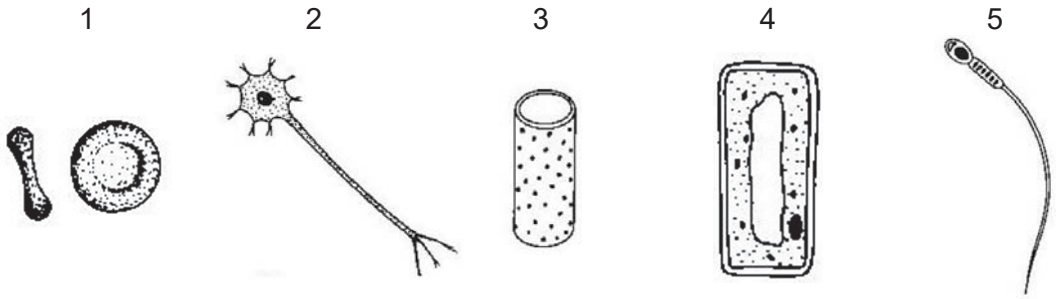
21 The diagram below shows **five** different types of cells.



Which row identifies the functions of the cells shown?

	transmits nerve impulses	manufacture sugar	carry genetic information	conducts water and mineral salts	transports oxygen
A	5	3	2	4	1
B	2	3	5	1	4
C	3	4	2	5	1
D	2	4	5	3	1

22 A type of mammalian red blood cell is found to contain cytoplasm that is isotonic to 1% salt solution. If these red blood cells were immersed in 0.5% salt solution they would

A gain water by active transport and burst.
B gain water by osmosis and burst.
C lose water by active transport and shrink.
D lose water by osmosis and shrink.

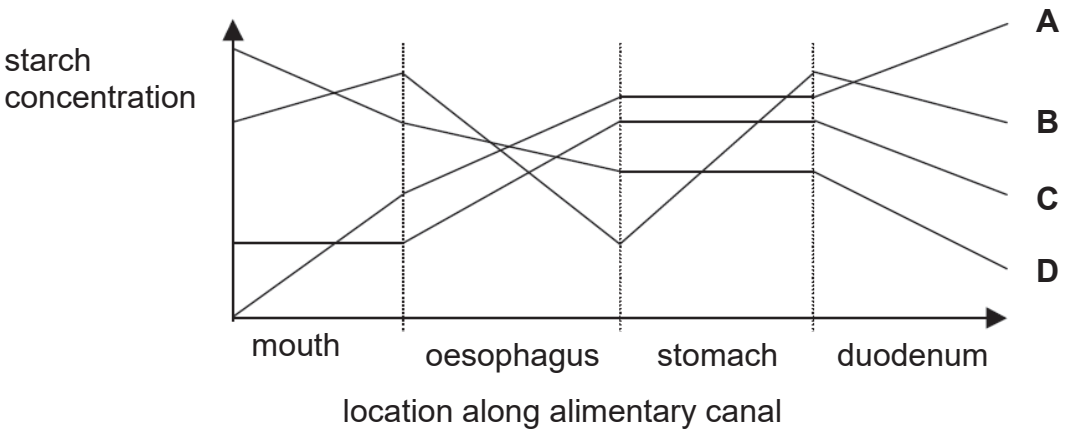
23 According to the lock and key hypothesis, which is the lock and key for fat digestion?

	key	lock
A	fatty acids	glycerol
B	lipase	lipids
C	lipase	glycerol
D	lipids	lipase

