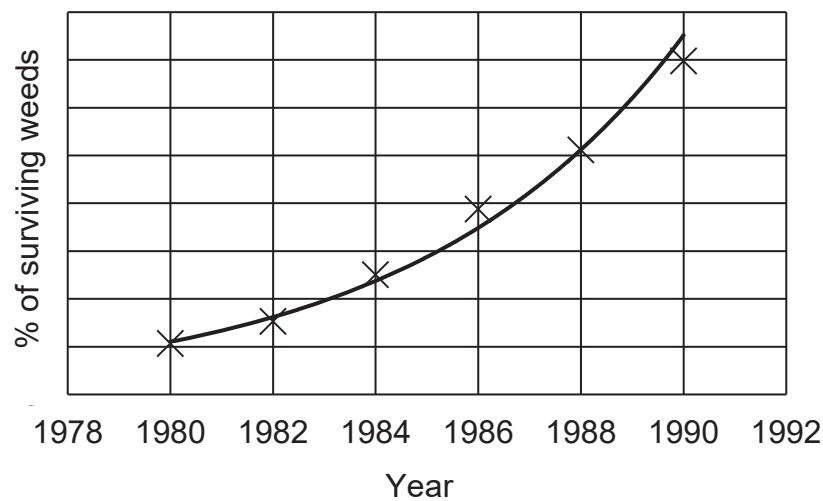


What does structure **P** always contain?

- A** an X chromosome
- B** a Y chromosome
- C** either an X or a Y chromosome
- D** both an X and a Y chromosome

- 34** A 1:1 phenotypic ratio in the offspring in a test cross for a monohybrid trait indicates that _____.
- A** the alleles are dominant
 - B** the alleles are co-dominant
 - C** one parent must have been homozygous dominant
 - D** one parent must have been a heterozygote
- 35** A study was done to evaluate the effectiveness of an herbicide over 6 years. A fixed amount of herbicide was sprayed onto a field of weeds in January and the percentage of weeds that survived was recorded in June.

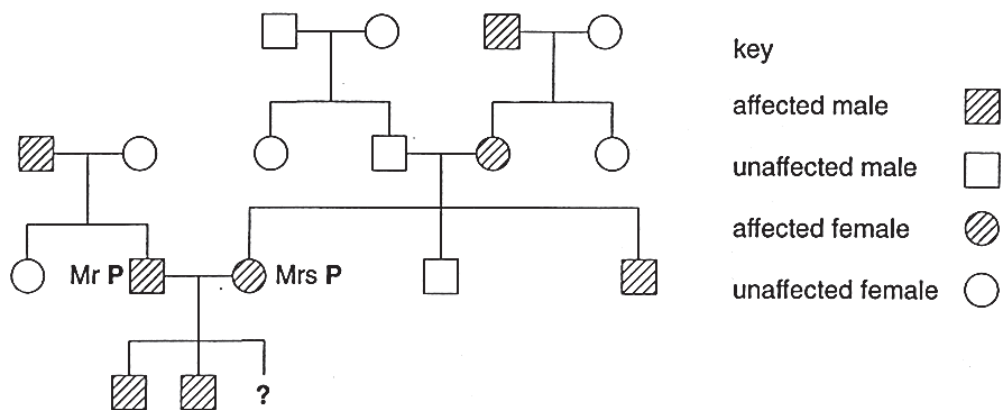
The graph below shows the results of the study.



Which of the following processes explains the results?

- A** artificial selection
- B** genetic engineering
- C** natural selection
- D** mutation

- 36 A woman with blood group O and a man with blood group AB had children together. Which statement about their children's blood groups is correct?
- A None of their children will have the same blood group as either parent.
- B 50% of their children will have the same blood group as their mother.
- C 50% of their children will have the same blood group as their father.
- D All their children will have the same blood group.
- 37 Mr and Mrs P both suffer from a rare heart disease. Children who inherit two copies of the dominant allele rarely survive beyond puberty.

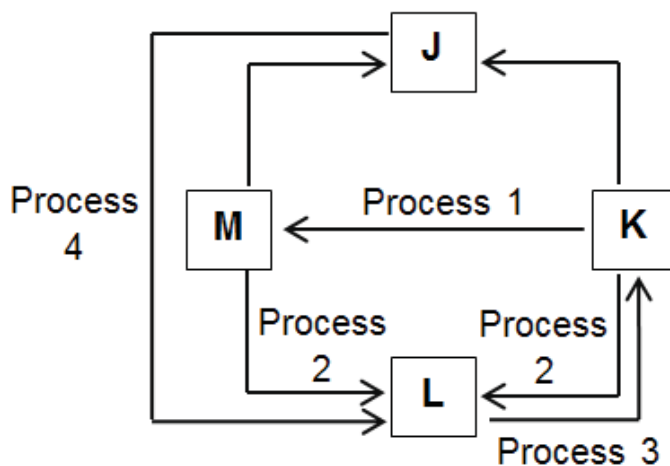


What is the probability that their third child will **not** be affected?

- A 0 %
- B 25 %
- C 75 %
- D 100%
- 38 Which of the following best explains why a food chain will usually not contain more than five trophic levels?
- A The amount of biomass is insufficient to support more levels.
- B The amount of energy is insufficient to support higher levels.
- C The number of organisms at higher levels will be too small.
- D There are very few organisms that feed on carnivores.

The carbon cycle can be illustrated using the following diagram. Processes **1**, **2**, **3** and **4** represent the processes involved in the flow of carbon compounds.

Refer to the diagram to answer questions **39** and **40**.



39 Which one of the following shows what each letter (**J**, **K**, **L** and **M**) could represent?

	J	K	L	M
A	atmosphere	grass	decomposers	sheep
B	decomposers	sheep	atmosphere	grass
C	decomposers	grass	atmosphere	sheep
D	sheep	atmosphere	grass	decomposers

40 Which one of the following would be likely to happen if process **4** does not occur?

- A** The population of the grass would increase.
- B** Carbon cycling would occur in the reverse direction.
- C** Carbon dioxide levels in the atmosphere would decrease.
- D** The rate at which carbon dioxide is released would increase.

***** END OF PAPER *****

Name	Class	Index Number

UNITY SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2019

SECONDARY FOUR EXPRESS



BIOLOGY 6093/02

18 SEPTEMBER 2019

PAPER 2

1 HOUR 45 MIN

Additional Materials : Nil

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number in the spaces provided on the writing papers.

Answer both **Section A** and **Section B**.

Section A:

Answer **all** the questions.

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

Section B:

Answer **all** the questions.

Question **10** is in the form of an **Either/Or** question and only one alternative should be attempted.

Write your answers in the spaces provided in the question paper.

The total mark for this paper is 80 marks.

This paper consists of **21** printed pages, including this cover page.

Section A: Structured Questions (50 marks)

- 1 In the past, the insulin protein was derived from pigs and cattle. Currently, bacterial plasmids are being utilised to produce human insulin for medical use.

Fig. 1.1 shows the stages involved in the insertion of the human insulin gene into a bacterial plasmid.

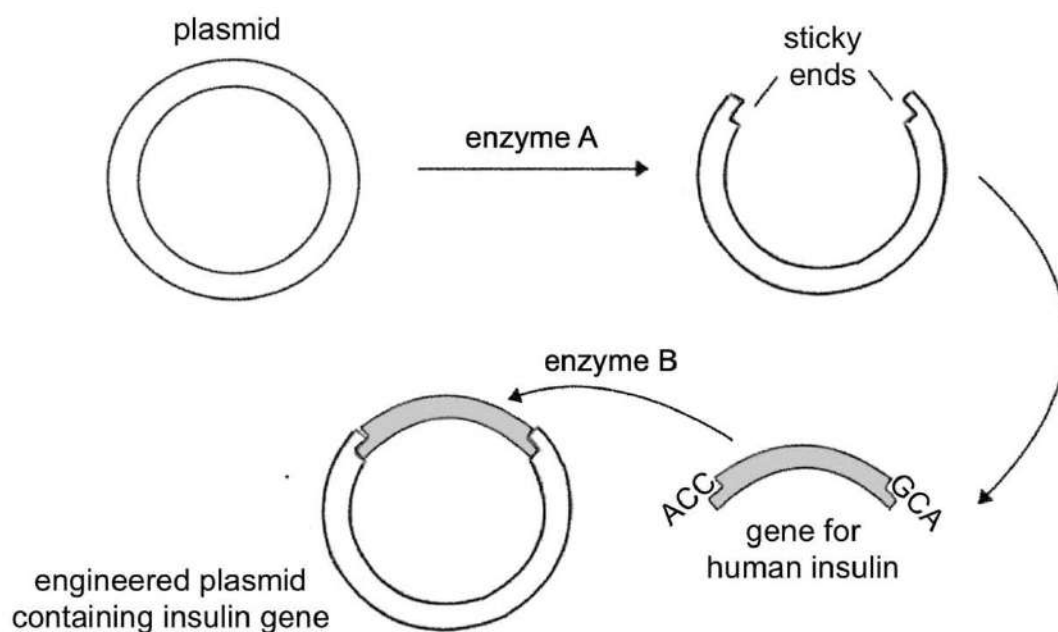


Fig. 1.1

- (a) (i) State the substance that makes up the plasmid.

..... [1]

- (ii) Name enzyme **A** and describe its role in insulin production.

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

- (iii) The sticky ends of the bacterial plasmid are complementary to the sticky ends found on the human insulin gene.

With reference to Fig. 1.1, state the pair of base sequences on the plasmid that would enable ligation of the human insulin gene.

..... [1]

- (iv) Suggest **one** advantage of using bacterial plasmids to produce insulin as compared to retrieving insulin from animal sources.

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

- (b) Purified insulin from bacterial cells is injected into diabetic patients.

Explain how diabetic patients would benefit from this treatment.

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

[Total: 8]

2 Fig. 2.1 shows the different stages in the life cycle of a plant.

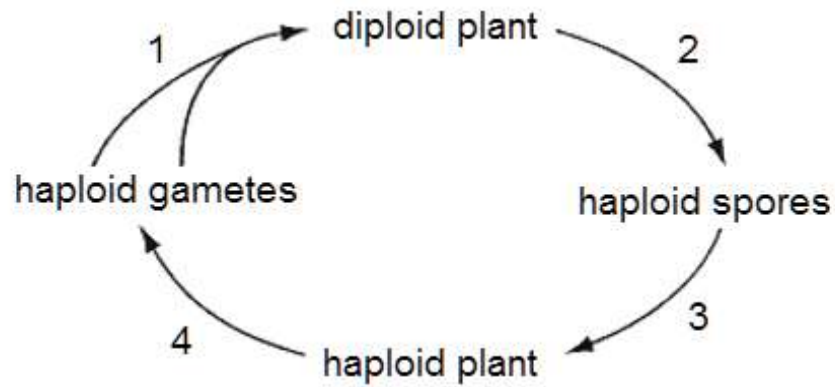


Fig. 2.1

(a) (i) Identify the stage(s) at which meiosis has taken place.

..... [1]

(ii) Explain 2 reasons why meiosis is important in reproduction.

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

(b) Fig. 2.2 shows an animal cell undergoing nuclear division.

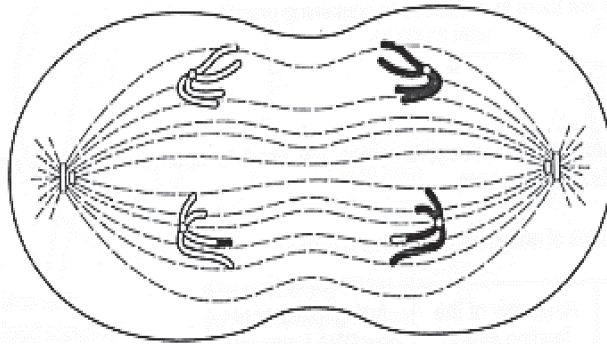


Fig. 2.2

(i) Identify the stage of nuclear division that is taking place in Fig. 2.2.

..... [1]

(ii) Give a reason for your answer in (i).

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

(iii) How would this process differ if it were occurring in a plant cell?

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

[Total: 6]

- 3 Fig. 3.1 shows the rate of oxygen production in a plant at varying temperatures.

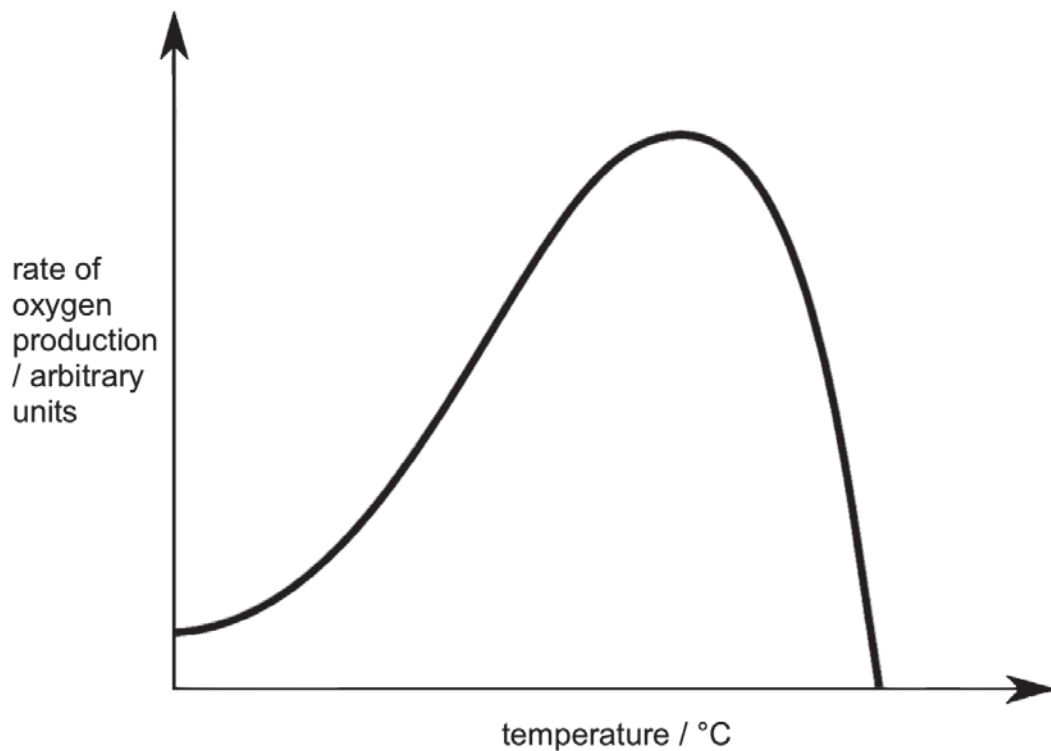


Fig. 3.1

- (a) (i) State the word equation for photosynthesis.

..... [1]

- (ii) Describe **and** explain the shape of the graph in Fig. 3.1.

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

(b) The temperature of the air surrounding the plant has an effect on transpiration rate.

(i) Explain how temperature affects the rate of transpiration.

.....

.....

.....

..... [2]

(ii) Explain **two** ways through which wilting affects the rate of photosynthesis.

1

.....

2

..... [2]

[Total: 7]

- 4 Cystic fibrosis (CF) is a serious genetic condition in humans that results from the failure to inherit the dominant allele of a particular gene. CF patients produce excessive mucus that leads to respiratory infections and digestive problems.

Mrs Tan is a CF patient and genetic analysis of Mr Tan shows that he is a carrier of the recessive CF allele. While they wished to have children, they were discouraged by their doctor from doing so.

- (a) (i) Use a fully labelled genetic diagram to show how cystic fibrosis may be inherited by the children of Mr and Mrs Tan.

Use the letter **D** to represent the dominant allele and **d** to represent the recessive allele.

[3]

- (ii) With reference to the expected ratio of phenotypes in their children, explain the doctor's recommendation to Mr and Mrs Tan.

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

- (b) Fig. 4.1 shows a section of the human alimentary canal and its accessory organs.

