Name :	Class	Register Number

DUNEARN SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2022
Secondary 4 Express

Biology 6093
Paper 1

26 Aug 2022 (Friday) **1100 - 1200** **1 hour**

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, register number, class and subject on the Answer Sheet in the spaces provided.

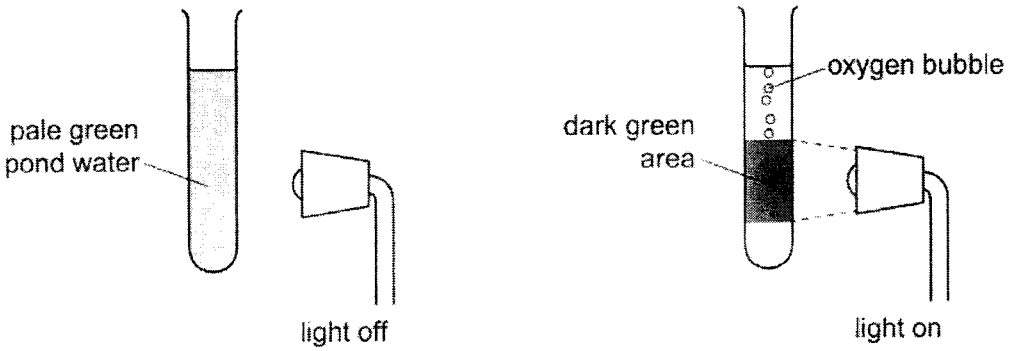
There are **forty** questions in this paper. Answer **all** questions. For each question, there are four possible answers, **A, B, C** and **D**.
Choose the **one** you consider correct and record your choice in soft pencil on the separate Answer Sheet.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
The use of an approved scientific calculator is expected, where appropriate.

Setter: Mr. Ng Hock Ping

This question paper consists of **17** printed pages including the cover page.

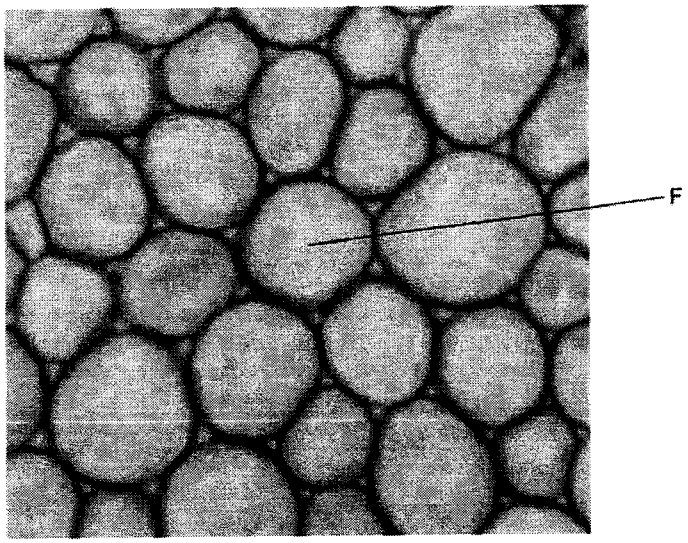
1 The diagrams show a test-tube containing pond water. The green colour is caused by microorganisms that have chloroplasts.



Which characteristics of living organisms are shown?

A excretion, growth and movement
B movement, nutrition and sensitivity
C nutrition, reproduction and respiration
D reproduction, sensitivity and growth

2 Some students were asked to look at the photomicrograph of a cross-section of unfamiliar material and describe what they could observe.



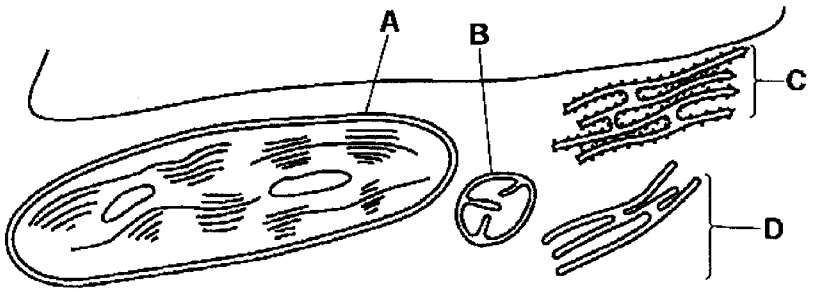
The students described the cross-section of F as:

1 circular
2 a hollow tube
3 spherical.

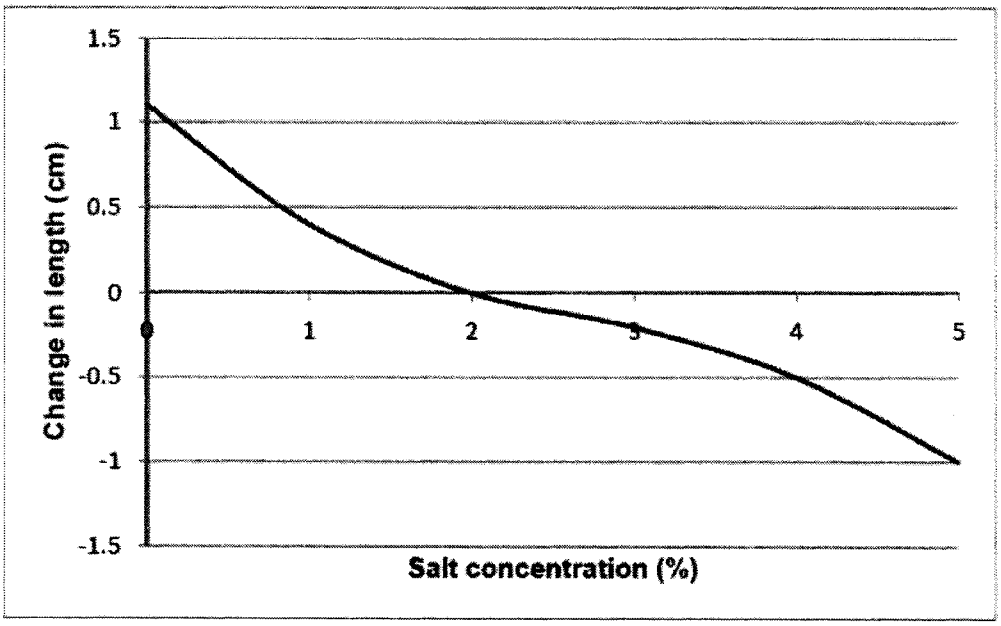
Which descriptions of the cross-section of F correctly state what the students could actually observe?

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

3 The diagram shows a drawing made from an electron micrograph of a leaf cell. Which organelle carries out detoxification?



4 Potato strips were soaked in salt solutions of different concentrations and the change in length was measured after 1 hour. The graph below shows the results that were obtained.



What can be concluded from the graph?

A When soaked in salt solutions 0-2%, salt molecules diffused into the potato cells.

B When soaked in 2% salt solution, the amount of water entering the potato cells equals to the amount of salt leaving the potato cells.

C There is no movement of salt into or out of the potato cells at any of the salt concentrations.

D When soaked in salt solutions of 2-5%, salt molecules diffused out of the potato cells.

5 Ethanol emulsion test and biuret test were carried out separately on peanuts. Which of the following correctly describes the results?

	ethanol emulsion test		biuret test	
	observation	**conclusion**	**observation**	**conclusion**
A	remains clear	fats are absent	blue solution remains	proteins are absent
B	remains clear	fats are present	violet mixture observed	proteins are present
C	white emulsion formed	fats are absent	blue solution remains	proteins are absent
D	white emulsion formed	fats are present	violet mixture observed	proteins are present

6 Which substances are made by linking together glucose molecules only?

A cellulose, glycogen and starch
B fats, cellulose and proteins
C proteins, oils and glycogen
D starch, fats and oils

7 The table shows some properties of enzyme molecules.

Which row is a correct description of enzymes?

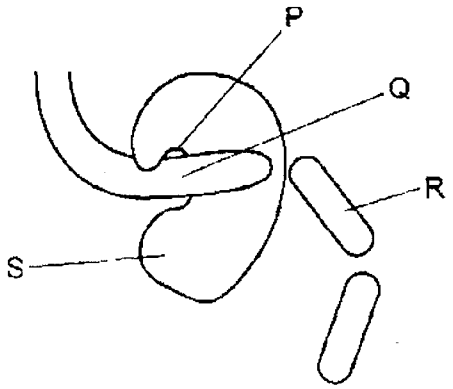
	chemical elements present	effect of changing temperature	enzyme activity
A	C, H and O only	can increase reaction rate	enzyme can be reused
B	C, H and O only	has no effect	enzyme is used up
C	C, H, O and N	can increase reaction rate	enzyme can be reused
D	C, H, O and N	can decrease reaction rate	enzyme is used up

8 What may take place during a hydrolysis reaction?

I a molecule of water is produced
II a sucrose molecule is split into fructose and glucose
III digestion of complex molecules into simpler ones using enzymes

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

9 The diagram shows a protease molecule catalysing the breakdown of a protein molecule.



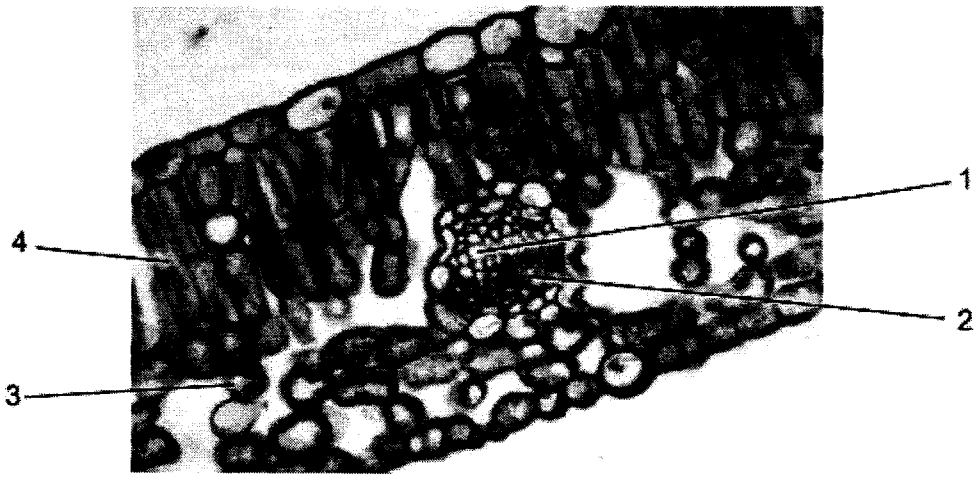
What are the parts labelled P, Q, R and S?

