



2012 Secondary School Examination Papers

Secondary Four Express Biology Paper 1 & 2

1	St. Patrick's School	SA2
2	Paya Lebar Methodist Girls' School (Secondary)	SA2
3	Presbyterian High School	SA2
4	Singapore Chinese Girls' School	SA2
5	Xinmin Secondary School	SA2
6	Zhonghua Secondary School	SA2
7	Temasek Secondary School	SA2
8	Nan Hua High School	SA2

FNAME	CLASS	INDEX No.
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ST. PATRICK'S SCHOOL MID-YEAR EXAMINATIONS 2012

SUBJECT : BIOLOGY (5094)
PAPER 1

DATE : 10 MAY 2012

LEVEL : SECONDARY 4 EXPRESS

DURATION : 1 HR

INSTRUCTIONS TO CANDIDATES:

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO.

1. 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 **OPTICAL ANSWER SHEET**.

INFORMATION FOR CANDIDATES:

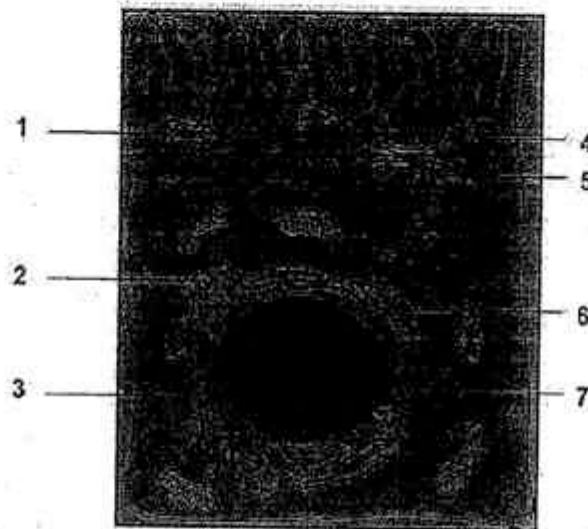
Each correct answer will score one mark. Marks will not be deducted for wrong answers. Any rough working should be done in this booklet. Your total score for Paper 1 will be the number of correct answers given.

This question paper consists of 19 printed pages.

Answer **ALL** questions.

Choose the most appropriate answer and shade the corresponding letter on the separate OAS provided.

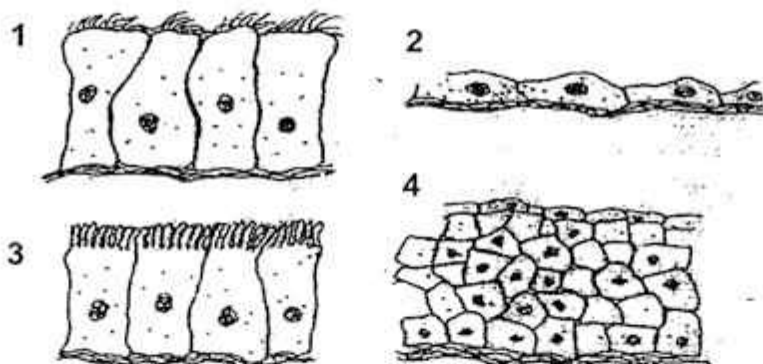
1. The figure below represents an epithelial cell lining the wall of the small intestine.



Which of the following correctly identifies the organelles responsible for energy release and packaging/modifying of materials?

	Energy Release	Packaging/modifying materials
A	1 and 2	3 only
B	4 only	6 and 7
C	1 only	4 and 5
D	6 only	3 and 6

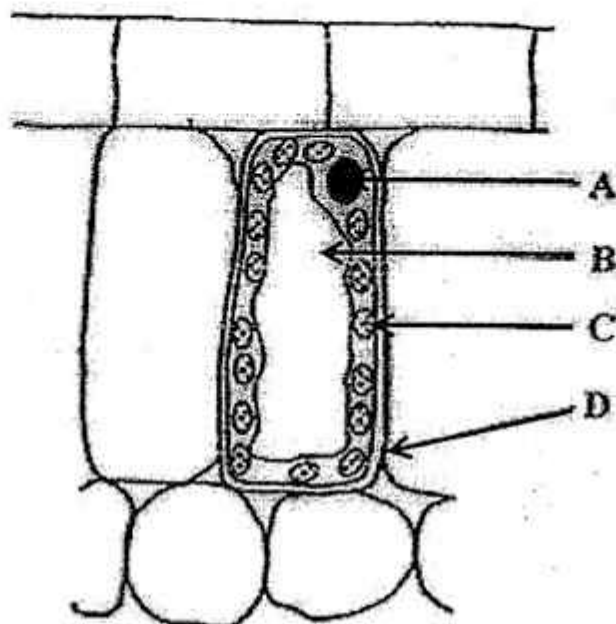
2. The diagram below shows four different types of cells, not drawn to scale.



Where can these four types of cells be found?

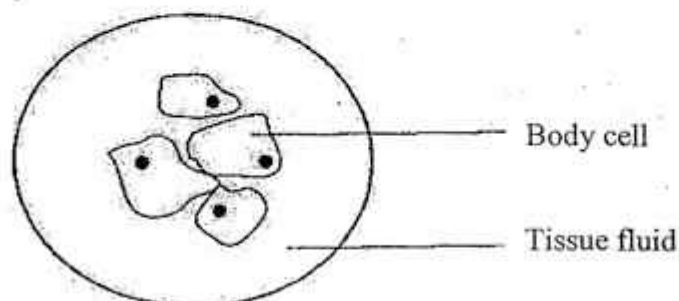
	1	2	3	4
A	villi	trachea	skin	blood vessel
B	trachea	blood vessel	villi	skin
C	skin	villi	blood vessel	trachea
D	blood vessel	skin	trachea	villi

3. The diagram below shows part of one cell in a leaf.



Which one of the labelled parts A, B, C or D is also found in an animal cell?

4. The diagram below shows a group of body cells surrounded by tissue fluid.



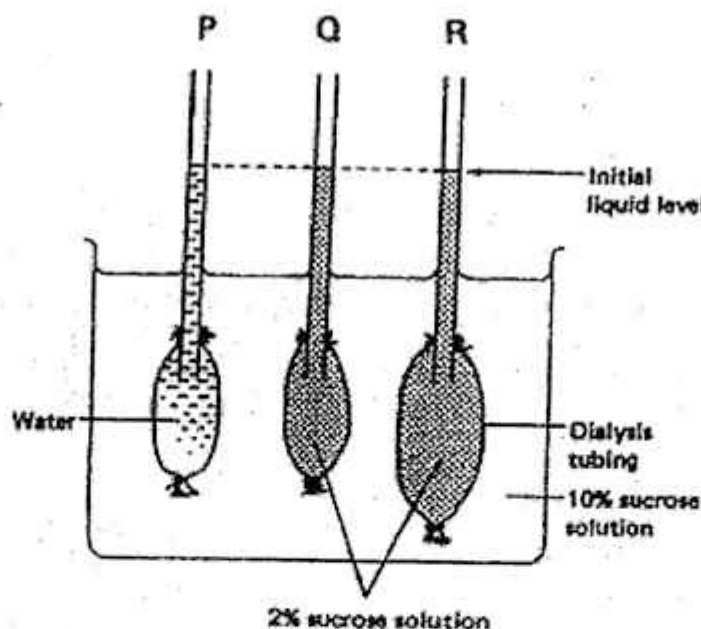
Which conditions ensure that body cells take in water?

	Concentration of tissue fluid	Water potential of cytoplasm in body cells
A	High	High
B	High	Low
C	Low	High
D	Low	Low

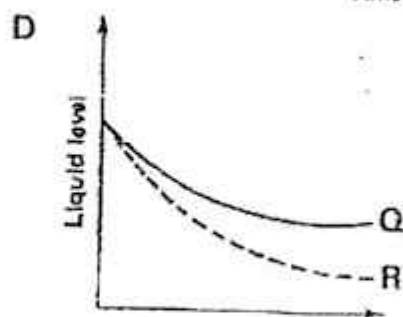
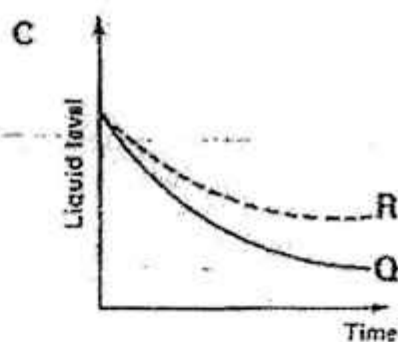
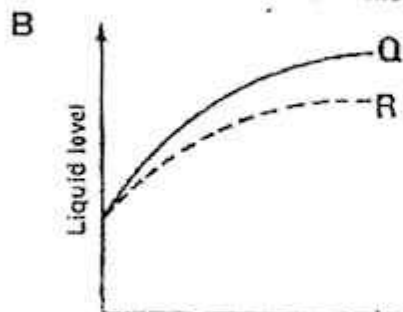
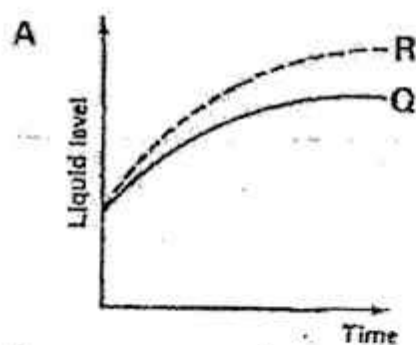
5. A pupil treated four identical pieces of potatoes in two stages, as described in the table below. Which piece of potato will show the largest increase in size after 3 hours?

	Stage 1	Stage 2
A	Unboiled	Placed in 15% sucrose solution for 3 hours
B	Boiled in water for 20 mins	Placed in distilled water for 3 hours
C	Boiled in water for 20 mins	Placed in 15% sucrose solution for 3 hours
D	Unboiled	Placed in distilled water for 3 hours

6. In the experimental set-up shown below, the tubing acts as a partially permeable membrane.



Which one of the following graphs illustrates the likely variations in liquid levels in tubings Q and R?



7. Which one of the following is an energy-rich carbohydrate stored in large quantities in the cytoplasm of liver and muscle?

A ATP
B Starch
C Protein
D Glycogen

8. For the same amount of mass, fats has the ability to produce more energy than carbohydrates. Yet, carbohydrates are always oxidized first to release energy during strenuous exercise.

Which of the following explains why?

Compared to carbohydrates, _____.

A fats cannot be stored in storage organs
B fats cannot be converted during anaerobic respiration
C fats take a longer time to be oxidised to release energy
D fats require less oxygen during respiration to release energy

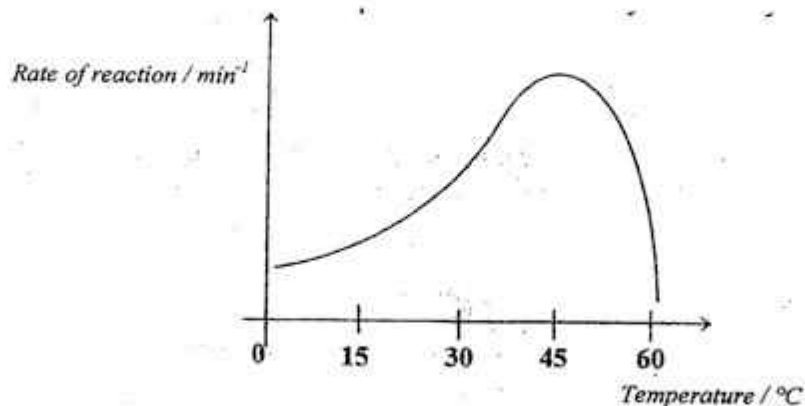
9. The table below shows an experiment carried out by a student.

Step	Food substance being tested	Substance added	Result
1	W	Benedict's solution	Solution remained blue
2	X	Iodine solution	Solution turned blue-black
3	X	Benedict's solution	Solution remained blue
4	X	Y	Z is formed
5	X	Y (boiled)	A mixture with W is formed
6	Z	Benedict's solution	Brick-red ppt observed

Which one of the following shows the correct identities of W, X, Y and Z?

	W	X	Y	Z
A	Reducing sugar	Starch	Saliva	Starch
B	Starch	Starch	Saliva	Reducing sugar
C	Starch	Saliva	Reducing sugar	Reducing sugar
D	Reducing sugar	Reducing sugar	Saliva	Starch

10. The graph below shows the effect of temperature on the activity of amylase.



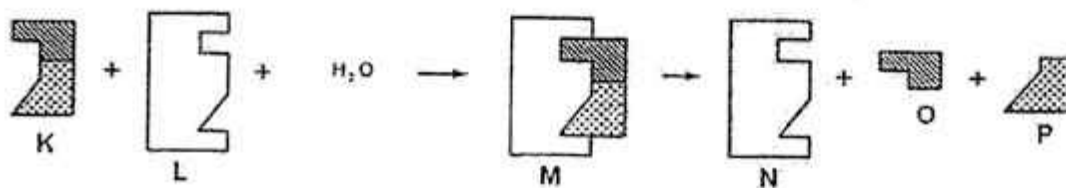
Based on the graph, some conclusions were drawn:

- I. Amylase is denatured at 0°C
- II. Amylase is most active at 45°C
- III. Amylase activity slows down at 60°C
- IV. Enzyme activity is directly proportional to the rise in temperature

Which of the above statement(s) is/are true about amylase?

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

For Questions 11 and 12, refer to the diagram below which shows the reactions between different substances.



11. Which one of the following statements is FALSE?

- A K is the substrate.
- B O and P are products of anabolism.
- C The nature of L remains the same at the end of the reaction.
- D L contains an active site which is of complementary shape to K.

12. What type of reaction is most likely illustrated by the diagram?

- A Digestion of starch.
- B Hydrolysis of lactose.
- C Formation of cellulose.
- D Synthesis of organic compounds.

13. Which of these is **not true** about bile?

- A It is produced by the pancreas.
- B It contributes to the alkalinity of the small intestines.
- C It is a mixture of special salts, water and cholesterol.
- D It helps to expose a large surface area of lipid for lipase to act on.

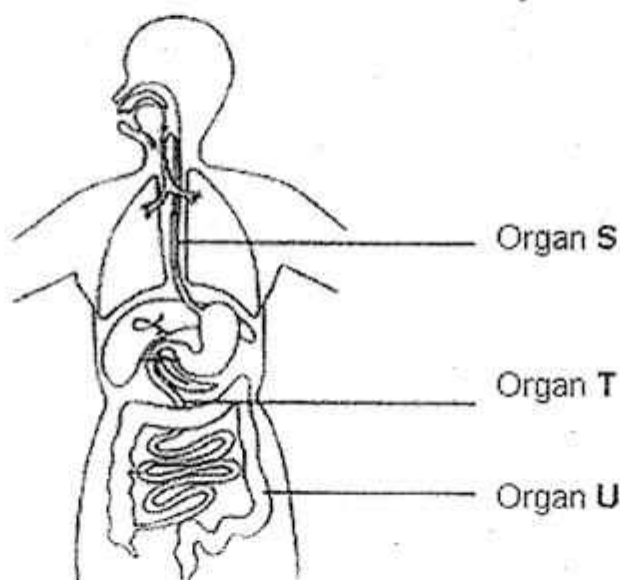
14. The table shows the results of an investigation on the absorption of digested products in the presence and absence of oxygen.

Product of digestion	Absorption in the presence of oxygen / arbitrary units	Absorption in the absence of oxygen / arbitrary units
Amino acids	6.5	1.5
Fatty acids	3.0	1.9
Glucose	7.6	2.5
Glycerol	4.9	4.7

Which conclusion can be drawn from these results?

- A All products of digestion are absorbed by diffusion only.
- B Fatty acids and glycerol are absorbed mainly by diffusion.
- C Amino acids and glucose are absorbed by active transport only.
- D All products of digestion are absorbed by both active transport and diffusion

15. Refer to the diagram which shows parts of the human digestive system.



What does each of the labelled organs (**S**, **T** and **U**) above have in common?

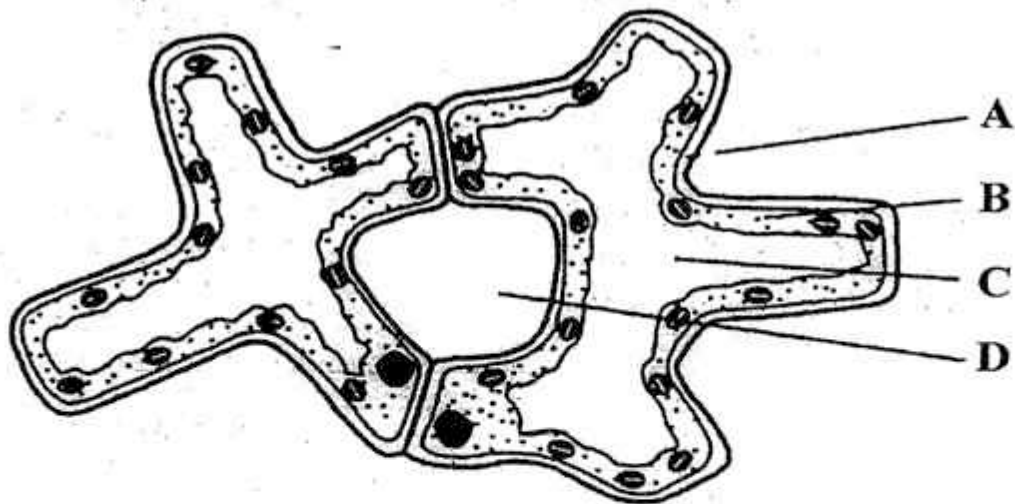
- A All the organs secrete digestive juices.
- B Protein digestion occurs in all three labelled organs.
- C Villi are present along the inner walls of all the organs.
- D All the organs move its content using peristaltic movement.

16. A grass patch was covered by a piece of plank for 4 days for an event. When the plank was removed after the event, it was observed that the grass in the covered region had turned yellow.

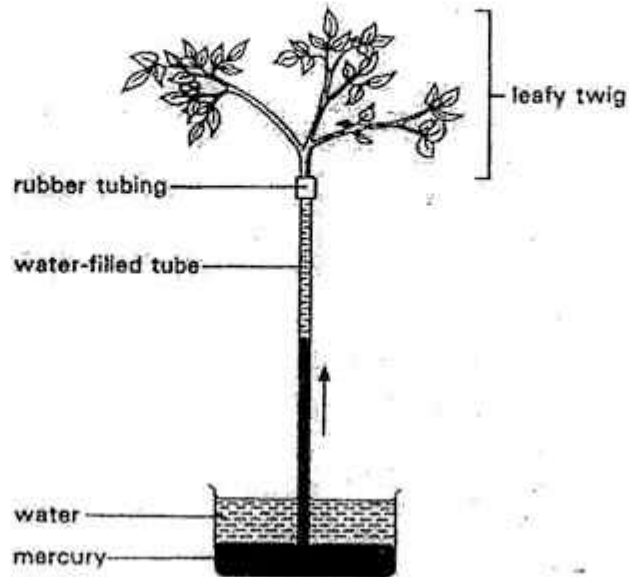
What had caused the grass to change colour?

- A Lack of light
- B Lack of water
- C Lack of magnesium
- D Lack of carbon dioxide

17. The diagram shows two cells from a leaf. When the leaf is in the dark, at which point will the concentration of carbon dioxide be highest?



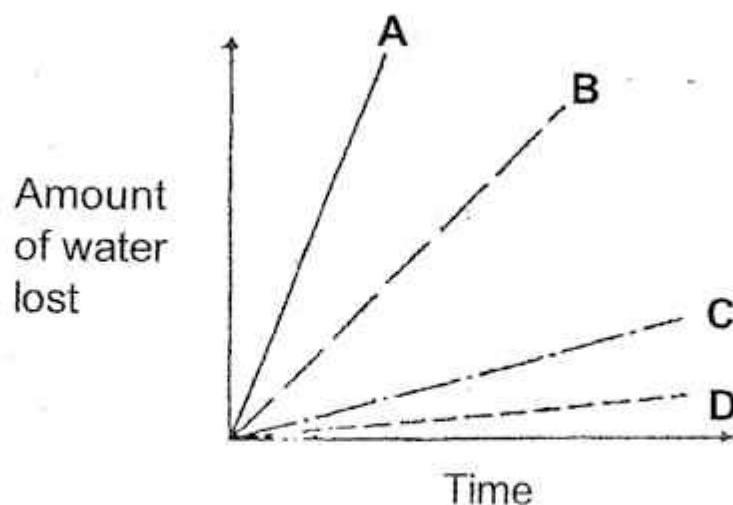
18. The following diagram shows that a leafy twig can draw up a column of mercury in a thin glass tube.



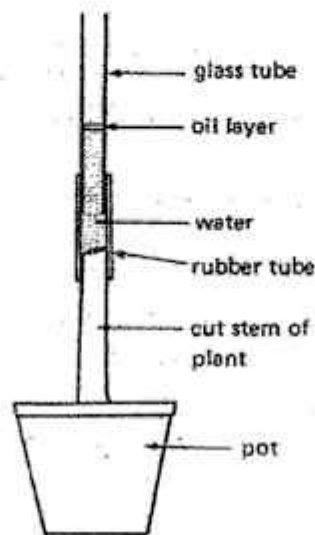
Which one of the following will lead to the greatest increase in the rate at which the mercury column is drawn up?

- A Increase in humidity.
 - B Increase in external environmental temperature.
 - C Increase in external environmental temperature and humidity.
 - D Increase in external environmental temperature and decrease in humidity.
19. In an experiment to investigate transpiration, four identical leafy shoots were treated as follows.
- I. Upper leaf surfaces covered with water-proof jelly
 - II. Lower leaf surfaces covered with water-proof jelly
 - III. Upper and lower leaf surfaces covered with water-proof jelly
 - IV. Untreated

The graph shows the water lost by the four shoots. Which line shows the results for shoot I?



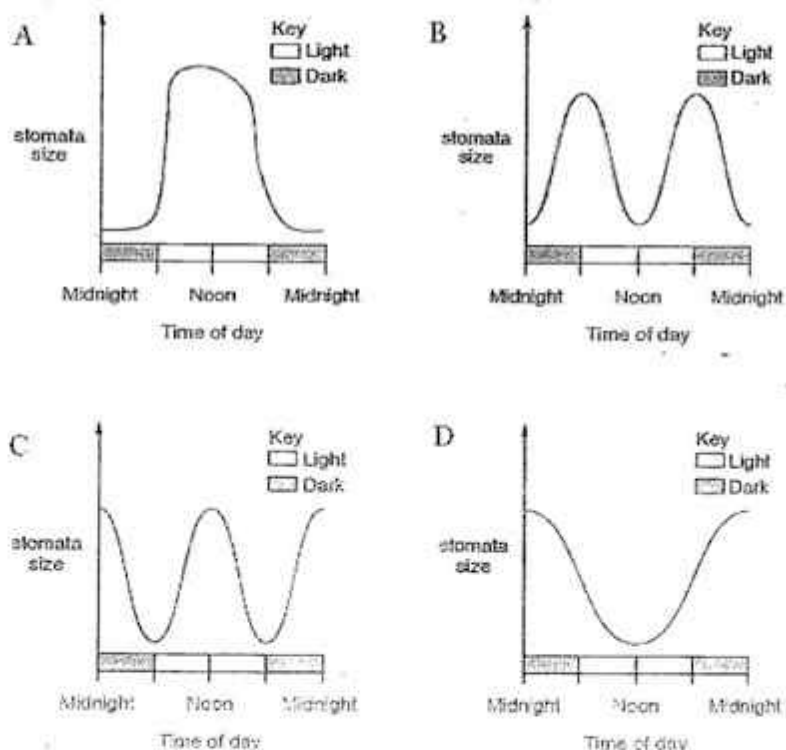
20. Refer to the diagram below which shows an experiment in progress.



What does the apparatus above demonstrate?

- A The presence of root pressure.
 - B The presence of capillary action.
 - C The presence of transpiration pull.
 - D The presence of xylem vessel in the plant.
21. Experiments were carried out on plants living in different environments to measure the size of the leaf stomata at different times of the day. Previous investigations had shown that plants transpire more water when the size of the stomata is larger.

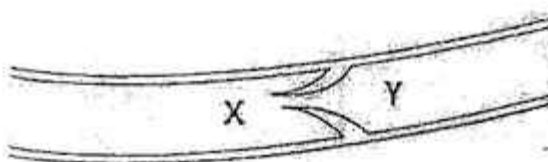
Which graph best represents a plant living in a dry environment?



22. When there is a cut on the skin, which is the correct sequence of involvement of the blood components in blood clotting?

	First → last			
A	fibrin	platelet	Red blood cell	fibrinogen
B	fibrinogen	Red blood cell	platelet	fibrin
C	platelet	fibrin	fibrinogen	Red blood cell
D	platelet	fibrinogen	fibrin	Red blood cell

23. The following diagram shows a valve in a section of a vein.



Which of the following statements is correct?

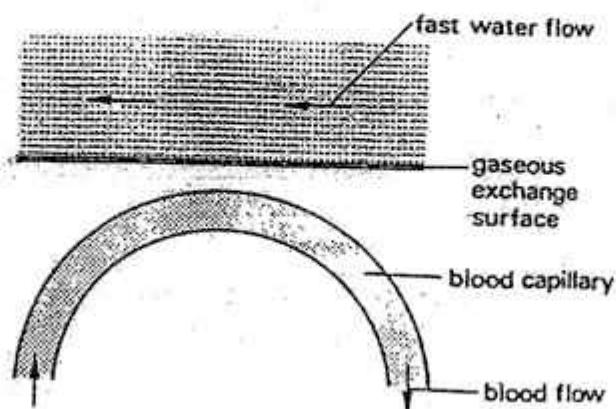
- A In order for the valve to remain open, blood will flow from X to Y.
- B The valve closes between heartbeats, due to the elasticity of the wall.
- C Muscles in the wall contract and close the valve, preventing backflow.
- D The valve is forced open when the blood pressure at Y is greater than at X.

24. Nicotine and carbon monoxide are present in tobacco smoke.

What are their effects on health?

	Nicotine	Carbon monoxide
A	Causes addiction	Causes atherosclerosis
B	Causes addiction	Causes emphysema
C	Increases blood pressure	Causes addiction
D	Paralyses cilia	Causes lung cancer

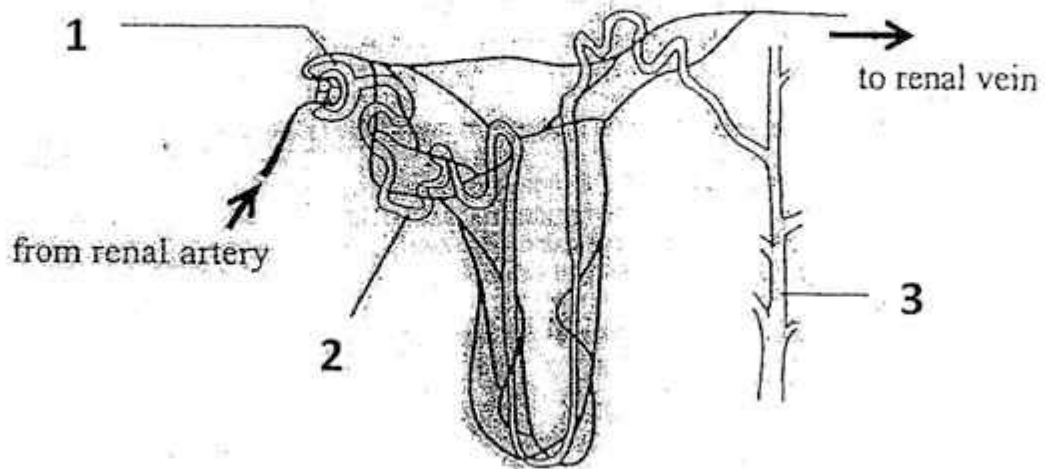
25. The diagram below represents the gaseous exchange surface of an aquatic organism such as a bony fish.



Which conditions would result in the maximum rate of diffusion of oxygen across the gaseous exchange surface?

	Amount of oxygen dissolved in water	Amount of oxygen dissolved in plasma	Rate of blood flow
A	small	large	fast
B	small	large	slow
C	large	small	fast
D	large	small	slow

Question 26 and 27 refer to the diagram below, which shows the structure of human nephron and its associated blood vessels.



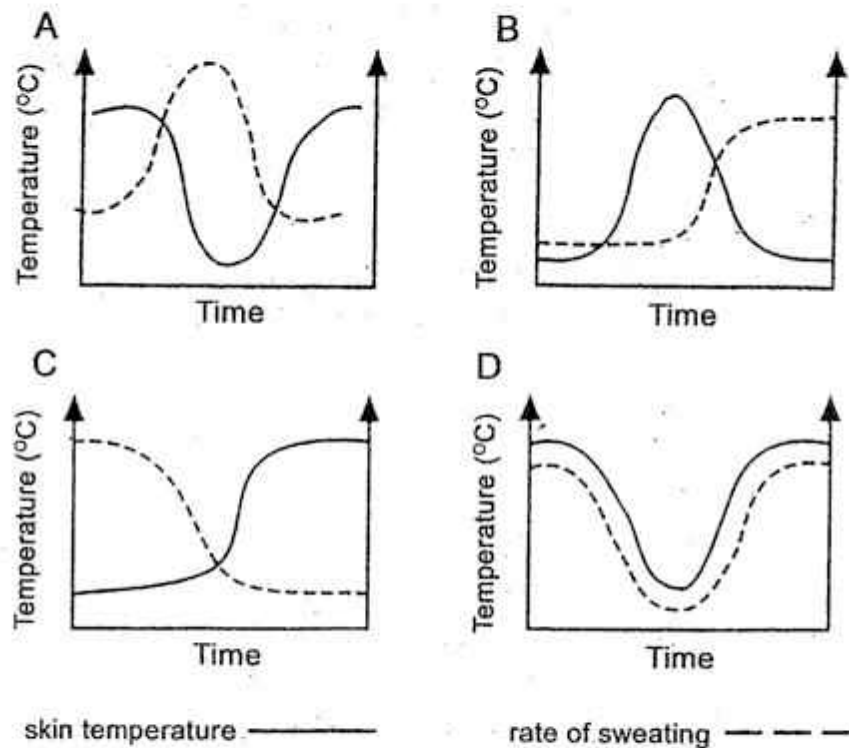
26. At sites 1 and 2, there is movement of glucose between the blood and the fluid in the nephron. Which of the following correctly states the processes responsible for the movement of glucose at these two sites?

	Site 1	Site 2
A	filtration	active transport
B	diffusion	diffusion
C	filtration	osmosis
D	diffusion	active transport

27. Which of the following correctly states and explains the change in concentration of fluid in site 3 of a person after a basketball match?

	Change in fluid concentration	Reason
A	Increase	More mineral salts are reabsorbed
B	Increase	A greater proportion of water is reabsorbed
C	Decrease	Less mineral salts are reabsorbed
D	Decrease	A smaller proportion of water is reabsorbed

28. 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 figure would most accurately represent the above situation?

29. During osmoregulation, which one of the following correctly describes the body's homeostatic response to a large intake of water?

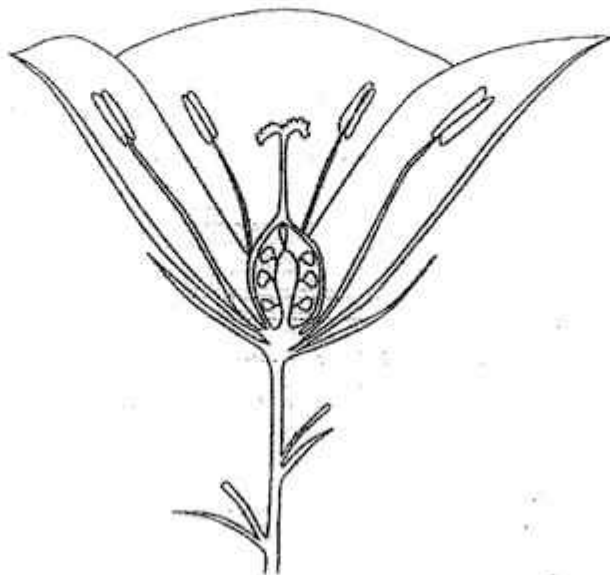
	Organ/ Region Stimulated	Hormone secreted	Kidney tubule Action	Water absorption
A	hypothalamus	less adrenaline	absorb	less
B	hypothalamus	less ADH	reabsorb	less
C	kidney	more ADH	reabsorb	more
D	kidney	more adrenaline	absorb	more

30. Which of the following is/are characteristics of a wind-pollinated flower?

- I. anthers with short filaments
- II. small smooth pollen grains
- III. flowers are small and dull-coloured
- IV. stigmas are large and protrude out of the flower

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

31. The diagram shows half a flower.



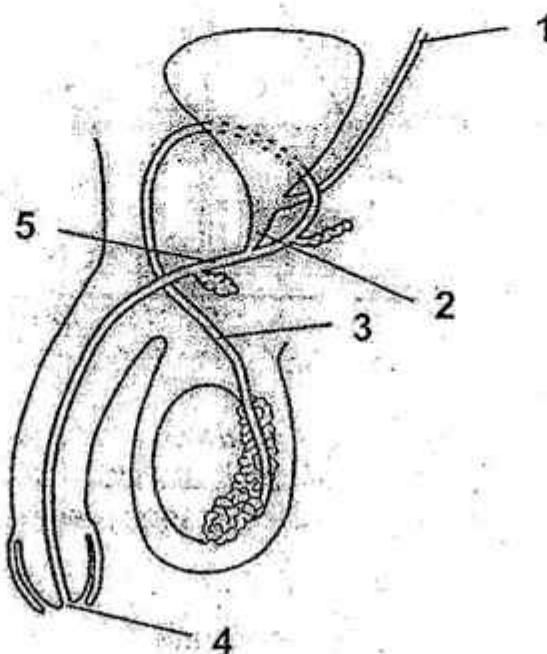
The following key may be used to identify the plant on which the flower is growing.

1. petals separate from sepals go to 2
petals and sepals joined plant P
2. flower with four stamens plant Q
flower with more than four stamens go to 3
3. ovary is as tall as it is wide plant R
ovary is taller than it is wide go to 4
4. flower has two petals plant S
flower has more than two petals plant T

To which plant does the flower belong?

- A plant P
- B plant Q
- C plant R
- D plant T

For questions 32 and 33, refer to the diagram of the male reproductive organs.



32. Which labelled structure carries sperms but not urine?

- A 1
- B 3
- C 4
- D 5

33. What is the most obvious effect of gonorrhoea on the male reproductive organs?

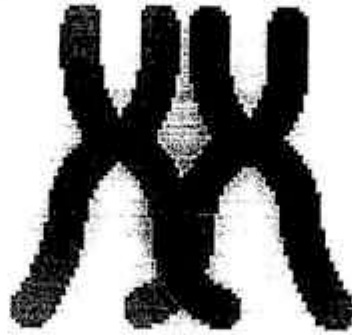
- A A sore ulcer at 2.
- B A discharge of pus at 4.
- C A blockage of the tube at 3.
- D An increase in urine flow in 1.

34. In which of the following processes does meiosis occur?

- I. The production of red blood cells in the bone marrow
- II. The production of pollen grains in the anther lobes
- III. The production of sperms in the testes of mammals
- IV. The production of new cells in the liver of mammals
- V. The production of egg cells in the ovule of flowering plants

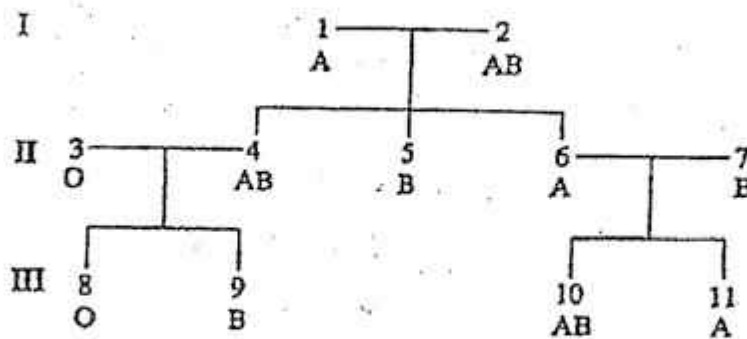
- A I and IV only
- B II and V only
- C I, II and IV only
- D II, III and V only

35. The diagram below shows a pair of homologous chromosomes during meiosis. At which stage does this occur?



- A Interphase
- B Prophase I
- C Anaphase I
- D Metaphase I

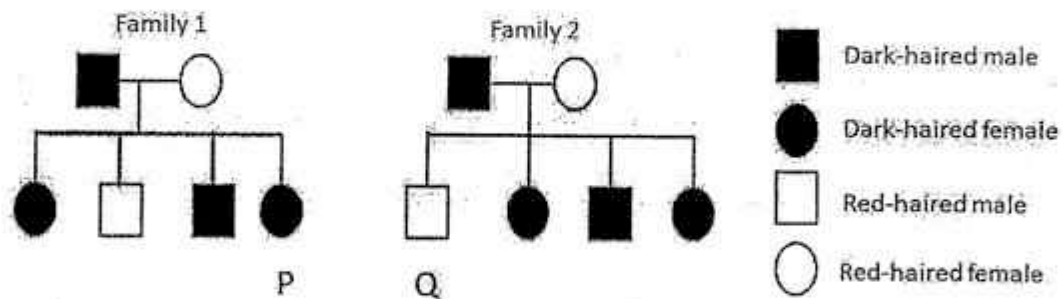
36. The figure below shows three generations of a family and their blood group of each individual.



Which individual is most likely to have been adopted?

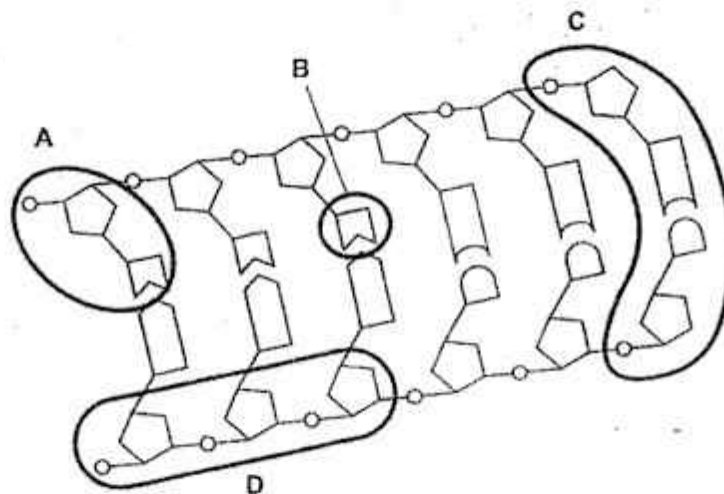
- A 4
- B 6
- C 8
- D 10

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



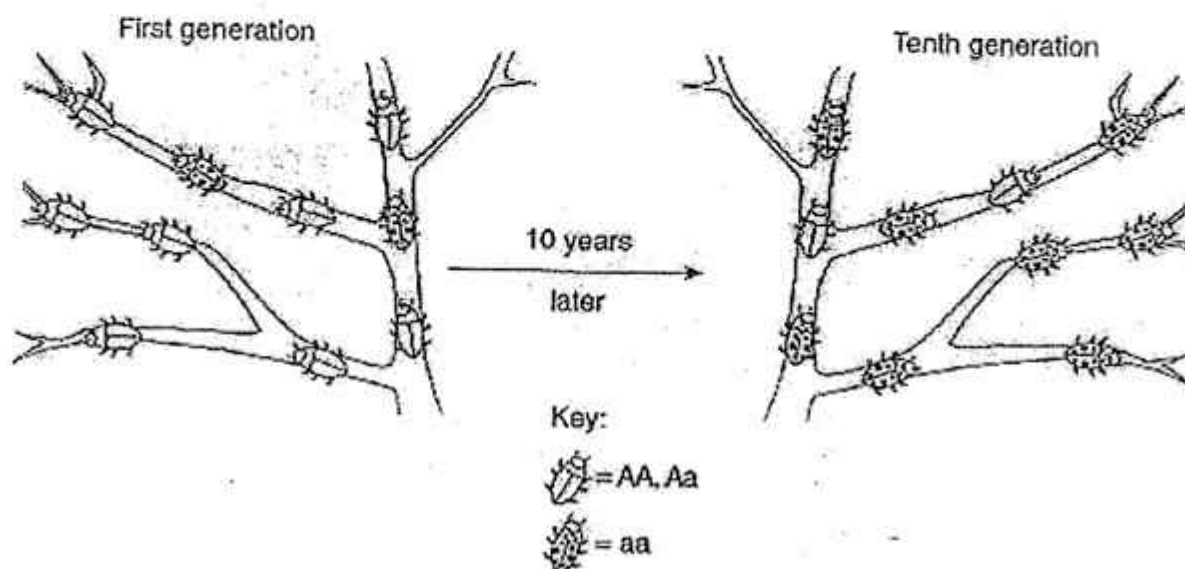
If individuals **P** and **Q** marry, which prediction can be made about the hair colour of their children?

- A All the children will have red hair.
 - B All the children will have dark hair.
 - C Half the children will have dark hair.
 - D Three quarters of the children will have red hair.
38. A person had blood group AB. What determines this blood group?
- A Same alleles on same chromosomes.
 - B Different alleles on same chromosomes.
 - C Same alleles on different chromosomes.
 - D Different alleles on different chromosomes.
39. The diagram shows part of a DNA molecule.



Which part of the DNA molecule shows a nucleotide?

40. The diagram below illustrates the change that occurs in the frequency of phenotypes in an insect population over 10 generations.



A probable explanation for this change would be that over time there was

- A a decrease in the mutation rate of gene a
- B a decrease in the adaptive value of gene a
- C an increase in the population of this insect
- D an increase in the adaptive value of gene a

----- END OF PAPER -----

NAME	CLASS	INDEX NO.
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ST. PATRICK'S SCHOOL MID-YEAR EXAMINATIONS 2012

SUBJECT : BIOLOGY (5094)
PAPER 2

DATE : 9 MAY 2012

LEVEL : SECONDARY 4 EXPRESS

DURATION : 1 HR 45 MINS

INSTRUCTIONS TO CANDIDATES:

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO.

1. This paper consists of **Two (2) Sections: Section A and Section B.**
2. Section A: Answer **ALL** questions. Write your answers in the spaces provided.
3. Section B: Answer **3** questions on the separate writing paper provided. Begin each question on a new sheet of writing paper.
4. At the end of the examination, fasten all separate writing papers securely to the question paper, using the string provided.

INFORMATION FOR CANDIDATES:

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

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

Parent's Signature: _____

Target Grade: _____

PAPER 1	/ 40
PAPER 2	
SECTION A :	/ 50
SECTION B :	
Question-9	/ 10
Question 10	/ 10
Question 11 E/O	/ 10
TOTAL	/ 120
GRADE	

This question paper consists of 16 printed pages.

SECTION A (50 marks)

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

1. The effect of temperature on the action of enzyme amylase on starch was investigated.

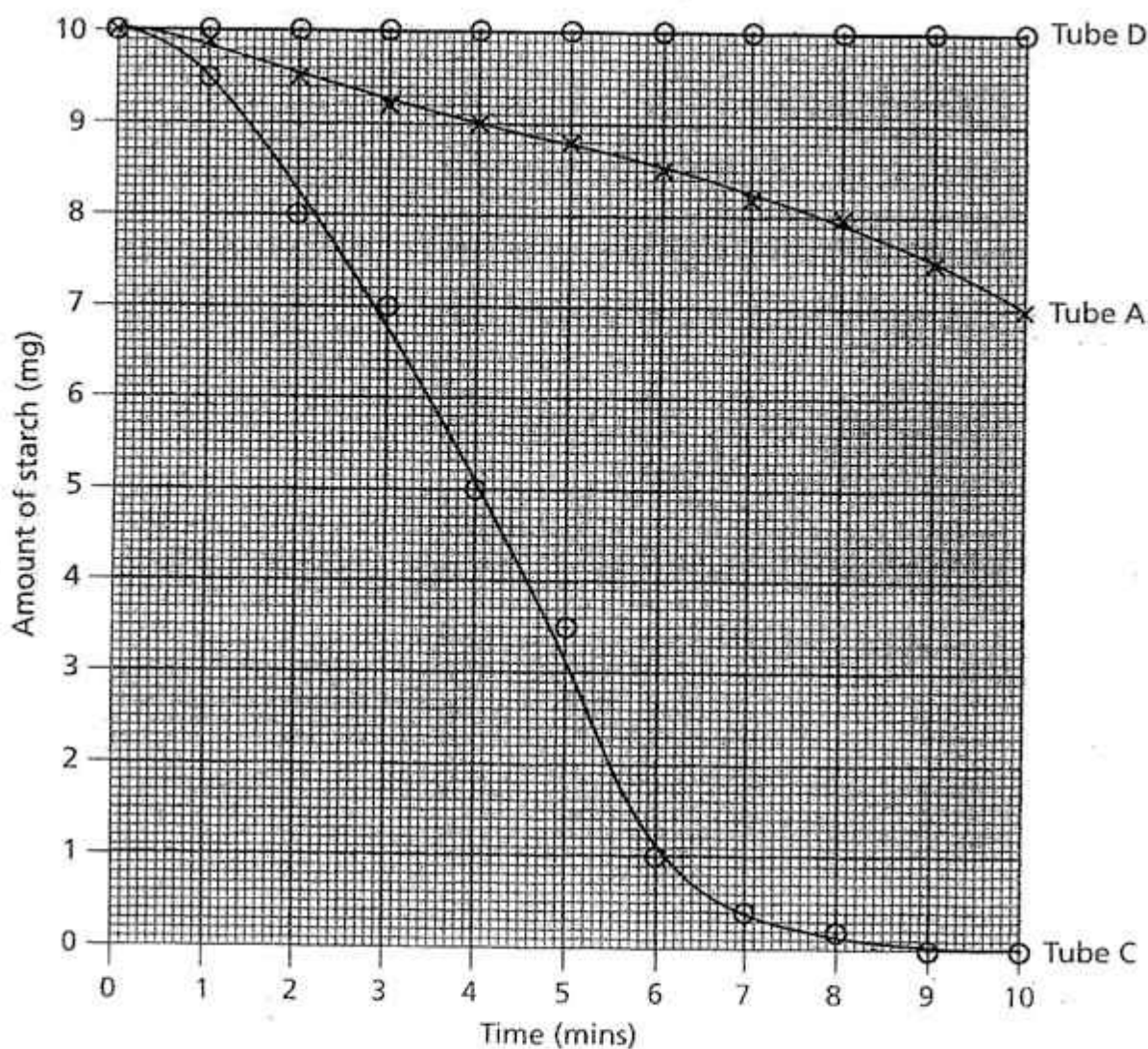
Tube **A** contains starch suspension and amylase kept at 10°C.

Tube **B** contains starch suspension and amylase kept at 20°C.

Tube **C** contains starch suspension and amylase kept at 40°C.

Tube **D** contains starch suspension and **boiled** amylase kept at 40°C.

The results for tubes **A**, **C** and **D** are shown in **Graph 1.1**.



Graph 1.1

- (a) Predict the results of tube **B** by sketching a line graph on **Graph 1.1**.

[1]

- (b) How long did it take the un-boiled enzyme to completely break down the starch at 40°C?

[1]

- (c) What **two** substances were left in tube **C** at the end of the experiment?

[1]

- (d) Biological washing powders contain starch-digesting enzymes. What advice would you give to the consumer on how to obtain the best results from a biological washing powder? Give a reason to support your advice.

[2]

2. **Fig. 2.1** shows the section of the human alimentary canal and some details of the internal features.

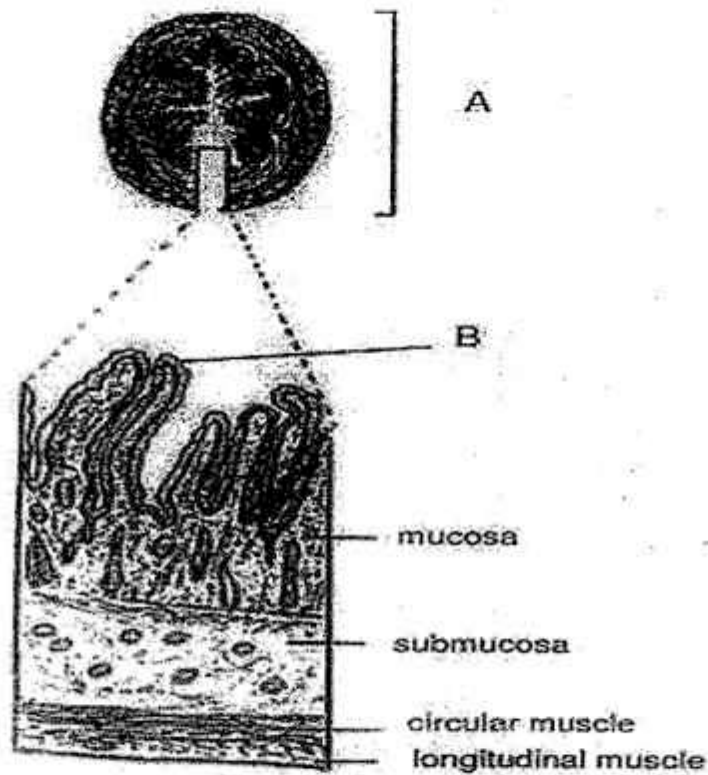


Fig 2.1

- (a) State a function of structure **A**.

[1]

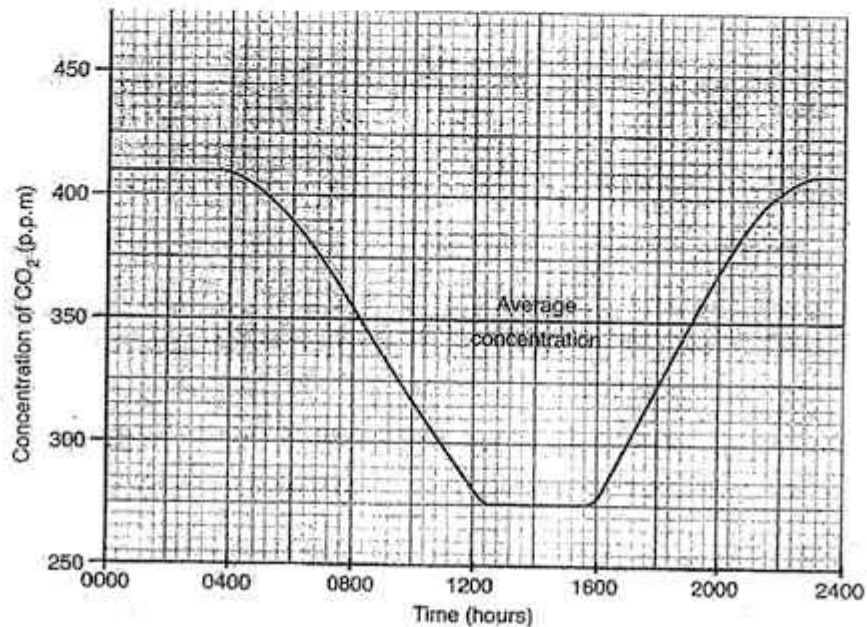
- (b) State and explain three adaptations of structure **B** which allows it to carry out its function effectively.

[3]

- (c) Lectins are proteins found in beans that can cause over-secretion of mucus in structure **A**. Suggest how this might adversely affect the function of this section of the human alimentary canal.

[2]

3. The graph below shows the changes in carbon dioxide concentration measured in a field of grass during a warm day in summer.



- (a) What is the highest concentration of carbon dioxide recorded?

[1]

- (b) Why is the concentration of carbon dioxide highest between 0000 to 0400 hours?

[1]

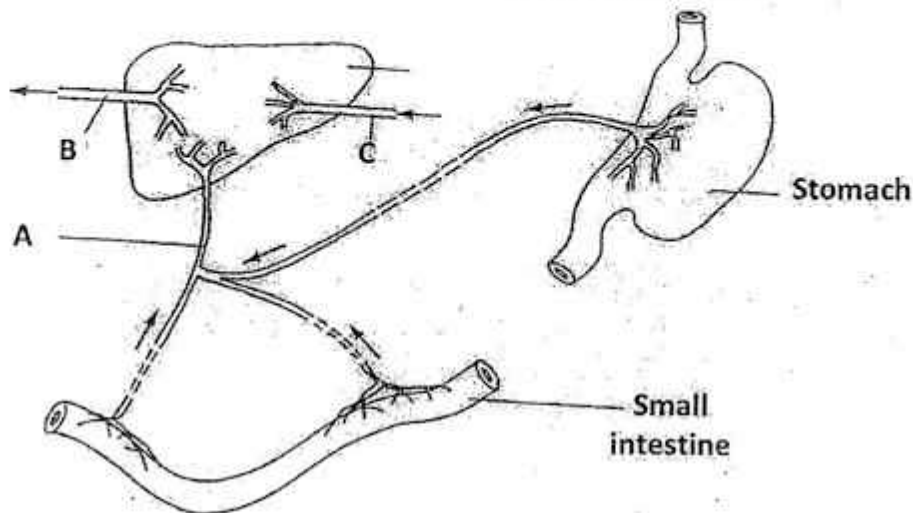
- (c) Why does the carbon dioxide concentration drop from 0400 to 1200 hours?

[2]

- (d) A botanist measured the amount of oxygen given out and taken in by the plant. At one point in the early morning, the grass neither gave out nor took in oxygen. Identify and explain the reason for this occurrence.

[1]

4. The figure below shows a small part of a circulatory system in the abdominal cavity in man. The arrows indicate the direction of blood flow.



- (a) (i) Name blood vessels A to C.

A: _____

B: _____

C: _____

- (ii) The person has recently eaten a meal containing protein and carbohydrates. By using letters only in the diagram, state which of the blood vessels will contain the highest percentage of:

oxygen: _____

glucose: _____

urea: _____

[3]

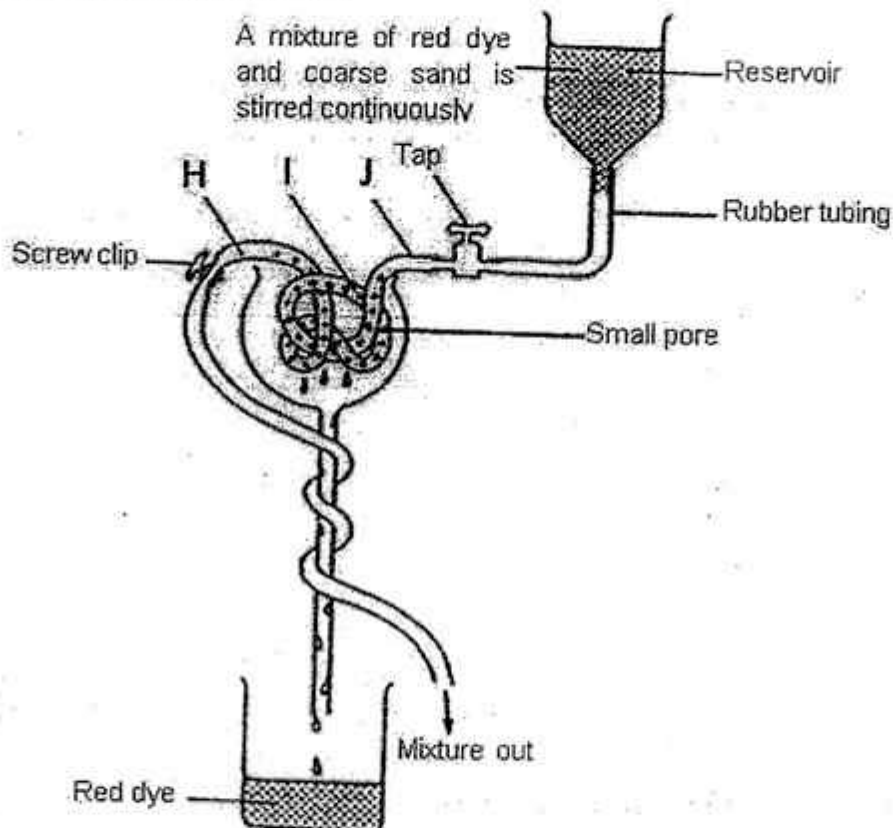
- (b) State one way in which the concentration of glucose of the plasma in blood vessels **A** and **B** will differ after the person has eaten for one day. Explain how the difference in concentration of the glucose has occurred.

[2]

- (c) Suggest how damage to the liver may lead to poor digestion of fats.

[2]

5. The diagram below shows the model of a nephron. It is used to demonstrate the how the nephron functions.



- (a) Identify the labelled structures in the mammalian body that are represented by:

I: _____

J: _____

[1]

- (b) What is the purpose of tightening the tubing near part H with a screw clip?

[2]

- (c) Name one cell type or organic compound in the mammalian body that is represented by the coarse sand in the mixture present in the reservoir.

[1]

- (d) In the case of kidney failure, a dialysis machine can be used if no kidney donor is found. Outline the key features of a dialysis machine.

[3]

6. Fig. 6 shows the development of a zygote (L) into a foetus.

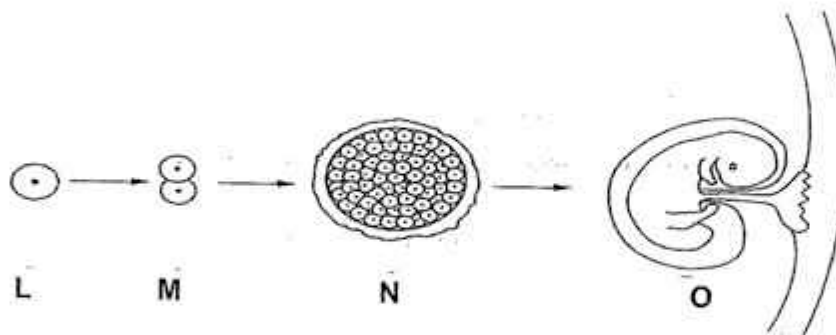


Fig. 6

- (a) State where structure M would usually be found in the female reproductive system.

[1]

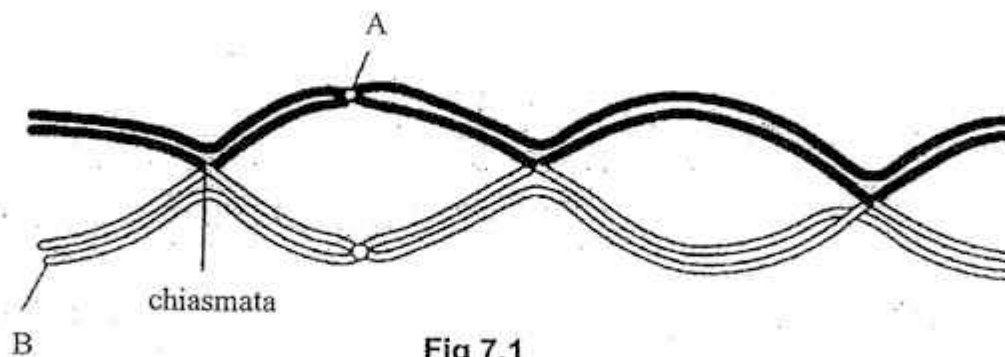
- (b) Describe **two** developmental processes that occur after N reaches the uterus that enables it to continue to develop into a foetus.

[2]

- (c) Describe how the foetus is protected at O.

[2]

7. Fig 7.1 below shows a pair of homologous chromosomes at Prophase I.



- (a) Define the term homologous chromosomes.

_____ [1]

- (b) Identify structures A and B.

_____ [1]

- (c) State two ways in which prophase I of meiosis is different from prophase in mitosis

_____ [2]

- (d) State two ways in which genetic variation is introduced in meiosis.

_____ [2]

- (e) Explain the functions of meiosis and why it is important.

[2]

- (f) Fig 7.2 below shows cells of a root tip undergoing various stages of mitosis.

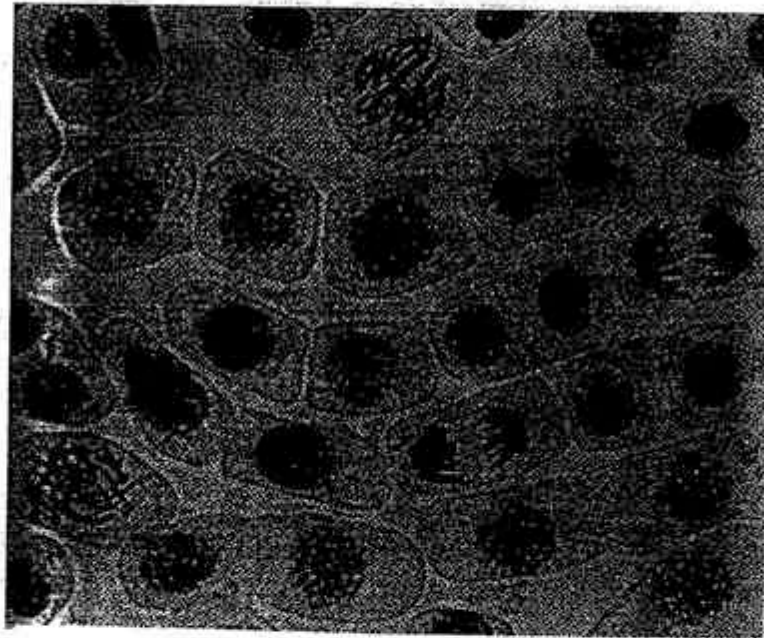


Fig 7.2

On the diagram,

- (i) circle and label a cell undergoing prophase with a **P**. [1]
- (ii) circle and label a cell undergoing anaphase with an **A**. [1]

8. DNA is a double-stranded molecule composed of mononucleotides.

- (a) In the space below, draw a diagram to show **two** mononucleotides joined together in a **single** strand of DNA (polynucleotide). Use the symbols shown for each component in your diagram.

Phosphate group



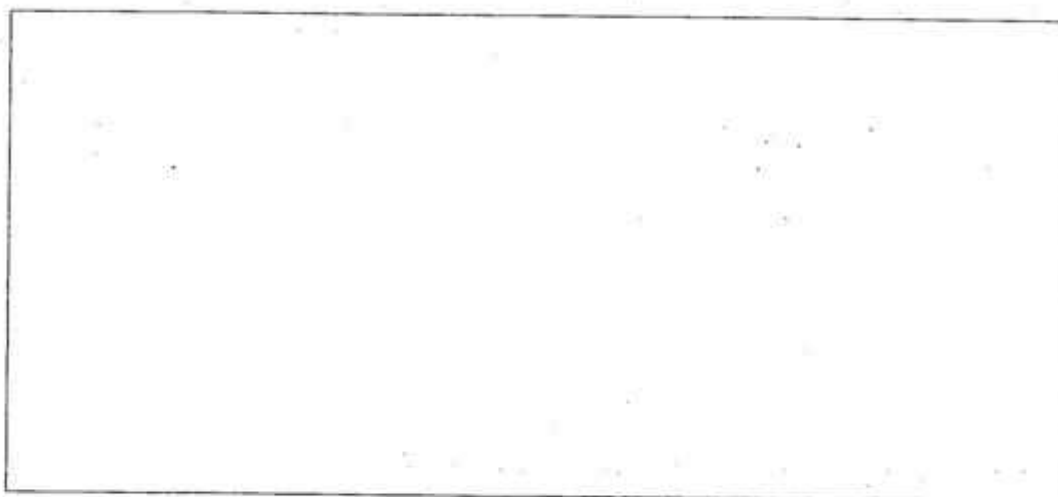
Base



Deoxyribose sugar



Bond



[2]

- (b) (i) Complete **Table 8.1** to give the names of the other two bases and state the percentages of the bases in the given DNA sample.

Table 8.1

Percentage of base in DNA sample	Name of base
30	thymine (T)
20	guanine (G)

[2]

- (ii) The given sample of DNA contained 2000 bases. Calculate the number of thymine bases in the sample of DNA.

[1]

----- **END OF SECTION A** -----

SECTION B (30 marks)

Answer **THREE** questions from this section on the separate writing paper provided.

Question 11 is the form of an **EITHER / OR QUESTION**. **ONLY ONE PART SHOULD BE ANSWERED.**

Begin each question on a new sheet of writing paper.

9. Table 9.1 shows the relative metabolic rate of mammals in relation to their mass. Relative metabolic rate is the rate of metabolic activities taking place at a state of rest.

Table 9.1

Mass (kg)	30	40	50	60	70	80	100	120
Relative metabolic rate	20	16	10	9	5	4	2	1

- (a) Plot on the graph paper provided a graph of relative metabolic mass against mass (kg). [3]
- (b) With reference to the graph, state and explain the relationship between the basal metabolic rate and the body mass of the mammals. [4]
- (c) Explain how mammals regulate their body temperature in a hot climate. [3]

10. In fruit fly, grey body colour is completely dominant over black body colour. Three groups of fruit flies **A**, **B** and **C** with grey body colour were crossed in the following pattern and the following results were obtained.

Use **G** to represent dominant trait and **g** to represent the recessive trait.

Crosses	Parents	Result	
		Grey-bodied flies	Black-bodied flies
1	A × C	207	-
2	A × B	158	52
3	B × C	182	-

- (a) Identify the possible genotypes of the flies **A**, **B** and **C** respectively. Explain your answers. [5]
- (b) If the flies **A** are crossed with black-bodied flies, what is/are the expected genotype/s and phenotypic ratio of the offspring in the cross? Explain using a genetic cross. [3]
- (c) These grey-bodied and black-bodied flies were released in an industrial city which is heavily polluted with soot particles. Which type of fruit flies can better survive? Give a reason to support your answer. [2]

11. EITHER

- (a) Describe the changes in the respiratory system during inhalation. [4]
- (b) Describe how the circulatory system and respiratory system enable muscle cells to carry out activities during exercise. [4]
- (c) Explain why the level of oxygen uptake remains high during the 5 minutes immediately after exercise. [2]

11. OR

- (a) Describe and explain how water moves
 - (i) Into a root hair cell [2]
 - (ii) From the root hair cell to the xylem. [1]
 - (iii) From the leaf to the atmosphere. [3]
- (b) With reference to a named plant with insect-pollinated flowers and a named plant with wind-pollinated flowers, compare the structure and floral parts of the two types of flowers. [4]

----- END OF PAPER -----



ST. PATRICK'S SCHOOL

MID-YEAR EXAMINATIONS 2012

SUBJECT : BIOLOGY (5094)

DATE : 9 MAY 2012 (PAPER 2)
10 MAY 2012 (PAPER 1)

LEVEL : SECONDARY 4 EXPRESS

DURATION : 1 HR 45 MINS, 1 HR

PAPER 1: MCQ (40 m)

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

PAPER 2: SECTION A (50 m)

1a	A line between A and C [1]	[1]	[5]
1b	It took 9 minutes [1]	[1]	
1c	Maltose [1/2] Amylase [1/2]	[1]	
1d	<ul style="list-style-type: none"> The enzymes in biological washing powders will work most effectively at an optimum temperature [1/2] of about 40°C [1/2] as shown in the graph. The temperature should not be high [1/2] as enzymes are denatured by high temperatures [1/2] as shown in the graph. <p>Or</p> <ul style="list-style-type: none"> Allow the clothing to be soaked for a while before washing [1] as time is needed by the enzymes [1/2] to digest the proteins [1/2] 	[2]	

2a	<ul style="list-style-type: none"> To produce <u>intestinal juice/ enzymes</u> [1/2] for digestion of food such as carbohydrates, proteins and fats [1/2] OR To absorb digested food [1/2] into the bloodstream [1/2] 	[1]	[6]
2b	<ul style="list-style-type: none"> Any 3 adaptations: The villi are finger-like projections [1/2] which increase surface area to volume ratio to absorb digested food more efficiently [1/2] The epithelial cells of the villi have microvilli [1/2] which further increase surface area to volume ratio [1/2] The epithelium of the villi is one-cell thick / the villi has thin walls [1/2] to enable efficient absorption of food [1/2] The villi have many blood and lymphatic capillaries [1/2] to carry away the absorbed food substances / maintaining a concentration gradient for the absorption of digested food substances [1/2] Epithelial cells have mitochondria [1/2] to enable active transport of substances into the capillaries [1/2] Reject: length of small intestine is long 	[3]	
2c	<ul style="list-style-type: none"> The presence of mucus might form a layer over the villi / block villi / cover villi [1/2] This reduces the surface area available for the absorption of substances into the blood and lymphatic capillaries [1/2] Efficiency of absorption of substances into the blood and lymphatic capillaries may be reduced [1] 	[2]	

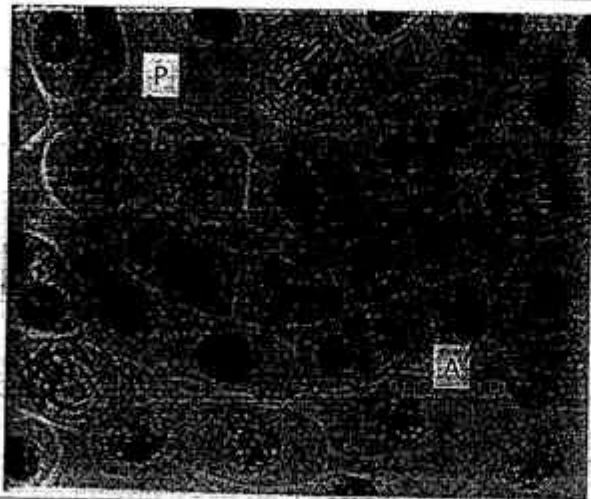
3a	410 ppm [1]	[1]	[5]
3b	<ul style="list-style-type: none"> No photosynthesis occurs as there is no light [1/2] Only respiration occurs, producing carbon dioxide [1/2] 	[1]	
3c	<ul style="list-style-type: none"> As light intensity increases to a maximum (during day time) [1/2] rate of photosynthesis increases / Rate of photosynthesis is higher than rate of respiration [1] using up more carbon dioxide / there is net uptake of carbon dioxide [1/2] 	[2]	
3d	<ul style="list-style-type: none"> Rate of photosynthesis is equals to rate of respiration [1/2] No net movement of oxygen and carbon dioxide gases in and out of plant [1/2] 	[1]	

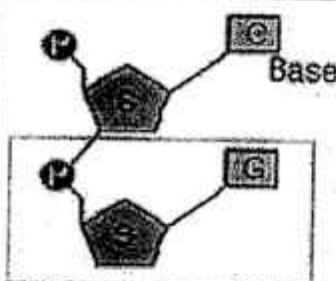
4ai	A: hepatic portal vein [1/2] B: hepatic vein [1/2] C: hepatic artery [1/2]	[1.5]	[7]
4aii	oxygen: C [1/2] glucose: A [1/2] urea: B [1/2]	[1.5]	
4b	<ul style="list-style-type: none"> lower concentration of glucose in blood vessels A [1/2] no glucose is absorbed by the small intestine [1/2] higher concentration of glucose in blood vessels B [1/2] glycogen is broken down into glucose [1/2] 	[2]	
4c	<ul style="list-style-type: none"> bile is not produced [1] no emulsification / slower digestion of fat [1] 	[2]	

5a	I: Glomerulus [1/2] J: Afferent arteriole [1/2]	[1]	[7]
5b	<ul style="list-style-type: none"> The purpose is to reduce the lumen of tubing near H [1/2] so as to set up a high pressure in I [1] and enables the small molecules to pass through tubing I at a fast rate [1/2] 	[2]	
5c	Red blood cells / blood plasma proteins [1]	[1]	
5d	<ul style="list-style-type: none"> The dialysis fluid contains the same concentration of essential substances [1/2] (such as mineral salts) as the blood to ensure that essential substances are not lost / diffuse out of blood [1/2] Dialysis fluid does not contain metabolic waste products such as urea [1/2] to ensure a concentration gradient [1/2] for the waste products to diffuse out of the blood into the dialysis fluid. The tubing is narrow, long and coiled [1/2] to increase surface area to volume ratio / speed up rate of exchange of substances between blood and dialysis fluid [1/2] OR The direction of blood flow is opposite to the flow of dialysis fluid [1/2] to maintain the concentration gradient for removal of waste products from blood [1/2] <p>Any 3 points</p>	[3]	

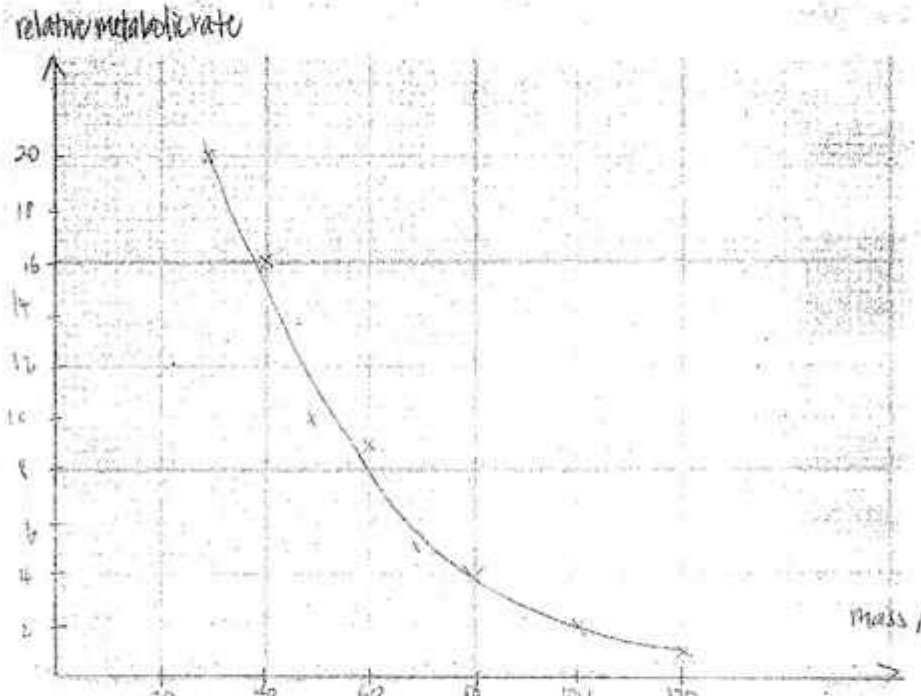
6a	oviduct/Fallopian tube [1]	[1]	[5]
6b	<ul style="list-style-type: none"> <u>Implantation</u> / attaches to <u>lining</u> (endometrium) of uterus [1] forming placenta [1] 	[2]	
6c	<ul style="list-style-type: none"> Enclosed in the amniotic sac with amniotic fluid [1] thus protecting it from mechanical injury [1/2] and it <u>absorbs shock</u> [1/2] 	[2]	

7a	<ul style="list-style-type: none"> Pair of chromosomes that carry the same order of genes [1/2] have the same length / shape / size [1/2] 	[1]	[10]
7b	A: centromere [1/2] B: chromatid [1/2]	[1]	
7c	<ul style="list-style-type: none"> No pairing up of homologous chromosomes for mitosis [1] No crossing over for mitosis [1] 	[2]	
7d	<p>Any 2 points:</p> <ul style="list-style-type: none"> Crossing over [1/2] of homologous chromosomes [1/2] OR chiasmata formation [1/2] during prophase I [1/2] Random arrangement of chromosomes [1/2] during metaphase I and II [1/2] (Just stating Law of independent assortment [1/2]) Chromosomes assort randomly into two gametes [1/2] which have an equal chance of fertilizing to form a zygote [1/2]. (Just stating Law of independent segregation [1/2]) 	[2]	
7e	<ul style="list-style-type: none"> Produce haploid gamete / cell [1/2] Restore the diploid no. of chromosomes in zygote during fertilization [1/2] Results in genetic variation [1/2] Increase chance of survival of species [1/2] 	[2]	

7fi 7fii		[2]	
-------------	--	-----	--

8a	 <p>Nucleotide 1m for correctly drawing one nucleotide 1m for drawing two nucleotides joined together</p>			[2]	[5]									
8b	<table border="1"> <thead> <tr> <th>percentage of base in DNA sample</th> <th>name of base</th> </tr> </thead> <tbody> <tr> <td>30</td> <td>thymine (T)</td> </tr> <tr> <td>20</td> <td>guanine (G)</td> </tr> <tr> <td>20 [1/2]</td> <td>cytosine (C) [1/2]</td> </tr> <tr> <td>30 [1/2]</td> <td>adenine (A) [1/2]</td> </tr> </tbody> </table>	percentage of base in DNA sample	name of base	30	thymine (T)	20	guanine (G)	20 [1/2]	cytosine (C) [1/2]	30 [1/2]	adenine (A) [1/2]		[2]	
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20	guanine (G)													
20 [1/2]	cytosine (C) [1/2]													
30 [1/2]	adenine (A) [1/2]													
8c	30% of 2000 bases = 600 thymine bases			[1]										

PAPER 2: SECTION B (30 m)

9a	<ul style="list-style-type: none"> Plotted points — all correct (allow for 1 missing or 1 error) [1] Best fit curve [1] Label of axis [1] 	[3]	[10]
9b	<p>(i) The greater the body mass, the lower the basal metabolic rate [1]</p> <p>(ii)</p> <ul style="list-style-type: none"> Greater mass means decreased surface area: volume ratio [1] This causes less heat to be lost [1] Hence the metabolism at rest does not need to be high to maintain its body temperature [1] <p>OR</p> <ul style="list-style-type: none"> smaller mass means increased surface area: volume ratio [1] This causes more heat to be lost [1] Hence the metabolism at rest needs to be high to maintain its body temperature [1] 	[1] [3]	
9c	<p>Max [3]</p> <ul style="list-style-type: none"> A rise in blood temperature activates the hypothalamus to send out nerve impulses to different parts of the body [1/2] Arterioles in skin dilate while shunt vessels constricts [1/2] to allow more blood to flow through the capillaries in the skin; [1/2] Increased production of sweat to lose heat [1/2] By latent heat of vaporization Rapid breathing [1/2] Metabolic rate slows down [1/2] Hair erector muscles relax / hair flattens [1/2] 	[3]	

10a	<p>Assume dominant allele as G (grey bodied) and recessive allele as g (black bodied);</p> <ul style="list-style-type: none">A – Gg or heterozygous dominant [1/2]B – Gg or heterozygous dominant [1/2]C – GG or homozygous dominant [1/2] <p>EITHER</p> <ul style="list-style-type: none">When A (or B) crosses with C, offspring with homozygous dominant (GG) [1/2]and heterozygous dominant (Gg) will be produced [1/2]only grey bodied flies can be produced [1/2]When A crosses with B, possible genotypes areGG [1/2]Gg and [1/2]gg [1/2]black bodied flies and grey bodied flies are produced [1/2] <p>OR</p> <p>Using table to show genetic crosses e.g</p> <table><tr><td></td><td colspan="2">A</td><td colspan="2">C</td></tr><tr><td>Parents phenotype</td><td colspan="2">Grey</td><td colspan="2">Grey</td></tr><tr><td>Parents genotype</td><td colspan="2">Gg</td><td colspan="2">GG</td></tr><tr><td>Gametes</td><td>G</td><td>g</td><td>G</td><td>G</td></tr><tr><td>F1 genotype / crossing over</td><td>GG</td><td>GG</td><td>Gg</td><td>Gg</td></tr><tr><td>F1 phenotypic ratio</td><td>Grey</td><td>Grey</td><td>Grey</td><td>Grey</td></tr><tr><td>Ratio</td><td colspan="4">All Grey</td></tr></table> <table><tr><td></td><td colspan="2">A</td><td colspan="2">B</td></tr><tr><td>Parents phenotype</td><td colspan="2">Grey</td><td colspan="2">Grey</td></tr><tr><td>Parents genotype</td><td colspan="2">Gg</td><td colspan="2">Gg</td></tr><tr><td>Gametes</td><td>G</td><td>g</td><td>G</td><td>g</td></tr><tr><td>F1 genotype / crossing over</td><td>GG</td><td>Gg</td><td>Gg</td><td>gg</td></tr><tr><td>F1 phenotypic ratio</td><td>Grey</td><td>Grey</td><td>Grey</td><td>Black</td></tr><tr><td>Ratio</td><td colspan="4">3 grey : 1 black</td></tr></table>		A		C		Parents phenotype	Grey		Grey		Parents genotype	Gg		GG		Gametes	G	g	G	G	F1 genotype / crossing over	GG	GG	Gg	Gg	F1 phenotypic ratio	Grey	Grey	Grey	Grey	Ratio	All Grey					A		B		Parents phenotype	Grey		Grey		Parents genotype	Gg		Gg		Gametes	G	g	G	g	F1 genotype / crossing over	GG	Gg	Gg	gg	F1 phenotypic ratio	Grey	Grey	Grey	Black	Ratio	3 grey : 1 black				[5]	[10]
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10c	<ul style="list-style-type: none">black bodied flies [1]Pollution with soot particles release black and dense smoke [1/2]grey bodied flies will be easily spotted by their predators [1/2]	[2]	1 ½ ½																																																																						

11	EITHER		
a	<ul style="list-style-type: none"> The diaphragm contracts and flattens [1/2] The external intercostals muscles contract [1/2] while the internal intercostals muscles relax [1/2] Ribs move upwards and outwards [1/2] Volume of thoracic cavity increases [1/2] Air pressure in the lungs causes them to expand to fill up the enlarged space in the thorax [1/2] Air pressure inside lungs decreases [1/2] Air rushes into the lungs due to the high atmospheric pressure [1/2] 	[4]	[10]
b	<ul style="list-style-type: none"> During exercise the heart rate increases [1/2] to pump more blood into the muscles [1/2] This provides more oxygen [1/2] and glucose to the muscles [1/2] and takes away carbon dioxide more quickly [1/2] Breathing rate increases to [1/2] increase uptake of oxygen [1/2] and removal of carbon dioxide [1/2] 	[4]	
c	<ul style="list-style-type: none"> To provide sufficient oxygen to repay the oxygen debt [1/2] This happens <u>in the muscles</u> [1/2] Lactic acid is removed from the muscles and transported to the liver [1/2] In the liver, lactic acid is oxidised to produce energy to convert remaining lactic acid to glucose [1/2] 	[2]	

11	OR																								
a	(i)	<ul style="list-style-type: none">The cell sap in the root hair cell is concentrated / have lower water potential than the soil solution (reject water concentration) [1]Water enters root hair cell by osmosis [1]	[2]	[10]																					
	(ii)	<ul style="list-style-type: none">The root hair cell is more dilute / has higher water potential than the inner cell [1/2]hence water enters by osmosis into inner cells, and continues till reach xylem vessels [1/2]	[1]																						
	(iii)	<ul style="list-style-type: none">In spongy mesophyll cells water moves out by osmosis (reject palisade) [1]and forms thin layer of moisture on cell surface [1]water evaporates into intercellular air spaces [1/2]water vapour diffuses out of leaf + through stomata [1/2]	[3]																						
b	<ul style="list-style-type: none">Plant with insect-pollinated flower: <i>Clitoria</i> (accept other valid examples) [1/2]Plant with wind-pollinated flower: <i>Ischaemum muticum</i> (accept other valid examples) [1/2] <p>Differences between the <i>Clitoria</i> & <i>Ischaemum muticum</i>: Any 3 comparisons – 1/2 m for each correct comparison for each flower</p> <table><tr><th>Clitoria</th><th>Ischaemum muticum:</th><th></th></tr><tr><td>large, conspicuous blue petals</td><td>No petals / small dull flowering glumes</td><td>[1]</td></tr><tr><td>Nectar guides present</td><td>No nectar guides</td><td>[1]</td></tr><tr><td>Nectar present</td><td>Absence of nectar</td><td>[1]</td></tr><tr><td>Stigma is enclosed within flower</td><td>Stigma is pendulous</td><td>[1]</td></tr><tr><td>Not feathery, small stigma</td><td>Feathery, large stigma</td><td>[1]</td></tr><tr><td>Stamen enclosed within flower / not pendulous</td><td>long, thin and pendulous</td><td>[1]</td></tr></table>			Clitoria	Ischaemum muticum:		large, conspicuous blue petals	No petals / small dull flowering glumes	[1]	Nectar guides present	No nectar guides	[1]	Nectar present	Absence of nectar	[1]	Stigma is enclosed within flower	Stigma is pendulous	[1]	Not feathery, small stigma	Feathery, large stigma	[1]	Stamen enclosed within flower / not pendulous	long, thin and pendulous	[1]	[4]
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Paya Lebar Methodist Girls' School (Secondary)
Preliminary Examination Two 2012
Secondary 4 Express

Subject: Pure Biology (SPA)

Duration: 1hr

Paper Number: 5094 Paper 1

Class: 4A1/4A3

Name:

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Date: 28 August 2012

Centre Number

S				
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Index Number

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READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your name, Centre number and index number on the Answer Sheet.