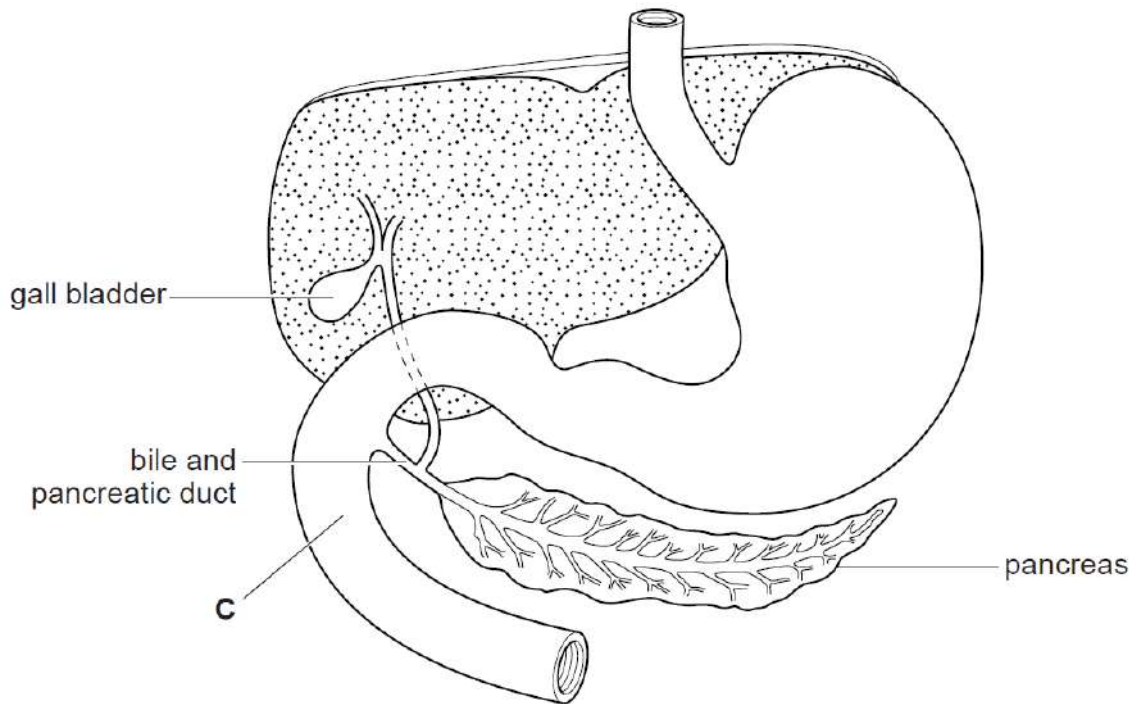


Fig. 4.1

- (i) Name the region of the small intestine labelled **C**.

..... [1]

- (ii) One effect of cystic fibrosis is that the bile and pancreatic duct becomes blocked with mucus.

Suggest why a person whose bile and pancreatic duct is blocked may find it difficult to gain weight despite eating a balanced diet.

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

[Total: 8]

- 5 (a) Fig. 5.1 shows the pressure changes in the left side of the heart for a single heartbeat.

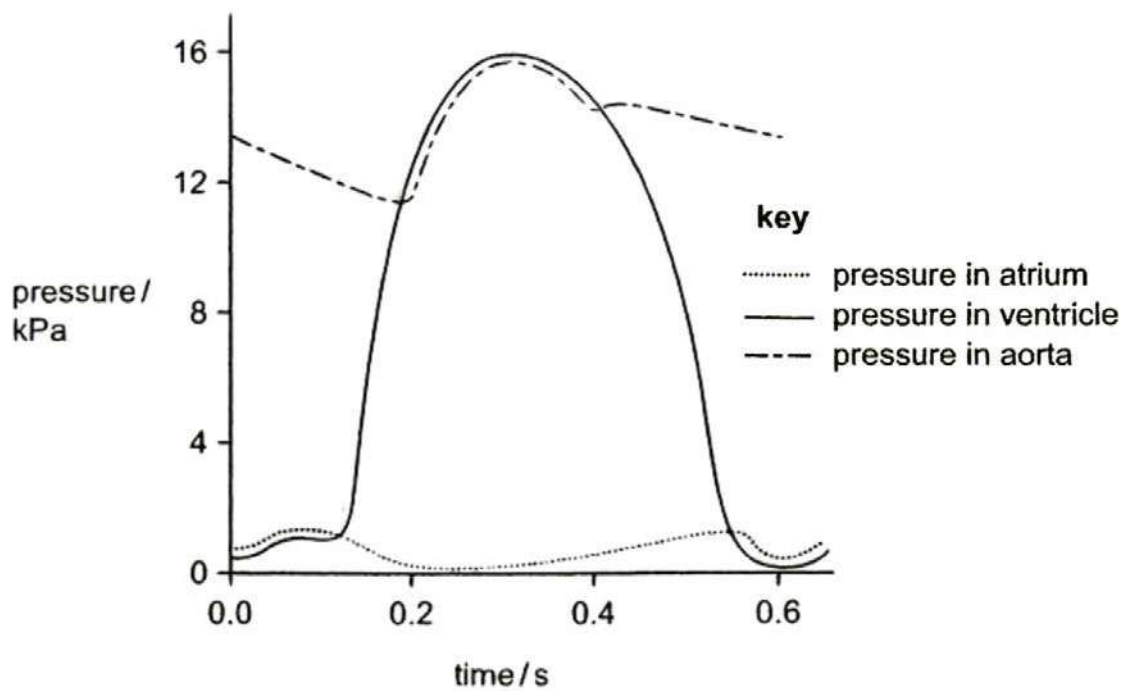


Fig. 5.1

- (i) State the time when the aortic valve starts to open.

..... [1]

- (ii) With reference to Fig. 5.1, describe **and** explain the pressure changes in the left ventricle from 0.1 s to 0.3 s.

.....

 [3]

- (iii) Explain why the ventricular pressure in the right side of the heart is much lower during contraction as compared to the left side.

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

- (b) Fig. 5.2 shows the left side of a normal heart and the heart of a patient with diastolic heart failure.

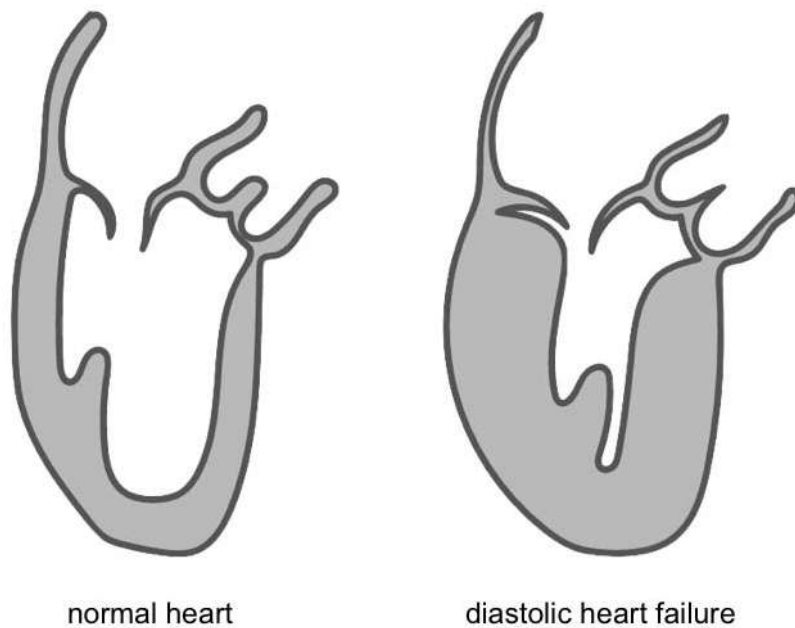


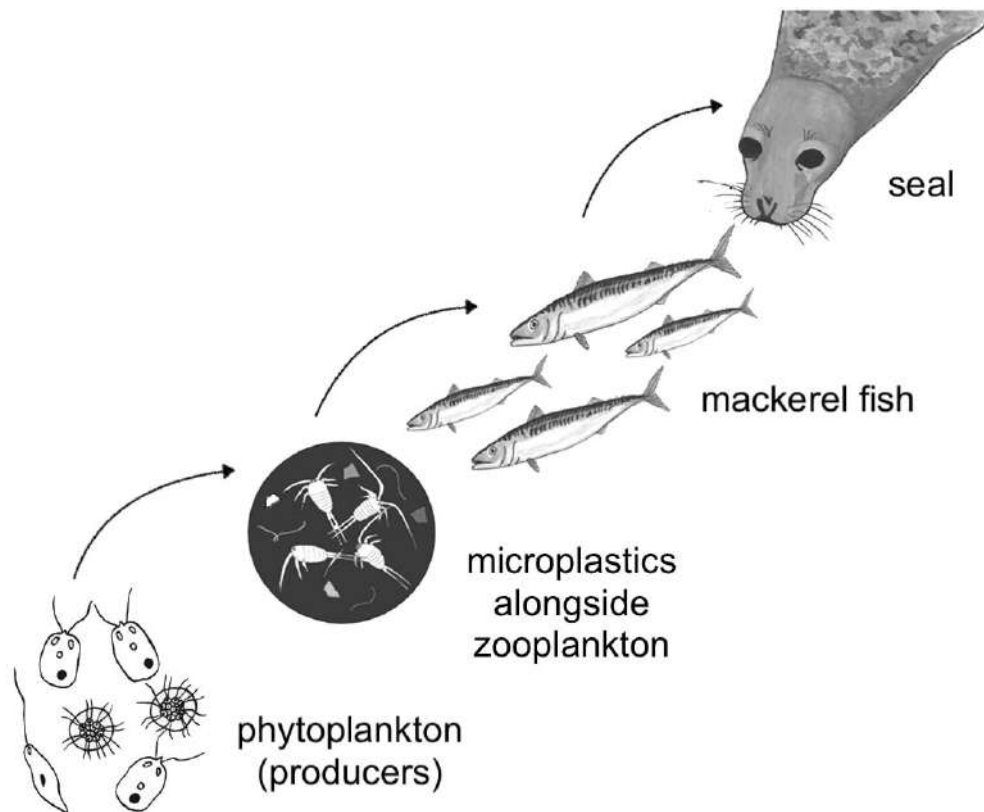
Fig. 5.2

Suggest why patients with diastolic heart failure often complain of excessive tiredness.

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

[Total: 8]

- 6 Recently, microplastics have become a pollution concern for marine organisms. Fig. 6.1 shows the interactions between organisms in a North American sea.



Nelms *et. al.*, 2018. <https://www.sciencedirect.com/science/article/pii/S0269749117343294>

Fig. 6.1

- (ii) Draw a **labelled** diagram of a pyramid of biomass for the food chain depicted in Fig. 6.1.

[2]

- (a) (i) With reference to at least **one** organism in Fig. 6.1, explain what is meant by the term *trophic level*.

.....

.....

.....

..... [2]

- (b) Small fishes that directly consume these non-biodegradable microplastics along with zooplankton are generally unaffected by it.

However, organisms higher up the food chain, such as seals and humans, are at risk of toxic effects caused by the presence of microplastics in their bodies.

Explain why this is so.

.....

.....

.....

.....

.....

..... [3]

[Total: 7]

- 7 Fig. 7.1 shows the changes in the concentration of urine and the concentration of anti-diuretic hormone (ADH) in the blood plasma changes.

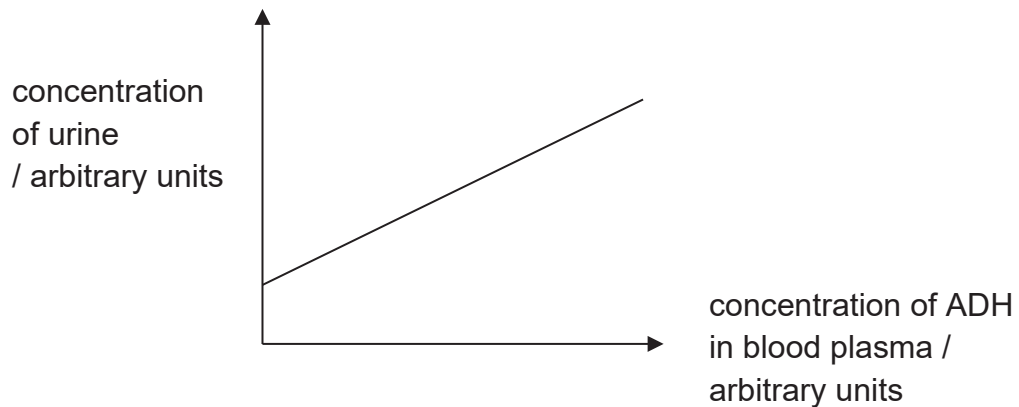


Fig. 7.1

- (a) With reference to Fig. 7.1, describe **and** explain the relationship between the concentration of ADH in the blood plasma and the concentration of urine.

.....

.....

.....

.....

.....

..... [3]

- (b) Explain how vigorous exercise may alter the concentration of ADH in the blood.

.....

.....

.....

.....

..... [3]

[Total: 6]

Section B: Free Response Questions (30 marks)

Answer all questions.

Question **10** is in the form of an **Either/Or** question and only **one** alternative should be attempted.

Write your answers in the spaces provided.

- 8** An experienced sprinter was asked to run rapidly on a treadmill for eight minutes.

Fig. 8.1 shows the number of breaths per minute the sprinter took over the course of the experiment.

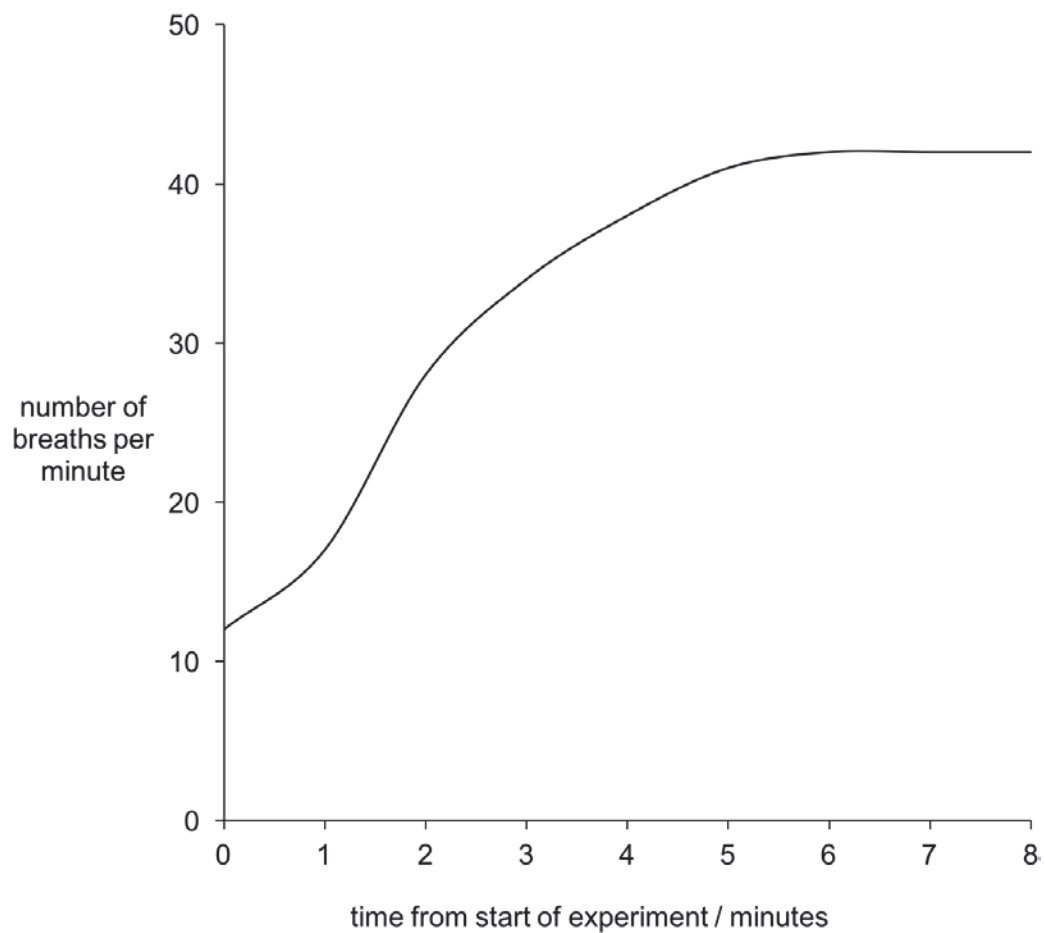


Fig. 8.1

(a) Compare the differences between aerobic and anaerobic respiration.