	enzyme	product	substrate	active site
A	P	Q	R	S
B	R	S	P	Q
C	S	P	Q	R
D	S	R	Q	P

10 What is **not** an example of assimilation?

A synthesis of glycogen from glucose
B synthesis of fats from fatty acids and glycerol
C synthesis of glucose from starch
D synthesis of proteins from amino acids

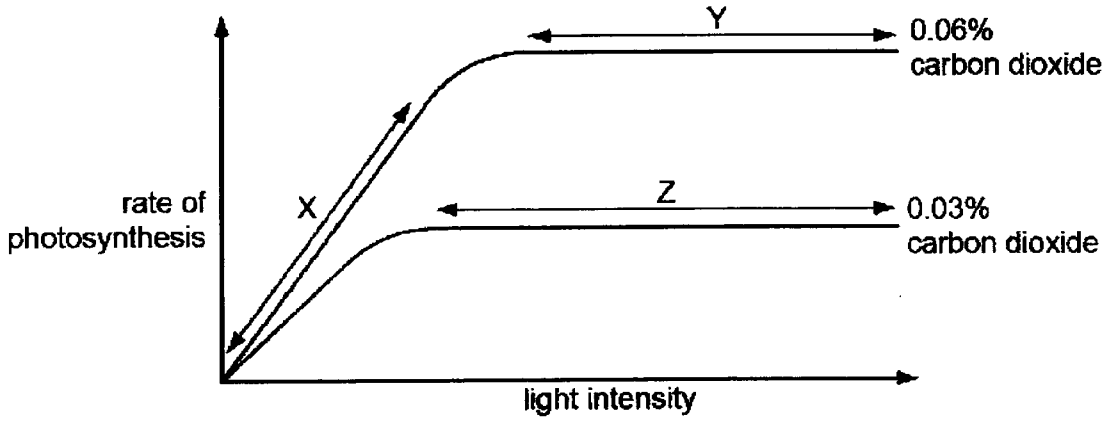
11 The diagram shows a transverse section of a dicotyledonous leaf.



What are the correct labels for 1, 2, 3 and 4?

	1	2	3	4
A	phloem	xylem	palisade mesophyll	spongy mesophyll
B	phloem	xylem	spongy mesophyll	palisade mesophyll
C	xylem	phloem	palisade mesophyll	spongy mesophyll
D	xylem	phloem	spongy mesophyll	palisade mesophyll

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



What are the limiting factors at X, Y and Z?

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

13 Reactions X and Y take place within the human body.

reaction	equation
X	$Hb + O_2 \leftrightarrow HbO_2$
Y	$CO_2 + H_2O \leftrightarrow H_2CO_3$

Which row correctly matches X and Y to the site where each occurs, and whether an enzyme is needed?

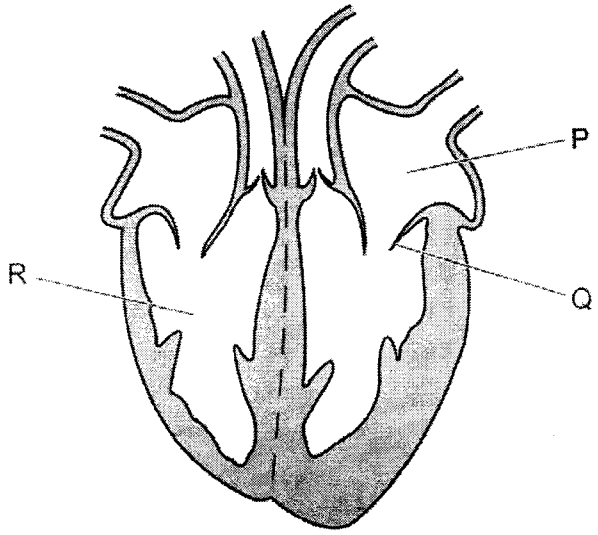
	reaction X		reaction Y	
	enzyme needed	location	enzyme needed	location
A	yes	alveoli	no	red blood cell
B	no	plasma	no	alveoli
C	no	red blood cell	yes	red blood cell
D	yes	red blood cell	yes	plasma

14 During the process of blood clotting, damage to blood vessels stimulates component L, and component M is converted to component N.

What are L, M and N?

	L	M	N
A	fibrin	platelets	fibrinogen
B	fibrinogen	platelets	fibrin
C	platelets	fibrin	fibrinogen
D	platelets	fibrinogen	fibrin

15 The diagram shows a section through the heart.

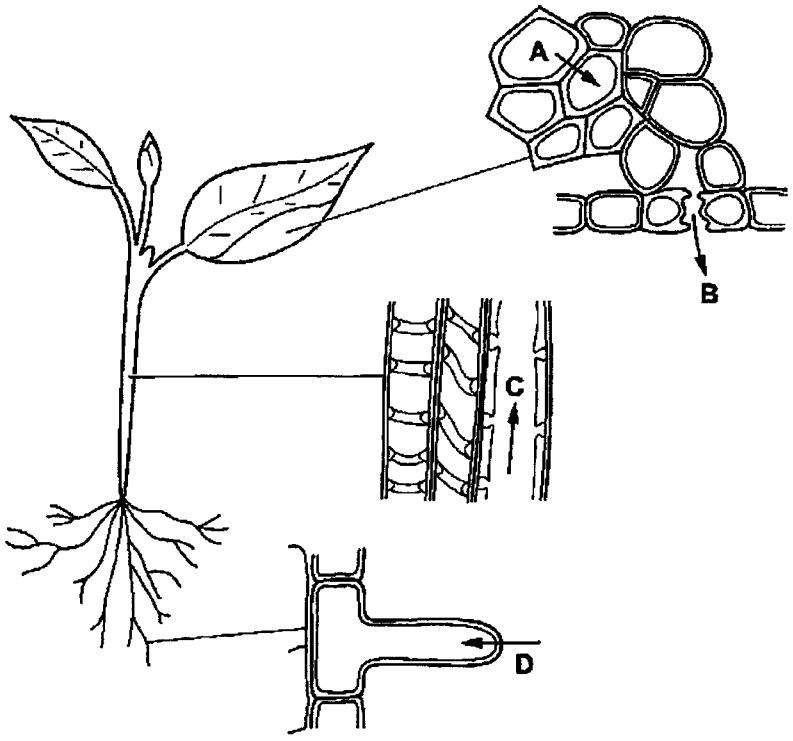


What is the function of the structure labelled Q?

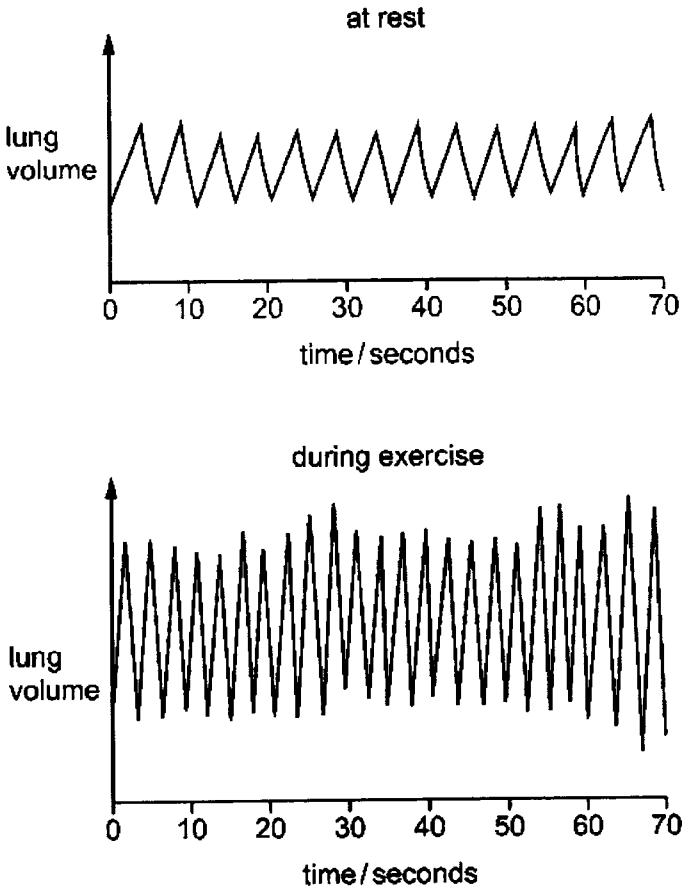
A It controls the amount of blood leaving the heart.
B It increases the pressure in part R.
C It prevents backflow of blood into part P.
D It prevents blood flowing into the vena cava.

16 The diagrams show stages in the passage of water through a plant.

Which arrow shows water moving from cell to cell?



17 The graphs show records of a person's breathing at rest and during exercise.

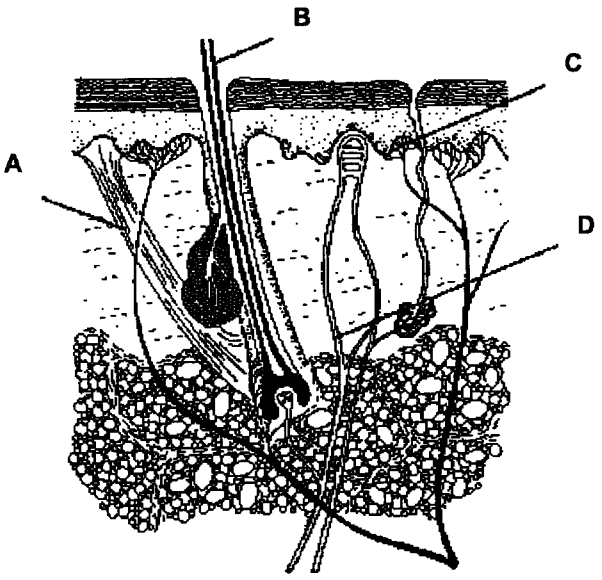


What is the increase in breathing rate when the person is at rest and then exercises?