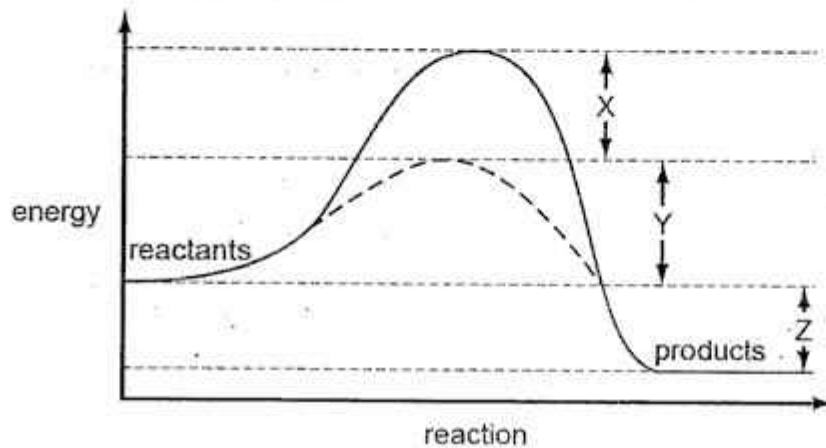
There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

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

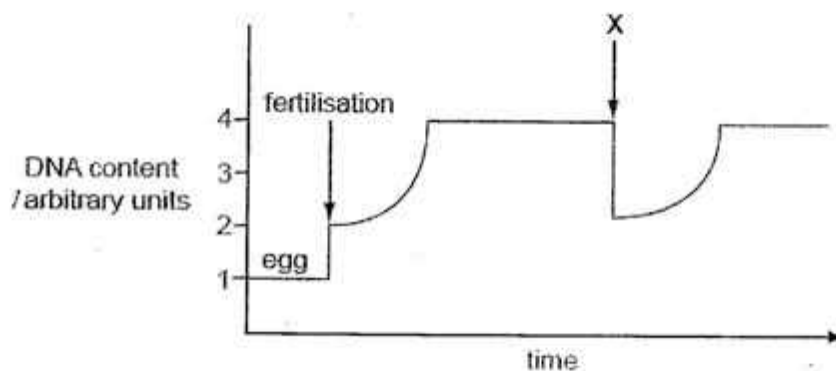
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

1. The graph below shows the activation energy of an enzyme-catalysed reaction and the same reaction without a catalyst. Which of the following shows the activation energy of the uncatalysed reaction?



- A $X + Y - Z$
 B $X + Z - Y$
 C $X + Y$
 D $Y + Z$
2. The graph represents the changes in the quantity of DNA present in one nucleus at different stages in the life cycle of a mammal. Which stage takes place at X?



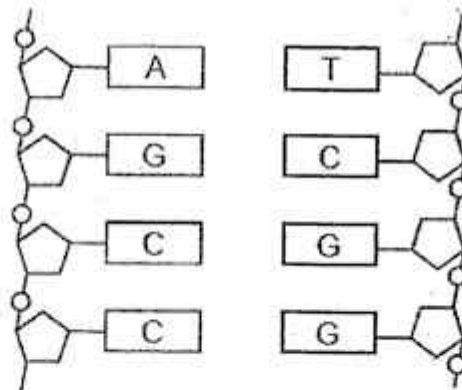
- A interphase
 B metaphase
 C prophase
 D telophase

3. At which stage of mitosis do these events occur?

	centromeres separate	spiralisation and condensation of DNA
A	anaphase	interphase
B	anaphase	prophase
C	metaphase	interphase
D	metaphase	telophase

4. The diagram shows part of a DNA molecule.

How many hydrogen bonds are involved in holding these strands of DNA together?



- A 11
- B 9
- C 8
- D 4

5. There is less oxygen at high altitude compared to ground level. Which is a correct description and reason for the response of the body to high altitude?

	Description	Reason
A	more red blood cells	because haemoglobin breaks down more rapidly
B	red blood cells have genes switched on	so red blood cells produce more haemoglobin
C	fewer red blood cells	to compensate for an increase in oxygen unloading in tissues
D	more red blood cells	so more red blood cells are produced to carry more haemoglobin

6. What events occur during the contraction of the left ventricle?

A	The bicuspid valve opens and semilunar valve in the aorta opens.
B	The bicuspid valve closes and semilunar valve in the aorta closes.
C	The pressure in the left atrium becomes greater than in the left ventricle.
D	The pressure in the left ventricle becomes greater than the pressure in the aorta.

7. Blood and tissue fluid has different composition. Which row shows the composition of tissue fluid?

	contains red blood cells	contains water	contains antibodies	contains lipids
A	X	√	√	√
B	√	√	√	X
C	√	√	X	√
D	X	X	√	√

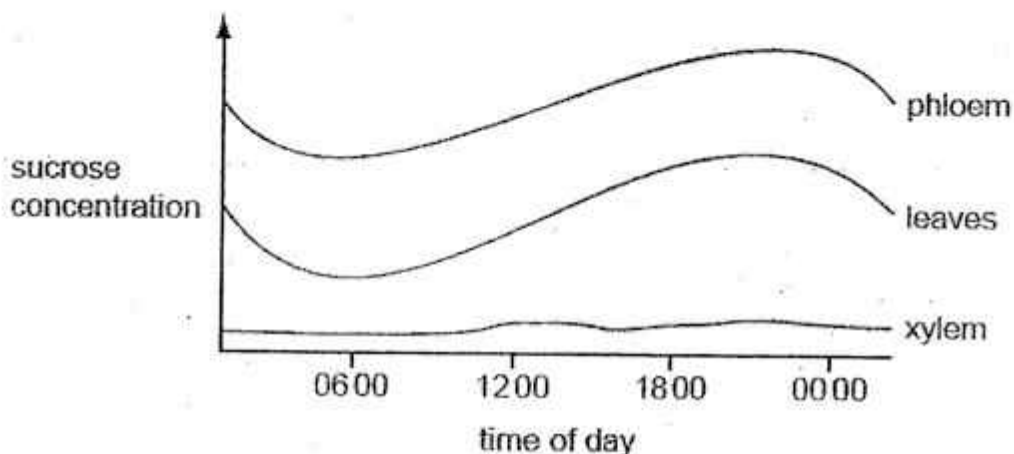
8. Which of the following processes are involved in transport in phloem?

1. diffusion
2. active transport
3. osmosis

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

9. The graph shows the results of measuring the concentration of sucrose in the xylem, phloem and leaves of a plant during 24 hours.

Which conclusion can be drawn from these results?

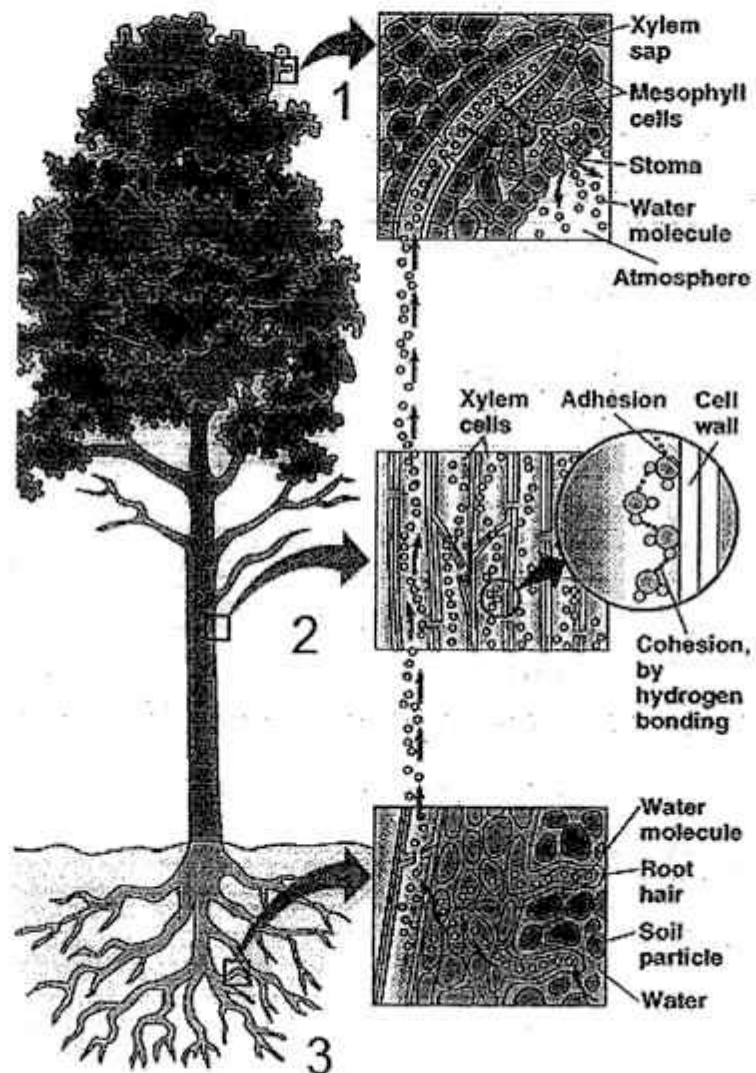


A	Osmosis moves water from the xylem to the phloem.
B	Sucrose is actively transported into the phloem from the leaves.
C	Sucrose is moved in both directions in the phloem.
D	Xylem tissue uses sucrose as a source of energy.

10. The breakdown of hydrogen peroxide to water and oxygen is catalysed by the enzyme catalase. In an investigation of the effect of pH on the rate of reaction of catalase, potato cubes were added to hydrogen peroxide. Which dependent variable should be recorded?

A	the change in mass of the potato after a given time
B	the pH of the solution at regular time intervals
C	the number of potato cubes added at the start
D	the volume of oxygen given off at regular time intervals

11. The diagram represents the movement of water through a plant.



Which row identifies the processes involved during the stage of water movement shown?

	cohesion and adhesion	transpiration	osmosis
A	1	2	3
B	3	1	2
C	2	1	3
D	2	3	1

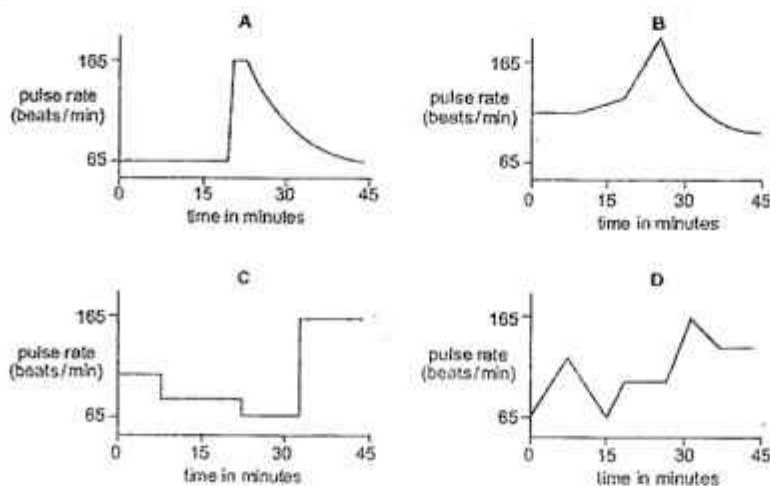
12. Anhydrous cobalt chloride paper which is placed against the lower surface and upper surface of a leaf, has faster change of colour on the lower surface. This shows that _____

- A transpiration takes place through the stomata.
- B there are more stomata on the upper surface of the leaf.
- C there are more stomata on the lower surface of the leaf.
- D the rate of transpiration is faster on the lower surface of the leaf than the upper surface of the leaf.

13. A graph shows changes in a person's heart rate over a period of 45 minutes. The sequence of events involves:

- waiting in a queue
- entering a sports stadium
- seeing a goal scored
- relaxing during half time

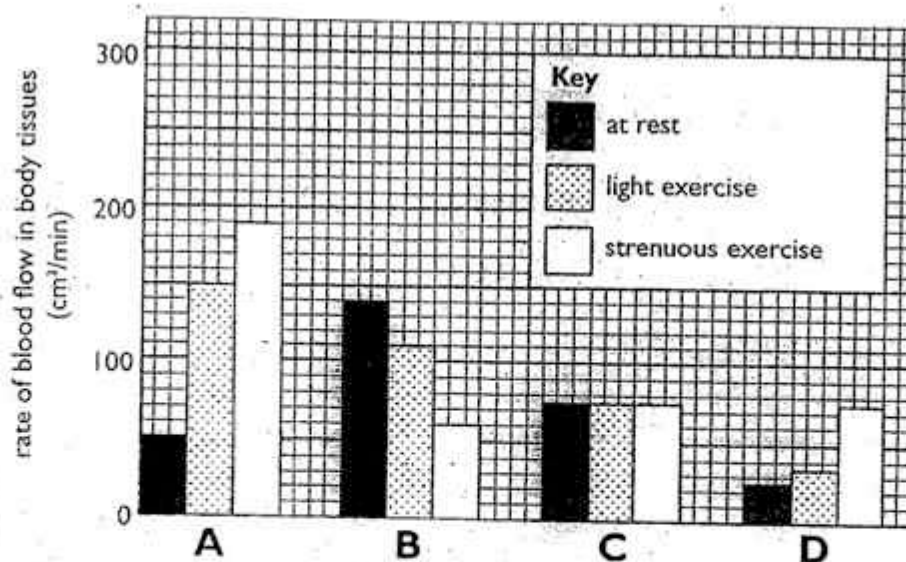
Which graph shows this sequence of events?



14. What is an example of excretion?

- A Removal of carbon dioxide from the lungs
- B Release of adrenaline from the adrenal glands
- C Removal of digested food from the duodenum
- D Removal of faeces from the alimentary canal

For questions 15 and 16, refer to the bar graph below which shows the rate of blood flow in four parts of the body when the body is in different states of activity.

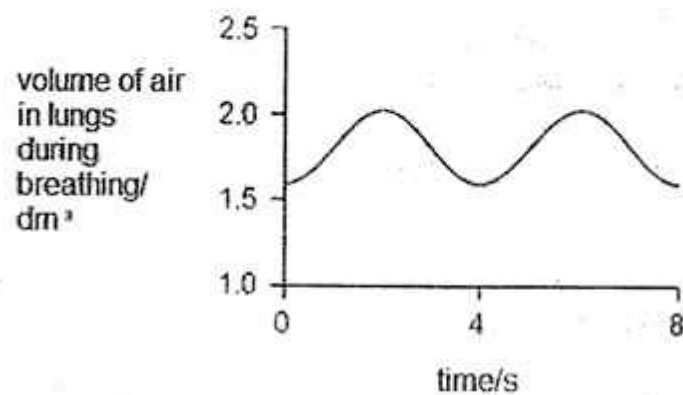


15. Which group of bars represents the small intestines?

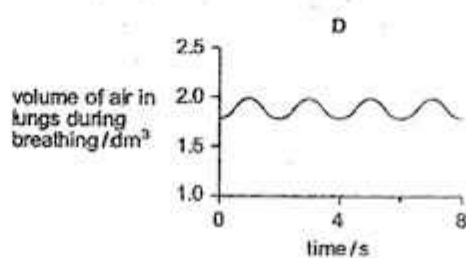
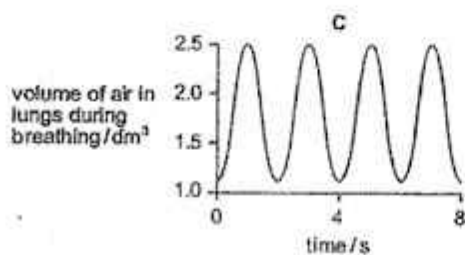
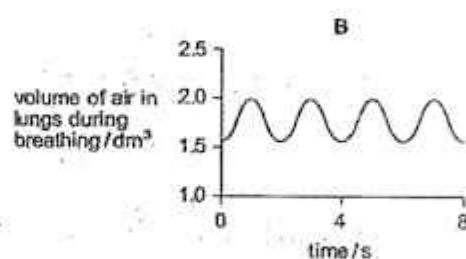
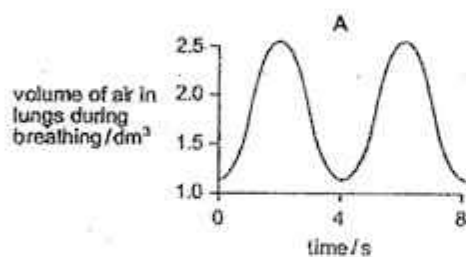
16. The group of three bars labelled **A** may possibly represent all of the following **EXCEPT** _____.

- A heart
- B muscles
- C lungs
- D bladder

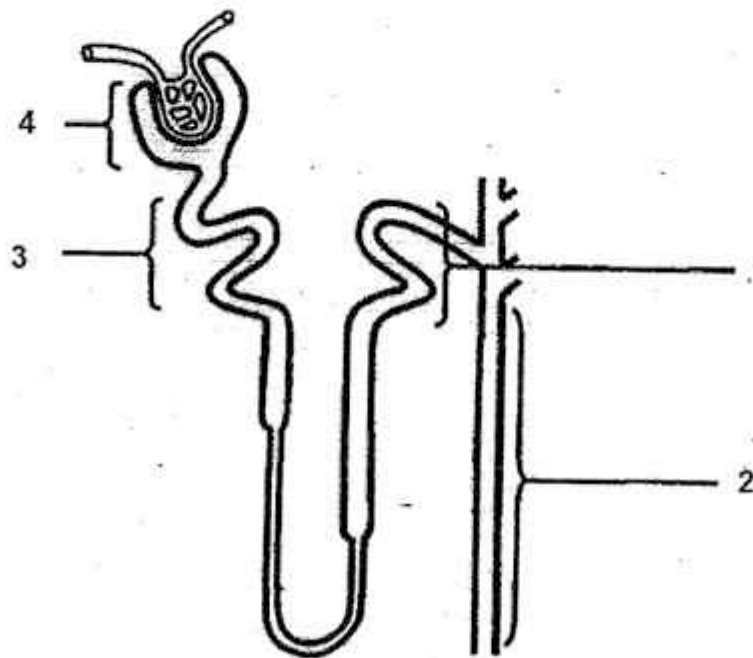
17. The graph below shows the depth of breathing in a person before a period of intense exercise.



Which graph will show the depth of breathing of the same person immediately after the period of intense exercise?



18. The diagram below shows the structure of a nephron.



Which region of the nephron has cells with the greatest number of mitochondria?

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

19. Samples of blood from the renal artery and the renal vein are analysed.

What does the blood in the renal artery contain, in comparison with the blood in the renal vein?

- A less carbon dioxide and more urea
- B more carbon dioxide and less urea
- C less oxygen and more urea
- D more oxygen and less urea

20. Which identifies the receptor, central nervous system and effector?

	receptor	central nervous system	effector
A	at end of motor neurone	includes brain	muscle
B	at end of sensory neurone	includes islets of Langerhans	gland
C	at end of sensory neurone	includes spinal cord	at end of motor neurone
D	at end of motor neurone	includes relay neurones	at end of sensory neurone

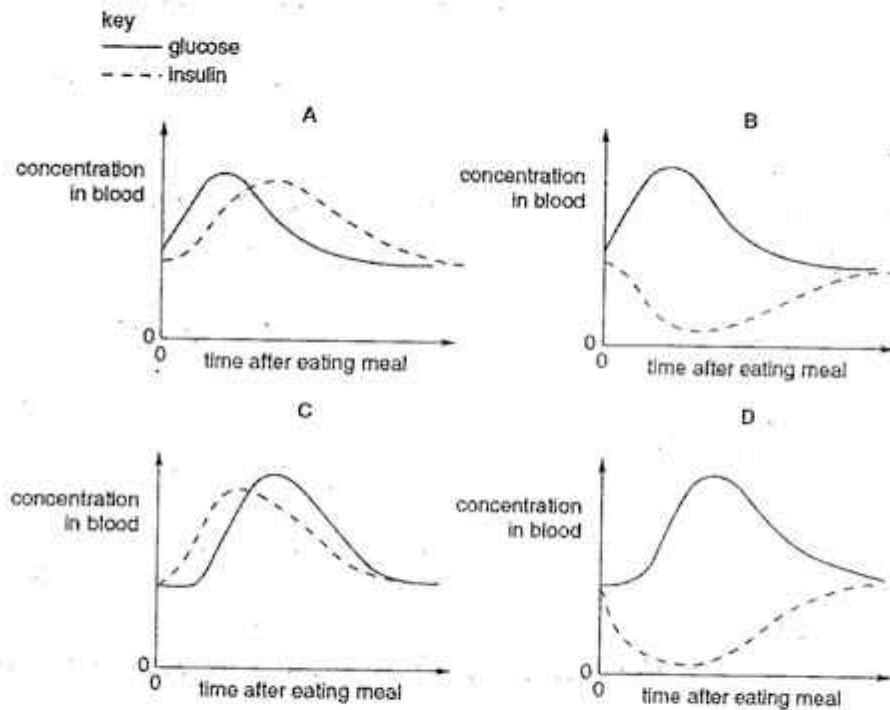
21. Which one of the following parts of the eye causes the greatest refraction of light?

- A Aqueous humour
- B Cornea
- C Lens
- D Vitreous humour

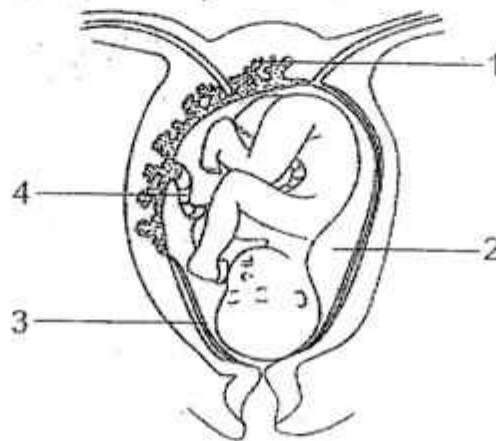
22. A boy was looking at a distant aeroplane in the sky. What happens when he looked down to check the time on his wrist watch?

	ciliary muscle	suspensory ligaments	pull on the lens	lens shape
A.	contracts	loose	less	more convex
B.	contracts	loose	more	more convex
C.	relaxes	tight	more	less convex
D.	relaxes	tight	less	less convex

23. The graphs show the concentrations of glucose and insulin in the blood of a healthy person. Which graph shows the changes expected after a meal containing starch?



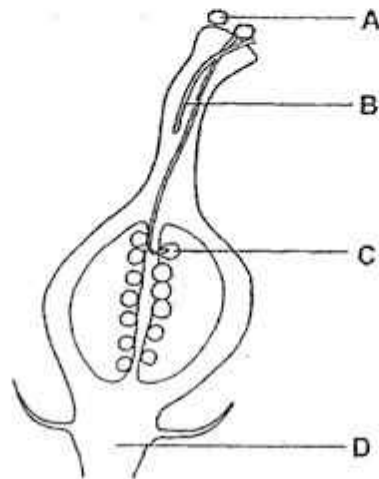
24. The diagram shows a fetus in the uterus.



Which statement is true?

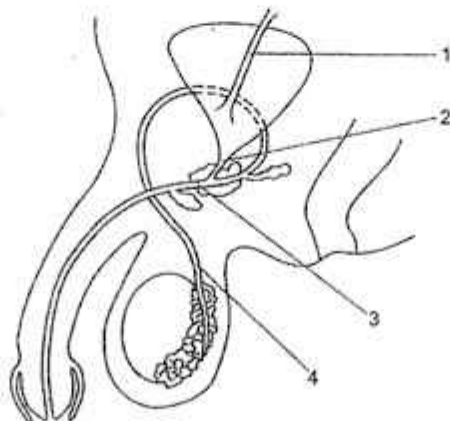
- A The part labelled 1 prevents nicotine and alcohol from diffusing to the fetus.
- B The part labelled 2 spreads pressure evenly around the fetus.
- C The part labelled 3 provides oxygen and nutrients for the fetus.
- D The part labelled 4 holds the fetus in place in the uterus.

25. New plants may be grown from groups of cells that are taken from other plant parts. The diagram shows part of plant X.



From which structure will cell samples grow into new plants that are genetically identical to plant X?

26. The diagram shows part of the male urinary and reproductive systems in side view. What is transported in the tubes labelled 1, 2, 3 and 4?



	1	2	3	4
A.	sperm only	sperm and urine	urine only	urine only
B.	sperm and urine	urine only	sperm and urine	sperm only
C.	urine only	sperm and urine	sperm only	urine only
D.	urine only	urine only	sperm and urine	sperm only

27. Which of the following correctly describes pollen grains and sperms?

- A They are motile.
- B They can fertilize the egg and produce the zygote.
- C They only contain the male nucleus.
- D They both carry the Y chromosome.

28. In which of the following parts of a flowering plant would meiosis take place?

- A Anthers
- B Germinating seed
- C Pollen tube
- D Stigma

29. An alternate form of a gene is known as _____.

- A genotype
- B a variant
- C phenotype
- D an allele

30. Which of the following is not an example of continuous variation?

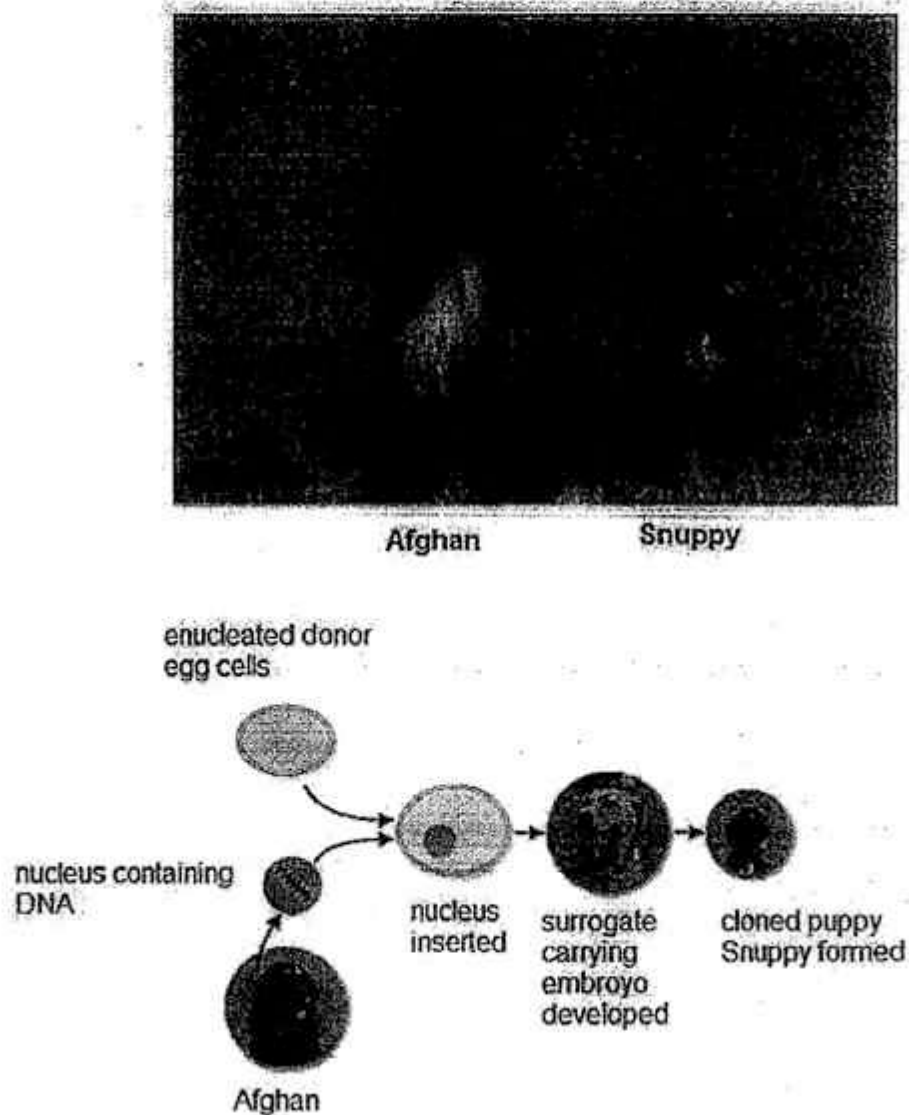
- A Height
- B Skin colour
- C Intelligence
- D Colour-blindness

31. Which structure is most responsible for maintaining cell homeostasis?

- A Cell wall
- B Cytoplasm
- C Mitochondria
- D Plasma membrane

For questions 32 and 33, refer to the case study below.

Snuppy was the first dog to be cloned. He was cloned by a team of scientists in South Korea. The diagram shows how Snuppy was cloned using a nucleus extracted from Afghan.



32. The nucleus used to make Snuppy was from _____.

- A Afghan's sperm cell
- B the puppy's stem cell
- C the Afghan's skin cell
- D the donor egg cell

33. Which statement is true of the case study on Snuppy?
- A Snuppy is genetically identical to the surrogate mother.
 - B Snuppy is genetically identical to the donor of the enucleated cell.
 - C Snuppy is genetically identical to the Afghan.
 - D Snuppy is not genetically identical to the Afghan or the surrogate mother.
34. Which of the following features is always true about the trophic levels of an ecosystem?
- A The higher the trophic level, the more the energy they need.
 - B The higher the trophic level, the bigger the size of the organisms.
 - C The lower the trophic level, the bigger the number of organisms.
 - D The lower the trophic level, the more the biomass.
35. The following shows four types of pollutants.
- S. Domestic waste
 - T. Agriculture waste
 - U. Industry waste
 - V. Oil spill
- Which of the above pollutants contribute to water pollution?
- A T and U only
 - B S, U and V only
 - C T, U and V only
 - D S, T, U and V

36. Which of the following steps can reduce the problem of pollution?

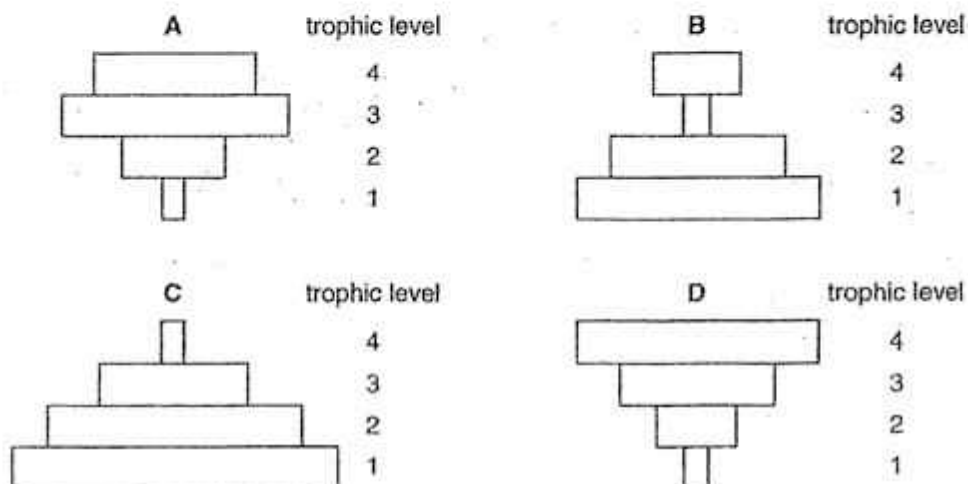
1. Recycling paper, aluminium tins and glasswares.
2. Using unleaded petrol
3. Producing charcoal as a source of fuel
4. Destroying pests by using pesticides.

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

37. Two food chains are shown below. Which diagram is a pyramid of energy representing both food chains?

tree → aphid → insectivorous bird → bird of prey

phytoplankton → zooplankton → plankton-feeding fish → carnivorous fish



38. The following are **effects** of eutrophication **except**

- A excessive algae growth that prevents light penetration
 B organic fertilizers being introduced through run – offs from farms
 C high rate of reproduction of microorganisms
 D oxygen is used up rapidly

39. The Earth would be capable of sustaining the world human population if farmland was used to grow vegetable and cereal crops only. Why can vegetable and cereal crops feed more people than farming cattle for beef?

- A Cattle needs more room than plants to grow.
- B Cattle needs to use some energy to keep them warm.
- C Plants take more time to grow than cattle.
- D Plants can be genetically modified but cattle cannot.

40. Crops can be genetically modified to contain vitamins. A concern about this is that genetically modified crops _____.

- A need special conditions in which to grow
- B will be more easily destroyed by pests
- C may have a detrimental effect on the food chain
- D have little or no benefit to humans or animals



Paya Lebar Methodist Girls' School (Secondary)
Preliminary Examination Two 2012
Secondary 4 Express

Subject: Pure Biology (SPA)

Duration: 1hr 45 min

Paper Number: 5094 Paper 2

Class: 4A1/4A3

Name:

Date: 28 August 2012

Centre Number

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Index Number

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READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.

Write in dark blue or black pen on both sides of the paper.

You may use a soft pencil for any diagrams, graphs, tables 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 on the lined paper provided and, if necessary, continue on separate answer paper.

At the end of the examination, submit Section A and Section B separately.

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

Indicate the questions you have answered in Section B in the box below.

For Examiner's Use	
Section A [50m]	
Section B [30m]	
Q	
Q	
Q E/O	
TOTAL [80m]	

This document consists of 26 printed pages.

Section A

Answer **all** questions in this section.

Write your answers in the spaces provided.

1. Fig 1.1 shows part of a transverse section through a mammalian ileum.

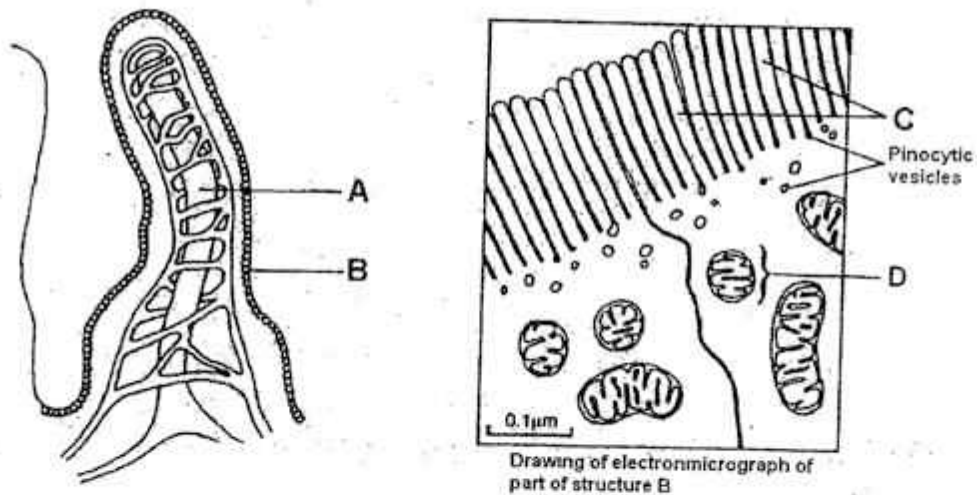


Fig 1.1

- (a) Label structures A to D.

[2m]

A: _____
 B: _____
 C: _____
 D: _____

- (b) With reference to structures A to D, describe any **two** features shown in the diagram above and explain how they enable the ileum to carry out its function of absorption.

[2m]

- (c) Fig 1.2 shows an experiment to investigate the uptake of glucose by the villi.
- Two leak-proof bags were set up.
- One bag was made from artificial partially permeable membrane (Visking tubing).
- The other bag was made from a piece of small intestine containing **living** cells, with its inner surface inside the bag.
- The bags were filled with equal volumes of a dilute glucose solution.
- The bags were suspended in the same glucose solution for two hours.
- After two hours, the volumes of the bags were measured and the contents were tested for the concentration of glucose.

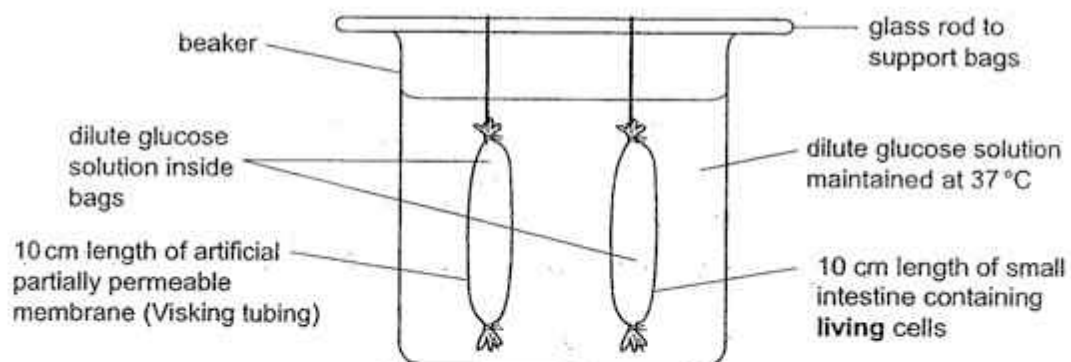


Fig 1.2

Inside the bag made from small intestine the volume and concentration of the glucose solution **decreased**. There were no changes to the volume and concentration in the Visking tubing bag.

- (i) State and explain the process responsible for the **decrease** in the glucose concentration in the bag made from small intestine. [2m]

- (ii) After 2 hours there was lesser water in the bag made from the small intestine.
The volume of water in the bag made from the small intestine decreased, but the volume in the bag made from Visking tubing did not change. Explain why. [2m]

[Total: 8m]

2. Fig 2.1 shows part of a transverse section of a leaf.

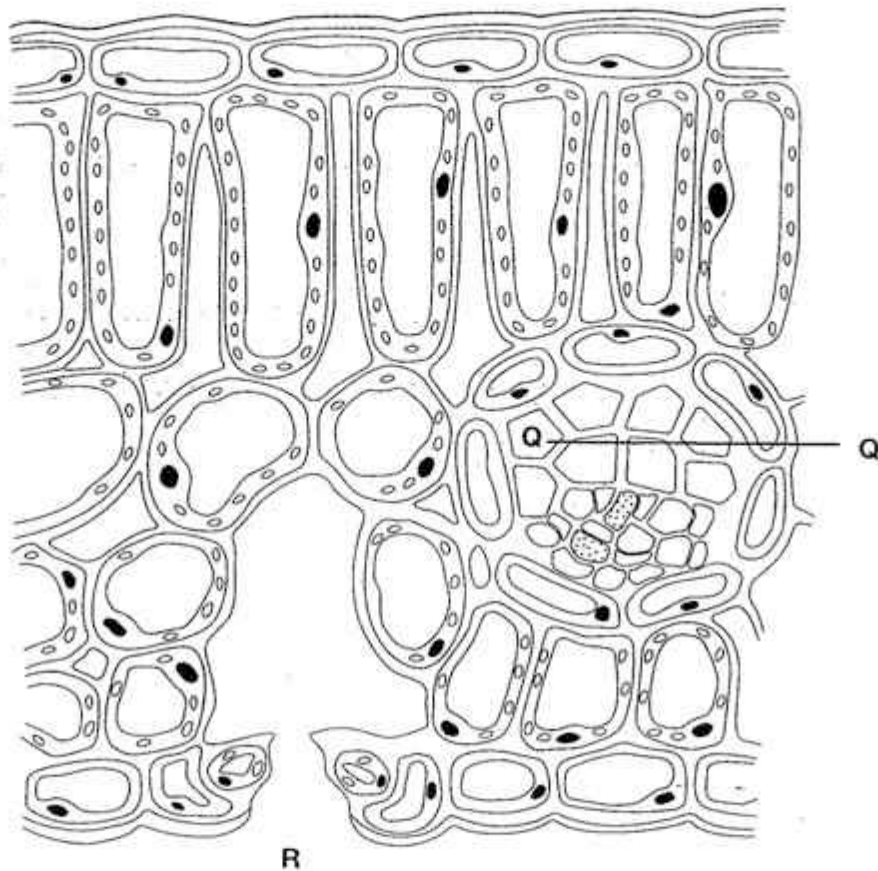


Fig 2.1

- (a) Identify structure **Q** and describe how it is adapted to transport water. [2m]

Structure **Q**: _____

- (b) Water vapour formed in the leaf is eventually lost to the environment.
Clearly outline the pathway of water out of the leaf to **R** by drawing arrows on the diagram. [1m]

- (c) Fig 2.2 shows a comparison of water vapour loss by a plant growing in damp soil and a plant growing in dry soil.

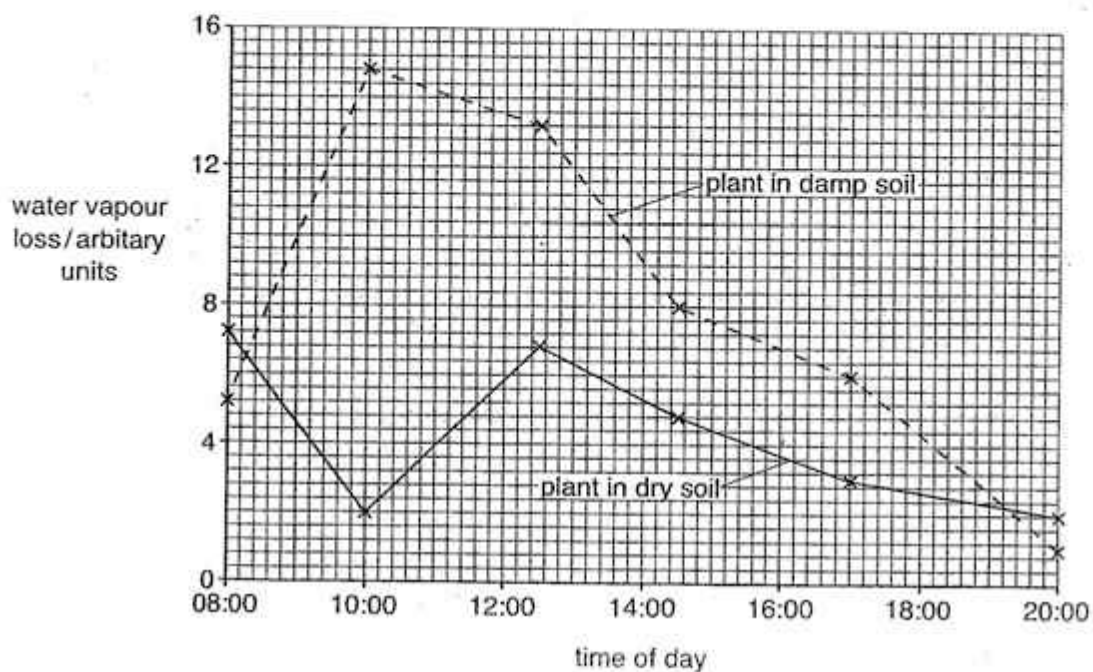


Fig 2.2

- (i) Explain the rise in the rate of water vapour loss between 08:00 and 10:00 by the plant in damp soil. [3m]

- (ii) Suggest why the rate of water vapour loss from the plant in dry soil decreased during the same period of time. [2m]

[Total: 8m]

3. In an investigation, clamping the artery, as shown in Fig 3.1, prevented the blood flow in the hepatic artery of a small mammal.

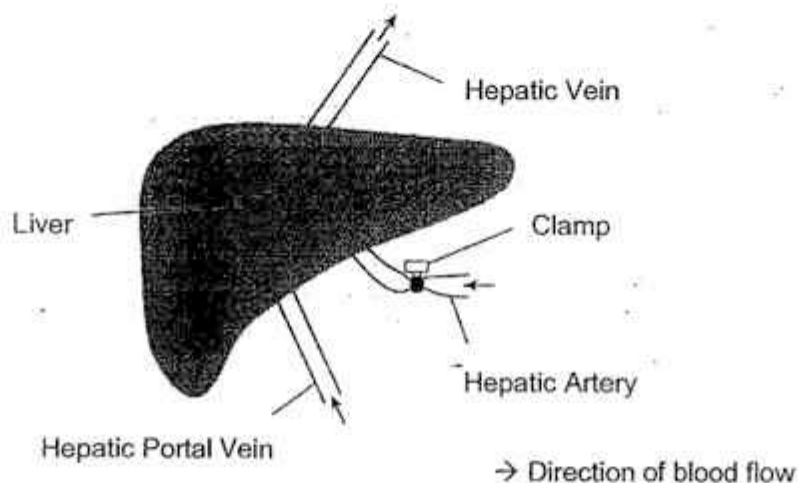


Fig 3.1

The rate of blood flow and the concentration of glucose in the blood of the hepatic portal vein and hepatic vein were then measured at 15-minute intervals. Insulin was injected into the blood at 35 minutes and adrenaline was injected into the blood at 65 minutes. The results are shown in Table 3.1.

Time /minutes	Rate of Flow / $\text{cm}^3 \text{min}^{-1}$	Glucose concentration / mg dm^{-3}	
		Hepatic Portal Vein	Hepatic Vein
0	154	1020	1060
15	151	1010	1040
30	148	1030	1070
Insulin injected			
45	145	940	720
60	144	970	780
Adrenaline injected			
75	74	1070	1270
90	82	1060	1190
105	126	1040	1110

Table 3.1

- (a) Between 0 and 30 minutes, the concentration of glucose in the hepatic vein was slightly higher than that in the hepatic portal vein. Suggest a possible reason for this data. [2m]

- (b) Explain the effect of insulin on the concentration of glucose in the blood in the hepatic vein. [2m]

- (c) The effect of insulin on the glucose concentration in the hepatic vein was greater than its effect on the glucose concentration in the hepatic portal vein. Suggest an explanation for this. [2m]

- (d) Adrenaline has a similar effect to that of exercise on the rate of blood flow in the body. Explain how adrenaline caused a fall in the rate of blood flow in the hepatic portal vein between 60 and 75 minutes. [1m]

[Total: 7m]

4. A healthy kidney controls the excretion of urea and other waste products of metabolism from the blood.

After kidney failure there are two possible treatments: dialysis or a kidney transplant.

Fig 4.1 shows how blood and dialysis fluids move through a dialysis machine.

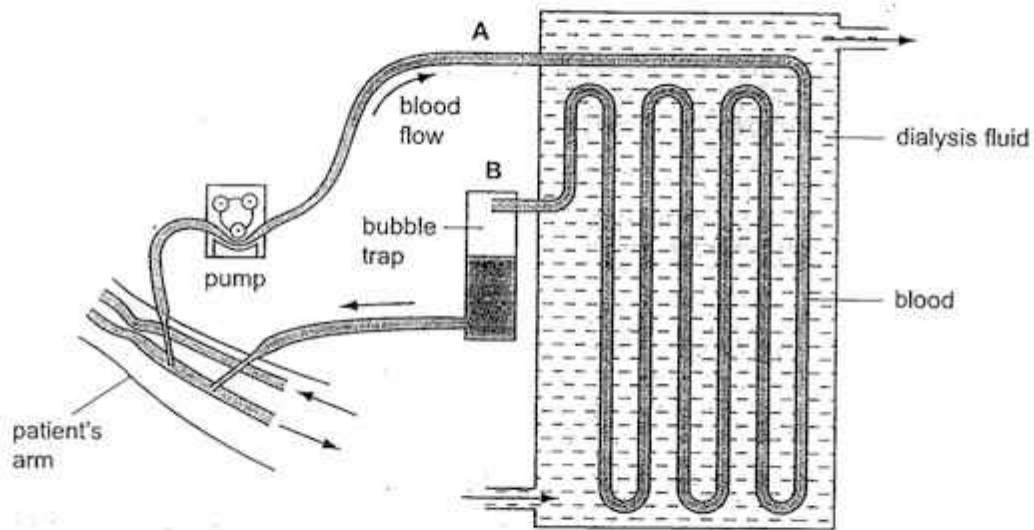


Fig 4.1

- (a) The dialysis fluid is first warmed up to about 37°C before the patient's blood enters the dialysis machine. Explain why it is necessary to do this. [1m]

- (b) Describe and explain how the dialysis machine is able to remove unwanted urea from the patient's blood. [2m]

- (c) The time taken for each treatment is found to be rather long and causes suffering for the patients.

Suggest a modification to the dialysis machine to shorten the time of treatment. [2m]

- (d) Fig 4.2 shows the effect of countercurrent flow (in the opposite direction), rather than parallel flow (in the same direction), of dialysis fluid on the percentage of urea in the patient's blood at different distances along the dialysis tubing.

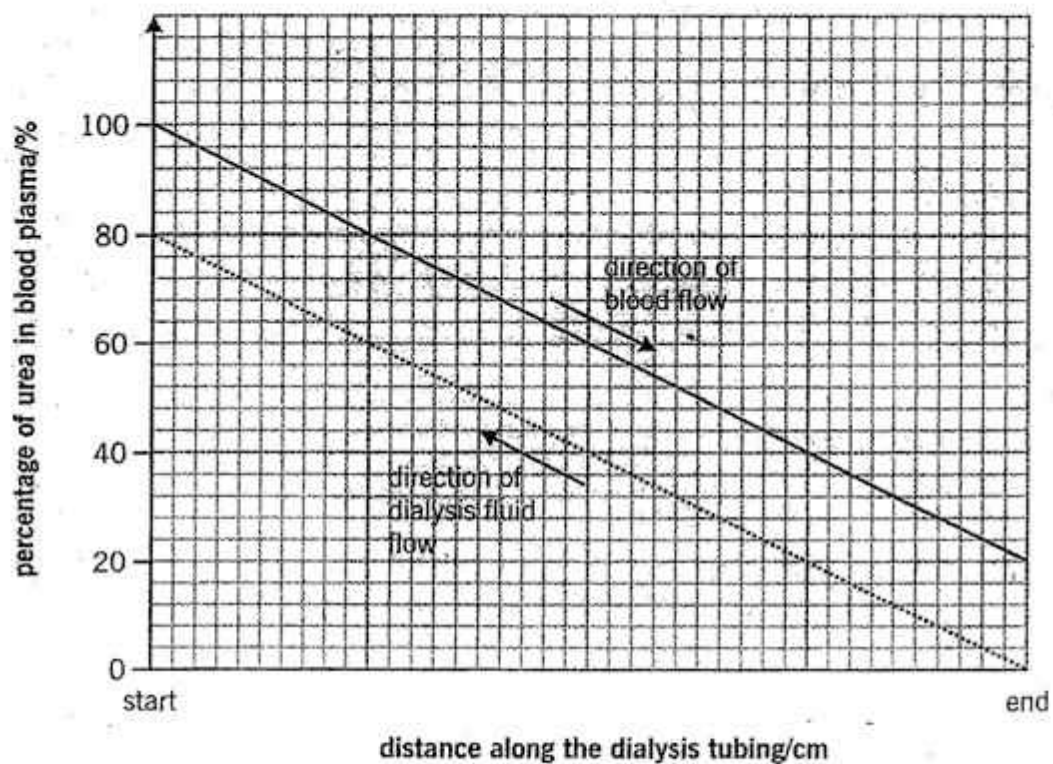
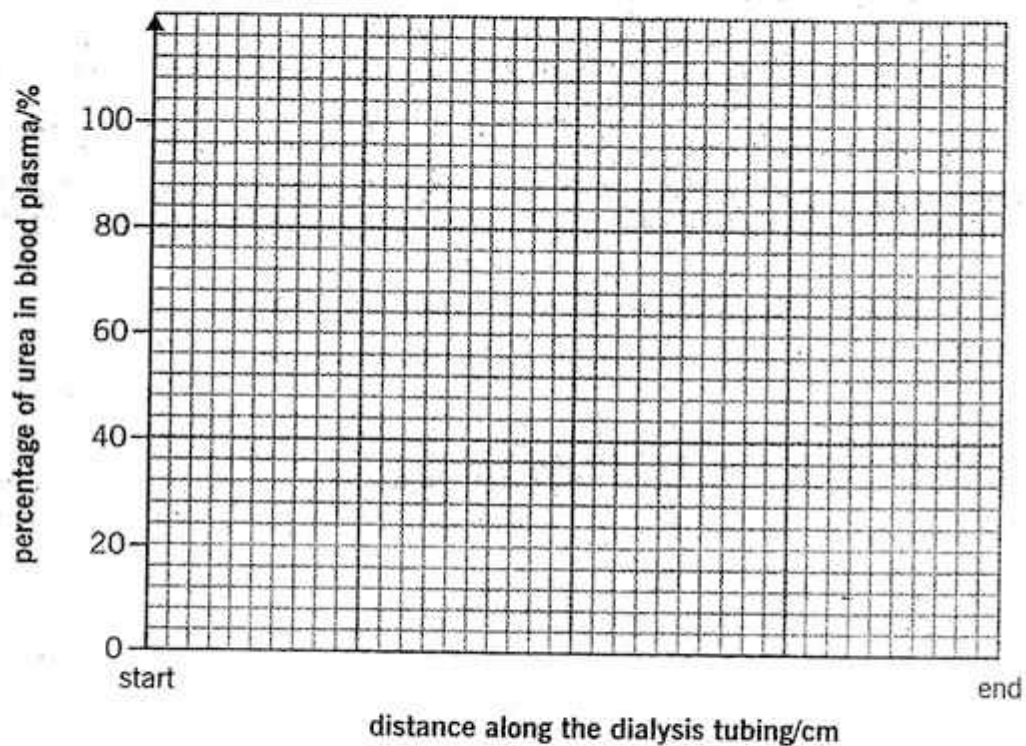


Fig 4.2

- (i) From the graph, what percentage of urea is **removed** from the blood at the end of dialysis? [1m]

- (ii) Suggest why countercurrent flow is more efficient for the removal of urea than parallel flow? [2m]

- (iii) By using a straight line () for blood flow and a dashed line (-----) for the flow of dialysis fluid, sketch the possible graph to show the concentrations of urea in the **patient's blood** and **dialysis fluid** for **parallel flow** on the graph below. [2m]



[Total: 10m]

5. Fig 5.1 shows a vertical section through a flower of soybean, *Glycine max*, following self-pollination. Fig 5.2 shows part of the section at a higher magnification.

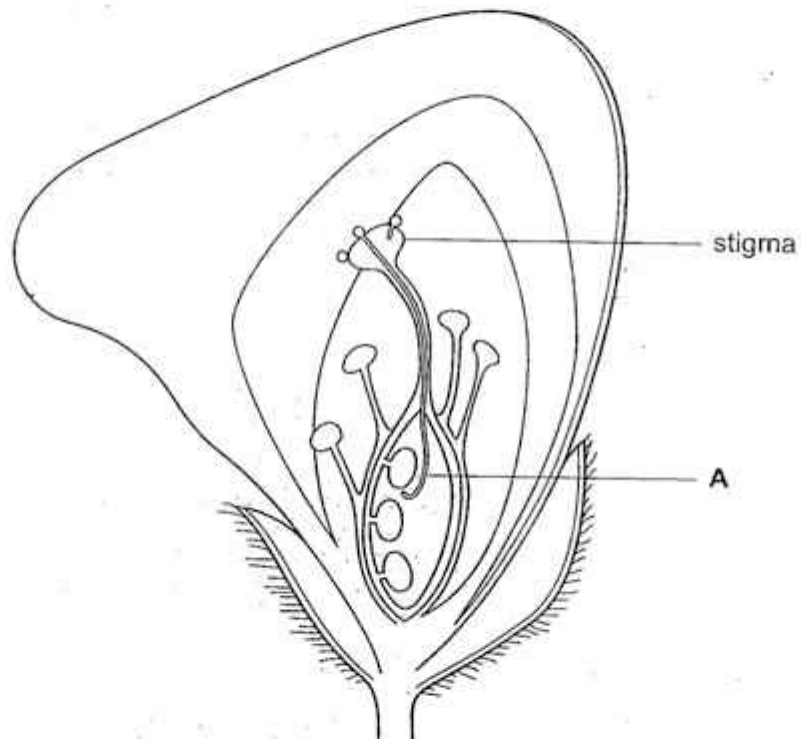


Fig 5.1

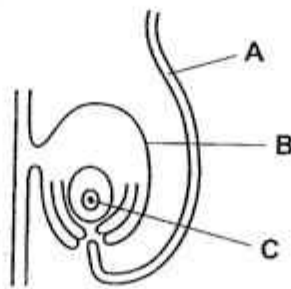


Fig 5.2

- (a) Name the parts labeled **A** to **C** shown in Figs 5.1 and 5.2. [3m]

A: _____

B: _____

C: _____

- (b) Explain the advantages and disadvantages of self-pollination for flowering plants, such as soybean. [4m]

Advantages:

Disadvantages:

[Total: 7m]

6. Fig 6.1 shows 3 species of zebra.

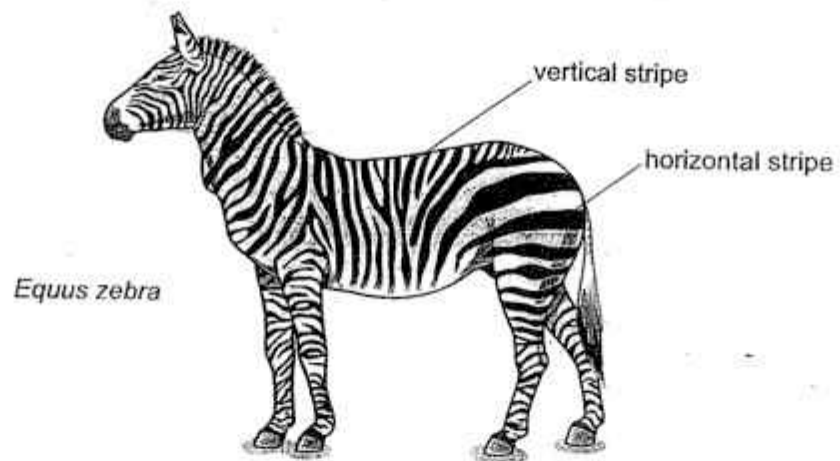
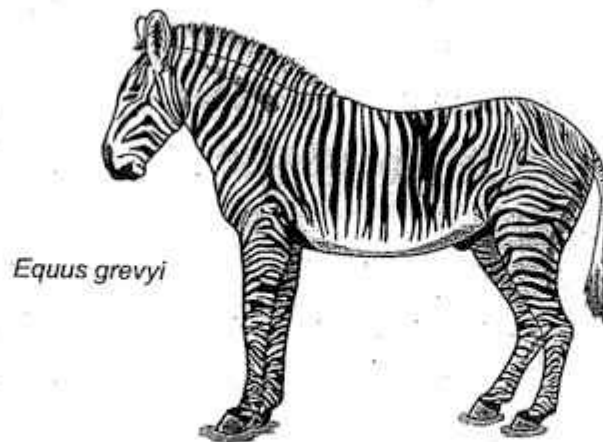
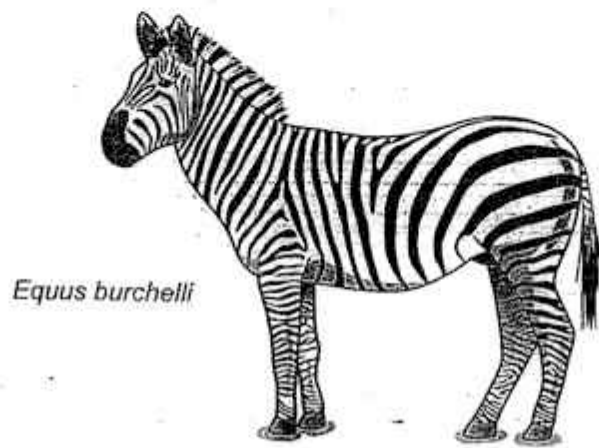


Fig 6.1

(a) Studies have shown that the hotter the environment, the more stripes the zebras have.

(i) State the type of variation that would result in different number of stripes. [1m]

(ii) From Fig 6.1, suggest which species of zebra lives in the hottest environment.

[1m]

(b) Tsetse flies attack animals with short fur, sucking their blood and spreading diseases. Scientists have discovered that zebras with more horizontal stripes attract fewer tsetse flies.

Describe how a species of zebra could gradually develop more horizontal stripes.

[3m]

- (c) Fig 6.2 shows some molecules involved in the synthesis of the protein responsible for the production of the black pigment in zebras.

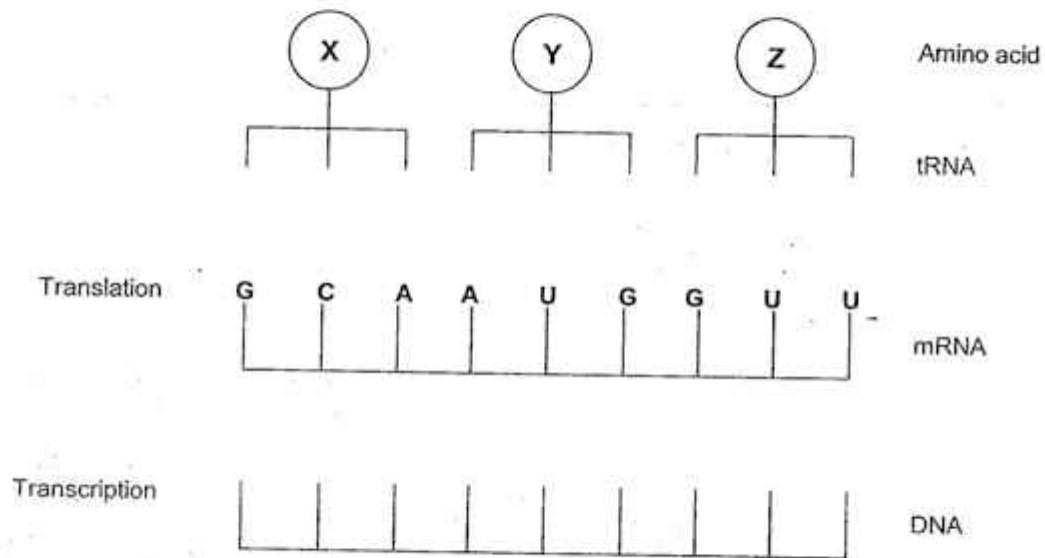


Fig 6.2

- Complete the figure above to show [2m]
- the bases on the DNA strand from which the mRNA was transcribed;
 - the bases forming the anticodons of the tRNA molecules.

- (d) Occasionally, zebras that are born are almost completely black. The change in appearance is the result of mutation.

Figure 6.3 shows the effect of this mutation of the DNA on the base sequence of the mRNA. The table shows the mRNA codons for three amino acids.

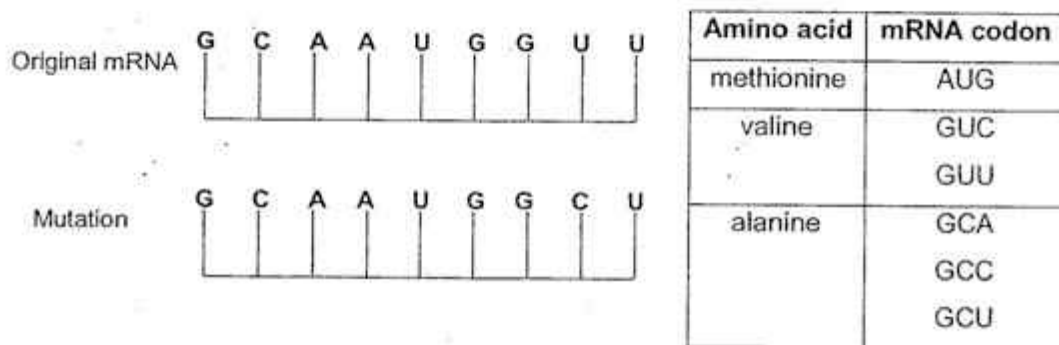


Fig 6.3

- (i) Define the term mutation. [1m]

- (ii) Explain how the mutation in Fig 6.3 may affect the polypeptide for this section of the DNA. [2m]

-[Total: 10m]

Section B

Answer **three** questions.

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

7. In a series of observations, Adrian, with one eye covered, looked at a moving object whilst the degree of curvature (convexity) of the lens of the uncovered eye was continuously recorded. Table 7.1 below shows the results.

Time/seconds	0	1	2	3	4	5	6	7	8
Degree of curvature of lens (arbitrary units)	1.00	2.40	3.80	3.80	3.80	1.00	2.75	1.90	1.05

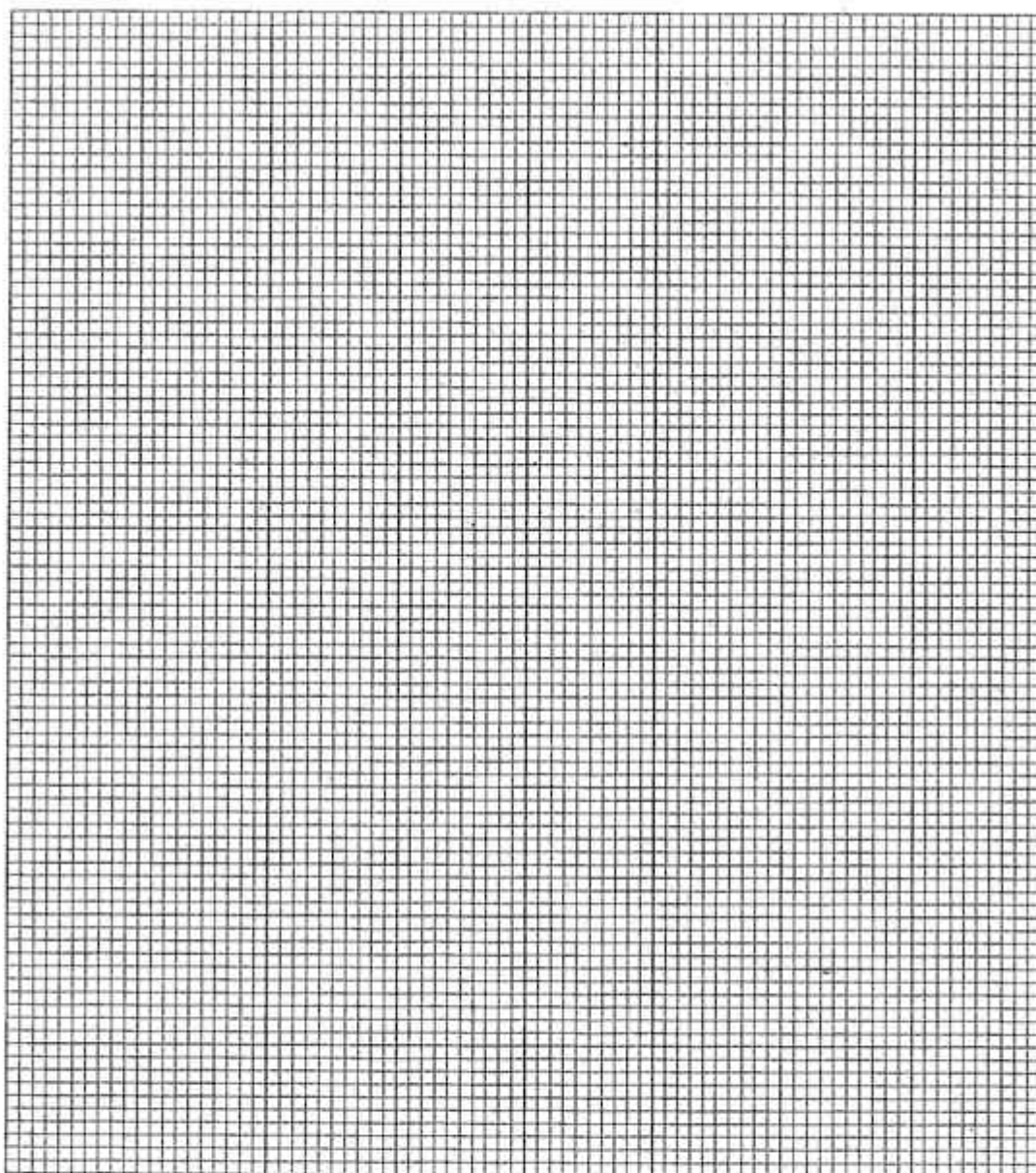
Table 7.1

Detach this section (pages 19 to 26) and submit it separately.

Secondary 4E Biology Preliminary Examination (2) 2012 – Section B

Name of Candidate	Class	Serial No
-------------------	-------	-----------

- (a)(i) Plot a graph of the results to show how the curvature of Adrian's lens changed with time. [4m]



- (ii) Describe and explain the changes in the curvature of Adrian's lens in relation to the movement of the object, from 0 seconds to 5 seconds. [3m]

- (b) Describe the changes in the eye that allow the lens to change in curvature from 6 seconds to 8 seconds. [3m]

[Total: 10m]

8. Marine conservationists are concerned that fish stocks in the sea are decreasing. Drastic measures will have to be taken to stop the extinction of many fish species. Fig 8.1 shows a marine food web. Tuna are large carnivorous fish that are an important human food. Dolphins may be caught in fishermen's nets and die.

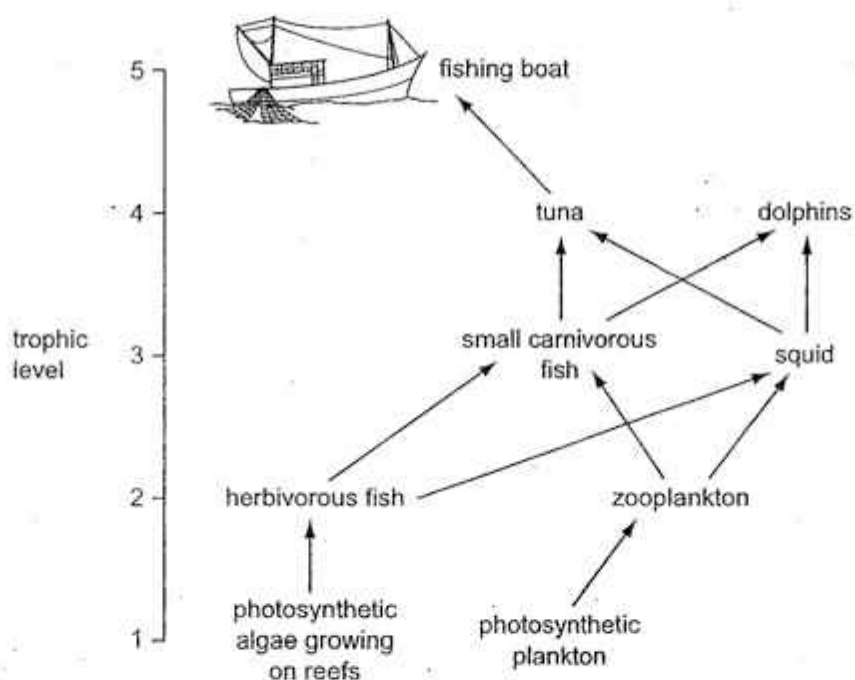


Fig 8.1

- (a) Nutrients are recycled in ecosystems but energy is not recycled.