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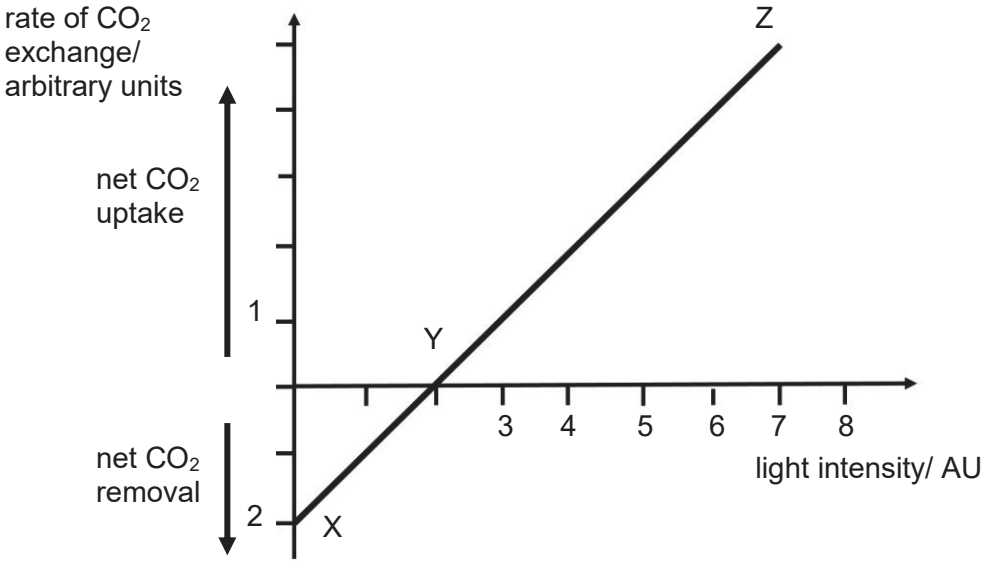
24 Which of the lines represents the activity of amylase in starch digestion?



25 What would happen if a person's bile duct became blocked?

A Carbohydrate digestion would stop.
B Fat digestion would be reduced.
C Fat digestion would stop.
D Manufacture of bile would stop.

26 The graph shows the effect of changing light intensity on the amount of carbon dioxide (CO_2) absorbed or released by green plants.



Which of the following statements is/are **not** true?

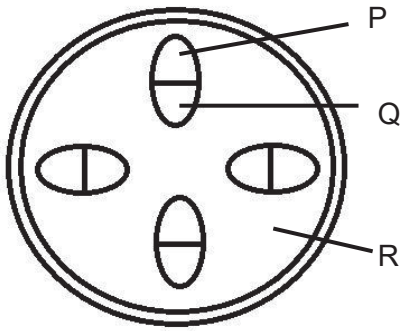
I The photosynthetic rate is greater than the respiratory rate between X and Y.
II The respiratory rate is greater than the photosynthetic rate between Y and Z.
III There is no respiration occurring at Z.

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

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27 The diagram shows sections from the stem of a plant which had been standing in coloured solution for one day.



Which tissues would be most heavily stained?

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

28 Translocation occurs in the phloem and aphids feed on the contents of phloem tubes.

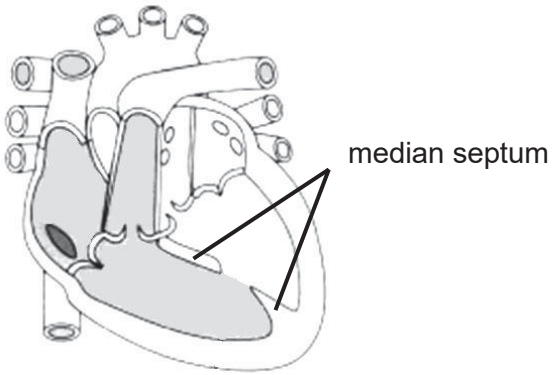
What type of food would be lacking in their diet?

A amino acid.
B glucose.
C lipids.
D sucrose.