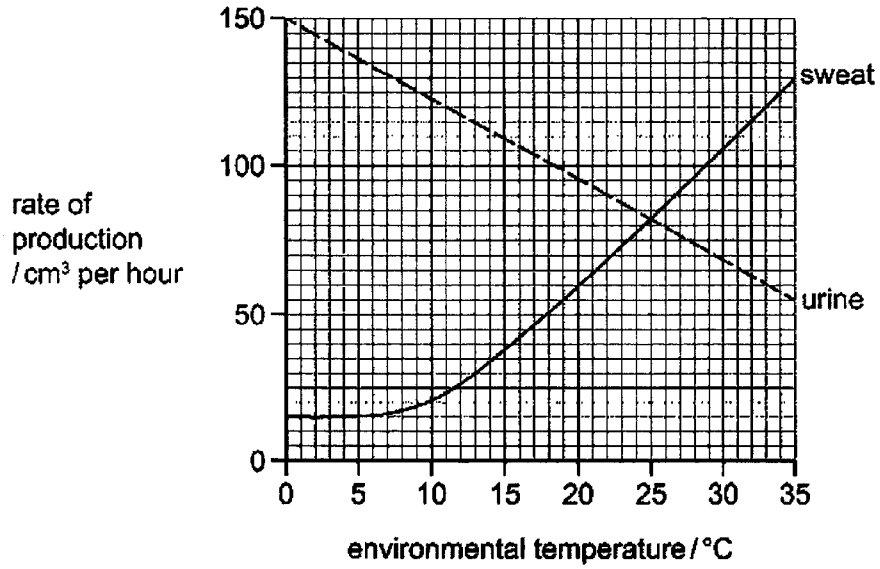
A 9 breaths per minute
B 12 breaths per minute
C 21 breaths per minute
D 60 breaths per minute

18 A person walks into a very cold room. Shortly afterwards, the hairs on their skin are raised.

Which labelled structure detects the change in temperature in this reflex?



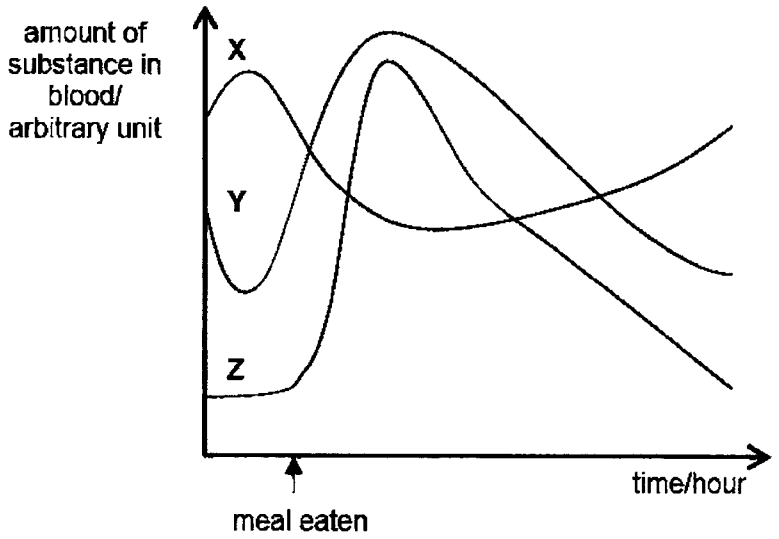
19 The graph shows the rates of sweat production and urine production at different environmental temperatures.



Which statement is correct?

A As the temperature increases, the rates of sweat and urine production increase.
B As the temperature increases, the rate of urine production increases.
C At 25 °C the rates of sweat and urine production are the same.
D Urine and sweat production are directly proportional to environmental temperature.

20 Blood glucose levels in the body are regulated by insulin and glucagon. The graph below shows the glucose and hormone levels of an individual before and after his meal.



Which of the following shows the accurate changes in glucose and hormone levels?

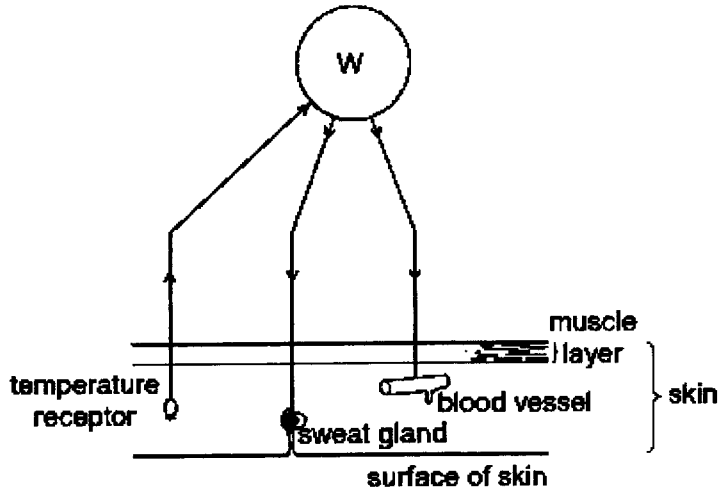
	line **X**	line **Y**	line **Z**
A	insulin	glucose	glucagon
B	glucose	glucagon	insulin
C	glucose	insulin	glucagon
D	glucagon	glucose	insulin

21 A man injures his hand in an accident. Shortly after, he can feel the objects touching his hand, but he cannot move his hand away from them.

What could have caused this?

A Receptors in his hand are damaged.
B Relay neurones in his hand no longer function.
C The nerve connection is cut only between the receptors in his hand and his central nervous system.
D The nerve connection is cut only between his central nervous system and the effectors in his arm.

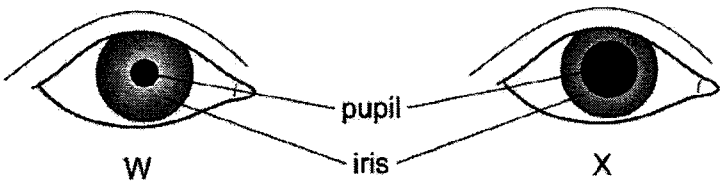
22 The diagram shows some nerve pathways involved in temperature control of the human body.



Which part of nerve pathway does W represent?

A hypothalamus
B ovary
C pituitary gland
D spinal cord

23 The diagrams show the front view of the pupil and iris of the eye in different light intensities.

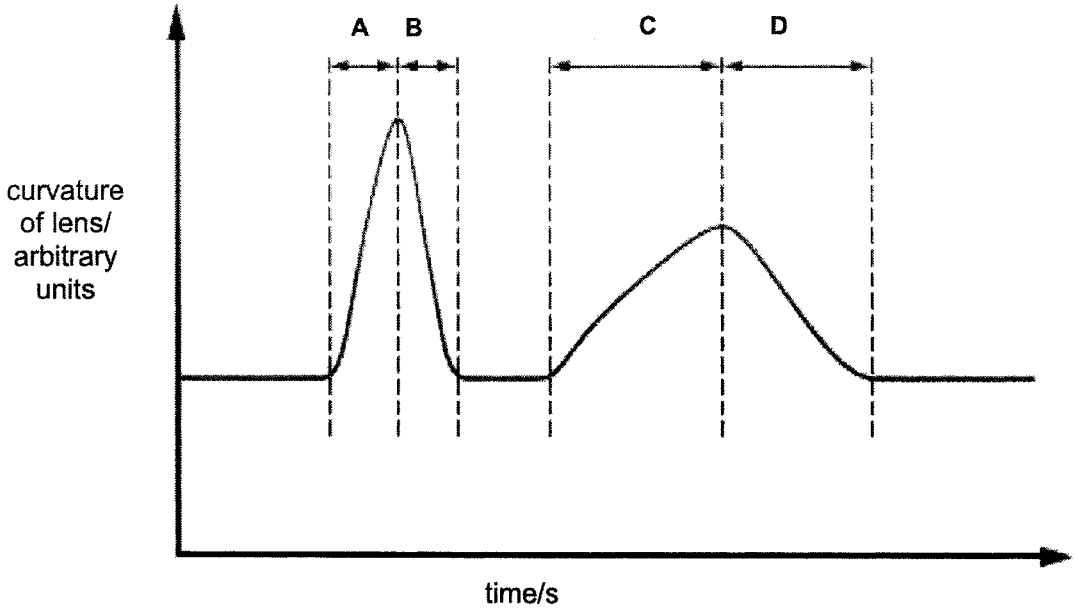


Which row correctly describes diagram X?

	light intensity	circular muscles of the iris	radial muscles of the iris
A	bright light	relaxed	contracted
B	bright light	contracted	relaxed
C	dim light	relaxed	contracted
D	dim light	contracted	relaxed

24 The diagram shows the curvature of the lens in a person's eye.
The shape of the lens changes as the person watches two motorbikes moving at different speeds.

Which period indicates that a motorbike was moving towards the person at a higher speed?



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

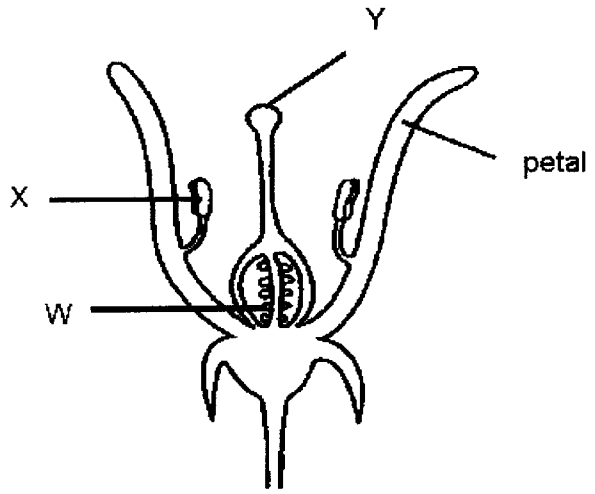
	hormones are carried by	hormones are destroyed by
A	blood plasma	kidney
B	blood plasma	liver
C	red blood cells	kidney
D	red blood cells	liver

26 Which of the following correctly describe(s) the action of adrenaline?

I removal of urea from the body
II raises the depth of breathing
III raises the rate of breathing
IV is controlled by secretions from the pituitary gland

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

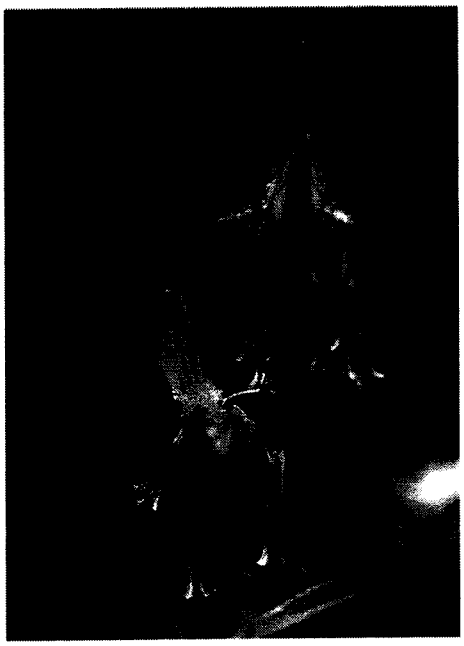
27 The diagram shows a section through a flower.