Explain why there are no more than four trophic levels in the ecosystem shown in Fig. 8.1. [3m]

- (b) Explain why it is more energy efficient for humans to eat herbivorous fish rather than tuna. [3m]

- (c) Explain why it is necessary to conserve animals, such as tuna and dolphins, which are at trophic level 4. [4m]

[Total: 10m]

9 EITHER

The familiar orange-pink colour of salmon (a type of fish) flesh is due to a gene that allows salmon to process carotene found in its crustacean and plankton diet. In the wild, about 1 in 20 salmon are white fleshed. White flesh in salmon is a recessive trait.

- (a) An orange-pink fleshed salmon was crossed with a white-fleshed salmon. Of the 2500 hatched eggs, about half were orange-pink fleshed while the rest were white fleshed.

What is the genotype of the parent that is orange-pink fleshed? Explain your answer with the help of a clearly labeled genetic diagram and a suitable letter symbol to represent the flesh colour of salmon. [4m]

(b) Scientists have genetically modified salmon to grow faster. They have taken a gene from the ocean pout (another species of fish) and inserted it into the 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 (GM) salmon grows to maturity in 18 months instead of 3 years and appears to be larger than its wild-type counterparts.

(i) Outline the procedure by which scientists combine the ocean pout gene with a bacterial plasmid to form a recombinant DNA which is produced into bacterial cells.

[4m]

(ii) Environmentalists claim that genetically modified salmon can harm the ecosystem. Suggest an effect on the ecosystem if GM salmon are introduced into the wild. [2m]

[Total: 10m]

9 OR

Cystic fibrosis is an inherited disorder in humans in which an important protein is not produced. This protein is responsible for preventing the accumulation of thick and sticky mucus in the breathing tubes.

- (a) The allele which causes cystic fibrosis is recessive to the normal allele (N).

Draw a genetic diagram to show if it is possible for a healthy man and a woman who is a carrier to produce a baby with cystic fibrosis. Identify the phenotypes of the children. [4m]

- (b) Suggest how the build up of sticky mucus in the breathing tubes would affect a sufferer of cystic fibrosis. [3m]

- (c) Cystic fibrosis may also cause the pancreatic duct to become blocked by mucus. Suggest 2 effects of cystic fibrosis as a result of this and how these may affect health. [3m]

[Total: 10m]

End of Paper



Biology 5094/1 MCQ Prelim Paper 2 2012

Answer Scheme

Paper 1

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

Sec 4 Exp Bio
Prelim 2 2012 Ans Scheme

Section A

1(a) A: lacteal

B: epithelium

C: microvilli

D: mitochondria [1/2m each – max 2]

- (b) - presence of numerous mitochondria (D) to provide energy for active transport for the absorption of nutrients.
- epithelium (B) is one cell thick to allow for faster diffusion of nutrients.
- microvilli (C) increases surface area for faster diffusion of nutrients.
[any 2, 2m]

(c)(i) active transport [1m]

glucose molecules were transported against conc gradient [1m]

glucose was used up during respiration to release energy [1m]

[any 2, 2m]

(ii) *small intestine*

glucose, taken up by cells / moved outside bag

lower water potential outside bag

water, moves out of bag

by osmosis

Visking tubing

no difference in water potential

no (net), osmosis of water ; R 'no diffusion'

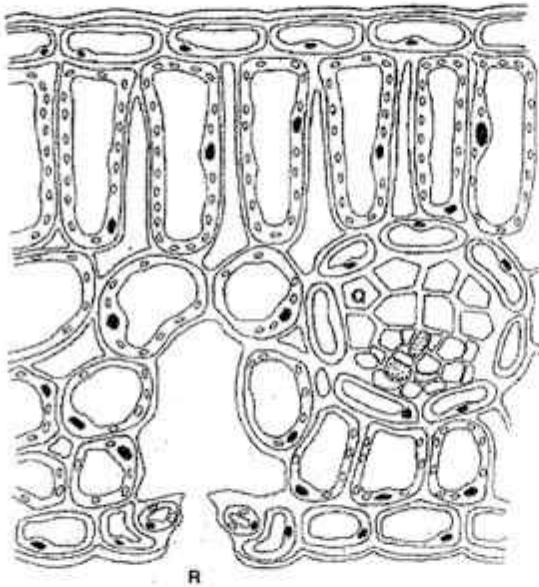
[1/2m each; max 2m]

2(a) Q - xylem [1m]

Hollow, with no protoplasm/ cross walls [1/2m]

Allow the smooth transport of water [1/2m]

(b)



(c)(i) Between 0800 and 1000,

temperature of environment increases [½ m]

increased loss of water vapour/transpiration [½ m]

increase in light intensity, guard cells photosynthesise [½ m]

glucose is produced, lowering water potential of cell [½ m]

water enters guard cells by osmosis [½ m]

guard cells are turgid, opening stomata [½ m]

increased loss of water vapour/transpiration

(ii) plant is unable to replace water loss [½ m]

plant loses turgidity/ wilts [½ m]

guard cells become flaccid [½ m]

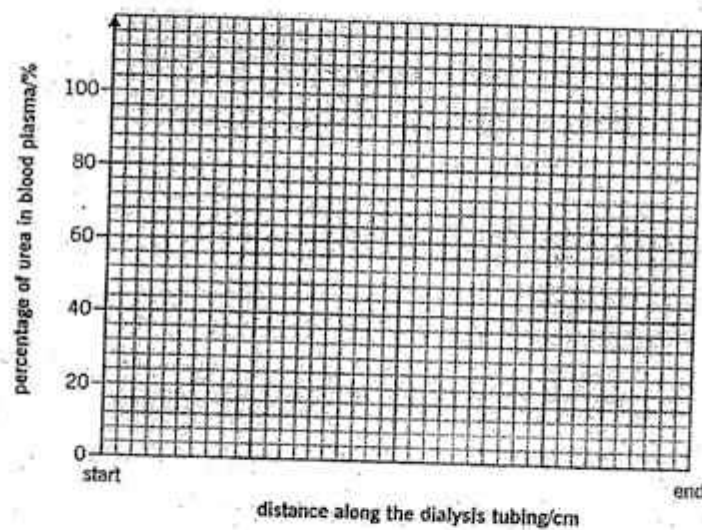
stomata closes [½ m]

decreased water vapour loss

- 3(a) breakdown of glycogen to glucose in the liver [1m]
 glucose is transported out of the liver via hepatic vein [1m]
 little glucose from the gut; in between meals [1m]
 [max 2m]
- (b) Insulin causes uptake of glucose by the liver [1]
 Glucose is either converted to glycogen; respired off [1]
- (c) Insulin only affects the liver cells and/or muscle cells [1].
 Changes in the glucose concentration can be detected in the hepatic vein that carries blood from the liver [1/2m]
 Instead of the hepatic portal vein which carries blood towards the liver only [1/2m]
- (d) Constriction of the arteries in the gut [1/2m]
 Dilation of arteries in the muscles during exercise. [1/2m]
 Therefore, the blood from the gut entering the hepatic portal vein would decrease.
- 4(a) prevent heat loss [1/2m]
 from patient's blood to the dialysis fluid [1/2m]
- (b) Dialysis fluid does not contain any urea [1/2m]
 Conc grad btw blood and fluid [1/2m]
 Urea diffuses [1/2m] out of blood into fluid [1/2m]
- (c) Increase the no. of coils of dialysis tubing [1m]
 increase SA to V ratio to increase rate of exchange of urea [1m]
- (d)(i) 80%

- (ii) Never reach equilibrium between the blood and fluid [1m]
 Conc grad always maintained to allow constant removal of urea [1m]

(iii) 2m



- 5(a) A: pollen tube
 B: ovule
 C: ovum/zygote [1m each, max 3m]

(b) **Advantages**

self-pollination perpetuates variety that is well adapted to habitat ;
 greater chance of pollination / ensures pollination occurs
 Less wastage of pollen / gametes / energy (in pollen production)
 no need for pollinating agent

Disadvantages

less variation R: genetically identical
 genotype becoming homozygous
 harmful alleles/genes expressed
 less chance of adapting to changing conditions
 more susceptible to diseases
 [1/2m each; max 2m per section; total 4m]

6(a)(i) Continuous [1m]

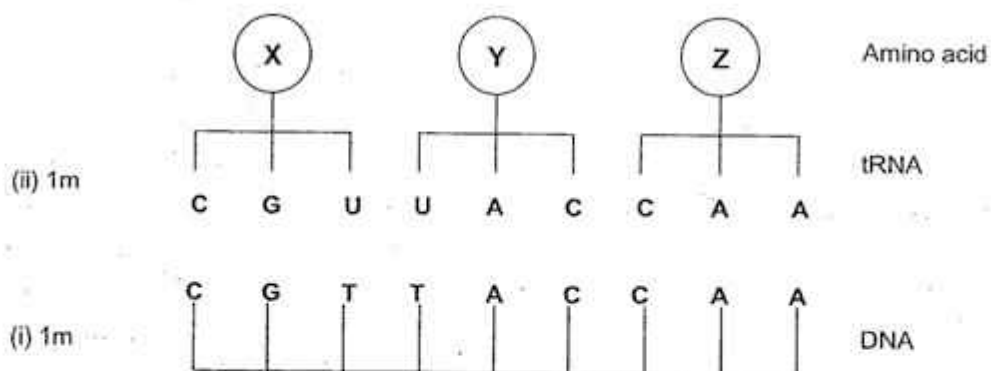
(ii) *Equus grevyi* [1m]

(b) Zebras with fewer horizontal stripes will most likely be attacked by the tsetse flies and die from disease before they can reproduce. [1m]

Zebras with more horizontal stripes will more likely survive and pass on their gene for more stripes to their offspring. [1m]

Over many generations, by natural selection [1m] the species of zebra will develop more horizontal stripes. [Max: 3m]

(c) (i)& (ii)



(d)(i) Spontaneous/sudden change [$\frac{1}{2}$ m] in the structure of the gene or number of chromosomes. [$\frac{1}{2}$ m]

(ii) The mutation leads to a change in the sequence of amino acids as GCU codes for alanine instead of valine[1m]

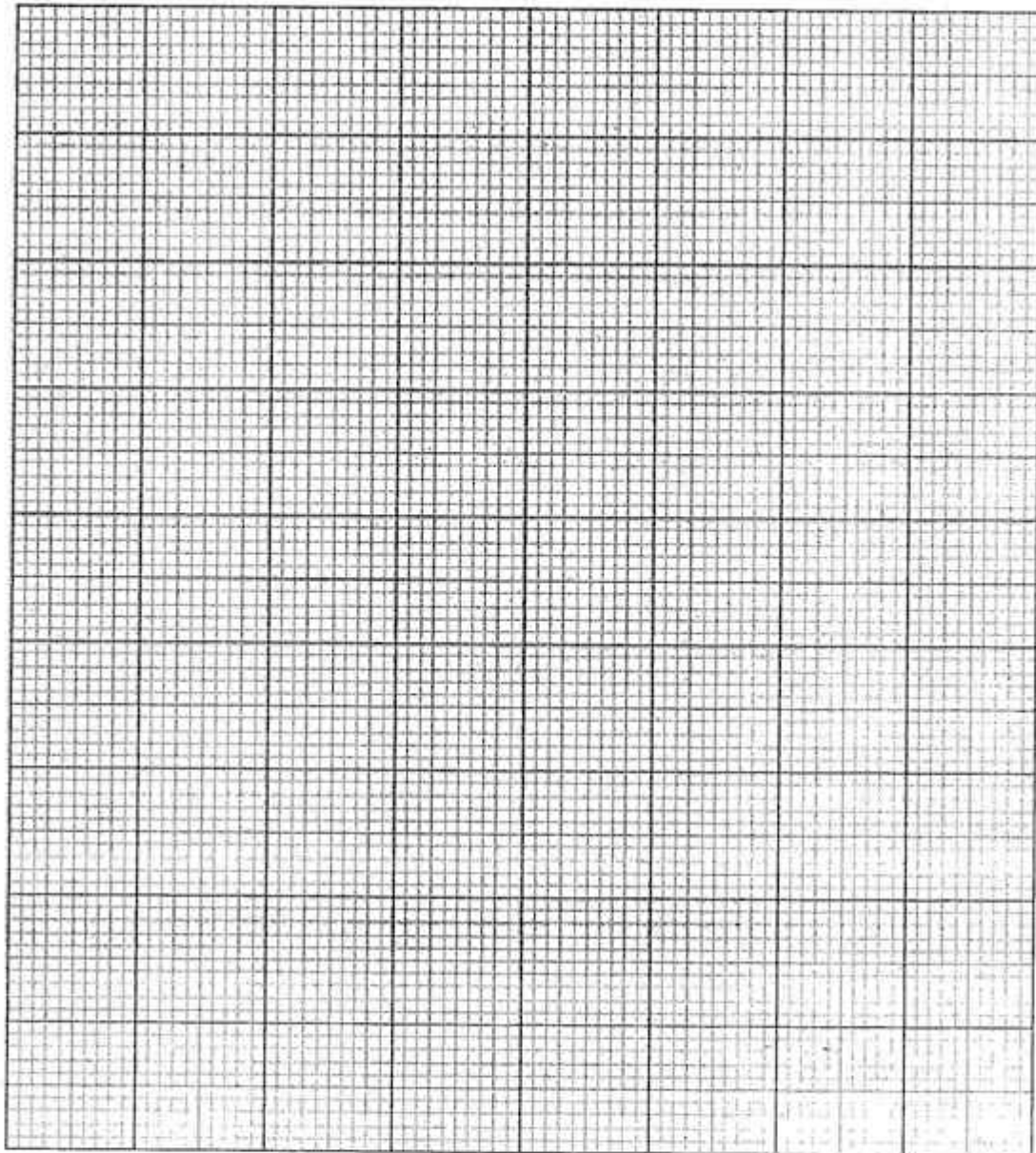
This would lead to a change in the final 3D structure of the polypeptide.[1m]

7(a)(i) points - 1m

scale - 1m

curve - 1m

axes - 1m



- (ii) - From 1 to 2s, curvature of lens is increasing
- object is moving towards Adrian
- From 2 to 4s, the curvature of lens remain constant at 3.8 arbitrary units
- object remains stationary
- From 4 to 5s, the curvature of the lens is decreasing back to normal of 1 arbitrary unit
- object is moving away from Adrian / back to its starting point
[1/2m each, max 3m]

- (b) Ciliary muscles relax
suspensory ligaments taut
lens become less convex
[1m each]

- 8(a) - small percentage of energy from sun is absorbed during photosynthesis
- most energy from sun not available / reference to wrong wavelength
- most/90% energy is lost, between / within, trophic levels / along food chain
- 10% energy transfer to next trophic level
- energy lost to material that is, inedible / not digestible
- energy lost, in respiration / heat / (named) metabolic process / decomposers
- small total percentage reaching fourth trophic level
- not enough energy in fourth trophic level to support another level ;
[1/2m each; max 3m]

(b) - 90 % energy is lost, along the food chain / at each trophic level / between trophic levels

- lost through respiration / movement / heat loss / metabolism/ excretion
- food not eaten / food not digested / egested
- only 10% energy passed on to next trophic level
- tuna / top carnivores, are in smaller numbers
- more energy available in, trophic level 2 / herbivorous fish,
- than in, level 4 / tuna or dolphins ;

[1/2m each; max 3m]

(c) - if not conserved they would become extinct

- maintaining numbers of other species in food web / disruption of food web / maintaining balance in food web
- maintaining (bio)diversity
- lead to increase in number of carnivorous fish / squid / trophic level 3
- reduction in, herbivores / herbivorous fish / zooplankton / trophic level 2
- less food available for consumers
- would be less tuna / food, for humans
- any aesthetic reason (for conserving)
- any economic reason (for conserving)

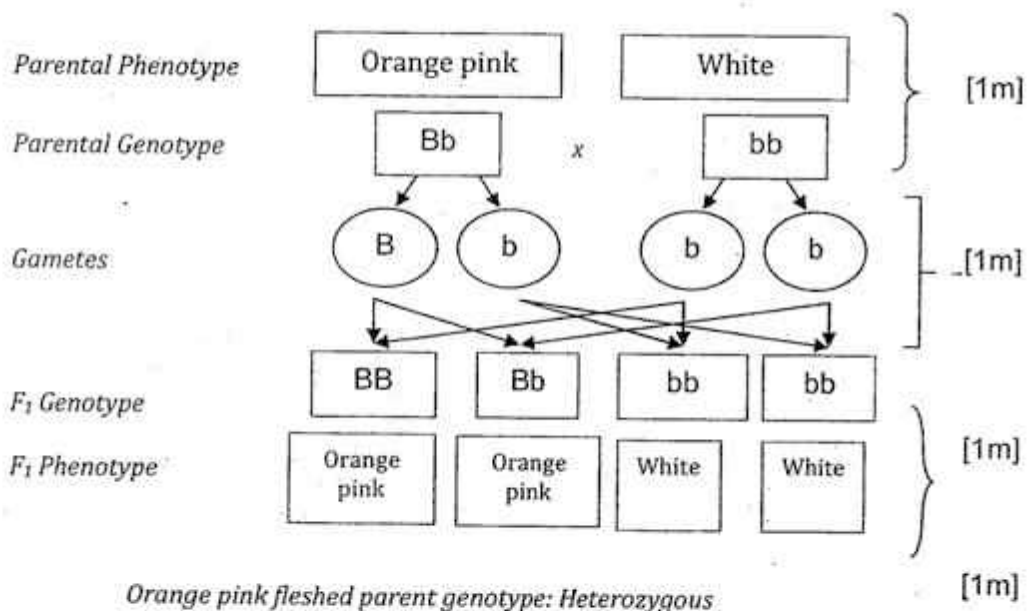
[1/2m each; max 4m]

9 Either

(a) Key:

B – orange pink

b – white [1m]



[max: 4m]

(b)(i) - Isolate the ocean pout gene

- Ocean pout gene is cut using a suitable restriction enzyme.
- The plasmid is cut using the SAME restriction enzyme.
- This produces complementary sticky ends on the ocean pout DNA fragment and plasmid.
- The ocean pout gene is mixed with the plasmid and inserted into it using DNA ligase.
- Recombinant DNA is inserted into the bacterial cell after weakening the cell membrane with heat OR packaging into a retrovirus and allowing it to infect the cell.

[1/2m each; Max 4]

- (ii) - Loss of wild varieties/ less diversity of salmon
 - GM salmon grow faster and are larger, compete better for food/ mates more so more likely to survive and reproduce while smaller wild type cannot feed,
 - Less likely to survive and reproduce, thus numbers will dwindle

OR

- Disturbance to the food chain, wild type of salmon cannot compete and die off.

OR

- Other animals in the food chain may lose their source of food or may over-populate because of loss of predator.

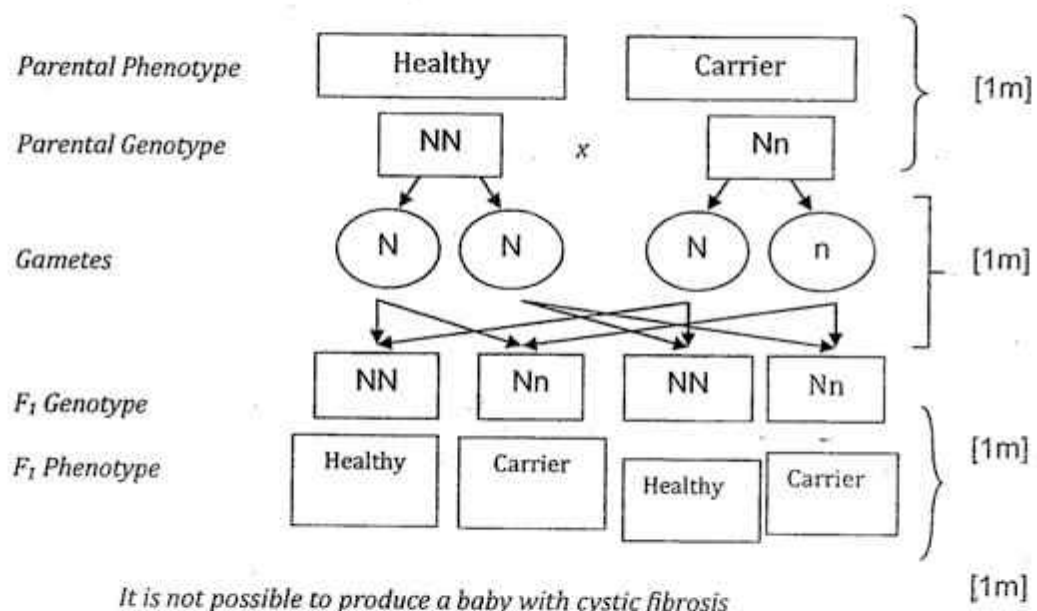
[1m each; any 2; max 2m]

9 OR

(a) Key:

N – healthy

n – cystic fibrosis [1m]



[max: 4m]

- (b)
- cilia would not be able to sweep up mucus
 - narrowing of lumen of bronchioles due to excess mucus
 - person would cough often to clear air passages
 - breathless
 - feel fatigued
 - insufficient air into lungs, reduced absorption of oxygen
 - reduced respiration to release energy

[1/2m each, max 3m]

- (c)
- since the pancreatic duct is blocked, no/fewer enzymes from the pancreatic juice can pass into the small intestine from the pancreas
 - this would reduce the digestion of fats, carbohydrates and proteins
 - these would not be able to be absorbed as they are too large and
 - would be removed from the body as undigested food materials in the faeces.
 - the person would not be getting enough nutrients and would suffer from malnutrition / weight loss
 - the growth of the person would also be reduced.

[1/2m; max 3m]

PRESBYTERIAN HIGH SCHOOL



BIOLOGY

5094/01

Paper 1 Multiple Choice

14 September 2012

Thursday

1 hour

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2012 SECONDARY FOUR EXPRESS PRELIMINARY EXAMINATION

INSTRUCTIONS TO CANDIDATES:

DO NOT OPEN THIS QUESTION PAPER UNTIL YOU ARE TOLD TO DO SO.

Write in soft pencil.

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

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

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

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

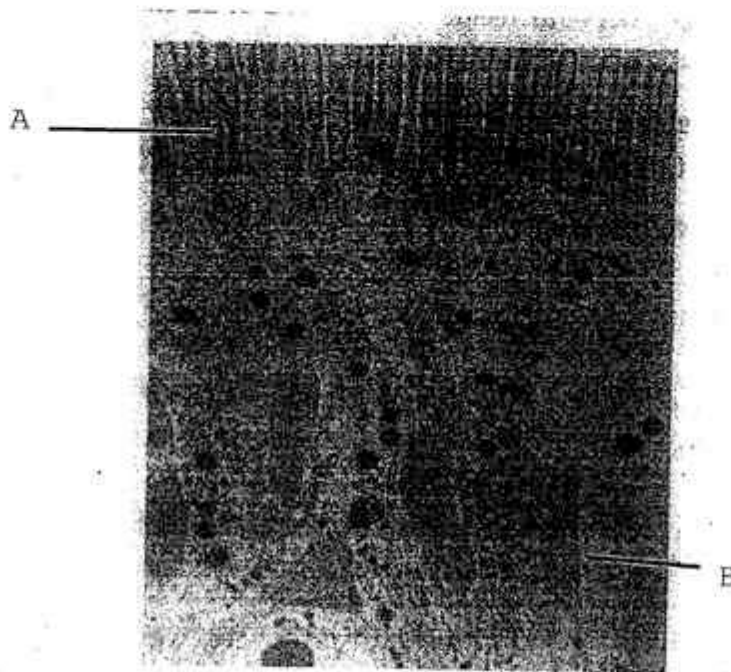
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

Setter: Mr Chandrasegaran P

This question paper consists of **17** printed pages(including this cover page) and **1**blank page.

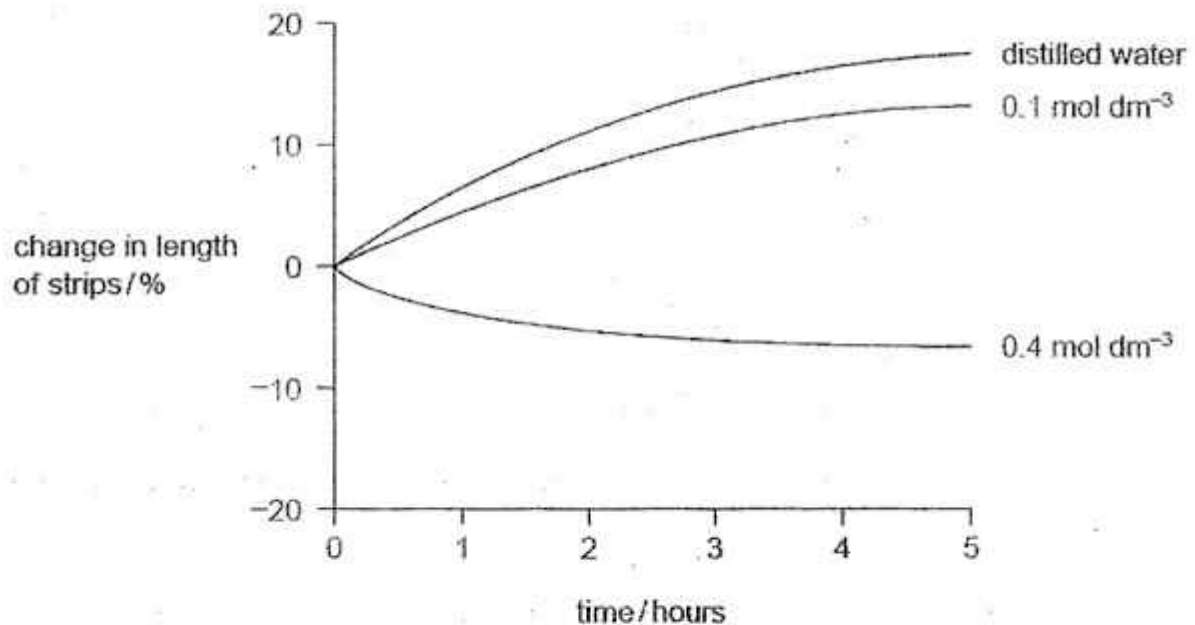
Refer to the photomicrograph below to answer Questions 1 and 2.



- 1 What is the structure labelled B?
 - A Golgi body
 - B endoplasmic reticulum
 - C mitochondrion
 - D nucleus
- 2 What is the function of structure A?
 - A increases surface area to volume ratio to enhance absorption of nutrients
 - B increases surface area to volume ratio to enhance secretion of digestive enzymes
 - C provides sweeping action to speed up movement of food substances down the small intestine
 - D slows down movement of food substances down the small intestine by obstructing flow
- 3 Which of the following statements about osmosis are correct?
 - 1 Osmosis can only take place in living tissues.
 - 2 Osmosis is an active process.
 - 3 Osmosis is the movement of water from a solution with high water potential through a partially permeable membrane to a solution with lower water potential.
 - 4 Osmosis occurs when two solutions of different concentrations are separated by a partially permeable membrane.
 - 5 When the water potential on both sides of a partially permeable membrane is the same, osmosis stops and there is no movement of water.

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

- 4 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 explains the change that occurred in the potato strips immersed in 0.1 mol dm⁻³ sucrose solution?

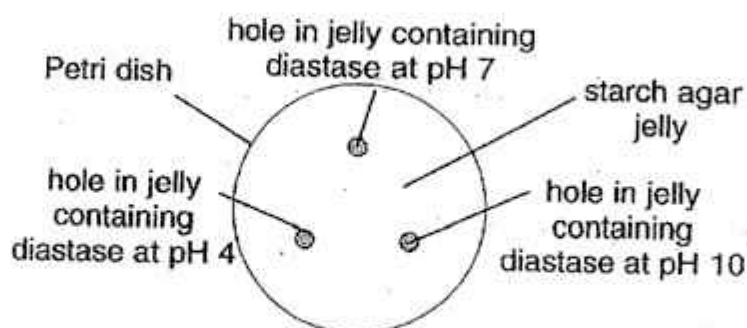
- A Sucrose molecules diffused into the potato cells.
 - B Sucrose molecules were actively transported into the potato cells.
 - C The water potential of the sucrose solution was higher than the water potential inside the cells.
 - D The water potential of the sucrose solution was lower than the water potential inside the cells.
- 5 Which statement defines active transport?
- A movement of large molecules through the cell surface membrane into the cytoplasm of a cell
 - B movement of molecules or ions from where they are in a low concentration to where they are in a higher concentration
 - C movement of molecules or ions from where they are in a high concentration to where they are in a lower concentration
 - D net movement of water molecules across a partially permeable membrane from a region of higher water potential to one of lower water potential

- 6 Which property of water is essential for blood to be pumped by the human heart?
- A It has high specific heat capacity.
 - B It is an excellent solvent.
 - C It is most dense at +4 °C.
 - D It is incompressible.

- 7 Food tests were carried out on a liquid sample containing reducing sugar and protein. Which of the following shows the correct results obtained?

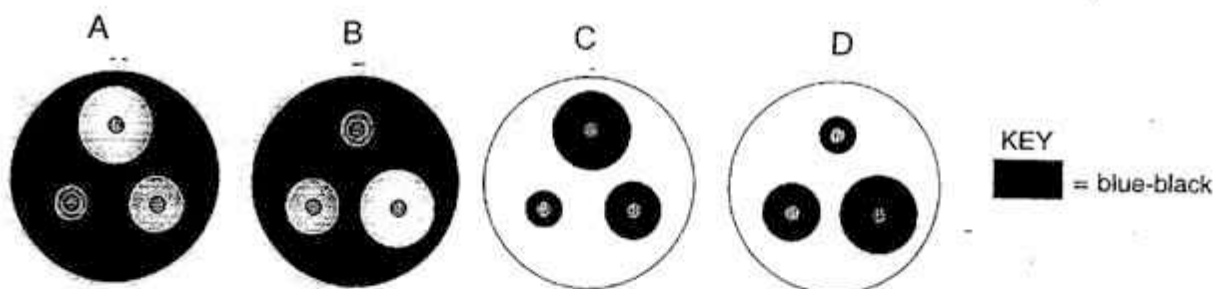
	Benedict's test	Biuret's test	iodine test
A	brick red	purple	black
B	brick red	blue	brown
C	blue	purple	brown
D	brick red	purple	brown

- 8 Diastase (plant amylase) is an enzyme which digests starch to maltose. The accompanying diagram shows a petri dish of starch agar set up to investigate the effect of pH on the activity of diastase.

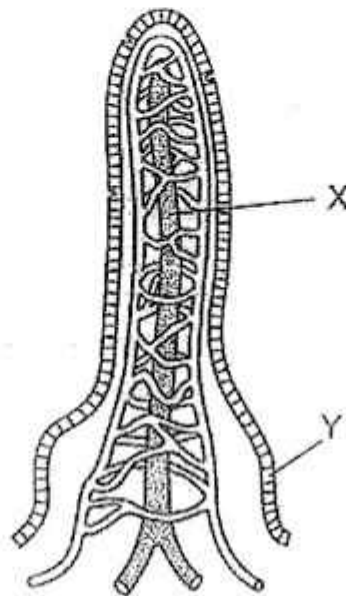


After 24 hours at room temperature, the plate was flooded with iodine solution.

Which of the following diagrams indicates that diastase is most active at pH 7?



- 9 The diagram shows a section through a villus.



What is a function of structure X and of structure Y?

	X	Y
A	to absorb amino acids	to digest starch
B	to carry blood	to secrete enzymes
C	to transport fats	to secrete mucus
D	to transport glucose	to help peristalsis

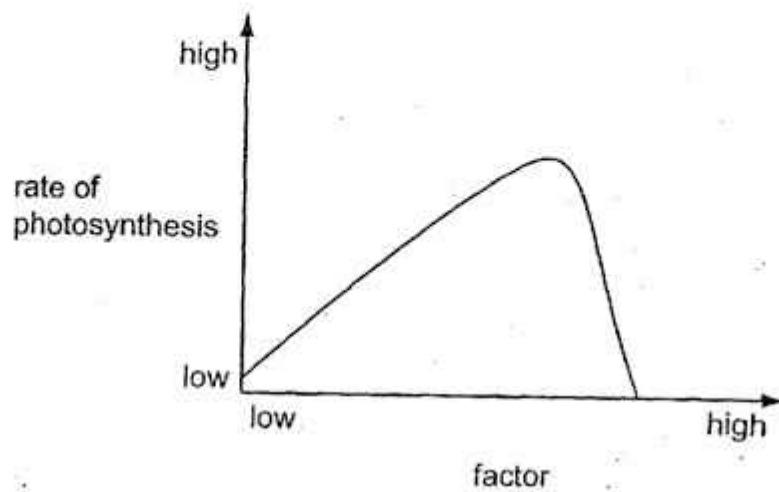
- 10 Which function of the liver is correctly paired with the chemical involved?

	function	chemical
A	deamination	glycogen
B	detoxification	alcohol
C	excretion	urea
D	storage	amino acids

- 11 Which of the following accurately shows where bile is produced and used in digestion?

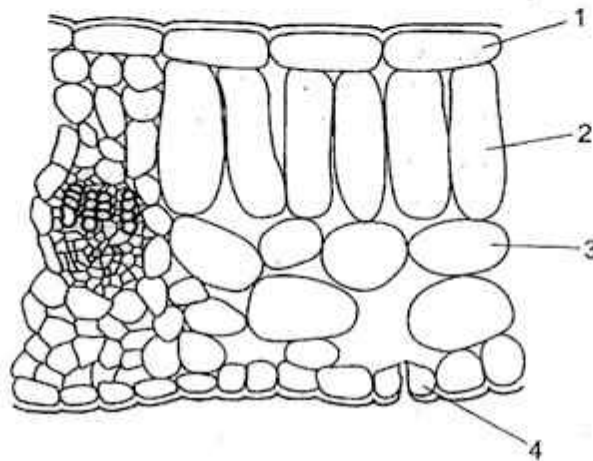
	where produced	where used
A	liver	gall bladder
B	liver	duodenum
C	duodenum	gall bladder
D	gall bladder	duodenum

- 12 The graph shows the rate of photosynthesis plotted against an unknown factor.



Which factor is limiting the rate of photosynthesis?

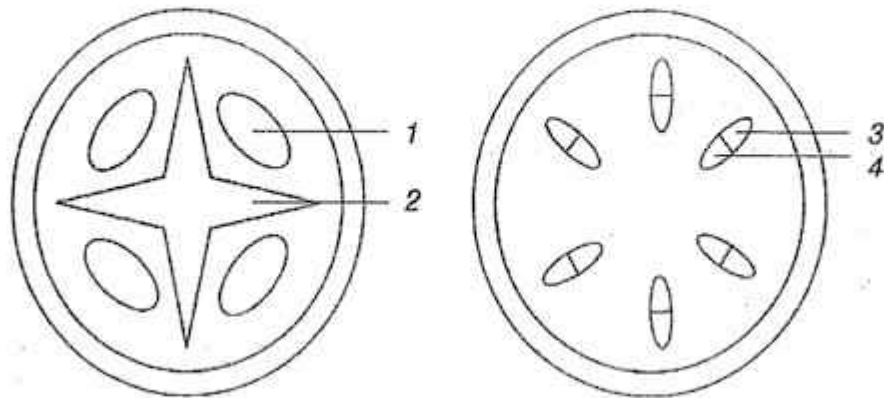
- A carbon dioxide concentration
 - B light intensity
 - C number of chloroplasts
 - D temperature
- 13 The diagram shows part of a transverse section of a leaf.



Where does photosynthesis take place?

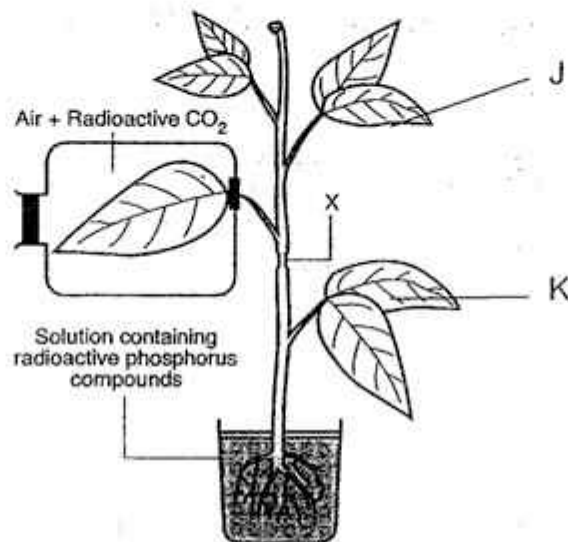
- A 1 and 2 only
- B 1, 2 and 3 only
- C 2 and 3 only
- D 2, 3 and 4 only

- 14 The diagrams show sections from the root and stem of a plant.



Which tissues carry amino acids in solution?

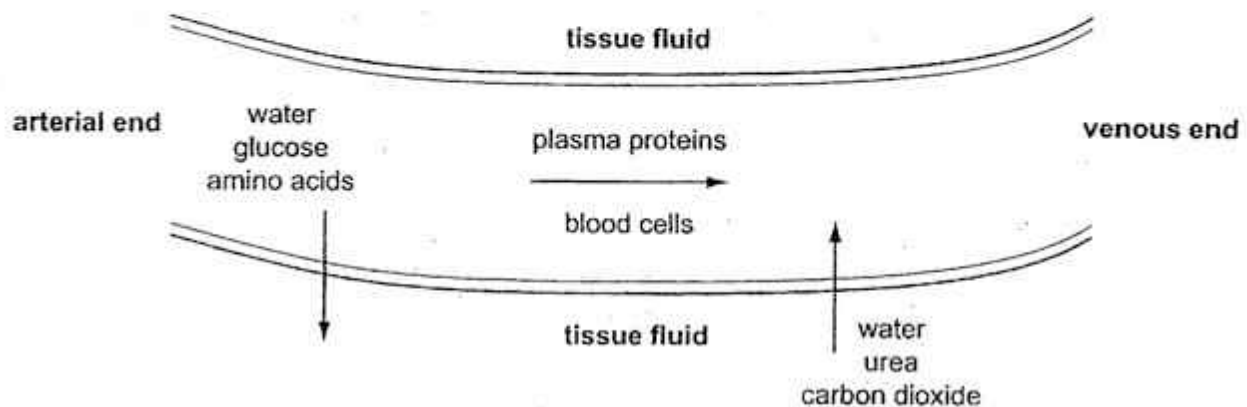
- A 1 and 3 B 2 and 3 C 1 and 4 D 2 and 4
- 15 An experiment was designed to study the movement of materials in a green plant. A ring of tissues was removed at X leaving only the woody inner part exposed. After several hours, the relative amounts of radioactive carbon and phosphorus compounds in different parts of the plant were determined.



It would be reasonable to expect that the data collected would show that

- A radioactive carbon compounds are present in the tissues of the root.
 B radioactive carbon compounds are found in both leaves J and K.
 C radioactive phosphorus compounds are found in leaf K but not in leaf J.
 D radioactive phosphorus compounds are found in both leaves J and K but radioactive carbon in leaf J only.

- 16 The arrows on the diagram show the direction of movement of some of the substances carried in plasma as they enter and leave a capillary.



Which two factors cause water to re-enter the capillary at the venous end?

	plasma water potential	blood pressure in the capillary
A	decreased	decreased
B	decreased	increased
C	increased	decreased
D	increased	increased

- 17 The table shows the blood groups of four people and the type of blood each received in a transfusion.

Which person is at risk from agglutination?

	blood group of person (under ABO system)	blood type received in transfusion
A	A	O
B	B	AB
C	AB	B
D	O	O

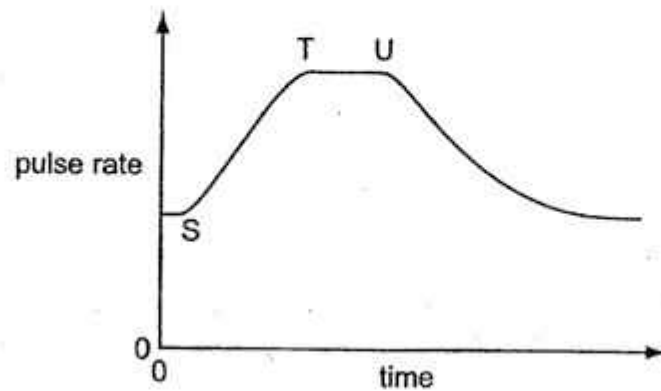
- 18 Which process in the cytoplasm of red blood cells is catalysed by an enzyme?

- A dissociation of carbonic acid, releasing hydrogencarbonate ions
- B dissociation of oxyhaemoglobin, releasing oxygen
- C reaction between water and carbon dioxide, forming carbonic acid.
- D diffusion of oxygen into the the red blood cell

- 19 What is an effect of inhaling tobacco smoke?

- A decreased mucus production
- B increased movement of cilia
- C less oxygen transport by blood
- D narrowing of the bronchioles

- 20 The pulse rate of a girl was measured every two minutes and plotted on the graph.



Her exercise started at S and finished at T but her pulse rate did not start to drop until U.

Which process(es) would occur during the T- U interval?

- 1 accumulation of lactic acid from muscle cells
- 2 increased supply of oxygen to the muscle cells
- 3 increased transport of carbon dioxide to the lungs

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

- 21 Which of the following factors are controlled by homeostasis?

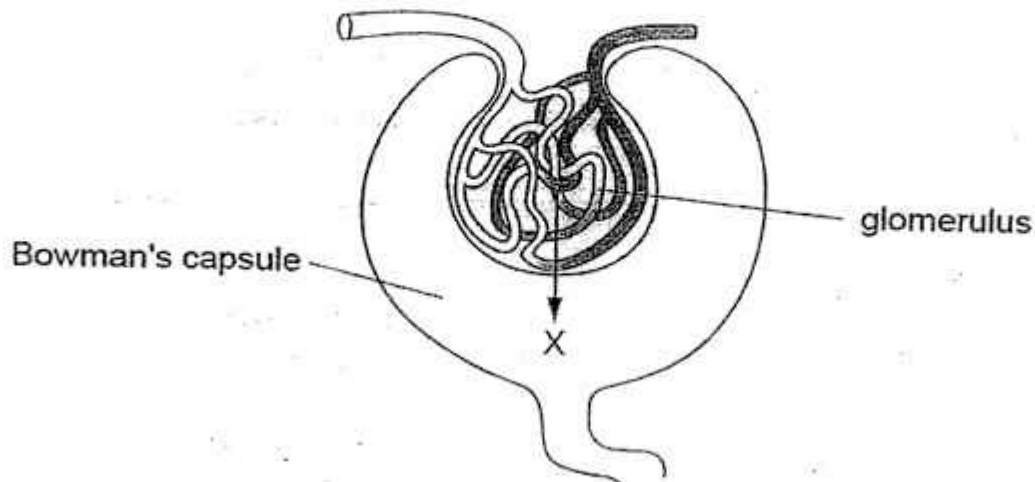
- 1 water content in the colon
- 2 temperature in the uterus
- 3 pH in the stomach
- 4 glucose concentration in blood

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

- 22 A woman runs a marathon, sweats profusely and drinks little fluid.
Which line in the table correctly summarises the events that result from this behaviour?

	ADH production	water reabsorption	urine output
A	increase	increase	decrease
B	increase	decrease	decrease
C	decrease	decrease	increase
D	decrease	increase	increase

- 23 The diagram shows part of a nephron and blood vessels,

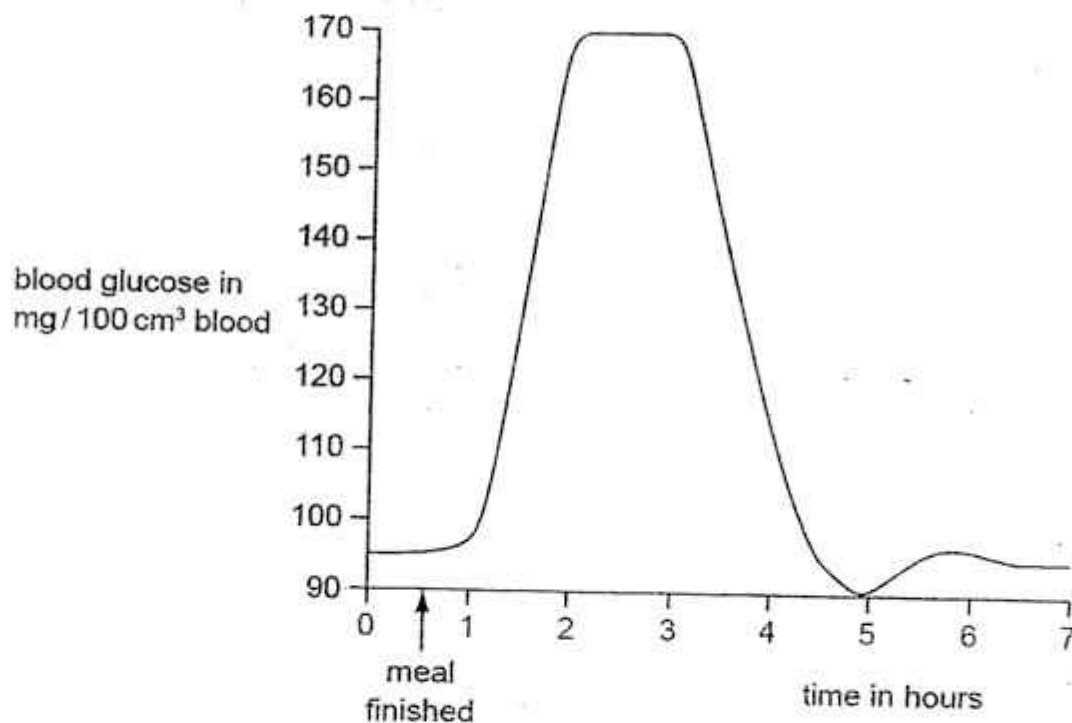


In addition to water, what is present in the fluid at X?

	glucose	mineral salts	protein	urea
A	✓	✓	✓	X
B	X	✓	X	✓
C	✓	X	✓	✓
D	✓	✓	X	✓

key: ✓ = present
X = absent

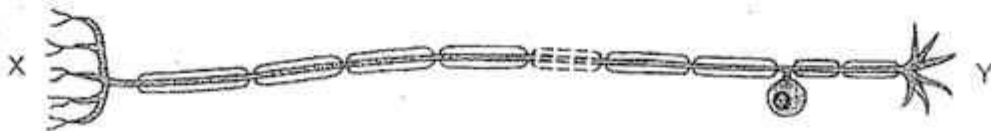
- 24 The graph shows the blood glucose concentration of a person after a meal rich in starch.



During which period after the meal would the secretion of glucagon begin to rise?

- A 0.5 – 1.5 hours
- B 1.5 – 2.5 hours
- C 4.5 – 5.5 hours
- D 5.5 – 6.5 hours

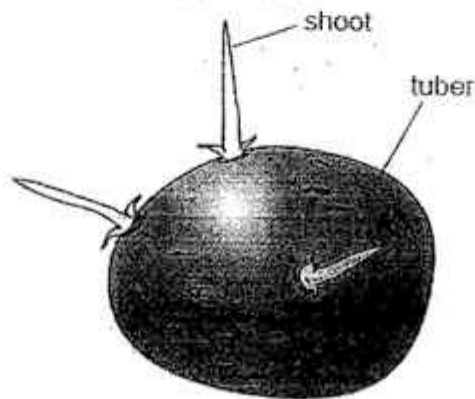
25 The diagram shows a neurone.



Which structures could be found at X and Y ?

	X	Y
A	brain	kidney
B	brain	leg
C	eye	hand
D	skin	spinal cord

26 The diagram shows a potato tuber developed from the stem of a parent potato plant. Three shoots are starting to grow from the tuber.



How do the genotypes of the shoots compare with the genotypes of the tuber and of the parent?

- A They are all different.
- B They are all identical.
- C The shoots are identical to each other, but are different from the tuber and the parent.
- D The shoots are identical to the tuber, but are different from the parent.

- 27 The following investigation was carried out using flower buds growing on three plants of the same species:

Plant 1 – The anthers were carefully removed and the buds left open to the air.

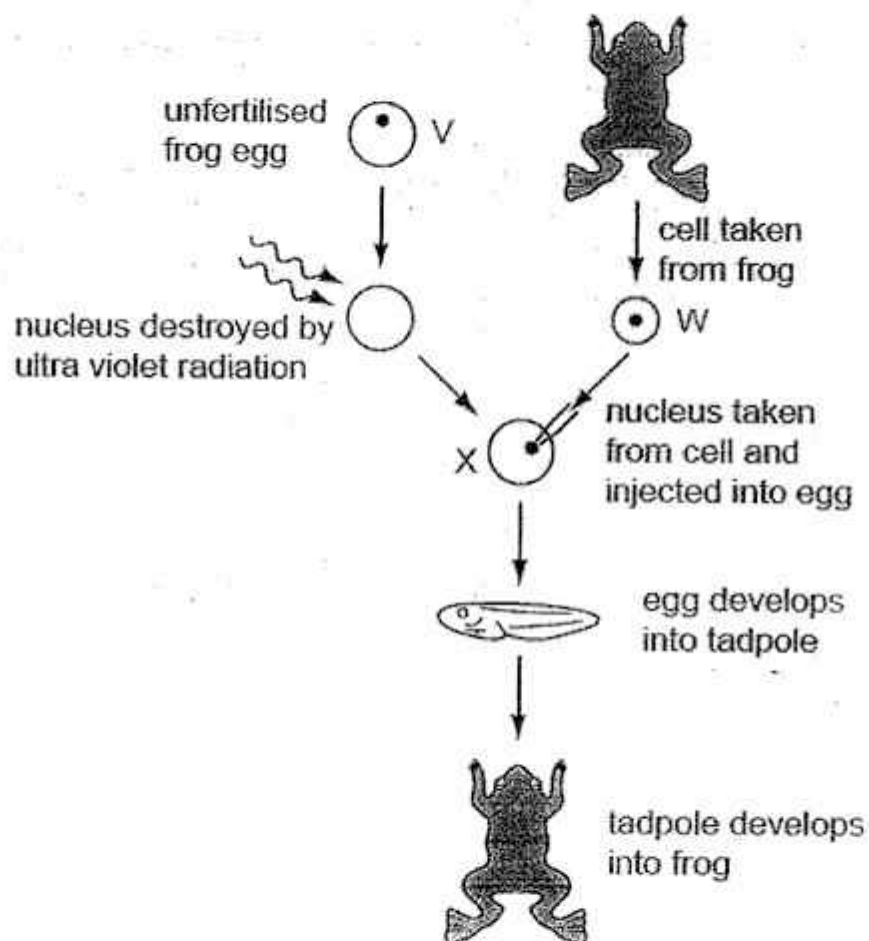
Plant 2 – The anthers were left untouched and a paper bag was tied tightly around each bud.

Plant 3 – The anthers were carefully removed and a paper bag was tied around each bud.

Although all flowers later opened normally, only those on plant 1 produced seeds.

This result shows that in the species

- A only cross-pollination can take place.
 - B only wind-pollination can take place.
 - C only insect-pollination can take place.
 - D both self-and cross-pollination can take place.
- 28 The diagram shows how genetically identical frogs can be developed from unfertilised frog eggs.
- The diploid number ($2n$) for frogs is 26.



Which combination of numbers correctly identifies the number of chromosomes in each of the types of cell in the diagram?

	V	W	X
A	13	13	26
B	13	26	13
C	13	26	26
D	26	26	13

29 Which of the following gives the correct order of events in the sexual reproduction of a flowering plant ?

- 1 fertilization
- 2 growth of pollen tube through the style
- 3 meiosis in the anther and ovule
- 4 mitosis in the growth of the embryo
- 5 pollination

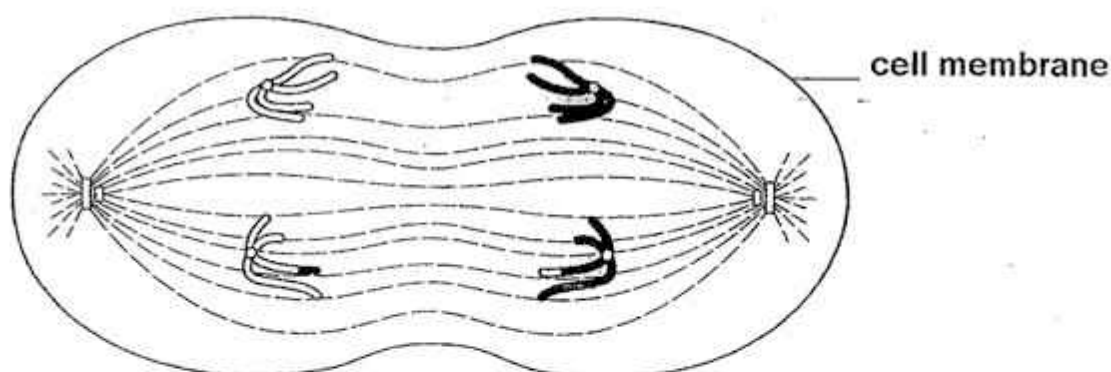
- A 1, 2, 4, 3, 5
 B 3, 4, 5, 2, 1
 C 3, 5, 2, 1, 4
 D 5, 2, 1, 4, 3

30 To which of the processes shown does mitosis make a contribution?

	genetic variation	increase in cell number	replacement of damaged cells
A	X	✓	✓
B	✓	X	X
C	✓	✓	X
D	X	X	✓

key: ✓ = contributes to process
 X = does not contribute to process

31 The diagram shows an animal cell undergoing nuclear and cell division.



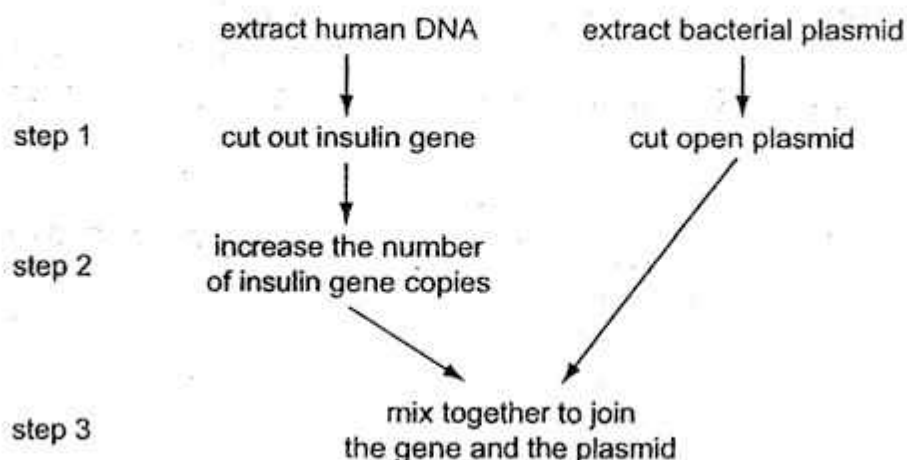
	type of cell division	number of chromosomes in the cell	phase of cell division
A	mitosis	8	metaphase
B	meiosis II	4	anaphase
C	meiosis I	8	prophase
D	meiosis I	4	anaphase

32 Which process occurs during prophase of the mitotic cell cycle in an animal cell?

- A division of centromeres
- B formation of chromosomes
- C replication of DNA
- D separation of centrioles

33 The diagram outlines part of the process to produce recombinant DNA that will synthesise human insulin.

At steps 1, 2 and 3, enzymes have to be used.



Which row correctly identifies the enzyme in each step?

	step 1	step 2	step 3
A	polymerase	ligase	restriction
B	polymerase	restriction	ligase
C	restriction	ligase	polymerase
D	restriction	polymerase	ligase

34 Organs may have diploid or haploid cells or both. Which row is correct?

	organ	diploid cells present	haploid cells present
A	penis	yes	yes
B	ovary	yes	no
C	testis	yes	yes
D	uterus	no	yes

35 Which molecule has its synthesis directly controlled by DNA?

- A amylase
- B cholesterol
- C glycogen
- D phospholipid

36 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 were sown in similar conditions except that they received light.

The table gives the results obtained.

numbers of seedlings			
kept in the dark		kept in the light	
green leaves	cream leaves	green leaves	cream leaves
?	405	320	110

What was the number of green-leaved plants formed from seeds germinating in the dark?

- A 0 B 110 C 320 D 405

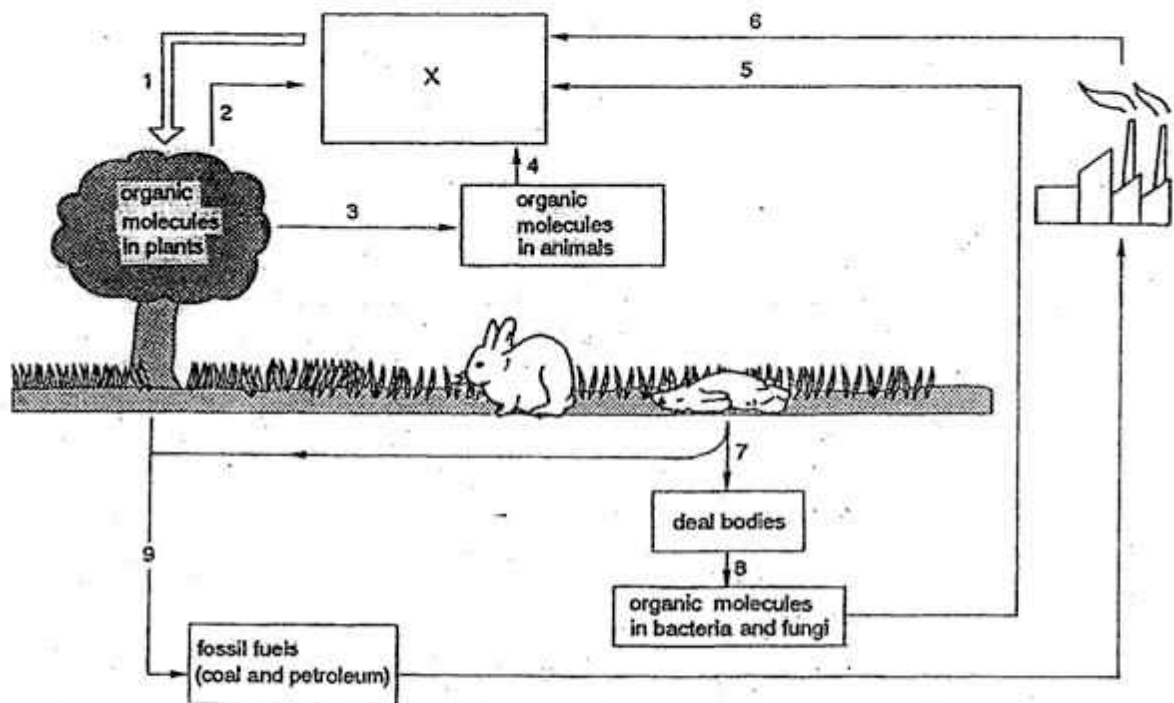
37 The statements refer to natural selection.

- 1 Competition between organisms alters their genes.
- 2 More organisms are produced than reach maturity
- 3 Organisms inherit characteristics from their parents.
- 4 Organisms vary in their adaptations.
- 5 Only one species can occupy an ecological niche.
- 6 Well-adapted organisms survive and reproduce.

Which **four** statements summarise the theory of evolution by natural selection?

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

38 The following diagram shows the carbon cycle.



Which combination shows the processes that release energy?

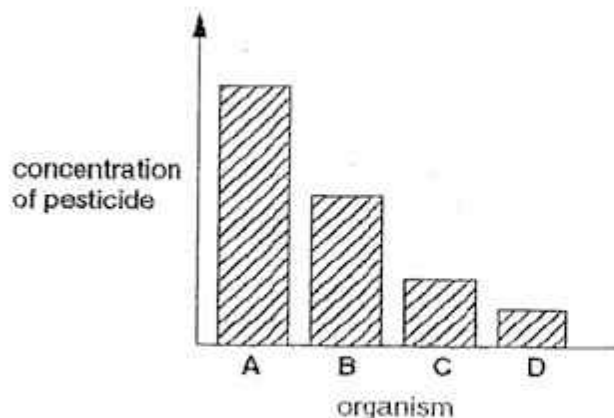
- A 1, 2, 4 and 9
- B 1, 3, 4 and 6
- C 2, 4, 5 and 6
- D 2, 4, 6 and 7

39 The diagram shows part of a food chain in a lake.



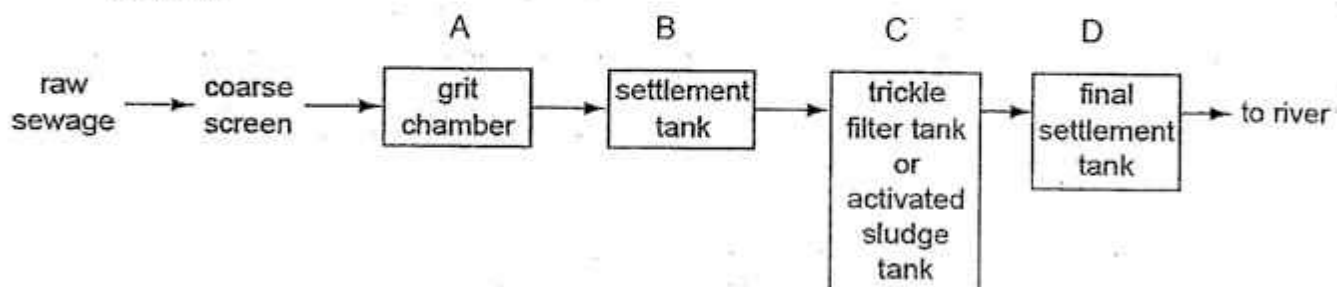
The chart shows the concentration of a pesticide in the bodies of each organism in the food chain.

Which organism on the chart is the small crustacean?



40 The diagram shows the main stages in the treatment of sewage.

At which stage shown is most of the organic material broken down by aerobic bacteria?



END OF PAPER

Name: Register/Index Number: Class:

PRESBYTERIANHIGH SCHOOL



BIOLOGY

5094/2

Paper 2

11 September 2012

Tuesday

1 hour 45 minutes

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2012 SECONDARY FOUR EXPRESS PRELIMINARY EXAMINATION

INSTRUCTIONS TO CANDIDATES

Write your class, register number and name on all the work you hand in.
Write in dark blue or black pen.
Do not use correction fluid.

Section A

Answer **all** questions.

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

Section B

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

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.

Setter: Mr Chandrasegaran P

For Examiner's Use	
Section A	
Section B	
Total	

This question paper consists of **18** printed pages (including this cover page) and **0** blank page.

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

- 1 Fig. 1.1 shows the process of protein synthesis in a cell.

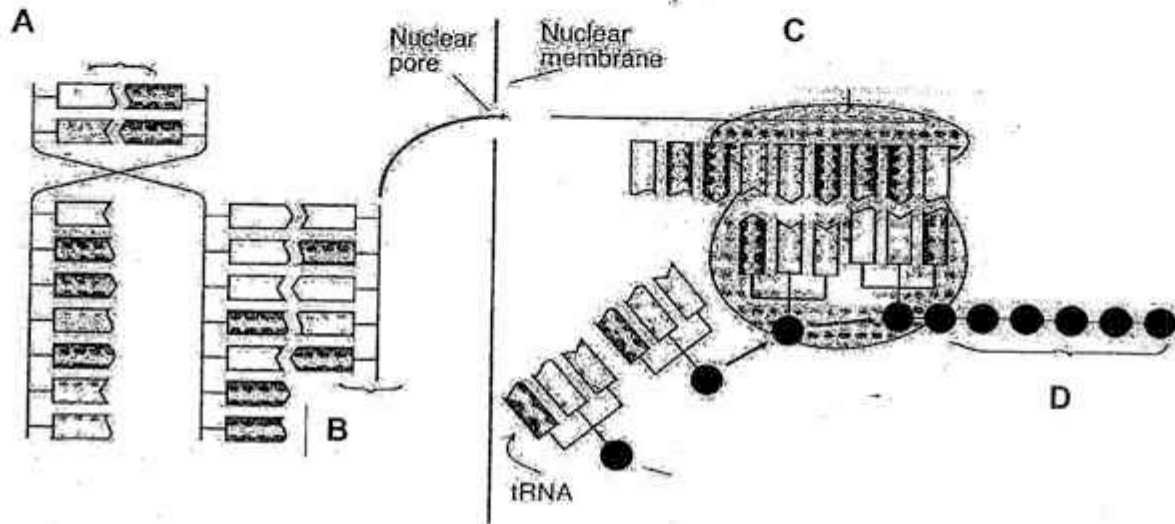


Fig. 1.1

- (a) Name molecules B, C and D.

B

C

D

[3]

- (b) State the significance of the order of bases in molecule A.

.....

.....

.....

.....[2]

- (c) Describe the roles of the endoplasmic reticulum and the Golgi apparatus between the synthesis of the protein and its release from the cell.

.....

.....

.....

.....

.....

.....[3]

[Total: 8]

-
- A line drawing of an alligator in profile, facing left. Four labels with leader lines point to internal structures: 'Lungs' points to the large, sac-like lungs in the anterior body; 'Liver' points to a large, rounded organ just behind the lungs; 'Muscles' points to the elongated muscle mass in the mid-body; and 'Hip bone' points to the pelvic girdle at the posterior end.

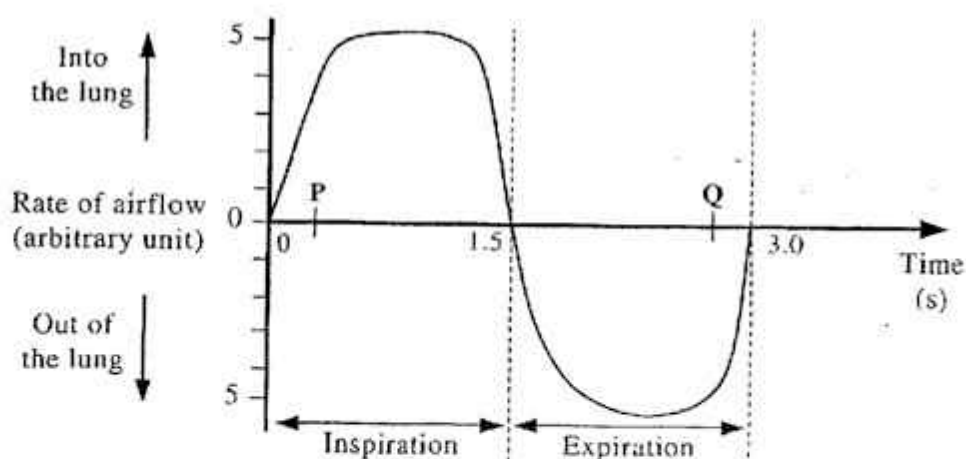


Fig. 2.2

On Fig. 2.3a and Fig. 2.3b, sketch a graph to show how the pressure changes when breathing in (inspiration) and breathing out (expiration).

(0 is atmospheric pressure)

[2]

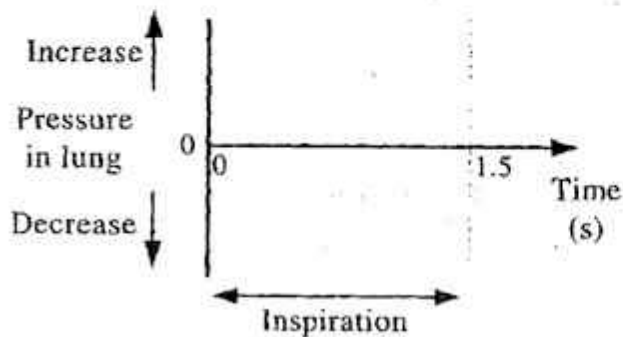


Fig. 2.3a

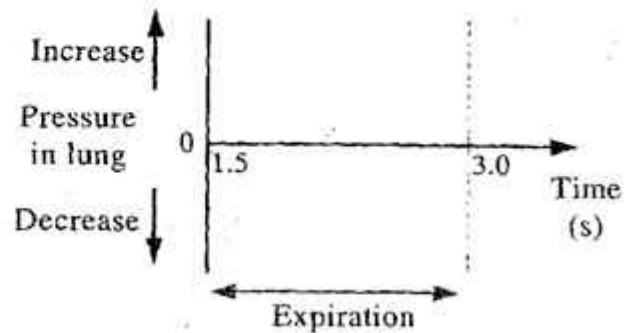


Fig. 2.3b

- (c) Describe the differences in the composition of **two** gases in inhaled and exhaled air. Explain how these differences are caused.

.....

.....

.....

.....

.....

[2]

[Total: 8]

- 3 Macular degeneration is a disease resulting in the loss of light-sensitive cells in the yellow spot of patients.

- (a) State the function of the light-sensitive cells.

.....

.....

[1]

- (b) Briefly describe how an image is focused onto the retina in a normal human eye.

.....

.....

.....

.....

.....

.....

.....

[3]

- (c) Suggest how the vision of a patient with macular degeneration differs from normal vision.

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

- (d) The vision of patients with macular degeneration may be helped by bionic eyes. Fig. 3.1 shows a bionic eye which consists of a camera mounted on a pair of glasses worn by a patient. Signals from the camera are sent wirelessly to a device implanted behind the retina of the eye of the patient as shown in Fig. 3.2.

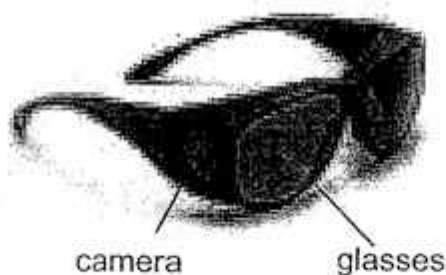
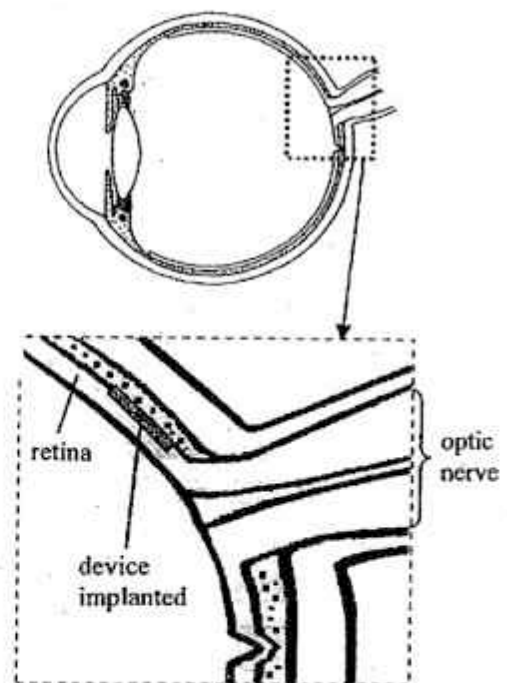


Fig. 3.1



The device generates electrical signals.

Fig. 3.2

- (i) Why can the bionic eyes help the patients to see even when the lenses in their eyes become cloudy?

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

- (ii) Can the bionic eyes be used to help patients without any light-sensitive cells in their retina? Give **one** reason for your answer.

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

[Total: 8]

- 4 Fig. 4.1 shows the temperature of the skin at different points along the arm.

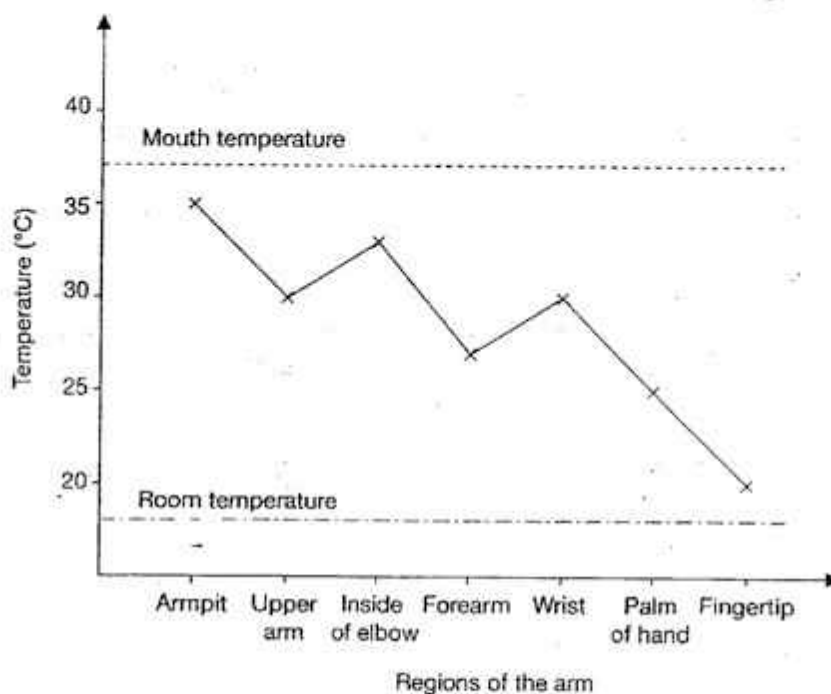


Fig. 4.1

- (a) i What is the temperature difference between the skin of the wrist and that of the forearm? [1]
- ii How would you account for the temperature difference between the wrist and the forearm? [1]

The hand was then immersed in a water bath set at 40 °C for ten minutes. This caused the temperature of the fingertips to rise.

- (b) (i) Deduce how the mouth temperature varied when the hand was immersed in the water bath. What is the significance of this? [2]
- (ii) Suggest one reason why the temperature of the fingertips did not reach 40 °C. [1]

- [4]

[Total: 9]

-
- The graph shows the pressure changes in three parts of the heart and the aorta over 0.80 seconds. The y-axis represents blood pressure in kPa, ranging from -2 to 16. The x-axis represents time in seconds, ranging from 0 to 0.80. The legend identifies three curves: aorta (dashed line), left ventricle (solid line), and left atrium (dash-dot line). The left atrium pressure starts at approximately 11.5 kPa and gradually decreases to about 11.2 kPa. The aorta pressure starts at 0 kPa, rises to a peak of about 15.5 kPa at 0.45 s, and then gradually declines. The left ventricle pressure starts at 0 kPa, rises sharply to a peak of about 15.2 kPa at 0.4 s, and then falls sharply back to 0 kPa by 0.6 s. Points A, B, C, D, E, F, G, and H are marked on the curves to indicate specific pressure levels and events.
- | Time (s) | Aorta (kPa) | Left Ventricle (kPa) | Left Atrium (kPa) |
|----------|-------------|----------------------|-------------------|
| 0.00 | 0.0 | 0.0 | 11.5 |
| 0.10 | 0.5 | 0.5 | 11.3 |
| 0.20 | 1.0 | 1.0 | 11.1 |
| 0.30 | 13.0 | 13.0 | 10.9 |
| 0.40 | 15.0 | 15.2 | 10.7 |
| 0.45 | 15.5 | 15.0 | 10.6 |
| 0.50 | 14.5 | 14.0 | 10.5 |
| 0.60 | 13.5 | 0.0 | 10.3 |
| 0.70 | 12.5 | 0.0 | 10.1 |
| 0.80 | 11.5 | 0.0 | 10.0 |

Fig. 5.1

Complete the table below using the appropriate letter, A to H, to match the points from the graph to the correct statement.

You must only put one letter in each box. You may use each letter once, more than once or not at all.

statement	letter
left atrioventricular (bicuspid) valve start to open	
left atrioventricular (bicuspid) valve starting to close	
left ventricle starting to contract	
minimum blood remaining in left ventricle	

[2]

- (b) Fig. 5.2 shows the blood pressure changes as blood travels through one circuit of the circulatory system.

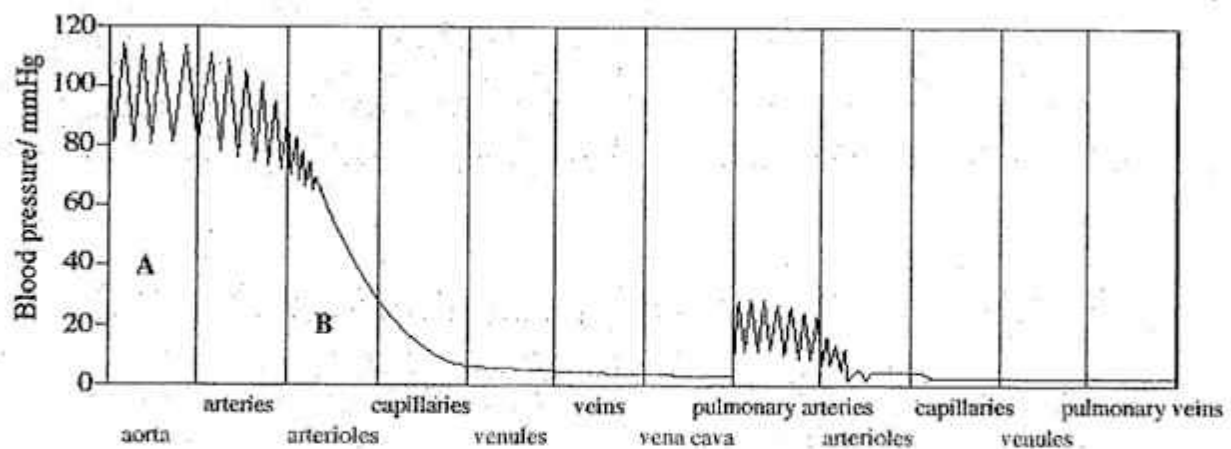


Fig. 5.2

- (i) Explain what causes the alternating high and low blood pressure in region A.