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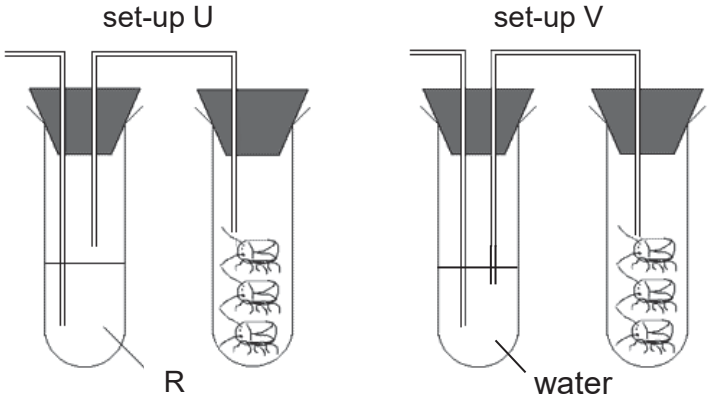
29 The diagram shows a congenital defect in which the median septum of the heart fails to fully form resulting in a “hole in the heart”.



Which of the following would **not** be a likely consequence of the disease?

A There would be a reduction in the pressure of blood entering the lungs.
B There would be a reduction in the amount of oxygen brought to body cells.
C The heart will become weaker and contract less.
D There would be a reduction in the pressure of blood leaving through the aorta.

30 The figure shows a setup to investigate respiration. Three live cockroaches are placed in set-up U and set-up V. R is a solution which absorbs oxygen.



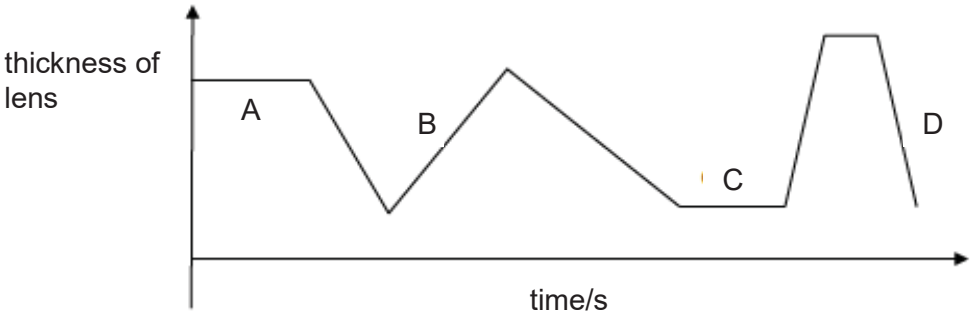
What results would you expect to observe after 24 hours?

A The cockroaches in setup U will die.
B The cockroaches in setup V will die.
C The cockroaches in both setups will die.
D The cockroaches in both setups will live.

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For questions **31** and **32**, refer to the graph below. The graph shows the thickness of the lens of a woman as she looked at the movement of a mosquito.



31 During which period was she looking at a mosquito biting her hand?

32 During which period was she looking at the mosquito flying away from her?

33 The following investigation was carried out using flower buds growing on three plants of the same species.

Plant X **–** The anthers were carefully removed and the buds left open to the air.
Plant Y **–** The anthers were left untouched and a paper bag was tied tightly around each bud.
Plant Z **–** The anthers were carefully removed and a paper bag was tied tightly around each bud.

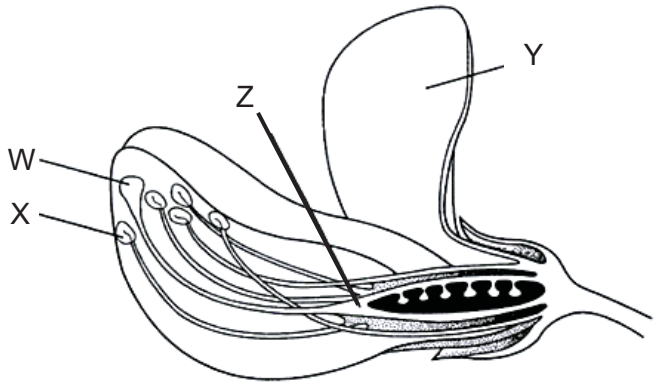
Although all flowers later opened normally, only those in Plant X produced seeds. This result shows that in this species,

A only cross-pollination can be successful.
B only wind-pollination can be successful.
C only insect-pollination can be successful.
D both self-pollination and cross-pollination can be successful.