Which row about the labelled parts is correct?

	contains haploid nuclei	produces pollen	receives pollen
A	X only	W	Y
B	W only	X	Y
C	X and W	X	Y
D	X and Y	Y	W

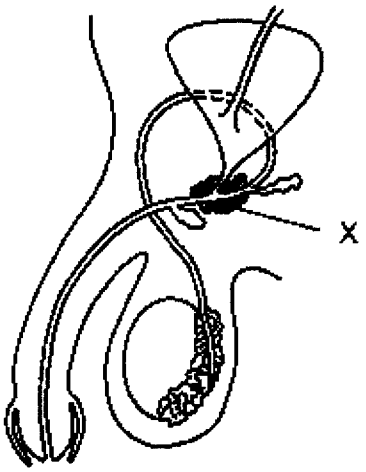
28 The photograph shows two wind-pollinated flowers.



Which row shows the features of these flowers?

	large petals	anthers positioned inside the flower	feathery stigmas
A	yes	yes	no
B	yes	no	no
C	no	no	yes
D	no	yes	yes

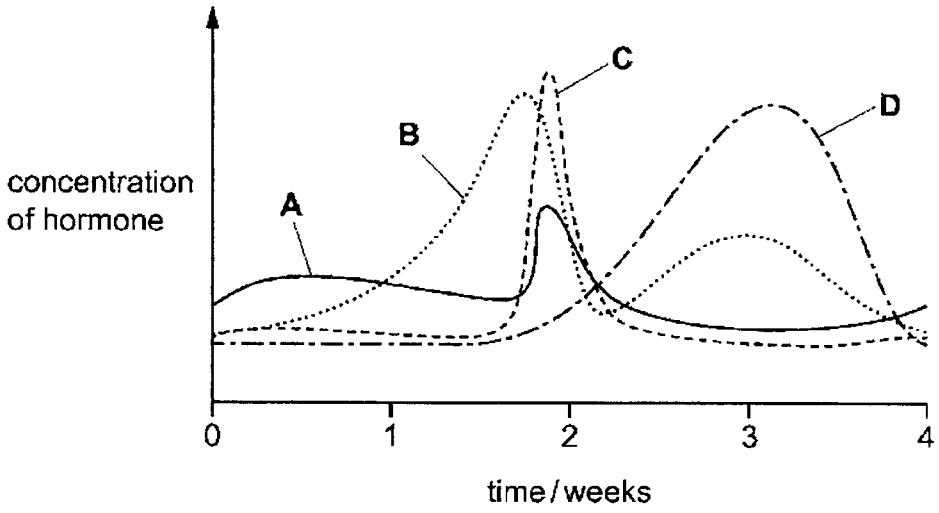
29 The diagram shows a section through the male reproductive system.



What will be the effect if gland X is removed?

A fewer sperms are formed
B fewer sperms can be stored
C less testosterone produced
D sperms are less active

30 The graph shows the four hormones that control the menstrual cycle.
Which curve on the graph represents the hormone oestrogen?



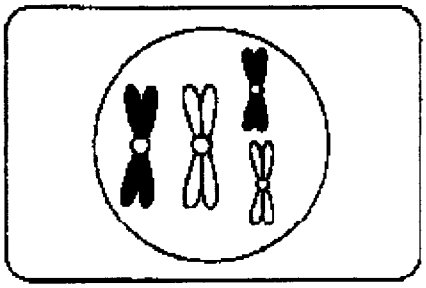
31 The table gives statements about HIV.

Which row correctly marks the statements as true or false?

	all HIV-positive people develop AIDS	an unborn baby is at risk if their mother is HIV positive
A	X	√
B	√	X
C	X	X
D	√	√

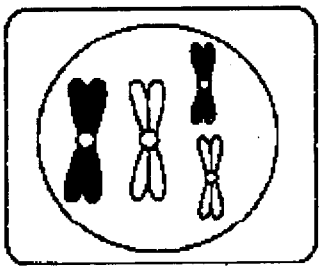
key:
√ = true
X = false

32 The diagram shows a cell during prophase of meiosis.

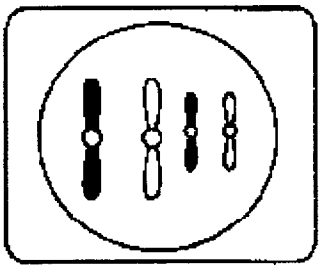


At the end of meiosis, which of the following will one of the daughter cells look like?

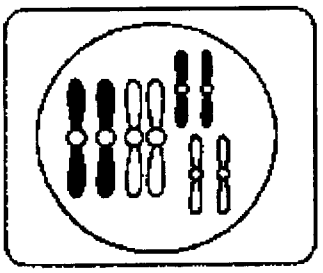
A



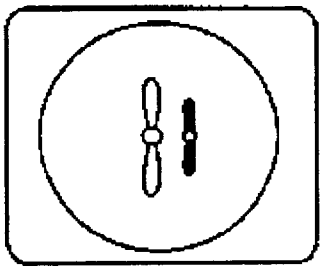
B



C



D

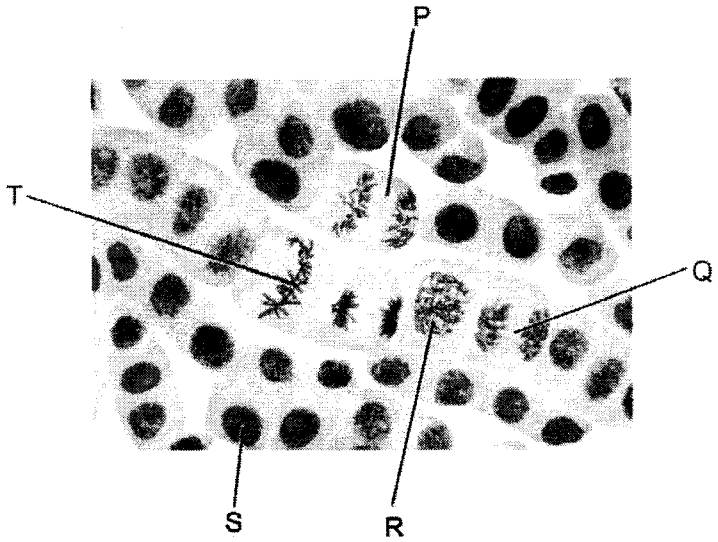


33 A toxin (poison) causes the malfunction of centrioles in an animal cell undergoing meiosis.

Which of the following processes will be directly affected by the presence of the toxin?

A chiasma formation between homologous chromosomes
B furrowing of cell membrane between daughter cells
C migration of chromosomes to opposite poles of cell
D replication of centromeres

34 The photomicrograph shows cells in different stages of mitosis.

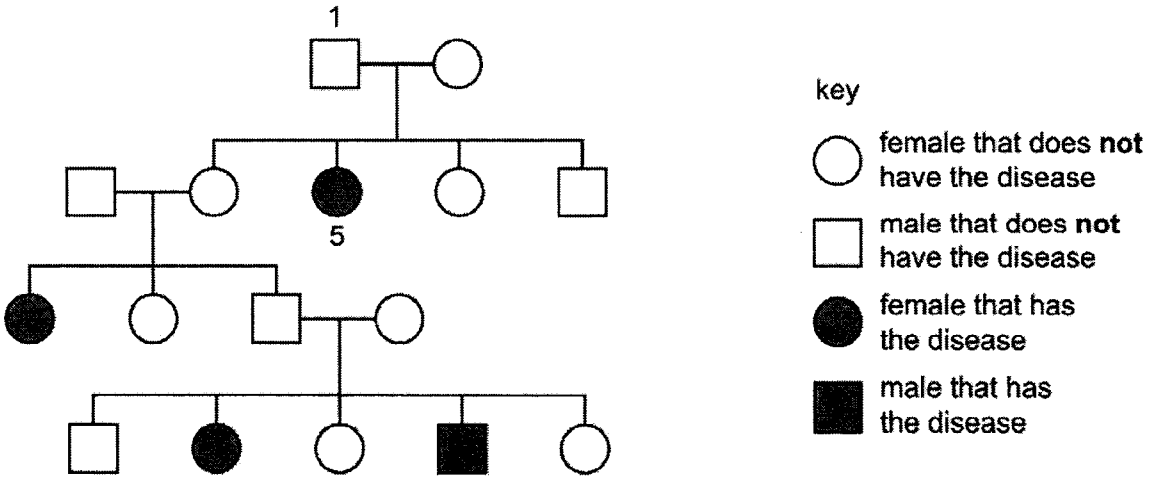


1 Cell T shows metaphase.
2 DNA replication occurs in cell R.
3 The amount of DNA in cell P is the same as in cell T.
4 The correct order for the stages is S → R → T → P → Q.

Which statements are correct?

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

35 The pedigree diagram shows the inheritance of a genetic disease in a family.



Which row describes the correct genotypes for individual 1 and individual 5, for this genetic disease?

	individual 1	individual 5
A	heterozygous	homozygous dominant
B	heterozygous	homozygous recessive
C	homozygous dominant	heterozygous
D	homozygous recessive	heterozygous

36 Some stages in the production of human insulin are listed.

1 Genetically modified E. coli bacteria are grown in large fermenters.
2 The gene for human insulin is inserted into the DNA of a bacterium called E. coli.
3 The gene for human insulin is obtained from human pancreas cells.
4 Human insulin is extracted and purified.

What is the correct sequence of these stages?

A $3 \rightarrow 1 \rightarrow 2 \rightarrow 4$
B $4 \rightarrow 3 \rightarrow 2 \rightarrow 1$
C $3 \rightarrow 2 \rightarrow 4 \rightarrow 1$
D $3 \rightarrow 2 \rightarrow 1 \rightarrow 4$

37 What is **not** an advantage of genetic engineering?

A Genes from genetically modified crops can spread to wild plants.
B It can give predictable results.
C It can improve the taste and nutritional value of crops.
D It can reduce the need to use insecticides and fungicides.

38 A scientist studied wild birds that lived by a lake. He observed that one bird species had a beak that was adapted to extract small insects from the water.

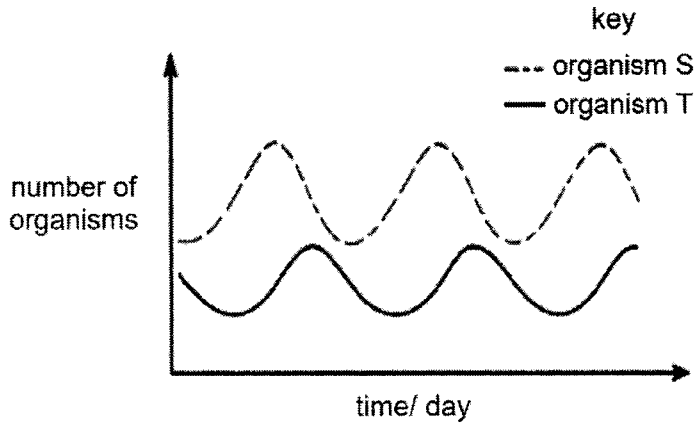
Which process would have occurred in the development of this specialised beak?