.....

 [2]

- (ii) Why does the blood pressure decrease so rapidly in region B?

.....

 [2]

- (iii) There is difference between the arterial pressures and the capillary pressures. Explain, in relation to the functions of these vessels, why this is more efficient.

.....

[2]

[Total: 8]

- 6 (a) Fig. 6.1 shows the changes in the uterus during the menstrual cycle.

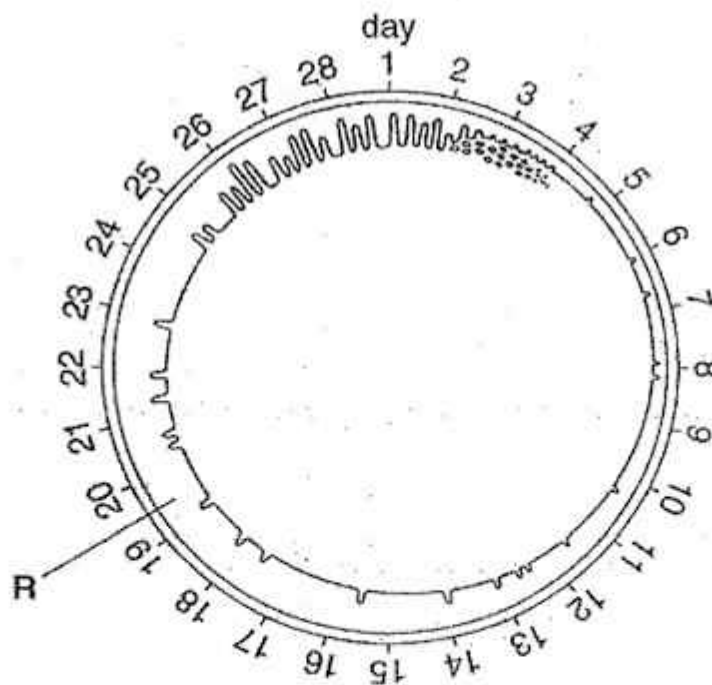


Fig. 6.1

- (i) Identify **R**. [1]
 (ii) On Fig. 6.1, use an arrow and the letters **J** to show one occasion when sudden large hormone changes may occur. [1]
 (iii) If fertilization is successful, draw on Fig. 6.1 to show what happens to **R** after day 24 to day 5 in the second month. [1]
 (iv) Explain why it is important for **R** to change in the way you have drawn.

.....
 [1]

- (b) The placenta has many roles during pregnancy.

Suggest why leakage of blood in either direction across the placenta might harm the foetus.

[3]

- (c) Table 6.1 shows that temperature determines whether the eggs of a particular species of reptile hatch into a male or a female.

Table 6.1

	temperature / °C									
	29	30	31	32	33	34	35	36	37	38
% of females hatching	100	100	99	50	1	0	50	99	100	100
% males hatching	0	0	1	50	99	100	50	1	0	0

State **two** ways in which the production of a male human child differs from the production of the male form of this reptile.

1

2

[2]

[Total: 9]

Section B

Answer **three** questions.

Question 9 is in the form of an **Either/Or** question.

Only **one** part should be answered.

7. Fig. 7.1 shows a small, deep-rooted bush growing in a warm, dry climate. Branches B and C have a similar number of leaves, but the leaves of branch B are enclosed in a transparent polythene bag that empties into a container.

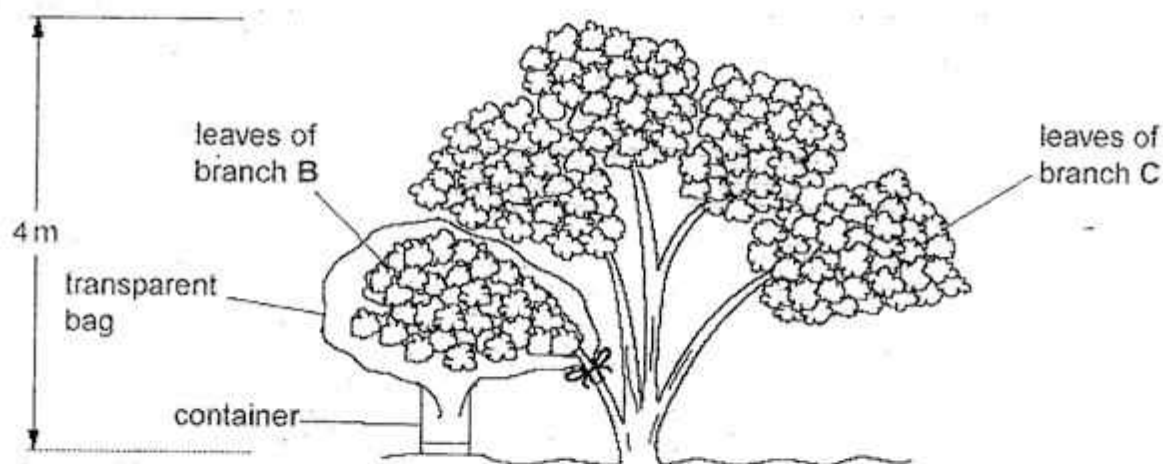


Fig. 7.1

Fig. 7.2 is a graph showing the total volume of water lost by the leaves of branch B from 0600 h to 1800 h.

Table 7.1 shows the total volume of water lost by the leaves of branch C during the same day.

Table 7.1

time of day / h	0600	0800	1000	1200	1400	1600	1800
total volume of water lost / cm ³	2.2	2.6	4.2	7.0	9.6	11.9	12.2

- (a) (i) Plot the graph for branch C on Fig. 7.2.

[2]

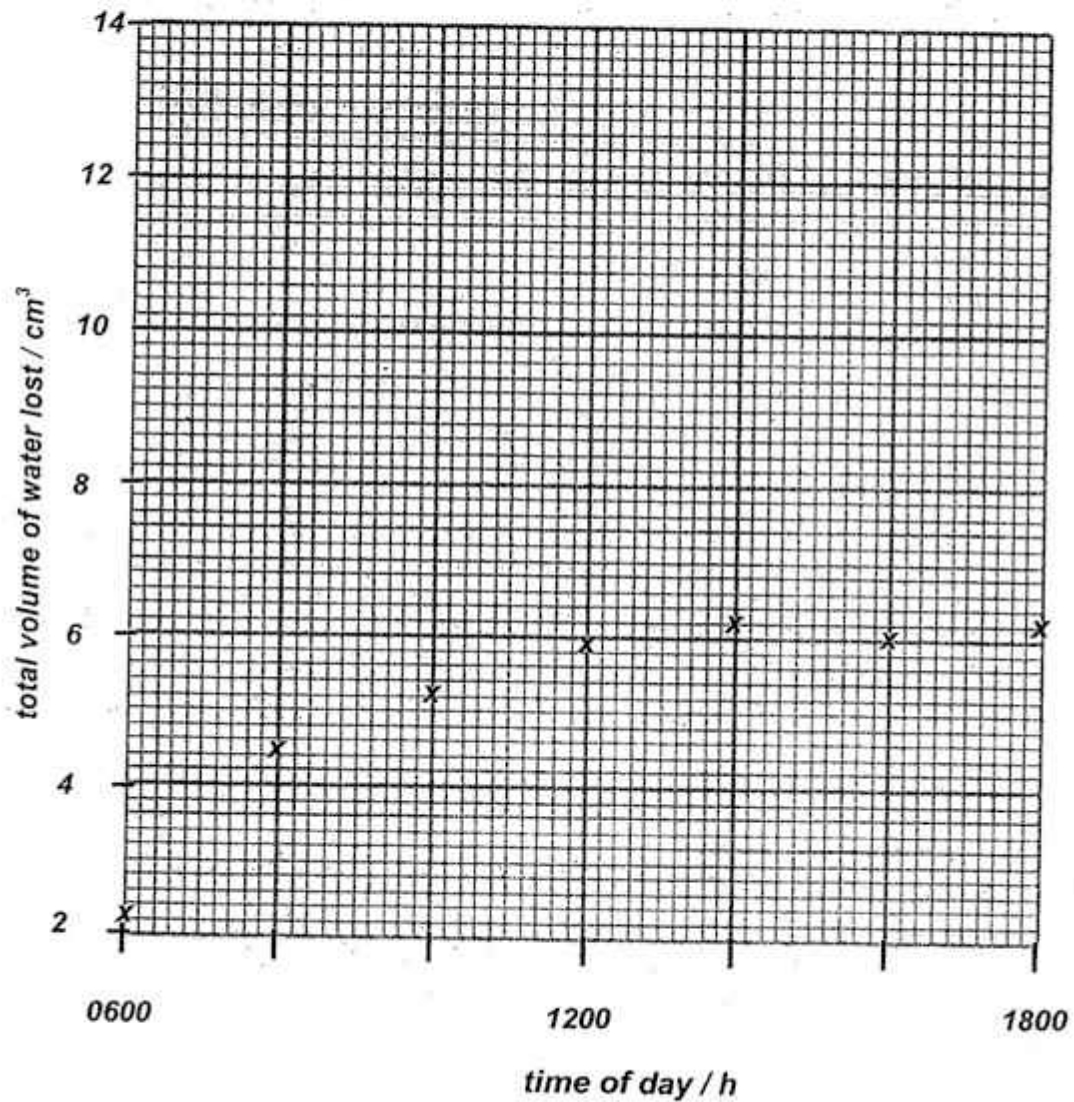


Fig. 7.2

- (ii) State **two** environmental factors responsible for the water loss during the day by branch C.

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

- [4]

[4]

- [3]

[3]

TURN OVER TO THE NEXT PAGE

- 8

Children with TSC can, with treatment, lead reasonably normal lives.

- (a) Describe the part played by each of the following in the inheritance of TSC:

gene, allele, chromosome and meiosis.

[5]

TURN OVER TO THE NEXT PAGE

- (b) A couple wish to start a family. The man does not have TSC but the woman does have TSC. The woman's father does not have the condition.

Complete a genetic diagram to show the probability of the couple's first child having TSC

[4]

[Total: 9]

9 Either

Describe the similarities and differences between the following processes:

- (a) self-pollination and cross-pollination,

[3]

[3]

[3]

[Total: 9]

9

Or

(a) Describe the entry and flow of energy in an ecosystem.

[4]

(b) Explain how (i) control of pollution and (ii) management of fishing grounds are important in the conservation of species.

[5]

[Total: 9]

END OF PAPER



PRESBYTERIAN HIGH SCHOOL SCIENCE DEPARTMENT MARKING SCHEME

Subject: Biology
Setter : Mr Chandra
Level : Sec 4EXP

Exam: Plm
Year : 2012

Q/N	Scoring Points								Sub Total	Total
	PAPER 1									
	1	C	11	B	21	D	31	D		
	2	A	12	D	22	A	32	C		
	3	C	13	D	23	D	33	D		
	4	C	14	A	24	C	34	C		
	5	B	15	D	25	D	35	A		
	6	D	16	C	26	B	36	A		
	7	D	17	B	27	A	37	C		
	8	A	18	C	28	C	38	C		
	9	C	19	C	29	D	39	C		
	10	B	20	A	30	A	40	C		
	Section A (25 MARKS)									
1a	B:mRNA C: ribosome D: polypeptide								1 1 1	3
b	Order determines the polypeptide produced; Polypeptide determines characteristic of the organism.								1 1	2
c	ER transports/transfers/passes sends/ proteins + to Golgi body; Proteins are modified/add carbohydrate; Golgi packages these substances into vesicles to fuse with cell membrane;								1 1 1	3
									8	
2a	Muscles contraction in both brings stretches lungs/decrease pressure in lungs; In man, muscles of diaphragm contract to flatten; Intercostal muscles contract + ribcage moves upwards & outwards; Volume of thoracic cavity/ increases, pressure in lungs decrease so air rushes in,								1 1 1 1	4
b										2
c	Inhaled air: higher percentage of oxygen than inhaled air; Oxygen is used in respiration to release energy for muscle contraction;								½ ½	1
	Inhaled air: lower % of CO ₂ than exhaled air. CO ₂ is waste product of respiration;								½ ½	1
									8	
3a	To detect changes in light intensity; Produce impulse;								½ ½	1

b	Light passing through cornea is refracted into pupil; Light rays pass through the lens; Lens focus light rays onto fovea of retina;	1 1 1	3
c	Centre of vision is blurred	1	1
d	i. Light rays need not pass through the lens but camera. ii. Yes. The device produces impulse; Carried by optic nerve to brain;	1 1 $\frac{1}{2}$ $\frac{1}{2}$	3
			8
4ai	3 °C	1	1
ii	More blood vessels located beneath the skin;	1	1
bi	The mouth temperature remained relatively constant/ more or less the same as internal body temperature; Shows that rate of metabolism remained constant/not changed by external temperature;	1 1	2
ii	Heat transported away by blood to other parts;	1	
iii	Arterioles in skin dilate; More blood flows in the capillaries near skin surface; More heat is lost by convection, radiation; Sweat glands more active; More sweat produced; Water in sweat evaporates removing latent heat; Ensures body temperature remains more or less constant;	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ 1 $\frac{1}{2}$	4
			8
5a	C G G B/C	$\frac{1}{2}$ EA	2
bi	Contraction of left ventricles causes increased blood pressure; Drops when ventricles relax; Elastic recoil of arteries;	1 1 1	2
ii	Arteries divide to form arterioles/blood distributed in large number of blood vessels; Larger surface area	1 1	2
iii	Arteries function to transport blood; so efficient at high speed and pressure; Capillaries function in exchange of materials between blood and cells; So require slow speed for longer contact with surrounding	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	2
			8
6ai	Uterine lining/endometrium;	1	1
ii	J : 9 or 10; K: 12 or 13; at least 3 days interval between J and K	1 1	2
iii	No change /slight change in thickness; No wavy lines to show rupturing;	$\frac{1}{2}$ $\frac{1}{2}$	1
iv	Embryo can implant	1	1

b	blood pressure of mother is higher than fetus; damage blood capillaries and may kill foetus;	1																			
	incompatible blood groups; maternal antibodies may cause fetus blood to agglutinate, block blood vessels leading to death; some drugs and pathogens may reach foetus; results in mental and physical abnormality;	1																			
c	sex determination in human not dependent on temperature; male sex due tp presence of Y/sex chromosomes; sex of child determined at fertilization/when zygote/embryo formed	1 1 1	2																		
			9																		
7ai	All points correct; Smooth curve;	1 1	2																		
ii	Humidity; Heat; wind speed; light intensity; available of soil water;	Any 2	2																		
iii	The volume of water lost from branch B is greater than C up to 1100h; Then remains less; The trapped air warms up quickly; As humidity increases, rate of water loss decreases;	1 1 1 1	4																		
b	Higher than C up to 0900h , then level off	1	1																		
b.	Water n mineral salts comes from the soil (not plant) ; carried in xylem / xylem just hollow tubes ; <u>metabolites carried in phloem /poison remains in cells ;</u> it is only water that evaporates during transpiration ; [1 1 (1) 1	3																		
			12																		
8	<table><tr><td><i>parental phenotypes</i></td><td>man without TSC</td><td>woman with TSC</td></tr><tr><td><i>parental genotypes</i></td><td>tt</td><td>Tt</td></tr><tr><td><i>gametes</i></td><td>all t</td><td>T or t</td></tr><tr><td><i>offspring genotypes</i></td><td>Tt</td><td>tt</td></tr><tr><td><i>offspring phenotypes</i></td><td>TSC</td><td>normal</td></tr><tr><td><i>probability of child having TSC</i></td><td>50% / 0.50 / 1in 2 ;</td><td></td></tr></table>	<i>parental phenotypes</i>	man without TSC	woman with TSC	<i>parental genotypes</i>	tt	Tt	<i>gametes</i>	all t	T or t	<i>offspring genotypes</i>	Tt	tt	<i>offspring phenotypes</i>	TSC	normal	<i>probability of child having TSC</i>	50% / 0.50 / 1in 2 ;		1 1 1 1	4
<i>parental phenotypes</i>	man without TSC	woman with TSC																			
<i>parental genotypes</i>	tt	Tt																			
<i>gametes</i>	all t	T or t																			
<i>offspring genotypes</i>	Tt	tt																			
<i>offspring phenotypes</i>	TSC	normal																			
<i>probability of child having TSC</i>	50% / 0.50 / 1in 2 ;																				
8a		5	5																		
			9																		
9E																					
a	Both involve transfer of pollen from anther to stigma; Self-pollination involves transfer of pollen to stigma within same flower or another flower on the same plant; Cross-pollination involves transfer of pollen to stigma of flowers on another plant.	(1) 1 1	3																		

b	Both select the desired trait or characteristic; Plants and animals used in breeding must belong to same species; Genes from any organism can be inserted into non-related species; Slow process, required several generation; Individual cells grow rapidly in controlled environment;	(1) $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	3
c	Both involve motor neurone/nerve impulse; Response under control of the will vs Not under conscious control; Learned behavior vs automatic; Initiated from forebrain vs response to stimuli	(1) 1 1 1	3
			9
9 Or			
a.	Ref to photosynthesis, conversion of light energy to chemical energy; Energy stored as carbohydrate in tissues of producers; Primary consumers feed on producers to obtain energy; Some energy is lost as heat, undigested material and also in uneaten parts; Less energy is used for growth/increase in biomass; The next trophic level also has only 10% energy for growth; Energy in faeces and dead animals, parts of producers are unlocked by decomposers; Energy is released to environment as heat during respiration; Energy decreases and never recycled.	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	4
bi	Pollution, eg water pollution or stated example Release of untreated sewage/raw sewage into river/ponds results in eutrophication; Prolific growth of algae, aquatic plants on surface kills plant at bottom; Growth of only a few variety of floating plants; Decreased oxygen level kills aquatic organisms, loss of biodiversity; Chemical pollution Bioaccumulation affects higher order animals like, fish, birds, etc Population of animals in the higher trophic decreases or slower to replace;	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	2
ii	Fishing Controlling fishing eg. Net size/frequency of fishing/fishing zones/tonnage of fish caught, etc (any two); Allows time for marine organisms to reproduce and replace; Prohibition of dredging Allows species in the sea bed to thrive Food chain not affected, ecological balance;	$\frac{1}{2}$ 1 $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	3
			9



SINGAPORE CHINESE GIRLS' SCHOOL
PRELIMINARY EXAMINATION 2012

BIOLOGY

5094/01

Paper 1 Multiple Choice

Tuesday

7 August 2012

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Shade your answers in soft pencil.

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

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

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.

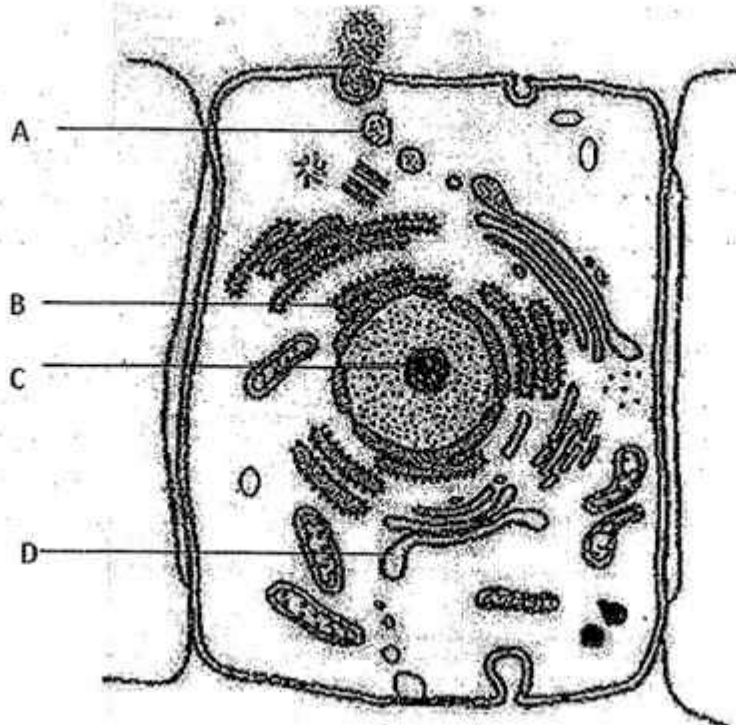
Any rough working should be done in this question paper.

This question paper consists of 20 printed pages, inclusive of this cover page.

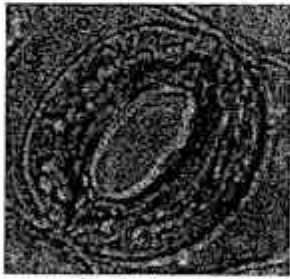
- 1 Which of the following combinations between sub-cellular structures and their function is incorrect?

	Structure	Function
A	Nucleus	Carry genetic material
B	Mitochondrion	Oxidation of glucose
C	Smooth endoplasmic reticulum	Lipid digestion
D	Golgi apparatus	Prepare proteins for secretion

- 2 Radioactively-labeled amino acids are injected into the cytoplasm of a cell using a very fine micropipette. In which cell structure will the radioactivity first appear?



- 3 The following represent different structures from a plant.



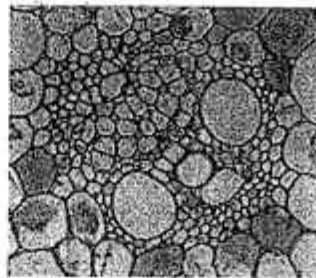
A



B



C



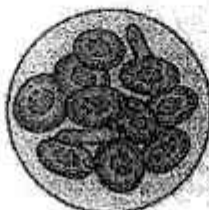
D

Which picture reflects the concept of a tissue?

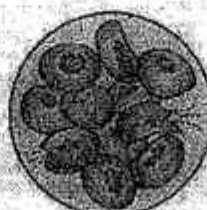
- 4 The diagrams below show red blood cells in sodium chloride solutions X, Y and Z.



solution X



solution Y

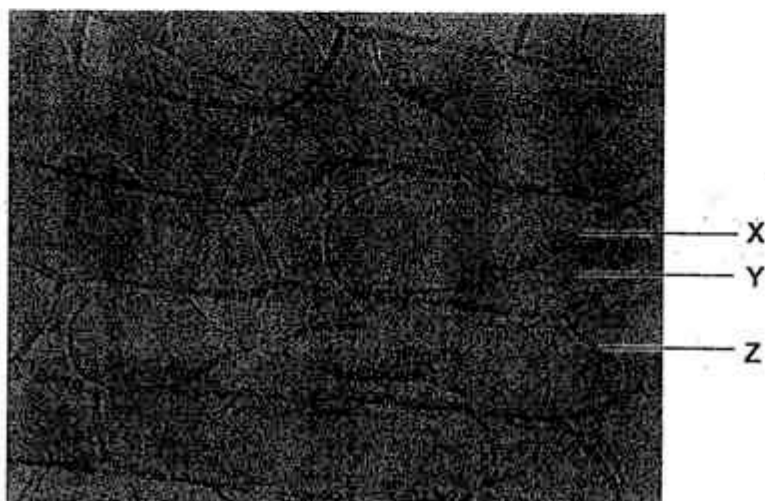


solution Z

If a patient has lost a large amount of water due to diarrhoea, which solution(s) could be injected into the patient's body as an emergency treatment?

- A X only
- B Y only
- C Z only
- D Y and Z only

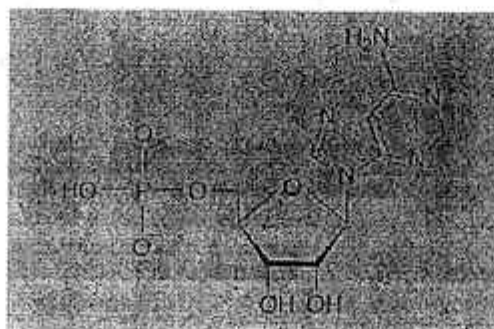
- 5 The light micrograph below shows the appearance of some onion cells after they had been placed in a concentrated salt solution for some time.



Identify X, Y, Z and describe the condition of the cells above.

	X	Y	Z	Condition of cells
A	Cell membrane	Salt solution	Cell wall	Plasmolysed
B	Tonoplast	Cytoplasm	Cell wall	Crenated
C	Tonoplast	Salt solution	Cell membrane	Plasmolysed
D	Nuclear envelope	Cytoplasm	Cell membrane	Crenated

- 6 The diagram below shows the structure of a certain molecule found in the body.

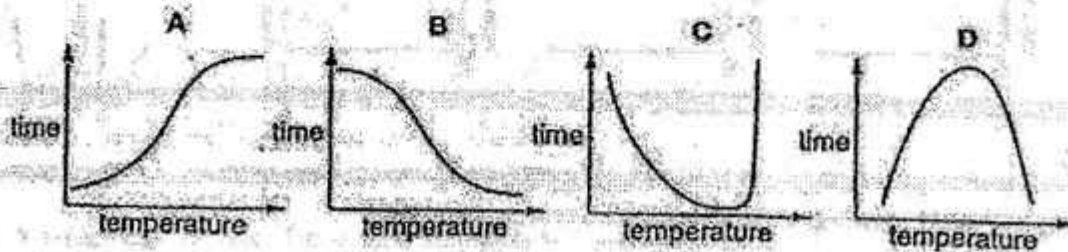


The molecule belongs to the group of biomolecules known as

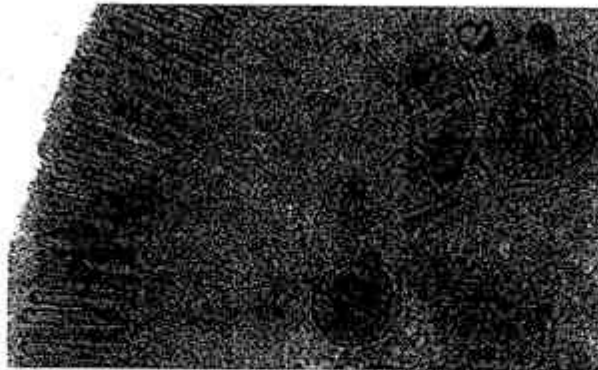
- A lipids.
- B proteins.
- C carbohydrates.
- D nucleotides.

- 7 In an investigation to determine the effect of temperature on the activity of an enzyme, the time for all the substrate to disappear from a standard solution was recorded.

Which graph shows the results of this investigation?



- 8 The micrograph below shows part of a specialised cell.

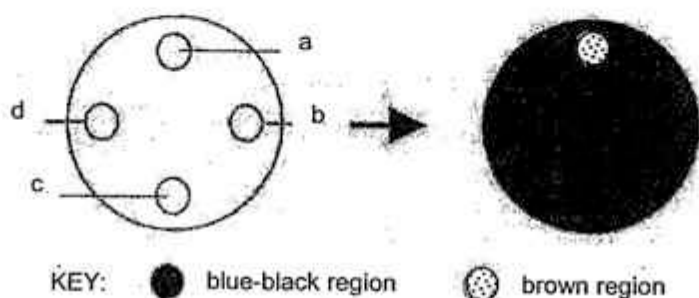


In which part(s) of the body would this type of cell be found?

- I. Trachea
- II. Small intestine
- III. Fallopian tube

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

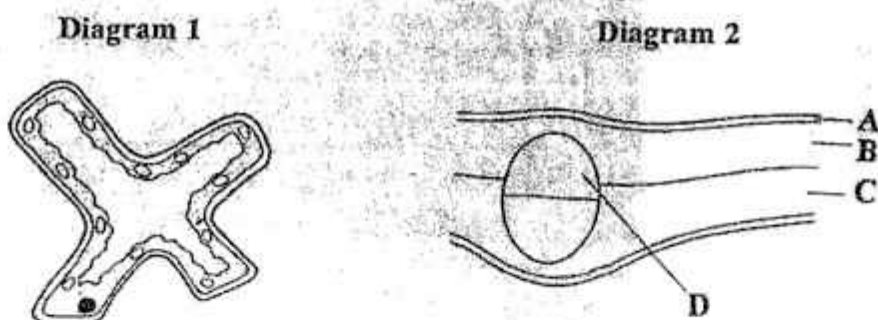
- 9 The diagram below shows the result of an experiment used to study the effect of pH on the activity of amylase. Four filter paper discs (a to d) were soaked in different solutions and put onto the surface of a starch agar plate. After 1 hour of incubation at 35°C, the filter paper discs were removed and the agar plate flooded with iodine. The result is shown below.



Which of the following correctly states the solutions in which the paper discs were soaked?

	a	b	c	d
A	amylase	boiled amylase	water	amylase + hydrochloric acid
B	amylase	water	amylase + water	boiled amylase
C	amylase + sodium hydroxide	boiled amylase	amylase + hydrochloric acid	amylase + sucrase
D	amylase + sucrase	amylase	boiled amylase	water

- 10 Diagram 1 shows the structure of a plant cell.
Diagram 2 shows a section through part of a leaf of a land plant.



In which part of the leaf would the cell be found?

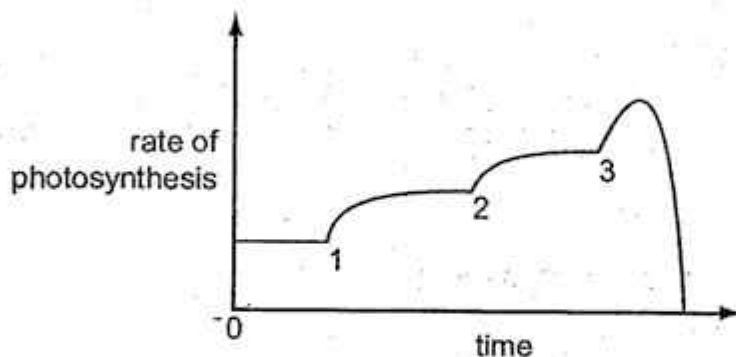
- 11 Sally wants to rear fish with some water plants in a glass tank, but she has forgotten to buy an air pump. Which of the following methods would help the fish to get sufficient oxygen?

- I. Use a stronger aquarium lamp
- II. Place more water plants in the tank
- III. Add a small amount of sodium hydrogen carbonate
- IV. Treat the water with soda lime prior to adding in the fish

- A I and II
- B II and III
- C I, II and III
- D I, II, III and IV

- 12 Temperature, light intensity and carbon dioxide concentration are three limiting factors in photosynthesis.

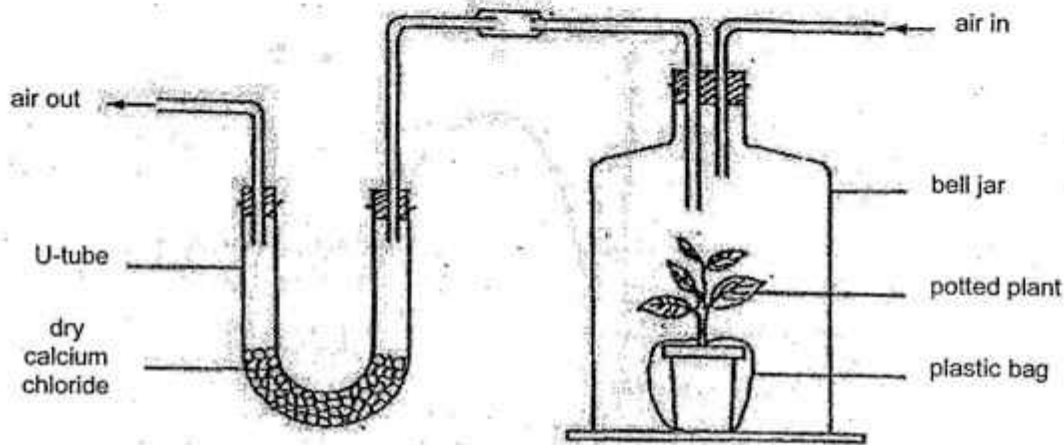
In an experiment, each factor is increased in turn. The graph shows the results.



Which of the following sets of numbered points correctly represents when each factor was increased?

	Carbon dioxide concentration	Light intensity	Temperature
A	1	2	3
B	2	3	1
C	3	1	2
D	3	2	1

Questions 13 and 14 refer to the diagram below which shows a set-up for measuring water loss from a plant.



- 13 The mass of the U-tube and its contents were recorded at different times of the experiment.

Treatment	Time of measurement	Mass of the U-tube and its contents (g)
1. Without plant in bell jar	At the beginning	100
	After one hour	105
2. With plant in bell jar	At the beginning	100
	After one hour	120

How much water was lost from the plant in one hour?

- A 5g
 - B 10g
 - C 15g
 - D 20g
- 14 Which of the following would increase the rate of transpiration by the plant?
- A Decrease in light intensity
 - B Decrease in air temperature
 - C Decrease in the rate of air flow
 - D Decrease in humidity of the air pumped in

- 15 Substances are exchanged between the plasma, tissue fluid and red blood cells.

The table below shows some statements and whether they apply or do not apply to the three components of the body.



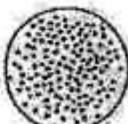
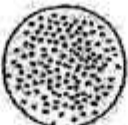

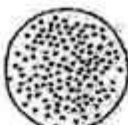
Row	Statement	Plasma	Tissue Fluid	Cytoplasm of red blood cells
I	Formed by leakage of capillaries	x	✓	x
II	Contains antibodies	x	x	✓
III	Contains haemoglobin	✓	x	✓
IV	In direct contact with muscle cells	x	✓	x

✓ = applies to the body component

x = does not apply to the body component

Which rows in the table are correct?

- A I and II
 B I and IV
 C II and III
 D I, II and IV
- 16 Three people, John, Jacob and Jennifer carried out some blood group testing. The test results 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

To which blood group does each belong?

	John	Jacob	Jennifer
A	A	O	AB
B	A	AB	O
C	AB	A	B
D	B	AB	O

- 17 **Figure 1** shows the sectional top view of the heart and **Figure 2** shows a graph of the pressure changes that occur during a single heart beat.

At which point do valves P and Q close?

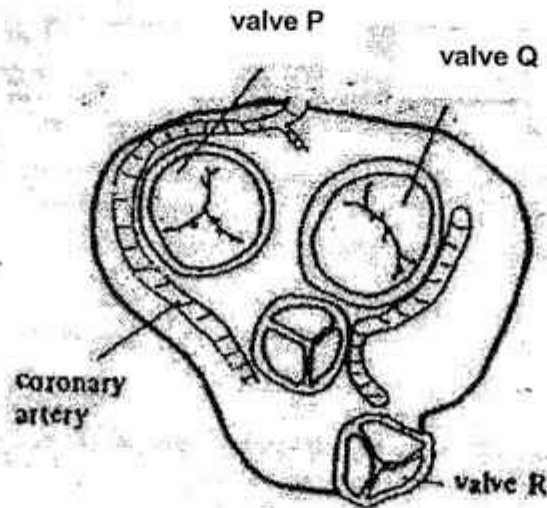


Figure 1

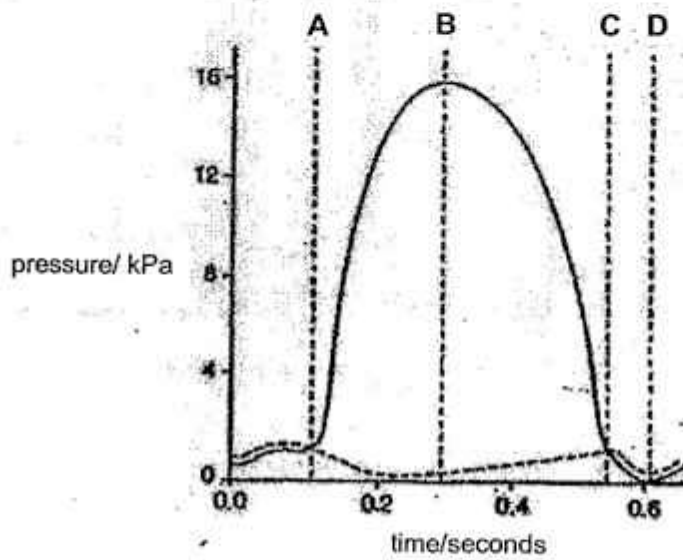


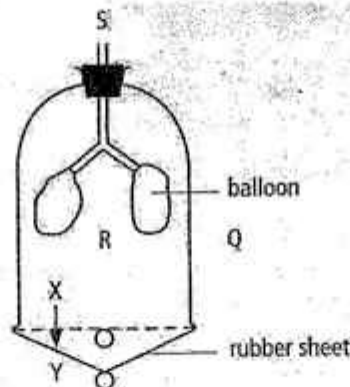
Figure 2

Key ——— ventricle - - - - - atrium

- 18 Which one of the following is a common feature of air sacs of the lungs and the convoluted tubules of the nephrons?

A They are both freely permeable to dissolved substances.
 B They both have a rich blood supply.
 C They both have cells covered with cilia.
 D They both have cells with a high metabolic rate.

- 19 The diagram below represents the apparatus used to demonstrate the action of the diaphragm. Which of the following will occur, if the rubber sheet moves from X to Y?



- I. The pressure in R will increase.
 II. The pressure in R will decrease.
 III. Air will enter the bell jar through S.
 IV. The volume inside the balloons will increase.

A I only
 B II and III
 C II, III and IV
 D I, III and IV

- 20 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	1.5
2	40	48	7.5
3	90	40	4.0

Which veins were sampled?

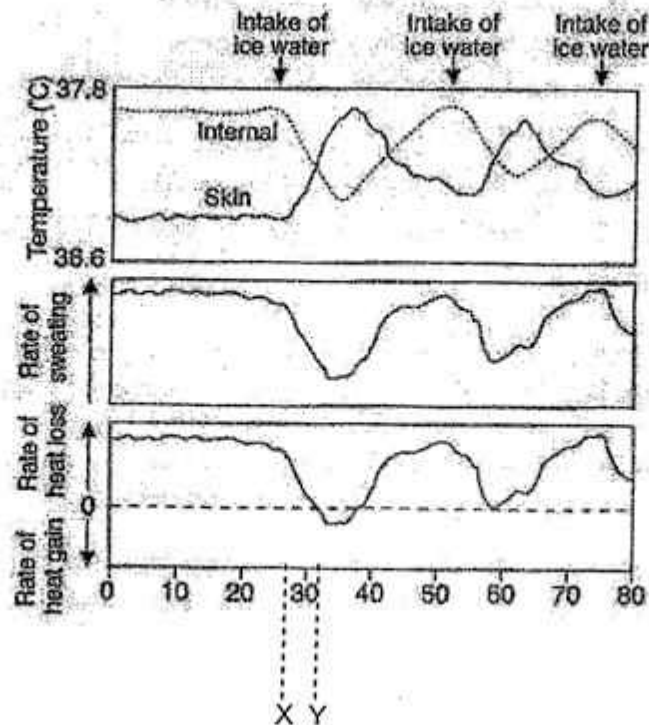
	Hepatic vein	Pulmonary vein	Renal vein
A	3	2	1
B	2	3	1
C	1	3	2
D	1	2	3

- 21 Teleost fish have body fluids which are maintained at a higher water potential than sea water.

What is likely to happen to the amount of urine produced when a teleost fish is transferred from sea water to pure water?

- A Cannot be determined
- B Remains unchanged
- C Decreases
- D Increases

- 22 In an experiment, a healthy man, David, was made to drink a large volume of ice water at regular intervals in a room with an air temperature of 50°C. The graphs below show the measurements of internal body temperature, skin temperature, the rate of sweating and body heat loss/gain over the length of the experiment.



Which of the following describe the changes happening in David's skin from point X to Y?

- I. Arterioles become dilated.
- II. Sweat glands become inactivated.
- III. Less latent heat of vaporisation is being lost.
- IV. Thermoreceptors in skin become more stimulated.

- A I and IV
- B II and III
- C II, III and IV
- D I, II and III

23 Four statements about negative feedback are given below.

1. Effectors bring about corrective responses.
2. A receptor detects a change in the internal environment.
3. Variation from the norm is counteracted.
4. A nerve or hormone message is generated.

The order in which these events occur is

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

24 John has been reading a murder mystery for 2 hours under constant light intensity. His eyes feel tired due to the continuous contraction of the

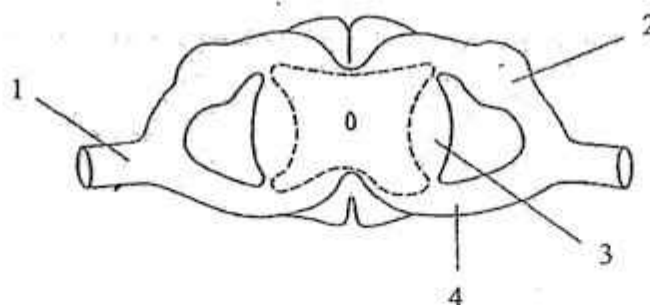
- A lens.
- B suspensory ligaments.
- C radial muscles.
- D ciliary muscles.

25 A hormone differs from an enzyme in that it

- A is produced by a gland.
- B is not made up of protein.
- C is carried by blood to the target organ.
- D catalyses a wide range of metabolic reactions.

26 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 below represents the spinal cord of the person, which area(s) is/are likely to be damaged?

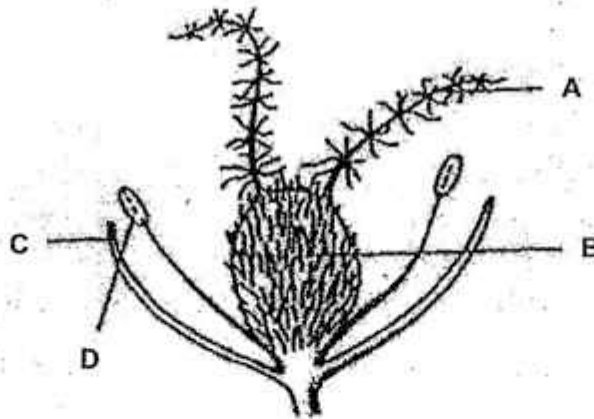


- A 2 only
- B 4 only
- C 2 and 3
- D 1 and 4

27 Many flowering plants have structures to ensure cross-pollination rather than self-pollination because cross-pollination

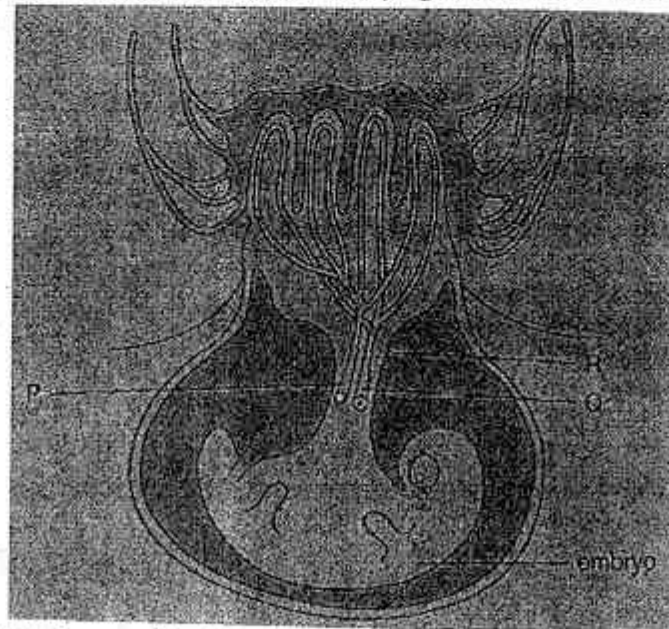
- A depends on external agents of transfer to occur.
- B increases the likelihood that beneficial genes are passed down to the offspring.
- C does not require as much energy from the plant.
- D increases the chance of survival of the species in a changing climate.

28 A diagram of a flower is shown below.



In which labeled structure do pollen grains develop?

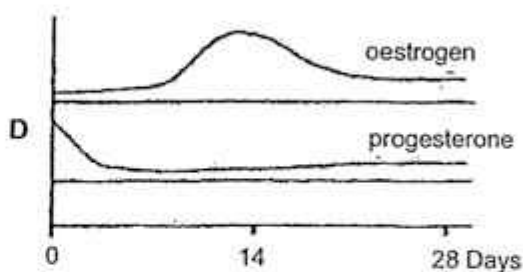
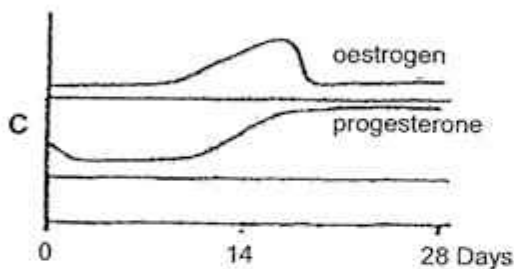
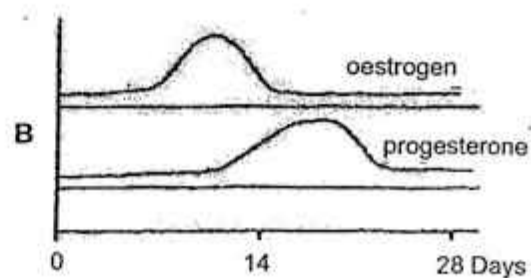
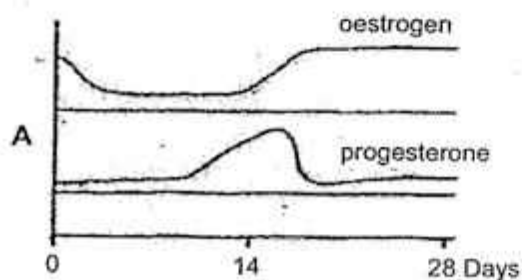
- 29 The diagram below shows an embryo developing inside the uterus of a mammal.



Which of the following combinations is correct?

	P	Q	R
A	Umbilical vein	Umbilical artery	Umbilical cord
B	Umbilical vein	Umbilical artery	Placenta
C	Umbilical artery	Umbilical vein	Umbilical cord
D	Umbilical artery	Umbilical vein	Placenta

- 30 The graphs below show possible hormone levels in a woman, with menstruation starting on Day 0 and ovulation taking place on Day 14. Which of the following graphs shows the correct levels of these hormones if fertilisation takes place?

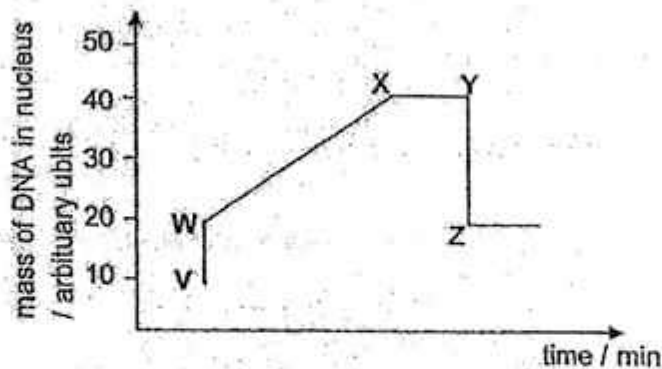


- 31 The mitotic index is defined by the following ratio:

$$\frac{\text{number of cells undergoing mitosis}}{\text{total number of cells present}}$$

When/ where will the value of the mitotic index be high?

- A During formation of multiple pollen grains
 - B During cell enlargement in the shoot
 - C During root tip growth
 - D In mature tissues
- 32 The graph shows the mass of DNA present in a cell. At the starting point, V, the cell is a gamete with 10 units of DNA.



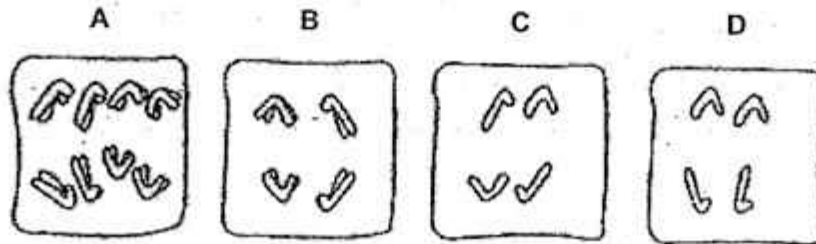
Which of the following statements is true?

- A Fertilisation occurs between V and W.
- B The cell is actively dividing between W and X.
- C Between X and Y, the cell is at interphase.
- D The cell undergoes meiosis between Y and Z.

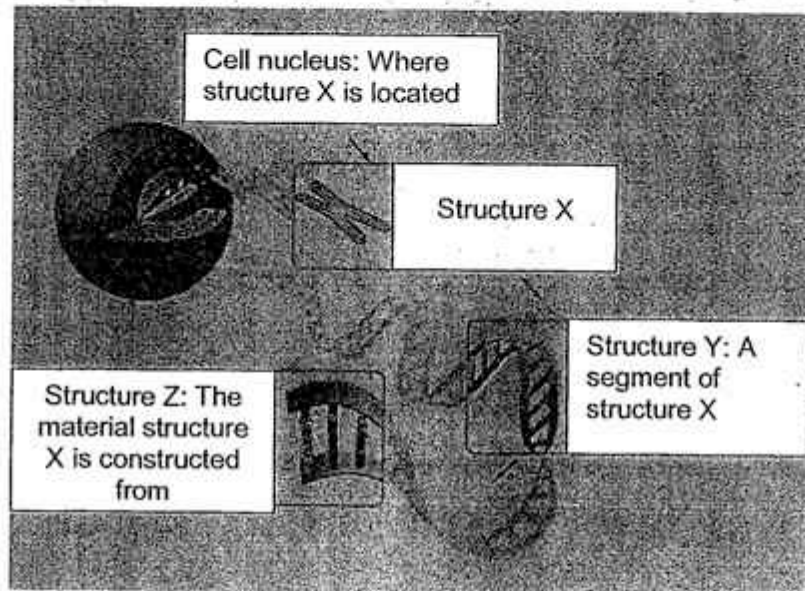
- 33 The diagram shows a cell during a stage in mitosis.



Which diagram shows a stage in meiosis I in the same organism?



- 34 The diagram below shows different levels of organisation of a structure found in the nucleus.



What are the identities of X, Y and Z?

	Structure X	Structure Y	Structure Z
A	Gene	Chromatin	Nucleic Acids
B	Nucleic acid	Chromatin	DNA
C	Chromosome	DNA	Nucleotides
D	Chromosome	Gene	DNA

- 35 The table shows the percentage concentration of three bases in DNA from four different sources. Which source is a species of mammal with a concentration of adenine of 31.0%?

source	guanine	cytosine	thymine
A	19.1	30.9	19.0
B	22.8	22.8	23.4
C	19.5	19.7	29.8
D	30.9	19.1	19.0

- 36 A protein molecule is made up of two polypeptide chains joined together. One of the chains is 20 amino acids long while the other is 35 amino acids long.

Based on the above information, which of the following statements is true?

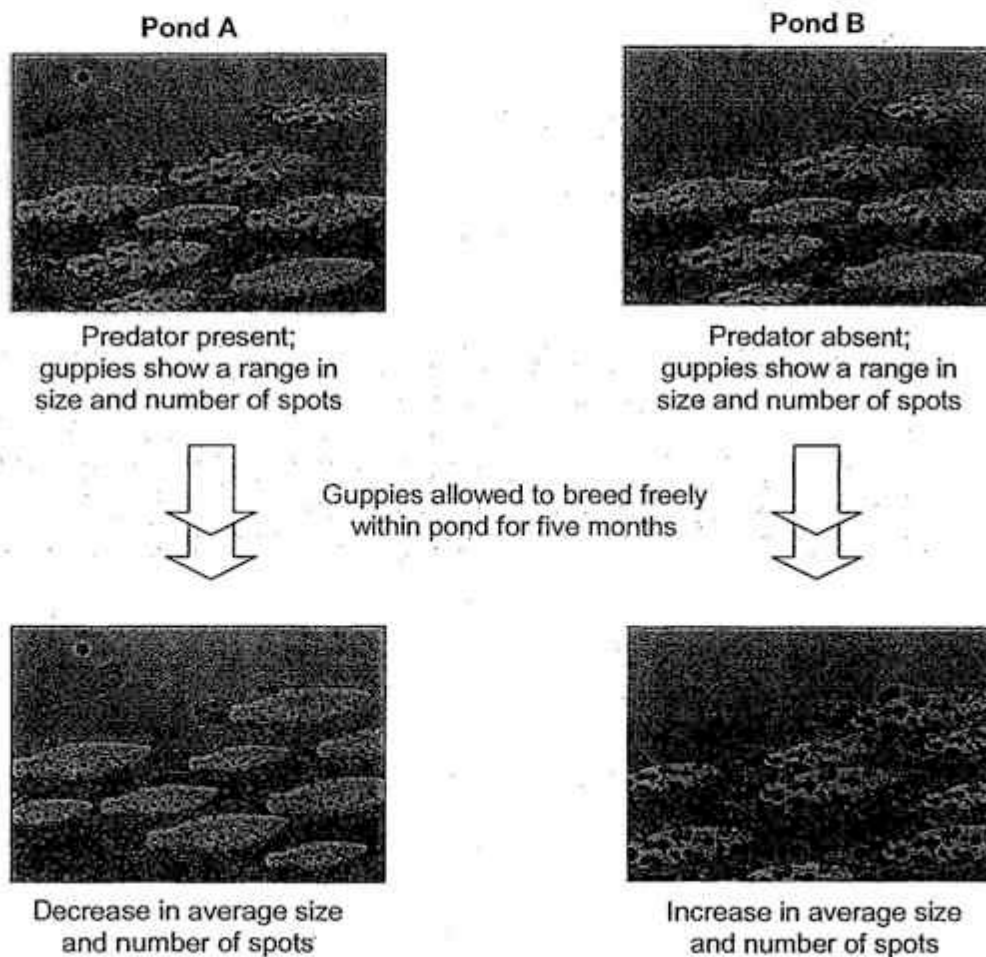
- A The synthesis of the protein involves 165 codons.
 - B The process whereby ribosomes make the polypeptide chains is called transcription.
 - C The genetic code for the protein comprises 55 nucleotides in total.
 - D Two different genes are responsible for making the protein.
- 37 Two parents, both of blood group A, have a daughter of blood group O.

What is the probability that their next child will be a daughter with genotype $I^A I^A$?

- A $1/8$
- B $1/6$
- C $1/4$
- D $1/3$

- 38 The body of male guppies have coloured spots that attract females to mate. The number and size of guppy spots are largely genetically controlled.

To examine the theory of evolution by natural selection, a scientist carried out an experiment with wild guppies. The following set-ups were established in two separate ponds, with observations made after five months:



Source of pictures: <http://evolution.berkeley.edu/>

Which of the following statements **do not** apply to natural selection acting on the guppy populations?

- A In pond A, individual guppies develop less spots to evade predation.
- B In pond B, the more colourful guppies have a selective advantage.
- C In ponds A and B, meiosis and mutation give rise to variations in the population.
- D In ponds A and B, competition among individuals lead to a shift in the genetic make-up of the population.

- 39 The statements below describe negative consequences that may result in a lake that receives too much fertilizer run-off from nearby farms.

- I. Submerged plants are unable to photosynthesise
- II. Organisms in lake die from lack of oxygen
- III. Bacteria multiply rapidly
- IV. Profuse growth of algae in lake (eutrophication)

Which of the following states the correct sequence of events?

- A III → II → IV → I
- B III → IV → I → II
- C IV → I → II → III
- D IV → I → III → II

- 40 Through which of the following does the least amount of energy flow in a food chain?

- A Decomposers
- B Producers
- C Herbivores
- D Carnivores

Centre Number	Index Number	Name	Class



SINGAPORE CHINESE GIRLS' SCHOOL
PRELIMINARY EXAMINATION 2012

BIOLOGY

5094/02

Paper 2

Friday

27 July 2012

1 hour 45 minutes

No Additional Materials required.

READ THESE INSTRUCTIONS FIRST

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

Write in dark blue or black pen.

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

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

Section A

Answer **all** questions.

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

Section B

Answer **all** questions.

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

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

You are advised to spend no longer than one hour on Section A and no longer than 45 minutes 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	
Section A	
Section B	
7	
8	
9	
Total	

This question paper consists of 18 printed pages, inclusive of this cover page.

Section A

Answer **all** questions.

Write your answers in the spaces provided.

- 1 Figure 1.1 shows how genetic engineering can be used to manufacture an enzyme, chymosin, that clots milk in the stomach of young mammals.

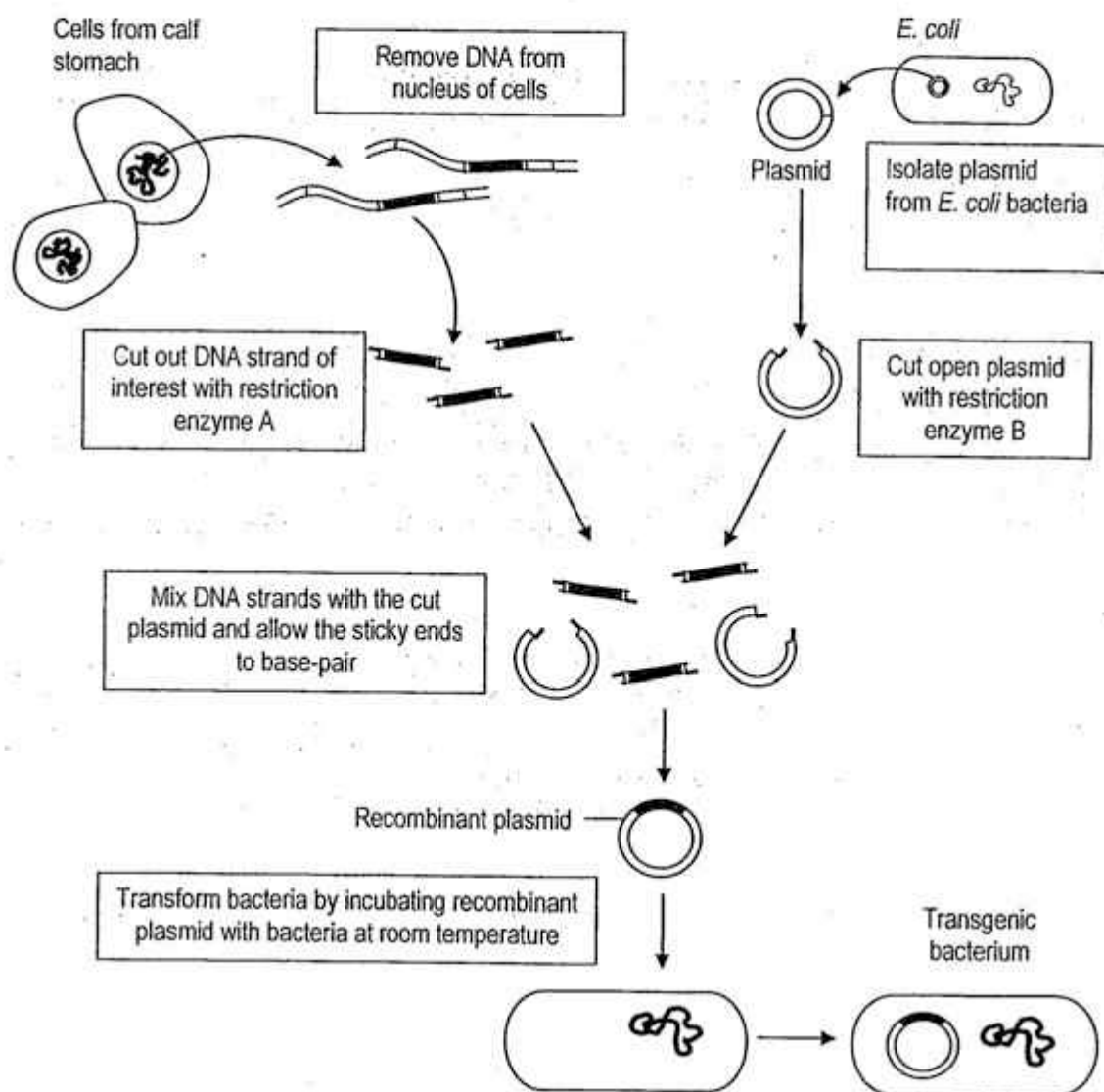


Figure 1.1

- a) Name the DNA strand of interest cut out from calf stomach cells in Figure 1.1. [1]

- b) Figure 1.1 contains some key errors or missing information. Suggest two ways in which the procedure should be modified and explain why each change or additional step is necessary. [2]

- c) A pilot fermenter as shown in Figure 1.2 is set up to grow the transgenic bacteria.

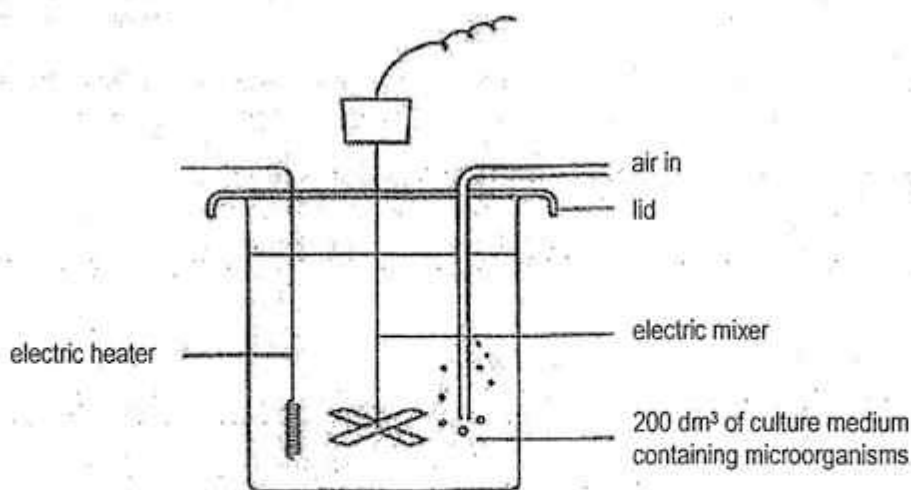


Figure 1.2

In order to grow the bacteria on an industrial scale, the fermenter will have to be made larger.

- (i) State and explain two other alterations that should be made to the fermenter if the bacteria are to be grown on an industrial scale. [4]

1.

2.

The graph in Figure 1.3 shows the populations of bacteria cells in two different fermentation tanks, A and B. An equal number of bacteria cells were initially added to both tanks. The bacteria are of the same species.

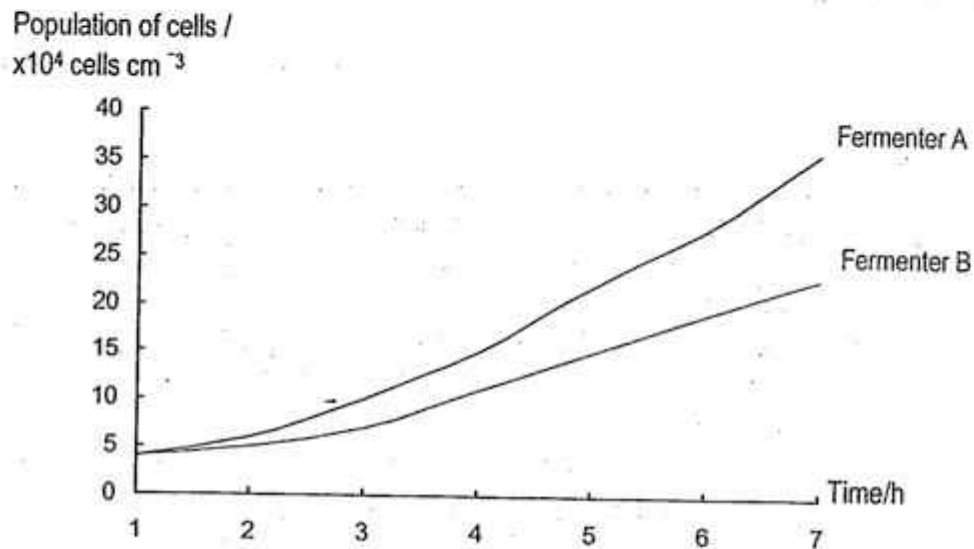


Figure 1.3

- (ii) State one factor, other than temperature, which could account for the different growth rates in the two fermentation tanks. Explain how the factor affects growth rate. [2]

- d) Bacteria have been genetically modified in a similar manner to produce human insulin to treat diabetes mellitus. However, there may be public concern about the safety of using insulin produced this way. Write a short statement to explain why there should be no danger in the use of such insulin. [1]

[Total: 10]

- 2 Figure 2 shows three set-ups used to investigate the action of digestive juices. Each visking tubing is put in a beaker filled with distilled water.

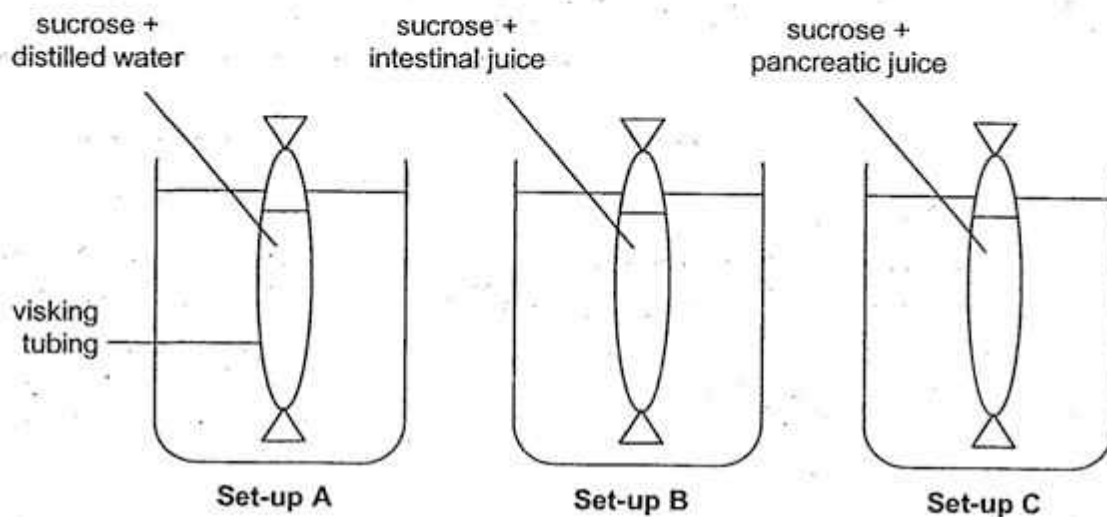


Figure 2

Each set-up was incubated at 30°C for 30 minutes. Benedict's test was then carried out on the distilled water in each beaker.

- a) Complete the table to show the expected observations for all three set-ups. [2]

Set-up	Observations for Benedict's test
A	
B	
C	

- b) In the experiment, the visking tubings could be likened to the small intestine.

Explain how the movement of sugars from the visking tubing into the surrounding water differs from the actual absorption of sugars into the blood. [2]

- c) A similar experiment was carried out with the **same concentration** of reactants. Suggest and explain one specific way to speed up the digestive process so that similar results can be achieved in a shorter time. [4]

[Total: 8]

- 3 Figure 3.1 shows sections of the phloem tissue in a plant.

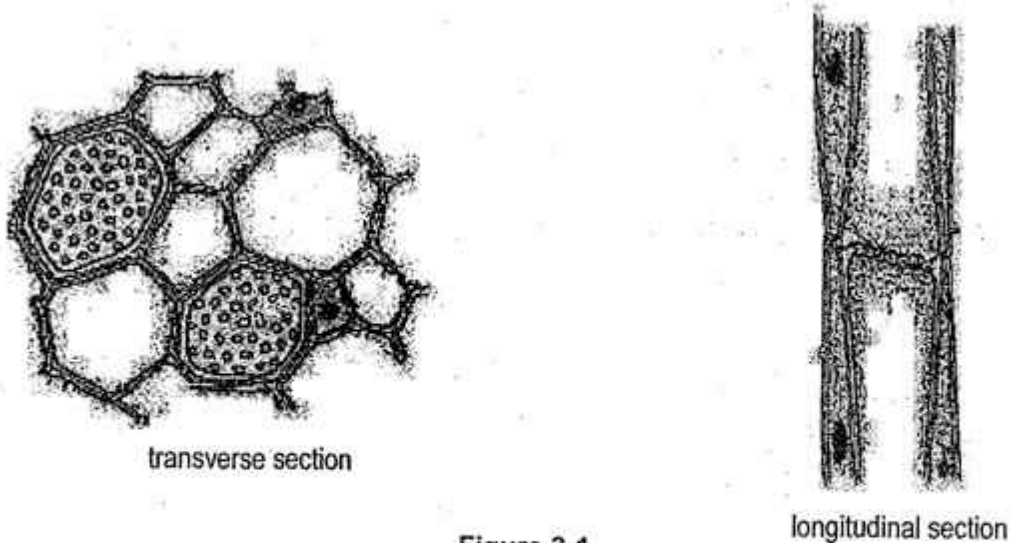


Figure 3.1

- a) On Figure 3.1, label a sieve tube cell and a companion cell in **both** the transverse section and the longitudinal section. [1]
- b) Sieve tube elements are made up of living, tubular cells linked end to end. The cytoplasm is thin and peripheral. What is the significance of these structural adaptations? [1]
- c) When a plant was exposed to a poison that inhibits respiration, the movement of solutes in the phloem stopped. Identify the cells affected and explain why the movement stopped. [2]

- d) Research using carbon dioxide containing a radioactive label, C^{14} , has revealed the following evidence about the mechanism of translocation:

- P radioactive carbon can be observed in the phloem soon after being supplied to a well-lit plant;
- Q the rate of movement of sugars in the phloem is many times faster than can be achieved by diffusion alone.

Other research has revealed that:

- R an insect feeds on sap by inserting its proboscis (feeding stylet) into the phloem;
- S the phloem companion cells contain several organelles such as ribosomes;
- T the pH of the sieve tubes and companion cells is lower than surrounding cells.

Using the letters **P, Q, R, S** and **T**, select any **two** pieces of evidence from the above list that support the theory that translocation occurs in the phloem. [1]

- e) In another study, young sunflower plants were watered with water that had been labeled with radioactive oxygen.
- (i) Figure 3.2 shows the outline of the transverse section of the stem of one of these plants. Draw in and identify the transport vessels that would become radioactive first.

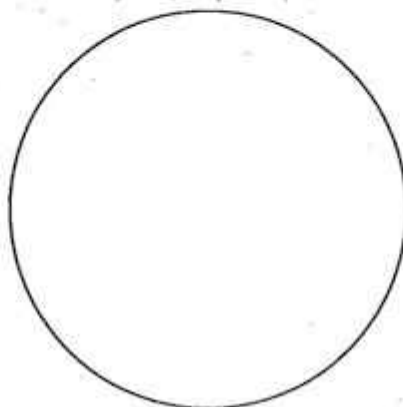


Figure 3.2

[1]

- (ii) Radioactivity was subsequently detected in the air around the sunflower plants. Which of the following substance(s) could account for the presence of radioactivity in the air? Tick the correct option(s). [1]

- ☐ Carbon dioxide
- ☐ Glucose

- ☐ Oxygen
- ☐ Water vapour

[Total: 7]

- 4 A spirometer is an instrument used to measure the air capacity of the lungs.

Figure 4 compares a normal spirometer trace with one from a trained athlete and one from a bronchitis sufferer.

Each curve shows the volume of air exchanged during one normal breath, followed by the volume inhaled and exhaled after breathing in and out as much as possible in one single breath.

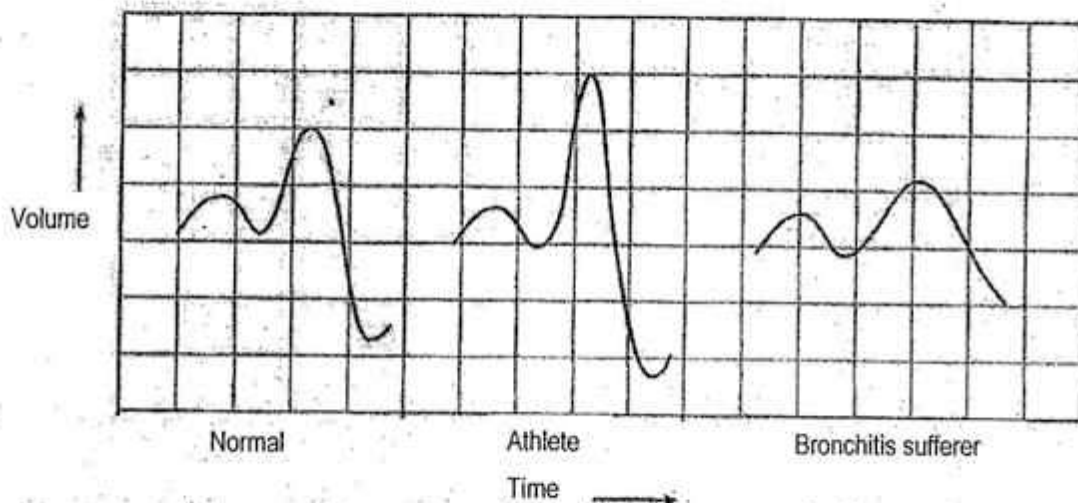


Figure 4

- a) Vital capacity refers to the maximum amount of air a person can expel from the lungs after breathing in as deeply as possible.

Describe and explain how bronchitis affects vital capacity.

[2]

- b) Describe how the carbon dioxide produced in respiring tissues is transported in the blood to the lungs.

[4]

- c) During an 800m race, an athlete's muscles may respire anaerobically. Write a word equation for anaerobic respiration in the muscle cells. [1]

[Total: 7]

- 5 Figure 5.1 shows how blood pressure changes as blood travels through one circuit of the circulatory system.

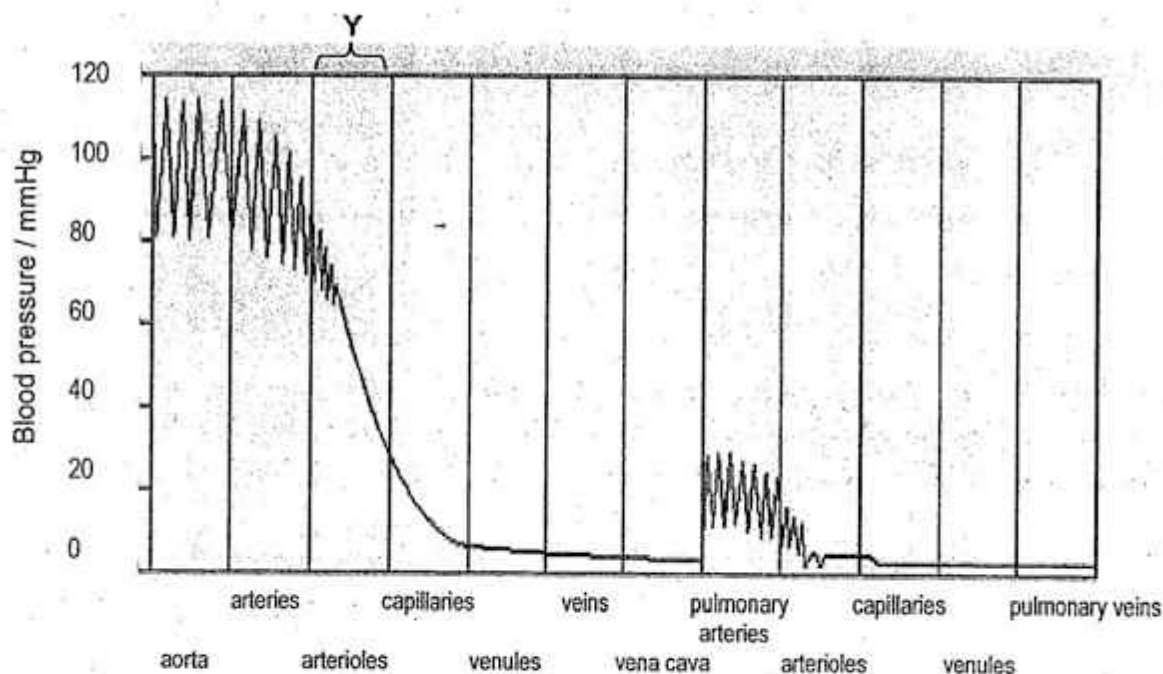


Figure 5.1

- a) Explain why the blood pressure decreases so rapidly in region Y. [2]

- b) In the space below, draw a labeled diagram to show the cross-sectional view of a blood capillary. [1]

- c) Give **two** reasons to explain how a return flow to the heart is possible when the pressure in the veins is so low. [2]

- d) Figure 5.2 shows a blocked artery being treated with the use of a stent (small tube of stainless steel mesh). A balloon with the stent is inserted into the artery and inflated. The balloon is then removed and the stent remains inside the artery.