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..... [4]

(b) At the end of the experiment, the athlete reported that he was out of breath, his heart was beating fast, and his leg muscles were aching.

With reference to Fig. 8.1, explain the athlete's symptoms.

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..... [6]

[Total: 10]

- 9 Two patterns of response by the human body towards stimuli of different nature are outlined below.

Pattern A

stimulus → receptor → central nervous system → effector → action

Pattern B

stimulus → receptor → gland → effector → action

(a) With reference to one or both of the two patterns,

- (i) describe the pathway of nerve impulses when a barefoot person steps on a sharp nail.

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..... [4]

- (ii) describe the sequence of events which occur after a man consumes a heavy meal rich in carbohydrates.

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..... [4]

- (b) Suggest the advantages that pattern **B** has over pattern **A**.

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.....

.....

..... [2]

[Total: 10]

10 Either

- (a) (i)** The menstrual cycle is controlled by several hormones.

Use your knowledge of the role of these hormones in the menstrual cycle to suggest why progesterone is a component of contraceptive pills.

.....

.....

.....

..... [2]

- (ii)** The pill is ineffective in preventing the transmission of HIV. Why is this so?

Suggest **one** way HIV transmission can be prevented during sexual intercourse.

.....

.....

.....

..... [2]

- (b)** The placenta is an organ that develops in the uterus during pregnancy. It attaches to the wall of the uterus, and gives rise to the umbilical cord.

- (i)** Explain why blood does not pass directly from the mother to the foetus in the placenta.

.....

.....

.....

..... [2]

(ii) Describe the role of the placenta during pregnancy.

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..... [4]

[Total: 10]

10 Or

Antibodies are proteins secreted by specialised cells in the immune system to fight pathogens that enter our bloodstream.

(a) Briefly outline the process of how an antibody protein is synthesised from DNA.

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..... [6]

- (b) Describe the pathway taken by an antibody protein from the site of production to the outside of the specialised cells.

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..... [4]

[Total: 10]

***** ***End of Paper*** *****

Pure Biology Prelims 2019 Answer key

Paper 1


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

Paper 2 (Section A)

Q1	a	i)	<u>DNA / Deoxyribonucleic acid / nucleotides;</u>	1
		ii)	<ul style="list-style-type: none"> Enzyme A is a <u>restriction enzyme / endonuclease;</u> It <u>cuts the plasmid at specific nucleotides</u> to create <u>sticky ends</u> which are <u>complementary to the insulin gene;</u> 	2
		iii)	<u>TGG, CGT;</u>	1
		iv)	<ul style="list-style-type: none"> More <u>rapid / efficient;</u> <u>Lowered rejection/immune reaction</u> as it is human insulin; Less ethical issues; Less manpower required <p>(max 1m)</p>	1
	b		<ul style="list-style-type: none"> Insulin <u>increases the membrane permeability of liver and muscle tissues</u> to glucose; This <u>increases rate of absorption of glucose/promotes conversion of glucose to glycogen</u> for storage; Thus <u>reducing overall blood glucose level;</u> 	3

Q2		a	i)	Stage 2;	1
			ii)	<ul style="list-style-type: none">to form gametes with half the number of chromosomes as the parent cell ;to ensure that the diploid number of chromosomes will be restored after fertilisation ;meiosis give rise to genetic variation through crossing over and independent assortment ;give rise to genetic variation through random fusion of gametes produced ; <p>(Any 2)</p>	1 1 1 1
		b	i)	Anaphase I	1
			ii)	<u>Homologous chromosomes</u> are being separated and <u>pulled to opposite ends of the cell</u> ;	1
			iii)	Centrioles would be <u>absent/cell plate is formed</u>	1
Q3	a	i)	<div>light energy</div> <div>carbon dioxide + water → glucose + oxygen</div> <div>chlorophyll</div>		1
		ii)	<ul style="list-style-type: none">As <u>temperature increases</u>, rate of <u>oxygen production increases</u> because <u>enzyme activity in photosynthesis increases</u>;<u>Beyond</u> optimum temperature, rate of oxygen production <u>drops drastically</u> as <u>enzymes are denatured</u>;		1 1

		ii)	<ul style="list-style-type: none"> The couple's children have a <u>high risk of contracting cystic fibrosis</u>; As the expected phenotypes of their children are <u>1 CF : 1 Carrier / 50% CF to 50% Carrier</u>; 	1 1
	b	i)	Duodenum;	1
		ii)	<ul style="list-style-type: none"> Reduction in enzymes (lipase)/ bile entering duodenum, leading to reduced digestion/emulsification of fats; Less nutrients absorbed for growth / storage; 	2
5	a	i)	<ul style="list-style-type: none"> Any answer from <u>0.18s - 0.2s</u> <p><i>(R: answers without units)</i></p>	1
		ii)	<ul style="list-style-type: none"> From <u>0.1s to 0.3s</u>, <u>pressure</u> in the ventricle <u>increases</u> From <u>1 kPa to 16 kPa</u>; As the <u>muscles</u> of the ventricle <u>contract</u>; <p><i>(-1m if no data quoted)</i></p> <p><i>(R: ventricle contracts)</i></p>	1 1 1
		iii)	<ul style="list-style-type: none"> The right ventricle only pumps blood <u>to the lungs</u> over a <u>shorter distance</u>; Has <u>thinner muscular walls</u> compared to left ventricle; 	1 1
	b		<ul style="list-style-type: none"> The left ventricle is <u>unable to relax</u> and <u>fill with sufficient blood</u> / <u>smaller volume</u> in left ventricle; <u>Less blood / oxygen</u> is pumped around the body; 	1 1

Q6	a	i)	 <p>(1m for correct shape; 1m for labelling in correct order)</p>	2
		ii)	<ul style="list-style-type: none"> • A trophic level represents the <u>feeding position</u> of an organism in a food chain / food web ; <ul style="list-style-type: none"> ○ The <u>first</u> trophic level refers to <u>producers</u> like the <u>phytoplankton</u> which <u>produce their own food</u>; ○ The <u>second</u> trophic level refers to <u>primary consumers</u> such as the <u>zooplankton</u> that <u>feed on producers</u> like phytoplankton; ○ The <u>third</u> trophic level refers to <u>secondary consumers</u> such as <u>mackerel</u> that <u>feed on primary consumers</u> like zooplankton ; ○ The fourth trophic level refers to <u>tertiary consumers</u> like the <u>seal</u> that feed on secondary consumers; ○ (Max 1m out of the above 3) <p>(-1m if no reference is made to any organism in Fig. 6.1)</p>	1
	b		<ul style="list-style-type: none"> • Microplastics <u>cannot be excreted</u> and is thus <u>passed along in food chains</u>; • <u>Concentration</u> of microplastics <u>increases</u> with each trophic level/<u>Bioamplification</u> with each trophic level; • Resulting in <u>bioaccumulation</u> of microplastics <u>in top consumers</u>; 	1 1 1

Q7	a	<ul style="list-style-type: none">• The concentration of urine <u>increases</u> as concentration of ADH increases;• <u>ADH increases the permeability of collecting ducts to water</u>;• More <u>water re-enters the blood</u> from the urine/filtrate; <p>(R: ADH “changes” permeability of collecting ducts)</p>	1 1 1
	b	<ul style="list-style-type: none">• Profuse <u>sweating</u> from vigorous exercise would cause <u>water loss</u>;• <u>Water potential of the blood drops</u>;• Hypothalamus is stimulated to <u>release more ADH</u> into the bloodstream;	1 1 1

Paper 2 (Section B)

Q8	a	<table><tr><td>Aerobic respiration</td><td>Anaerobic respiration</td></tr><tr><td>Takes place in the presence of oxygen</td><td>Takes place in the absence of oxygen</td></tr><tr><td>Oxidises glucose OR Uses oxygen and glucose as substrates</td><td>Does not oxidise glucose OR Glucose is the only substrate</td></tr><tr><td>Produces carbon dioxide and water</td><td>Produces lactic acid</td></tr><tr><td>Releases a large amount of energy</td><td>Releases an additional small amount of energy</td></tr><tr><td>Takes place in mitochondria</td><td>Takes place in cytoplasm</td></tr></table>	Aerobic respiration	Anaerobic respiration	Takes place in the presence of oxygen	Takes place in the absence of oxygen	Oxidises glucose OR Uses oxygen and glucose as substrates	Does not oxidise glucose OR Glucose is the only substrate	Produces carbon dioxide and water	Produces lactic acid	Releases a large amount of energy	Releases an additional small amount of energy	Takes place in mitochondria	Takes place in cytoplasm	(1m for every valid point-to-point comparison)	4
	Aerobic respiration	Anaerobic respiration														
Takes place in the presence of oxygen	Takes place in the absence of oxygen															
Oxidises glucose OR Uses oxygen and glucose as substrates	Does not oxidise glucose OR Glucose is the only substrate															
Produces carbon dioxide and water	Produces lactic acid															
Releases a large amount of energy	Releases an additional small amount of energy															
Takes place in mitochondria	Takes place in cytoplasm															
	b	<ul style="list-style-type: none">At first, the <u>muscle cells</u> of the legs <u>respire aerobically</u>;<u>Breathing rate increases</u> from <u>12 to 42 breaths</u> per minute to <u>take in more O₂</u> and <u>remove CO₂ faster</u>;<u>Heart rate also increases</u> to transport <u>glucose and O₂</u> to respiring cells <u>faster</u>;However, there is a <u>limit</u> to <u>heart rate</u> & <u>breathing rate</u>,At <u>~5mins</u> the athlete's breathing rate has reached a <u>maximum/plateau</u> of <u>42 breaths per minute</u>;To continue the exercise, muscle cells have to start <u>respiring anaerobically</u>, releasing a <u>small amount of energy</u> and <u>lactic acid</u> as a by-product.<u>Accumulation</u> of <u>lactic acid</u> to high concentrations leads to muscle aches <p>(any 6)</p> <p>(-1m for no data/insufficient data quoted)</p>		6												

Q9	ai	<ul style="list-style-type: none"> • <u>Pain receptor in skin</u> stimulated and produce <u>impulses</u>; • Nerve impulses travel along <u>sensory neurone to spinal cord</u> (central nervous system) • Nerve impulses transmitted across synapse to <u>relay neurone</u> and then across another synapse to <u>motor neurone</u>; • Nerve impulses travel along motor neurone to <u>leg muscle</u> (effector); • Leg <u>muscle contracts</u> and <u>withdraws foot</u> from nail (action) <p><i>(max 4m; -1m if no mention of keywords in pattern A)</i></p>	4
	a ii	<ul style="list-style-type: none"> • Blood glucose concentration <u>increases</u> (stimulus) • <u>Islets of Langerhans</u> (receptor) in <u>pancreas</u> stimulated and release <u>insulin</u> into bloodstream • Insulin carried by blood to <u>liver</u> (effector) • Liver <u>converts glucose into glycogen</u> / <u>Uptake of glucose by cells / usage of glucose in respiration</u> (action) • Blood glucose concentration returns to normal levels <p><i>(max 4m; -1m if no mention of keywords in pattern B)</i></p>	4
	b	<ul style="list-style-type: none"> • Endocrine control can have <u>long-lived or short-lived</u> responses while nervous control has only short-lived responses; • Endocrine control <u>can affect more than one target organ</u> while nervous control is usually localised; • <i>Medical conditions under endocrine control can be more easily treated by medication which alter hormone levels</i> • <i>(or any other reasonable answer)</i> 	2

Q10 E	ai	<ul style="list-style-type: none"> • Progesterone <u>inhibits FSH secretion</u> by the <u>anterior pituitary gland</u> by negative feedback; • When FSH is low, <u>primary follicles are not developed</u> in the ovary and thus <u>ovum will not be released</u>, preventing fertilisation; 	2
	aii	<ul style="list-style-type: none"> • The pill is a chemical contraceptive that <u>does not prevent the exchange of bodily fluids</u> during sexual intercourse; • Males could wear condoms/ practice abstinence / fidelity to one partner 	6
	bi	<ul style="list-style-type: none"> • High blood <u>pressure</u> of the mother would <u>kill</u> the foetus; • Maternal and foetal blood may be incompatible, i.e. <u>different blood group</u> when mixed, would lead to <u>agglutination</u>; 	
	bii	<ul style="list-style-type: none"> • Allows <u>useful substances</u>, e.g. oxygen and glucose, to <u>diffuse from the mother's blood to foetus' blood</u>; • Allows metabolic <u>waste products</u>, e.g. urea and carbon dioxide, to <u>diffuse from foetus' blood to mother's blood</u>; • Allows <u>protective antibodies</u> to diffuse from mother's blood to foetus' blood that would <u>protect</u> the baby against disease-causing organisms; • <u>Produces progesterone</u> to <u>maintain the thickness of the endometrium</u> during pregnancy; 	

Q10 Or	ai	<ul style="list-style-type: none"> • A <u>gene</u> found on the DNA <u>codes for the antibody protein</u>; • Every <u>3 DNA nucleotides / codon</u> codes for <u>an amino acid</u>; • The <u>template strand</u> of the gene is used to make <u>mRNA</u>; • Which is transported <u>out of the nucleus into the cytoplasm</u>; • The mRNA attaches to a <u>ribosome</u>; • Which <u>translates</u> the message in mRNA into a <u>sequence of amino acids</u>; • By recruiting <u>tRNAs containing anti-codons</u> that are <u>complementary</u> to the mRNA; • Amino acids are joined by <u>peptide bonds</u> to form <u>polypeptide chains</u>; <p>(any 6)</p>	6
	b	<ul style="list-style-type: none"> • <u>Ribosomes</u> on the RER <u>synthesise</u> the antibodies / <u>vesicles</u> containing the antibodies <u>pinch off from the RER</u>; • To <u>fuse with the Golgi apparatus</u> which <u>stores and modifies</u> the protein/antibody; • <u>Secretory vesicles</u> containing the protein/antibody <u>pinch off from the Golgi apparatus</u>; • And move to <u>fuse with the cell surface membrane</u>, releasing the antibody outside of the cell; 	4

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ZHONGHUA SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2019
SECONDARY 4E

Candidate's Name

Class

Register Number

	4E4	
--	------------	--

BIOLOGY

6093 /01

20 September 2019
1 hour

Additional Materials: OTAS

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

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

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.

Total	40
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Setter: Ms Rozianna

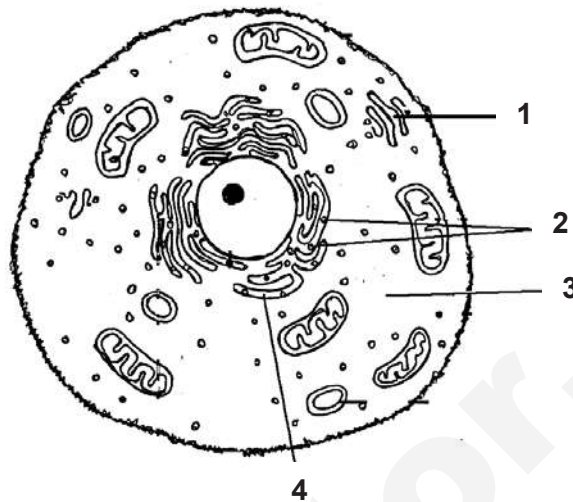
Vetter: Mr Goh Tze Mian

This document consists of **20** printed pages, including this cover page.

Section A

Answer **all** questions in the OTAS.

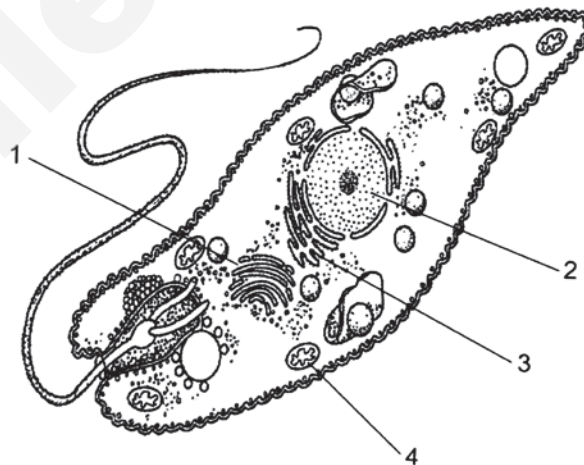
- 1 The diagram shows a typical animal cell with cell components involved in the synthesis and secretions of an enzyme.