A fossilisation
B genetic engineering
C natural selection
D selective breeding

39 What is a food chain?

A a diagram showing an organism getting its energy by feeding on other organisms
B a diagram showing an organism's diet
C a diagram showing the flow of energy through a chain of organisms
D a diagram showing the names of trophic levels

40 The diagram shows a graph of the number of organisms over time.



What could organism S and T be?

	S	T
A	duck	plant
B	eagle	rabbit
C	lion	lamb
D	worm	chicken

End of Paper

Name :	Class	Register Number
	4 Opal	

DUNEARN SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2022
Secondary 4 Express

Biology 6093
Paper 2

26 Aug 2022 (Friday) **0815 - 1000** **1 hour 45 min**

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number in the spaces provided.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Section A
Answer **all** questions.
Write your answers in the spaces provided on the question paper.
Section B
Answer **all** the questions, the last question is in the form either/or.
Write your answers in the spaces provided on the question paper.

An approved electronic calculator may be used.

You are advised to spend no longer than one hour on Section A and no longer than 45 minutes on Section B.
The number of marks is given in brackets [ ] at the end of the question or part question.

Paper 1	**Paper 2**						Sub-total for P2 Section A	/50
	A1	A2	A3	A4	A5	A6		
							Sub-total for P2 Section B	/30
/40	B7	B8	B9(E)	B9(O)			**Total marks for Paper 2**	/80
							Overall marks	**/ 120**

Setter: Mr Ng Hock Ping

Parent's /Guardian's Signature: .....

This question paper consists of **20** printed pages including the cover page.

For Examiner's Use

Section A [50 marks]

Answer all the questions in the spaces provided.

1 Fig. 1.1 is a simplified diagram representing a transverse section of part of a young root. The diagram is not to scale.

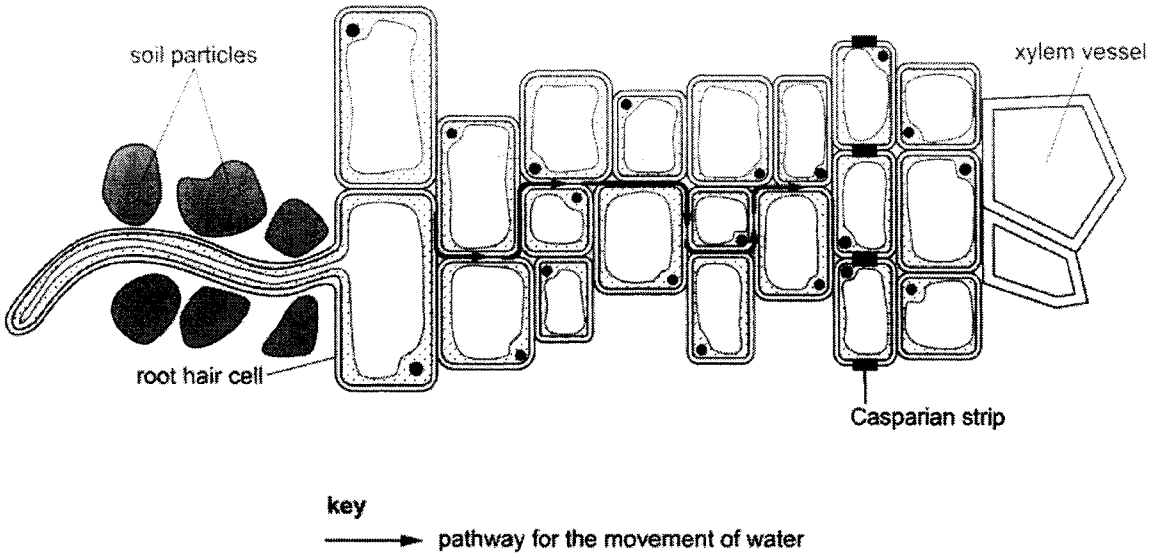


Fig. 1.1

(a) Table 1.2 shows three of the processes by which substances in solution can move across cell membranes in the young root. It also lists five statements that may apply to each of these three processes.

Complete Table 1.2 to show which of the statements apply to each of the three processes shown. Use a tick (√) to show that the statement applies or a cross (X) to show that the statement does not apply. Each box must contain a tick or a cross. The first row has been completed for you.

Table 1.2

statement	process		
	active transport	osmosis	diffusion
require energy	√	X	X
movement of oxygen into a root hair cell			
down a concentration gradient			
movement of mineral ions into the xylem			
movement of water as shown by arrows in Fig. 1.1			

[4]

For Examiner's Use

(b) **(i)** On Fig. 1.1 **draw a label line** and label with the letter **C** to identify the cell membrane. [1]

(ii) Root hairs measure approximately 5μm in diameter and 500μm in length. Explain how this adapts root hairs for the absorption of water.

.....

.....

..... [1]

(iii) The Casparian strip is composed of impermeable corky substances like lignin and suberin, while ordinary cell walls are made of lignin alone. Suggest how the pathway for the movement of water shown by the arrows in Fig. 1.1 will continue toward the xylem vessels.

.....

.....

..... [1]

(c) Water enters the xylem vessels shown in Fig. 1.1. Explain how water moves up the xylem vessels to the leaves in a continuous column.

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..... [3]

[Total: 10]

For Examiner's Use

2 Fig. 2.1 shows part of the thoracic and abdominal cavity in a human.

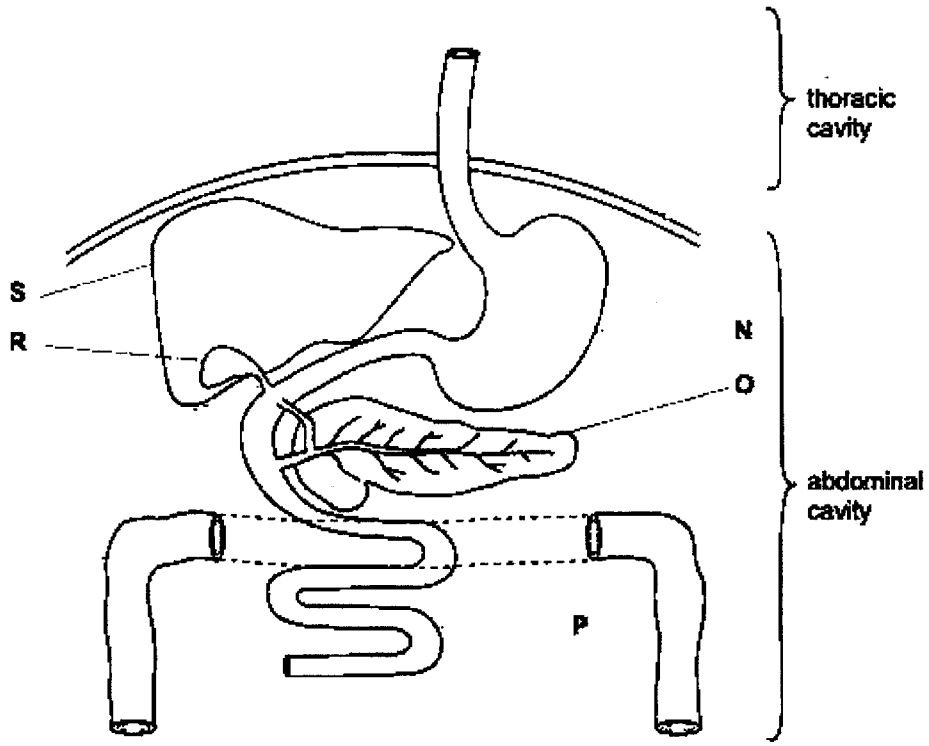

Fig. 2.1

(a) Organs **N**, **O** and **P** all secrete digestive enzymes.

(i) Define the term enzyme.

.....

.....

.....

..... [2]

(ii) Identify organs **N**, **O** and **P** and state the identity of one digestive enzyme secreted by each of these structures.

organ	identity	one digestive enzyme secreted by organ
N		
O		
P		

[3]

For Examiner's Use

(b) Fig. 2.2 shows what happens to fat globules in organ **P** in the presence of bile.

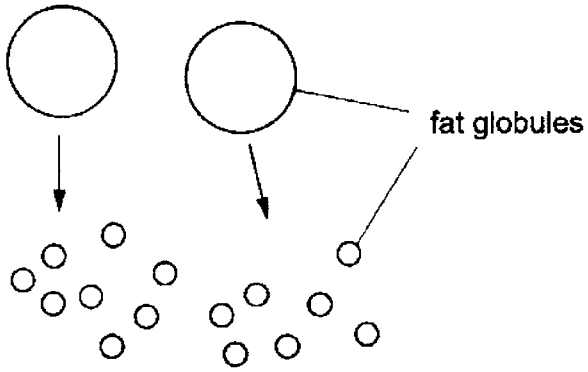

Fig. 2.2

(i) Name the process occurring in Fig 2.2.

..... [1]

(ii) Using Fig. 2.1, identify which letter represents the organ that produces bile.

..... [1]

(iii) Explain the advantage of the process shown in Fig. 2.2.

.....

.....

..... [1]

[Total: 8]

For Examiner's Use

3 Fig. 3.1 shows two sections of lung tissue as seen with a microscope.

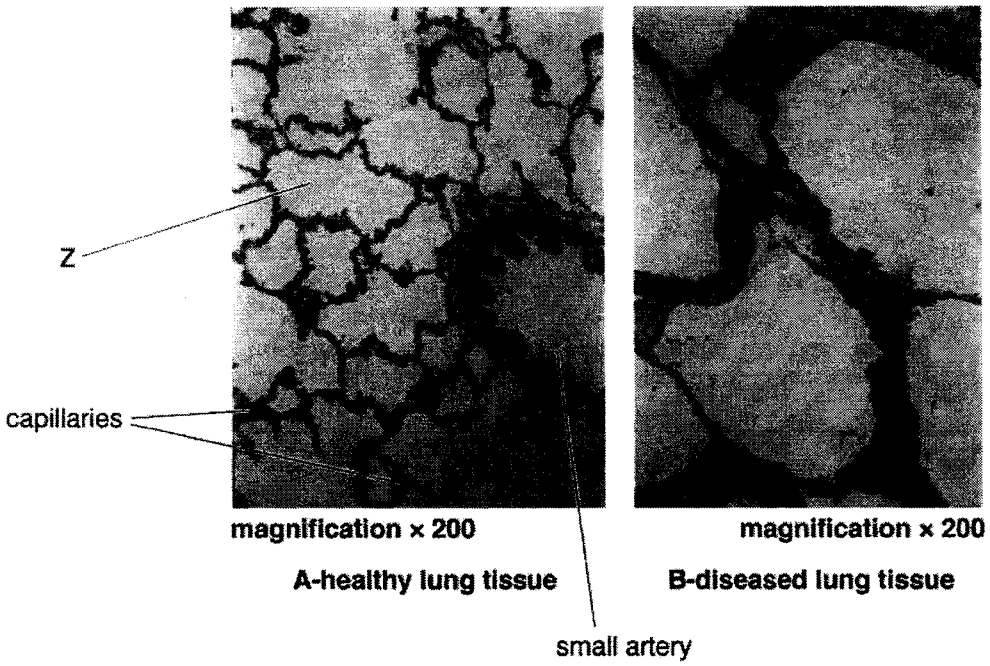

Fig. 3.1

(a) **(i)** Name the structure labelled **Z** in Fig. 3.1 **A**.