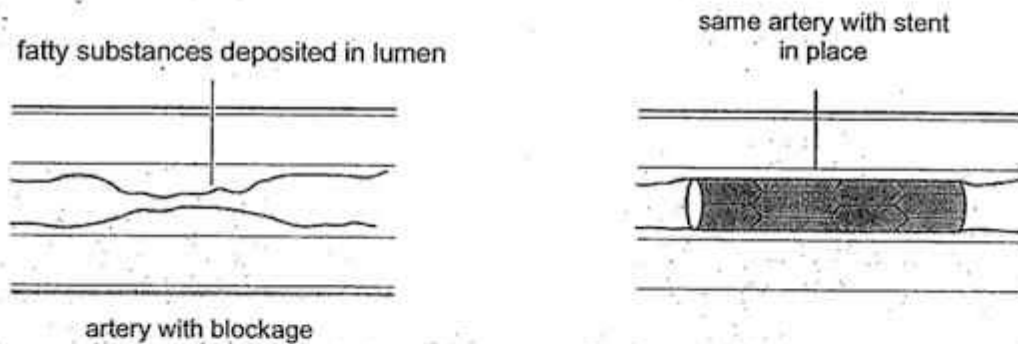


Figure 5.2

- (i) Suggest why the artery wall is able to 'bounce back' when the balloon used to inflate the artery is removed. [1]

- (ii) Explain why the ability of the artery wall to bounce back is important in a normal, healthy artery. [2]

[Total: 8]

- 6 Figure 6.1 illustrates a theoretical relationship between a population of foxes and a population of rabbits over a period of time.

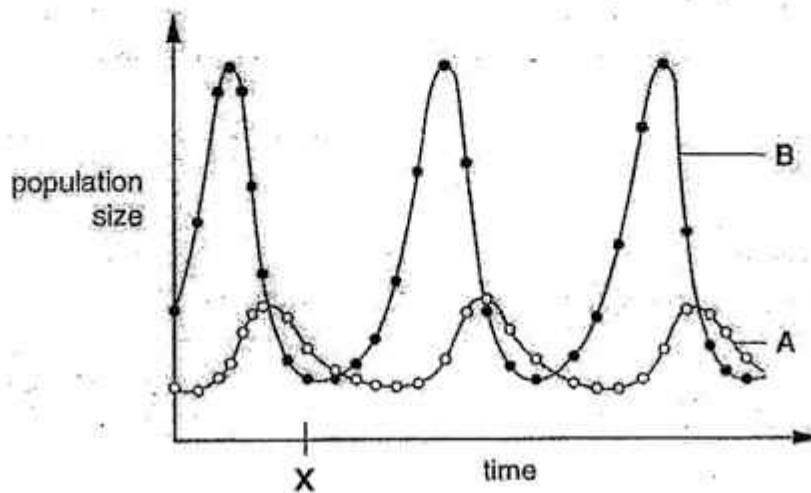


Figure 6.1

- a)(i) State which curve, A or B, represents the fox population. [1]

- (ii) With reference to Figure 6.1, describe and explain one feature of the population graph on which you based your answer to a)(i). [2]

- b)(i) State what a pyramid of biomass represents. [1]

- (ii) With reference to Figure 6.1, draw a likely pyramid of biomass made up of two trophic levels, to represent the fox and rabbit populations at time = X. Label the two trophic levels as "fox" and "rabbit". [1]

- c) Figure 6.2 illustrates the relationship among various entities in a habitat.

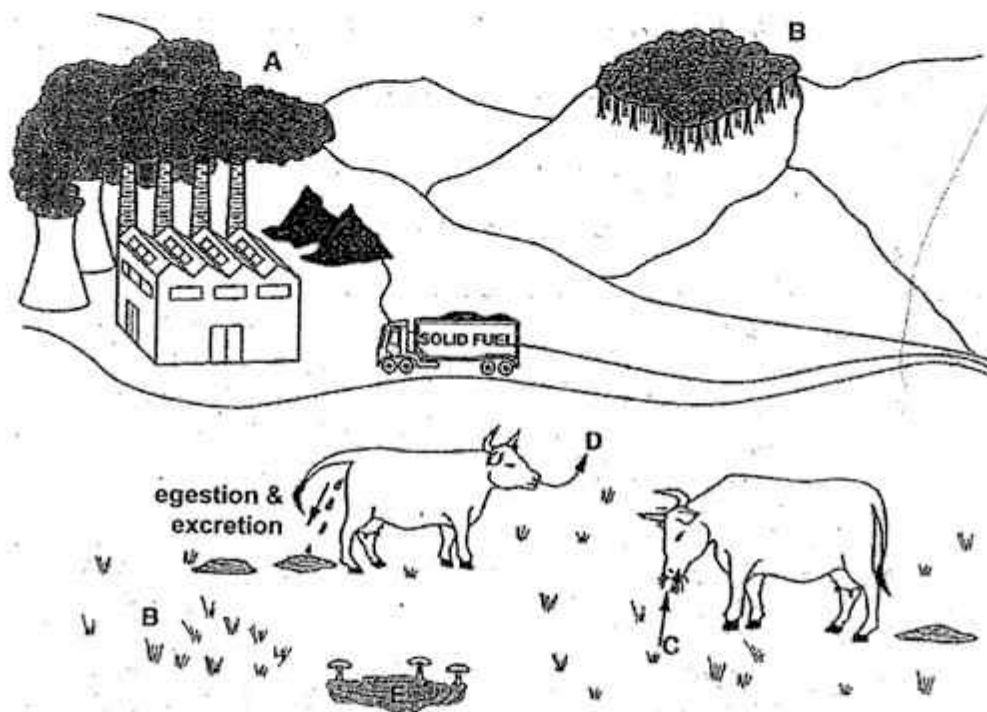
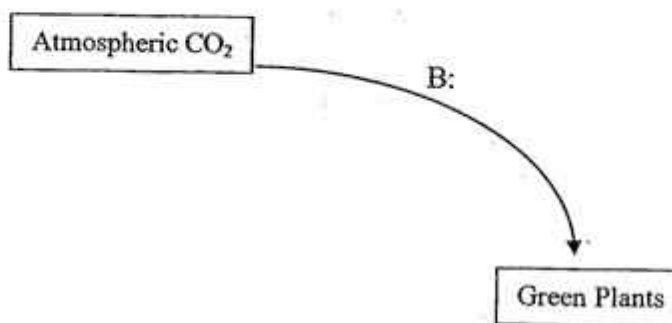


Figure 6.2

With reference to Figure 6.2, complete the flow diagram below to show the carbon cycle. Your diagram should illustrate the relationships among the entities in the habitat and include the identities of processes A to E. [5]

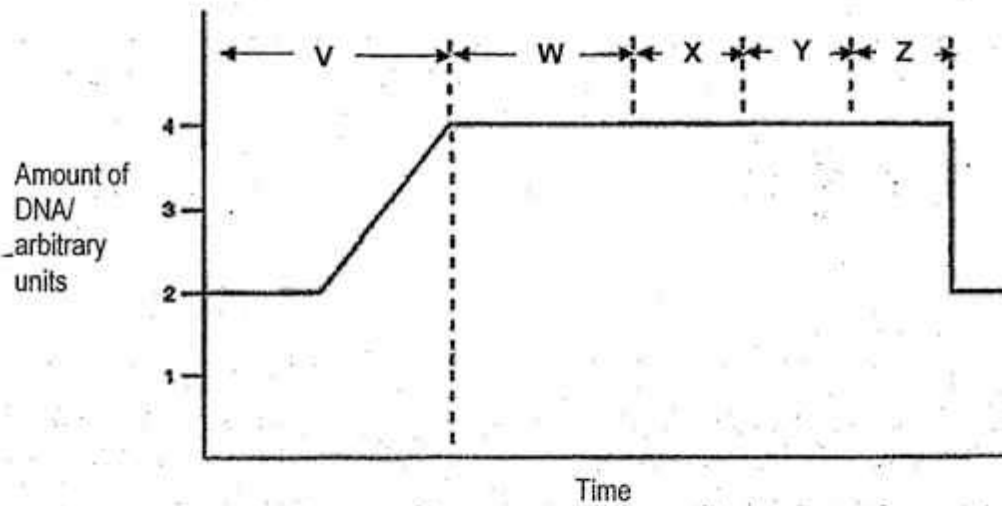


[Total: 10]

Section B
Answer **three** questions.

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

7. The graph below shows how the amount of DNA varies with time during the cell cycle. The different phases in the cell cycle are labeled V to Z.



With reference to the information in the graph, answer the following questions.

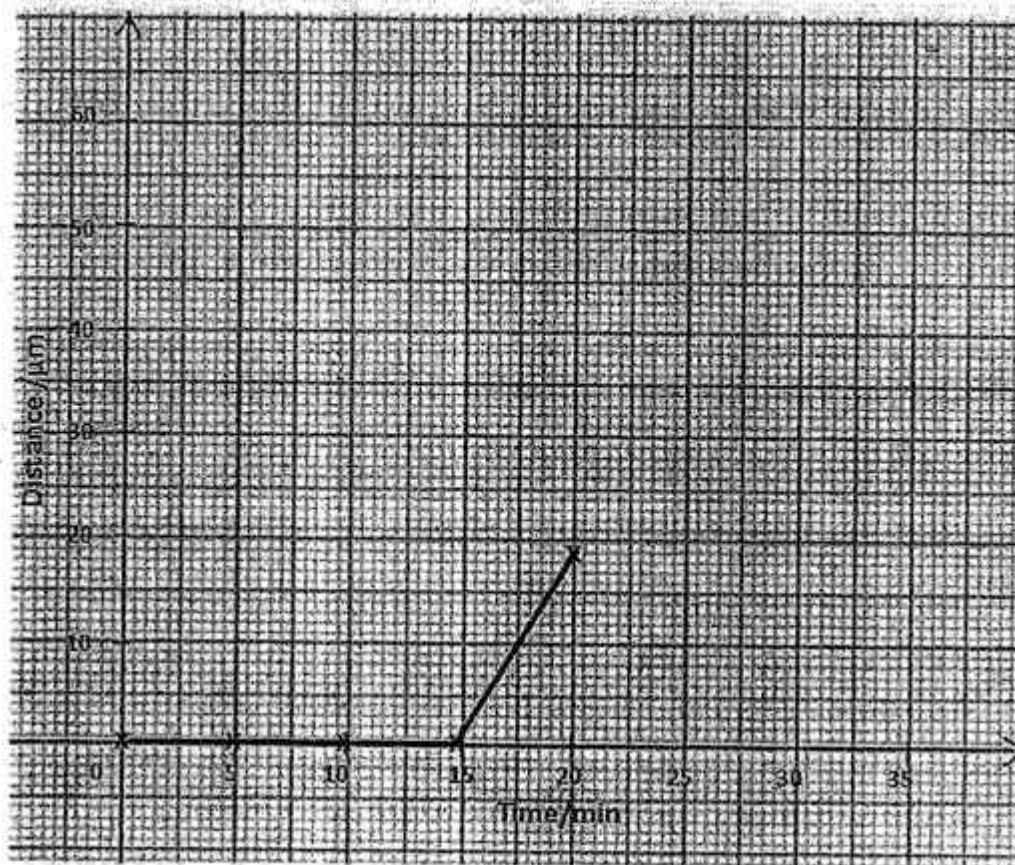
- a) Describe and explain how the amount of DNA varies in phase V. [2]

- b) Account for the change in the amount of DNA immediately after phase Z. [1]

- c) The table below shows the distance between the centromeres of sister chromatids at different time points during the cycle.

Time/min	Distance/ μm
0	0
5	0
10	0
15	0
20	19
25	38
30	47
35	58

Using information from the table, complete the graph below. The first five points have been plotted and drawn for you. [2]



- d) On the graph, indicate with an arrow and the letter "Y", the point which marks the beginning of phase Y. [1]

- e) Separase is an enzyme involved in breaking the bonds that hold two sister chromatids together. A drug is added to alter the shape of separase at phase W.

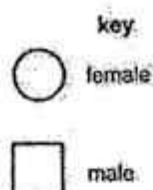
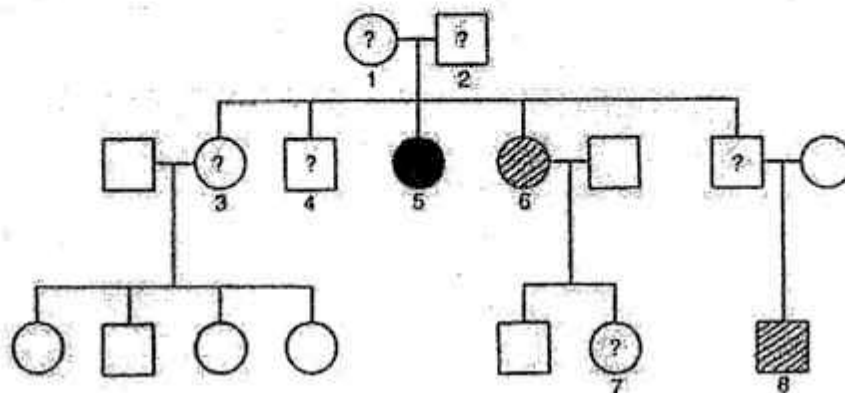
- (i) Explain how separase will no longer be able to carry out its function. [2]

- (ii) With reference to the insulin gene, state the **maximum** number of copies of the gene that could be found in a daughter cell, as a result of separase not being able to carry out its function during **mitosis**. [1]

[Total: 9]

8. The diagram below shows a family tree and the distribution of individuals with mild or severe form of sickle-cell anaemia, a genetic disease. This is determined by two alleles, the healthy haemoglobin allele **HbA**, and the sickle-cell allele **HbS**.

Individuals who inherit two sickle-cell alleles are seriously anaemic and usually die young, while those who are heterozygous for the condition are mildly affected.



Individuals badly affected are shown in **black**.

Those known to be mildly affected are shown **shaded**.

Healthy individuals are shown in **white**.

"?" denotes individuals whose condition is unknown.

- a) The following are four types of gene mutation. Identify with a tick the gene mutation that causes sickle-cell anaemia. [1]

- | | |
|---|---|
| <input type="checkbox"/> Deletion of one nucleotide | <input type="checkbox"/> Substitution of one nucleotide |
| <input type="checkbox"/> Deletion of one codon | <input type="checkbox"/> Addition of one codon |

- b) Describe how a gene mutation differs from a chromosomal mutation. [2]

- c) Suggest the possible genotype(s) of individual 1 and explain your answer. [4]

- d) Determine the probability of individual 6 having a child who inherits **one** sickle-cell allele only. Use a genetic diagram to illustrate your answer. [4]

[Total: 11]

9

Define homeostasis. Explain how the human body regulates its levels of amino acids and water after a meal of salty seafood. [10]

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There is no handwriting or printed text on the paper.

[Total: 10]

9 OR

Jason is walking past a construction site when the wind blows a cloud of cement dust towards him. His eyes blink and he raises his arm to rub them.

- a) Explain why Jason blinking his eyes is a reflex action.

[3]

- b) Starting with the stimulation of itch receptors in the eye area, describe the sequence of events that occur to cause Jason to raise his arm.

[7]

END OF PAPER

[Total: 10]



SCGS Prelim 2012 (Answer Key)

Paper 1

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

Paper 2

- 1a) Name the DNA strand of interest cut out from calf stomach cells in Figure 1.1. [1]

Chymosin gene

- b) Figure 1.1 contains some key errors or missing information. Suggest how the procedure should be modified and explain why each change or additional step is necessary. [2]

- Cut out chymosin gene and plasmid with the same restriction enzyme to generate complementary sticky ends;
- Add DNA ligase to permanently join chymosin gene with plasmid;
- Apply heat shock/ electric shock to open up pores in host cell membrane for uptake of plasmid

[max. 2]

- c) State and explain two other alterations that will have to be made to the fermenter if the microorganism is to be grown on an industrial scale. [4]

- i)
- Replace electric mixer with multiple impellers; to ensure even distribution of nutrients and oxygen (for microbes) / prevent microbes from clumping together;
 - Include a cooling jacket; to help maintain optimum temperature by removing heat generated by microbe growth;
 - Include pH controller; to help maintain optimum pH for growth of microbes;
 - Inlet for culture broth; ensure constant supply of nutrients for optimal growth of microbes;
 - Include sparger at base of fermenter, small air bubbles with large surface area to volume ratio dissolve readily to provide sufficient oxygen for aerobic respiration of microbes

[max. 2, with correct explanation]

The graph in Figure 1.3 shows the populations of bacteria cells in two different fermentation tanks, A and B. An equal number of bacteria cells were initially added to both tanks.

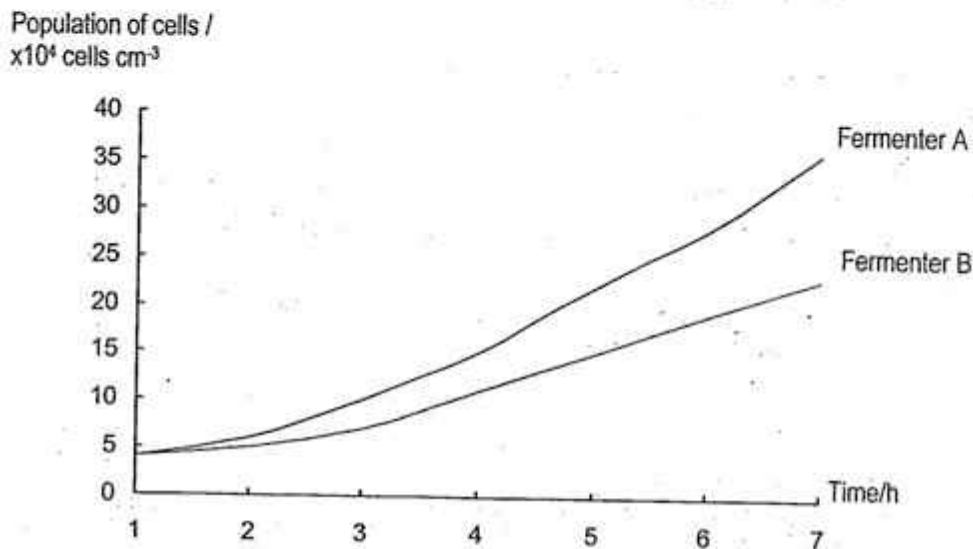


Figure 1.3

- (ii) State one factor, other than temperature, which could account for the different growth rates in the two fermentation tanks. Explain how the factor affects growth rate. [2]

c)(ii)

A at (more) optimum pH, B not at optimum pH; Sub-optimum pH decreases the activity of enzymes involved in various chemical processes during growth;

Less nutrients available in B. Lack of glucose decreases efficiency of respiration to release energy to do work, less amino acids less protein synthesis; insufficient mineral salts for healthy growth

Less efficient introduction of air in B; less O₂ available for respiration to release energy for growth;

Less efficient stirring device in B; clumping of bacteria means less surface area for efficient uptake of nutrients for growth/ nutrients and oxygen not well mixed with bacteria, resulting in less efficient uptake.

- d) Bacteria can be genetically modified in a similar manner to produce human insulin to treat diabetes mellitus. There may be public concern about the safety of using insulin produced this way. Write a short statement to explain why there should be no danger.

No risk of rejection since the insulin is produced by the human insulin gene/ it is exactly the same as the insulin produced by our bodies;

Not the bacteria but purified insulin that is injected into the body

Bacteria are grown in a sterile environment; little risk of contamination

(any other valid pt)

- 2 Figure 2 shows three set-ups used to investigate the action of digestive juices. Each visking tubing is put in a beaker filled with distilled water.

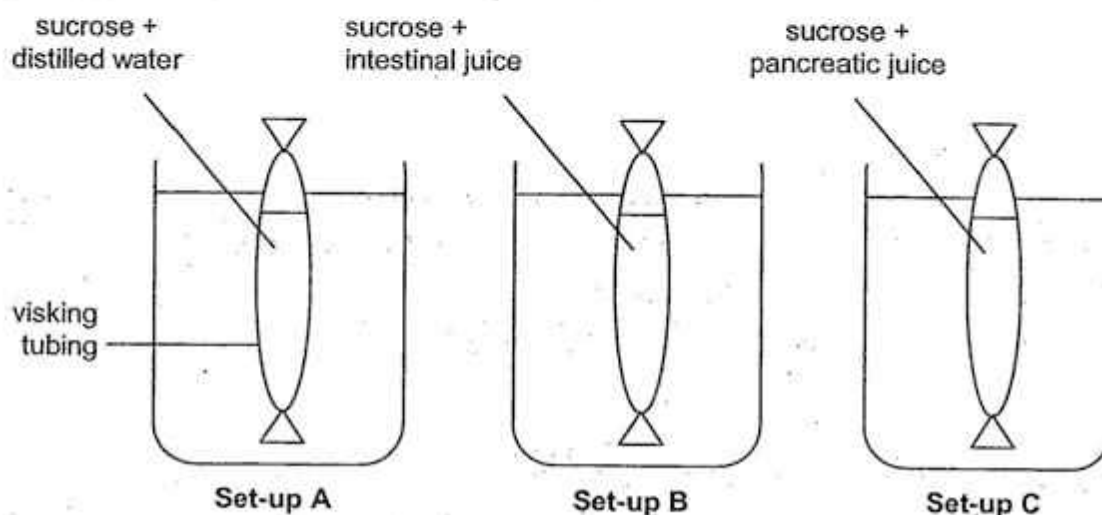


Figure 2

Each set-up was incubated at 30°C for 30 minutes. Benedict's test was then carried out on the distilled water in each beaker.

- a) Complete the table to show the expected observations for all three set-ups. [2]

Set-up	Observations for Benedict's test
A	Benedict's solution remains blue
B	Brick-red / orange ppt obtained
C	Benedict's solution remains blue [1 error, -1m]

- b) In the experiment, the visking tubings could be likened to the small intestine.

Explain how the movement of sugars from the visking tubing into the surrounding water differs from the actual absorption of sugars into the blood. [2]

- In visking tubing, molecules move by diffusion alone; small intestine, movement is by both diffusion and active transport;
- Movement out of visking tubing stops when conc. inside = outside; in small intestine, active transport ensures that all digested molecules will be absorbed

-
- c) A similar experiment was carried out with the same concentration of reactants. Suggest and explain one specific way to speed up the digestive process so that similar results can be achieved in a shorter time. [4]

-
- Carry out the experiment at 45 deg (or other suitable higher temp);
 - This increases the kinetic energy of the reactants (substrate + enzyme)
 - Increasing the frequency of collisions between reactants
 - To form the E-S complex, leading to products.
-

[Total: 8 Marks]

- 3 Figure 3.1 shows sections of the phloem tissue in a plant.

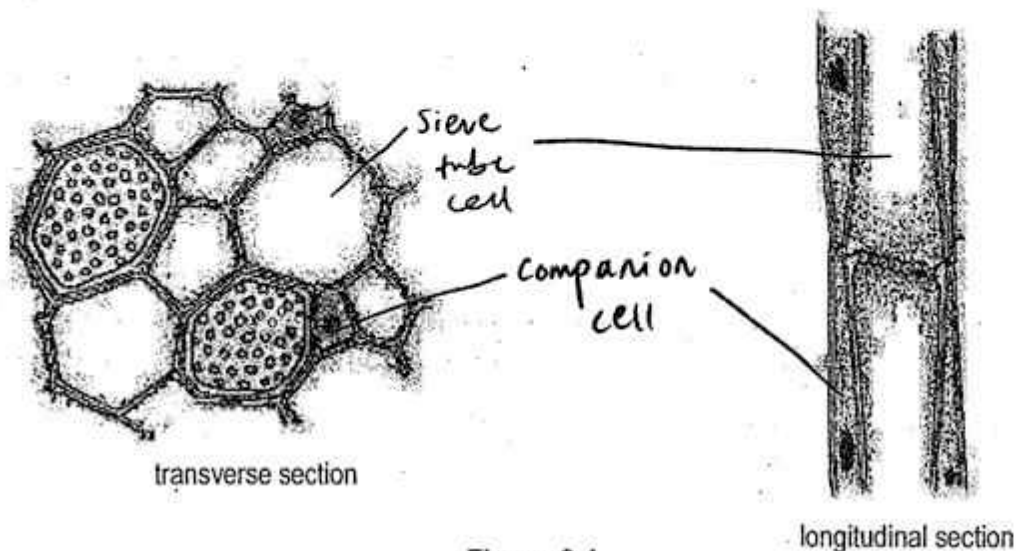


Figure 3.1

- a) On Figure 3.1, label a sieve tube cell and a companion cell in both the transverse section and the longitudinal section. [1]

- b) Sieve tube elements are made up of living, tubular cells linked end to end. The cytoplasm is thin and peripheral. What is the significance of these structural adaptations? [1]

Allow unimpeded flow of solutes;

- c) When a plant was exposed to a poison that inhibits respiration, the movement of solutes in the phloem stopped. Identify the cells affected and explain why the movement stops. [2]

- Poison inhibited respiration in companion cells;
- No more release of energy to translocate solutes by active transport

- d) Research using carbon dioxide containing a radioactive label, C^{14} , has revealed the following evidence about the mechanism of translocation:

P labeled carbon can be observed in the phloem soon after being supplied to a well-lit plant;

Q the rate of movement of sugars in the phloem is many times faster than can be achieved by diffusion alone.

Other research has revealed that:

R an insect feeds on sap by inserting its proboscis (feeding stylet) into the phloem;

S the phloem companion cells contain several organelles such as ribosomes;

T the pH of the sieve tubes and companion cells is lower than surrounding cells;

Using the letters **P, Q, R, S** and **T**, select **two** pieces of evidence from the above list that support the theory that translocation occurs in the phloem. [1]

P, Q, R (any 2, mark 1st two letters only)

- e) In another study, young sunflower plants were watered with water that had been labeled with radioactive oxygen.
- (i) Figure 3.2 shows the outline of the transverse section of the stem of one of these plants. Draw in and identify the transport vessels that would become radioactive first.

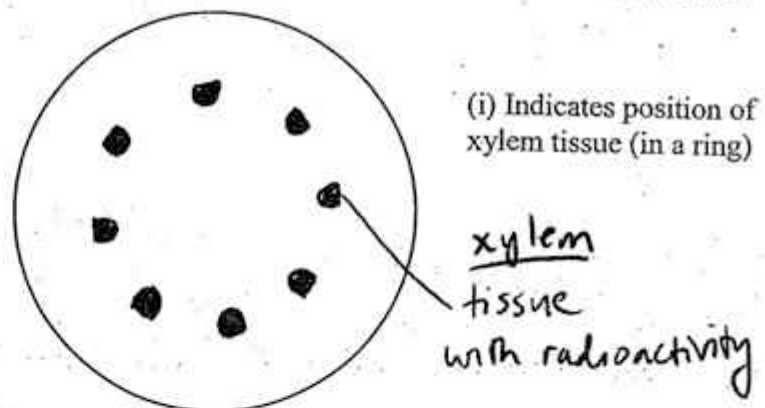


Figure 3.2

[1]

- (ii) Radioactivity was subsequently detected in the air around the sunflower plants. Which of the following substance(s) could account for the presence of radioactivity in the air? Tick the correct option(s). [1]

☐ Carbon dioxide

☒ Oxygen

☐ Glucose

☒ Water vapour

[Total: 7 Marks]

- 4 A spirometer is an instrument used to measure the air capacity of the lungs.

Figure 4 compares a normal spirometer trace with one from a trained athlete and one from a bronchitis sufferer.

Each curve shows the volume of air exchanged during one normal breath, followed by the volume inhaled and exhaled after breathing in and out as much as possible in one single breath.

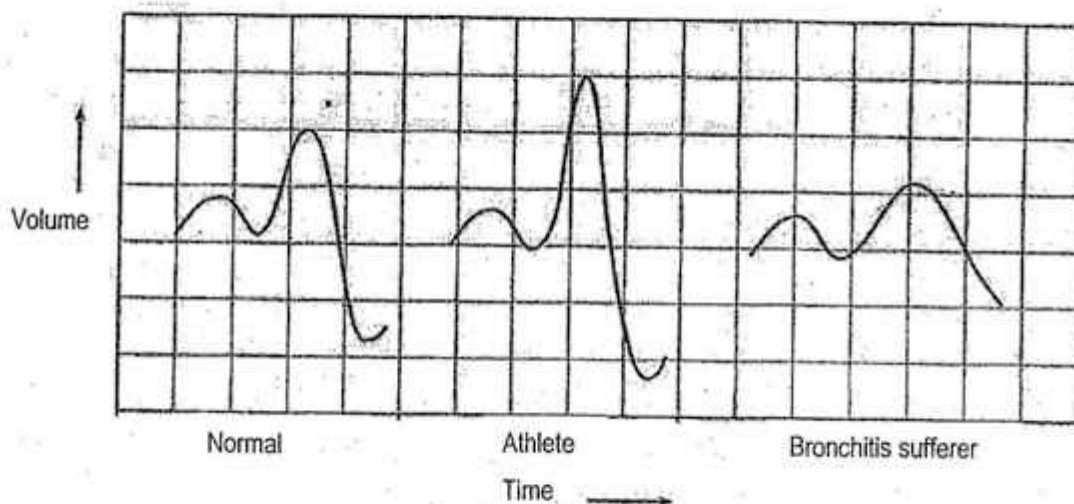


Figure 4

- a) Vital capacity refers to the maximum amount of air a person can expel from the lungs after breathing in as deeply as possible.

Describe and explain how bronchitis affects vital capacity.

[2]

- Vital capacity is decreased (as max. volume of air exhaled after a max. inhalation is less than normal);
- Constriction / inflammation of the bronchial lining and/or excessive mucus restrict air flow/ lowers the effective volume in lungs;

- b) Describe how the carbon dioxide produced in respiring tissues is transported in the blood to the lungs.

[4]

- Carbon dioxide diffuses* into RBC;
- Carbonic anhydrase catalyzes conversion of $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{CO}_3$ /carbonic acid;
- Carbonic acid (dissociates to) form HCO_3^- ;
- HCO_3^- diffuses* into plasma (/ CO_2 mostly transported as HCO_3^- in plasma;

* appears at least once

- c) During an 800m race, an athlete's muscles may respire anaerobically. Write a word equation for anaerobic respiration in the muscle cells. [1]
- glucose \rightarrow lactic acid + (small amount of) energy;

[Total: 7 Marks]

- 5 Figure 5.1 shows how blood pressure changes as blood travels through one circuit of the circulatory system.

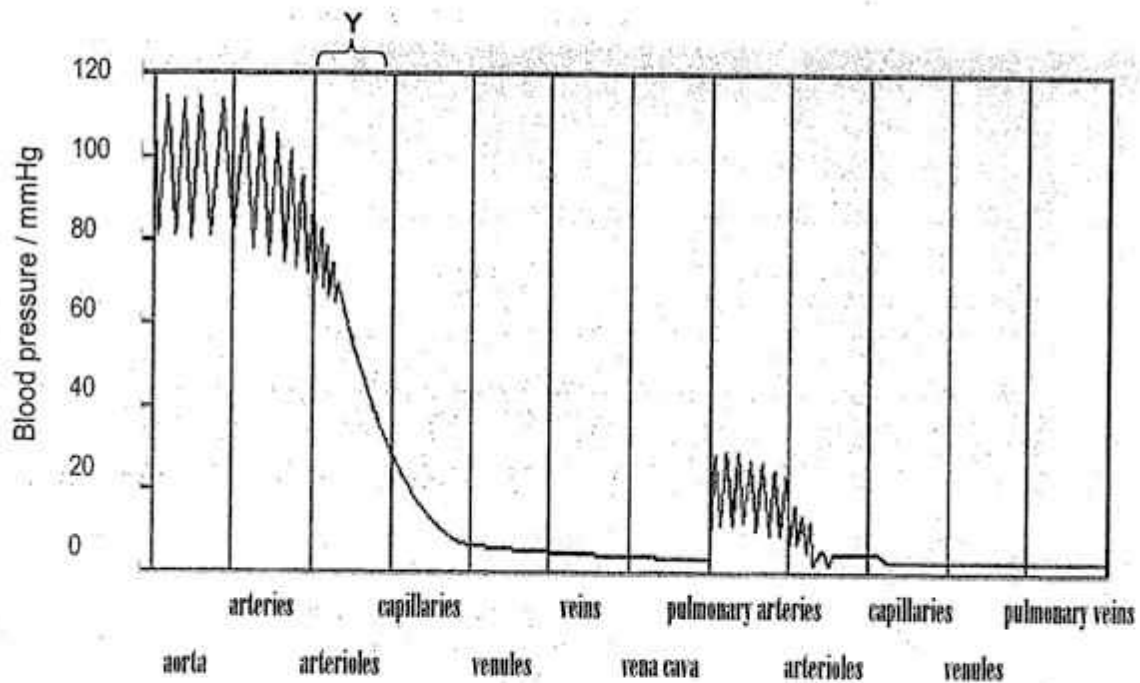
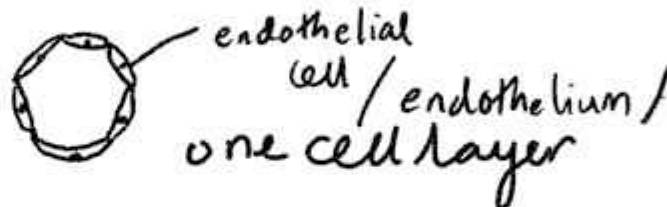


Figure 5.1

- a) Explain why the blood pressure decreases so rapidly in region Y. [2]
- • Arteries are dividing into many arterioles;
 - • with a larger total cross-sectional area (all arterioles combined), pressure is greatly reduced / greater resistance due to larger surface area so blood flow slows down.
 -
 -
- b) In the space below, draw a labeled diagram to show the cross-sectional view of a blood capillary. [1]



- c) Give **two** reasons to explain how a return flow to the heart is possible when the pressure in the veins is so low. [2]

- Prevention of backflow by semi lunar valves;
- Massaging effect of (skeletal) muscles/ movement of skeletal muscles help push the blood along;
- Relaxing heart muscles cause pressure in heart to become lower than in veins;

(any 2 valid points)

- d) Figure 5.2 shows a blocked artery being treated with the use of a stent (small tube of stainless steel mesh). A balloon with the stent is inserted into the artery and inflated. The balloon is then removed and the stent remains inside the artery.

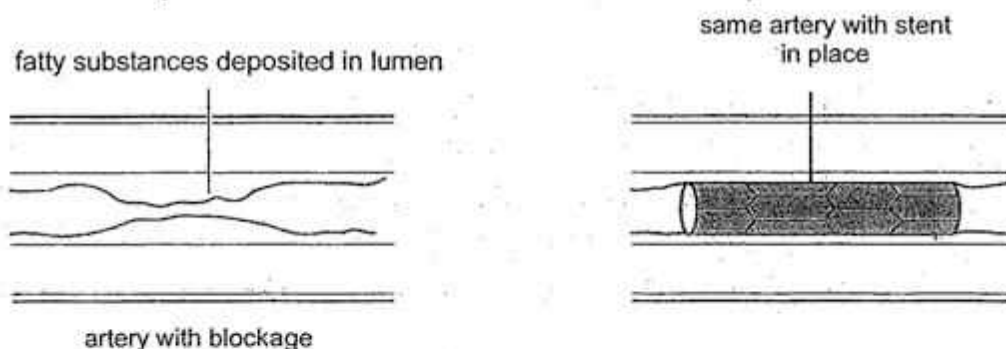


Figure 5.2

- (i) Suggest why the artery wall 'bounces back' when the balloon is removed. [1]
- Presence of elastic tissue in walls of artery;

- (ii) Explain why the ability of the artery wall to bounce back is important in a normal, healthy artery. [2]

- Walls can stretch and recoil;
- helps to push the blood along / to maintain continuous blood flow / to even out fluctuations in pressure;

[Total: 8 Marks]

6. Figure 6.1 illustrates a theoretical relationship between a population of foxes and a population of rabbits over a period of time.

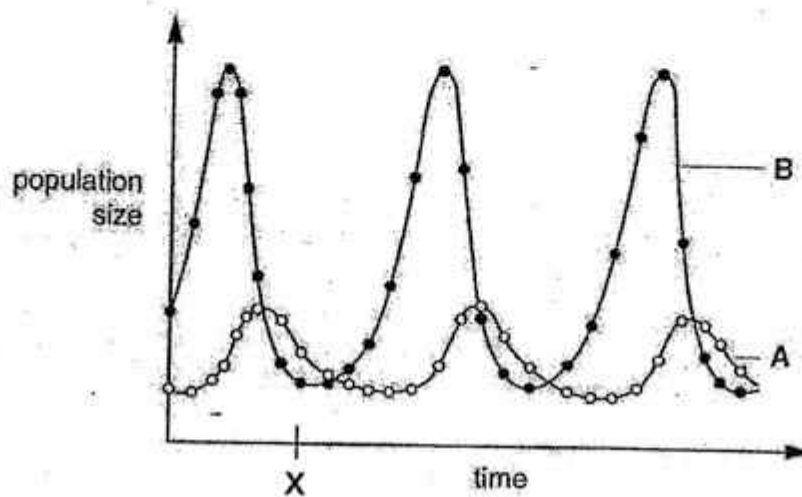


Figure 6.1

- (a)(i) State which curve, A or B, represents the fox population.

[1]

A

- (ii) With reference to Figure 6.1, describe and explain one feature on which you based your answer to a)(i).

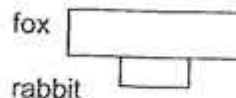
[2]

The average population size of rabbits (B) must be larger to have sufficient energy to support the fox population (A) due to energy loss between successive trophic levels, rabbit population can only support a smaller fox population; OR
When population size of B declines, population size of A also declines soon after, indicating that A is likely to depend on B for its survival.

- (b)(i) Describe what a pyramid of biomass represents. [1]

Represents the dry mass of organisms at each trophic level at any one time.

- (ii) With reference to Figure 6.1, draw a likely pyramid of biomass made up of two trophic levels, to represent the fox and rabbit populations at time = X. Label the two trophic levels as "fox" and "rabbit". [1]



- (c) Figure 6.2 illustrates the relationship among various entities in a habitat.

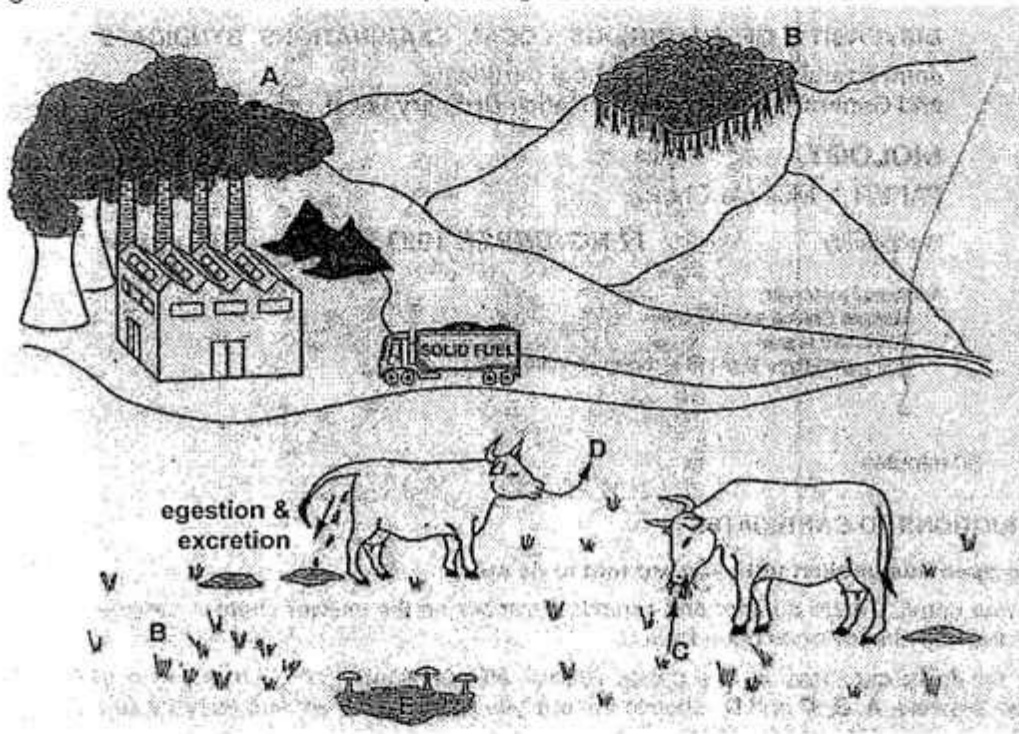
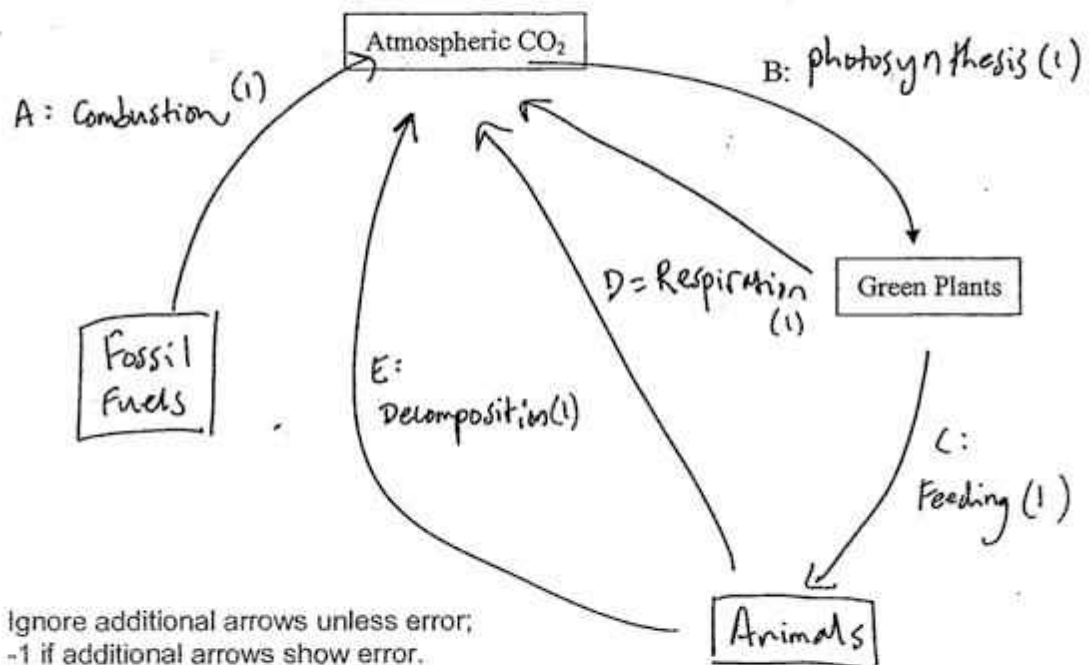


Figure 6.2

With reference to Figure 6.2, complete the flow diagram below to show the carbon cycle. Your diagram should illustrate the relationships among the entities in the habitat and include the identities of processes A to E. [5]

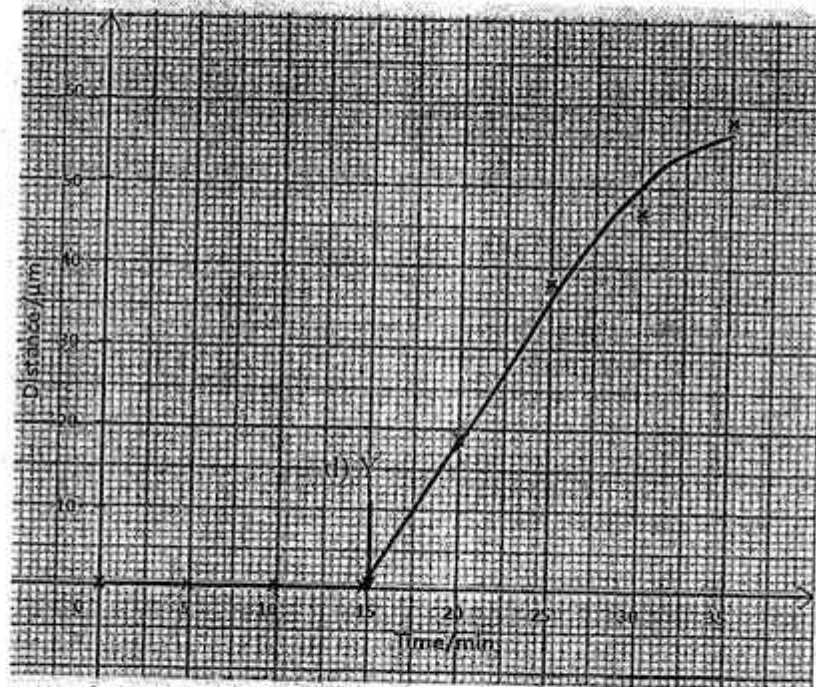


Section B

7a Increases from 2au to 4au;
DNA replication taking place/duplication of DNA or chromosomes;

7b Cytokinesis/cell division takes place;

7c



Points plotted correctly;
Smooth best fit curve;

7ei Alters the shape of the active site;
Active site no longer complementary to shape of substrate/ centromere region no longer able to fit into the active site;
Unable to form enzyme-substrate complex to give product (2 max)

7eii Four

8a Substitution of one nucleotide;

8b A gene mutation is a change in the structure of a gene/sequence of bases/nucleotides that make up a gene;
Chromosomal mutation is a change in the number (or structure) of chromosomes;

8c Individual 1 has genotype HbAHbS or HbSHbS;
Offspring (individual 5) has a severe form of the disease/genotype HbSHbS;
Therefore individual 1 must have at least one HbS allele;
The other allele could be HbA since individual 6 is a heterozygote who could have inherited the HbA from individual 1.

8d Parent phenotype: Mild form x Healthy
Parent genotype: HbAHbS x HbAHbA [1]

Gametes: HbA HbS HbA HbA [1]

Random fertilization

Offspring genotype: HbAHbA HbAHbA HbAHbS HbAHbS [1]

Offspring phenotype: Healthy:Mild form

Phenotypic ratio: 1:1

Probability of having one HbS allele = $\frac{1}{2}$ [1]

Improper labeling -1

No labeling -2

Not simplest ratio -1

9 EITHER

Maintenance of constant internal environment;

Amino acids brought to cells to form proteins/protoplasm (assimilation);

Excess are deaminated in liver;

To form urea;

Excreted by kidneys;

Decrease in water potential of blood;

Detected by hypothalamus;

Pituitary gland releases more ADH;

Kidney nephrons reabsorb more water;

So less water is lost in concentrated urine.

9 OR

a)

- Is immediate;

- In response to the stimulus of dust entering the eye;

- Happens without conscious control;

b) Stimulation of itch receptors generates a nerve impulse;

Sent via sensory neurone;

To CNS/brain

Where it crosses a synapse to a relay neurone;

(Relay neurone then conveys impulse from brain to spinal cord)

Across another synapse to a motor neurone;

Finally across motor end plate to effector muscle (biceps) in arm;

Which contracts to cause raising of arm.



Class	Index Number	Name
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XINMIN SECONDARY SCHOOL

新民中学

SEKOLAH MENENGAH XINMIN

PRELIMINARY EXAMINATION 2012

BIOLOGY

5094/01

Paper 1

30 Aug 2012

1 hour

Additional Materials required: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

Setter: Mr. Michael Rodrigues

Parents' Signature:

Moderator: Mrs. Seetoh Lai Yip

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

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

Shade the lozenge that corresponds to your index number on the Answer Sheet in **soft pencil**.

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.

- 1 Fig. 1.1 shows a smooth muscle cell.

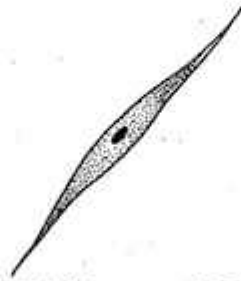


Fig. 1.1 (Source: UCLES)

Which structures are present in both the smooth muscle cell and the red blood cell?

- A cell membrane
 - B cell membrane and cytoplasm
 - C cell membrane, cytoplasm and nucleus
 - D nucleus
- 2 Cellulose and lignin are substances that may be found in the cell walls of plant cells. Fig. 2.1 shows part of a vascular bundle from a plant.

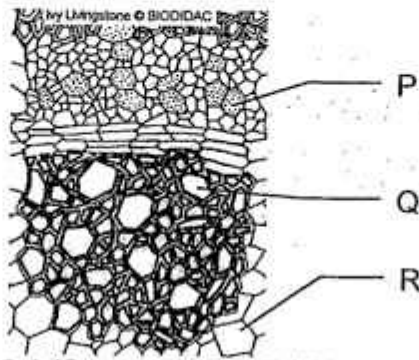


Fig. 2.1 (Source: BIODIDAC)

Which substances are present in the cell walls of cells P, Q and R?

	cellulose	lignin
A	P, Q, R	P, Q, R
B	P, Q, R	P, Q
C	P, Q, R	Q
D	P, R	Q

- 3 Fig. 3.1 shows a photomicrograph of an animal cell as seen under an electron microscope.

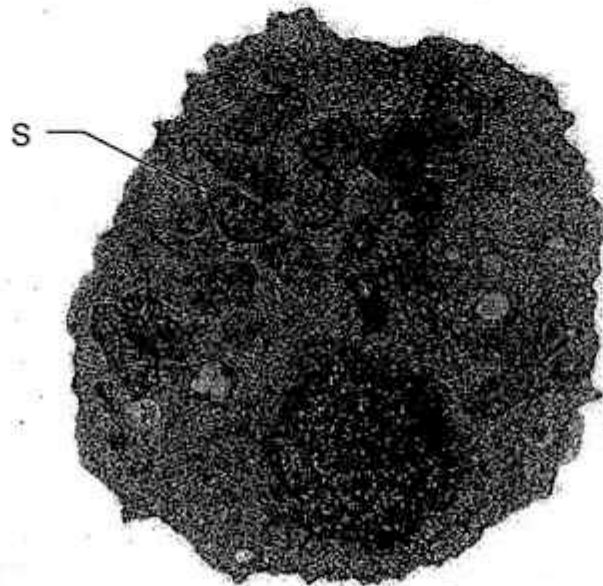


Fig. 3.1 (Source: Unknown)

What is structure S?

- A Golgi apparatus B mitochondrion
C smooth endoplasmic reticulum D rough endoplasmic reticulum
- 4 Fig. 4.1 shows an experiment using a partially permeable membrane.

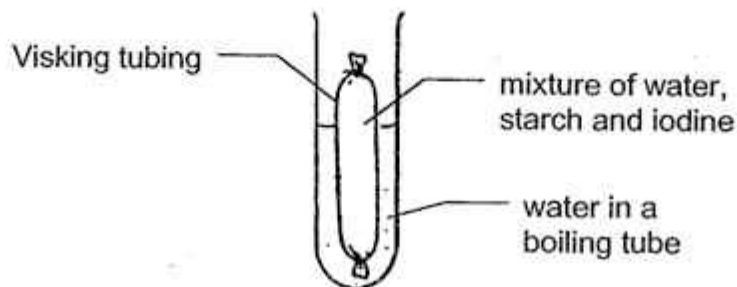


Fig. 4.1

What is the name of the process responsible for the movement of iodine molecules into the surrounding water?

- A absorption B active transport C diffusion D osmosis
- 5 Which substance enters a root hair cell by active transport?
- A carbon dioxide B nitrate ions C oxygen D water

Question 6 and 7 refer to Fig. 6.1.

Cooked rice was pressed into the shape of a cube with a mass of 10 g. Fig. 6.1 shows an experiment to investigate the action of amylase on a 10 g cube of cooked rice. After 20 minutes at 20°C, 2.5 g of starch was converted into maltose.

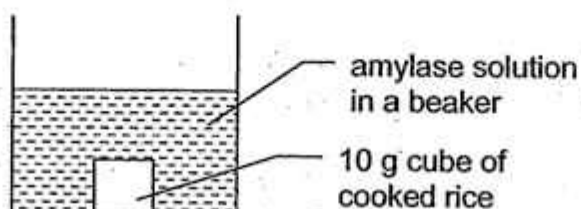


Fig. 6.1

- 6 How much starch would be digested if the experiment was repeated at a temperature of 30°C?
- A 0.0 g B 1.5 g C 2.5 g D 5.0 g
- 7 At the end of 20 minutes, food tests using Biuret and Benedict's solutions were conducted on a sample of amylase solution.

What was the final colour observed for each food test?

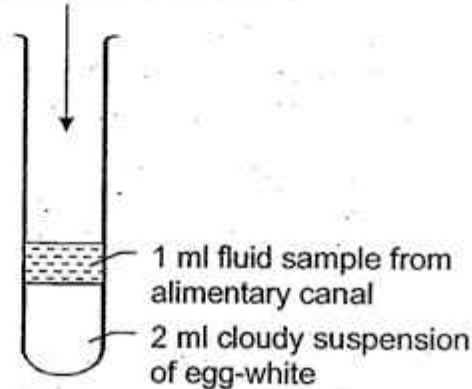
	Biuret	Benedict's
A	purple	brick red
B	purple	blue
C	blue	brick red
D	blue	blue

- 8 Which two structures produce substances involved in the digestion of fat?
- A liver and gall bladder B liver and pancreas
C stomach and gall bladder D stomach and pancreas

- 9 Fig. 9.1 shows an experiment where samples of 4 fluids were taken from the alimentary canal and added to 4 different test-tubes containing a cloudy suspension of egg-white. Hydrochloric acid was added to the mixtures in the test-tubes. The test-tubes containing the mixtures were then placed in a water bath maintained at 37°C for 20 minutes. If a protease present in the fluid digests the protein in the egg white, the cloudy suspension will turn clear.

5 drops of hydrochloric acid added

Fig. 9.1



Fluid samples from alimentary canal

1. saliva
2. gastric juice
3. pancreatic juice
4. intestinal juice

Which fluid samples turned the cloudy egg-white suspension clear?

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

- 10 Fig. 10.1 shows part of the circulatory system. The arrows indicate the direction of blood flow.

After a meal, which blood vessel will contain blood with the most amino acids?

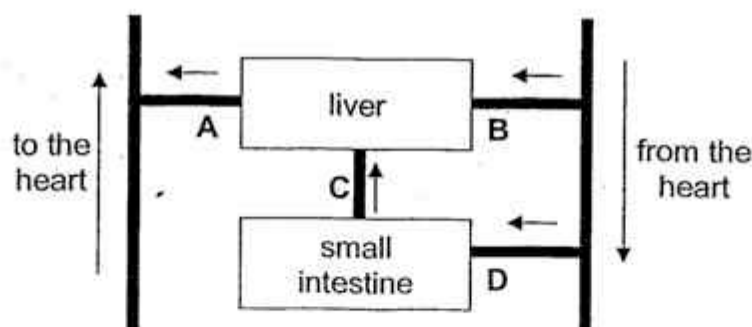


Fig. 10.1

- 11 Fig. 11.1 shows an experimental set-up that can be used to investigate photosynthesis. The rate of photosynthesis is measured by counting the number of bubbles released per minute.

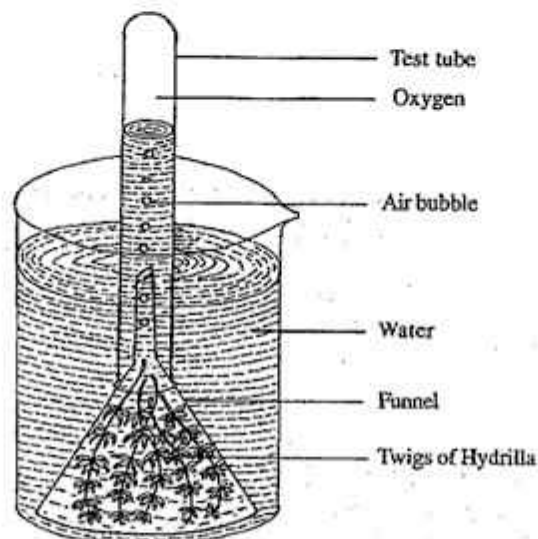
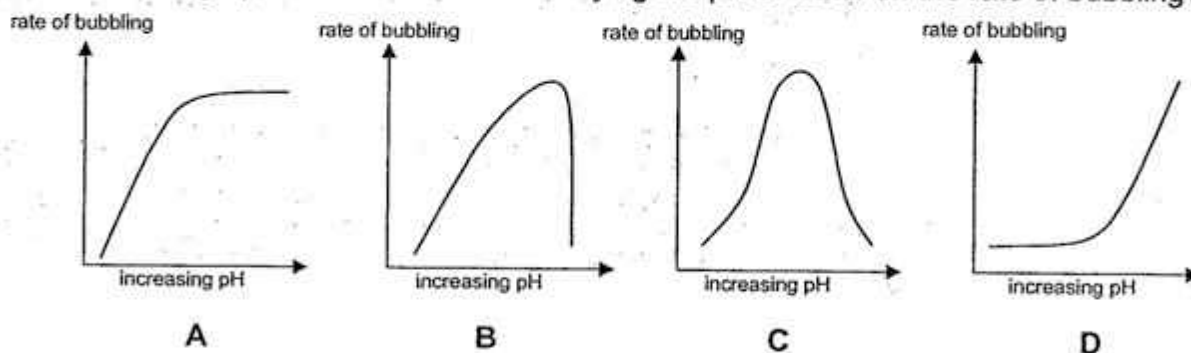


Fig. 11.1 (Source: www.tutornext.com)

Which graph shows the effect of varying the pH of water on the rate of bubbling?



- 12 What is the function of the companion cell found in the phloem of a plant?

- A develop into sieve tubes cells
- B supply energy to the surrounding cells
- C transport sucrose and amino acids
- D transport water and minerals

- 13 Fig. 13.1 shows the arrangement of cells inside a green leaf. In which layers is chlorophyll present?

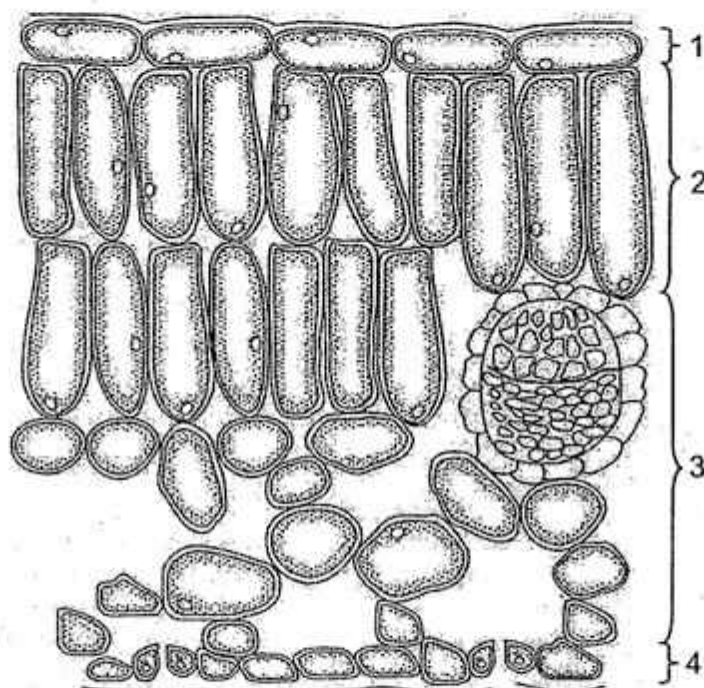


Fig. 13.1 (Source: UCLES)

- A 1, 2, 3 and 4
 B 2 only
 C 2 and 3
 D 2, 3 and 4
- 14 Which combination of factors results in the highest rate of water loss from the aerial parts of a plant?

	humidity	light intensity	temperature
A	high	high	low
B	high	low	high
C	low	high	high
D	low	low	low

- 15 Fig. 15.1 shows an experiment to investigate the transport of water in a stalk of celery using a coloured dye.

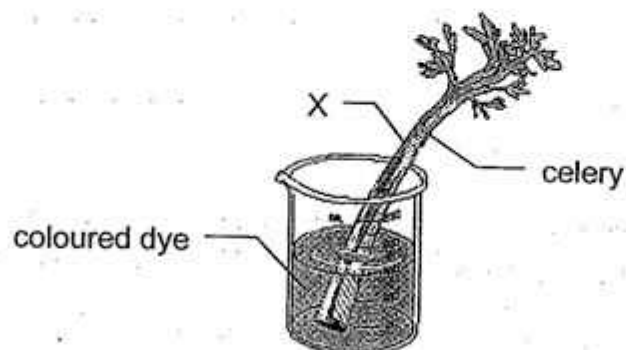


Fig. 15.1 (Source: Unknown)

Fig. 15.2 shows a section through the celery stalk taken at X after one hour. The section shows the arrangement of the vascular bundles.

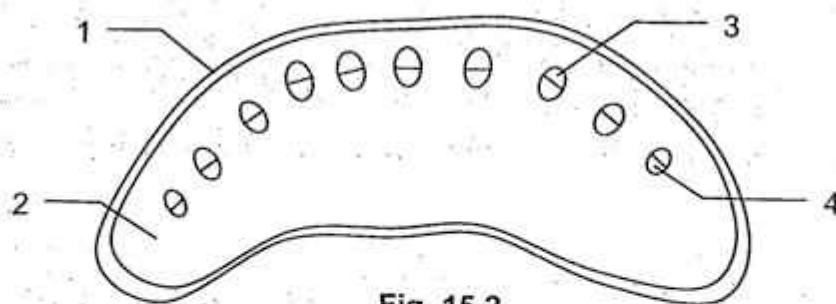


Fig. 15.2

Which region was most stained by the dye?

- A 1, 2, 3 and 4
 - B 2, 3 and 4
 - C 3 and 4
 - D 4 only
- 16 What happens to the bicuspid valve and aortic semi-lunar valve of the heart when the muscles of the ventricles contract?

	bicuspid valve	aortic semi-lunar valve
A	closed	closed
B	closed	opened
C	opened	closed
D	opened	opened

- 17 The allele I^A may be combined with other alleles to determine a person's blood group. What will happen when blood from donors with genotypes $I^A I^O$, $I^A I^A$ and $I^A I^B$ are mixed in a transfusion with the blood of a recipient with genotype $I^O I^O$?

	$I^A I^O$	$I^A I^A$	$I^A I^B$
A	-	-	-
B	-	-	+
C	-	+	+
D	+	+	+

Key: + : agglutination - : no agglutination

- 18 What is the state of the following muscles when a person inhales?

	diaphragm muscle	external intercostal muscles
A	contracted	contracted
B	contracted	relaxed
C	relaxed	contracted
D	relaxed	relaxed

- 19 What is the approximate content of oxygen and carbon dioxide in exhaled air?

	oxygen	carbon dioxide
A	16%	0.03%
B	21%	4%
C	16%	4%
D	21%	0.03%

20 Which substance in cigarette smoke damages the inner wall of blood vessels?

- A carbon monoxide B cholesterol C nicotine D tar

21 In which of the following organs is urea formed?

- A kidneys B liver C pancreas D urinary bladder

22 Fig. 22.1 shows the kidney and tubes associated with it. The arrows indicate the direction of flow of fluids within the tubes.

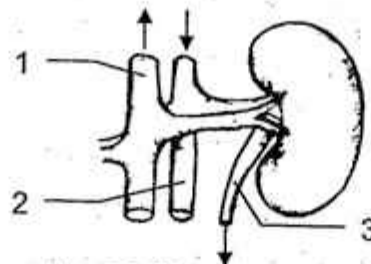


Fig. 22.1 (Source: UCLES)

Where will urea be found in significant amounts?

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

23 Which of the following describes the condition of the blood vessels and sweat glands of the skin after a period of exercise?

	blood vessels	sweat glands
A	constricted	inactive
B	contracted	inactive
C	dilated	active
D	relaxed	active

24 Which part coordinates osmoregulation in the body?

- A hypothalamus B kidney tubules
C pituitary gland D sweat glands

25 What explains why the rate of heat loss in a young mammal is greater than that in an adult mammal?

- A The younger mammal consumes more fat and carbohydrate from milk.
- B The younger mammal has a higher surface area to mass ratio.
- C The younger mammal's sweat glands are less active.
- D The younger mammal is still growing.

26 What is the effect of an increase in the levels of the following hormones on the concentration of glycogen in the liver?

	adrenaline	glucagon	insulin
A	increase	decrease	increase
B	increase	increase	decrease
C	decrease	decrease	increase
D	decrease	increase	decrease

27 Which of the following transmits the nerve impulse from the central nervous system that results in the secretion of adrenaline by the adrenaline gland?

- A motor neurone
- B receptor
- C relay neurone
- D sensory neurone

28 Fig. 28.1 shows a grass flower. In which one of the labelled structures do pollen tubes develop?

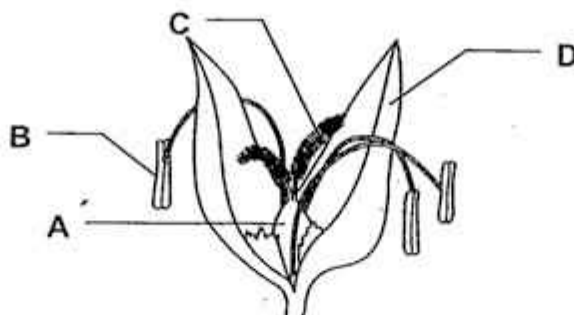


Fig. 28.1 (Source: UCLES)

- 29 Fig. 29.1 shows how an offspring can result from a parent using a method of vegetative propagation known as layering.

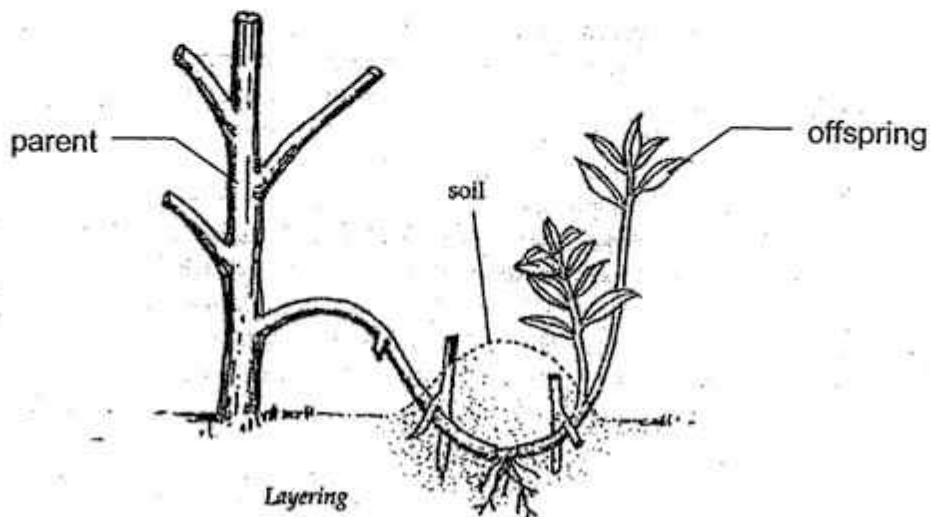


Fig. 29.1 (Source: Marshall Cavendish Education)

Which of the following statements about the offspring is **true**?

- A It is likely to be more resistant than its parent to disease.
 - B It is likely to develop into a new variety.
 - C It is likely to grow bigger than its parent.
 - D It is likely to have the same flower colour as its parent.
- 30 In the human foetus, what is the concentration of oxygen in the following blood vessels?

	umbilical vein	umbilical artery
A	low	high
B	low	low
C	high	high
D	high	low

- 31 Some steps in the production of genetically engineered insulin are listed below.
1. Isolate the insulin gene
 2. Cut a bacterial plasmid
 3. Insert insulin gene into bacterial plasmid
 4. Insert modified plasmid into bacterium
- Which steps involve the use of enzymes?

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

- 32 During which stages of meiosis do crossing over and independent assortment of chromosomes occur?

	crossing over	independent assortment
A	prophase I	prophase II
B	prophase I	metaphase I
C	metaphase I	anaphase I
D	metaphase I	anaphase II

- 33 Which stage of the cell cycle marks the end of mitosis?

A cytokinesis B interphase C prophase D telophase

- 34 Which of the following describes a gene?

A It is a segment of deoxyribonucleic acid.
 B It is made up of a sugar, a phosphate group and a nitrogen-containing base.
 C It may be dominant, recessive or co-dominant.
 D It speeds up the production of proteins in a cell.

- 35 What is the cause of sickle cell anaemia?

A A deficiency of iron in the diet
 B A mutation that results in a change in chromosome number
 C A mutation that results in a chemical change to the gene
 D An infection by the malaria-causing parasite

- 36 Which of the following characteristics show discontinuous variation?

1. gender 2. height 3. blood group 4. eye colour

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

- 37 A pure-breeding black-haired goat was crossed with a pure-breeding white-haired goat. All the goats of the first generation had grey-haired coats. If the grey-haired goats were mated what percentage of black-haired goats could be expected in the second generation?

A 0% B 25% C 50% D 75%

Questions 38 and 39 refer to the food chain below.

1. mango tree → 2. aphids → 3. bird → 4. blood-sucking ticks

38 Which of the following organisms in this food chain are likely to cause an inverted pyramid of numbers?

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

39 Which organism is the secondary consumer?

- A 1 B 2 C 3 D 4

40 Fig. 40.1 shows the various stages in the treatment of sewage.

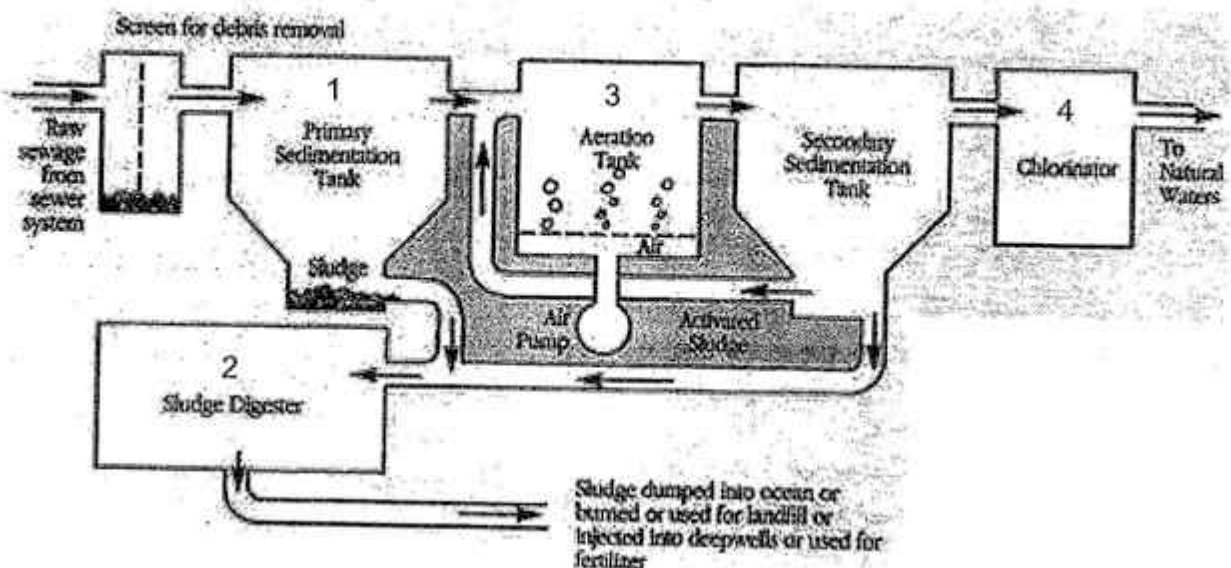
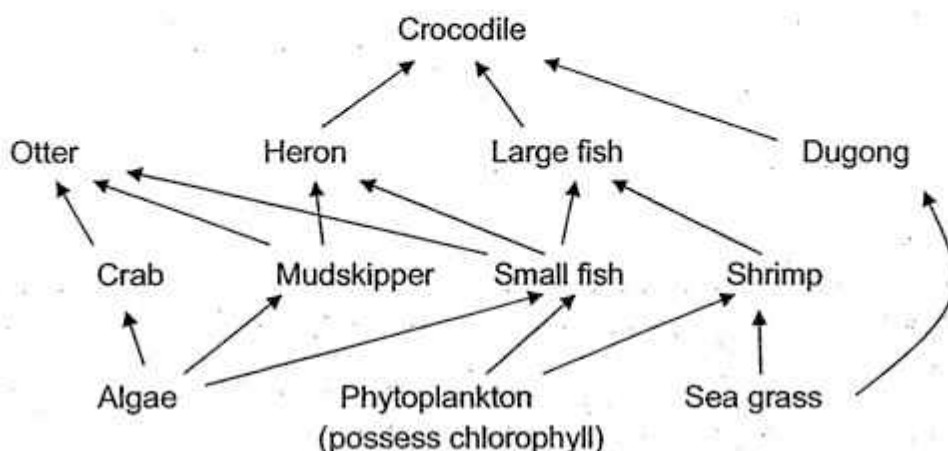


Fig. 40.1 (Source: www.filtronics.com)

In which stages are microorganisms used to treat sewage?

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

- 5 The food web below shows the feeding relationships between some organisms in a coastal mangrove habitat.



- (a) Name the primary consumers of the food web.

_____ [1]

- (b) The loss of which producer will have the greatest impact on the stability of the food web? Give a reason for your answer.

_____ [2]

- (c) The pollution of the coastal mangrove habitat by pesticide runoff resulted in a drop in the crocodile population. Explain how this may have happened.

_____ [3]

[Total: 6]

Section B [30 marks]

Answer **three** questions.

Question 8 is in the form of an **Either / Or** question.

Only one part should be answered.

Draw your graph on the graph paper provided.

Write your answers on the writing paper provided.

- 6 An investigation was carried out into the rate of urine production in humans. Twenty people fasted overnight, then, at 8.00 a.m., emptied their bladders. Ten people then each drank 1 litre of water, while the other ten (the control group) drank nothing. All twenty then remained at rest and emptied their bladders every half an hour for 2.5 hours. The mean volume of urine produced every half hour, by each of the two groups, was recorded. **Table 6.1** shows the results of the investigation.

Time / min	Mean Volume of Urine / ml	
	Drank 1 litre of water	Control
30	60	25
60	285	10
90	290	35
120	190	15
150	65	10

Table 6.1

- (a) Plot graphs using the data in **Table 6.1** to show the mean volume of urine produced by both groups of people over a period of 2.5 hours. [4]
- (b) Explain the difference between the results for the group who drank water with those for the control group. [4]
- (c) Suggest how the results for the group who drank water might have differed if they had exercised during the experiment. Explain your answer. [2]

[Total: 10]

7 Explain the importance of the following structures in the human body.

(a) cilia; [5]

(b) villi. [5]

[Total: 10]

8E (a) With reference to photosynthesis explain the term *limiting factors*. [4]

(b) Describe how nitrates from the soil reach a mesophyll cell. [6]

[Total: 10]

8O (a) Describe an experiment to investigate the effect of varying concentrations of carbon dioxide on the rate of photosynthesis. [6]

(b) Suggest how food from a plant benefits a parasitic insect such as an aphid. [4]

[Total: 10]

END OF PAPER

Class	Index Number	Name
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XINMIN SECONDARY SCHOOL

新民中学

SEKOLAH MENENGAH XINMIN

PRELIMINARY EXAMINATION 2012

BIOLOGY

5094/02

Paper 2

22 Aug 2012

1 hour 45 minutes

Additional Materials required: Graph paper and writing paper

Setter: Mr. Michael Rodrigues

Parents' Signature:

Moderator: Mrs. Seetoh Lai Yip

READ THESE INSTRUCTIONS FIRST

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

Section A

Answer **all** questions.

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

Section B

Answer **three** questions.

Question 8 is in the form of an **Either / Or** question. Only one part should be answered.

Draw your graph on the graph paper provided. Write your answers on the writing paper provided.

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 your answers for Section B securely together.

Hand in the Question Paper and your answers for Section B **separately**.

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

For Examiner's Use	
Section A	50
Section B	30
Total	80

This document consists of 11 printed pages (inclusive of the cover page).

[Turn over

Section A [50 marks]

Answer **all** questions.

Write your answers in the spaces provided.

- 1 **Fig. 1.1** shows apparatus set up to investigate the movement of substances where the Solution X and Y was varied by using either 1% or 10% sugar solution. **Fig. 1.2** and **Fig. 1.3** show two possible results of the investigation.

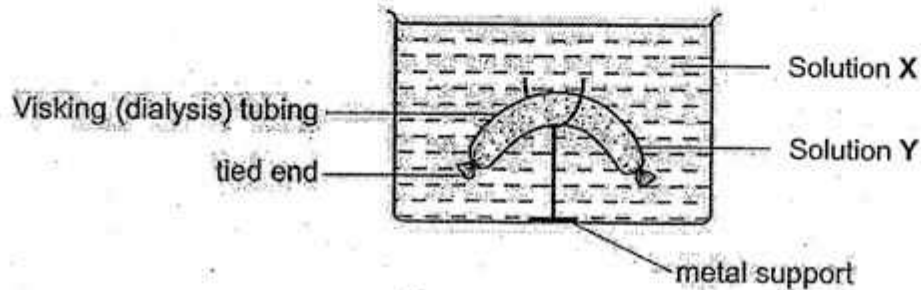


Fig. 1.1 (Source: UCLES)

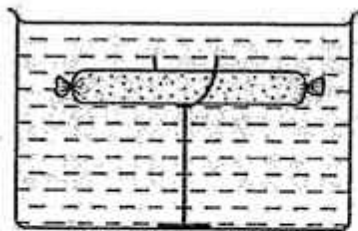


Fig. 1.2 (Source: UCLES)

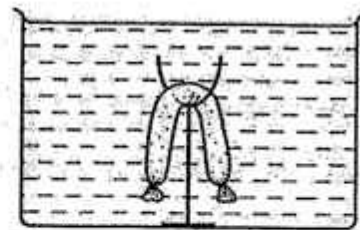


Fig. 1.3 (Source: UCLES)

- (a) Name and describe the process being investigated.