Which is the correct route taken by an amino acid molecule during enzyme production?

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

- 2 The diagram shows a freshwater single-celled organism.



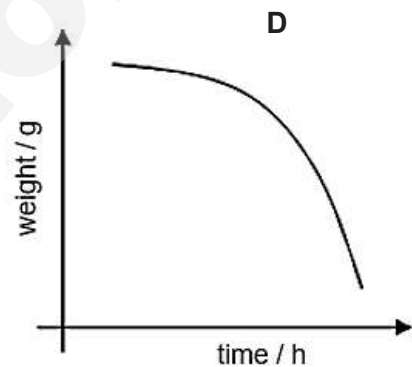
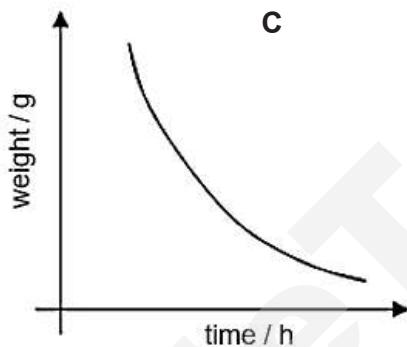
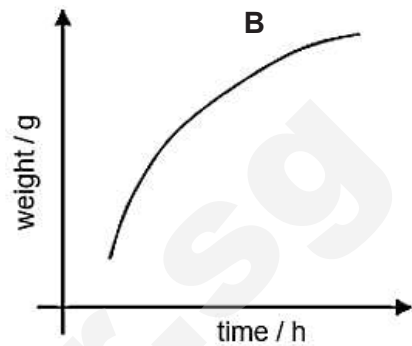
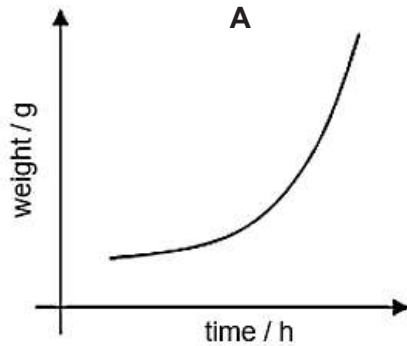
Which of the statements correctly identifies structures 1 to 4 and its function?

- 1 smooth endoplasmic reticulum synthesises fats and steroids
- 2 chromosomes control polypeptide synthesis
- 3 Golgi body synthesizes proteins
- 4 chloroplast captures light energy for photosynthesis

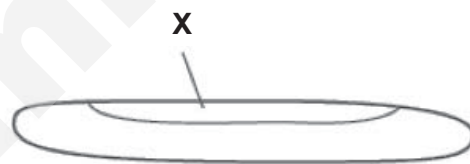
- A 1, 2, 3 and 4
- B 1, 3 and 4
- C 2 only
- D 2 and 3

- 3 Concentrated starch solution is added into a cow's urinary bladder until it is half full. The bladder is tied, weighed and then placed in a dilute starch solution. The weight of the urinary bladder is taken every hour.

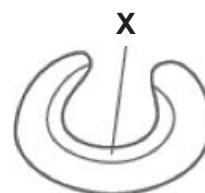
Which graph best reflects these results?



- 4 The diagram shows a xerophytic leaf in different conditions, **P** and **Q**.



condition **P**



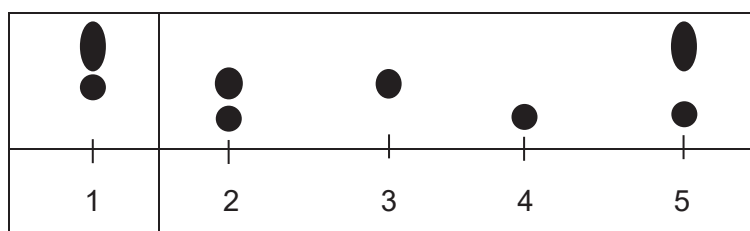
condition **Q**

Which statements about the cells of the leaf in conditions **P** and **Q** are correct?

- 1 water potential in condition **P** is higher than in condition **Q**
- 2 cells may be turgid in condition **P** and plasmolysed in condition **Q**
- 3 turgidity of cells in condition **P** is lesser than in condition **Q**
- 4 no net diffusion of water into cells in layer **X** in either condition **P** or **Q**

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

- 5 Five disaccharides were each hydrolysed with dilute acid and the purified products were separated by chromatography. The results are shown below.

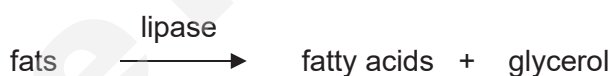


The spots from 1 represent the products obtained from the hydrolysis of sucrose.

Which represents the results obtained from the hydrolysis of lactose and maltose?

	lactose	maltose
A	2	3
B	2	4
C	5	2
D	5	3

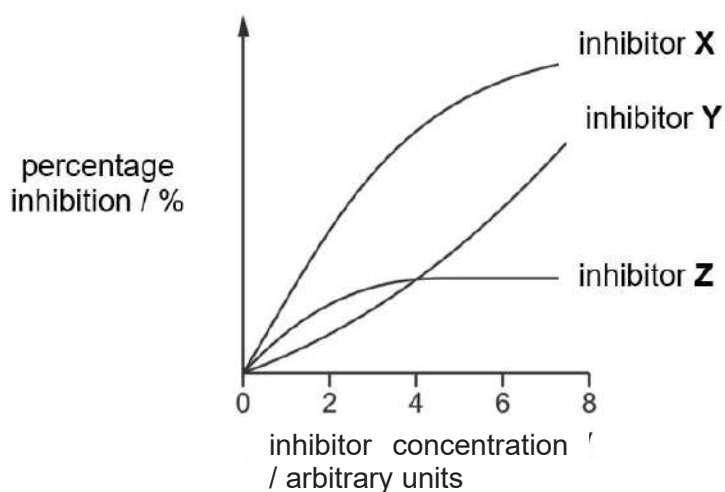
- 6 Lipase catalyses the conversion of fats into fatty acids and glycerol.



Three different enzyme inhibitors of lipase **X**, **Y** and **Z**, which prevent the above reaction from occurring, were investigated.

The percentage inhibition of lipase was measured at different concentrations of inhibitor.

The graph shows the results of the investigation.

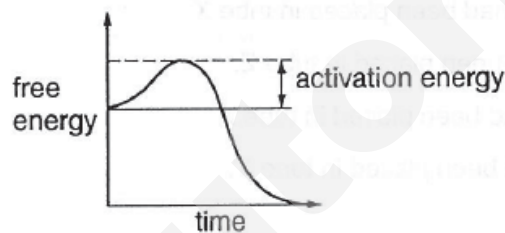


Which is/are valid conclusion(s) from these results?

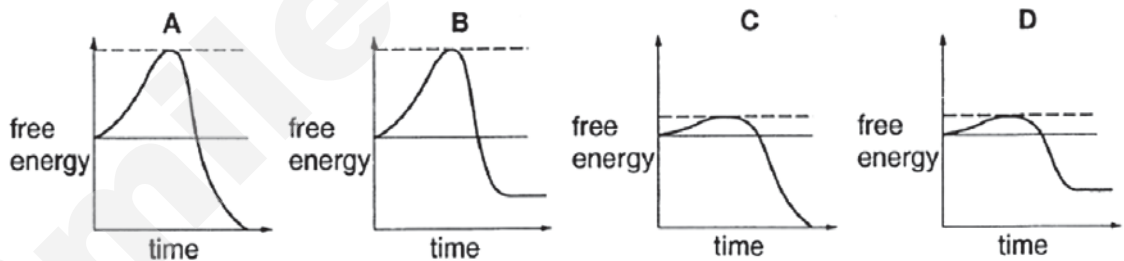
- 1 The higher the concentration of inhibitor **X**, the lesser the amount of fats is broken down.
- 2 The production of fatty acids and glycerol using inhibitor **Y** is higher than when inhibitor **Z** is used.
- 3 The production of fatty acids and glycerol at an inhibitor concentration of 2 arbitrary units is lower than at an inhibitor concentration of 4 arbitrary units, for all inhibitors.

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

- 7 The graph shows energy changes during an enzyme-catalysed chemical reaction.



Which graph shows the energy changes for the same reaction when the enzyme is absent?



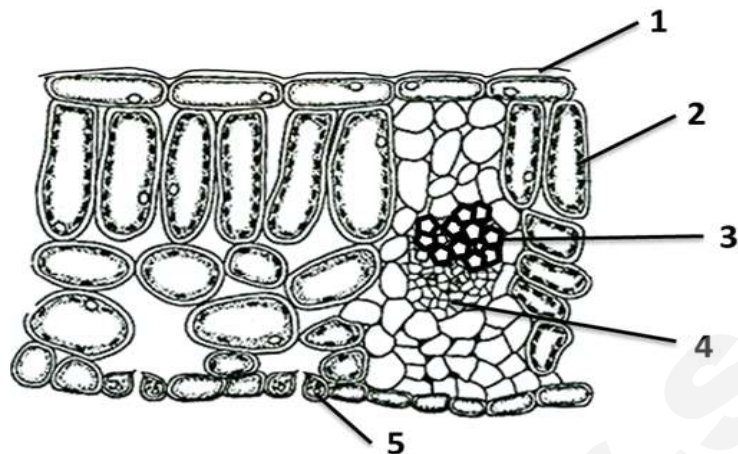
- 8 The diagram shows some chemical reactions that occur in plants.



Which stage/s depend/s on the use of nitrate ions as a raw material?

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

Refer to the diagram of a dicotyledonous leaf to answer questions 9 and 10.



- 9 A drop of concentrated salt solution was placed on the surface of the leaf at 1.

Which statement describes the movement of water molecules between the salt solution and the plant cells in the leaf?

- A There is no movement of water molecules between the salt solution and the plant cells.
 - B There is no net movement of water molecules between the salt solution and the plant cells.
 - C Water molecules move from the plant cells into the salt solution by osmosis.
 - D Water molecules move from the salt solution into the plant cells by osmosis.
- 10 The plant was placed in a glass jar containing radioactive carbon dioxide and then exposed to sunlight.

In which order would radioactivity be detected in the leaf?

- A 1, 5, 2
- B 1, 5, 4
- C 5, 2, 4
- D 5, 4, 3

- 11 Which process is an example of assimilation?

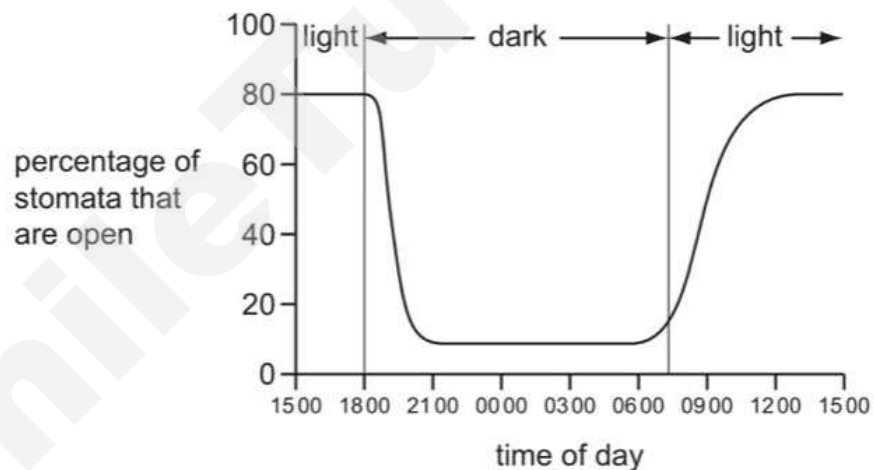
- A formation of carbon dioxide from glucose
- B formation of cell membranes using lipids
- C formation of sweat from blood plasma
- D formation of urea from amino acids

- 12** In patients with cystic fibrosis, thick mucus blocks the pancreatic duct.

Which are possible effects of this blockage?

- 1 egesting oily stool
 - 2 weight loss
 - 3 malnourishment
 - 4 hyperglycemia (high blood glucose)
- A** 1 and 3
- B** 1, 2 and 3
- C** 1, 3 and 4
- D** 2 and 3

- 13** The graph shows stomatal opening and closing in leaves during a 24-hour period.



What can be concluded from the graph?

- A** Gaseous exchange occurs when stomata are open.
- B** Stomata open as light intensity increases.
- C** Gaseous exchange does not occur in the dark.
- D** Transpiration does not occur in the dark.

- 14** The photomicrograph shows an aphid feeding on a branch of a woody tree, *Tilia*. The fluid extracted by the aphid consists of sieve element sap. The high turgor pressure in the sieve element forces the cell contents through the food canal of the aphid. Once every 30 minutes, a droplet of undigested sap exits from the aphid. Plants exhibiting extensive aphid damage can display a variety of symptoms, such as decreased growth rates, stunted growth, low yields and death.



Which pair of observation and explanation is correct?

	observation	explanation
A	sieve element sap	rich in solutes, especially sucrose and amino acids
B	high turgor pressure in sieve element	numerous mitochondria in sieve tubes to carry out active transport
C	undigested sap	product of defecation and not excretion
D	variety of symptoms	due to low levels of manufactured food substances left for <i>Tilia</i> plant

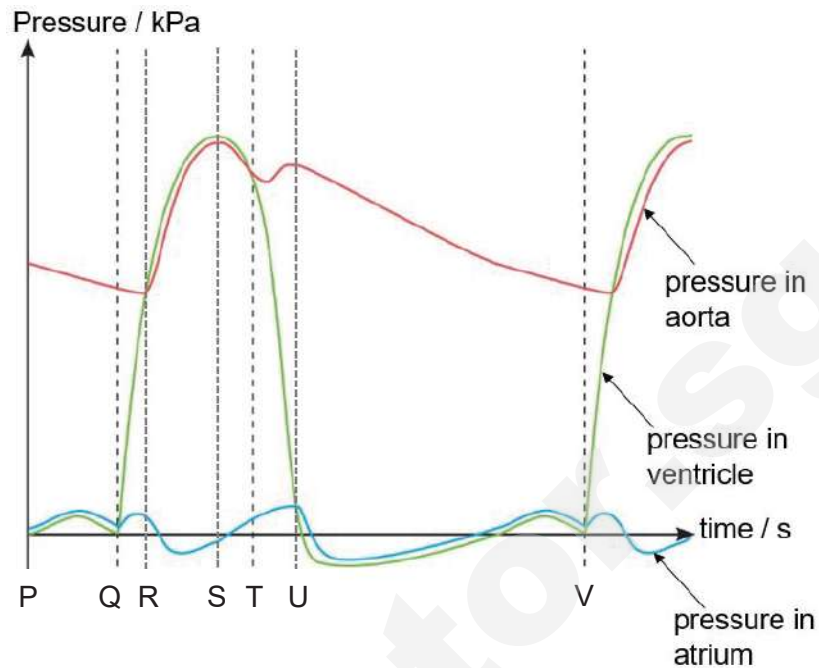
- 15** Blood samples from three veins in the body were tested for the concentration of oxygen, carbon dioxide and urea. The results, in arbitrary units, are shown in the table.

vein	oxygen concentration	carbon dioxide concentration	urea concentration
1	40	48	1.3
2	40	48	7.5
3	90	40	3.9

What are the identities of the three veins?

	hepatic vein	pulmonary vein	renal vein
A	1	3	2
B	2	3	1
C	3	1	2
D	3	2	1

- 16 The graph below shows the pressure changes in the left side of the heart. The letters P, Q, R, S, T, U and V represent time in seconds.



At which time frame does ventricular systole take place?