..... [1]

(ii) Explain, using features visible in Fig. 3.1 **A**, how the healthy lung tissue is adapted for gas exchange.

.....

.....

.....

.....

.....

.....

..... [3]

(b) **(i)** Describe one visible difference between the diseased and healthy lung tissue shown in Fig. 3.1.

.....

..... [1]

(ii) Suggest one possible cause for the diseased lung tissue shown in Fig. 3.1.

.....

.....

..... [1]

[Total: 6]

4 The kidney has the second highest mitochondrial content and oxygen consumption after the heart. Fig. 4.1 is an electron micrograph section of the proximal convoluted tubule. Microvilli form the brush border on the surface facing the lumen. Mitochondria are present closer to the plasma membrane of the cells.

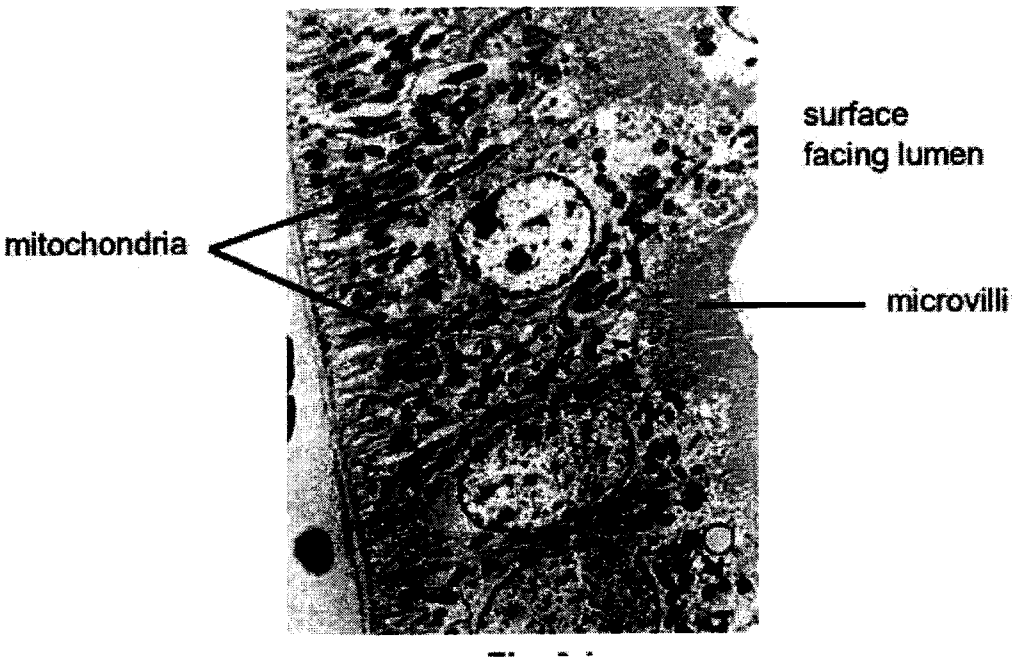

Fig. 4.1

(a) Suggest why proximal tubular cells have a large number of mitochondria.

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.....

..... [2]

For Examiner's Use

(b) Suggest the purpose of microvilli in the proximal tubular cells.

.....

.....

..... [2]

When a person suffers kidney failure, they are given dialysis as shown in Fig. 4.2.

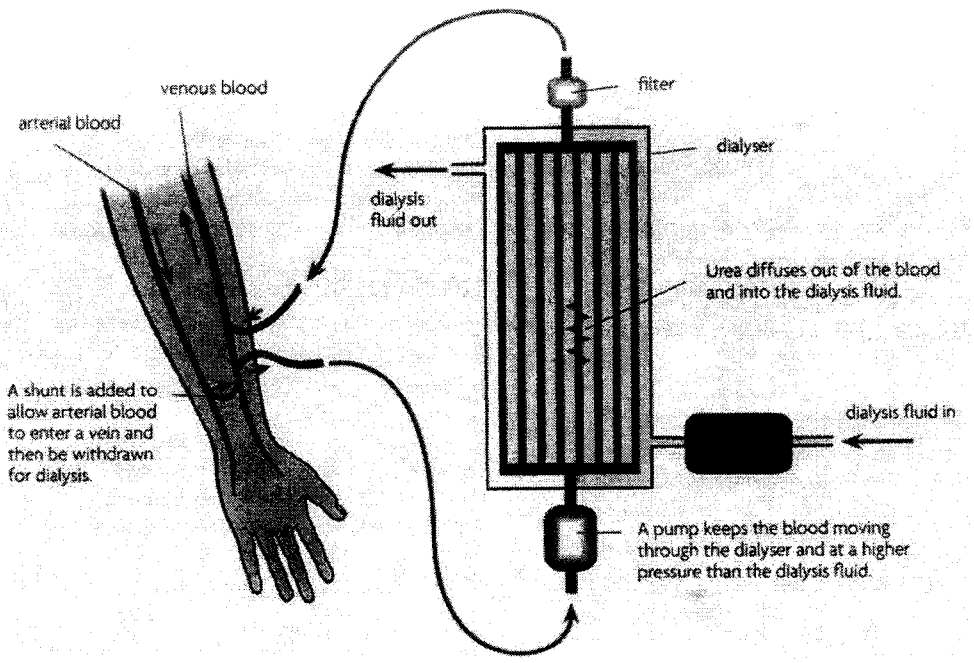

Fig. 4.2

(c) Compare and contrast the mechanism of kidney dialysis to the structure and function of the proximal tubular cells and its microvilli in the kidney.

.....

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..... [4]

[Total: 8]

For Examiner's Use

5 Scallops, which are bivalve molluscs, are important commercially throughout the world. The marine bay scallop, *Agropecten irradians*, has three distinct shell colours, yellow, orange and black. The shell colour is controlled by a gene with three alleles, yellow, S^y, orange, S^o, and black, S^b.

Scallops are hermaphrodite and are able to fertilise themselves to produce offspring. Single mature adult specimens of yellow, orange and black scallops were collected and kept in separate tanks of seawater until they produced young. The young were then recorded for shell colour.

The results were as follows:

adult	offspring
yellow scallop	25 yellow and 8 black
orange scallop	31 orange and 9 black
black scallop	27 black

(a) Explain the results from the orange and black scallops. Your answers should include a genetic diagram for orange scallop to explain the situation.

(i) orange scallop

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..... [4]

For Examiner's Use

(ii) black scallop

.....

.....

.....

.....

..... [2]

(b) Orange scallops are more valued for human consumption. Describe how a marine biologist could produce a pure-breeding line of orange scallops for commercial exploitation using the offspring from the single orange scallop.

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.....

.....

..... [2]

(c) (i) It is known that genetic variation within a population of species helps to increase their survival rate. Explain one way how meiosis can lead to genetic variation when scallops produce gametes for fertilisation.

.....

.....

..... [1]

(ii) Not all scallops are hermaphrodites. Non-hermaphroditic scallops require another scallop to reproduce. Suggest why scallops that are non-hermaphroditic have a greater genetic variation compared to scallops that are hermaphroditic.

.....

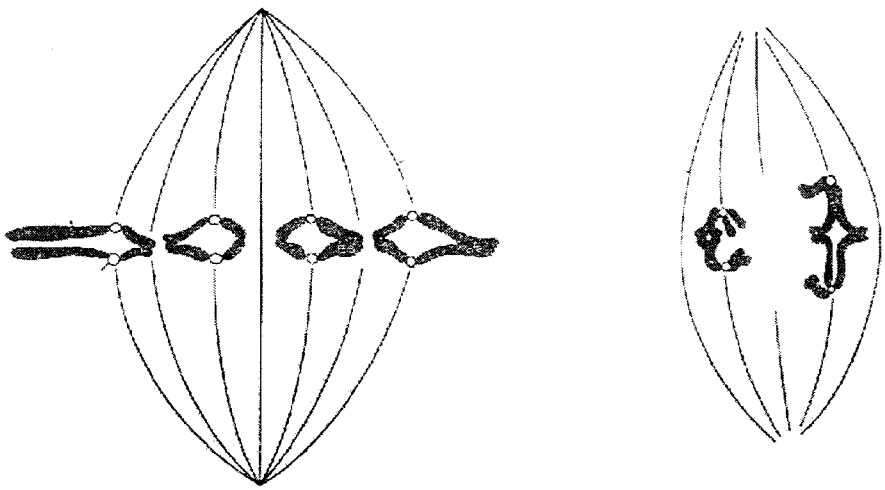
.....

..... [1]

[Total:10]

For Examiner's Use

6 **Fig. 6.1** shows the same stage in the two types of cell division in the cells of an organism.



Cell 1 **Cell 2**

Fig 6.1

(a) State the type of nuclear division and the stage of division in each cell.

Type of division

Cell 1: ..... Cell 2: .....

Stage:.....[2]

(b) Use your knowledge of cell division to describe two visible differences between the arrangements of chromosomes in cell 1 and cell 2.

.....

.....

.....

.....[2]

(c) Fig. 6.2 is a diagram showing the structure of part of a DNA molecule in the chromosome.