[3]

- (b) Explain the differences in the results shown in **Fig. 1.2** and **Fig. 1.3**.

[5]

[Total: 8]

- 2 The table below shows the diploid number of chromosomes found in the nuclei of some animal cells.

Animal	Diploid Number
Human	46
Donkey	62
Horse	64

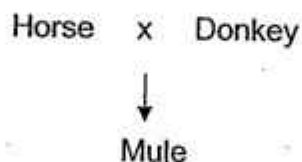
- (a) Explain what is meant by the term *diploid number*.

[1]

- (b) Which cells in the human body do not contain the *diploid number* of chromosomes?

[2]

- (c) A donkey and a horse are similar in structure. If they mate they can produce a hybrid organism called a mule.



- (i) What would be the number of chromosomes found in the body cells of a mule? Explain your answer.

[2]

- (ii) When two mules are mated, they are unable to produce offspring and are described as infertile. Suggest an explanation for this infertility.

[2]

- (d) Explain why genetic variation that results from meiosis is different from the variation that results from mitosis.

[4]

[Total: 11]

- 3 Some diet supplements are designed to replace a meal. This diet may help people lose weight.

An investigation was set up to test a supplement to find out what it contained. The results of three food tests are recorded in the table below.

Tested for	Reagent	Colour at start	Colour at end	Result
Glucose		blue	brick red	
Starch	Iodine			present
	Biuret	blue		present

- (a) Complete the table by writing the correct word in each empty box. [3]

- (b) In the test for glucose, explain how you could heat the reagent and sample safely.

[2]

- (c) If the diet supplement is used to replace a meal, suggest **two** other components that are needed to ensure a balanced diet. For each component you suggest, describe its role in the body.

1.

[2]

2.

[2]

(d) Starch and glucose are both carbohydrate molecules.

(i) State **one** difference between the properties of these molecules.

[1]

(ii) Describe how this difference relates to their function in plants.

[4]

[Total: 14]

- 4 In one year in Country K, 20 030 people died from different diseases linked to cigarette smoking. The table below shows the percentage of people dying from the different diseases.

Cause of Death	%
Cancer, including lung cancer	39.7
Heart disease	21.2
Chronic bronchitis and emphysema	20.1
Others, including stroke	18.3
Passive smoking	0.7

- (a) Calculate how many of the 20 030 people died from cancer. Show your working. Give your answer to a whole number.

Answer: _____ [2]

- (b) Explain the relationship between emphysema and cigarette smoking.

[4]

(c) Cigarette smoking is not the only factor that can increase the risk of heart disease.

(i) Name **two** other factors that can increase the risk of heart disease.

1. _____

2. _____ [2]

(ii) Explain how heart disease may lead to death.

_____ [3]

[Total: 11]



XINMIN SECONDARY SCHOOL

新民中学

SEKOLAH MENENGAH XINMIN

Preliminary Examination 2012

Subject : Biology Paper 1 (5094/1)
Level : Secondary 4 Express
Duration : 1 hour
Date : 30 Aug 12
Setter : Mr Michael Rodrigues
Moderator : Mrs Seetoh Lai Yip

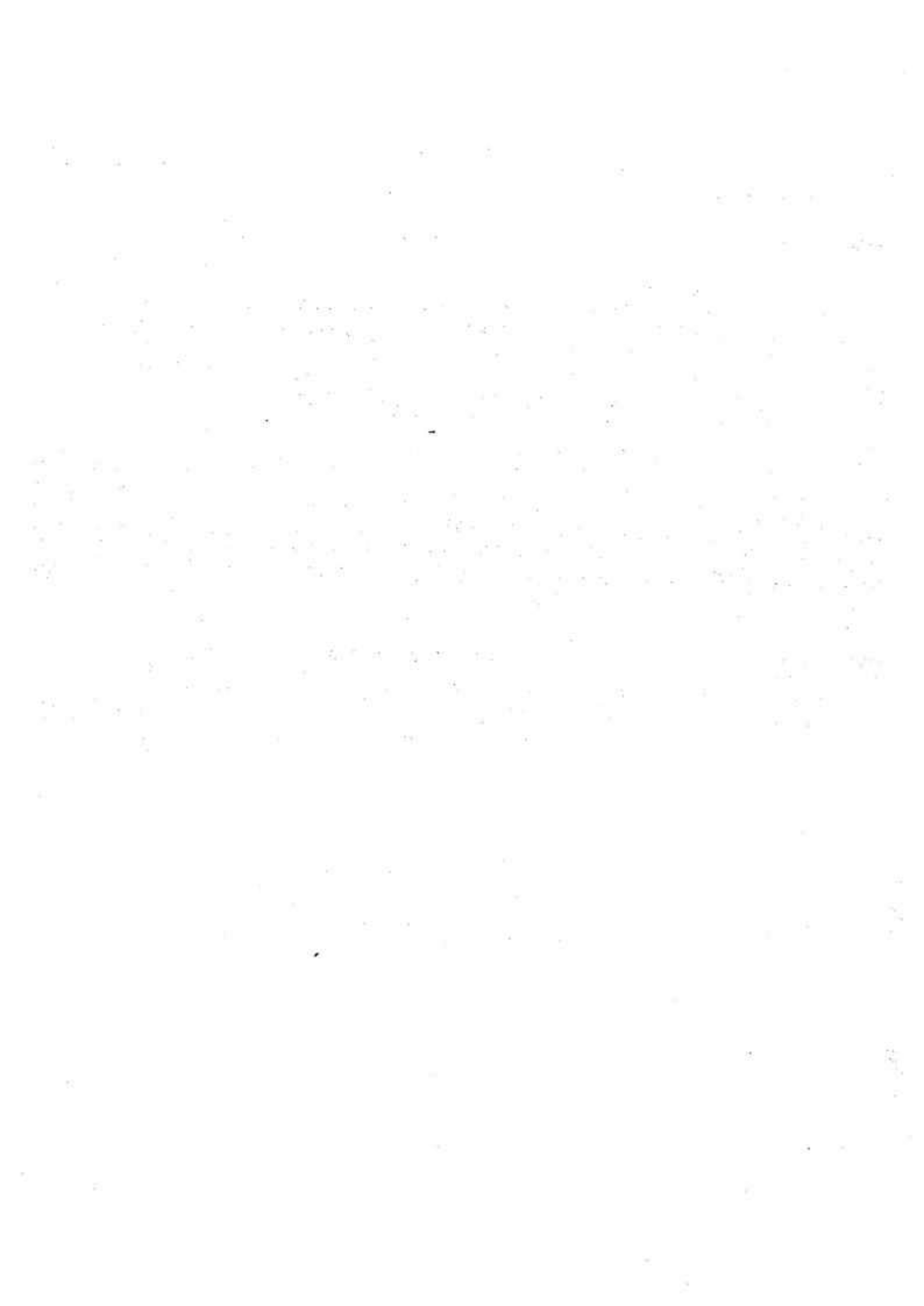
KEY

No.	Key
1	B
2	C
3	B
4	C
5	B
6	D
7	A
8	B
9	C
10	C

No.	Key
11	C
12	B
13	D
14	C
15	D
16	B
17	D
18	A
19	C
20	A

No.	Key
21	B
22	C
23	C
24	A
25	B
26	C
27	A
28	C
29	D
30	D

No.	Key
31	B
32	B
33	D
34	A
35	C
36	C
37	B
38	B
39	C
40	C





XINMIN SECONDARY SCHOOL
新民中学
SEKOLAH MENENGAH XINMIN
Preliminary Examination 2012

Subject : Biology (5094)
Level : Secondary 4 Express
Duration : 1 hour 45 minutes
Date : 22 Aug 12
Setter : Mr Michael Rodrigues
Moderator : Mrs Seetoh Lai Yip

MARK SCHEME

Symbols and abbreviations used in mark scheme

; – separates points for the award of a mark
/ – separates alternatives for a marking point
ref. – makes reference to
() – points within brackets need not be in the answer for a mark to be awarded
cf. – compared to
e.c.f. – error carried forward
wrt – with respect to
R – reject
I – ignore/irrelevant
A – accept
AW – alternative wording

Q No.	Marking Points	Part Marks	Examiner's Remarks
1(a)	<ul style="list-style-type: none"> • <u>osmosis</u> ; • movement of <u>water</u> molecules from a region of high <u>water potential</u> to a region of low water potential ; • across a partially/selectively permeable membrane (R semipermeable) ; 	3	
(b)	<ul style="list-style-type: none"> • (Fig. 1.2) Solution X – 1% sugar solution + Solution Y – 10% sugar solution ; • (Fig. 1.3) Solution X – 10% sugar solution + Solution Y – 1% sugar solution ; • 1% sugar has higher water potential than 10% sugar / converse ; • movement of water in the correct direction (in Fig. 1.2 or 1.3) ; • turgid (Fig. 1.2) / flaccid (Fig. 1.3); 	5	
2(a)	two sets of chromosomes / chromosomes in pairs / $2n$ / full set of chromosomes / AW ;	1	
(b)	<ul style="list-style-type: none"> • gametes ; • sperm (cells) ; • ovum / ova / egg (cells) ; 	max 2	
(c)(i)	<ul style="list-style-type: none"> • 63 ; • 31 from donkey + 32 from horse ; • 	2	
(ii)	<ul style="list-style-type: none"> • cannot form gametes / cannot form haploid / AW ; • 31.5 / (63) odd number of chromosomes / can't be halved / AW ; 	2	
(d)	<ul style="list-style-type: none"> • (mitosis) no genetic variation / (meiosis) results in genetic variation ; • (meiosis) involves gametes / haploid / reduction in chromosome number / AW ; • (meiosis) crossing over ; • (meiosis) independent assortment ; • random fertilisation / random fusion of gametes ; 	max 4	

Q No.	Marking Points	Part Marks	Examiner's Remarks
3(a)	<ul style="list-style-type: none"> Benedict's + present ; yellow/brown + black/blue-black/purple-black ; Protein + purple/violet/lilac ; 	3	
(b)	<ul style="list-style-type: none"> water bath ; (water bath) water filled to a safe level / not to the brim of the beaker / AW ; (water bath) prevents liquid spurting out of test-tube / AW ; test-tube holder ; safety-goggles ; mouth of test-tube directed away from others ; 	max 2	
(c)	<ul style="list-style-type: none"> fat / lipid ; store of energy/insulation ; fibre / roughage ; peristalsis / prevents constipation ; named mineral ; relevant function of named mineral ; (if mineral is not named award 1 mark only) named vitamin ; relevant function of named vitamin ; (if vitamin is not named, award 1 mark only) water ; solvent / transport / medium for chemical reactions / hydrolysis / other relevant functions ; 	max 4	
(d)(i)	<ul style="list-style-type: none"> smaller molecule (glucose) / larger molecule (starch) ; soluble (glucose) / insoluble (starch) ; monosaccharide (glucose) / polysaccharide (starch) ; 	max 1	
(ii)	<p>(glucose)</p> <ul style="list-style-type: none"> respiratory substrate / respiration ; energy release ; <p>(starch)</p> <ul style="list-style-type: none"> no osmotic effect / complex ; storage ; 	4	

Q No.	Marking Points	Part Marks	Examiner's Remarks
4(a)	<ul style="list-style-type: none"> • $(39.7 / 100) \times 20\ 030$; • 7 592 ; 	2	
(b)	<ul style="list-style-type: none"> • irritants / named substance ; • severe coughing / smokers' cough ; • walls of alveoli damaged/sustain loss of elasticity and form ; • capillaries surrounding alveoli break apart ; • decreased surface area for gaseous exchange ; • incomplete emptying of alveoli ; 	4	
(c)(i)	fatty diet / obesity / lack of exercise / genes / stress / alcohol / high blood pressure / age / gender / other relevant risk factors ;	max 2	
(ii)	<ul style="list-style-type: none"> • blocked (coronary) artery ; • lack of glucose ; • lack of oxygen ; • respiration hindered / reduced energy ; • lactic acid ; • heart attack / heart stops ; 	max 3	
5(a)	crab + mudskipper + small fish + shrimp + dugong ;	1	
(b)	<ul style="list-style-type: none"> • algae ; • has most number of primary consumers depending on it / sole energy source for crab and mudskipper / reference to loss of primary consumers affecting secondary and tertiary consumer ; 	2	
(c)	<ul style="list-style-type: none"> • absorbed by producers ; • non-biodegradable / cannot be metabolised (by liver) ; • ref. to bioaccumulation / stored in (fatty) tissue ; • ref. to biomagnification / bioamplification / increase in concentration along food chain / • concentrations reach a level that, are toxic to crocodiles / causes a specified harm e.g. sterility / fragile egg shells / ref. to smaller concentrations being harmless but larger concentrations being harmful to crocodiles ; 	max 3	

Q No.	Marking Points	Part Marks	Examiner's Remarks
6(a)	<ul style="list-style-type: none"> suitable scale (graphs should occupy at least half the area of the graph paper) ; both graphs plotted using the same axes + points plotted accurately + time on the x-axis + mean volume of urine on the y-axis (\pm if one plotting error, R if more than 1 plotting error) ; labels + units (\pm for one instance of missing units, R if more than 1 instance of missing units, R for any missing labels) ; best fit line drawn + graphs do not extrapolate beyond 30 min and 150 min ; 	4	
(b)	<ul style="list-style-type: none"> increase in water potential of blood plasma ; stimulates hypothalamus ; less ADH secreted (by pituitary gland) ; decreased reabsorption of water by kidney tubules ; more urine produced / urine more dilute ; 	4	
(c)	<ul style="list-style-type: none"> less urine ; water loss through sweating / sweating lowers water potential of blood plasma ; 	2	
7(a)	<ul style="list-style-type: none"> trachea/bronchus/bronchiole ; movement of mucus ; keeps air clear of dirt/pathogens ; oviduct ; movement of ovum ; positions ovum for fertilisation ; movement of zygote to uterus for implantation ; 	max 5	
(b)	<ul style="list-style-type: none"> finger-like/elongated* ; increases surface area for absorption/exchange* ; small intestine / jejunum ; glucose + capillary / respiration ; fat + lacteal / energy store / cell membrane ; embryonic villi ; placenta ; two named substances + correct direction of movement in relation to the blood capillary ; <p>*either for small intestine or embryonic villi</p>	max 5	

Q No.	Marking Points	Part Marks	Examiner's Remarks
8E(a)	<ul style="list-style-type: none"> • necessary for photosynthesis to occur; • at least two named factors; • the one in the shortest supply; • controls the rate at which photosynthesis occurs; • even though others are plentiful; 	max 4	
(b)	<ul style="list-style-type: none"> • roots / root hair cells ; • active transport ; • in solution / dissolved ; • diffusion ; • xylem ; • root pressure ; • capillarity ; • transpiration pull/stream ; 	max 6	
8O(a)	<ul style="list-style-type: none"> • describes replicable setup in words or a diagram ; • describes how concentration of carbon dioxide is varied ; • describes how rate of photosynthesis is measured ; • describes how temperature is kept constant ; • describes how light intensity is kept constant ; • describes one measure taken to minimise experimental errors ; • describes how the results are interpreted ; 	max 6	
(b)	<ul style="list-style-type: none"> • phloem ; • sugar / sucrose (R glucose/starch) ; • source of energy ; • amino acids ; • protein synthesis / growth / repair / enzymes ; 	max 4	
Total		90	



ZHONGHUA SECONDARY SCHOOL

PRELIMINARY I EXAMINATION 2012

Name of Pupil : _____ ()
Class : 4E__
Subject / Code : BIOLOGY / 5094 / 01
Level : Secondary 4 Express
Date : 10 July 2012
Duration : 1 hour
Set by : Mr Tan Li Chun
Vetted by : Ms Rozianna Affendi

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your name and register number on the Answer Sheet in the spaces provided unless this has been done for you.

There are **forty** questions in this paper. Answer **all** questions. For each question, there are 4 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.

- 1 A plant root hair cell and a human red blood cell are specialized cells.

Which of the following best describes the root hair cell and human red blood cell?

- A Both cells contain haemoglobin.
- B Both cells have a cellulose cell wall.
- C Both cells contain a diploid DNA content.
- D Both cells have a large surface area to volume ratio.

- 2 The small intestine contains a low concentration of glucose as a result from the digestion of starch.

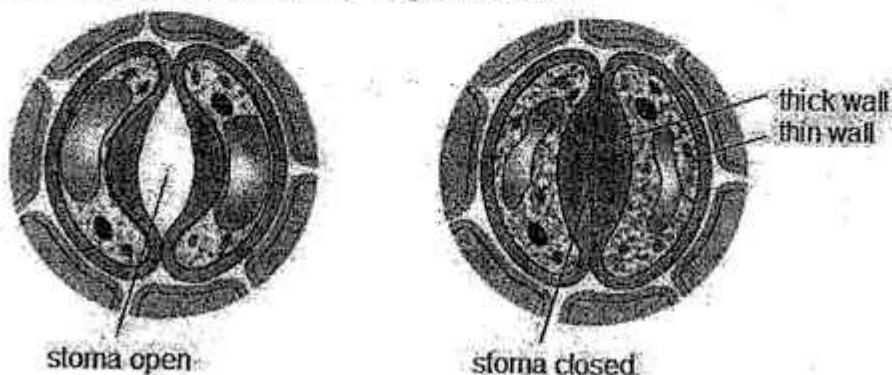
Which describes the uptake of glucose molecules into the cells of the villi?

- A by active transport against the concentration gradient
- B by active transport down the concentration gradient
- C by osmosis along with water molecules surrounding the glucose molecules
- D by diffusion down the concentration gradient

#

For questions 3 and 4, refer to the the diagrams below.

3



The stomata of a plant close and open according to the needs of the plant.

Which of the following statements best describes the mechanism which helps a stoma open?

- A Increase turgidity of the guard cells as water leaves the guard cells. This results in a decrease in the curvature of the guard cells.
- B Increase turgidity of the guard cells as water enters the guard cells. This results in a decrease in the curvature of the guard cells.
- C Increase turgidity of the guard cells as water leaves the guard cells. This results in an increase in the curvature of the guard cells.
- D Increase turgidity of the guard cells as water enters the guard cells. This results in an increase in the curvature of the guard cells.

- 4 The control of concentration of potassium ions, K^+ , in the guard cells is essential in regulating the opening or closing the stomata.

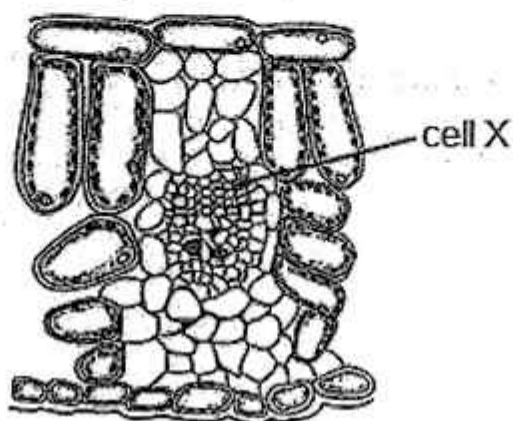
Which of the following best describes the concentration of K^+ ions in the guard cells and the mechanism which helps to maintain the concentration when the stomata is open?

	resultant concentration of K^+ ions in guard cell	mechanism
A	low	diffusion
B	low	osmosis
C	high	active transport
D	high	diffusion

- 5 Which of the following does **not** contain digestive enzymes?

- A bile
- B gastric juice
- C intestinal juice
- D saliva

- 6 The diagram below shows a cross-section of a leaf.



Samples of the contents of cell X are tested.

Which results will be obtained?

	Benedict's solution	iodine in a potassium iodide solution
A	+	+
B	+	-
C	-	+
D	-	-

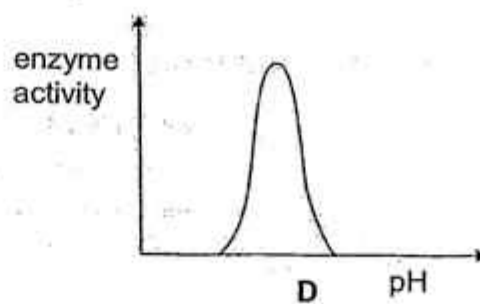
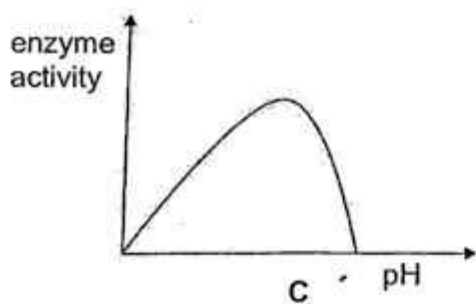
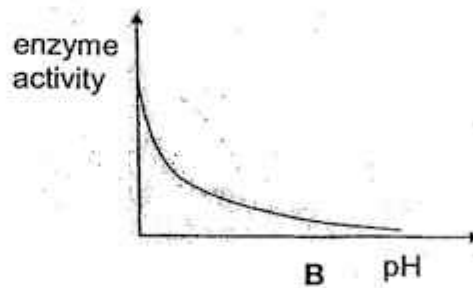
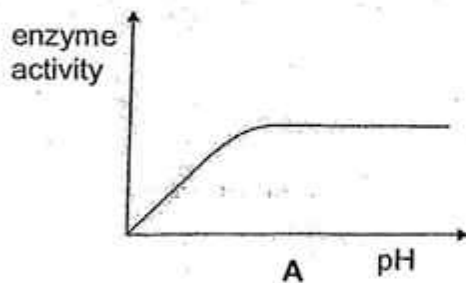
- 7 10 ml of saliva was added to each of four tubes each containing 5 ml of starch solution. The tubes were then incubated under four different conditions for 1 hour.

tube	conditions
1	incubated at 60 °C, pH 3.0
2	incubated at 36 °C, pH 3.0
3	incubated at 60 °C, pH 7.0
4	incubated at 36 °C, pH 7.0

1 ml of iodine solution was added to each tube. In which tube did a blue-black colour develop?

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

- 8 Which graph shows the correct relationship between pH and enzyme activity?



9 Listed below are elements that occur in biological molecules.

- 1 carbon
- 2 phosphorus
- 3 nitrogen
- 4 oxygen
- 5 sulfur
- 6 hydrogen

Which elements are common to carbohydrates, fats and proteins?

- | | |
|----------------|---------------------|
| A 4 and 6 only | B 1, 4 and 6 only |
| C 1, 3 and 4 | D 1, 2 4 and 6 only |

10 Due to a viral infection, a person had part of his liver surgically removed.

Which of the following is / are the expected consequence(s) of the removal of part of the liver?

- 1 lighter-coloured faeces
- 2 reduced absorption of amino acids
- 3 reduced production of bile
- 4 slower fat digestion

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

11 Which of the following best describe the function of the hepatic portal vein?

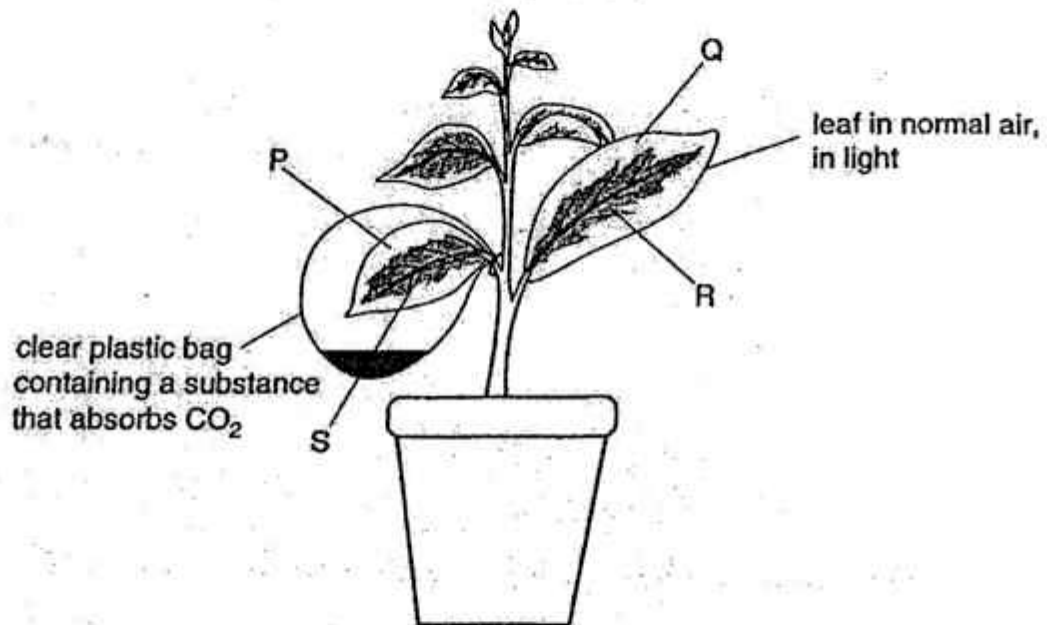
- A transport waste by products from respiration from the body to the liver
- B transport waste by products from respiration from the body to the kidney
- C transport soluble end products of digestion from the ileum to the kidney
- D transport soluble end products of digestion from the ileum to the liver

12 Leaves are specialized organs of a plant.

Which of the following best describes how a leaf is able to absorb carbon dioxide rapidly?

- A arrangement of the leaves on the stem
- B green pigmentation
- C large surface area
- D thick section through leaves

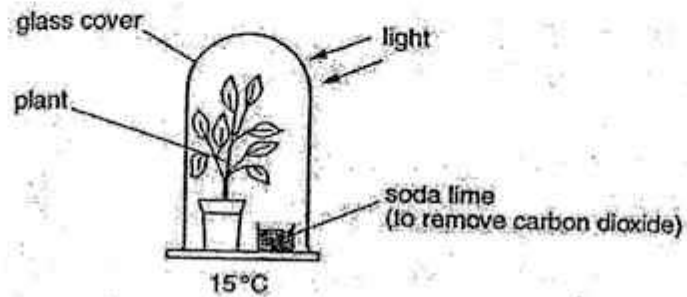
- 13 The diagram shows a setup investigating photosynthesis. The plant has variegated leaves as shown.



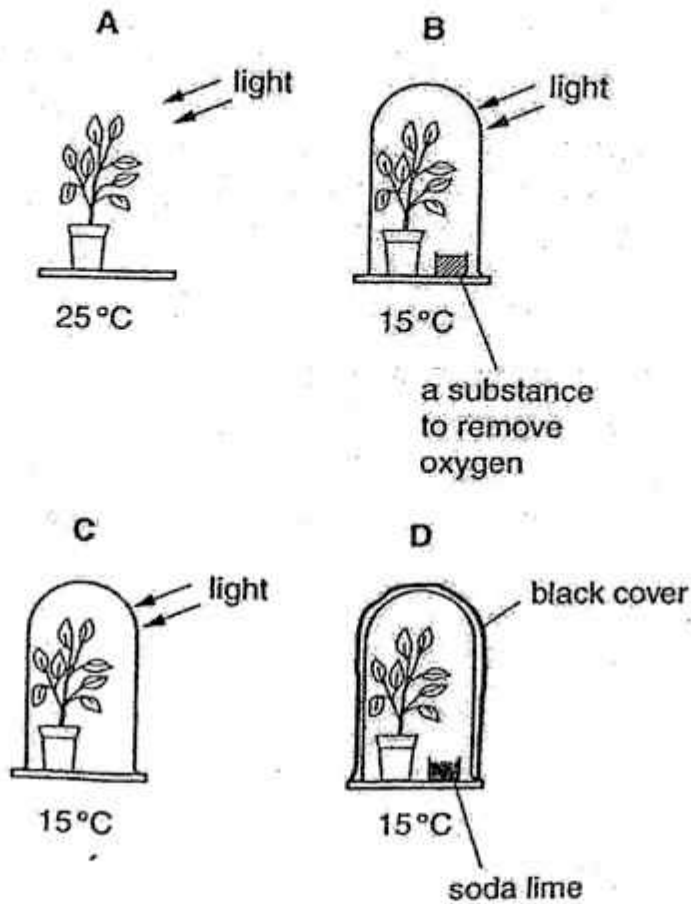
Which two areas indicated above only lacks **one** factor needed for photosynthesis?

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

- 14 The diagram below shows an experiment to find out whether carbon dioxide is needed for photosynthesis.



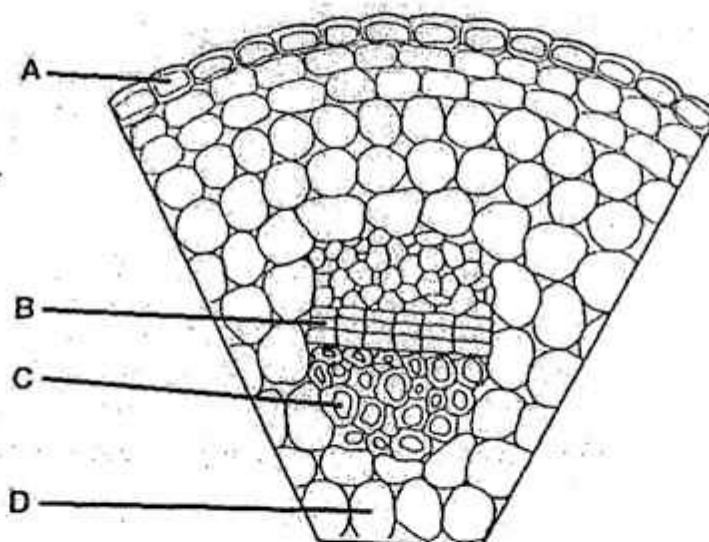
Which is the most suitable control for this experiment?



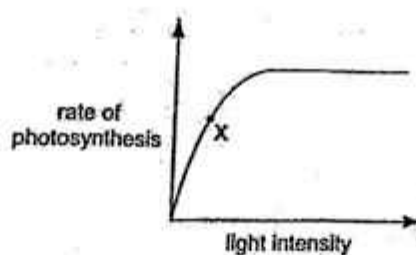
- 15 A piece of celery is placed in a beaker containing a red dye.

The diagram shows part of a section of the stem of the celery after immersion in the red dye for 3 days.

Which part of the stem will be stained most by the red dye?



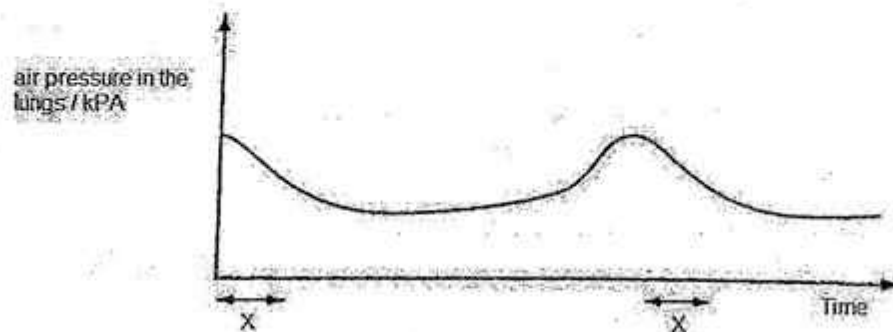
- 16 The graph shows the results of an experiment measuring the rate of photosynthesis in a pond plant at differing light intensities.



At point X on the graph, what is the limiting factor in this experiment?

- A carbon dioxide
- B light intensity
- C temperature
- D water

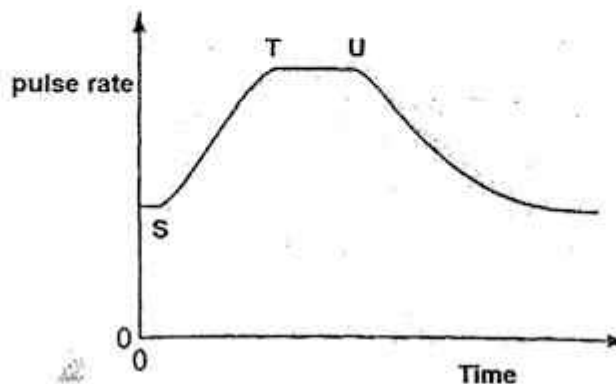
17 The graph shows changes in air pressure in the lungs during breathing



What causes the change in air pressure during X?

- A contraction of the diaphragm muscles
- B decrease in the volume of the lungs
- C movement of the ribs downwards
- D relaxation of the external intercostal muscles

18 The pulse rate of an athlete was measured every two minutes and plotted on the graph below.



His exercise started at S and finished at T but his pulse rate did not start to drop until U.

Which process(es) would occur during the T- U interval?

- 1 Accumulation of lactic acid in the muscle cells.
 - 2 Increase supply of oxygen to the muscle cells.
 - 3 Increased transport of carbon dioxide to the lungs.
- A 1, 2 and 3
 - B 1 and 3 only
 - C 2 only
 - D 2 and 3 only

19 Which of the following is not mainly found in the plasma?

- A urea
- B oxygen
- C hydrogencarbonates
- D hormones

20 Fitness training increases the concentration of lactic acid that the athletes can tolerate in their muscles.

What is the 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.

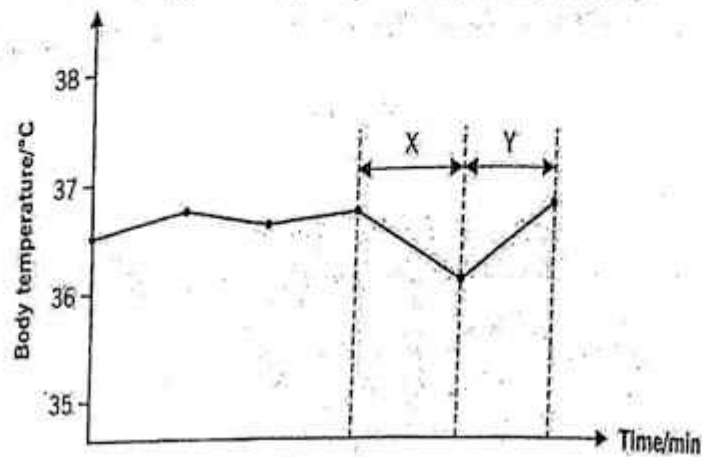
21 Which of the following is not an effector involved in the process of thermoregulation?

- A brain
- B sweat gland
- C blood vessels
- D skeletal muscles

22 How is the concentration of glucose in the blood regulated?

	blood glucose concentration	pancreas stimulated to secrete	liver converts	blood glucose level concentration	pancreas reduces secretion of
A	fall	glucagon	glycogen to glucose	rise	glucagon
B	fall	insulin	glycogen to glucose	rise	insulin
C	rise	glucagon	glycogen to glucose	fall	glucagon
D	rise	insulin	glycogen to glucose	fall	insulin

- 23 The graph below shows changes in a person's body temperature.



Which of the following best explains the changes in body temperature during period X and Y?

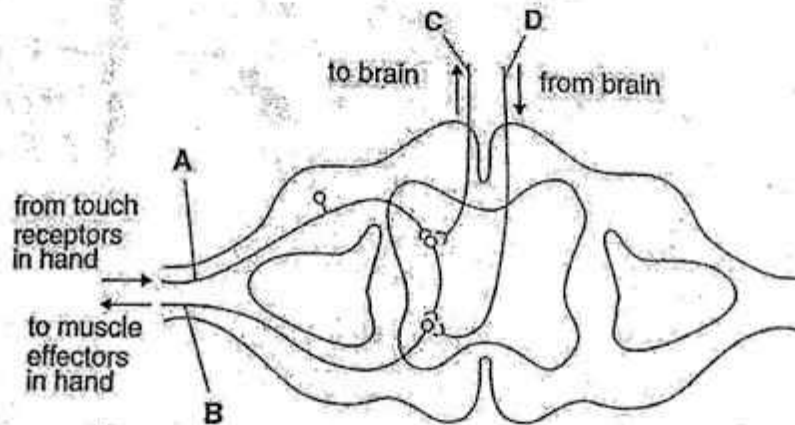
	period X	period Y
A	air temperature increases	contraction of arterioles
B	air temperature decreases	dilation of arterioles
C	air temperature increases	dilation of arterioles
D	air temperature decreases	contraction of arterioles

- 24 Which of the following is **NOT** an example of excretion carried out by an excretory organ?

- A Removal of glycogen via the liver.
- B Removal of uric acid via the skin.
- C Removal of excess water via the kidneys.
- D Removal of bile pigments via the liver.

- 25 The diagram shows some neurones present in a section through the spinal cord.

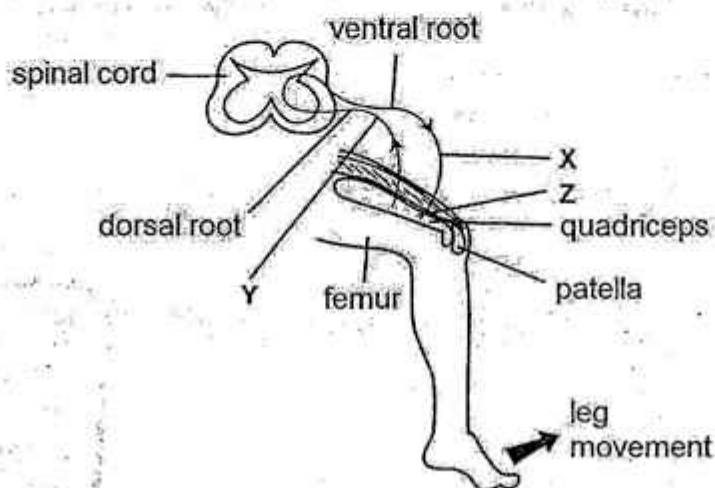
Which neurone, when cut, would cause a person to not know that he has touched a hot object, but will still enable him to move his hand?



- 26 What type of messages do the hormone and neurone relay?

	hormone	neurone
A	electrical	mechanical
B	mechanical	electrical
C	mechanical	chemical
D	chemical	electrical

- 27 The following diagram shows the knee jerk reflex.



Which of the following completes the diagram?

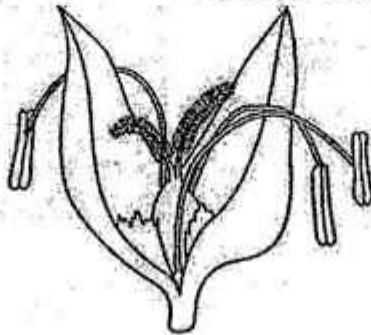
	X	Y	Z
A	motor neurone	motor neurone	relax
B	motor neurone	sensory neurone	contract
C	motor neurone	sensory neurone	relax
D	sensory neurone	motor neurone	contract

- 28 When examining an object in dim lighting, it is observed that it is difficult to distinguish colours.

Which of the following statements best explain this?

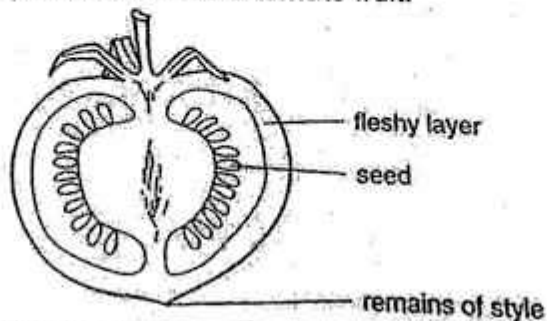
- A Rods do not work well in dim light.
- B Cones do not work well in dim light.
- C Insufficient light enters the eye as the pupil cannot fully dilate.
- D Less nerve impulses from the optic nerve was transmitted to the brain.

- 29 The diagram shows the flower of a common species of grass.



Which characteristic is the flower likely to have?

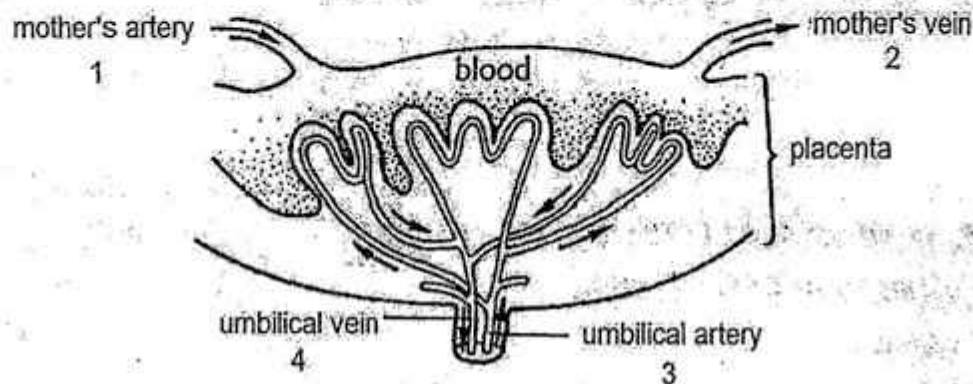
- A Anthers with short filaments.
 - B Nectaries producing nectar.
 - C Short, unbranched stigmas.
 - D Small, smooth pollen.
- 30 The diagram shows the structures inside a tomato fruit.



Which part of the tomato flower swells to form the seeds of the fruit?

- A style
 - B stigma
 - C ovary
 - D ovum
- 31 When is the sex of a baby determined?
- A before ovulation
 - B during child birth
 - C after the first division of the zygote
 - D during fertilization

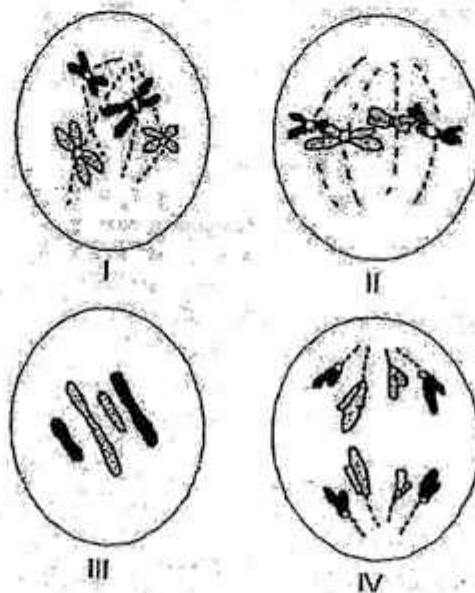
- 32 The diagram shows part of the placenta



In which numbered parts does blood contain the most oxygen and nutrients?

- A 1 and 2
B 1 and 3
C 1 and 4
D 2 and 3
- 33 If X units of DNA are present in the nucleus of a root tip cell during interphase before DNA replication, what is the relative amount of DNA present in this cell during prophase of the next mitosis?
- A X
B $X/2$
C $2X$
D $X/4$
- 34 A human cell has a total of 23 pairs of chromosomes. Following mitosis, the daughter cells would each have a total of _____ chromosomes. After meiosis I, the two daughter cells would have _____ chromosomes, and after meiosis II the gametes formed would have _____ chromosomes.
- A 23, 46, 23
B 46, 46, 23
C 46, 23, 23
D 46, 46, 46

- 35 The following diagrams show four different stages during cell division.



The correct sequence of the stages is _____.

- A I, II, III, IV
 - B III, I, II, IV
 - C I, II, IV, III
 - D IV, III, II, I
- 36 The following are some events that take place during transcription.

- 1 mRNA moves from nucleus to cytoplasm
- 2 one of the two DNA chains acts as the template
- 3 partial unwinding of the DNA molecule
- 4 sequence of bases in DNA copied to produce MRNA

Arrange the events in the correct sequence.

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

- 37 A strand of mRNA is transcribed from an original strand of DNA. The original bases on the DNA strand were G A G A C A.

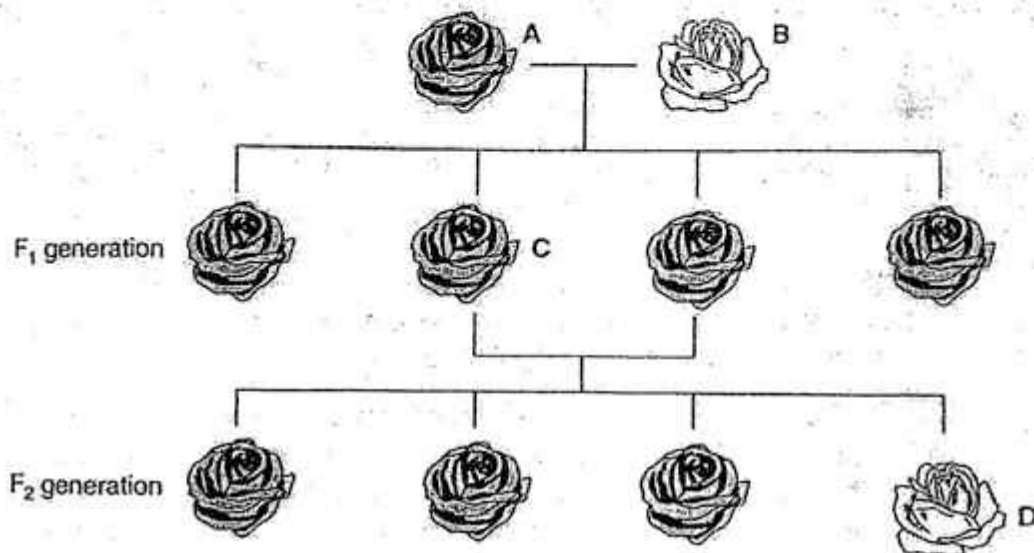
What is the base sequence on the mRNA strand produced from this?

- A CUCUGU
- B UGUCUC
- C CTCTGT
- D TGTCTC

- 38 What is a disadvantage of producing transgenic plants?

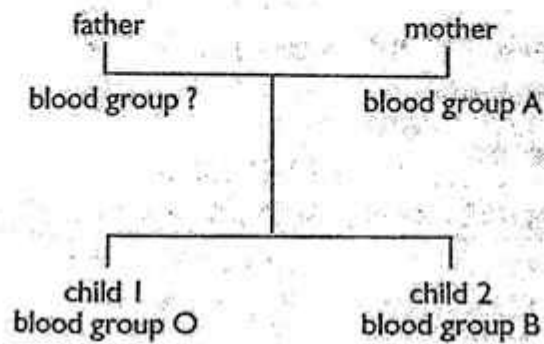
- A Enabling crops to grow in extreme conditions.
- B Producing pesticide-resistant crops.
- C Producing plants to compete with naturally occurring varieties.
- D Producing crops with high nutritional quality.

- 39 The diagram shows the inheritance of flower colour in pure breeding roses.



Which flower is heterozygous for colour?

- 40 The diagram shows blood group phenotypes for a mother and her two children.



Which is the genotype of the father's blood group?

- A $I^A I^B$
- B $I^A I^O$
- C $I^B I^O$
- D $I^O I^O$



Secondary 4 Prelim 1 Biology

Answer Scheme

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



ZHONGHUA SECONDARY SCHOOL PRELIMINARY I EXAMINATION 2012

Name of Pupil : _____ ()

Class : 4E _____

Subject / Code : BIOLOGY/ 5094/ 02

Level : Secondary 4 Express

Date : 3 July 2012

Duration : 1 hour 45 minutes

Set by : Mr Desmond Chong Eng Soon

Vetted by : Ms Rozianna Mohammed Affendi

Parent's Signature : _____

READ THESE INSTRUCTIONS FIRST

Write your Name and Register Number in all the work you hand in.
Write in dark blue or black ink in the spaces provided on the Question Paper.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction liquid.

Section A

Answer all questions.

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

Section B

Answer all the questions.

Write your answers on the separate Answer Paper provided.
At the end of the examination, fasten all separate answer papers securely to the question paper.

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

You are advised to spend about one hour on Section A and 45 minutes on Section B.

For Examiner's Use	
Section	Score
A	/50
B	/30
TOTAL	/80

Section A

Answer all questions.

Write your answers in the spaces provided.

- 1 Fig. 1.1(a) shows a flower very shortly after it has opened and Fig. 1.1(b) shows the same flower when it is several days older.



Fig. 1.1(a)



Fig. 1.1(b)

- (a) On Fig. 1.1(b), label a filament and a sepal.

[2]

- (b) With reference to Fig. 1.1(a), state two features of the flower that could have attracted the insect.

1.....

2.....[2]

- (c) Using information in Fig. 1.1(a) and Fig. 1.1(b),

- (i) Explain why flowers of this plant are rarely self-pollinated.

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

[3]
Total: 9

[Total: 9]

- (a) Complete Table 2.1 below using a tick ✓ or cross X in each box to show whether or not the structure shows the particular feature.

Table 2.1

	feature			
structure	lined with cilia	reinforced with cartilage	site of gas exchange	contains smooth muscles
trachea			X	
bronchus				
bronchiole				✓
alveolus				

[4]

1.
2.
- [2]

[2]

(c) Describe the effects of nicotine and carbon monoxide in cigarette smoke on the cardiovascular system.

nicotine.....

carbon monoxide.....

[2]

[Total: 8]

3 (a) Describe the role of insulin in the regulation of blood glucose concentration.

[3]

(b) State two advantages of treating diabetes with insulin produced by gene technology.

1.....

2.....

[2]

(c) Fig. 3.1 shows some of the steps involved in the production of bacteria capable of synthesizing human insulin.

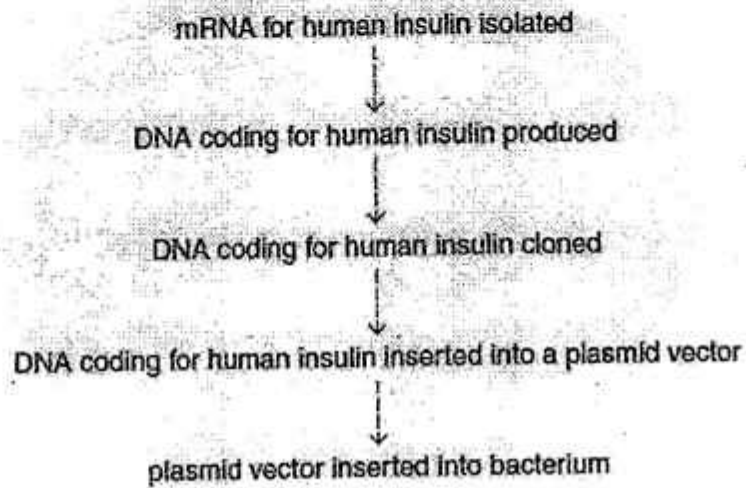


Fig. 3.1

State the role of each of the following enzymes in the production of bacteria capable of synthesizing human insulin:

(i) DNA polymerase

.....

(ii) restriction enzymes

.....

(iii) DNA ligase

.....

[3]
 [Total: 8]

- 4 (a) Fig. 4.1 shows a cross-section of the heart at the level of the valves.

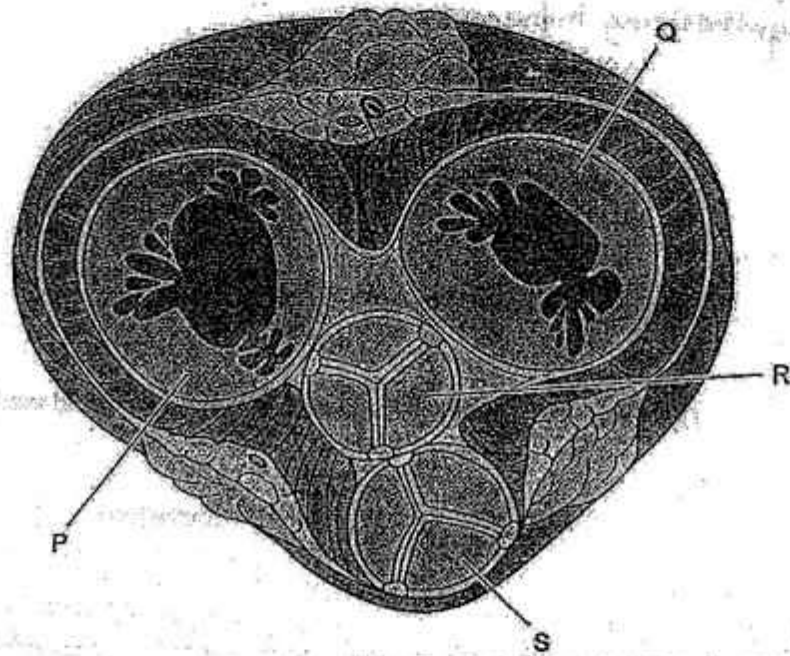
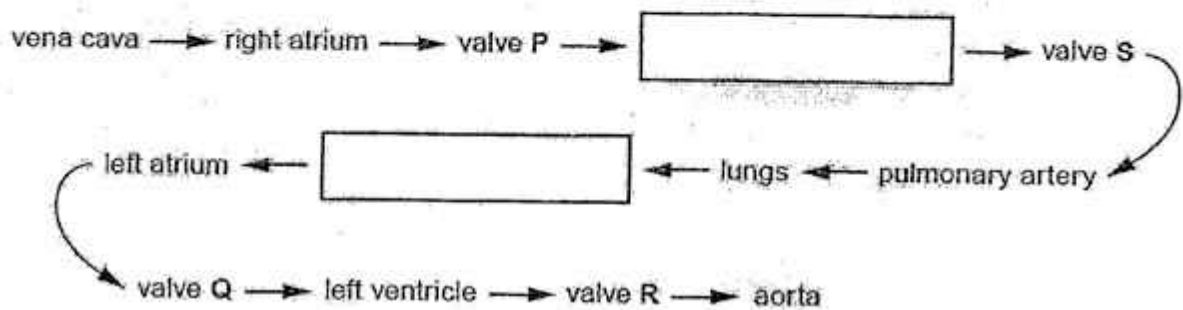


Fig. 4.1

- (i) Complete the following flow chart to show the pathway of blood through the heart.



[2]

- (ii) Explain how the valves P and Q ensure one-way flow of blood through the heart.

.....

.....

.....

.....[2]

- (b) The cardiac cycle describes the events that occur during one heart beat. Fig. 4.2 shows the changes in blood pressure that occur within the left atrium, left ventricle and aorta during one heart beat.

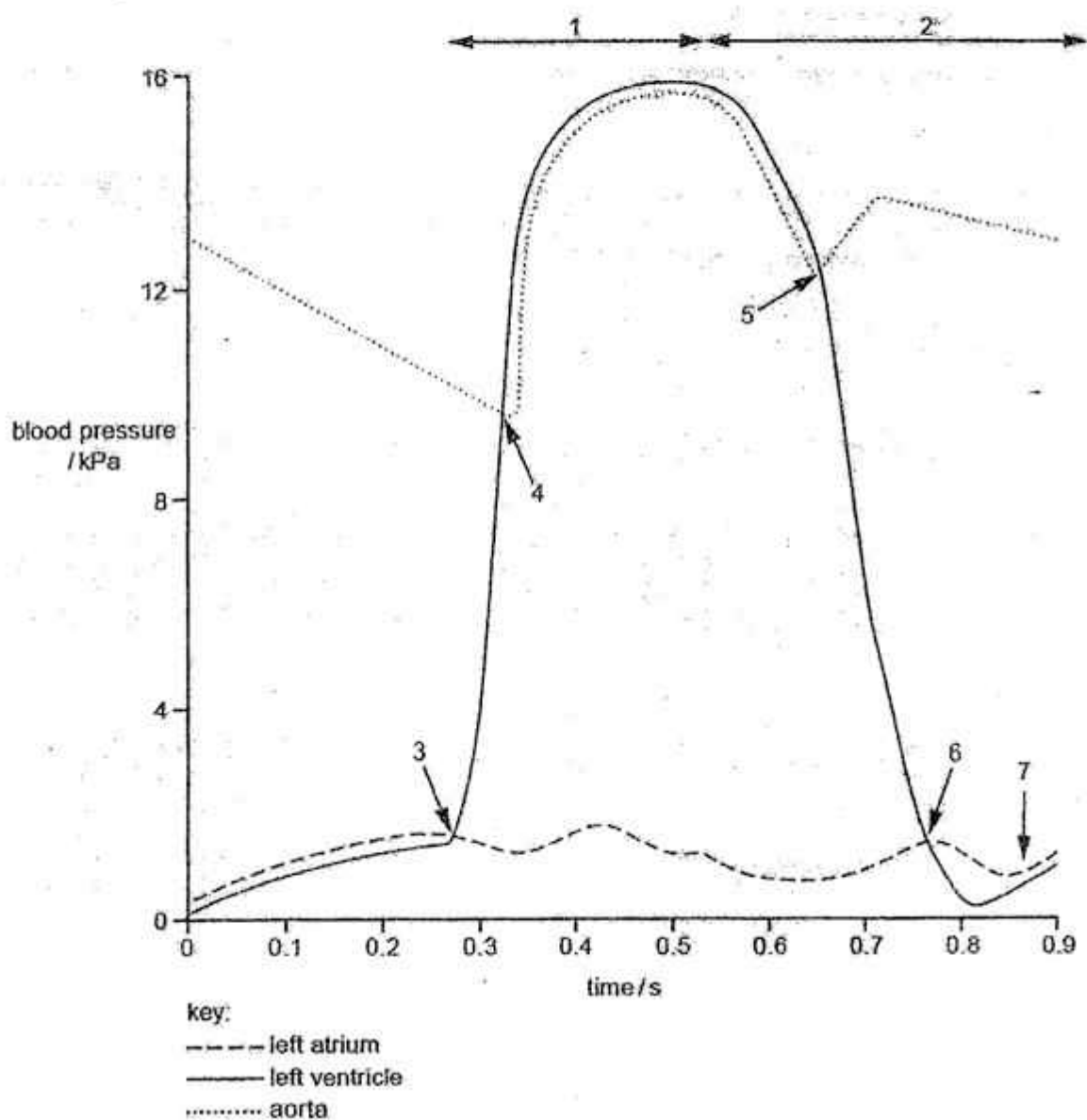


Fig. 4.2

In Table 4.3, match up each event during the cardiac cycle with an appropriate number 1 to 7 on Fig. 4.2.

You should put only one number in each box. You may use each number once, more than once or not at all.

The first answer has been completed for you.

Table 4.3

event during the cardiac cycle	number
atrioventricular (bicuspid) valve opens	6
ventricular systole	
semilunar (aortic) valve closes	
left ventricle and left atrium both relaxing	
semilunar (aortic) valve opens	

[4]

[Total: 8]

- 5 In mammalian kidneys, the loop of Henle is closely associated with the process of osmoregulation.

(a) Explain what is meant by osmoregulation.

.....

.....

.....

.....[2]

water potential of renal fluid / kPa

region of nephron

A — proximal convoluted tubule
B — midway along descending loop
C — apex of loop
D — midway along ascending loop
E — distal convoluted tubule

Region of Nephron	Water Potential (kPa)
A (proximal convoluted tubule)	-900
B (midway along descending loop)	-1500
C (apex of loop)	-3600
D (midway along ascending loop)	-1000
E (distal convoluted tubule)	-800

(b) Using the information given in Fig. 5.1, describe and explain what happens to the renal fluid as it passes through the loop of Henle.

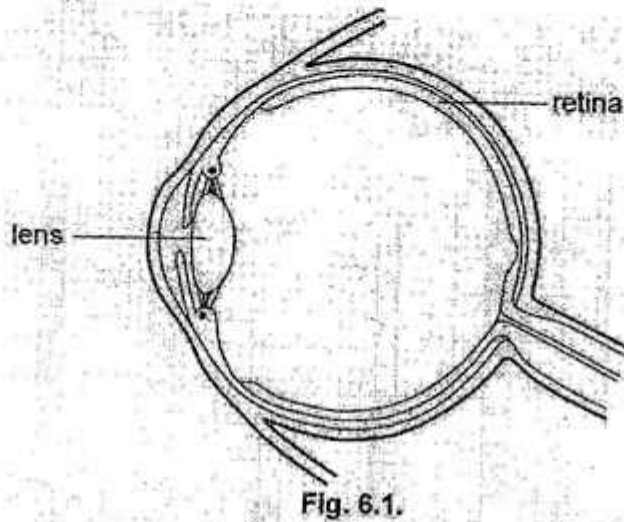
[5]

- Receptor

Effector

Page 9 of 18

- 6 Fig. 6.1 shows a horizontal section through the eye of a student who is looking at a distant object in dim light.



- (a) In Fig 6.1, use label lines and the letters L and M to identify the blind spot and the cornea respectively.

L: blind spot
M: cornea

[1]

- (b) The student then focuses on an object that is close to the eye and in extremely bright light.

- (i) Describe what happens to the shape of the lens when the student does this.

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

- (ii) Describe how this change to the lens is brought about.

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

(iii) Describe the change that occurs in response to the extremely bright light.

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

(iv) Explain how this change is brought about.

.....
.....
.....
.....[2] -
[Total: 8]

Section B

Answer all three questions.

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

- 7 (a) Explain what is meant by the term gene mutation.**

.....

.....

.....

.....[2]

- (b) Two pea plants with red flowers were crossed and produced 177 seeds. 44 of these seeds grew into white flowered pea plants and 133 seeds grew into red flowered pea plants**

Using the symbols R and r to represent the alleles, by means of a labelled genetic diagram, explain the inheritance of flower colour in this cross.

[3]

- You may use this space for any working.

(d) Explain how the knowledge of genetics has helped breeders to improve the quality of wool produced by sheep.

[4]
Total: 10

- 8 Fig. 8.1 is a drawing of a transverse section of a leaf.

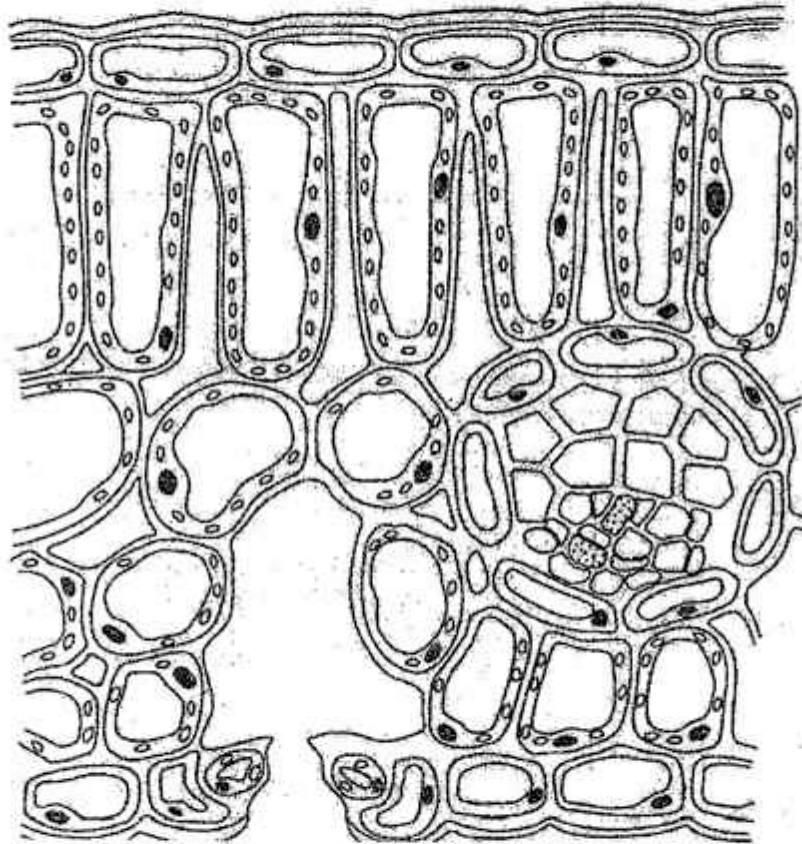


Fig. 8.1

- (a) Use label lines and the letters X, S, E and D to indicate the following on Fig. 8.1:

X – a xylem vessel
S – a phloem sieve tube
E – a lower epidermal cell
D – a palisade mesophyll cell

[4]

- (b) Name two assimilates that move from the palisade mesophyll cells to the vascular tissue to be exported from the leaf.

1.....

2.....[2]

- [4]
Total: 10

9 EITHER

A detailed anatomical diagram showing a cross-section of a blood vessel (likely a capillary or arteriole) within a tissue bed. The vessel is labeled 'A' at its lumen. The vessel wall is labeled 'B'. The surrounding tissue is labeled 'C'. The vessel is surrounded by a dense network of capillaries, labeled 'D'. The diagram illustrates the relationship between the blood vessel and the surrounding tissue, showing the vessel's structure and its connection to the capillary network.

Fig. 9.1

- A**.....[2]
B.....
C.....
D.....[2]

- (b) Blood flow through the skin changes in response to changes in the air temperature.

State what happens to blood flow through the skin when the temperature of the surrounding air becomes very cold and explain how the changes reduce heat loss.

[5]

- (c) The control of body temperature is an example of negative feedback.

Describe how negative feedback is involved in the control of body temperature.

[3]

[Total:10]

OR

Fig. 9.2 shows changes in the uterus during the menstrual cycle.

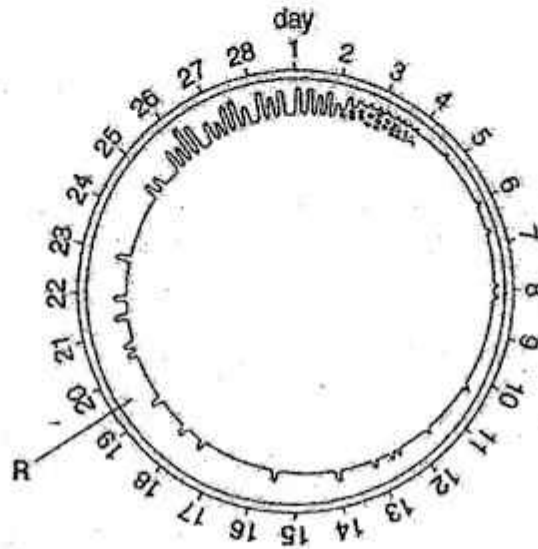


Fig. 9.2

(a) What does R represent?

.....[1]

(b) State the days when each of the following processes are most likely to occur during the cycle.

(i) fertilisation

(ii) implantation

[2]

(c) Suggest and explain why blood must not pass directly from the mother to the fetus during pregnancy, even though it contains substances necessary for fetal development.

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

(d) Describe the chief signs and symptoms of HIV/AIDS.

.....

.....

.....

.....

.....[2]

(e) Explain how HIV/AIDS is spread.

.....

.....

.....

.....

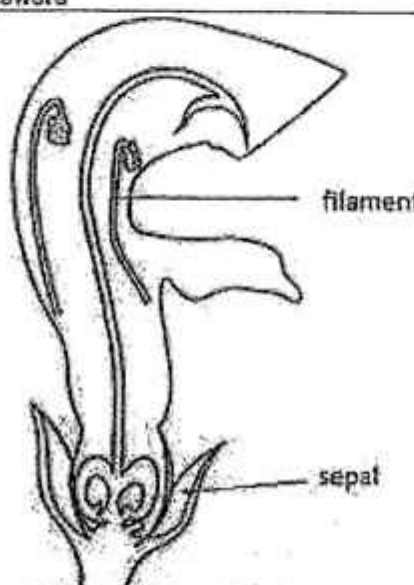
.....[2]

[Total:10]

~End – of – paper~

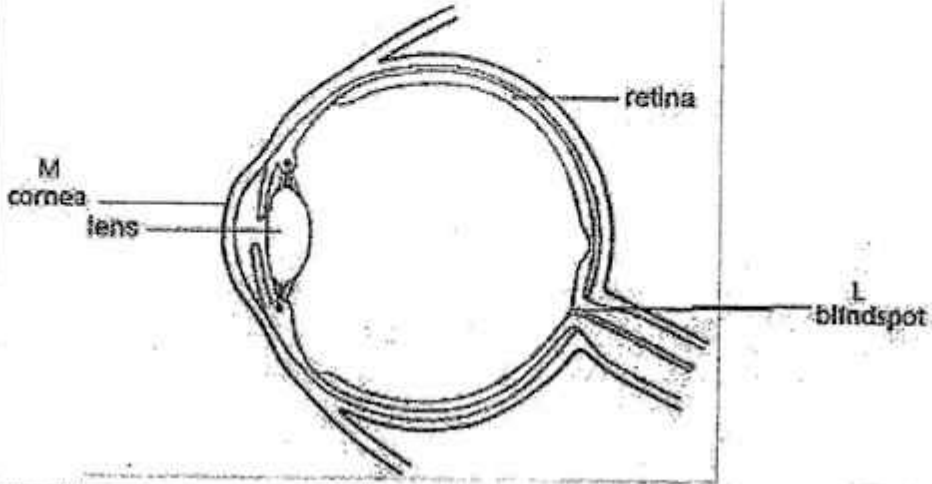
"The important thing in science is not so much to obtain new facts as to discover new ways of thinking about them."
Sir William Bragg (1862 - 1942)

Answers to Biology Prelim 1 Paper 2

Qn	Answers	Marks																									
1a		1; 1																									
1b	large petals, smell, nectar, brightly colour	1; 1																									
1c i	<p>Fig 1.1 a shows the flower having the anthers maturing and ready of anthesis while the stigma is not fully develop'd due to its length.</p> <p>Fig 1.1b show that The stigma is developed however the stamen has disintegrated.</p> <p>This shows that both the stamen and stigma ripens at different time, thus making success pollination not possible.</p>	<p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1/2</p> <p>Max 2</p>																									
1 c ii	<p>The insect will lands on the flower moves in to reaches for the nectar.</p> <p>Its body will <u>hit its stamens / anthers</u> and <u>transfer pollen onto its back</u>.</p> <p>It will fly off to another flower and its back will <u>hit the style/stigma of flower of same species</u>.</p> <p>The <u>stigma collects pollen from bee's back</u>.</p> <p>Any additional correct ref. older / younger flowers / ref. cross pollination / to other flower;</p>	<p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1/2</p> <p>Max 3</p>																									
2a	<table border="1"> <thead> <tr> <th></th> <th>lined with cilia</th> <th>reinforced with cartilage</th> <th>site of gas exchange</th> <th>contains smooth muscles</th> </tr> </thead> <tbody> <tr> <td>trachea</td> <td>✓</td> <td>✓</td> <td>X</td> <td>✓</td> </tr> <tr> <td>bronchus</td> <td>✓</td> <td>✓</td> <td>X</td> <td>✓</td> </tr> <tr> <td>bronchiole</td> <td>✓</td> <td>X</td> <td>X</td> <td>✓</td> </tr> <tr> <td>alveolus</td> <td>X</td> <td>X</td> <td>✓</td> <td>X</td> </tr> </tbody> </table>		lined with cilia	reinforced with cartilage	site of gas exchange	contains smooth muscles	trachea	✓	✓	X	✓	bronchus	✓	✓	X	✓	bronchiole	✓	X	X	✓	alveolus	X	X	✓	X	1 mark each correct row
	lined with cilia	reinforced with cartilage	site of gas exchange	contains smooth muscles																							
trachea	✓	✓	X	✓																							
bronchus	✓	✓	X	✓																							
bronchiole	✓	X	X	✓																							
alveolus	X	X	✓	X																							
2 b	Good/circulating blood supply – The heart continuously pump deoxygenated blood to	1/2																									

	<p>the alveoli and once the red blood cell is oxygenated, it is pump away to ensure a concentration gradient</p> <p>There is continuous good ventilation/breathing movements that brings oxygen into the alveoli which creates a concentration gradient for oxygen gas to diffuse in. The air will also have lower concentration of carbon dioxide that causes carbon dioxide gas to diffuse out.</p> <p>1/2 for main statement, 1/2 for elaboration</p>	<p>1/2</p> <p>1/2</p> <p>1/2</p> <p>Max 2</p>
2 c	<p>nicotine</p> <p>increases heart rate / AW ;</p> <p>increases blood pressure ;</p> <p>makes platelets 'sticky' ;</p> <p>decreases blood flow to, extremities / AW ;</p> <p>constriction of blood vessels ; (max 1)</p> <p>carbon monoxide</p> <p>combines with haemoglobin / forms carboxyhaemoglobin / higher affinity for haemoglobin (than oxygen) ;</p> <p>reduces oxygen-carrying capacity / AW (in context of, haemoglobin / blood) ;</p> <p>promotes release of damaging free radicals / peroxides / superoxides / oxidising agents ;</p> <p>causes, platelets and neutrophils to stick together / platelets to stick to endothelium ;</p> <p>ref. hypoxia damage to cardiovascular system ; (max 1)</p>	<p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1/2</p> <p>Max 2</p>
3 a	<p>Increases, cellular uptake of glucose (from blood) / membrane permeability to glucose ;</p> <p>(by), liver / muscle / adipose, cells ;</p> <p>increased, respiration / metabolism, of glucose ; A increased glycolysis ;</p> <p>causes conversion of glucose to, glycogen / fat ; A inhibits glycogenolysis (blood glucose concentration maintained between) 80–120 mg per 100 cm³ ; or 3.6 and 5.8 mmol/L</p> <p>[3 max]</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>Max: 3</p>
3 b	<p>1 it is identical to human insulin / ora ;</p> <p>2 (more) rapid response ;</p> <p>3 no / fewer, rejection problems / side effects / allergic reactions ;</p> <p>4 ref. to ethical / moral / religious, issues ;</p> <p>5 cheaper to produce in large volume / unlimited availability ; R cheap to produce ;</p> <p>6 less risk of, transmitting disease / infection ;</p> <p>7 good for people who have developed tolerance to animal insulin ;</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>Max: 2</p>
3 c	<p>DNA polymerase</p> <p>produces, second strand of DNA / double stranded DNA ;</p> <p>by linking free DNA nucleotides to the parental sugar-phosphate backbones ;</p> <p>ref. semiconservative replication / ref. complementary base pairing ;</p> <p>Restriction enzymes</p> <p>cut DNA / cut plasmid ; R cuts gene A cuts out gene at specific sites ;</p> <p>to give sticky ends ; A blunt ends (max 2)</p>	<p>1/2</p> <p>1/2</p> <p>1/2</p> <p>Max : 1</p> <p>1/2</p> <p>1/2</p> <p>Max 1</p>

	DNA ligase used to "stitch" the donor DNA into the plasmid vector. by creating permanent bonds between the donor DNA and the plasmid DNA. To form the recombinant DNA (rDNA)	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ Max: 1										
4a	right ventricle ; pulmonary vein ;	1 1										
4a	When pressure in atria is larger than than of ventricle, AV valve opens to allow blood from atria to ventricles ; when ventricles contract, the pressure in the ventricle is larger than the atria thus causing the AV valves close to stop backflow ; Causing a one directional flow of blood in the heart	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ Max: 2										
4 b	<table border="1"> <thead> <tr> <th>event during the cardiac cycle</th><th>number</th></tr> </thead> <tbody> <tr> <td>ventricular systole</td><td>1</td></tr> <tr> <td>semilunar (aortic) valve closes</td><td>6</td></tr> <tr> <td>left ventricle and left atrium both relaxing</td><td>2</td></tr> <tr> <td>semilunar (aortic) valve opens</td><td>4</td></tr> </tbody> </table>	event during the cardiac cycle	number	ventricular systole	1	semilunar (aortic) valve closes	6	left ventricle and left atrium both relaxing	2	semilunar (aortic) valve opens	4	1 1 1 1 Max: 4
event during the cardiac cycle	number											
ventricular systole	1											
semilunar (aortic) valve closes	6											
left ventricle and left atrium both relaxing	2											
semilunar (aortic) valve opens	4											
5 a	The control of the water potential in the blood by the body Through the secretion of amount of antidiuretic hormone (ADH) circulating in the blood. Causing the kidneys to to increase or decrease water absorption in the tubules	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ Max: 2										
5 b	<p>Describe: The water potential becomes more negative from -900 kPa to -3600kPa as it moves from region A to Region C</p> <p>Values given with unit</p> <p>Explanation, As filtrate moves from the proximal tubules to the descending loop of Henle to the Apex of the loop, water moves out of the tubules by osmosis into the medulla causing the water potential to decrease.</p> <p>Describe: It becomes more positive as it increases from Region C to Region E from -3600kPa to -900 kPa</p> <p>Explanation, At D, in the ascending loop of Henle, the filtrate loses salt by active transport without giving up water and becomes more dilute causing water potential to be more positive</p>	1 1 1 1 1 1 Max: 6										
5 c	receptor – hypothalamus ; effector – pituitary gland / cells or walls of collecting duct	1 1										

6 a		
6 b	(i) lens becomes thicker / fatter / diameter is reduced; [1]	1
6 b	(ii) ciliary muscles contract; ciliary body reduced in diameter; suspensory ligaments slacken; [3] (ecf, allow the opposites if thinner lens is given in (b)(i) to a max of 2 marks)	1 1 1
6 b	(iii) pupil becomes smaller in diameter; [1]	1
6 b	(iv) circular muscles in iris contract; radial muscles in iris relax; reference to pupil reflex / nervous system involvement; (ecf, allow opposites for muscle action if pupil enlargement given in (b)(iii) to a max of 1 mark)	1 1 1 Max:2
7a	Gene mutation is a change in DNA/base sequence; producing different allele; causing different protein/polypeptide to be produced;	1 1/2 1/2 Max:2
7b	1 - $X^R X^R$; 3 - $X^R Y$; 3 - $X^r X^r$; 10 - $X^r Y$;	1 1 1 1 1
7c	Farmers used a method known as artificial selection In this process, sheep with better wool are selected to be bred selectively. The genes is passed to the offspring. Offspring that possessed the desired traits are then breed together. This process is repeated over many generation such that majority of the sheep over time will produce good quality wool	1 1 1 1 1 Max:4

8 a i		1 1 1 1
8 b	sucrose; amino acids	1
8 c	<p>Water will move via <u>osmosis</u> from a region of lower/more negative water potential to a region of higher water potential From xylem to the spongy/ palisade mesophyll tissue</p> <p>Water will continue to move until it reaches the spongy mesophyll tissue with is in contact with the intracellular air spaces.</p> <p>It will then move through and into the moist layer of the spongy mesophyll cells' cell wall</p> <p>This provides large surface area for the <u>evaporation</u> of water from spongy mesophyll cell walls into (substomatal/intercellular) air space;</p> <p>Water <u>vapour</u> then diffuse out of the leaves via the stomata.</p>	1 1 ½ ½ 1 1 Max. 4
Either 9a	A – hair ; B – (temperature) receptor ; A (sensory) nerve ending C – sweat gland ; D – fat (cell) ;	½ ½ ½ ½
9b	<p>blood distributes heat ;</p> <p>In cold environment, there will be vasoconstriction of the arterioles near the skin as well as dilation of the shunt vessel.</p> <p>This causes less blood flows to the capillaries of the skin. Thus less heat loss, by radiation ; by convection ; and conduction (to the air) ;</p>	1 1 1 1 ½ ½ ½

		Max: 5
9 c	<p>change in, body / skin, temperature acts as a stimulus ; Detected by the hypothalamus</p> <p>In a negative feedback system , the body would want to to keep temperature , constant / at 37 °C / within limits / near set point / at the norm / AW ;</p> <p>Thus a corrective / opposite / AW, action by the body ; e.g. qualified ref to sweating / vasodilation / vasoconstriction / AW ;</p>	<p>1/4 1/2</p> <p>1</p> <p>1/2 1/2</p>
Or 9a	R- spongy wall/(spongy or uterus) lining/endometrium	1
9b	<p>(i) 14-20 days ; (ii) 19-25 days ;</p>	1
9c	<p>necessary substances can diffuse across placenta ; bloods might be of different groups ; mother's blood pressure too great ; ref. possible exclusion of potentially harmful substances ;</p>	<p>1 1 1 1</p> <p>Max:3</p>
9d	<p>'flu-like symptoms (at first) ; destruction of white blood cells / lymphocytes ; lowered resistance to relatively minor infections ; general weakness ; disorders of the blood ; pneumonia ; of the nervous system ; cancers (e.g. Kaposi's) ;</p>	1/2 mark for each
9e	<p>HIV is spread through blood , semen or vaginal fluid thus</p> <p>carriers of HIV / virus ; (unprotected) sexual intercourse / contact ; blood transfusion ; shared needles ; body fluid to body fluid (accept examples) ; from infected mother to fetus ;</p>	<p>1 mark</p> <p>1/2 for each example</p>

"The important thing in science is not so much to obtain new facts as to discover new ways of thinking about them." Sir William Bragg (1862-1942)



TEMASEK SECONDARY SCHOOL
O Level Preliminary Examinations 2012
Secondary 4 Express

BIOLOGY

5094/01

Paper 1

1 hour

Question Booklet

Additional Material: Optical Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on the Optical Answer Sheet.