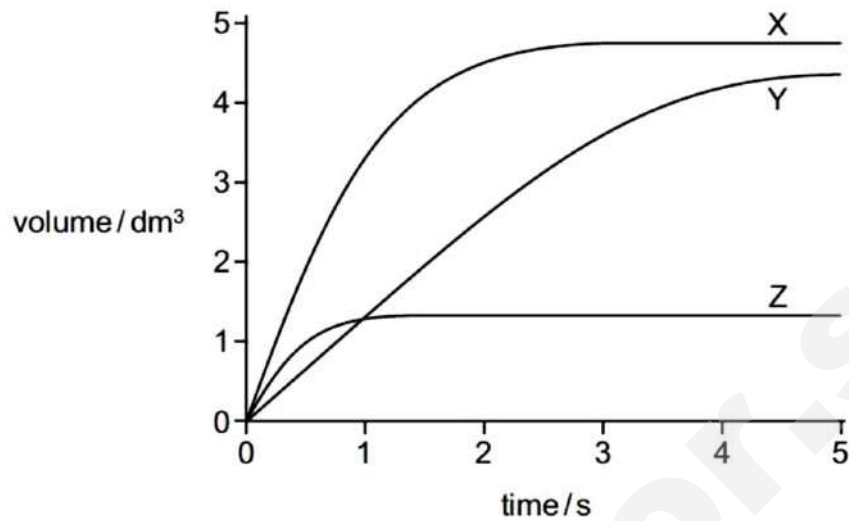
- A** between Q and S
B between Q and T
C between Q and U
D between P and Q
- 17 The table shows the results of a blood test of three volunteers, P, Q and R for blood transfusion.

		donor		
		P	Q	R
recipient	P		agglutination	no agglutination
	Q	no agglutination		no agglutination
	R	agglutination	agglutination	

Which of the following may be the blood types of volunteers P and Q?

	P	Q
A	A	AB
B	A	O
C	B	B
D	O	AB

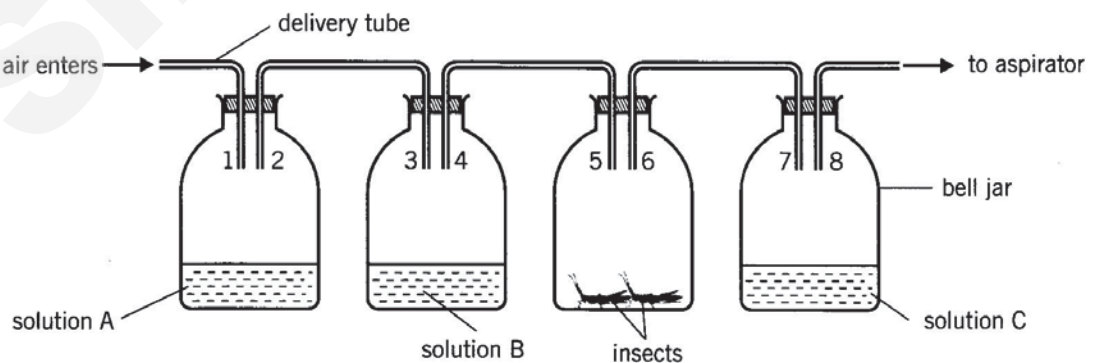
- 18 The graph shows the volume of air deeply inhaled by three different people, X, Y and Z immediately after breathing out quickly and with force.



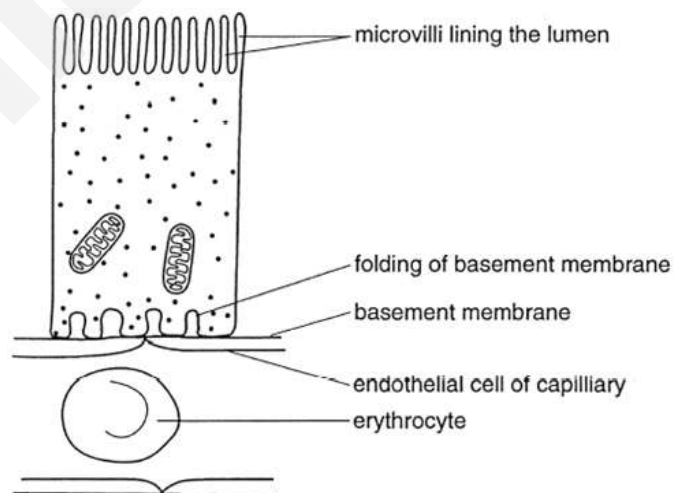
What is an explanation for the differences?

	chronic bronchitis	emphysema	healthy lung function
A	X	Y	Z
B	X	Z	Y
C	Y	Z	X
D	Z	Y	X

For questions 19 and 20, refer to the experimental set-up below. The set-up investigates respiration using living insects. Positions 1 to 8 indicate the end part of the delivery tube.



- 19 Which is the best suggestion to rectify the mistake in the experimental set-up?
- A Air should enter from tube 8 instead of tube 1.
 - B The insects should be replaced with freshwater fish as it is a more effective organism to study respiration.
 - C The end part of delivery tubes at 2 and 4 should be dipped into the solution to let the air flow through solutions A, B and C.
 - D The end part of delivery tubes at 1, 3 and 7 should be dipped into the solution to let the air flow through solutions A, B and C.
- 20 Assuming that the experimental setup has been rectified, which correctly identifies solution A and its purpose?
- A Bicarbonate solution. To detect carbon dioxide released by living organism during respiration.
 - B Sodium hydroxide solution. To remove atmospheric carbon dioxide.
 - C Potassium hydroxide solution. To detect carbon dioxide released by living organism during respiration.
 - D Bicarbonate solution. To remove atmospheric carbon dioxide.
- 21 The diagram shows the ultrastructure of a nephron with part of an adjacent blood capillary.



Which part of the nephron was this taken from?

- A afferent arteriole
- B Bowman's capsule
- C glomerulus
- D proximal convoluted tubule

22 Which statement correctly describes control by negative feedback?

- A** An injury to body tissue activates platelets in the blood and these activated platelets release chemicals which activate more platelets.
- B** During a menstrual cycle, luteinising hormone stimulates the release of oestrogen which in turn stimulates the release of more luteinising hormone.
- C** The onset of contractions during childbirth causes the release of a hormone, which stimulates further contractions.
- D** When blood pressure is high, nerve impulses from the brain cause the blood vessels to dilate and blood pressure is reduced.

23 Caleb injured his hand in a car accident. Shortly after that, he could feel the objects he touched with his hand but was unable to move his hand away from them.

What could have caused this?

- A** Receptors in his hand were damaged.
- B** Relay neurones in his hand could no longer function.
- C** The nerve connection was cut only between the receptors in his hand and his central nervous system.
- D** The nerve connection was cut only between his central nervous system and the effectors in his arm.

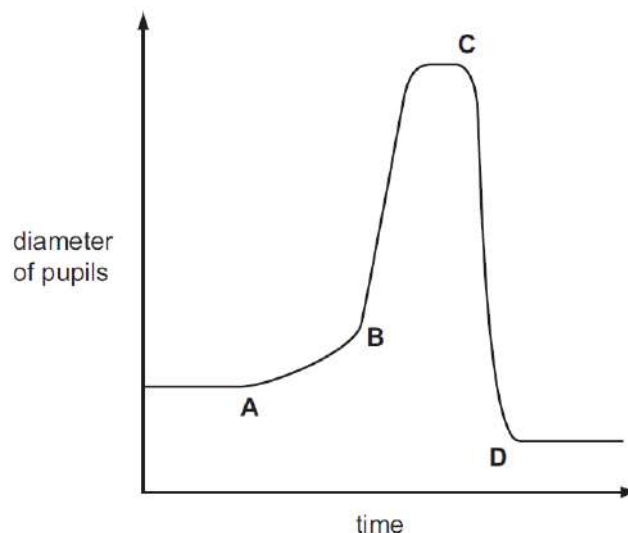
24 Our eyes feel strained when we read small prints for a long period of time.

Which of the following is the correct explanation for the incident described above?

- A** The suspensory ligaments become stretched.
- B** The retina will no longer record clear images.
- C** The optic nerve will no longer transmit impulses to the brain.
- D** The ciliary muscles become fatigued.

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?



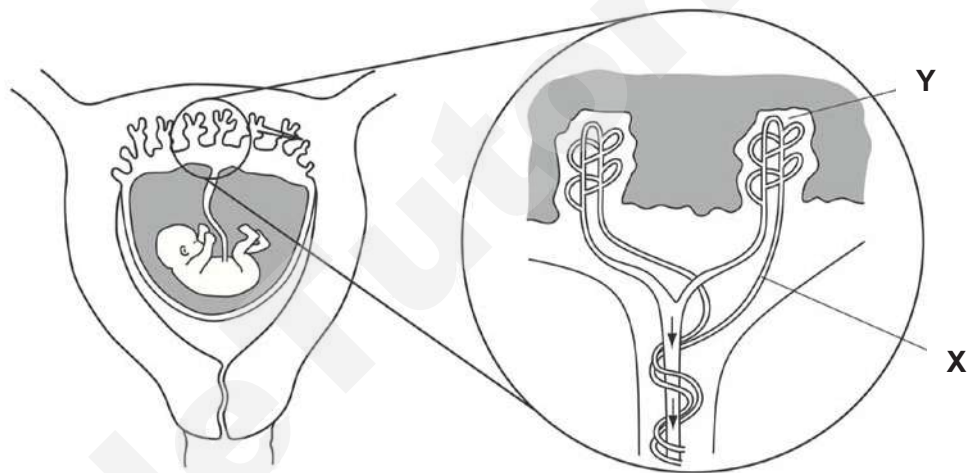
26 Insulin is injected into a diabetic patient rather than taken orally. This is because insulin

- 1 can be broken down by the digestive enzymes.
- 2 will be destroyed by the body immune system.
- 3 cannot be absorbed in the small intestine.
- 4 can travel faster through the blood stream than through the lymphatic network.

Which statement(s) are correct?

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

27 The diagram shows a fetus in the uterus.



Which substance will be at a lower concentration at **X** than at **Y**?

- A** carbon dioxide and glucose
B carbon dioxide and urea
C glucose and oxygen
D oxygen and urea

28 Which precautions should be taken to prevent the spread of HIV?

- 1 avoidance of any direct skin contact with another person
- 2 medical staff wearing gloves when treating patients
- 3 not sharing soap used by another person
- 4 prevent exchange of body fluids being in direct contact
- 5 treatment of blood products to destroy the virus

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

- 29 The table shows information about flowers of three different plants.

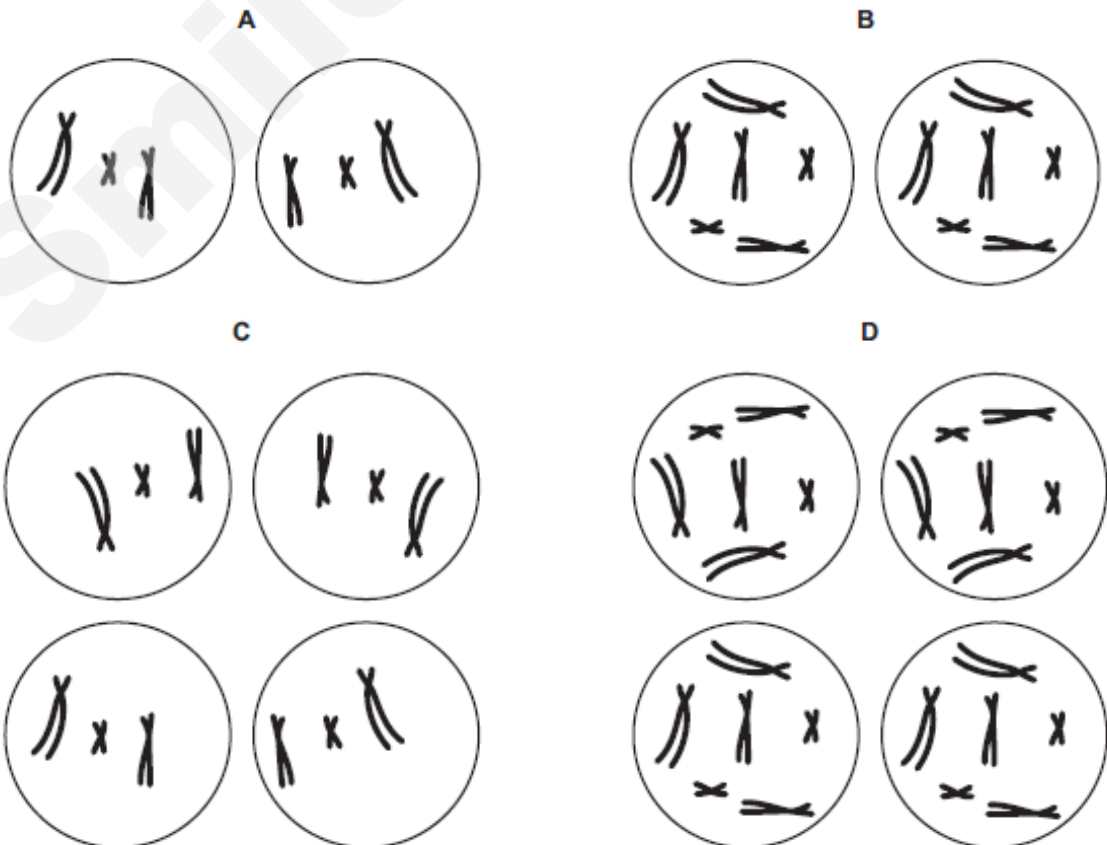
flower characteristics	plant X	plant Y	plant Z
petal colour	white	purple	bright yellow
aroma	none	pungent smell	sweet smell
petal size	0.4 cm	10.2 cm	3.9 cm
nectar volume	none	medium amount	large amount

Which inference is valid about the method of pollination for plants X, Y and Z?

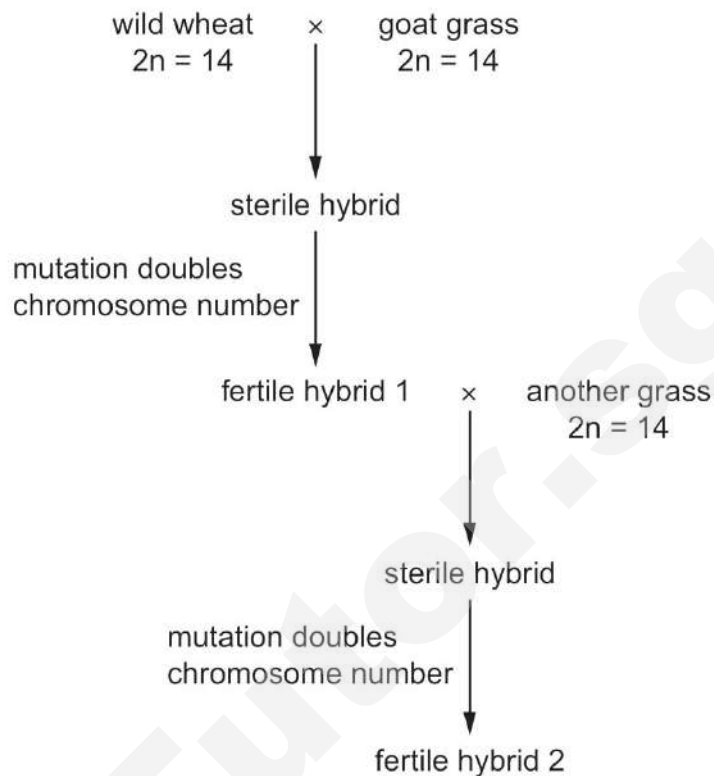
- A All three plants are wind pollinated.
 B All three plants are insect pollinated.
 C Plant X is wind pollinated but plants Y and Z are insect pollinated.
 D Plants X and Y are insect pollinated but plant Z is wind pollinated.
- 30 The diagram shows the chromosomes in a cell.



Which diagram shows the product of **one** division of the cell by mitosis?