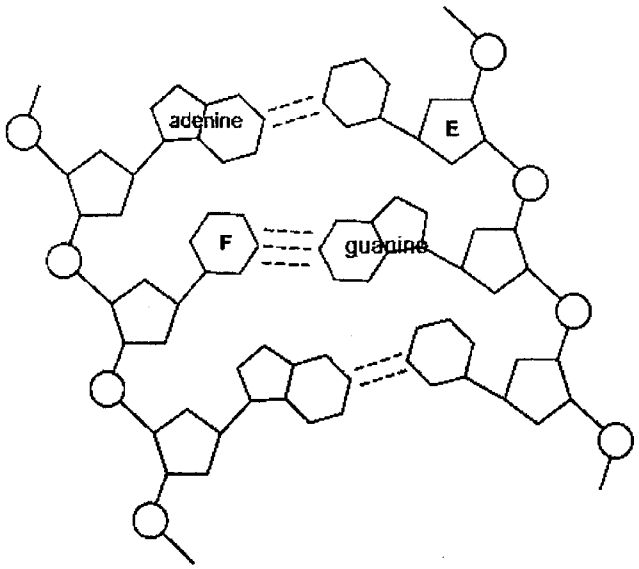


Fig. 6.2

(i) Identify structure **E** and structure **F** in Fig. 6.2.

E .....

F ..... [1]

(ii) On Fig. 6.2 **draw a circle** around one nucleotide. [1]

(iii) Suggest how DNA structure having weaker hydrogen bonds linking the two bases like adenine and thymine together and strong covalent bond linking two nucleotides together ensure genetic stability.

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..... [2]

[Total:8]

For Examiner's Use

Section B

Answer **three** questions

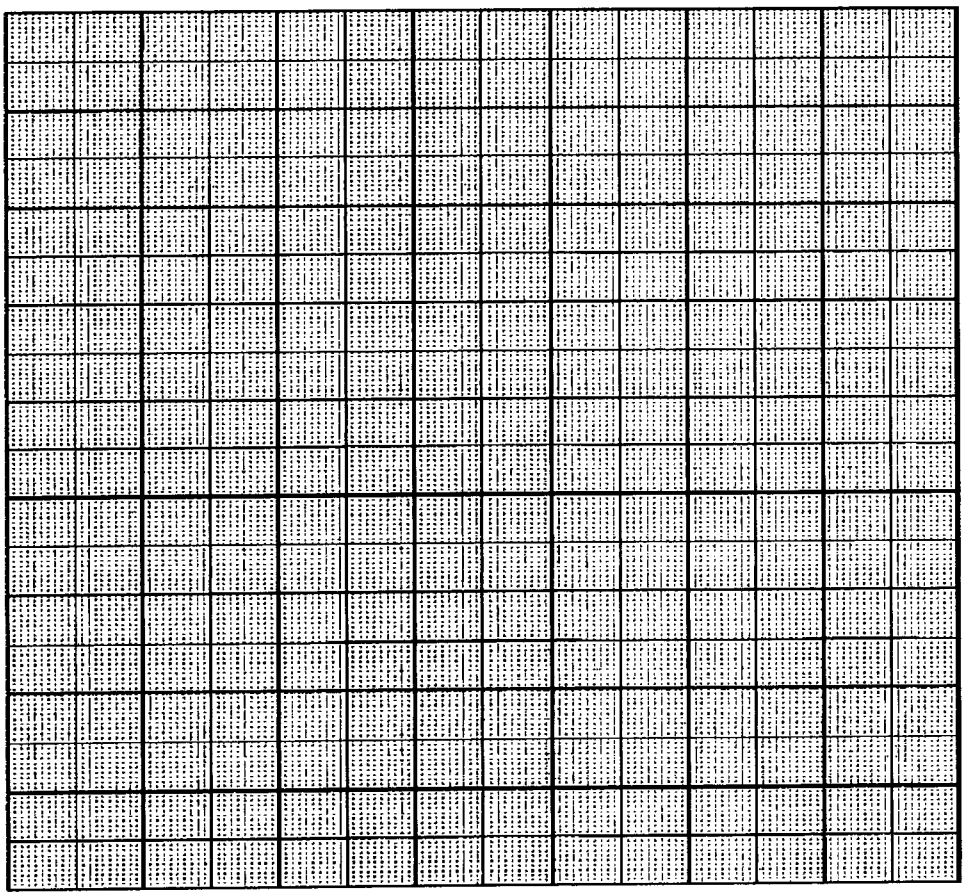
Question **9** is in the form of **Either/Or** question. Only one part should be answered.

7 Amy conducted an experiment to compare the rate of oxygen production of two different water plants, **A** and **B** at various light intensities. The conditions for both setup are similar. The results are shown in Table 7.1.

Light intensity / arbitrary units	Oxygen production / arbitrary units	
	Plant A	Plant B
0	0.0	0.0
10	0.9	2.1
20	2.2	4.0
30	4.5	4.5
40	6.5	4.9
50	7.0	5.0
60	7.0	5.0

Table 7.1

(a) Using the data in Table 7.1, plot a graph to show the relationship between the relative light intensity and the rate of oxygen production for water plant **A** and **B**.



[4]

(b) With reference to the data, compare and contrast the rate of oxygen production between water plant **A** and **B**.

.....

.....

.....

.....

.....

.....[3]

(c) Explain which of the potted plants should Amy choose as an indoor decorative water plant in an aquarium?

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.....

.....[2]

(d) State a possible limiting factor of photosynthesis for water plant **B** at a light intensity of 50 arbitrary units.

..... [1]

[Total: 10]

8 Fig. 8.1 shows the external features of the human heart and some of its blood vessels 1-5.

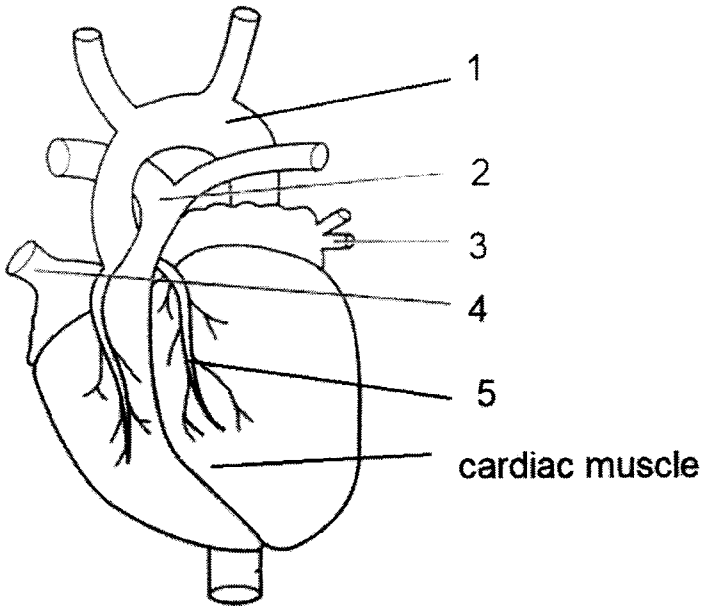

Fig. 8.1

(a) In the table below, name blood vessels 1-5, shown in Fig. 8.1 and explain how the structure of each blood vessel enables oxygenated blood to circulate into the cardiac muscle of the heart.

structure	name of blood vessel	explanation
1		
2		
3		
4		
5		

[5]

For Examiner's Use

(b) Describe how the circulatory system helps to stop bacterial infection from a cut in the skin.

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..... [3]

(c) Smoking tobacco can cause the occlusion of the blood vessel 5. Suggest the effects of occluding the blood vessel 5.

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..... [2]

[Total: 10]

For Examiner's Use

9 Either

Human activities affect the environment. Fig. 9.1 show the pyramid of numbers for one of the food chains in the sea.

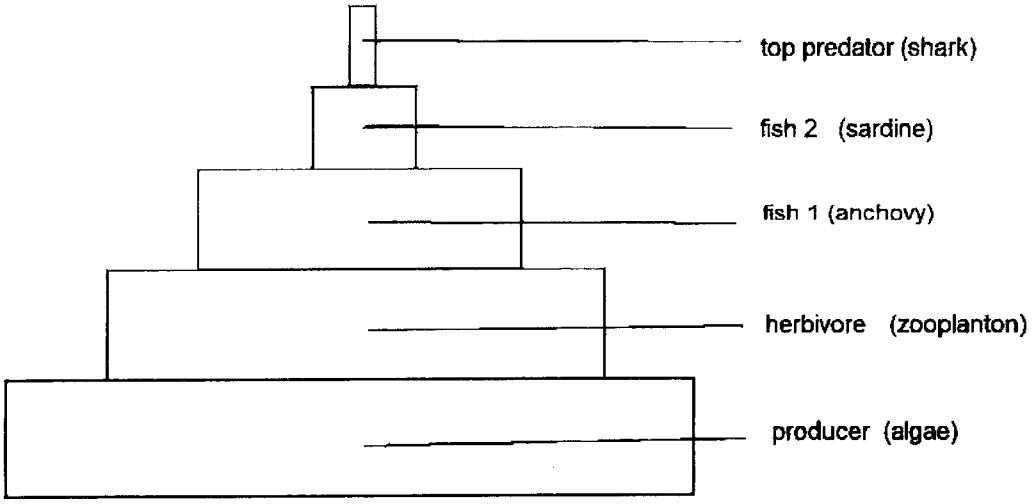

Fig. 9.1

(a) Explain why the pyramid of numbers has only 5 or less trophic levels.

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.....

..... [3]

(b) Sea fishing often remove the top predator fish like the sharks. Describe and explain the effect of removing the top predator fish through overfishing.

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..... [3]

For Examiner's Use

(c) Suggest how we can continue to fish but also maintain the biodiversity in the sea.

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.....

..... [4]

[Total: 10]

9 Or

Fig. 9.2 shows a large jar in which plants are growing. This jar provides an environment in which plants can live for many months without adding water or removing the tightly fitting cork to allow air to enter.

Fig. 9.2

(a) Explain the importance of placing the jar where it can receive a supply of sunlight. Briefly describe the non-cyclical nature of this energy flow.

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..... [3]

For Examiner's Use

(b) Explain why no air needs to be added to the jar. In your answer, identify the major ecological processes involved and the carbon sink in the jar.

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..... [4]

(c) Describe how we can continue to cut down trees for timber production but also maintain the biodiversity of forests.

.....

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.....

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.....

.....