You are **not** required to hand in this booklet.

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.

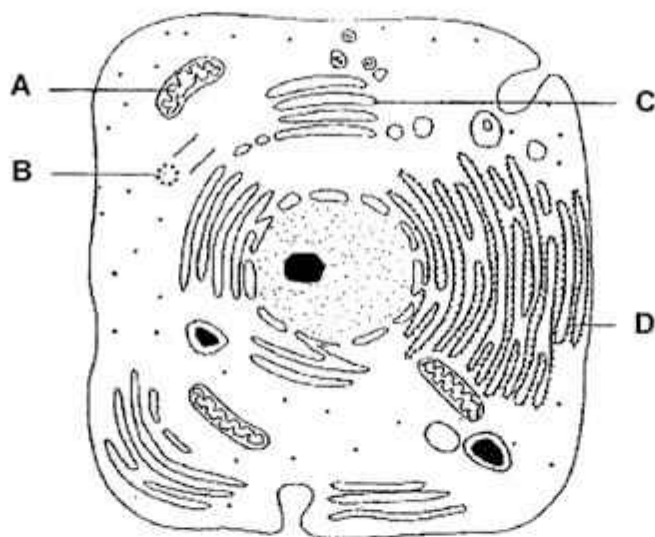
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

Attempt ALL questions in this section.

Choose the most appropriate answer and shade the corresponding letter on the separate answer sheet provided.

- 1 The diagram below shows the structure of an animal cell.
In which cell organelle is the molecular structure of insulin modified before secretion out of the cell?



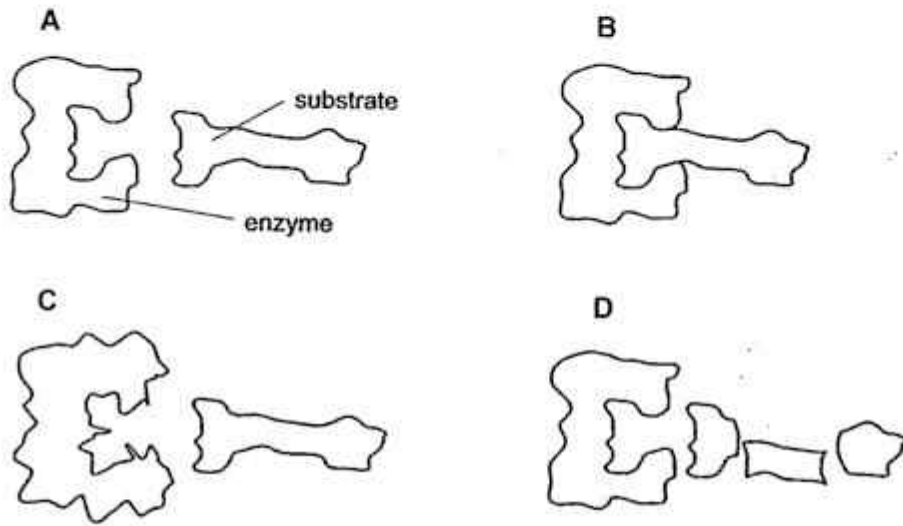
- 2 Plant cells are placed in solutions containing different concentrations of two substances, X and Y. The rate of X and Y uptake into the cells was measured with the results provided in the table below.

Substance	Concentration in solution (10^{-3} mol)	Rate of uptake per cell (10^{-3} mol/ min)
X	40	5
X	200	19
Y	20	8
Y	100	8

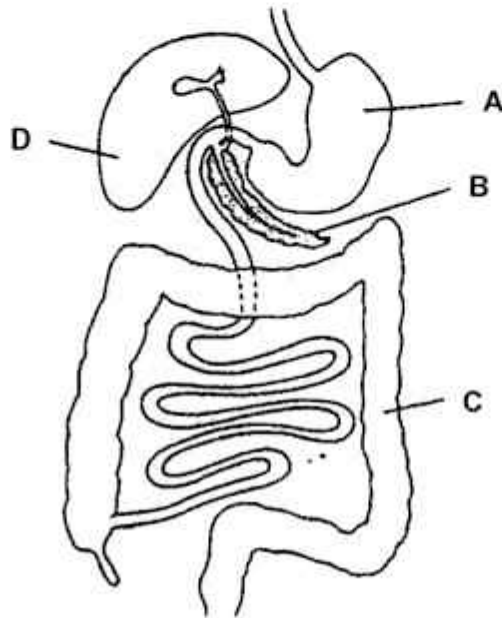
What conclusions can be drawn from this data?

- A X is a large molecule and Y is a small molecule.
 B Both X and Y are transported into the cells by active transport.
 C X moves into the cells by active transport and Y by diffusion.
 D X moves into the cells by diffusion and Y by active transport.

- 3 The diagrams represent an enzyme molecule and a substrate.
Which diagram shows these molecules after they are heated to 100°C?



Questions 4 and 5 refer to the diagram below which shows the human alimentary canal.



- 4 Which labelled organ on the diagram is responsible for the breakdown of alcohol?

- 5 Morbidly obese patients may consider having gastric bypass surgery where the size of structure **A** is drastically reduced. Which of the following would NOT be a consequence of this?

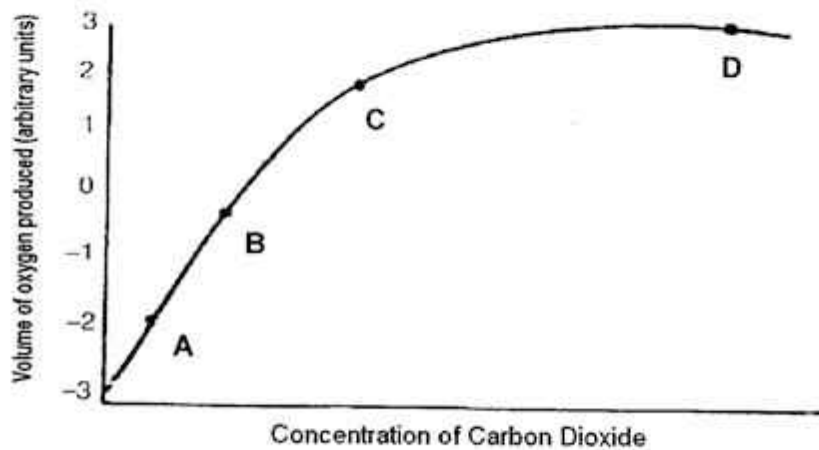
A Drastic weight loss
 B Malnutrition
 C Pepsin will be unable to function properly
 D Inability to consume large amounts of food at one sitting

- 6 A scientist investigated four species of insects. One of the insects feeds on plants and another feeds on human blood. As the insects look familiar, he investigated the digestive enzymes found in their guts. From the data that he gathered, as shown in the table below, which insect feeds only on human blood?

Insect	Enzymes present in insect guts			
	Amylase	Protease	Sucrase	Lipase
A	–	–	–	+
B	+	–	+	–
C	–	+	–	+
D	+	+	+	–

Key: + present; – absent

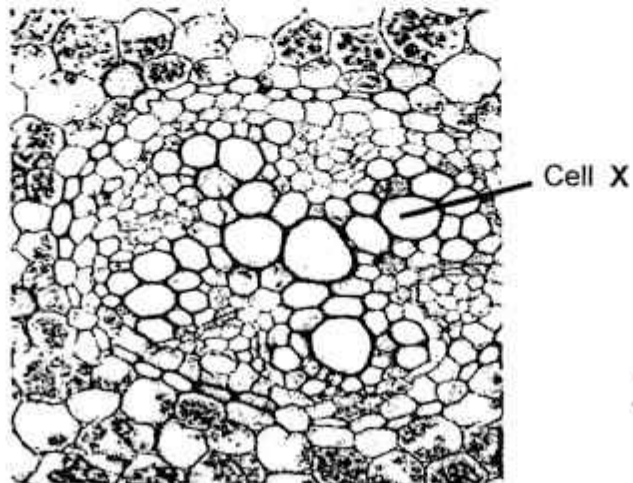
- 7 The graph shows the volume of oxygen produced in relation to the concentration of carbon dioxide supplied to a plant in a closed system.



Which one of the following statements about the graph is true?

- A At point A, there is no photosynthesis occurring.
 B At point B, the rate of photosynthesis almost equals the rate of respiration.
 C At point C, the maximum rate of photosynthesis is occurring.
 D At point D, photosynthesis has stopped.

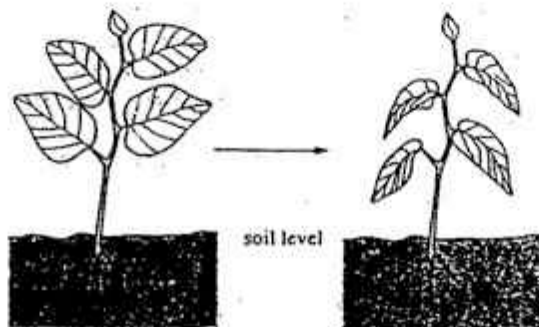
- 8 The photomicrograph shows part of a section of a plant.



Samples of the contents of cell X were tested. What results are expected?

	Iodine test	Benedict's test
A	Present	Present
B	Present	Absent
C	Absent	Present
D	Absent	Absent

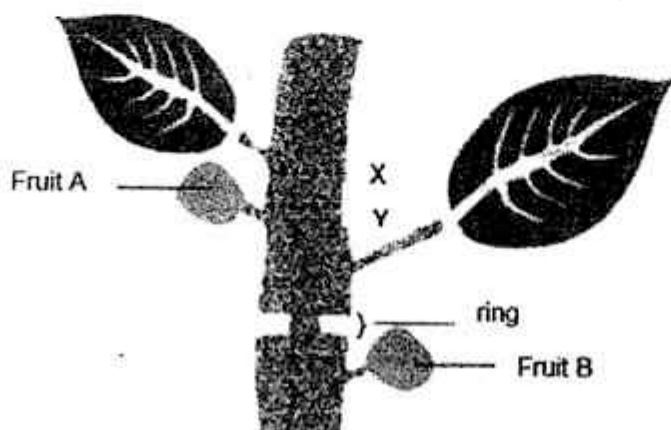
- 9 The diagram below shows how a seedling changes in appearance a few hours after planting.



Which of the following sets of conditions would have brought about the above change?

	Humidity	Light intensity	Temperature
A	High	High	Low
B	High	Low	High
C	Low	High	High
D	Low	Low	Low

Questions 10 and 11 refer to the diagram below which shows a stem of a potted plant with a ring of bark removed. The leaves remain alive after a few days.



- 10 Which of the following about fruit A and fruit B is correct?
- A Fruit A increases in size while fruit B remains the same.
 - B Fruit A decreases in size while fruit B increases in size.
 - C Fruits A and B increase in size.
 - D Fruit A remains the same while fruit B increases in size.
- 11 New cuts were made at X and Y respectively and a ring of tissue was removed. After two days, the lower leaf is observed to grow normally and remained turgid, while the upper leaf began to wilt. Which of the following statement about this experiment is INCORRECT?
- A The ring of tissues which were removed contain only phloem.
 - B The ring of tissues which were removed contain xylem.
 - C Water from the segment below Y cannot get to Y.
 - D The upper leaf wilted because the rate of transpiration was higher than the rate of water uptake.
- 12 Which is the shortest route that can be taken by blood travelling from the duodenum to the pancreas?
- A duodenum → liver → heart → lungs → pancreas
 - B duodenum → heart → lungs → heart → pancreas
 - C duodenum → heart → lungs → heart → liver → pancreas
 - D duodenum → liver → heart → lungs → heart → pancreas

- 13 Diagram X below shows a heart with certain parts removed to reveal various valves. Diagram Y shows the change in the ventricular volume of a person's heart within a short period of time.

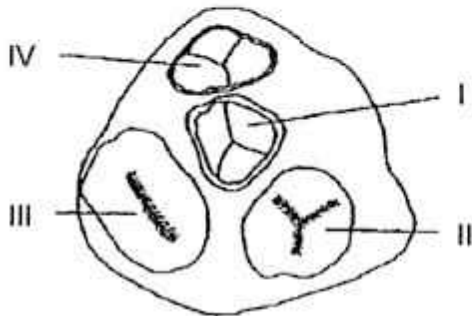


Diagram X

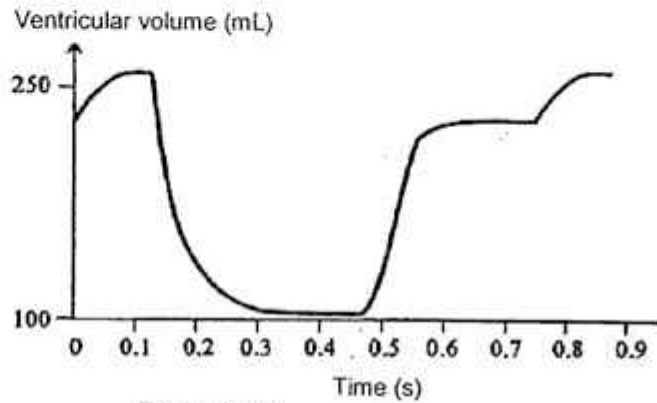


Diagram Y

At 0.2 second, which of the valves in diagram X are opened?

- A valves I and II
- B valves I and IV
- C valves II and III
- D valves III and IV

- 14 The high blood pressure in the aorta is maintained by _____.

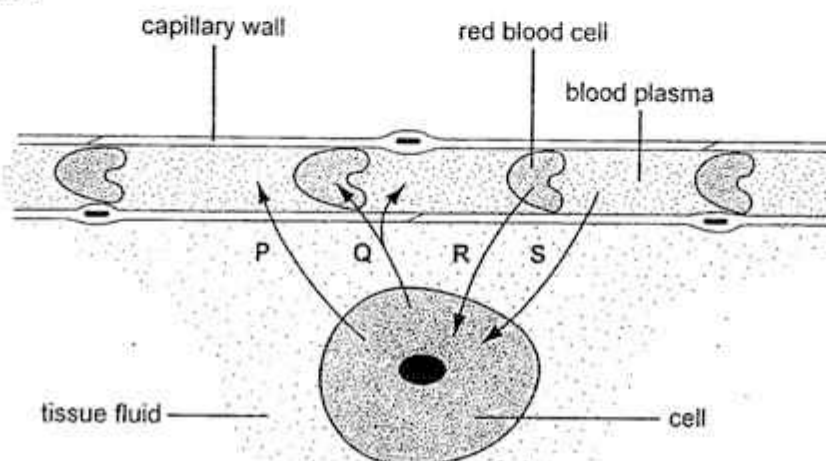
- I the pumping action of the heart.
- II the gravitational pull on blood.
- III the contraction of the skeletal muscles around the blood vessel.
- IV the elastic recoil of the vessel wall.

- A I and II
- B I and IV
- C II and III
- D III and IV

- 15 Which of the transfusions shown in the table below, if carried out, would be successful?

	Donor	Recipient
A	A	AB
B	AB	O
C	B	A
D	AB	A

- 16 The diagram represents the relationship between a respiring cell and blood capillary. The arrows indicate the direction of the substances exchanged between the capillary and the cell.



What could arrows P, Q, R and S represent?

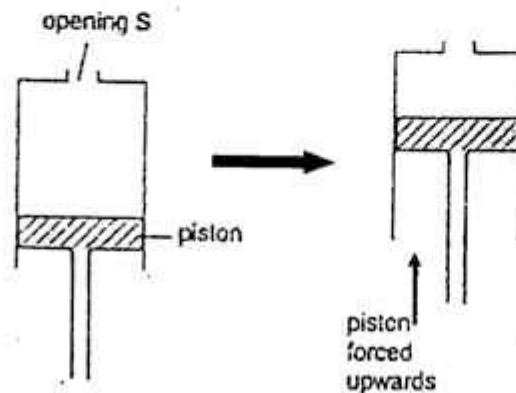
	P	Q	R	S
A	Ammonia	Oxygen	Carbon dioxide	Hydrogencarbonate ions
B	Salts	Carbon dioxide	Hydrogencarbonate ions	Ammonia
C	Urea	Salts	Oxygen	Plasma
D	Water	Carbon dioxide	Oxygen	Glucose

- 17 An athlete ran in a 100 m sprint race. Which of the following occur(s) inside his body during the run?

- I Lactic acid builds up in his muscles.
- II Glucose is converted to glycogen in his muscles.
- III Anaerobic respiration takes place in his muscle cells.
- IV Aerobic respiration takes place in his muscle cells.

- A I only
- B I and III only.
- C I, III and IV only.
- D I, II, III and IV

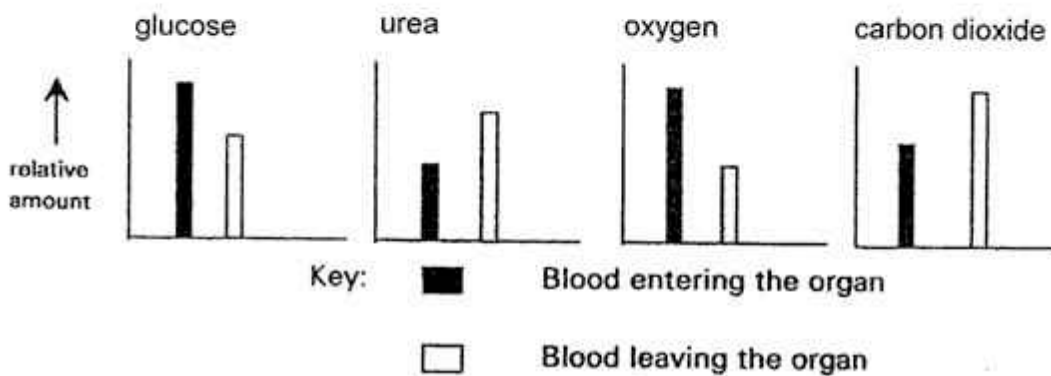
- 18 The figure below shows a model which demonstrates the action of a type of muscle used during breathing in a mammal.



Which of the following correctly describes what the model is demonstrating?

	Muscle represented by piston	Process shown
A	Diaphragm	Exhalation
B	Diaphragm	Inhalation
C	External intercostal muscles	Exhalation
D	External intercostal muscles	Inhalation

- 19 The bar charts below show the relative amounts of four substances in the blood entering and leaving a certain organ in the body of a mammal.



The organ is probably the

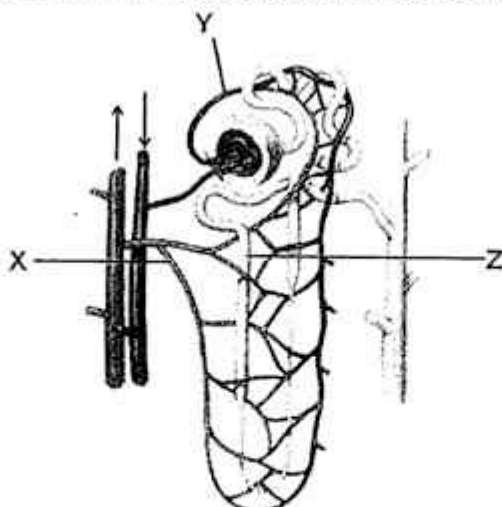
- A liver
- B kidney
- C small intestine
- D lung

- 20 Adrenaline is sometimes given to patients. In which of the following conditions would the administration of adrenaline be useful?

- I low heart rate
- II low blood sugar levels
- III low water potential of blood

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

- 21 The diagram below shows the structures associated with a human kidney.



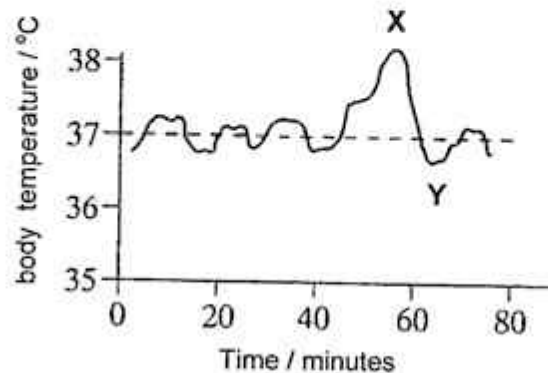
What are the relative concentrations of urea in X, Y and Z?

	X	Y	Z
A	High	Low	High
B	High	Low	Low
C	Low	High	High
D	Low	Low	High

- 22 Blood plasma in a healthy man contains about 1 g of glucose per litre of plasma. Which figure is most likely to represent the concentration present in the urine of this man?

- A 0 g/litre
- B 0.5 g/litre
- C 1.0 g/litre
- D 10.0 g/litre

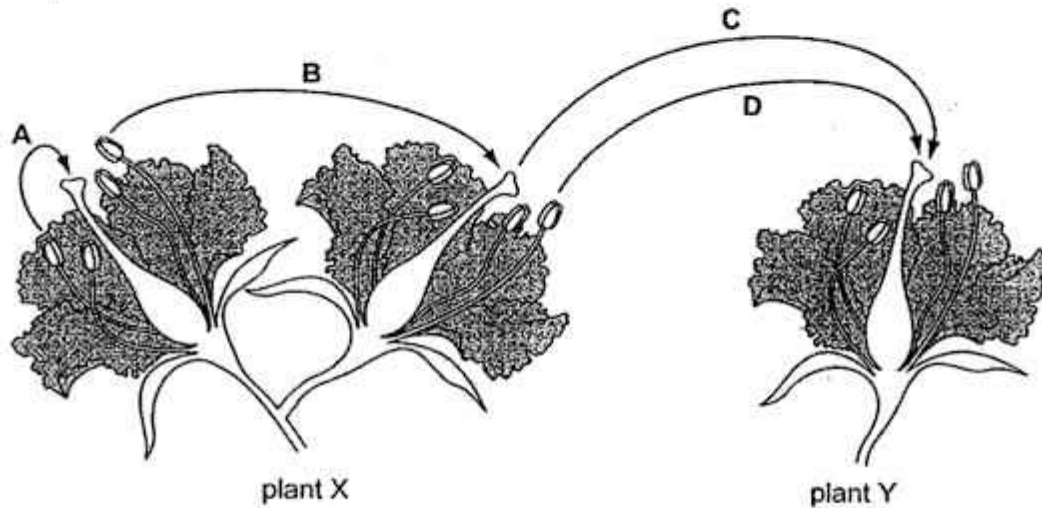
- 23 What changes will occur when the ciliary muscles in the eye of a mammal are relaxed?
- A Images of distant objects are focused on the retina.
 - B Decrease in the tension on the suspensory ligaments.
 - C Increase in thickness of the lens.
 - D Pupil diameter will increase.
- 24 The trigeminal nerve in humans connects the brain with both the teeth and the skin of the face. When the dentist administers a local anaesthetic by injection, you can no longer feel pain and you cannot smile properly. This allows you to conclude that _____
- A the trigeminal nerve contains both motor and sensory neurons.
 - B the trigeminal nerve contains mainly sensory neurons.
 - C the trigeminal nerve contains mainly motor neurons.
 - D the trigeminal nerve carries impulses from the brain to the teeth and back to the skin.
- 25 The graph below shows changes in a person's body temperature plotted against time.



What causes the change in temperature between X and Y?

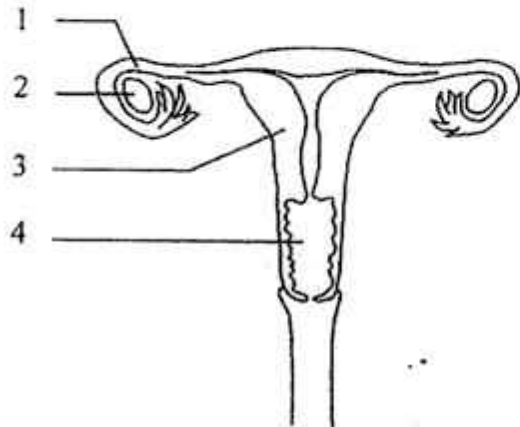
- A Shivering.
- B Increased evaporation of sweat.
- C Reduced blood flow through surface capillaries.
- D Increased air temperature.

- 26 The diagram shows two flowers on plant X and one flower on a different plant Y, of the same species.



Which transfer of pollen will bring about cross pollination?

- 27 The diagrams below show the human reproductive systems.



Female reproductive system

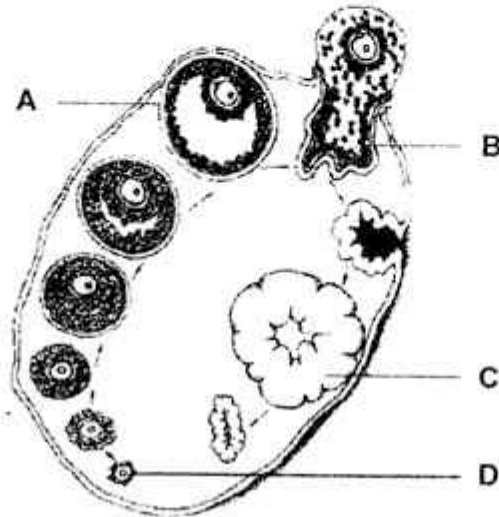


Male reproductive system

Which of the following structures serve similar functions?

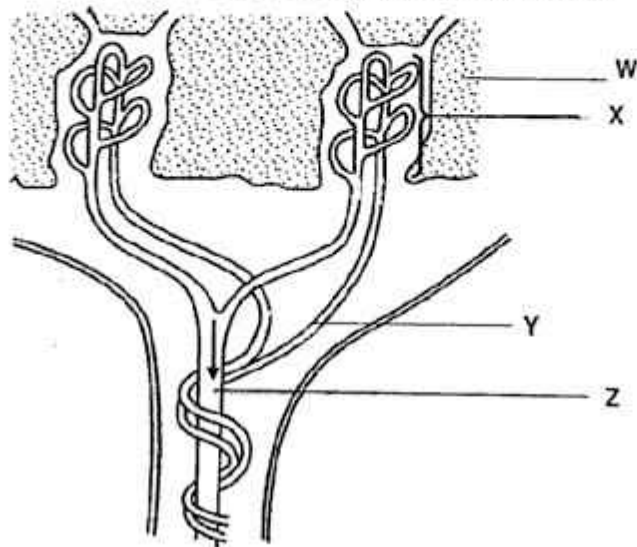
- A 1 and 6
- B 2 and 7
- C 3 and 5
- D 4 and 8

- 28 The diagram below shows the development of a follicle in an ovary.



Which labelled structure is involved in secreting progesterone?

- 29 The figure below shows part of the blood supply of the placenta.



In which region would you find the highest concentration of fetal urea and carbon dioxide?

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

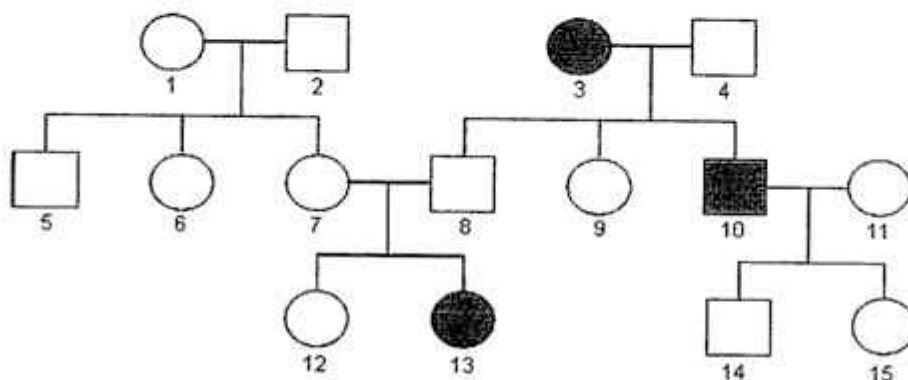
- 30 A flowering plant was found to have seeds that contain 16 chromosomes in their cells. What would be the total number of chromosomes in a cell taken from a petal?

A 8
B 16
C 32
D 64

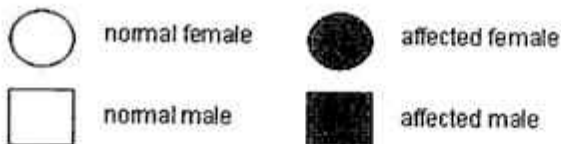
- 31 Small pieces of leaf tissue were taken from a rubber tree and placed in a nutrient medium. After some time, each piece produce a new rubber sapling. Which of the following describes the reproductive process and the genotype of the new saplings?

	Reproductive process	Genotype
A	Sexual	Different
B	Sexual	Identical
C	Asexual	Similar
D	Asexual	Identical

- 32 The family tree shows the inheritance of a condition caused by the recessive allele g.



Key



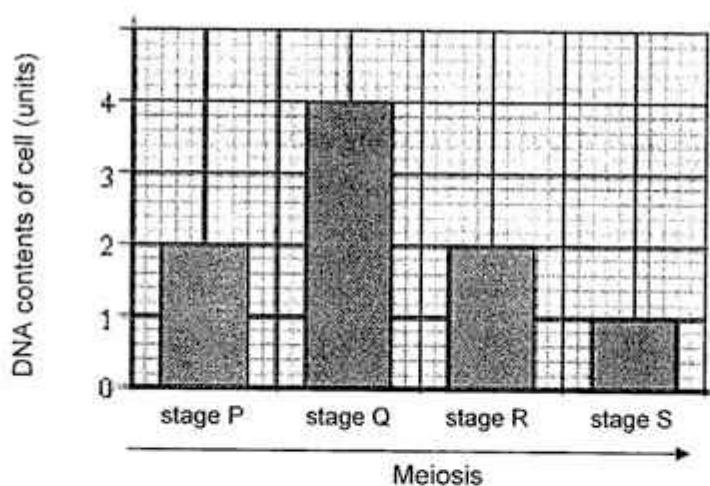
Which of the females are certain to have the genotype Gg?

- A 1, 6 and 7
B 1, 7 and 12
C 7, 9 and 15
D 9, 12 and 15

- 33 A woman with blood group AB marries a man who is heterozygous for blood group B. What is the probability of the couple having a son with blood group A?

A 6.25 %
 B 12.5 %
 C 25.0 %
 D 50.0 %

- 34 The bar graph below shows changes in the DNA content per cell during stages of meiosis.



When do the homologous chromosomes separate?

- A Before the start of stage P.
 B Between stages P and Q.
 C Between stages Q and R.
 D Between stages R and S.
- 35 The diagram shows a maize (corn) cob with purple and yellow fruits. Purple (P) is dominant to yellow (p).



What are the genotypes of the parent maize plants?

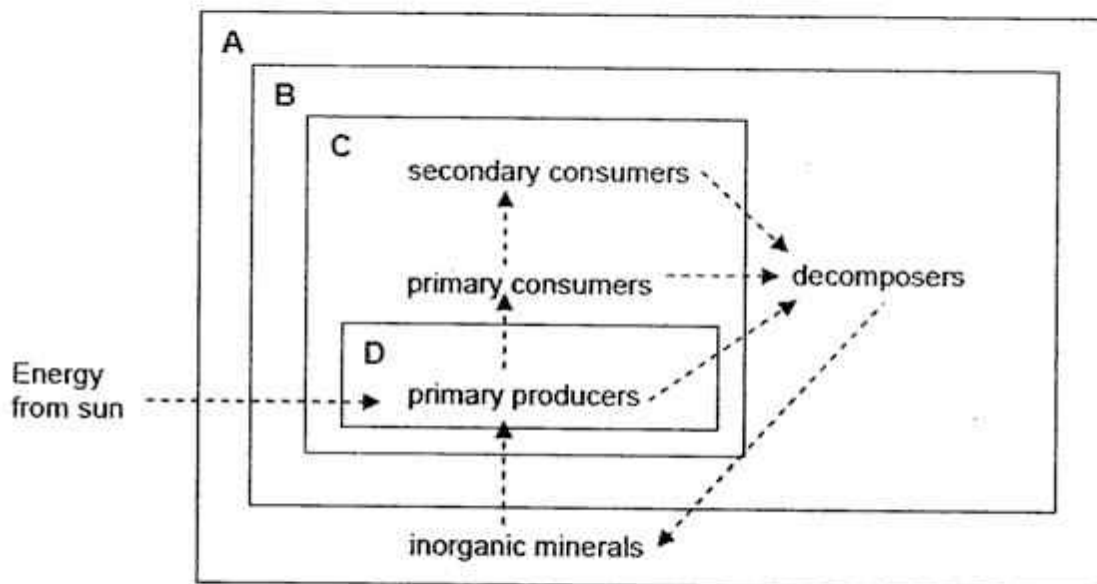
- A PP × pp
 B PP × Pp
 C Pp × Pp
 D pp × Pp

- 36 One of the mRNA codons for the amino acid proline is CCG. How many proline molecules are there in the following peptide consisting of six amino acids and is synthesized from the following DNA template?

TACGGCGGCCCGCCGCCG

Direction of transcribing the DNA template →

- A 0
B 1
C 2
D 3
- 37 A gene contains 900 phosphate groups. How many bases will it contain?
- A 300
B 900
C 1800
D 2700
- 38 Which box contains only the parts of an ecosystem which can be grouped together to form a food web?



39 Which of the following resources are recycled in an ecosystem?

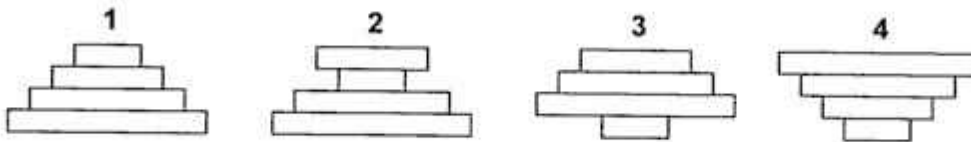
- | | | | |
|-----|----------|----|--------|
| I | Carbon | II | Energy |
| III | Nitrogen | IV | Oxygen |

- A I, II, III
 B I, III, IV
 C II, III
 D All of the above

40 A certain food chain is depicted below.

Grass → Rabbits → Hawks → Intestinal parasites

Below are four diagrams showing either pyramids of numbers or pyramids of biomass. Which ones apply correctly to the food chain above?



	Pyramid of biomass	Pyramid of numbers
A	1	2
B	1	3
C	2	3
D	4	2

END OF PAPER

Name: _____ Index Number: _____ Class: _____



TEMASEK SECONDARY SCHOOL
O Level Preliminary Examinations 2012
Secondary 4 Express

BIOLOGY

5094/02

Paper 2

1 hour 45 minutes

Question and Answer Booklet

Additional Material: Nil

READ THESE INSTRUCTIONS FIRST

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

Hand in this booklet at the end of the examination.

Write your name, index number and class on all the work you hand in.
Write in dark blue or black pen on both sides of paper.

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

Section A

Answer all questions.

Section B

Answer all the questions.

Write an **E** (for Either) or an **O** (Or) next to the number **11** in the grid below to indicate which question you have answered.

You are advised to spend no longer than one hour for Section A and no longer than 45 minutes for Section B. The number of marks is given in brackets [] at the end of each question or part question.

For Examiner's Use		
Section A		/50
Section B		/30
9		
10		
11		
Total		/80

SECTION A (50 MARKS)

Answer ALL the questions in this section.

- 1 People do not like buying carrots which are split. Scientists can use a wedge test to find out how easily a carrot splits. Fig.1.1 below shows a wedge test. Fig.1.2 shows the results of many wedge tests.

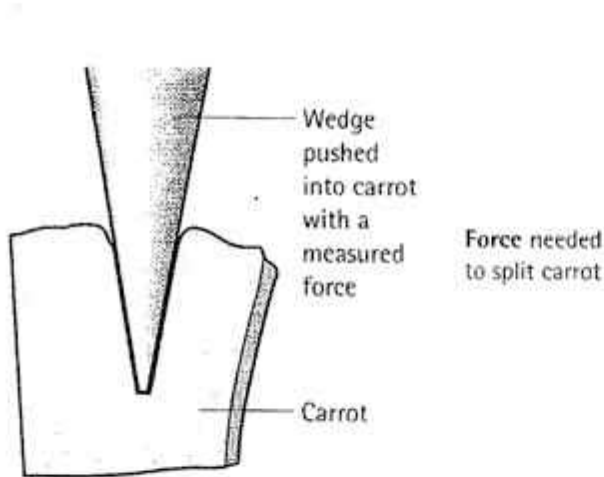


Fig. 1.1

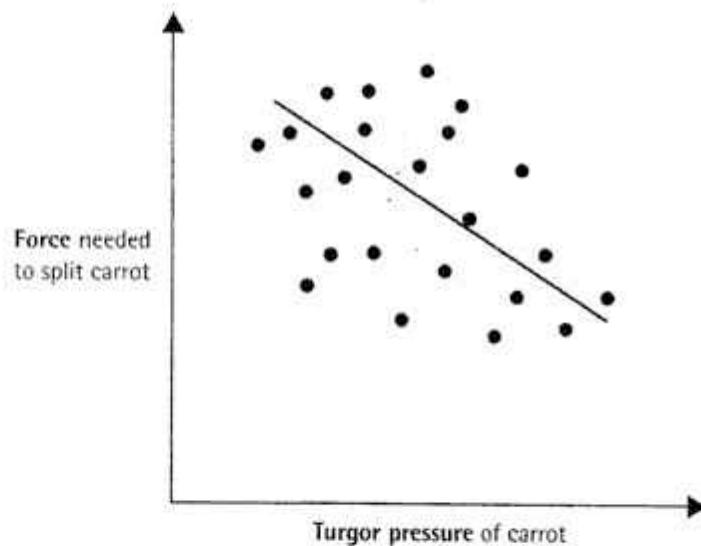


Fig. 1.2

- (a) What does the graph tell you about the relationship between turgor pressure and the amount of force needed to split carrot roots? [1]

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- (b) Suggest why carrots grown in low-rainfall areas are less likely to split. [2]

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- 2 Fig. 2 shows the heart of a fetus. In a fetus, the lungs do not function during gestation.

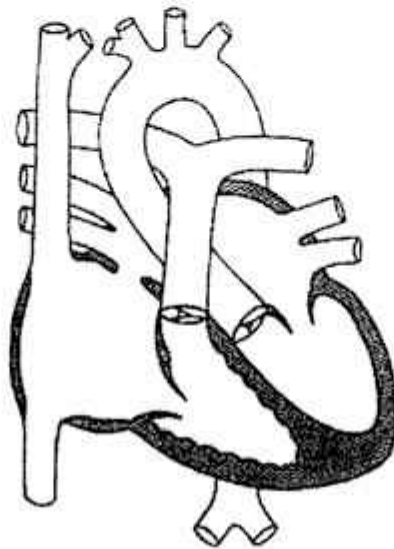


Fig. 2

- (a) (i) In Fig. 2, label the structure that separates oxygenated blood from deoxygenated blood. [1]
- (ii) On Fig. 2, write the letter F in the chamber of the heart that first receives oxygenated blood in an **adult** person.
Infer and write the letter FF in the chamber of the heart that first receives oxygenated blood in a **fetus**. [1]
- (iii) How is the pulmonary artery structurally different from the vena cava? [1]
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-
- (b) If the lungs do not function during gestation, explain how a fetus obtains its oxygen. [2]
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-

- (c) If you look carefully at the diagram, there is a hole in the septum between the left and right atria. When a baby is born, it takes its first breath. The hole in the septum of the heart closes quickly. Explain why this is important? [2]

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- 3 Kelvin recently discovered a new plant growing in his backyard which he had never seen before. He noticed that its flowers looked surprisingly like female bees. They had striking colours and gave off a pungent smell of rotting meat.

Fig. 3.1 below shows three longitudinal sections of a flower during the pollination period.

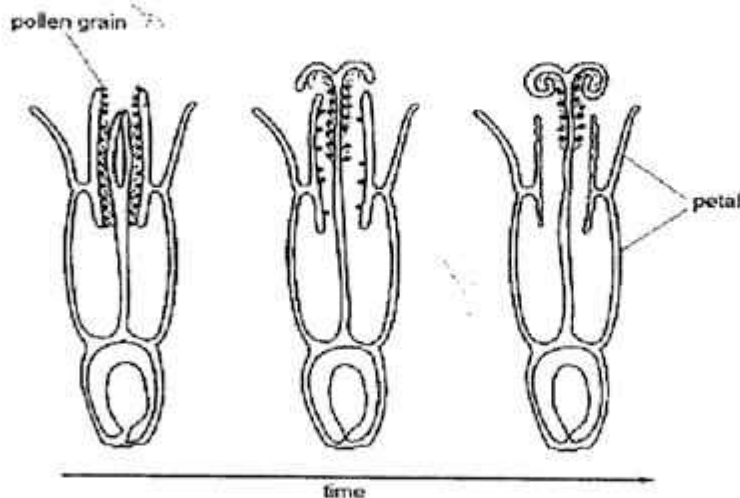


Fig. 3.1

- (a) Using Fig. 3.1 and the information provided, suggest, with reasons, what type of pollination this new plant encourages. [4]

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- (b) Out of curiosity, Kelvin decided to do an investigation on the newly discovered plant. He studied the effect of insects visiting the flowers on the percentage of flowers producing seeds. Some flowers were isolated from insects. Others received between one to fifty insect visits. The percentages of flowers that produced seeds are shown in Table 3.2 below.

<i>number of insect visits</i>	<i>percentage of flowers producing seeds</i>
0	92
1	92
10	95
20	97
50	97

Table 3.2

With reference to Fig. 3.1 and Table 3.2,

- (i) explain the results obtained by Kelvin;

[2]

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- (ii) suggest, with a reason, whether there is likely to be any difference in the genetic variation of offsprings receiving many insect visits and those receiving none.

[2]

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- 4 Fig. 4 below is an incomplete graph showing data obtained by measuring various parts of a boy's eye in response to the movement of a moth under varying ambient light intensity.

(a) Complete the graphs in Fig. 4.

[3]

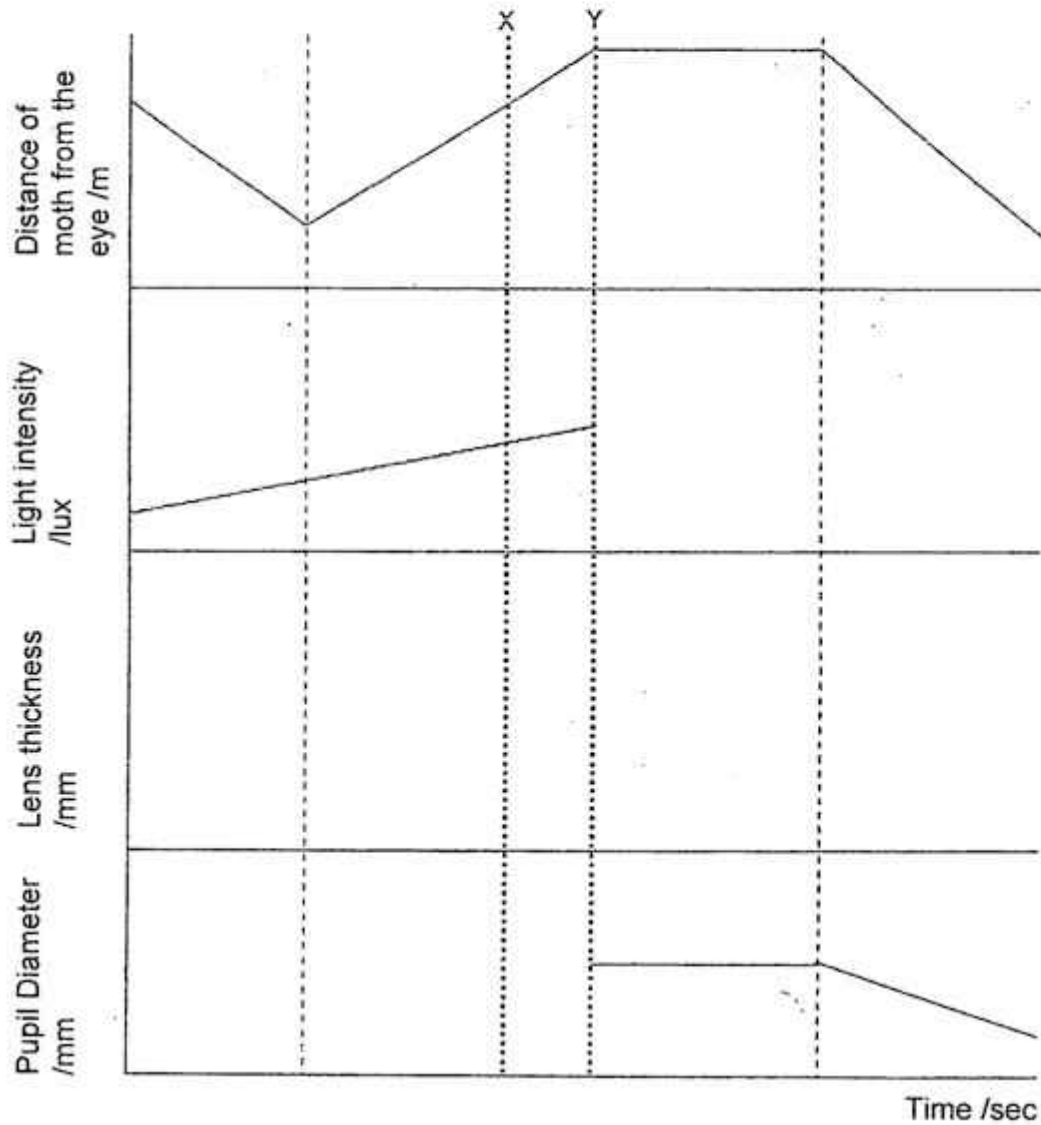


Fig. 4

- (b) Assume that a boy was looking at the moth on the book he was reading for the last 10 minutes. Suddenly, the moth flew off and landed on a wall and he continued to watch it.

(i) How will the shape of the lens in his eye be affected?

[1]

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(ii) Explain how this change is brought about.

[2]

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- 5 Fig. 5 below represents the nucleus of an animal cell ($2n = 4$) at early prophase of mitosis.

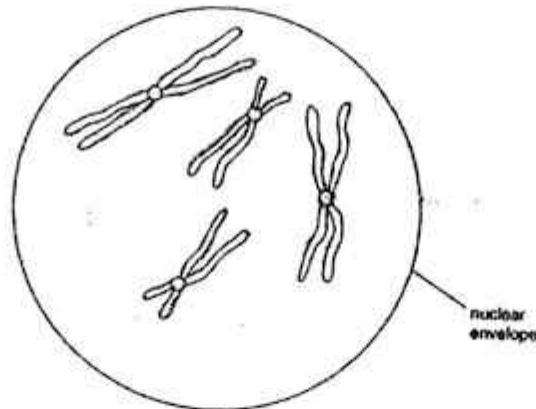
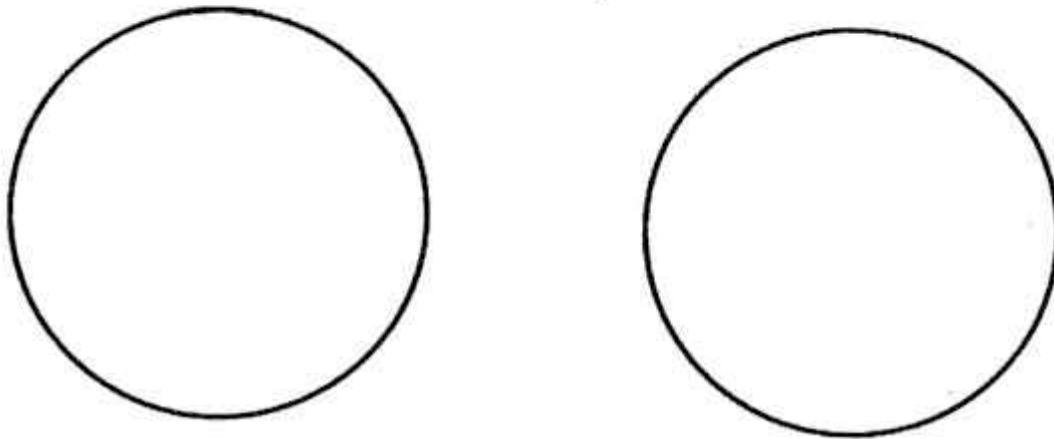


Fig. 5

- (a) (i) In the spaces below, draw clearly to show the main difference between mitotic metaphase and meiotic metaphase I in this cell.

[2]



(ii) Explain the significance of this difference.

[2]

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- (b) Explain why haploid cells need to be produced during a life cycle which includes sexual reproduction. [2]

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- 6 Maple syrup urine disease (MSUD) is an inherited metabolic disorder resulting from a defect in an enzyme involved in the breakdown of amino acids. It causes progressive nerve degeneration and often results in death at an early age. The disease derives its name from the distinct burnt sugar (maple syrup) smell of the urine of affected patients. Affected babies appear normal at birth, but within four to seven days they begin to display distinct symptoms: lethargy, poor feeding and failure to thrive. These progress to seizures, coma and death if untreated.

MSUD follows Mendelian inheritance patterns and is an autosomal recessive disease.

- (a) (i) Explain, with the use of a genetic diagram, the probability of a child inheriting the disease if both parents are carriers. Use alleles **A** and **a**. [3]

- (ii) A couple, both unaffected by the disease, are planning marriage, but both have siblings who have died of MSUD. Based on this information alone, what is the probability of both of them being carriers of this disease? Show how you arrive at this conclusion. [2]

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- (b) The classic form of MSUD have been found to be due to a gene mutation of one of the enzymes involved in the metabolism of essential amino acids leucine, isoleucine and valine. Suggest why this gene mutation has not been eliminated from the population by natural selection. [2]

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- 7 Fig. 7 below shows part of the process of protein synthesis.

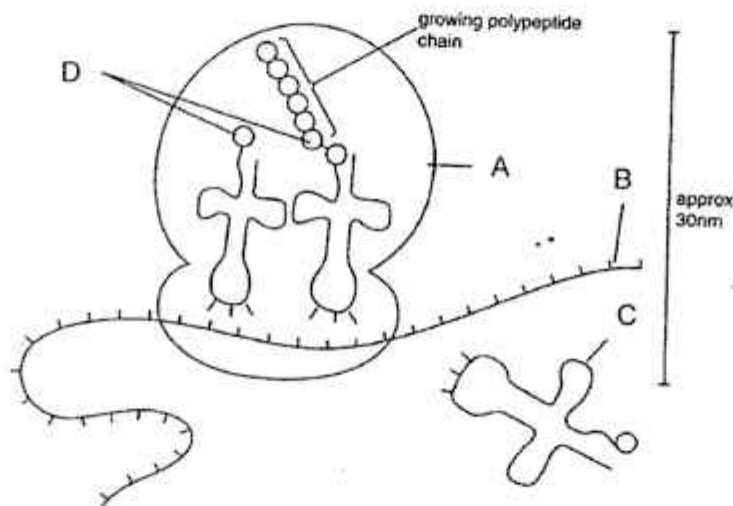


Fig. 7

- (a) Name the process illustrated in Fig. 7. [1]

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(b) Name A to D. [2]

A:

B:

C:

D:

(c) State two ways in which B is different from a DNA molecule. [2]

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8 Fig. 8 below shows information about living things in a lake.

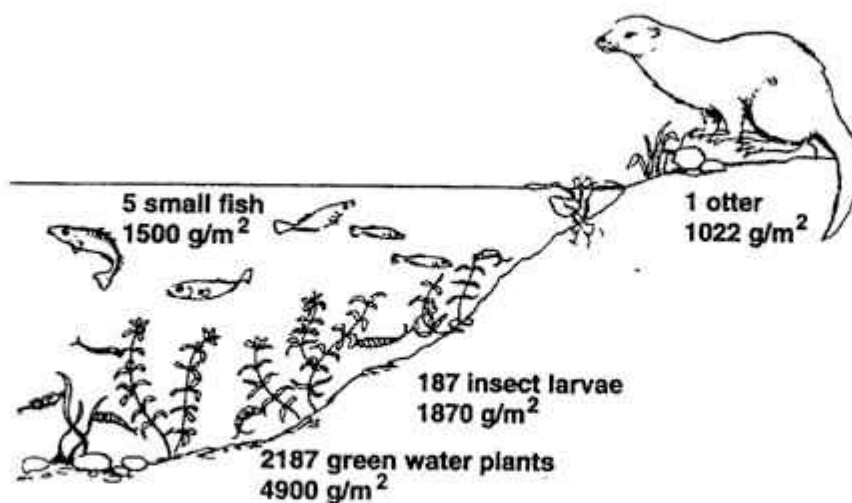


Fig. 8

(a) Use the information shown in Fig. 8 to answer the questions below.

(i) All the organisms shown in the diagram form a food chain. Draw and label a pyramid of biomass to represent this food chain. [2]

- (ii) Use your knowledge of energy transfer to explain the difference in biomass between the fish and their predators. [1]

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- (b) A biologist tested the lake and the living organisms for organochlorides, a compound found in insecticides and recorded his findings below.

	<i>parts per million (ppm) of organochlorides</i>
Water	0.03
Insect larve	1.20
Small fish	2.56
Otter	1680.00

Suggest how the organochlorides may have entered the lake and explain the relationship between the content of the diet and the concentration of organochlorides found in the organisms. [2]

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- (c) During the planting season, a farmer spread fertilisers on his field surrounding the lake. A few months later, all the small fish in the lake were dead. Explain what happened to cause the death of the fish. [3]

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SECTION B (30 MARKS)

Answer THREE questions in this section.

Question 11 is in the format of an EITHER / OR question. Only one part should be answered.

- 9 A student set up the apparatus shown in Fig.9.1 to investigate the effect of carbon dioxide concentration on the rate of photosynthesis of a pond plant. The student used five similar pieces of pond plant and five different concentrations of sodium hydrogencarbonate (NaHCO_3) solution, which provides the carbon dioxide. The student counted the number of bubbles produced by the pond plant over a period of five minutes.

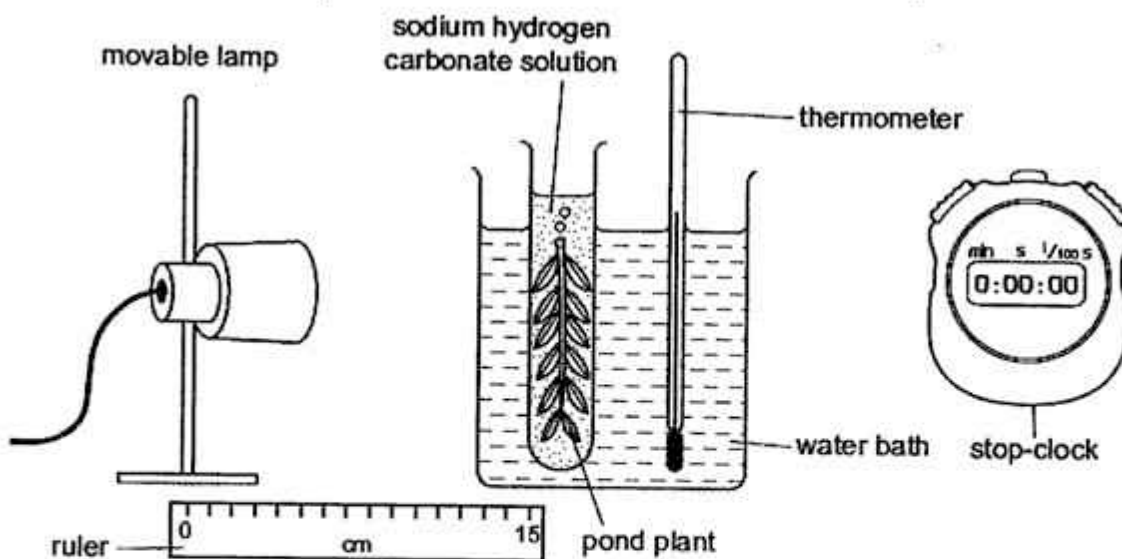


Fig. 9.1

- (a) Explain how the student made sure that the results were due only to the change in carbon dioxide concentration. [4]

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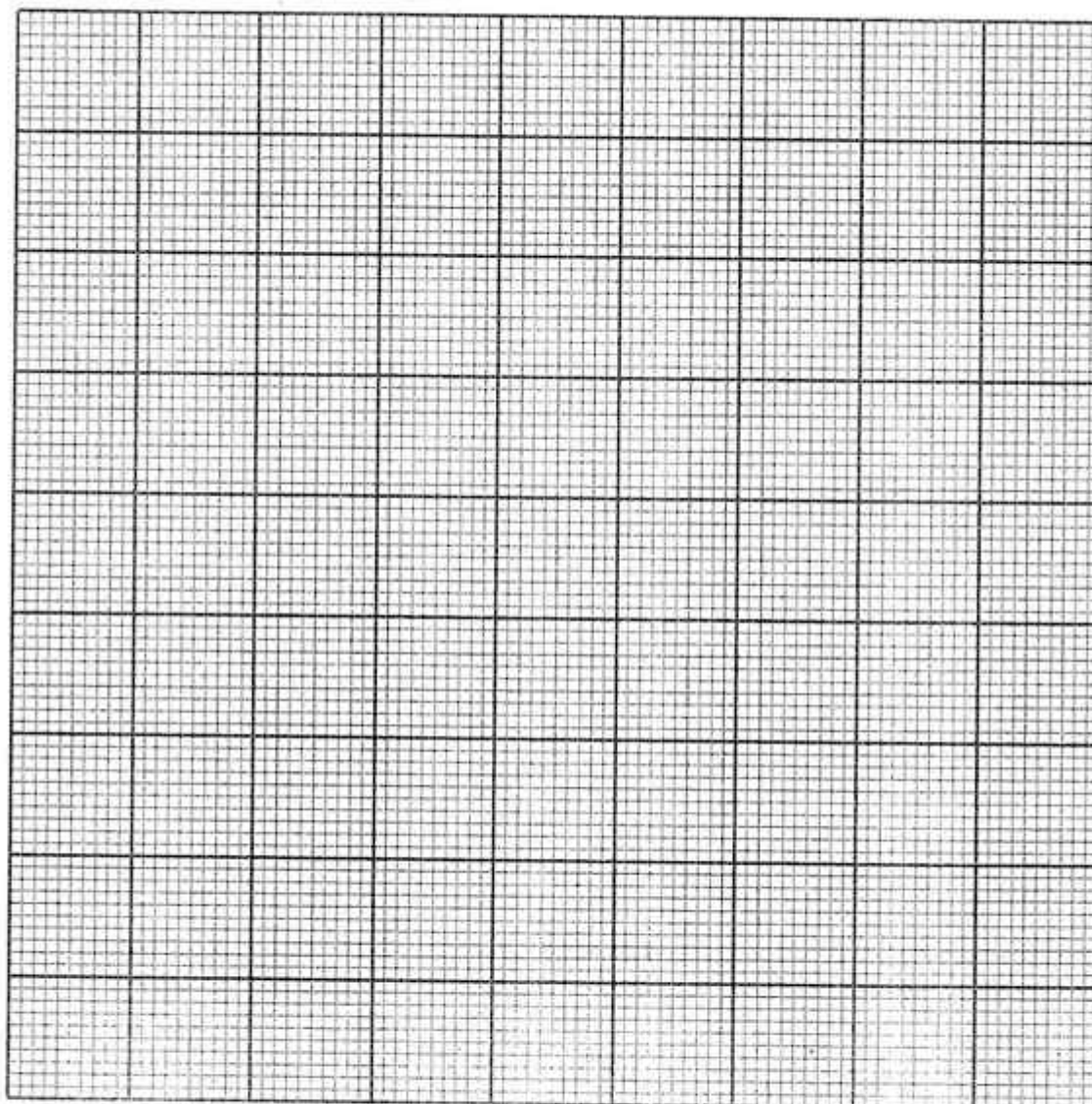
- (b) The student repeated the investigation at each concentration and calculated the rate of photosynthesis.
The student's results are shown in Table 9.2 below.

Carbon dioxide concentration / %	Rate of photosynthesis / number of bubbles per minute			
	1 st	2 nd	3 rd	Mean
0	3	2	4	3
0.1	6	4	5	5
0.2	12	7	11	10
0.3	14	15	16	15
0.4	18	22	21	20
0.5	19	23	21	21

Table 9.2

Plot the results from Table 9.2 on the grid below and draw an appropriate graph to show the relationship between carbon dioxide concentration and the rate of photosynthesis.

[3]



- (c) Explain the effect of increasing carbon dioxide concentration on the rate of photosynthesis up to 0.4% as shown in your graph. [2]

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- (d) Suggest the result that the student would get if a carbon dioxide concentration of 0.6% was used and explain your answer. [2]

Result: bubbles per minute

Explanation:

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- (e) The student used tap water as the 0% carbon dioxide concentration. Explain why the student recorded some bubbles being produced. [1]

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- (a) Discuss the advantages and disadvantages of growing tomato plants, into which the gene for T-toxin (an insecticidal substance) has been inserted, in the context of an ecosystem. [5]

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- (b) Outline and explain the significance of decomposers in an ecosystem. [3]

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11

- (a)

[illegible]

- (b)

[illegible]

11 OR

(a) A new slimming drug 'NewMe' claims to contain an amylase and a lipase inhibitor.

(i) Suggest how this product could reduce obesity in combination with frequent exercise. [5]

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(ii) Suggest two possible side effects of long term use of 'NewMe'. [2]

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- (b) Explain why a vegetarian diet might be described as more efficient in terms of energy than a diet containing meat. [3]

[illegible][illegible]



TEMASEK SECONDARY SCHOOL
O Level Preliminary Examinations 2012
Secondary 4 Express Biology

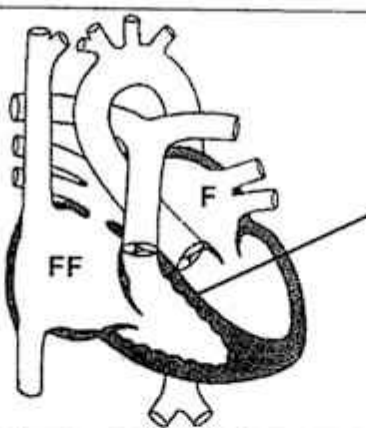
Paper 1 Answers

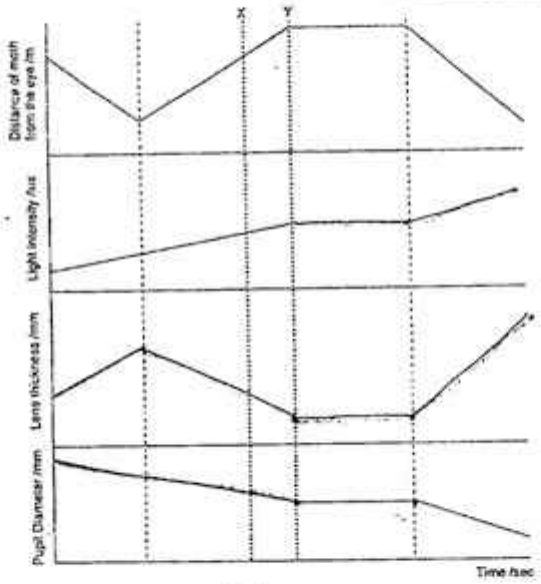
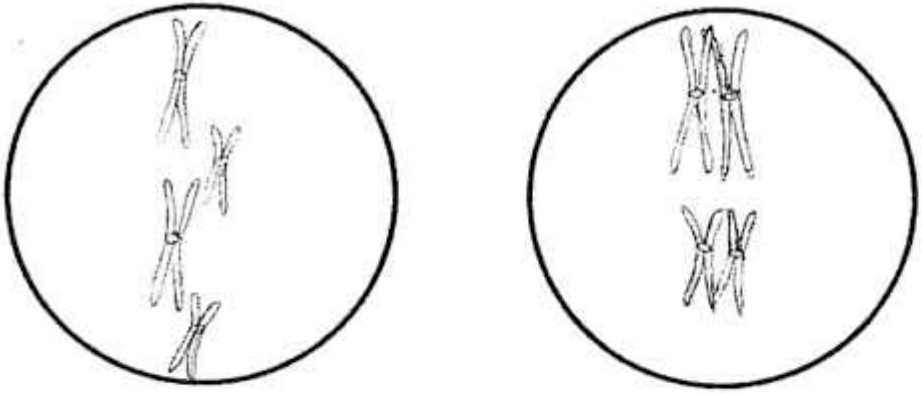
1	C	11	A	21	D	31	D
2	D	12	D	22	A	32	C
3	C	13	B	23	A	33	B
4	D	14	B	24	A	34	C
5	B	15	A	25	B	35	C
6	C	16	D	26	D	36	C
7	B	17	C	27	A	37	B
8	D	18	A	28	C	38	B
9	C	19	A	29	B	39	B
10	A	20	B	30	B	40	A

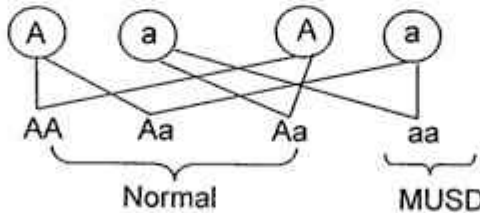
Sec 4 Biology 5094

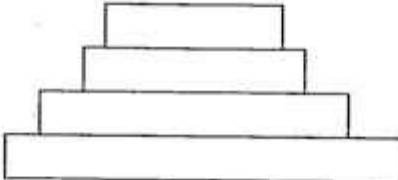
Preliminary Exam 2012 Mark scheme

Paper 2 Section A (50 marks)

Qn		Marks
1(a)	Amount of force needed to split carrot decreases with increasing turgor pressure of the carrot	1m
(b)	Less water available in the soil in low-rainfall areas, water leaves the carrot tuber as the surrounding soil solution has a lower water potential, cells become flaccid, turgor pressure drops, carrot does not split	1 1
		2m
2(a) (i) (ii)	 <p>(i) (median) septum</p>	1m 1m
(iii)	Pulmonary artery has thicker muscular wall / smaller lumen compared to vena cava	1m
(b)	At the placenta, oxygen from maternal blood diffuse into fetal blood, oxygenated blood is then transported back to the fetus via the vein in the umbilical cord	1 1
		2m
(c)	If the hole remains, oxygenated blood and deoxygenated blood from both atria will mix; Level of oxygen in the blood that is sent to all parts of the body from the left ventricle via the aorta will be much lower / less oxygen available for respiration in body cells	1 1
		2m
3(a)	Cross pollination by insects; - anther releases pollen before stigma matures; - flowers look like female bees to attract male bees to mate with them, these bees may carry pollen grains on their hairy body and deposit the pollen onto the stigma when they try to enter the flower; - striking colour and pungent smell attract other insects to the flowers so that they can also pick up and transfer pollen grains to other flowers	1 1 1 1
		4m
(b)(i)	Flowers are not totally dependent on insects for pollination, (as there was no significant differences in the percentages of seed production by the 2 groups of flowers); Flowers can carry out self-pollination in the absence of insects, as the style picks up pollen as it elongates while the stigma curls backwards when it matures to touch the pollen	1 1

(ii)	When insects, carrying pollen from another plant, visit the flowers, cross pollination is likely to occur, resulting in greater genetic variation; When no insects visit, flowers carry out self pollination, resulting in minimal genetic variation as it involves only one parent	1 1
		2m
4(a)	 <p style="text-align: center;">Fig. 4</p>	1 1 1
		3m
(b)(i)	Lens become thinner / less biconvex	1m
(ii)	Circular muscles of ciliary body relax; Suspensory ligaments become taut, pulling on the lens to make it thinner and less biconvex	1 1
		2m
5(a) (i)	 <p style="text-align: center;">Mitotic metaphase Meiotic metaphase I</p>	

(ii)	<p>When homologous chromosomes pair up and align along equator of cell during metaphase I, crossing over occurs between chromatids of the two chromosomes; this will lead to increased variation in the gametes that are subsequently formed; crossing over does not occur in mitotic metaphase</p> <p>OR</p> <p>Alignment of chromosomes in a single row during mitotic metaphase allows for separation of sister chromatids during anaphase, resulting in daughter cells containing same number of chromosomes as parent cell;</p> <p>Alignment of pairs of homologous chromosomes along equator of cell allows for separation of chromosomes, which will result in formation of haploid daughter cells after meiosis II.</p>	1 1
		2m
(b)	<p>When 2 haploid gametes fuse, the zygote that is formed has double the number of chromosomes, hence allowing the species to maintain its diploid number of chromosomes throughout all generations.</p>	1 1
		2m
6(a) (i)	<p>Key: A represents normal allele, a represents MUSD allele</p> <p>Parental phenotype: Normal Aa x Normal Aa</p> <p>Gametes: A, a, A, a</p> <p>F1 generation genotype: AA, Aa, Aa, aa</p> <p>phenotype: Normal (AA, Aa, Aa), MUSD (aa)</p> <p>Probability of a MSUD child = $\frac{1}{4}$ (25%)</p> 	3m
(ii)	<p>Parents of normal couple are heterozygotes (Aa) as they have children who suffer from MSUD(aa);</p> <p>From genetic diagram, probability of one of them (the couple) being a carrier is $\frac{1}{2}$;</p> <p>Probability of both of them being carriers = $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$ (25 %)</p>	$\frac{1}{2}$ $\frac{1}{2}$ 1
		2m
(b)	<p>The condition is only expressed when both recessive alleles are present; Carriers / heterozygotes do not suffer from the condition, are able to reproduce to pass the recessive allele to future generations.</p>	1 1
		2m
7(a)	Translation	1m
(b)	<p>A: ribosome B: messenger RNA C: transfer RNA D: amino acids</p>	2m

(c)	<table><tr><th>mRNA</th><th>DNA</th></tr><tr><td>Single strand polynucleotide</td><td>Double strand</td></tr><tr><td>Bases are adenine, uracil, cytosine and guanine</td><td>Bases are adenine, thymine, cytosine, guanine</td></tr><tr><td>Contain ribose sugar</td><td>Contain deoxyribose sugar</td></tr><tr><td>No fixed ratio between A:U & C:G</td><td>Ratio of A:T & C:G is 1:1</td></tr><tr><td>Small soluble molecule, made only when needed</td><td>Large insoluble molecule that is a permanent structure</td></tr></table> <p>Any two differences</p>	mRNA	DNA	Single strand polynucleotide	Double strand	Bases are adenine, uracil, cytosine and guanine	Bases are adenine, thymine, cytosine, guanine	Contain ribose sugar	Contain deoxyribose sugar	No fixed ratio between A:U & C:G	Ratio of A:T & C:G is 1:1	Small soluble molecule, made only when needed	Large insoluble molecule that is a permanent structure	2m
mRNA	DNA													
Single strand polynucleotide	Double strand													
Bases are adenine, uracil, cytosine and guanine	Bases are adenine, thymine, cytosine, guanine													
Contain ribose sugar	Contain deoxyribose sugar													
No fixed ratio between A:U & C:G	Ratio of A:T & C:G is 1:1													
Small soluble molecule, made only when needed	Large insoluble molecule that is a permanent structure													
8(a) (i)	<div>otter</div> <div>small fish</div> <div>insect larvae</div> <div>green water plants</div> 	2m												
(ii)	Only 10% of energy is transferred from fish to their predator (as 90% is lost through processes such as respiration and excretion); thus biomass of fish must be greater to be able to sustain the next trophic level	1m												
(b)	<ul style="list-style-type: none">Run-off from nearby farms that use insecticidesAs the organochlorides do not break down and are passed along from one organism to the next in the food chain,It will accumulate and will be present in the highest concentration in the top most consumer, the otter	$\frac{1}{2}$ 1 $\frac{1}{2}$												
(c)	<ul style="list-style-type: none">As fertilizers are washed off into the lakes by rain water, this results in eutrophicationProfuse growth and multiplication of algae and water plants due to the presence of nutrientsAlgae and plants die due to lack of sunlightDecomposition of algae and plants by bacteria results in consumption of oxygen in water for growth by bacteria / bacteria grow and multiply rapidly, using up oxygen in the water;Organisms such as fish start to die due to lack of oxygen	2m $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$												
		3m												

	Paper 2 Section B (30 marks)	
9(a)	By keeping all other factors constant and changing only concentration of sodium hydrogencarbonate solution; Using water-bath set at the same temperature for all experiments to keep the surrounding temperature constant; Placing the lamp at the same distance, thus keeping the light intensity constant; Using the same volume of NaHCO ₃ solution for each experiment; Counting number of bubbles produced in a fixed time of five minutes for all experiments; Choosing plant of same size / number of leaves for all experiments (any 4 ways of keeping factors constant)	4m
(b)	All points plotted accurately; Curved line of best fit; Correct axes with labels and units; Size of graph: 75% of space given	3m
(c)	Number of bubbles released in a given time is an indication of the rate of photosynthesis in a plant; hence graph shows that rate of photosynthesis increases as carbon dioxide increases; carbon dioxide is the raw material needed for photosynthesis, at concentration below 0.4 %, CO ₂ is the limiting factor.	½ ½ ½ ½ 2m
(d)	19 – 23 bubbles per minute At 0.6%, carbon dioxide is no longer the limiting factor, therefore no further increase in number of bubbles released; sufficient water / increased light intensity must be present to allow for more reaction	½ ½ 1 2m
(e)	Tap water contains some dissolved carbon dioxide, which can be used by the plant for photosynthesis; When plant respire, it produces carbon dioxide which can be used by the plant for photosynthesis (any one of the 2)	1m

10(a)	<p><u>Advantages:</u></p> <p>Use of costly pesticides that may damage the natural environment is reduced;</p> <p>Transgenic plants can survive better, less land need to be used for growing, leading to preservation of the natural environment and less loss of biodiversity;</p> <p>Plants do not suffer from pests attack, farmers are able to obtain higher yields when they harvest the fruits, which when sold, can lead to better income for them;</p> <p>(any 2)</p> <p><u>Disadvantages:</u></p> <p>Resulting death of insects that feed on the tomato plants may result in a loss of biodiversity in the long term;</p> <p>may upset the equilibrium of the ecosystem as one trophic level of a food chain is removed</p> <p>Insects that feed on the tomato plants may adapt and develop resistance to the toxin;</p> <p>Modifying a single gene in the plant could result in the alteration of some metabolic processes within the plant, may result in production of toxins not usually found within the plants, consumption of plant products by humans may pose serious health problems;</p> <p>Other than pests, insect pollinators that feed on nectar can also be killed, prevent pollination of tomato plants and hence affecting the formation of fruits</p> <p>(any 3)</p>	2
		3
		5m
(b)	<p>Decomposers help to break down dead organisms and waste so that they will not build up and pollute the environment;</p> <p>In breaking down organic matter, they release and return inorganic nutrients, carbon dioxide and nitrogen compounds into the physical environment so that they can be recycled / used again by green plants</p> <p>(carbon dioxide for photosynthesis and nitrates for growth)</p>	1
		1
		1
		3m

11	Either	
(a)	<u>Skin:</u> Water-proof cornified layer forms a protective layer over the body surfaces, preventing microorganisms from gaining entry into the body unless there is a cut in the skin; 1 Sebum produced by sebaceous gland has antiseptic effect that prevents growth of bacteria on the skin 1 <u>Respiratory surfaces</u> Dust and foreign particles are trapped by the hairs in the nostrils as well as by the mucus on the mucous membrane of the nasal passages; 1 Gland cells in epithelium lining bronchi and trachea secrete mucus to trap dust particles and bacteria that enter via inhaled air; 1 Cilia on epithelial cells help to sweep trapped particles up the bronchi and trachea into pharynx to be swallowed into the oesophagus 1 <u>Alimentary canal</u> Gastric glands lining stomach wall secrete gastric juice containing hydrochloric acid; 1 Low pH helps to kill microorganisms that enter together with the food eaten 1	
		7m
(b)	Phagocytes destroy foreign bodies by engulfing and ingesting and finally digesting the bacteria; 1 Lymphocytes produce antibodies in response to entry of bacteria into the bloodstream, Antibodies cause the bacteria to clump together so that they can be easily ingested by phagocytes / act as antitoxins, neutralising the toxins produced by bacteria / destroy bacteria by attaching to them, causing the bacterial membrane to rupture / attach themselves to viruses, making them unable to bind to the host cell 2	
		3m

11	OR	
(a)	<p>Inhibitors reduce action of amylase and lipase;</p> <p>Less starch can be digested to maltose and then to glucose by maltase, less fats can be digested to fatty acids and glycerol;</p> <p>leading to reduced amounts of glucose, fatty acids and glycerol absorbed by the small intestines;</p> <p>food reserves in the body eg glycogen and fats is converted to glucose to be used for respiration to release energy for exercise;</p> <p>energy expenditure is greater than energy intake, person will eventually lose weight</p>	<p>$\frac{1}{2}$</p> <p>1</p> <p>$\frac{1}{2}$</p> <p>1</p> <p>1</p> <p>1</p>
		5m
(b)	<p>Undigested fats defecated through anus, resulting in oily faeces leaking out and staining clothes / loose stools / diarrhoea;</p> <p>Lack of fats in the body affects storage of fat soluble vitamins (ADEK), may lead to vitamin deficiency diseases;</p> <p>Poisonous ketones produced due to oxidation of fats;</p> <p>Loss of appetite / underweight / malnutrition</p> <p>(any 2)</p>	2m
(c)	<p>A lot of energy is lost to the environment as food is transferred from one trophic level to the next.</p> <p>The shorter the food chain the less energy lost;</p> <p>Plants are food producers; vegetarians feed directly on plants hence least energy is lost as food is transferred to vegetarians;</p> <p>animals that eat meat will receive less energy as the food chain is longer, involving at least three trophic levels</p>	<p>1</p> <p>$\frac{1}{2}$</p> <p>1</p> <p>$\frac{1}{2}$</p>
		3m

Name: _____ ()

Class: Sec 4 / ()



南 华 中 学

NAN HUA HIGH SCHOOL
PRELIMINARY EXAMINATION 2012

Subject : Biology
Paper : 5094 / 1
Level : Secondary Four Special / Express
Date : 20 September 2012
Duration : 1 hour

INSTRUCTIONS TO CANDIDATES

Write in soft pencil.