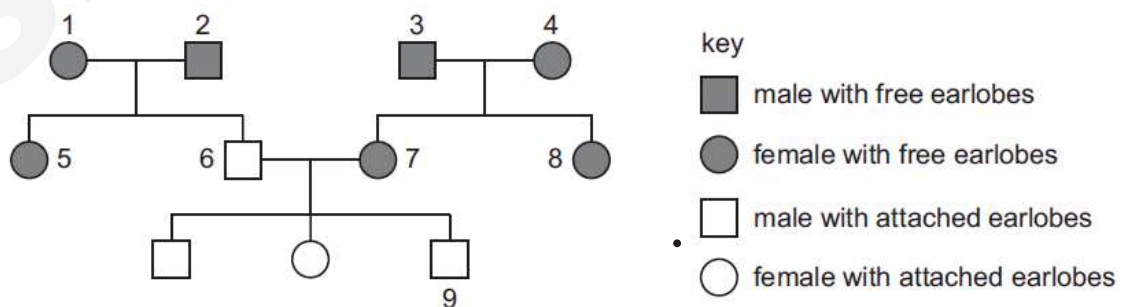
- 31 The diagram shows crosses between wild wheat and two types of grass.



What is the chromosome number of fertile hybrid 2?

- A** 28 **B** 42 **C** 56 **D** 140
- 32 Earlobes can either be attached to the cheek or 'free' (unattached). This characteristic is controlled by a single gene. The allele for attached earlobes is recessive.

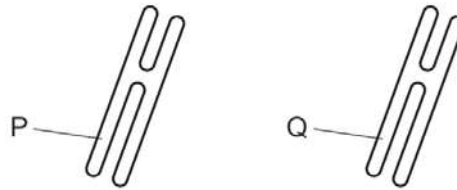
The diagram shows the inheritance of earlobe attachment in one family.



Which two individuals must be heterozygous for earlobe attachment?

- A** 1 and 7
B 3 and 4
C 5 and 8
D 6 and 9

- 33** The diagram shows a pair of chromosomes from the same cell.



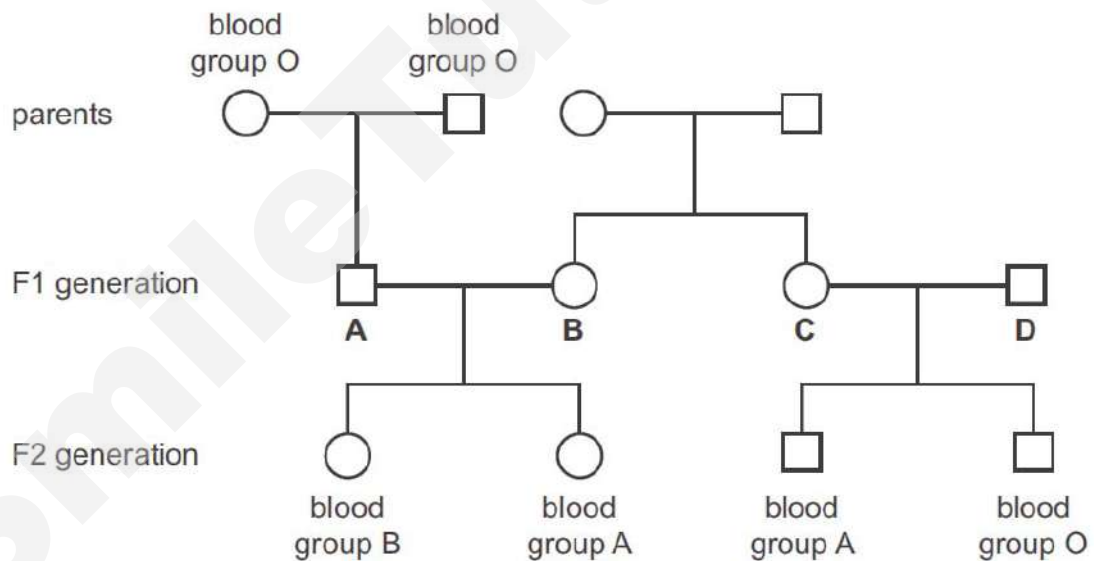
A gene is found at the point labelled P.

In a heterozygous individual, what can be found at the position labelled Q?

- A** a different allele of a different gene
- B** a different allele of the same gene
- C** a different gene of the same allele
- D** the same gene of the same allele

- 34** The diagram shows the blood group phenotypes of some members of a family.

Which member of the F1 generation must be heterozygous, with the codominant alleles?



- 35** In fruit flies, the allele for an ebony-coloured body is recessive to the allele for a grey-coloured body. In an investigation, an ebony-bodied fly is crossed with a grey-bodied fly.

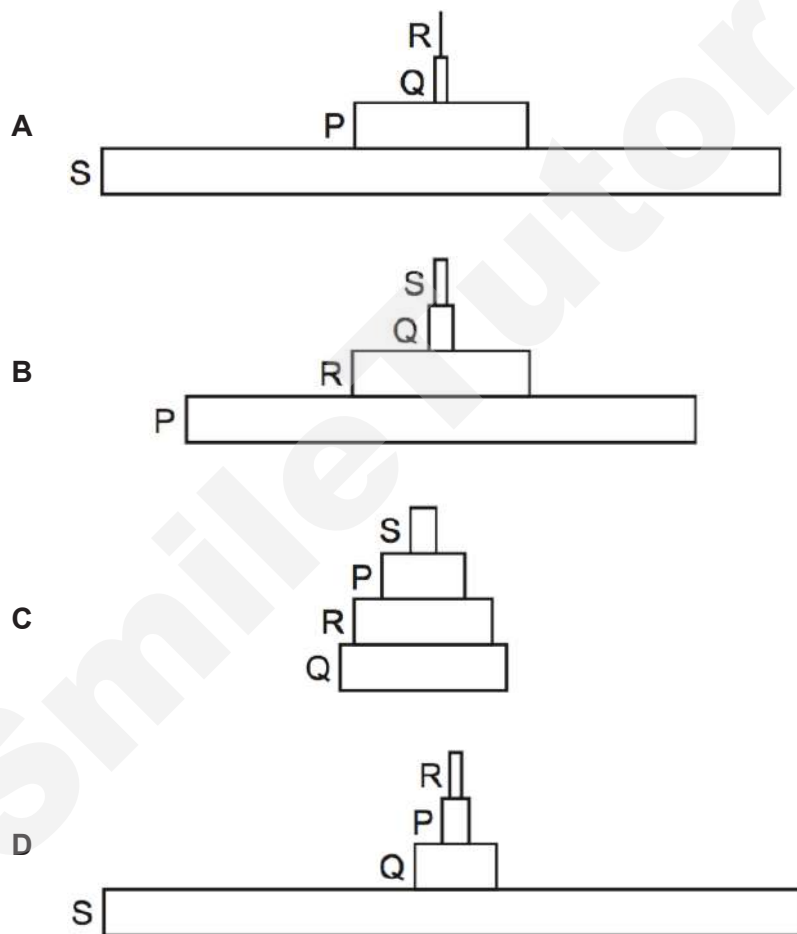
What will be the body colour of the offspring if the grey-bodied fly is heterozygous?

- A** all ebony
- B** all grey
- C** half ebony and half grey
- D** three-quarters grey and one-quarter ebony

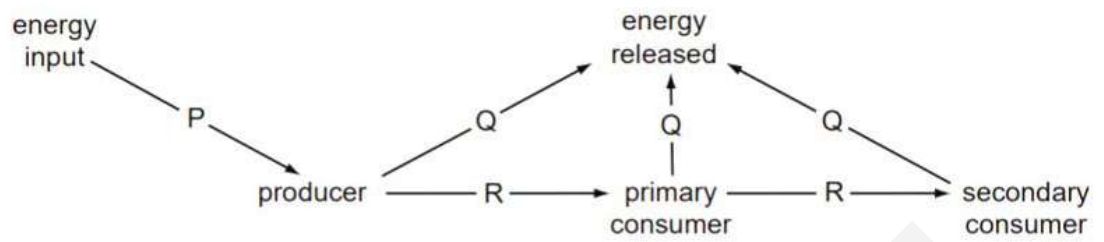
- 36** The table shows the results of a field study of four species in a food chain in an area of woodland.

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 is the correct pyramid of energy from these data?



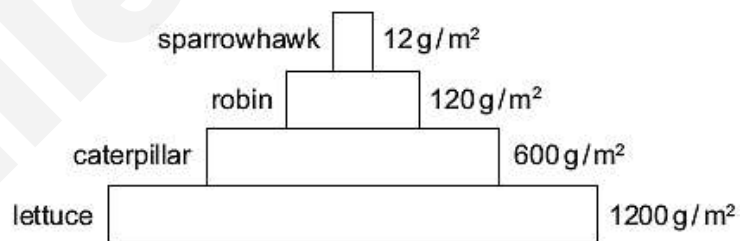
- 37 The diagram shows the flow of energy in a food chain.



What are the forms of energy P, Q and R?

	P	Q	R
A	chemical	light	heat
B	heat	chemical	light
C	light	chemical	heat
D	light	heat	chemical

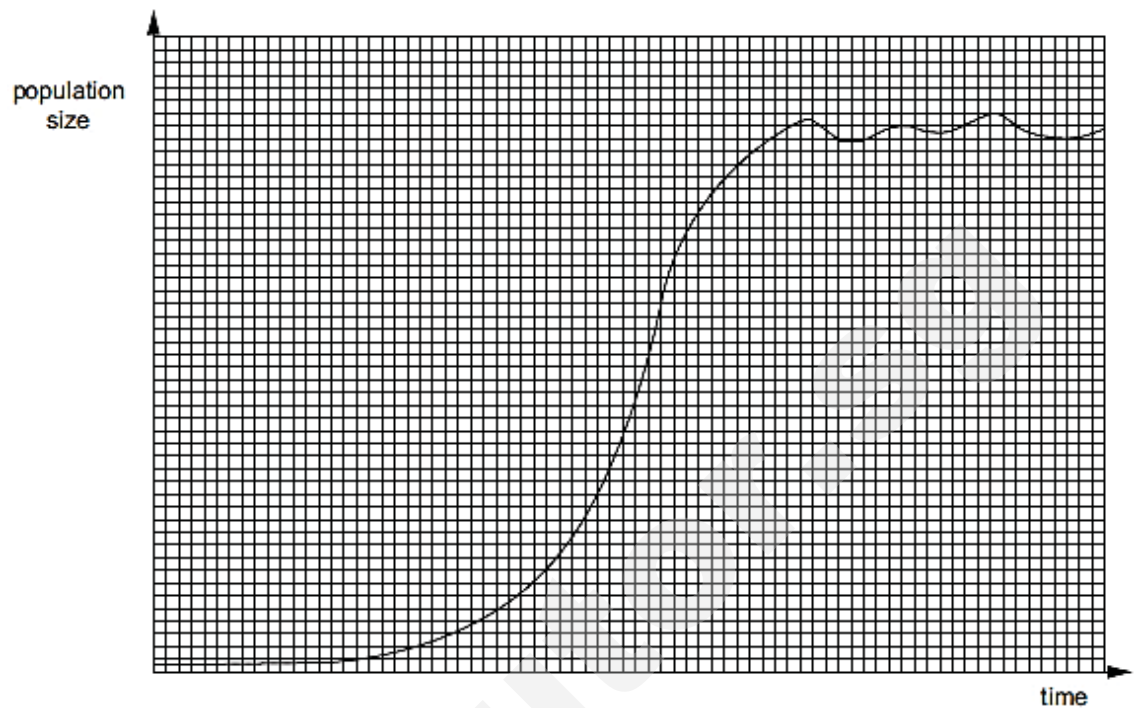
- 38 The diagram shows a pyramid of biomass.



Which percentage of biomass is passed from the primary consumer to the secondary consumer?

- A** 1%
- B** 10%
- C** 20%
- D** 90%

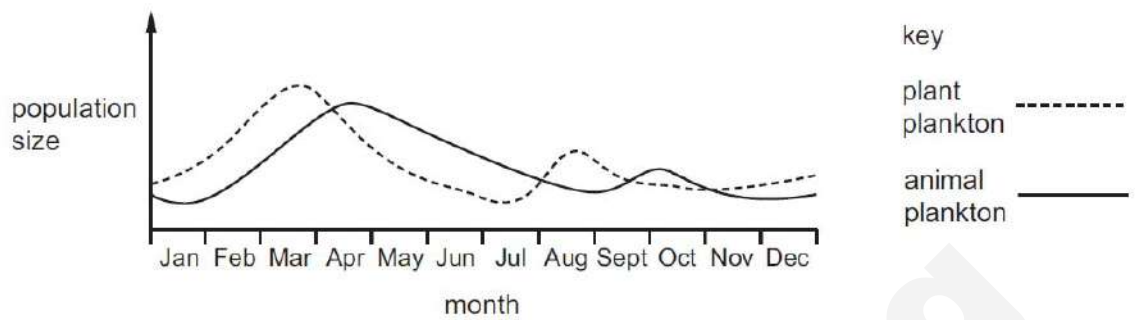
- 39 Some rabbits colonised an island for the first time. The graph shows how their population size changed over the next few years.



What explains the way the size of the rabbit population changed during the exponential (rapidly increasing) phase?

- A limiting factors begin to take effect
- B increase in the number of predators
- C birth rate and death rate in equilibrium
- D increasing number of rabbits able to reproduce

- 40 The graph shows changes in the populations of plant and animal plankton in a lake.



Consider the following statement in relation to the data provided by the graph.

‘Population changes in animal plankton lag behind similar changes in plant plankton because the animals feed on the plants.’

Into which category does the statement fall?

- A It is a reasonable interpretation of the data.
- B It is a restatement of the data, not an interpretation.
- C It is contradicted or not supported by the data.
- D More data are required in order for this interpretation to be made.

END OF PAPER

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ZHONGHUA SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2019

SECONDARY 4E

Candidate's Name	Class	Register Number
	4E4	

BIOLOGY

6093 /02

19 September 2019
1 hour 45 minutes

Additional Materials:

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class in the spaces at the top of this page and on all separate answer paper used.

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

Answer **all** questions.

Write your answers in the spaces provided on the question paper

Section B

Answer all **three** questions, the last question is in the form either/or.

Write your answers in the spaces provided on the question paper.

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.

All essential working must be shown clearly.

For Examiner's Use	
Section A	50
B8	10
B9	10
B10	10
Total	80

Setter: Ms Rozianna
Vetter: Mr Goh Tze Mian

Section A

Answer **all** the questions.

Write your answers in the spaces provided on the question paper.

- 1 Large trees produce sun leaves on the outside of the canopy and shade leaves inside the canopy.

Fig. 1.1 shows the rate of carbon dioxide uptake or production of a sun leaf and a shade leaf when exposed to increasing light intensity.

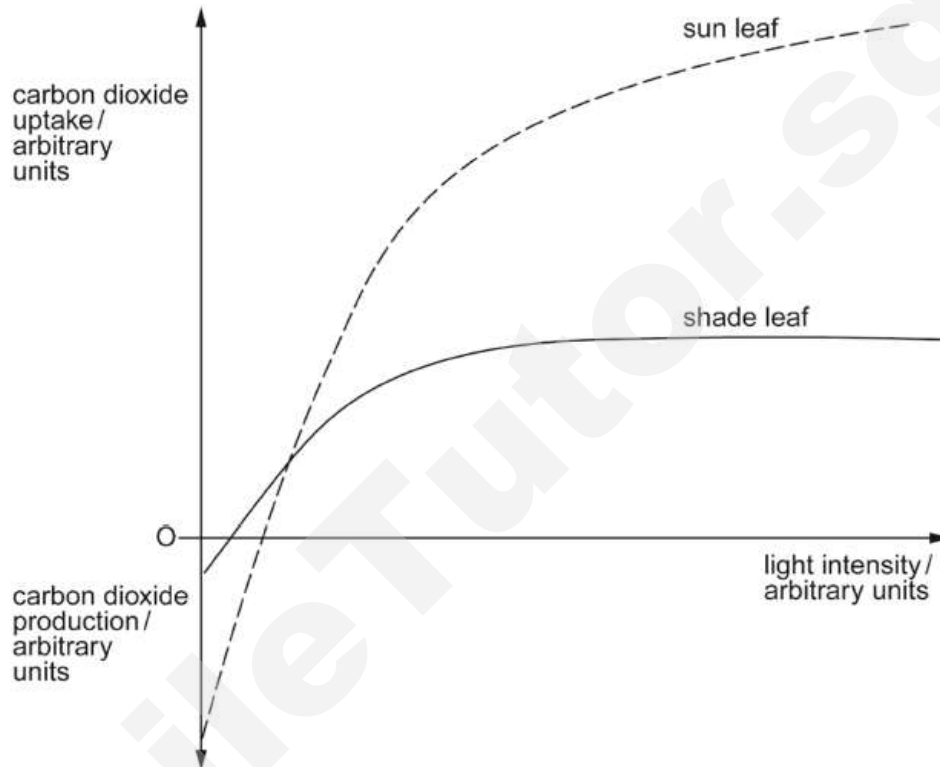


Fig. 1.1

- (a) Draw a line and letter X to label the light intensity at which the rate of respiration is equal to the rate of photosynthesis in the shade leaf on Fig. 1.1. [1]
- (b) With reference to Fig. 1.1, describe two ways in which the sun and shade leaf differ in their response to increasing light intensity.