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34 The diagram shows the structure of a flower.



The functions of the four labelled parts are:

1 attracts insects
2 develops into a fruit
3 produces pollen
4 receives pollen

Which of the following rows is **correct**?

	W	X	Y	Z
A	3	4	1	2
B	3	4	2	1
C	4	3	1	2
D	4	3	2	1

35 The following events occur after fertilization in humans.

P: A zygote is formed in the fallopian tube.
Q: Cell division occurs to form a ball of cells.
R: The embryo implants into the uterine lining.
S: The ball of cells travels down the fallopian tube.

Which is the correct order of events after fertilization in humans?

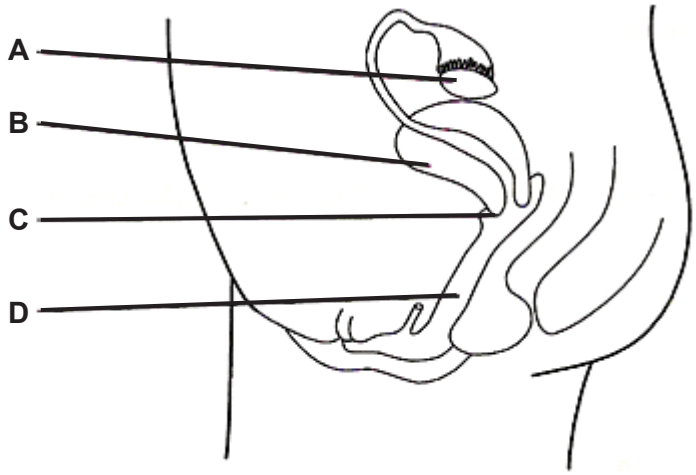
A P → Q → S → R
B Q → S → R → P
C Q → R → P → S
D R → P → Q → S

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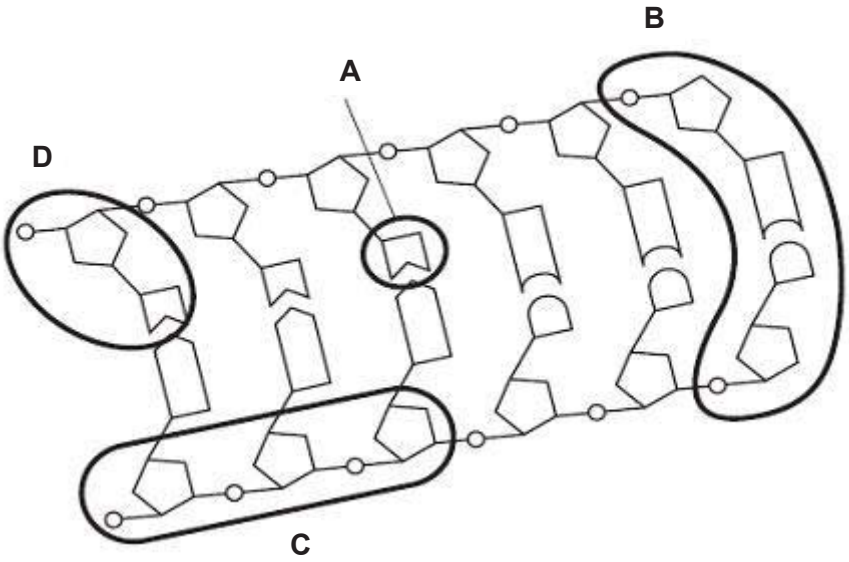
36 The diagram shows a side-view of the reproductive system of a woman.

Where does maturation of the ova occur?



37 The diagram shows part of a strand of deoxyribonucleic acid.

Which part represents a nitrogenous base?