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

Write your name, class and index number on the separate Answer Sheet provided.

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

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

INFORMATION FOR CANDIDATES

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

This paper consists of 20 printed pages.

- 1 Which of the following structures are found both in an animal cell and a plant cell?

A Cell membrane and Chloroplast
B Cell membrane and Mitochondrion
C Cell wall and Chloroplast
D Cell wall and Nucleus

- 2 A plant cell has the following states in three different solutions X, Y and Z.

X – Turgid
Y – Flaccid
Z – Plasmolysed

Which option correctly shows the relative water potential of each solution in arbitrary units?

	X	Y	Z
A	1	4	3
B	2	3	1
C	3	2	1
D	3	1	2

- 3 Cyanide interferes with the release of energy from respiration.
What would be the effect on the rate of photosynthesis if a plant was exposed to cyanide?

A Increase to make up for the decrease in energy release.
B Increase to remove cyanide from the plant.
C Stop due to a lack of carbon dioxide.
D Stop due to a lack of energy.

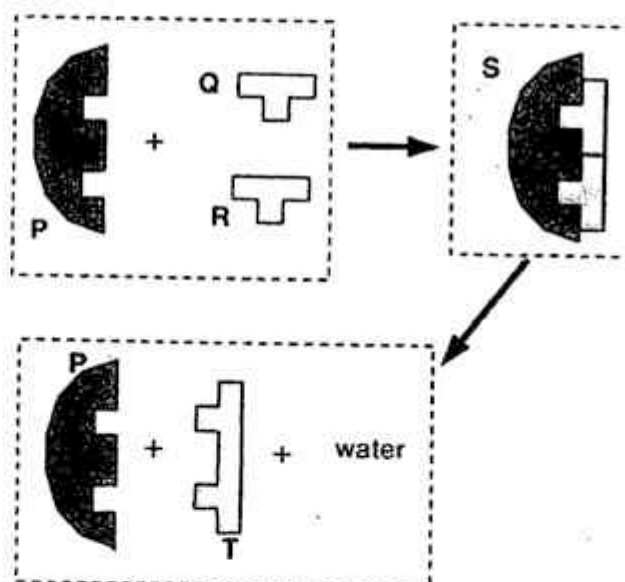
- 4 Which of the following statements is incorrect concerning constipation?

A It is a result of eating too little vegetables.
B It is caused by food of high fibre content.
C It occurs when peristalsis is ineffective.
D It may be improved by eating fruits.

- 5 Pineapples are added to steak before cooking to make the meat softer. Which of the following enzymes is present in pineapples?

A Amylase
B Diastase
C Lipase
D Protease

- 6 The following diagram represents an enzyme reaction.



Which of the following reactions can be represented by the above diagram?

	Substrate(s)	Product(s)
A	Amino acid	Protein
B	Fatty acids and glycerol	Fat
C	Maltose	Glucose
D	Glucose	Starch

- 7 Which of the following is not related to assimilation?

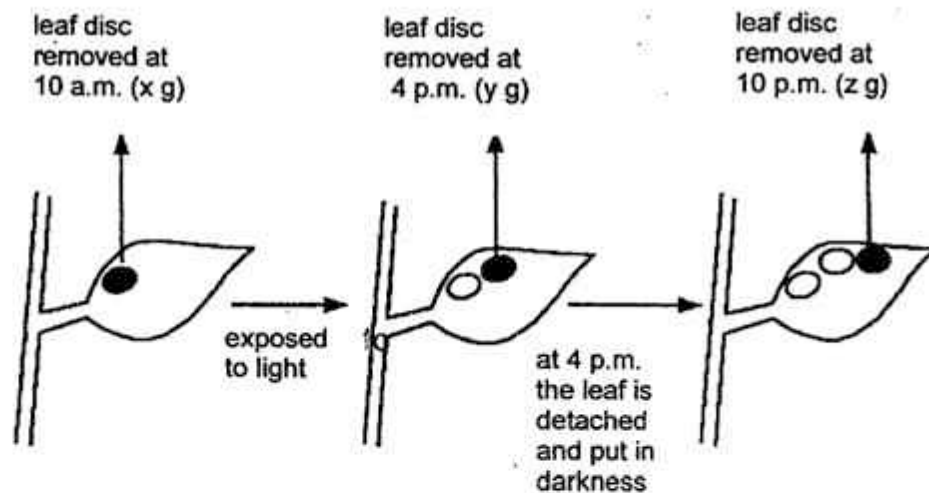
A Development of strong muscles.
B Build up of glycogen stores in muscles.
C Increase in bone mass after taking calcium pills.
D Absorption of water into the blood stream.

8 Intestinal juice contains all the following enzymes except

- A Amylase
- B Erepsin
- C Lipase
- D Maltase

9 Refer to the diagram below to answer Question 9 and 10.

The diagram below illustrates an experiment in which discs of equal area are removed from the **same** leaf of a destarched plant. The plant had been treated differently at different times of the day. The dry weight of the leaf discs were measured in g.



The value of $(y-x)$ g represents

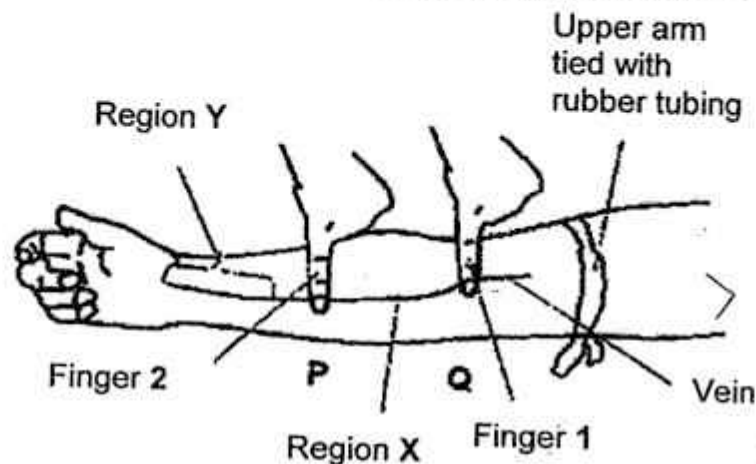
- A the amount of food consumed in respiration.
- B the amount of water lost in transpiration.
- C the net gain of food by photosynthesis.
- D the net gain of water by photosynthesis.

10 The value of $(y-z)/6$ g/h represents the rate of

- A transpiration
- B translocation
- C respiration
- D photosynthesis

- 11 Refer to the diagram below to answer Questions 11 and 12.

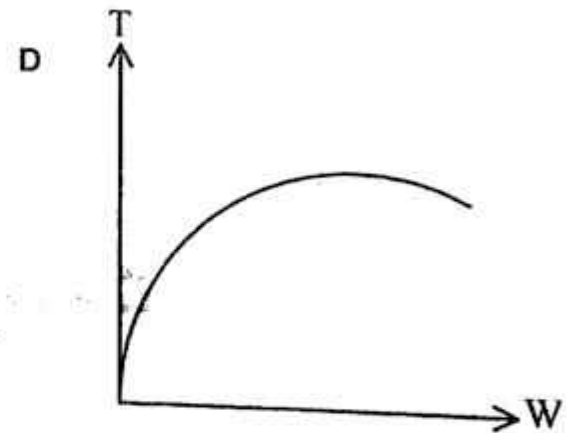
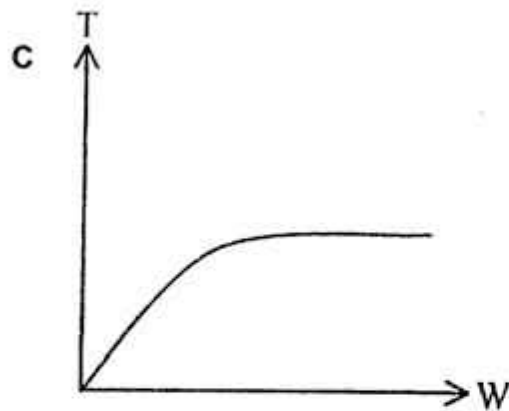
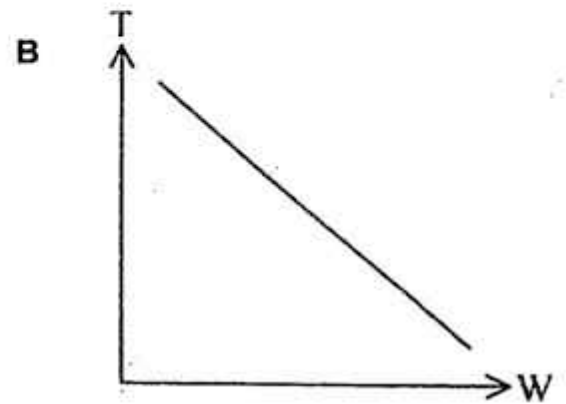
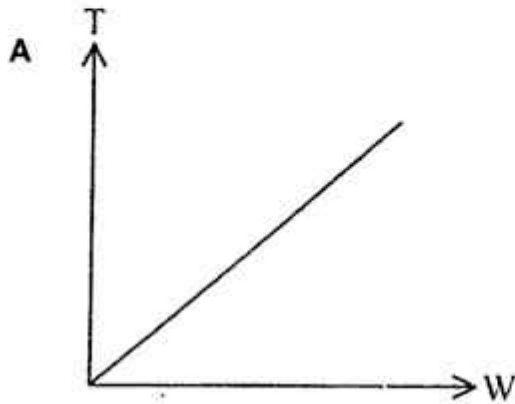
The diagram below that shows the demonstration of venous blood flow in the forearm.



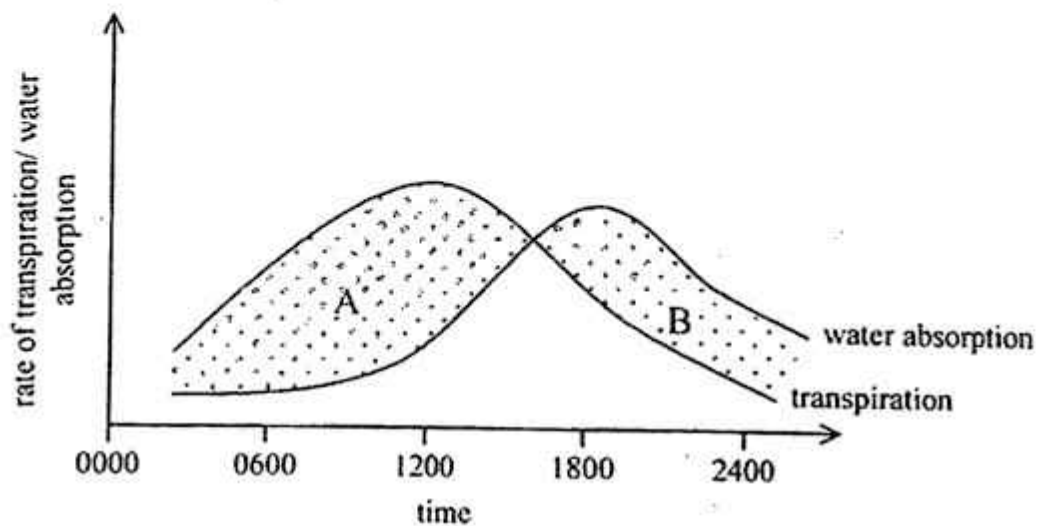
The upper arm tied with rubber tubing is used to

- A block the blood flow temporarily.
 - B make the vein more obvious.
 - C decrease blood flow from heart.
 - D open all the valves in the veins.
- 12 Two fingers were placed at position P initially. When Finger 1 pushes the blood from position P to Q and is then lifted off, region X would become empty. The reason is/are
- 1 blood flow is stopped by Finger 2.
 - 2 valves prevent the backflow of blood.
 - 3 rubber tubing prevents the backflow of blood.
- A 1 only
 - B 2 only
 - C 1 and 2 only
 - D 2 and 3 only

- 13 Which of the following graphs best illustrates the influence of wind speed on the rate of transpiration? (T represents rate of transpiration; W represents wind speed)



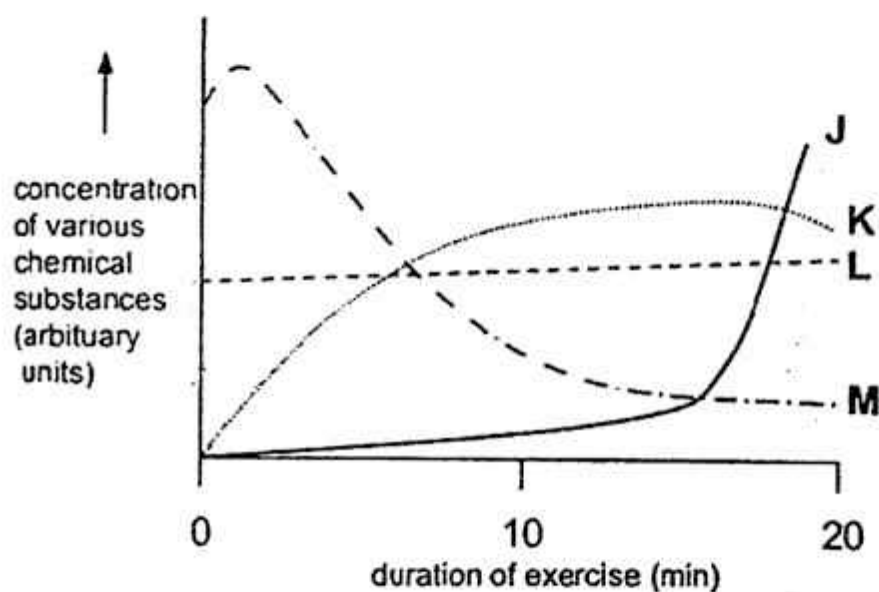
- 14 The graph below shows the rate of transpiration and water absorption of a leafy plant at different times on a hot day.



Which of the following can be implied from the fact that area A is larger than area B?

- A The plant is bearing a risk of wilting.
- B The plant is healthy without a lack of water.
- C The plant absorbs more water than it loses.
- D The plant reduces the transpiration rate by closing the stomata from late afternoon onwards.

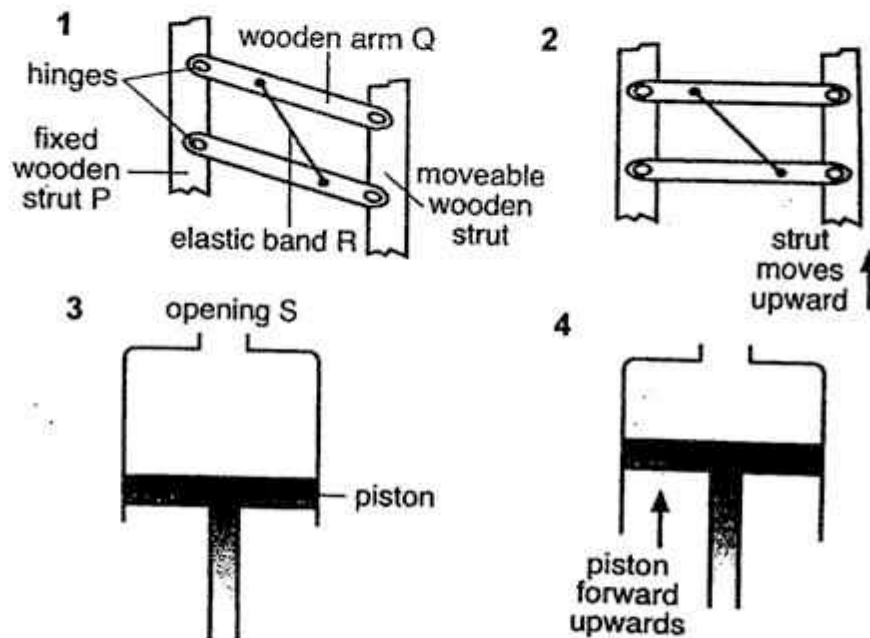
- 15 The graph below shows changes in the concentrations of various chemical substances in the thigh muscles of a person exercising vigorously on a bicycle.



Which of the following statements is correct?

- A Line J represents glycogen.
- B Line K represents carbon dioxide.
- C Line L represents oxygen.
- D Line M represents lactic acid.

- 16 The diagram below shows models which demonstrate the actions of two different sets of muscles used during breathing in a mammal.



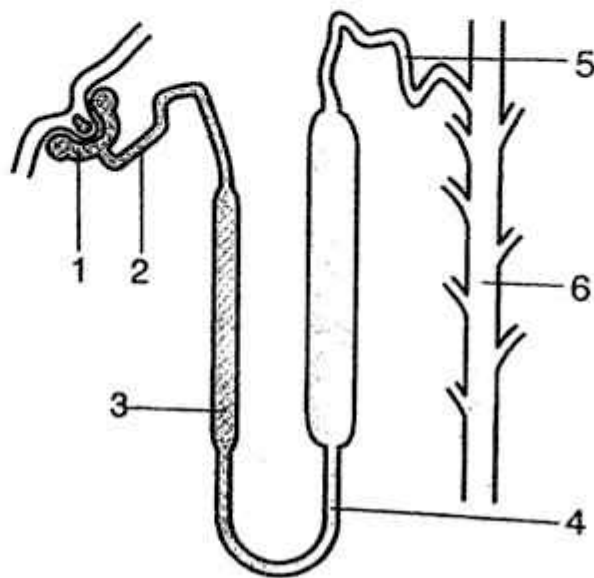
Which two diagrams represents the thorax during inspiration?

	(1)	(2)	(3)	(4)
A	✓		✓	
B		✓		✓
C	✓			✓
D		✓	✓	

- 17 Which component of faeces is an excretory product?

- A Bacteria
- B Cellulose
- C Bile pigments
- D Undigested food

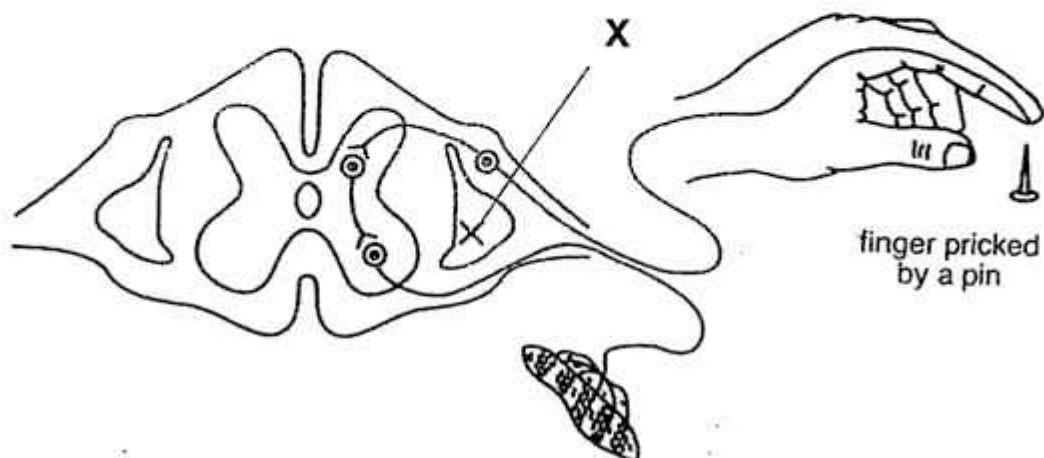
- 18 The diagram below represents a kidney nephron.



In a healthy person, which structures would contain the most amino acids?

- A 1 and 2
 - B 3 and 4
 - C 4 and 5
 - D 5 and 6
- 19 The Peripheral Nervous System consists of which of the following nerves?
- 1 Brain
 - 2 Cranial nerves
 - 3 Spinal cord
 - 4 Spinal nerves
- A 1, 2 and 3 only
 - B 1 and 3 only
 - C 2, 3 and 4 only
 - D 2 and 4 only

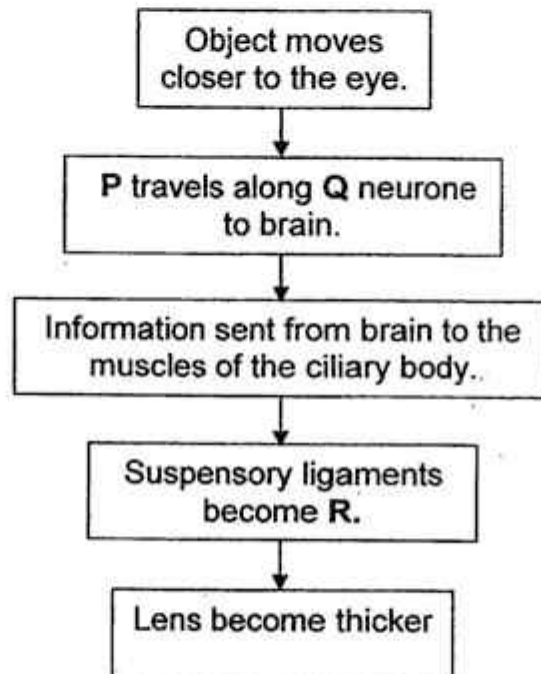
- 20 The diagram below shows a simple reflex arc. A cut has been made along line X.



What is the effect of this cut at X?

	Pin felt	Reflex arm movement
A	Yes	No
B	Yes	Yes
C	No	No
D	No	Yes

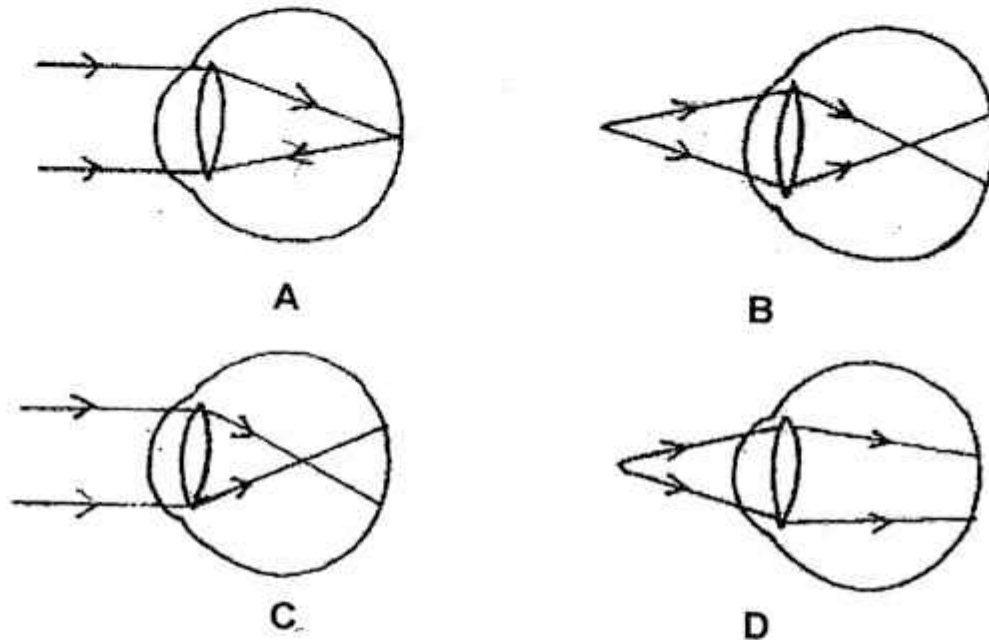
21 The diagram below shows a pupil reflex.



What do P, Q and R stand for?

	P	Q	R
A	Stimulus	Motor	Taut
B	Stimulus	Sensory	Slacken
C	Nervous impulse	Motor	Taut
D	Nervous impulse	Sensory	Slacken

22 Which of the following diagrams show how light from a distant source is focused?



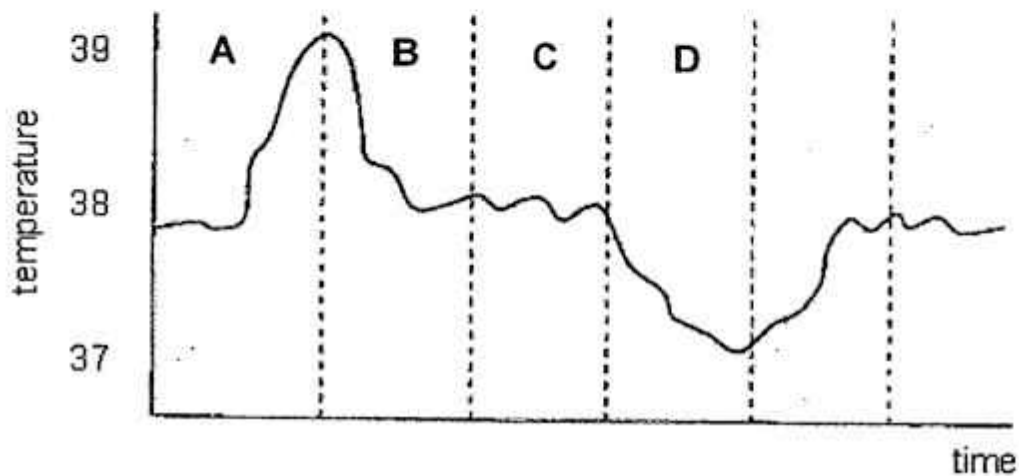
23 Two organs secrete substances which affect the body.

Organ 1 → Product 1
Organ 2 → Product 2

Negative feedback control of Product 2 would be achieved if

- A Product 1 counteracts Product 2.
- B Product 1 reinforces the effect of Product 2.
- C Product 2 inhibits Organ 1 and Product 1 stimulates Organ 2.
- D Product 2 stimulates Organ 1 and Product 1 stimulates Organ 2.

- 24 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 the surface capillaries first become constricted?



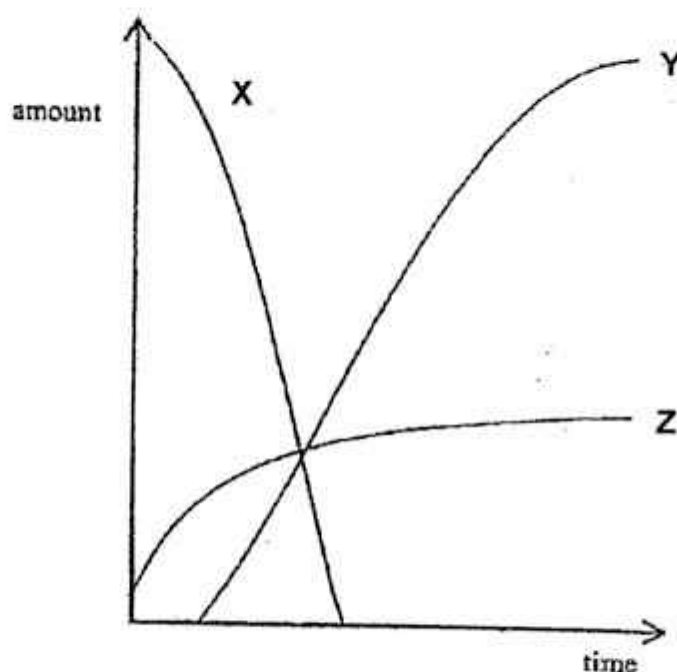
- 25 Hormones are destroyed in the _____.
- A liver
 - B kidney
 - C pancreas
 - D spleen
- 26 Adrenaline is sometimes given to patients. In which of the following conditions would the administration of adrenaline be useful?
- 1 Low pulse rate
 - 2 Low blood sugar levels
 - 3 Low water potential of blood
- A 2 only
 - B 1 and 2 only
 - C 2 and 3 only
 - D 1, 2 and 3

- 27 An insect pollinated flower would not have
- A nectaries producing nectar.
 - B large colourful petals.
 - C non protruding anthers.
 - D small, light pollen.
- 28 A flower on a plant has its anthers removed. It is observed that the flower continues to develop into a fruit. What conclusion can be made from this experiment?
- A The flowers on the plant are of the same sex.
 - B The flowers on the plant are cross pollinated.
 - C The flowers mature at different times.
 - D The flowers are adapted for insect pollination.
- 29 What is the route taken by the sperm?
- A Testis → epididymis → sperm duct → urethra → outside
 - B Testis → sperm duct → Cowper's gland → urethra → outside
 - C Epididymis → testis → sperm duct → urethra → outside
 - D Epididymis → sperm duct → prostate gland → outside
- 30 The following pairs of items relate to the menstrual cycle. Which one is not correctly matched?
- A Day 1 to 5 → discharge of the uterine lining
 - B Day 6 to 12 → repair of the uterine lining
 - C Day 13 to 15 → ovulation
 - D Day 16 to 25 → break down of the uterine lining
- 31 A DNA molecule is 300 base-pair long. If 20% of the nitrogenous bases are cytosine, how many adenine bases are there?
- A 60
 - B 90
 - C 180
 - D 360

- 32 Which process gives rise to organisms which are genetically different from each other?
- A Binary fission in amoeba.
 - B Production of spores by a mould fungus.
 - C Production of ovules by a flowering plant.
 - D Separation of small, fully-formed plants from a parent plant.
- 33 A study was made of 4 children (two boys and two girls) whose mother had blood group O and whose father had blood group AB. Which statement about their children is correct?
- A None of the boys will have the same blood group as either parent.
 - B None of the girls will have blood group A.
 - C All the girls will have blood group A.
 - D 50% will have the same blood group as their father.
- 34 Which fertilisation would result in a male child with Down's Syndrome?

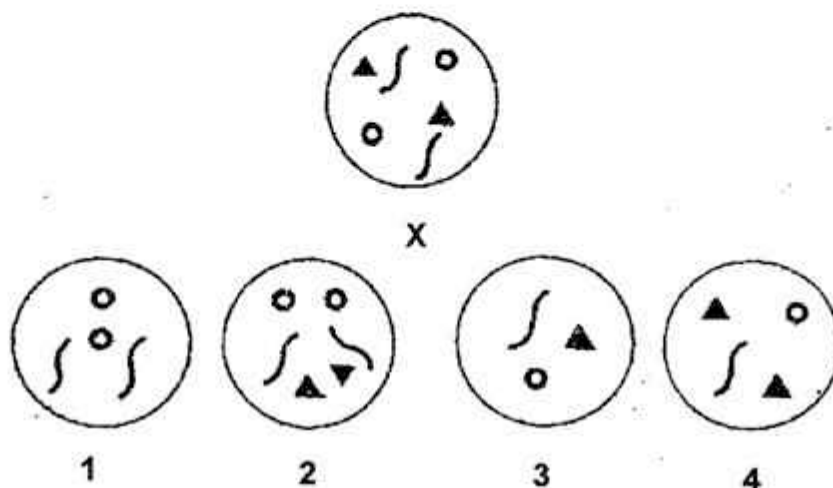
	Chromosomes in ovum	Chromosomes in sperm
A	22 + X	22 + Y
B	22 + X	23 + X
C	23 + Y	22 + X
D	23 + X	22 + Y

- 35 The graph below shows the changes taking place in the sugar concentration, insulin concentration and transgenic bacteria biomass during the making of insulin. Which one of the following shows the correct changes represented by the graphs?



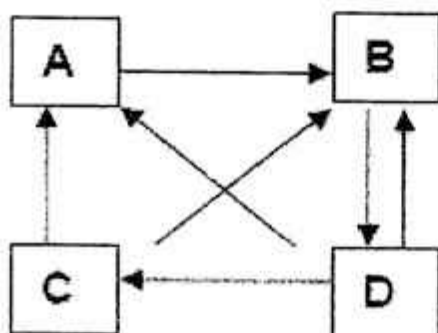
	Line X	Line Y	Line Z
A	Concentration of sugar	Amount of insulin	Amount of bacteria
B	Amount of insulin	Amount of bacteria	Concentration of sugar
C	Amount of bacteria	Concentration of sugar	Amount of insulin
D	Concentration of sugar	Amount of bacteria	Amount of insulin

- 36 The diagrams below show the chromosomes inside the nuclei of some cells. Cell X shows the normal chromosome pattern of a white blood cell.



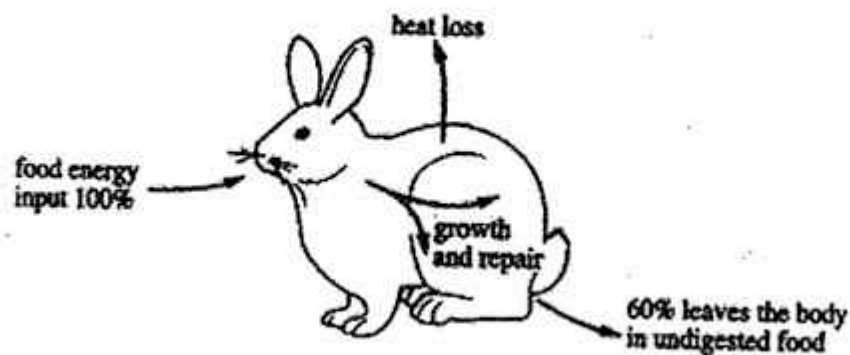
Which diagram represents the chromosomes in the cell of a testis?

- A 1
B 2
C 3
D 4
- 37 The four boxes below represent the following: cycling of carbon through the atmosphere, consumers, decomposers and producers in an ecosystem in no particular order.



Which box represents organisms whose growth rate would be increased by a rise in levels of atmospheric carbon dioxide?

- 38 The diagram shows the energy losses and gains of a rabbit.



Which of the following shows the percentage of energy used for growth and repair and the percentage lost as heat?

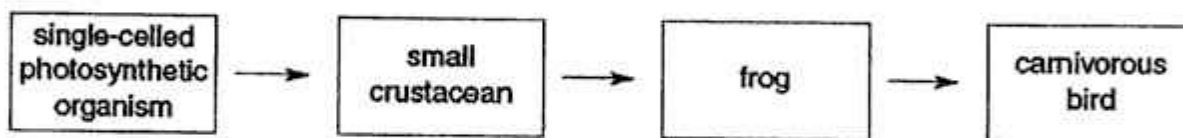
	% energy used for growth and repair	% energy lost as heat
A	10	30
B	30	10
C	30	60
D	60	30

- 39 The biological oxygen demand (BOD) of unpolluted river is about 3 mg oxygen per litre of water and that of raw sewage is about 325 mg oxygen per litre of water. Which of the reasons below explain the relatively high BOD of raw sewage?

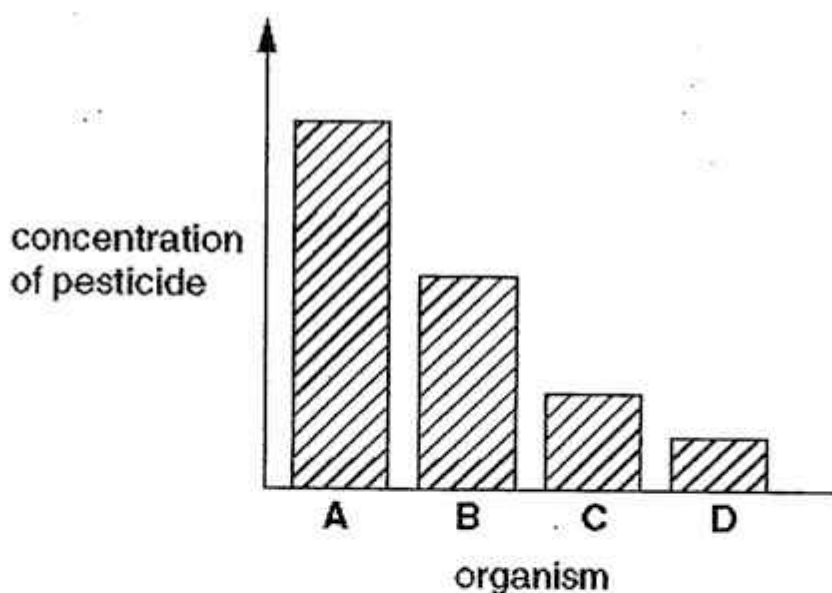
- 1 Increased population of decomposing bacteria in raw sewage.
- 2 Decreased levels of carbon dioxide in raw sewage.
- 3 Increased levels of organic wastes in raw sewage.
- 4 Decreased levels of organic wastes in raw sewage.

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

- 40 The diagram shows part of a food chain in a lake.



The chart shows the concentration of a pesticide in the bodies of each organism in the chain. Which organism on the chart is the carnivorous bird?



-----END OF PAPER-----



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



南 华 中 学

NAN HUA HIGH SCHOOL

PRELIMINARY EXAMINATION 2012

Subject : Biology
Paper : 5094/02
Level : Secondary Four Special/ Express
Date : 11 September 2012
Duration : 1 hour 45 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, class and index number in the spaces provided at the top of this page.
 Write in dark blue or black pen.
 You may use a pencil for any diagrams, graphs or rough working.
 Do not use staples, paper clips, highlighters, glue or correction fluid.

SECTION AAnswer **all** questions.

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

SECTION B

Answer all the questions.

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

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

INFORMATION FOR CANDIDATES

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

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

The total number of marks for this paper is 80.

For Examiner's Use	
Section A	
Section B	
13	
14	
15	
Total	

This paper consists of 23 printed pages.

Section A [50 marks]

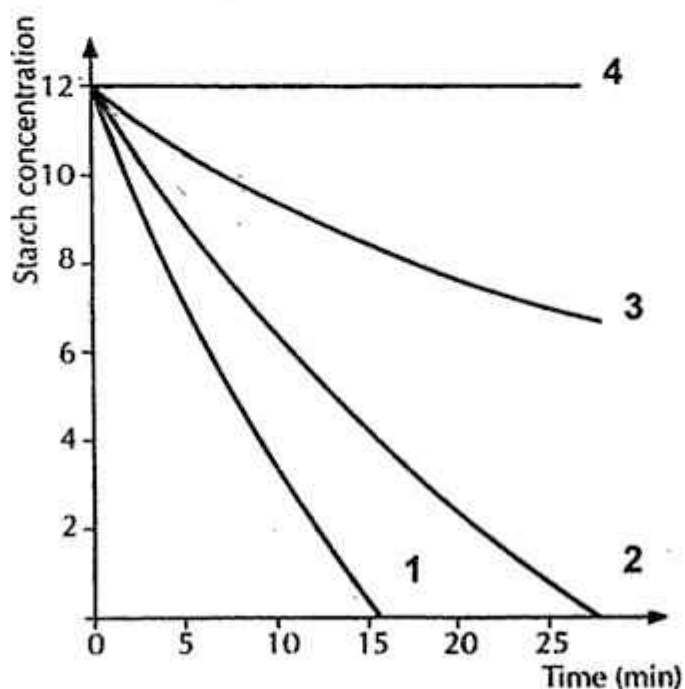
Answer **all** questions.
Write your answers in the spaces provided.

- 1 Four flasks labelled A, B, C and D were prepared. The contents of the flasks were given below.

Flasks	Contents in the flask
A	20 cm ³ starch solution + 5 cm ³ salivary amylase
B	20 cm ³ starch solution + 2 cm ³ salivary amylase
C	20 cm ³ starch solution + 5 cm ³ boiled salivary amylase
D	20 cm ³ starch solution + 2 cm ³ salivary amylase

Flasks A, B and C were kept in a water bath at 35°C. Flask D was kept at 10°C. Samples from each flask were obtained and iodine test was carried out at 5 minute interval. The experiment was stopped after 25 minutes, when starch breakdown was completed in two of the flasks.

The results of the experiment are shown in the graph below.



- (a) Match the curves to the flasks.

Flask A: Curve _____

Flask B: Curve _____

Flask C: Curve _____

Flask D: Curve _____

[2]

- (b) Concentrated hydrochloric acid was added to another flask, labelled E, containing 20 cm³ starch solution and 5 cm³ salivary amylase. It was set up for 25 minutes at 35°C. When the results were plotted onto the above graph, a curve that exactly matched one of the existing curves was obtained.

- (i) Which curve 1,2,3 or 4 would the results match?

_____ [1]

- (ii) Explain why these two results are similar?

_____ [1]

- (c) The experiment in Flask D was repeated at 20°C. Draw on the **same graph** the curve you would expect from this experiment.

[1]

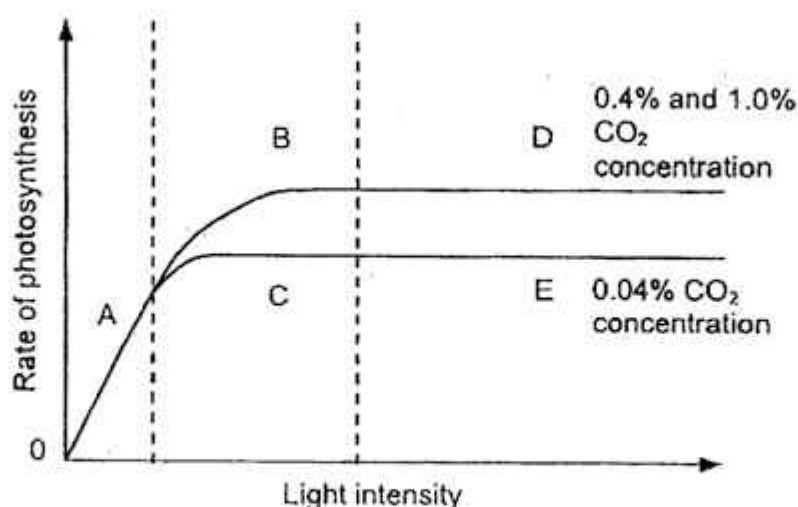
[Total:5]

- 2 Plants make glucose by photosynthesis. The glucose can also be converted into different substances. These substances can then be used in many different ways.

(a) Name **two** of these substances and explain how they are used in a plant.

[2]

- (b) Light intensity, wavelength of light and concentration of carbon dioxide affect the rate of photosynthesis. The graph below shows the rate of photosynthesis as light intensity changes at three different concentrations of carbon dioxide.



- (i) Write down the letter (A, B, C, D or E) which shows where light is the only limiting factor.

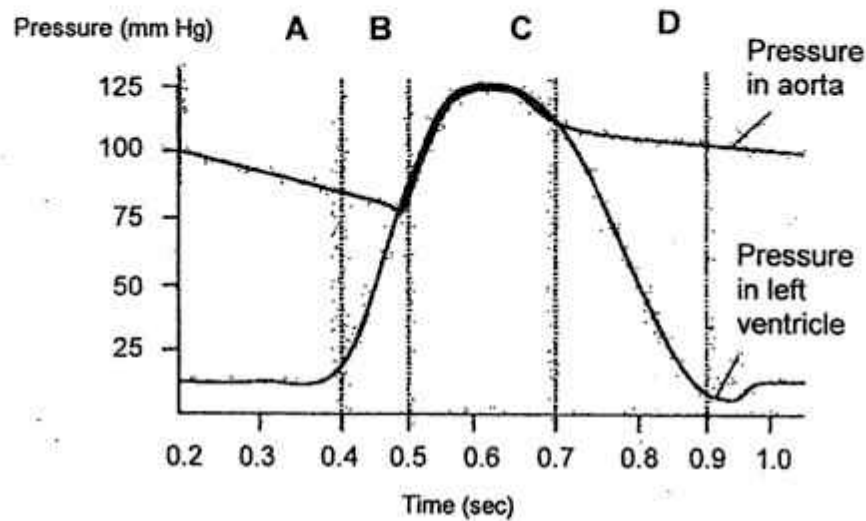
[1]

- (ii) Write down the letter (A, B, C, D or E) which shows that carbon dioxide is the only limiting factor. Explain your answer.

[2]

[Total:5]

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



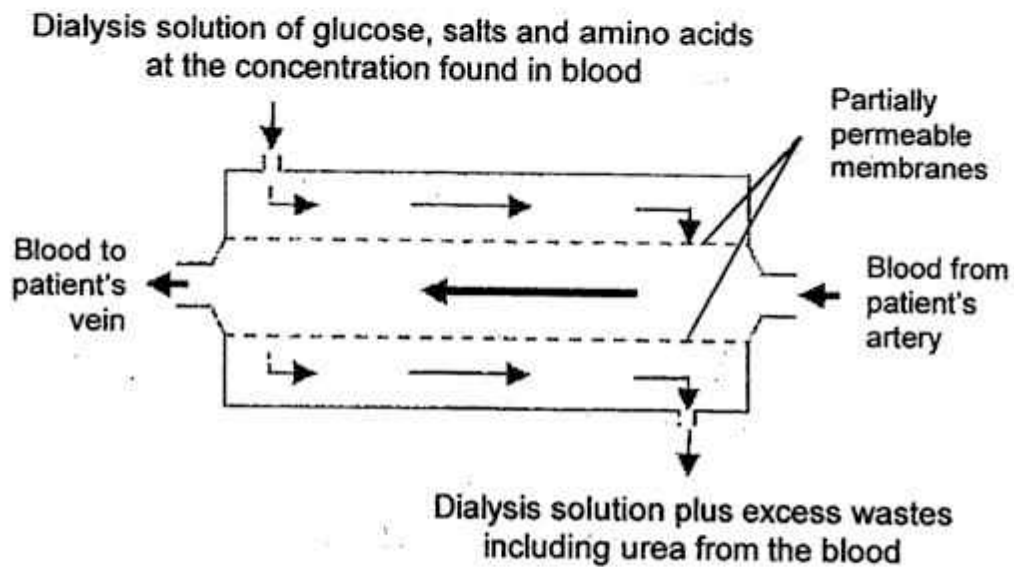
- (a) At which point does the aortic (semi-lunar) valve open, allowing blood to flow from the ventricle to the aorta? Explain your answer.

[2]

- (b) Describe the pressure changes in the left ventricle in relationship to blood flow at 0.2 sec to 0.9 sec.

[3]

- 4 Dialysis is used to treat a person with kidney failure. The diagram below shows the flow of solutions through a dialysis machine.



- (a) Explain why it is important that the dialysis solution contains glucose, salts and amino acids at the same concentration as in the blood.

[2]

- (b) Why are patients using the kidney machines told to limit the amount of protein in their dietary intake while allowing a normal intake of carbohydrate?

[3]

- 5 A man was driving his car out of Central Expressway Tunnel (CTE) Tunnel on a sunny day.



- (a) What change might have taken place in his eye when his car was leaving the tunnel? Explain how this change was brought about.

[2]

- (b) Opticians always advise people to wear only sunglasses with UV protection. What is the reason behind their advice?

[1]

[Total:3]

- 6 A 50-year old man lost the ability to control his left leg voluntarily after a stroke. However, when the region below the knee cap of his left leg was tapped, the leg kicked up.

(a) Explain why his leg could kick up though he could not move it at his own will.

[1]

(b) Explain why the jerking of the leg took place even earlier than the tap was felt.

[1]

(c) Use a flowchart to show the nervous pathway for the knee jerk response, including the types of neurones involved.

[1]

[Total:3]

- 7 Answer the following questions with reference to **Figure 7.1** below.

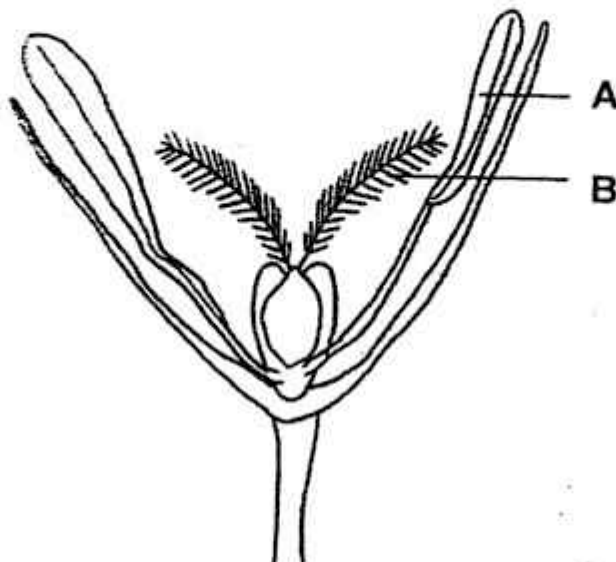


Figure 7.1

- (a) Name parts **A** and **B** and state their functions.

_____ [2]

- (b) Other than parts **A** and **B**, describe **two** ways how this flower may be adapted for wind pollination.

_____ [2]

8 Answer the following questions with reference to Figure 8.1 below.

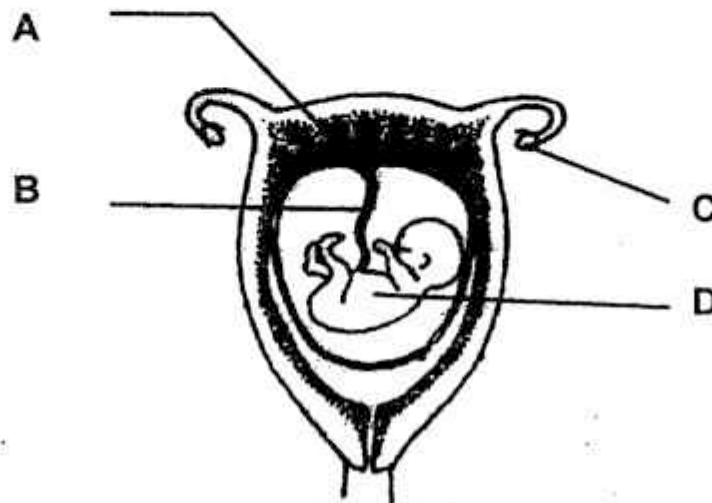


Figure 8.1

- (a) State **two** significant differences between the cells produced by cell division in structure C and D.

_____ [2]

- (b) Describe how the foetus obtains a constant supply of oxygen.

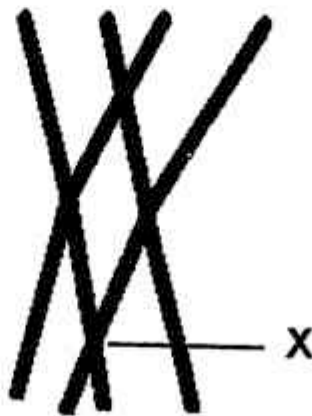
_____ [2]

- (c) Explain why a newborn baby is immuned against most common diseases.

_____ [1]

[Total:5]

- 9 The diagram below shows a pair of homologous chromosomes during meiosis.



- (a) State what stage of meiosis is shown.

[1]

- (b) Name X. Describe what has occurred between the two homologous chromosomes.

[2]

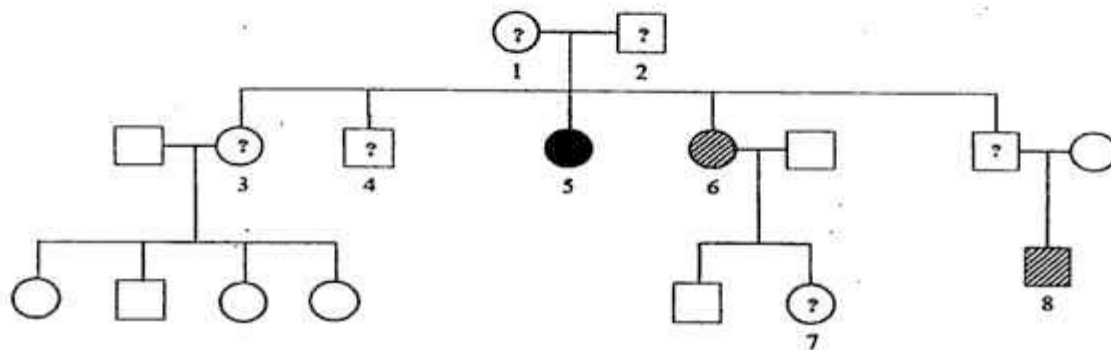
- (c) Explain how this can lead to genetic variation.

[1]

[Total:4]

- 10 Sickle-cell anaemia is a condition in which many of the red blood cells contain abnormal haemoglobin and are unable to transport as much oxygen. People who inherited two sickle cell alleles are seriously anaemic and usually die young while those who are heterozygous for the condition are mildly affected.

The diagram below shows members of a family affected by sickle-cell disease.



female	male	
		Normal
		Blood never tested-condition unknown
		Mildly affected
		Badly affected

Using H^s for the sickle-cell allele and H for normal allele

Construct a genetic diagram in the space below to illustrate a cross between members 1 and 2 to account for their offsprings 5 and 6.

[4]

[Total:4]

11 Chromosomes are long lengths of DNA. **Figure 11.1** shows part of a DNA molecule.

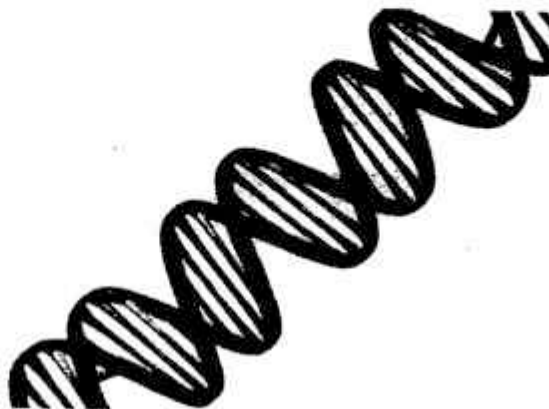


Figure 11.1

- (a)** State the function of the DNA.

_____ [1]



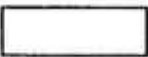

- (b)** A gene is a small segment of the DNA. Genes control the inheritance of characteristics. Give an example of an inherited characteristic in humans.

_____ [1]

- (c)** Occasionally, mutations occur within the DNA of an organism which can be passed onto its offspring. Suggest how mutation might be beneficial to the offspring.

_____ [1]

- (d) Translation refers to the process of decoding information in the mRNA, resulting in the synthesis of a protein. Essentially triple codons are utilized to arrange the amino acids in a meaningful manner based on the genetic sequence found in the mRNA.
Given that the triple codons correspond to the following amino acids as shown in the table below.

Triple Codon	Amino acid
AUU	
UGG	
AAG	
UUU	

In the space provided, draw the polypeptide structure based on the mRNA of the following sequence:

→ Direction of process

AAGUUUUUUUGGAUUUUU

[1]

[Total:4]

- 12 Dichloro-Diphenyl-Trichloroethane (DDT) is an effective insecticide against mosquitoes. DDT is fat soluble and is not metabolised very rapidly by animals. The biological half-life of DDT is about eight years.

Table 12.1 presents the data collected from a population in City A

Table 12.1: Measurement of the amount of DDT in Blood and Fats of human population in City A.

Year	Amount of DDT in Blood (ppm)	Amount of DDT in Fats (ppm)
1980	0.81	4.7
1985	0.301	22.25
1990	0.215	23.52
1995	0.201	24.11
2000	0.109	26.12

- (a) Account for the trend observed in amount of DDT in Fats from 1980 - 2000.

[1]

- (b) Suggest one harmful effect of insecticides.

[1]

- (c) Suggest one feature of the chemical that can be taken into account when one develops a new insecticide that is safe to the consumer.

[1]

[Total:3]

-----END OF SECTION A-----

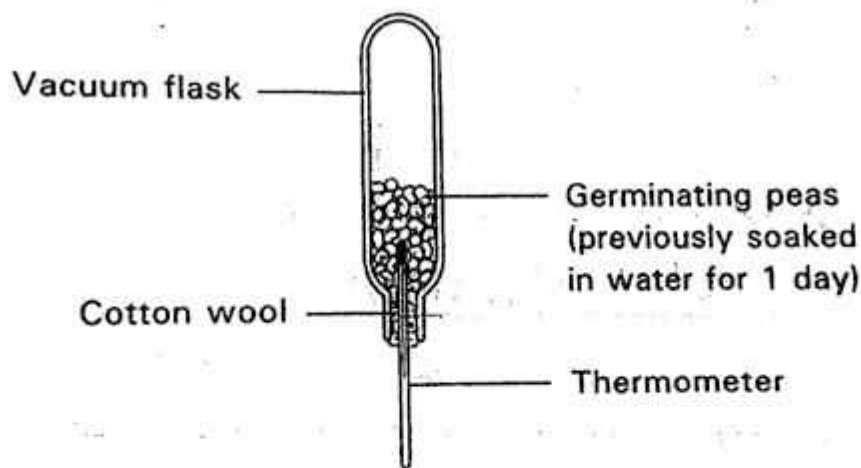
Section B [30 marks]

Answer **three** questions.

Question **15** is in the form of an **Either/Or** question.

Only one part should be answered.

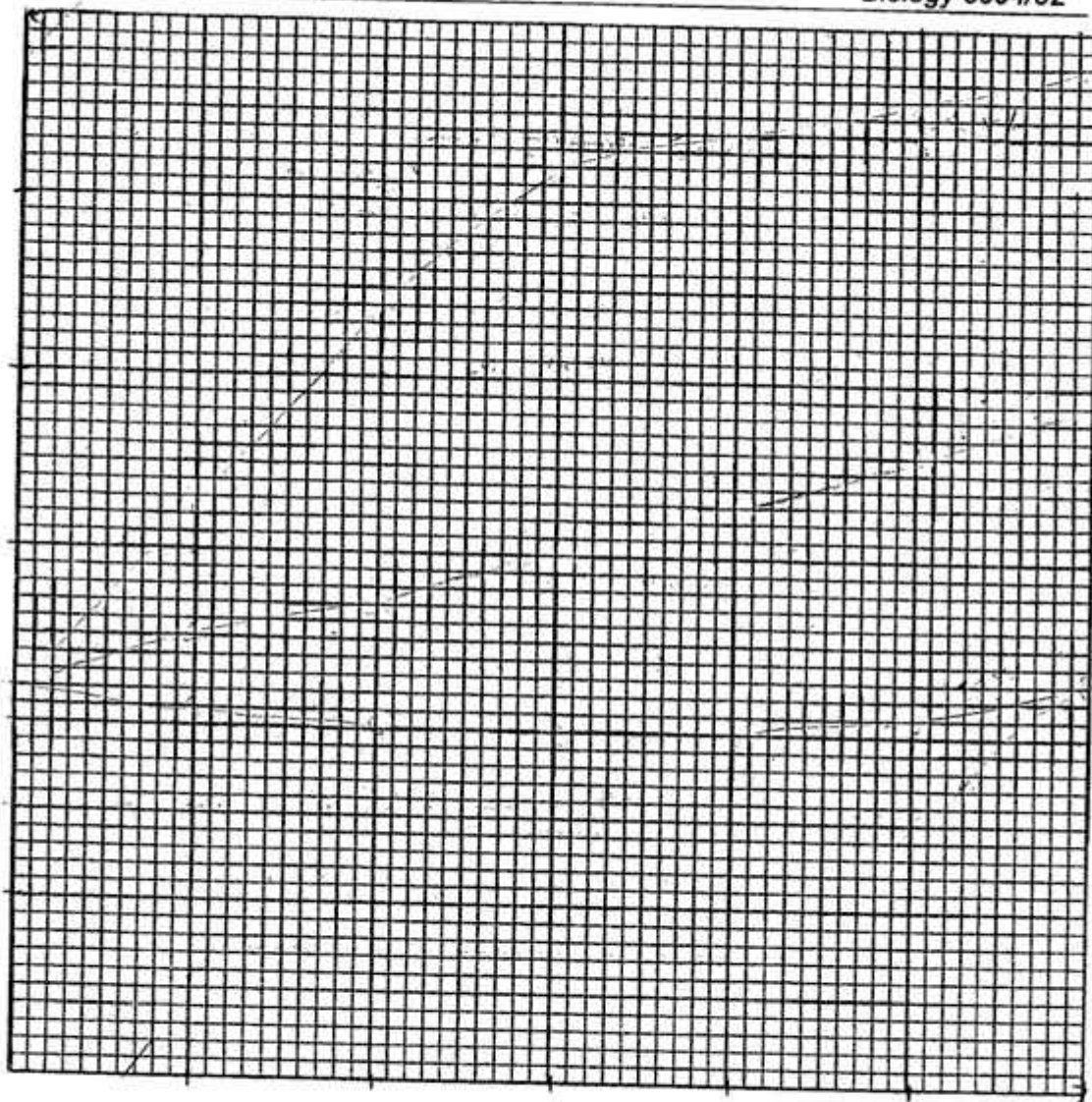
- 13** The diagram below shows an experimental set-up used to investigate a process in respiration.
Three similar sets of apparatus are prepared with the seeds treated differently. The temperatures inside the three flasks in the six consecutive days are recorded in **Table 13.1** as shown below:



Treatment of the seeds	Flask A	Flask B	Flask C
Temperature	Seeds properly soaked in water	Seeds washed in very mild disinfectant	Boiled seeds soaked in 10% formalin
At the beginning	22	22	22
Day 1	33	25	21
Day 2	44	27	20
Day 3	52	30	20
Day 4	54	33	20
Day 5	56	36	21
Day 6	58	39	23

Table 13.1

- (a) Using information in the table above, plot **three** curves on the **same** graph paper.



[4]

(b) Give **one** reason for carrying out each of the following practices when performing the experiment.

(i) A vacuum flask is used instead of a glass flask.

[1]

(ii) The mouth of the flask is plugged with cotton wool instead of a rubber stopper.

[1]

- (iii) Germinating seeds are used instead of equal mass of green leaves.

_____ [1]

- (c) (i) Describe the change in temperature of Flask A.

_____ [1]

- (ii) Explain the result of Flask A if it is studied for ten more days.

_____ [1]

- (d) Explain **one** difference in temperature change between Flask A and Flask B.

_____ [1]

[Total:10]

- 14 (a) (i) When Ryan played basketball at an open playground one afternoon on a hot day, his face became red. State and explain the significance of the physiological response observed.

[3]

- (ii) Apart from his face turning red, he also produced large amount of sweat. What is the significance of having this physiological response of sweating?

[2]

- (b) Read the following passage which is from an advice book for diabetes.



Hypoglycaemia or 'hypo' for short, occurs when there is too little sugar in the blood. It is important always to carry some form of sugar with you and take it immediately you feel a 'hypo' start. A 'hypo' may start because:

- you have taken too much insulin;
- you are late for a meal, have missed a meal altogether, have eaten too little at a meal;
- you have done more exercise than usual.

The remedy is to take some glucose.

- (i) Explain why there is too little sugar in the blood if too much insulin is taken.

[2]

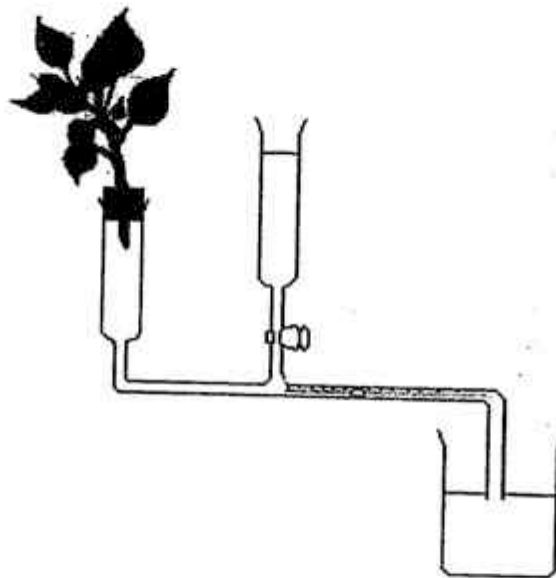
- (ii) Explain why sugar is recommended for a 'hypo' rather than starchy food.

[3]

[Total:10]

15 Either

The diagram below shows a potometer used to measure the rate of water loss from a plant.



- (a) (i) What assumption should be taken in doing the above experiment?

[1]

- (ii) State and explain **three** precautions that should be taken in carrying out this experiment.

[3]

- (b)** Describe how aphids can be used in the studies of translocation of food substances.

[6]

[Total:10]

15 Or

(a) In a food chain, explain how

(i) energy passes from the sun through the chain;

_____ [2]

(ii) energy is lost to the environment.

_____ [4]

(b) State **two** differences between energy transfer and nutrient transfer.

_____ [4]

[Total: 1


-----END OF PAPER-----

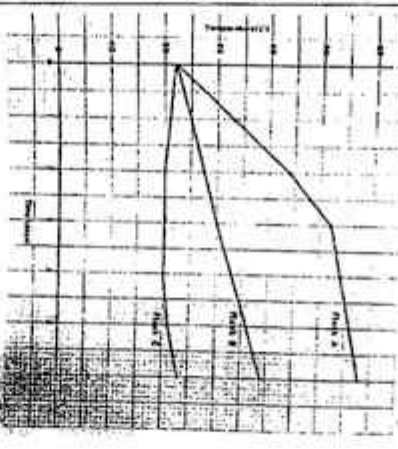
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1	(a)	Flask A-Curve 1, Flask B-Curve 2, Flask C-Curve 4, Flask D-Curve 3	[2]
	(b)	(i) Every 2 correct 1 mark Curve 4	[1]
		(ii) Salivary amylase denatured in both cases. Student must mention both cases; marks will not be awarded if they just mentioned one side.	[1]
	(c)	Curve in between Curve 2 and 3.	[1]
2	(a)	Sucrose / Starch: For storage as energy reserve	[1]
		Cellulose: To make cell wall. To maintain the shape of the cells	[1]
	(b)	(i) A	[1]
		(ii) E	[1]
		When the concentration of CO ₂ was increased, rate of photosynthesis also increased.	[1]
3	(a)	B	[1]
		The ventricular pressure is higher than the aortic pressure.	[1]
	(b)	At 0.2 – 0.4 sec, the pressure in the left ventricle is constantly low.	[1]
		At 0.4 – 0.6 sec, the ventricular pressure increases.	[1]
		At 0.6 – 0.9 sec, the ventricular pressure decreases.	[1]
4	(a)	To prevent diffusion of these substances into the dialysis fluid to maintain the osmotic concentration of blood	[1]
	(b)	Excess <u>proteins</u> will be <u>deaminated/ converted</u> to <u>urea</u> , which can be a toxic metabolic waste in high amounts.	[1]
		Patients will have to spend <u>more time on dialysis</u> as a result.	[1]
		Excess carbohydrate produced can be <u>stored as fat or glycogen</u> , unlike protein.	[1]
5	(a)	Pupil <u>constrict</u>	[1]
		Reject Iris constrict/pupil shrink (choice of words impl)	[1]
		Circular muscles of iris <u>contract</u> (Reject constrict); Radial muscles <u>relax</u>	[1]
	(b)	Pupil may dilate when light is cut down by sunglasses, thus more UV light may	[1]

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		enter eyes and cause damage.	
6	(a)	Knee jerk is a <u>reflex action</u> which does not involve the brain.	[1]
	(b)	It took <u>lesser time</u> for the impulse to travel through the reflex arc to the effector than to the brain. (Reject: short distance)	[1]
	(c)	Receptor → sensory neurone → relay neurone (spinal cord) → motor neurone → muscles in the leg	[1]
7	(a)	A - anther (Fn: Male part of the plant which produces pollen grains)	[1]
		B - stigma (Fn: Female part of the plant which receive pollen grains)	[1]
		(choice of words impl here: E.g. reject 'to stick on pollen')	
	(b)	The flower does not have large colourful petals to attract insects	[1]
		The flower does not have nectaries to attract insects. (Pollen tiny and <u>light/abundance</u> (Reject filament as part of the stamen)	[1]
8	(a)	Cells produced in mitosis are diploid vs haploid in meiosis.	[1]
		(Compare both sides in order for 1 mark to be awarded; Comparison must be related to the cells not what was happening that give rise to the cells)	
		2 daughter cells are produced per cycle in mitosis versus 4 in meiosis.	[1]
	(b)	Oxygen diffuses from the maternal blood to the foetus blood through the placenta and carried by umbilical cord vein to the foetus.	[1]
		(It does not mean the words are there means it is correct; there must be a link and concept must be right)	
	(c)	<u>Antibodies</u> from the maternal blood <u>diffuse</u> to the foetus during the course of pregnancy	[1]
9	(a)	Prophase 1	[1]
	(b)	X is <u>chiasma</u>	[1]
		Reject chiasmata	
		Homologous chromosomes pairing/ synapsis which results in <u>crossing over/ genetic material crossed over</u> .	[1]

(c)	May have <u>different alleles/</u> new combination of alleles.	[1]
10	<p>Parental phenotype mild x mild</p> <p>Parental genotype HH^S x HH^S</p> <p>Gametes H H^S x H H^S</p> <p>F1 genotypes HH HH^S HH^S H^SH^S</p> <p>F1 phenotypes normal : 2 mild : affected</p> <p>F1 ratio 25% normal : 50% mild : 25% affected</p> <p>correct parental genotype: gametes(circle): correct cross/show crossing with lines): correct ratio of offspring: no statement minus 1 mark</p>	[4]
11	<p>(a) The DNA carries genetic information/genes that determines the characteristics/traits of an organism/ codes for a specific polypeptide/protein. [1]</p> <p>(b) Hair colour/Eye colour/Blood group/ double/single eyelid/ ability to roll tongue/ attached eyelid</p> <p>Reject traits of continuous variation such as skin colour/height or disease traits such as sickle cell anaemia [1]</p> <p>(c) It could produce a new characteristics which is beneficial to the species/it could produce a new characteristics that gives the species a survival advantage/produces more variation which is better adapted to the environment. [1]</p> <p>(d)</p> <p>Allow lines at the end</p> 	[1]
12	<p>(a) The amount increases from 1980 – 2000; DDT being fat soluble/ is retained in the body/not metabolized the body/ accumulated in the body over time [1]</p> <p>(b) Bioaccumulation which leads to high concentration within a single organism/ water pollution/ kills aquatic life/ CFCs released that deplete the ozone layer/ [1]</p>	[1]

(c)	greenhouse effect/ global warming/loss of biodiversity/upsets ecosystem	
(c)	Make it <u>biodegradable/</u> Make it <u>water soluble/</u> less fat soluble/ Insoluble in fat	[1]
13	<p>(a)</p>  <p>For all three graphs (minus one for any missing)</p> <p>Axes labelled with units.</p> <p>Correct plotting</p> <p>Large</p> <p>Correct scale</p> <p>Smooth</p> <p>The 3 graphs must be labelled/ use different symbol with a legend.</p>	[4]
(b)	<p>(i) To prevent heat loss. [1]</p> <p>(ii) It permits the diffusion of oxygen and carbon dioxide in and out of the apparatus easily. (Reject allows continuous supply of oxygen as did [1])</p>	[1]

	not specify how it gets in)	
	(iii) Germinating seeds are metabolically active than green leaves to release energy	[1]
(c)	(i) The temperature rises rapidly in the first 3 days but the rate of increase slows down after Day 3. (Reject: Description must show trend specifically. (Reject: temp increase gradually for last 3 days as it is a bit vague)	[1]
	(ii) The temperature decreases because of the exhaustion of food storage.	[1]
(d)	The temperature change in Flask A is higher than that in Flask B because Flask A contains microorganisms which decay gives rise to a higher temperature.	[1]
14 (a)	(i) Large amount of heat produced by the vigorous <u>muscular contraction</u> <u>Vasodilation of arterioles</u> in the skin of his face to allow more blood with heat flowing into the skin. This helps to increase heat loss from skin by <u>conduction, convection and radiation</u> to prevent overheating	[1] [1] [1]
	(ii) Sweating helps to remove <u>latent heat of vaporization</u> of water from sweat to maintain a constant body temperature.	[1]
(b)	(i) Insulin stimulates liver to convert <u>excess sugar into glycogen</u> . Excess insulin causes too much sugar to be converted into glycogen causing decreased in blood sugar.	[1] [1]
	(ii) Glucose is <u>soluble</u> therefore can be absorbed quickly by diffusion Starch is <u>insoluble</u> , so must be broken down by digestion first before it can be absorbed.	[1] [1] [1]
15	<u>Either</u>	
(a)	Rate of water lost / transpiration is equal to the rate of water absorbed.	[1]
(b)	Cut the shoot under water to prevent air bubbles from blocking the xylem.	[1]

	Fill the pinhole into the apparatus under water to prevent the trapping of air bubbles in it.	[1]
	Smear all joints with Vaseline to make the whole apparatus air tight.	[1]
	Allow the plant to adapt to its surroundings over a period of time.	[1]
(c)	<u>Anaesthetize aphid</u> with <u>carbon dioxide</u> while it is feeding on the plant Cut off the body leaving the proboscis Analyse the fluid that exudes from the cut end for <u>sugars and amino acids</u> . Reject: glucose	[1] [1] [1] [1]
	Observe the <u>stem section</u> under microscope to determine where the proboscis is inserted.	[1]
	The <u>tissue which the proboscis is inserted</u> will determine the tissue that transport food substances.	[1]
16	<u>Or</u>	
(a)	(i) <u>Light energy</u> of sun gets converted to <u>chemical energy</u> Becomes stored in the form of <u>carbohydrates, proteins and fats</u> and passes on when organism <u>feeds</u> on one another. Reject: does not describe types of nutrients.	[1] [1] [1]
	(ii) <u>Energy</u> is lost as <u>heat during respiration</u> .	[1]
	<u>Undigested matter</u> as in <u>faeces / defecation</u> .	[1]
	<u>Excretory / metabolic waste products</u> as in <u>urine</u> .	[1]
	<u>Uneaten body parts like bones and left to be decompose</u> .	[1]
(b)	Energy flows down and is <u>lost linearly</u> from one trophic level to the next while <u>nutrients flow in a cycle</u> back to the producers.	[1]

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	Energy transfer involves <u>transfer of mainly carbohydrates, proteins and fats</u> while nutrients involve <u>potassium, nitrogen and other mineral ions</u>	[1]
	Energy is transferred only during <u>feeding or consumption</u> , but nutrient transfer <u>need not e.g. environment like soil/air to plant</u>	[1]
	Energy transfer to the next trophic level <u>drops by 90% every time</u> , but nutrient transfer is not so. It may be <u>less or even be constant or even increase</u> depending on the amount the organism has obtained.	[1]