..... [3]

[Total: 10]

End of Paper

Dunearn Secondary School
Preliminary Examination 2022
Secondary 4 Express Biology 6093
MARK SCHEME

Paper 1: Multiple Choice Questions (40 marks)

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

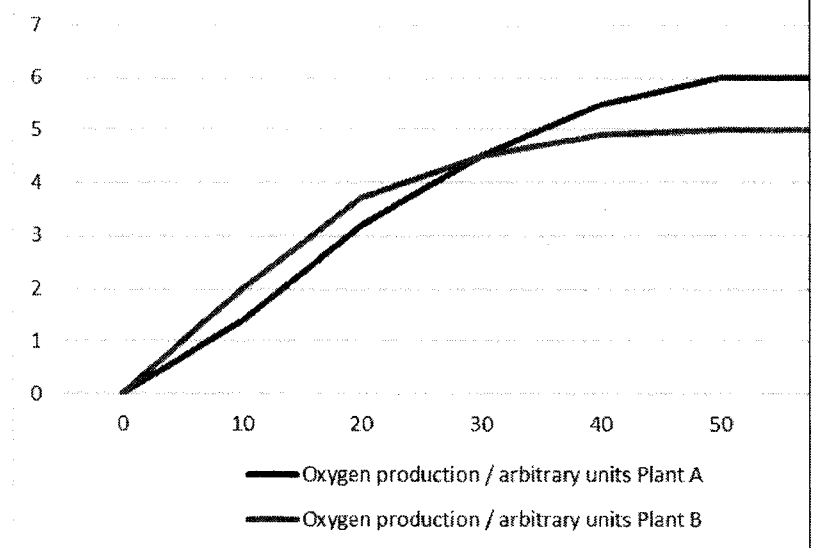
Paper 2 Section A: Structured Questions (50 marks)

<table>
<tr><th>No</th><th>Answer Key</th><th>Mark</th></tr>
<tr><td>1(a)</td><td>
<table>
<tr><th></th><th>active transport</th><th>osmosis</th><th>diffusion</th></tr>
<tr><td>movement of oxygen into a root hair cell</td><td>X</td><td>X</td><td>√</td></tr>
<tr><td>down a concentration gradient</td><td>X</td><td>√</td><td>√</td></tr>
<tr><td>movement of mineral ions into the xylem</td><td>√</td><td>X</td><td>√</td></tr>
<tr><td>movement of water as shown by arrows in Fig. 1.1</td><td>X</td><td>X</td><td>X</td></tr>
</table>
</td><td>1
1
1
1</td></tr>
<tr><td>(b)</td><td>(i) ruled line and label on any of the cell
(ii) large surface area to volume ratio ; efficient absorption
(iii) osmosis from cell to cell due to water potential gradient</td><td>1
1
1</td></tr>
<tr><td>(c)</td><td>Transpiration pull;
Long hollow and narrow tube of xylem;
Adhesion and cohesion forces;</td><td>1
1
1</td></tr>
<tr><td></td><td>Total</td><td>10</td></tr>
<tr><td></td><td>Marker's comments:</td><td></td></tr>
<tr><td>2 (a) (i)</td><td>Enzymes are proteins; organic catalyst; speed up chemical reaction ;
without any change to itself</td><td>1
1</td></tr>
<tr><td>(ii)</td><td>
<table>
<tr><th>organ</th><th>identity</th><th>one digestive enzyme secreted by organ</th></tr>
<tr><td>N</td><td>stomach</td><td>protease/pepsin/renin</td></tr>
<tr><td>O</td><td>pancreas</td><td>protease/trypsin/ amylase/lipase</td></tr>
<tr><td>P</td><td>Small intestine</td><td>sucrase/maltase/lactase/erepsin / protease/lipase</td></tr>
</table>
</td><td>1
1
1</td></tr>
</table>

(b)	(i) emulsification (ii) S (iii) digestion of fats will be faster due to smaller fat globules	1 1 1
	Total	8
	Marker's comments:	
3 (a)	(i) Alveoli/air sac	1
	(ii) one cell thick wall; rapid diffusion spherical shaped with large surface area to volume ratio; rapid diffusion dense blood capillaries; high concentration gradient thin layer of moisture; dissolved gases	1 1 1 1 Any three
(b)	(i) alveolar walls breakdown (ii) prolong coughing leading to emphysema/caused by irritants in cigarette smoking. Any logical answer	1 1
	Total	6
	Marker's comments:	
4 (a)	Aerobic respiration takes place to release energy for active transport during selective reabsorption	1 1
(b)	Provide a large surface area to volume ratio; rapid diffusion/reabsorption of **essential** nutrients like glucose and amino acids	1 1
(c)	Proximal tubular cells are replaced by thin dialysis membrane surrounded by dialysis fluid with same glucose and minerals concentration; no active transport but diffusion occurs Microvilli are mimicked with long narrow tubing to provide large surface area to volume ratio	1 1 1 1
	Total	8
	Marker's comments:	
5 (a) (i)	Hybrid Cross Parental Phenotype: yellow X yellow Parental Genotype: $S^y S^b$ $S^y S^b$ Gametes: S^y S^b S^y S^b Offspring Genotype: $S^y S^y$ $S^y S^b$ $S^y S^b$ $S^b S^b$ Offspring Phenotype: Yellow Yellow Yellow Black Ratio: Ratio of 3 yellow : 1 black Parent genotype can only be $S^y S^y$ or $S^y S^b$. Any other cross combination with one homozygous dominant yellow, $S^y S^y$ will always produce only yellow offspring	1 1 1 1
(ii)	Black is homozygous recessive; $S^b S^b$ bred true	1 1

<table>
<tr><td>(b)</td><td>Multiple generations of yellow X yellow
to obtain only yellow offspring ie breed true
or
Test Cross of orange with black
will produce all orange offspring</td><td>1
1
or
1
1</td></tr>
<tr><td>(c) (i)</td><td>Meiosis produces haploid daughter cells as gametes containing one chromosome from each homologous pair due to independent assortment/crossover</td><td>1</td></tr>
<tr><td>(ii)</td><td>Fertilisation ensures the fusion of the haploid gametes from two parents to form diploid zygote</td><td>1</td></tr>
<tr><td></td><td>Total</td><td>10</td></tr>
<tr><td></td><td>.</td><td></td></tr>
<tr><td>6
(a)</td><td><table><tr><th>Cell 1</th><th>Cell 2</th><th>Stage</th></tr><tr><td>mitosis</td><td>meiosis</td><td>metaphase</td></tr></table></td><td>1 (both cell 1 and 2)

1 (stage)</td></tr>
<tr><td>(b)</td><td>Cell 1 – random segregation of sister chromatids
Cell 2 – random segregation of homologous chromosomes</td><td>1
1</td></tr>
<tr><td>(c) (i)</td><td>E- deoxyribose sugar
F- cytosine</td><td>1</td></tr>
<tr><td>(ii)</td><td>Include deoxyribose sugar to base and phosphate group</td><td>1</td></tr>
<tr><td>(iii)</td><td>Replication of duplicate DNA can take place easily during interphase.
Minimise any errors in the base sequence which remain the same throughout replication/transcription.</td><td>1

1</td></tr>
<tr><td></td><td>Total</td><td>8</td></tr>
<tr><td></td><td>Marker's comments:</td><td></td></tr>
<tr><td colspan="3"><u>Paper 2 Section B</u>: Free Response Questions (30 marks)</td></tr>
<tr><td>7 (a)</td><td> 
</td><td>1</td></tr>
</table>

	scale ; correct plot points ; best fit curve ; correct axes and labels	1 1 1
(b)	Similarities: (b) At light intensity of 30, both plants shows the same i.e 4.5 au [1] (d) Rate of oxygen production remained constant (Reject: stopped) at 6.0 au for plant A and 5.0 au for plant B at light intensity of 50 au. Differences: (a) From light intensity of 0 to 20 au, plant B shows a higher rate of oxygen production. The oxygen production of plant Y increases to 3.7au while that of plant A only increase to 3.2 au with a difference of 0.5 au (manipulated data) [1] Accepted range: 0 TO 30 au Rejected range: 0 to 10 au (this is because the trend continues till 20au) (c) Above light intensity of 30, plant A shows a higher rate of oxygen production from 4.5 au to 6.0 au with a difference of 1.5 au as compared to plant B which has a rate of oxygen production from 4.5 au to 5.0 au with a difference of 0.5 au [1] (e) The maximum oxygen production of plant X was 6.0 while that of plant Y is 5.0 at light intensity of 50. [1]	1 1 1 [Any 3 points 1 from each category]
(c)	B; [1] B has a higher rate of oxygen production at lower light intensity indicating that it can photosynthesize better at lower light intensity while indoors. [1] *The relationship needs to be clearly made.	1 1
(d)	Carbon dioxide concentration in the water / temperature of the surrounding /size of leaves	1
	Total	10
	Marker's comments:	
8 (a)	Aorta – carry oxygenated blood at high pressure via arteries to the rest of the body including coronary arteries (blood vessel 5) Pulmonary artery - carry deoxygenated blood at high pressure	1 1

	to the lungs Pulmonary artery - carry oxygenated blood back from the lungs to the left atrium Vena cava- collect deoxygenated blood from the rest of the body to the right atrium coronary arteries (blood vessel 5) carry oxygenated blood to the cardiac muscle. 1,.2 and 5 have thick muscular elastic walls with small lumen 3 and 4 have thin muscular elastic wall with large lumen	1 1 1 1 1 1 Max 5
(b)	Bleeding of blood to flush the bacteria White blood cells are phagocytes and lymphocytes to fight against bacteria through phagocytosis and production of antibodies Clotting to prevent entry with formation of fibrin triggered by damaged platelets	1 1 1 1 1 Max 3
(c)	Less blood flow/narrow flow of oxygenated blood to cardiac muscle ; Blood clot; heart attack due to lack of oxygen for the cardiac muscle	1 1
	Total	10
	Marker's comments:	
9 E (a)	90% energy loss due to respiration, heat loss, excretion and defecation. 10 % retention through each tropic level Too little energy left for the 5^{th} or 6^{th} tropic level	1 1 1
(b)	The population of sardine will increase suddenly without the shark as predator; Equilibrium of the food pyramid will change with fluctuating population of anchovy, zooplanktons and algae. Loss of biodiversity due to collapse of the ecosystem with removal of keystone organism	1 1 1
(c)	Quota of catch for sustainability Conservations of fishing area Ban use of dredges and drift net/ cyanide fishing/mesh size Raising endangered species of fish in hatcheries for release into the sea	1 1 1 1
	Total	10
	Marker's comments:	
9 O (a)	Sunlight provides the energy for photosynthesis; inorganic → organic compounds in producer producers pass on the energy to consumers with 90% loss for each tropic level due to respiration, heat loss, excretion and defecation/10% retention of the nutrients/chemical energy	1 1 1
(b)	Carbon cycle; Photosynthesis by plants and algae reduces carbon dioxide concentration and Create carbon sink in organisms Living organisms released carbon dioxide during respiration	 1 1 1

	Dead organism decomposed to release carbon dioxide	1
(c)	Creation of laws to regulate the logging industry Reforestation: The planting of new trees or seedlings to replace trees that have been destroyed Designation of lands as forests reserves Research to improve quality of forests and making them more productive	1 1 1 1 Max 3
	Total	10
	Marker's comments:	