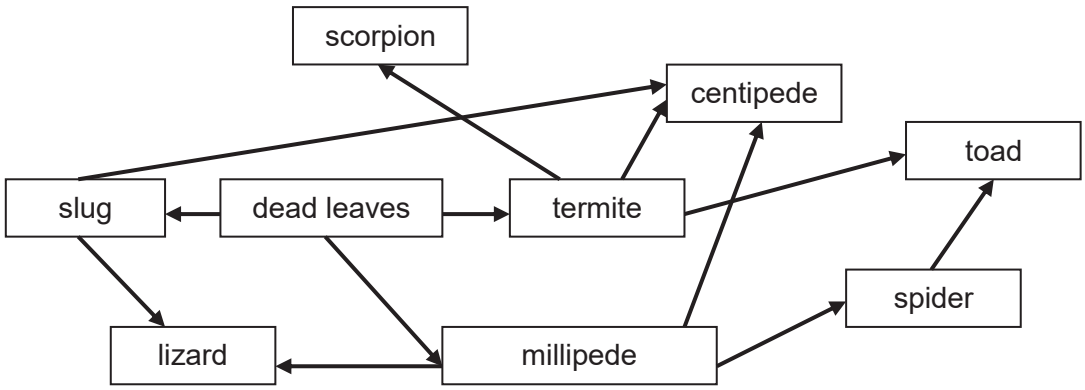


38 How does continuous variation differ from discontinuous variation?

	continuous variation has two or more distinct types of traits	continuous variation is controlled by
A	no	few genes
B	no	many genes
C	yes	few genes
D	yes	many genes

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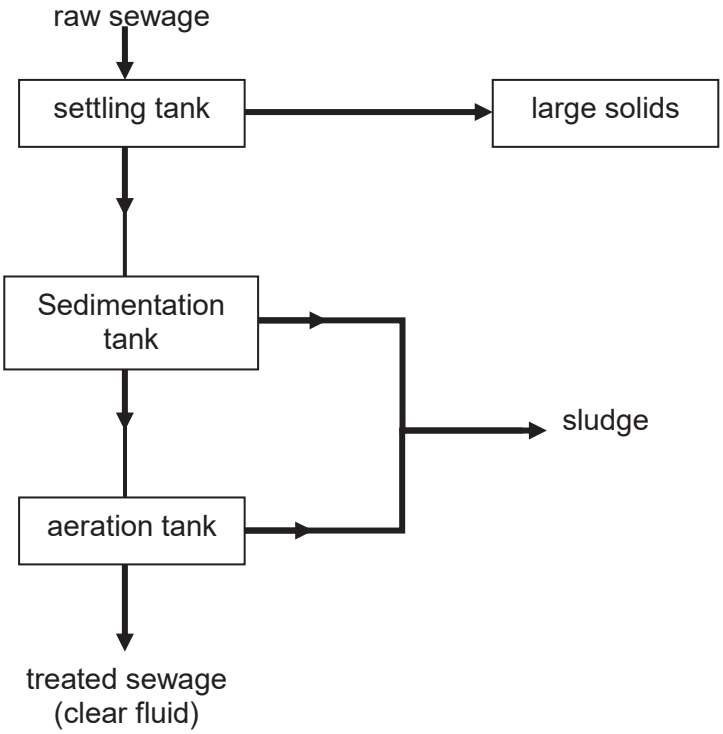
39 This shows the food web of an urban park habitat.



Which is a tertiary consumer?

A centipede
B slug
C spider
D toad

40 The diagram shows a simplified sewage treatment system.



Which of the following explains why air is continuously pumped into the sewage in the aeration tank?