1

.....

2

..... [2]

Total marks

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- (c) Fig. 1.1 shows the results taken at a temperature of 20°C.

Describe the effect on the sun leaf if the temperature was increased to 25°C.

.....

.....

.....

.....

.....

.....

[3]

- (d) Outline an experimental plan to investigate the effect of carbon dioxide concentration on rate of photosynthesis.

.....

.....

.....

.....

.....

.....

.....

.....

[3]

[Total: 9]

- 2 Fig.2.1 shows the series of events in a cardiac cycle of a man.

The outer ring of the circle (A to H) represents the sequence of events in the ventricles, while the inner ring (a to h) represents events in the atria.

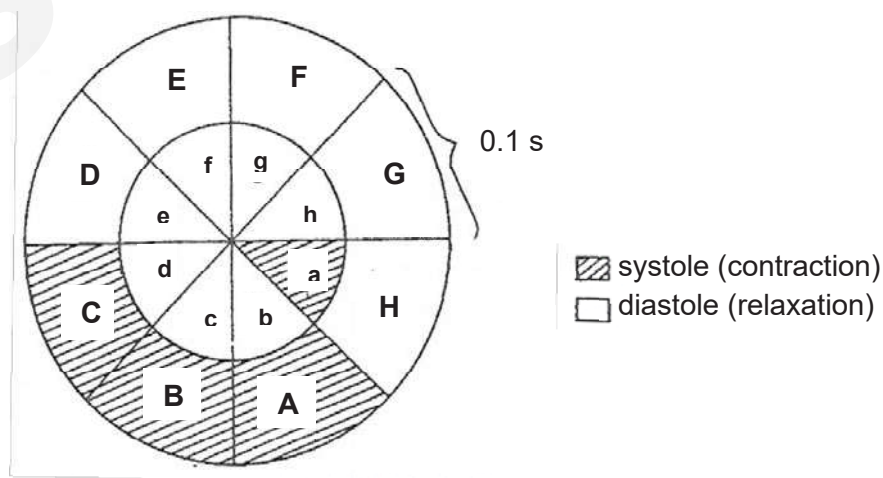


Fig. 2.1

Total marks

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- (a) Calculate the heart rate of the man in beats per minute. Show your working.

..... [1]

- (b) Identify the period (**A** to **H**), at which

(i) blood flows from the atria into the ventricles [1]

(ii) the semi-lunar valves close [1]

- (c) Describe the events that occur in the heart during the period **A** to **C**.

.....

 [3]

- (d) An atrial septal defect is a condition where there is a small hole found in the wall of the heart between the left and right atria.

Suggest why doctors advise patients with atrial septal defect to avoid vigorous sports.

.....

 [1]

[Total: 7]

- 3 Table 3 shows the clearance time of some substances for a patient undergoing kidney dialysis.

Table 3

substance in blood	concentration in blood / mg/l		
	time = 0 h	time = 0.5 h	time = 6 h
urea	176	144	126
creatinine	3.4	2.7	2.5
glucose	134	128	138
potassium	4.3	4.1	4.1
sodium	143	137	135
chloride	108		107

- (a) Complete Table 3 to show the estimated concentration of chloride at time = 0.5 h. [1]
- (b) Calculate the average hourly rate at which urea is removed from the blood of the kidney dialysis patient.

Show your working.

[2]

- (c) Explain the results when $t = 6$ h for potassium.

.....

.....

..... [1]

Total marks

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- (d) The table did not show the concentration of proteins in blood. Predict how the trend of proteins would look like between $t = 0$ h to $t = 6$ h. Give a reason for your answer

.....

.....

..... [2]

- (e) During each treatment, a patient has to undergo dialysis for a few hours. Suggest one way the time can be shortened.

.....

..... [1]

[Total: 7]

- 4 Fig. 4.1 shows the tissues of a mother and her fetus in a human placenta. The maternal blood and fetal blood remain separate.

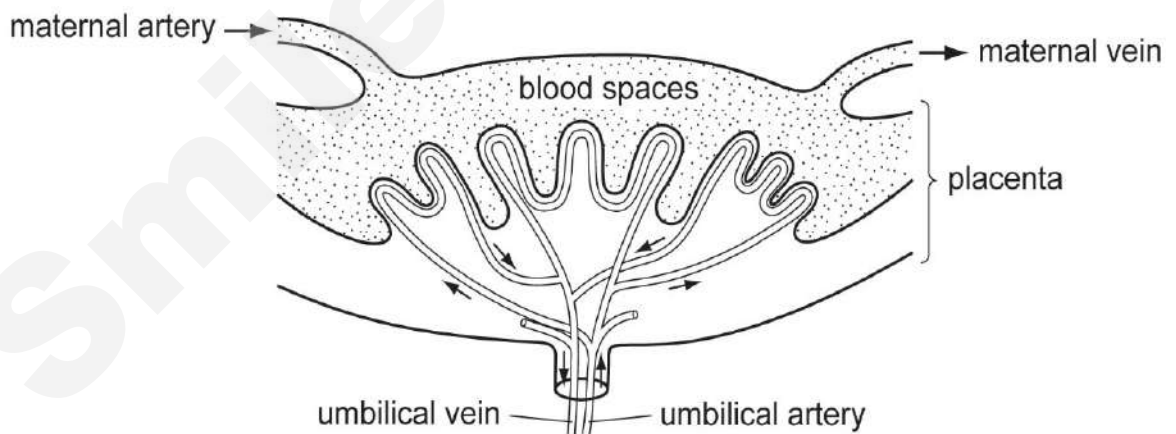


Fig. 4.1

- (a) State a reason why there must be no mixing of fetal and maternal blood.

.....

..... [1]

Total marks

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- (b) The placenta is often described as “a small intestine, a lung and a kidney”.

Explain how the placenta functions like the abovementioned organs.

small intestine

lung

kidney

[3]

- (c) Suggest two ways in which a pregnant mother could help in the healthy development of her fetus.

[2]

[Total: 6]

- 5** Scientists are able to treat people with some types of brain damage. They may do this by injecting a patient with cells taken from another person (donor). These cells then migrate to the brain where they divide and specialise to become groups of fully functioning brain cells.

(a) State the type of cell division that takes place when the injected cells reach the patient's brain.

..... [1]

(b) State the term used to describe a group of cells that are specialised to perform a specific function.

..... [1]

(c) Female patients were injected with cells from male donors. After a period of time, the scientists examined brain cells from these patients and looked for groups of brain cells containing the Y chromosome.

Explain why finding groups of brain cells containing the Y chromosome would suggest to the scientists that the treatment may have been successful.

..... [3]

[Total: 5]

- 6 In the inheritance of the colour of cat fur, the allele for yellow fur (**A**) is dominant to the allele for grey fur (**a**).

- (a) Two heterozygous yellow-coloured cats produced offspring. Use a fully labelled genetic diagram to show how the colour of cat fur is inherited by the offspring.

State the expected ratios of genotypes and phenotypes in the offspring.

[5]

A particular combination of these alleles is known as a 'lethal' combination. Young that inherit this combination die in the uterus during the very early stages of development. This results in a 2:1 ratio of fur colour in the surviving offspring.

- (b) Identify the lethal combination of alleles and explain how you reached this answer.

lethal combination

explanation

[3]

[Total: 8]

Total marks	
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- 7 Fig. 7.1 shows some of the interactions that take place in an aquatic ecosystem.

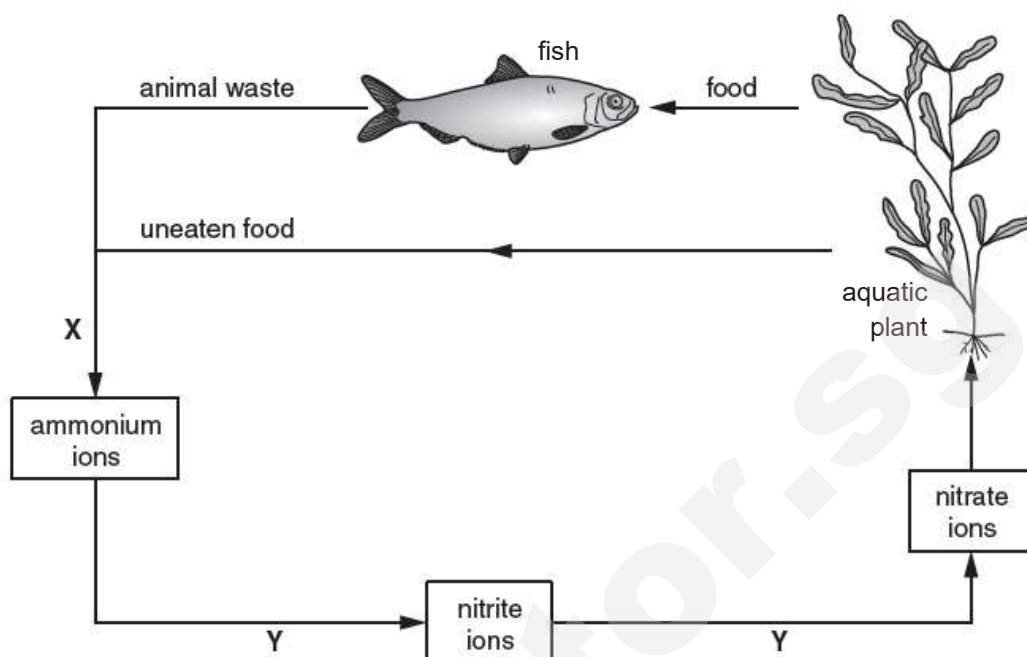


Fig. 7.1

- (a) Use the information in Fig. 7.1 to state the
 trophic level of aquatic plant
 trophic level of fish [2]
- (b) Explain one way, other than for food, that the fish may depend on the aquatic plant.

 [2]
- (c) Y represents the nitrification process responsible for the conversion of nitrogenous compounds into nitrate ions.
- State the name of process X and suggest the type of microorganism which carries out both processes X and Y.
- process X
 type of microorganism [1]

- (d) Describe the pollution effect that nitrogen-containing fertilizers might have on this ecosystem.

[3]

[Total: 8]

Section B

Answer all **three** questions, the last question is in the form **EITHER / OR**.

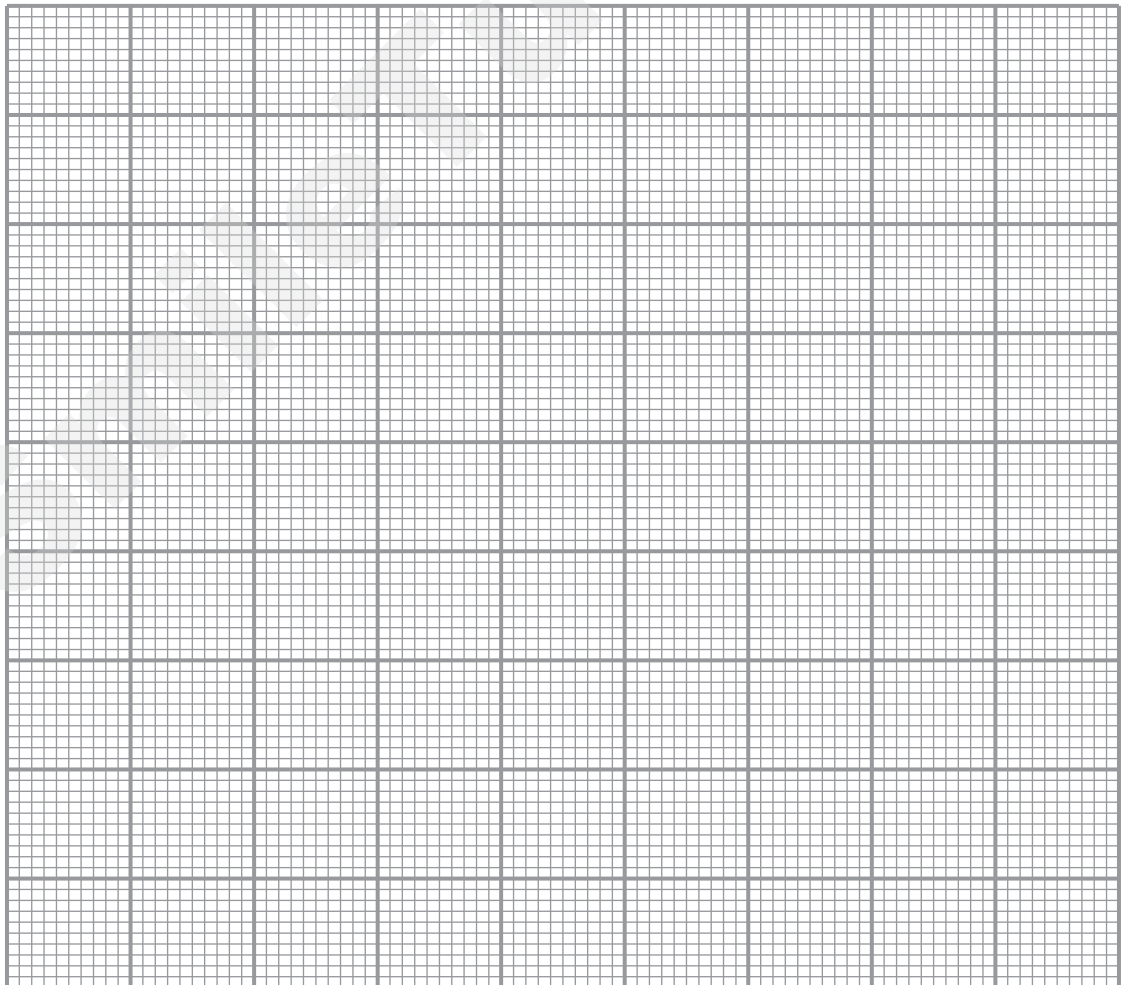
Write your answers in the spaces provided.

- 8 Table 8.1 shows the results obtained in an investigation to compare the rate of transpiration with the rate of water absorption of a plant taken at four hour intervals on a summer day.

Table 8.1

time / h	rate of water absorption / g/h	rate of transpiration / g/h	light intensity / %
04 00	1.5	0.25	0
08 00	1.5	2.0	70
12 00	3.5	5.0	100
16 00	5.5	7.25	100
20 00	3.25	2.5	10
24 00	2.0	0.75	0

- (a) Using the data in Table 8.1, plot a graph to show how the rate of water absorption and the rate of transpiration changes with time. Join the points using straight lines.



[4]

Total marks

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- (b)** Based on the results, what is the time of the maximum water absorption and maximum transpiration? Explain your answer.

[4]

- (c) With reference to Table 8.1, suggest whether the plant can live indefinitely under the conditions of the experiment.

[2]

[Total: 10]

- 9 Fig. 9.1 shows the stages in the process of genetic engineering to produce the hormone insulin.