A to increase the oxygen content of treated sewage before discharge
B to kill aerobic bacteria
C to provide enough oxygen for bacteria to decompose sewage
D to remove harmful gases such as hydrogen sulphide

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Centre Number: _____ Index Number: _____

KRANJI SECONDARY SCHOOL
Preliminary Examination
Secondary 4 Express/
5 Normal (Academic)

SCIENCE (BIOLOGY) **5078/4**
PAPER 4

Tuesday **14 Aug 2018** 1 hour 15 minutes

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READ THESE INSTRUCTIONS FIRST

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

INSTRUCTIONS TO CANDIDATES
Do not open this booklet until you are told to do so.
Write your name, class and register number in the spaces provided on the cover page.

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

Section B
Answer any **two** questions.
Write your answers in the spaces provided on the question paper.

INFORMATION FOR CANDIDATES
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	
9	
10	
11	
Total	/ 65

This question paper consists of 17 printed pages (including cover page).
[Turn over]

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Section A (45 marks)

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

1 Fig. 1.1 shows a single-celled organism, amoeba, that survive in an aquatic environment.

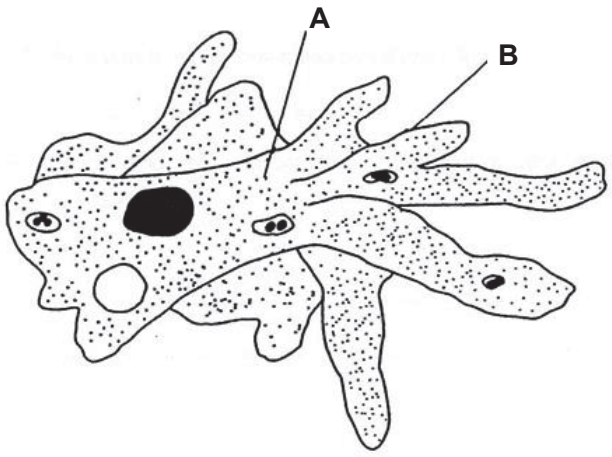


Fig. 1.1

(a) Identify the cell structures **A** and **B**.

A : .....

B : ..... [1]

(b) State the function of structure **B**.

.....

..... [1]

(c) Suggest how the amoeba take in water and nutrients from its surroundings.

.....

.....

.....

.....

..... [3]

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2 A student conducted an experiment with amylase to study its digestion of starch in the human alimentary canal.

Some amylase was added to a starch suspension in a test tube. The mixture was incubated at 40°C for 1 hour.

(a) A small sample, **X** , was removed and some food test were conducted.

(i) Describe how you would carry out a Benedict's Test on sample **X** and what you would expect to observe.

.....

.....

.....

..... [2]

(ii) In which part of the alimentary canal does this digestion take place?

..... [1]

(b) The experiment was repeated with the addition of concentrated hydrochloric acid.
A small sample, **Y**, was removed and Benedict's Test was conducted.

(i) What results would the student obtain for sample **Y**?

..... [1]

(ii) Explain your answer for Sample **Y**.

.....

.....

.....

..... [2]

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3 An experiment was conducted to investigate the loss of water vapour from plant leaves under different wind conditions. Forty similar leaves were removed from a plant and the end of each leaf stalk was covered and sealed with wax. The leaves were then divided into eight groups of five. Each of these groups of leaves were weighed and then suspended in a current of air moving at different speeds. After two hours, each group of leaves were weighed again. The results are recorded in table 3.1.

Table 3.1

group	air speed / ms^{-1}	initial total mass/ g	final total mass/ g	change in mass/ g
1	0	3.00	2.95	- 0.05
2	2	3.00	2.90	- 0.10
3	4	3.00	2.87	
4	6	3.00	2.84	
5	8	3.00	2.82	
6	10	3.00	2.81	
7	12	3.00	2.80	
8	14	3.00	2.80	

(a) Besides the mass of leaves, state one other variable that must be kept constant in this experiment.