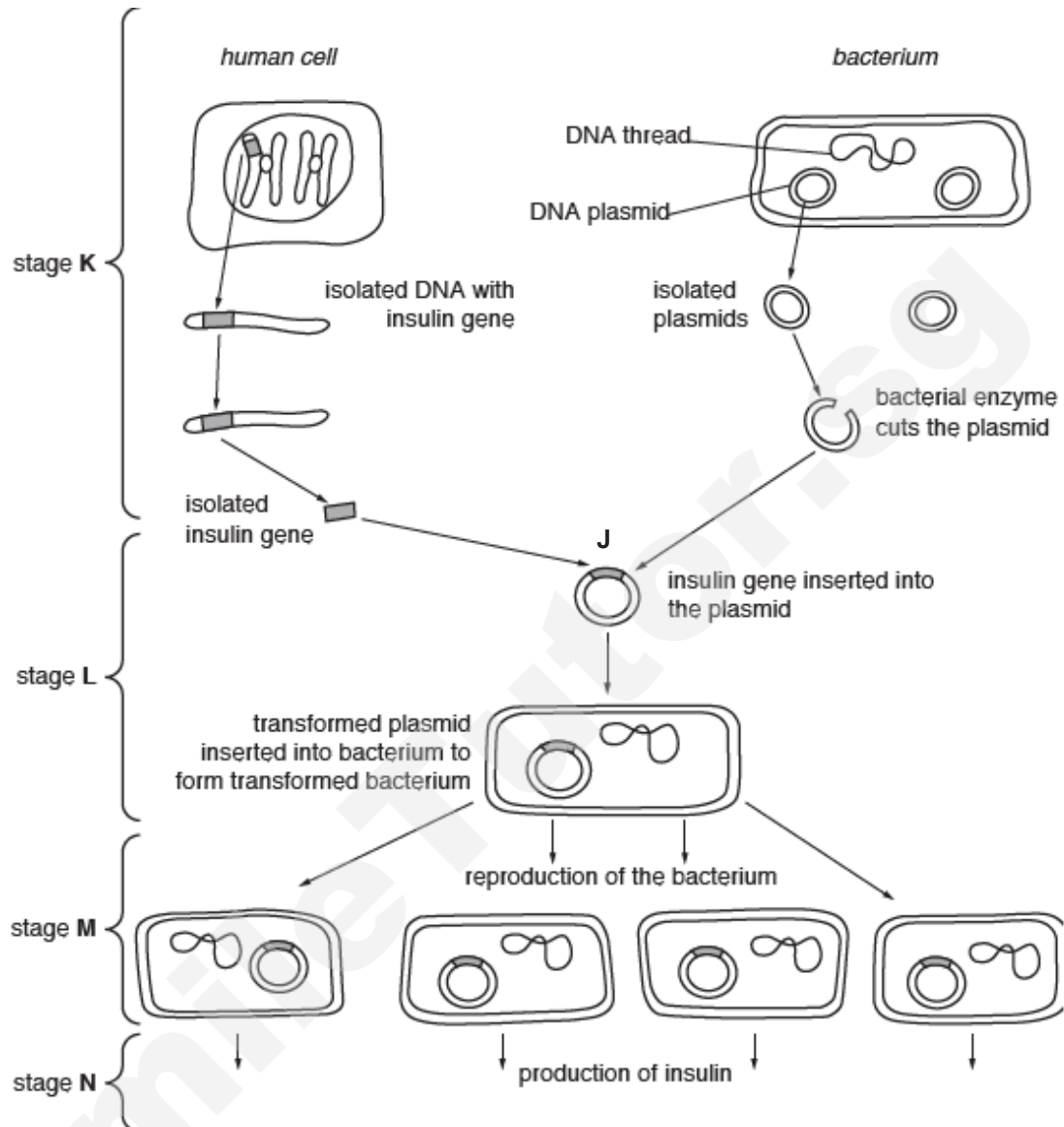


Fig. 9.1

- (a) (i) Describe how the location and organization of genetic material in the human cell shown in stage K of Fig. 9.1 is different from that in the bacterium shown.

.....

.....

.....

.....

[2]

Total marks

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- (ii) Describe how the events in stage **K** led to the production of **J**.

.....

.....

.....

.....

.....

..... [3]

- (iii) Stage **N** of Fig. 9.1 takes place in a container similar to that used in the large-scale production of antibiotics.

State the name of this type of container.

..... [1]

- (b) Genetic engineering can also be used to produce crop plants for humans to eat.

Discuss the potential advantages and dangers of using genetic engineering to produce crop plants for humans to eat.

advantages

.....

.....

.....

..... [2]

dangers

.....

.....

.....

..... [2]

[Total: 10]

Total marks	
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EITHER

- 10 (a)** A parasitic insect known as red scale affects mainly citrus trees. Fig. 10.1 shows the distribution of red scales and their predators before treatment with an insecticide, shortly after treatment and long after treatment.

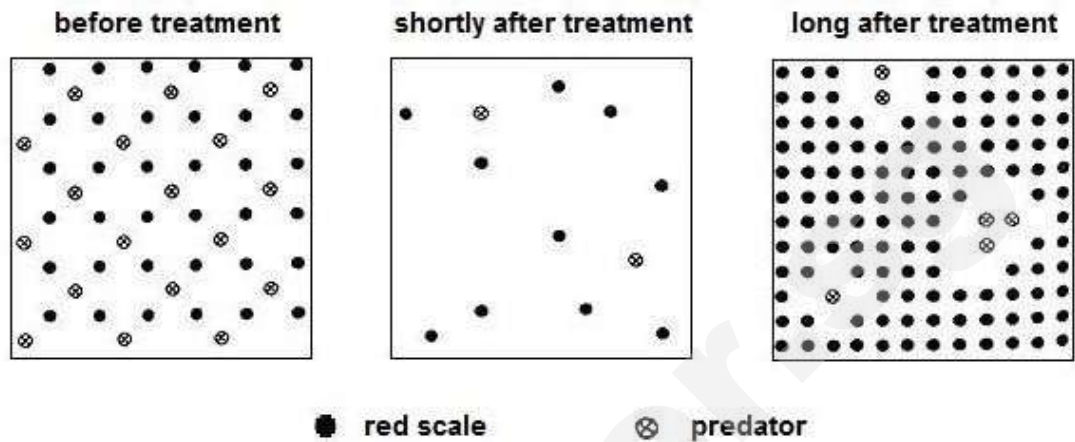


Fig. 10.1

With reference to Fig. 10.1, explain why the use of insecticides is not the best way of destroying the red scales.

[5]

(b) Fig. 10.2 shows a sewage treatment plant.

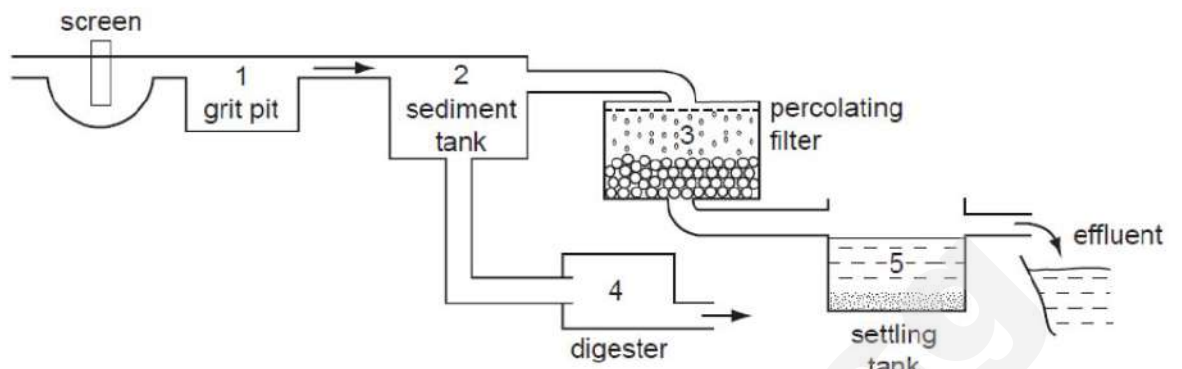


Fig. 10.2

With reference to Fig. 10.2, describe the role of microorganisms in the treatment of sewage.

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[5]

[5]

[Total: 10]

OR

- 10** 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 actions.

- (a)** moving a bolus in the oesophagus after ingestion of food

[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

Blank lined area for writing the answer to Question 4.

[Total: 10]

End of Paper

Total marks	
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PAPER 1
MULTIPLE-CHOICE QUESTIONS [40 MARKS]

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

PAPER 2 SECTION A
STRUCTURED QUESTIONS [50 MARKS]

Qn	Marking Point	Mark
1a	For an X at the point where graph for shade leaf intersects x axis	1
1b	The shade leaf did not produce or uptake CO ₂ at a higher light intensity than the sun leaf OR Higher rate of photosynthesis / CO ₂ uptake in the sun leaf than the shade leaf at higher light intensity	1
	The rate of photosynthesis increases more rapidly / (at a faster rate) in the sun leaf □ CO ₂ uptake is greater in the shade leaf at low light intensity	1
	More respiration occurred in the sun leaf at lower light intensity	1
	CO ₂ uptake levels off in the shade leaf	1
		Any 2
1c	The increase in temperature increases the <u>rate of enzyme-</u> controlled reactions involved in photosynthesis / <u>more successful collisions</u> in the chloroplast so there is more chemical reaction taking place	1
	Increasing temperature will <u>increase the rate</u> of photosynthesis	1
	And carbon dioxide uptake increases	1
1d	Immerse aquatic plant in five different concentrations of sodium hydrogencarbonate solutions	1
	Fixed light intensity / similar plant size and type	1
	Count number of (oxygen) bubbles released by leaf in five minutes	1
2a	Heart rate = 60 / 0.8 = 75 bpm	1
2bi	H	1
2bii	D	1
2c	Muscles in ventricular wall contract at A leading to increased pressure in ventricles	1
	Causing semi-lunar valves to open	1
	Blood then rushes from ventricles to aorta / pulmonary artery	1
2d	Low oxygen content in blood due to mixing of oxygenated and deoxygenated blood	1

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Qn	Marking Point	Mark
3a	Accept 1.06 to 1.08	1
3b	Rate = $50/6 = 8.33$ Correct units = mg/dl h^{-1}	1 1
3c	The bath fluid contains the same concentration of mineral salts No net movement of these substances	1 1
3d	Trend should show a straight horizontal line/constant Proteins are too large to pass through selectively permeable tubing, hence no change in concentration	1
3e	Change to machine <ul style="list-style-type: none"> • Increase the number of coils of tubing • Increase length and decrease diameter of tubing Accept others <ul style="list-style-type: none"> • Decrease protein intake in diet \rightarrow less urea to be removed 	1 1 1
4a	The mother and fetus can be of <u>different blood groups</u> which can <u>cause blood clumping / agglutination</u> Reject coagulation / clotting The <u>high pressure of the mother's blood</u> can <u>kill the fetus</u> .	1 1 Any 1
4b	<ul style="list-style-type: none"> • The placenta is <u>like the small intestine</u> as it allows the <u>diffusion of digested food substances / digested nutrients such as glucose / amino acids / fats from the mother's blood to the fetal blood</u>. • The placenta is <u>like the lungs</u> as it allows the <u>transport of oxygen from the mother's blood to the fetal blood</u> and <u>carbon dioxide from the fetal blood to the mother's blood</u>. • The placenta is <u>like the kidney</u> as it allows <u>transport of urea / nitrogenous waste from the fetal blood to the mother's blood</u>. 	1 1 1
4c	A pregnant mother, <ul style="list-style-type: none"> • should not smoke • should not drink alcohol • should not take non-medicinal drugs • should have a well-balanced or healthy diet • should carry out regular / light exercise 	1 Any 2
5a	Mitosis	1
5b	Tissue	1
5c	Y chromosome is only in males / female is XX; injected cells have travelled to brain; Replication / cell division has occurred / tissue has formed; Cells present after time period	1 1 1 1 Any 3
6a	Parental Phenotype Yellow x Yellow Parental Genotype Aa x Aa (R if wrong symbols used) Gametes A a A a F1 Genotype AA Aa Aa aa F1 Phenotype 3 yellow : 1 grey	1 1 1 1 1
6b	AA (e.c.f. for use of incorrect symbols) ; With reference to 1 in 4 being AA ; When the offspring with lethal combi dies, it leaves ratio 2 yellow : 1 grey	1 1 1

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Qn	Marking Point	Mark
7a	producer / 1st / 1 ; (primary) consumer / herbivore / 2nd / 2	1 1
7b	plant releases oxygen ; fish uses this (oxygen) for (aerobic) respiration lay eggs on weed / provides cover / nesting ;	1 1 1 1
7c	Decomposition Bacteria	$\frac{1}{2}$ $\frac{1}{2}$
7d	Eutrophication/algal bloom on water surface blocks off sunlight, leading to death of submerged water plants increased decay (of plants / waste products of fish) leading to increased numbers of bacteria more oxygen used by decomposers for respiration leading to death of fish / animals	1 1 1

PAPER 2 SECTION B
LONGER STRUCTURED QUESTIONS [30 MARKS]

8a	axes labelled with correct units suitable linear scales accurate plotting of points on a single set of axes for both graphs lines drawn	1 1 1 1
8b	1600 At 1600, light intensity is 100%, stomata are widely open , causing maximum water transpiration, Rate of water absorption also increases to the maximum to replace the amount of water loss At the same time at high light intensity, the rate of water absorption increases as the photosynthetic rate of plant increases .	1 1 1 1
8c	No Rate of transpiration is higher than rate of absorption, causing plant to wilt. [Quote data]: Over 24 hours, 71g (17.75 g/h per 4 hourly period) of water is lost through transpiration while only 17.25 g/h per 4 hourly period) of water is absorbed.	1 1
9ai	in nucleus (human) / within nuclear membrane ORA ; in cytoplasm (bacteria) ; thread-like + plasmid(s) (bacteria) ; genes / chromosomes paired (human)	1 1
9aii	Use of same restriction enzyme to isolate human insulin gene and to cut bacterial plasmid Formation of complementary sticky ends results in pairing between human insulin gene and plasmid Use of DNA ligase to seal bonds between insulin gene and plasmid to form recombinant DNA, J	1 1 1

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9aiii	Fermenter / bioreactor	1
9b	<p>potential advantages (Any 2)</p> <p>increased yield / more profitable / grow quicker / reduce famine</p> <p>able to grow in environmental extremes / grow in new areas ;</p> <p>more predictable results than selective breeding / more certain</p> <p>able to transfer (beneficial) genes / features between species</p> <p>nutritionally improved / visually improved / desirable outcome e.g. uniform shape</p> <p>disease / pest resistance</p> <p>potential dangers (Any 2)</p> <p>risk of genetic spread to other species</p> <p>may be patented / costs too much</p> <p>possible risk to health of other species</p> <p>possible risk to genes of other species</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>
10a	<p>population of red scale pest long after treatment is even greater than before treatment ;</p> <p>insecticide causes mutation + mutated red scale are immune to insecticide;</p> <p>insecticide kills non-resistant red scale, leaving naturally resistant red scale to reproduce + over time, population of resistant red scale increases;</p> <p>insecticide kills natural predators + less predation/ selection pressure on red scale, red scale population increases;</p> <p>ecological balance after treatment disrupted eg. reproduction rate of red scale higher than predator/ predators affected by effects of bioaccumulation;</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>
10b	<p>Use of aerobic and anaerobic bacteria and fungi</p> <p>aerobic conditions in percolating filter tank due to pumping of air bubbles</p> <p>anaerobic conditions in digester tank;</p> <p>bacteria secretes enzymes to decompose/ digest organic matter in wastes;</p> <p>useful / water-soluble matter absorbed and used by bacteria;</p> <p>treated effluent and sludge contains lower concentration of organic matter and harmful pathogens</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>
O10a	<p>Circular muscle behind the bolus contracts + longitudinal muscle relaxes</p> <p>oesophagus constricts;</p> <p>Below the food bolus, circular muscle relaxes + longitudinal muscle contracts – oesophagus widen;</p> <p>Squeezes and pushes the bolus downward;</p> <p>by peristalsis</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>
O10b	<p>Circular muscles of the iris contract + radial muscle relaxes;</p> <p>Pupil becomes smaller</p>	<p>1</p> <p>1</p>
O10c	<p>External intercostal muscles of the rib cage contract + internal intercostal muscles relax;</p> <p>Raised the ribcage upwards and outwards;</p> <p>(Together with the help of a lowered diaphragm)</p> <p>Volume in thoracic (chest) cavity increases + pressure lower than in lungs;</p> <p>Lungs expand, causing pressure in lungs to be lower than the atmospheric pressure</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>