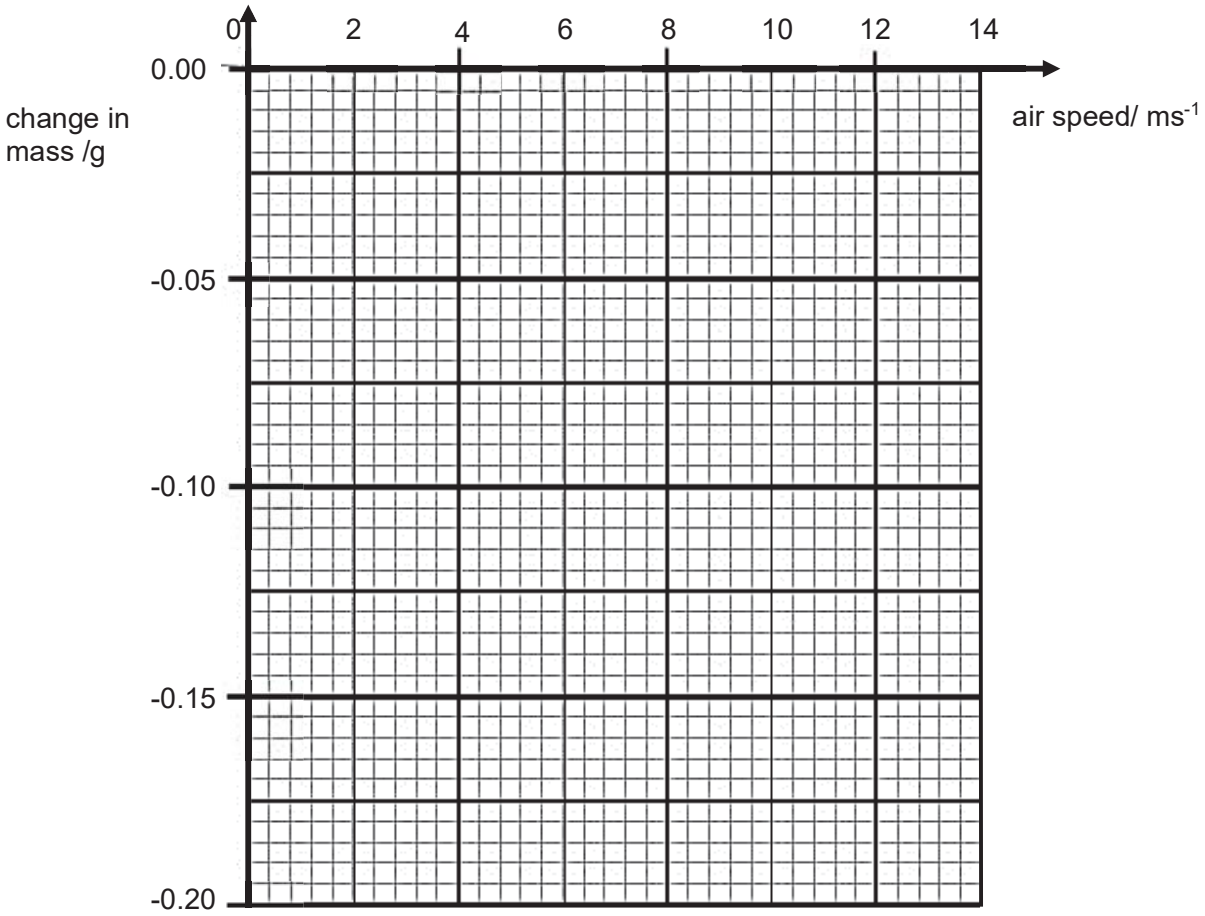
.....[1]

(b) **(i)** Complete Table 3.1 by calculating the change in mass. [1]

(ii) On the grid, plot the points and draw a best-fit curve. [2]

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(c) **(i)** Using the graph, describe the relationship between air speed and the change in mass.

.....

.....

.....

..... [1]

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(ii) Find the change in mass at 7 ms^{-1} and explain why it is different from 0 ms^{-1}.

.....

.....

.....

.....

.....

..... [4]

4 Fig. 4.1 represents the circulatory system, the lungs and body cells.

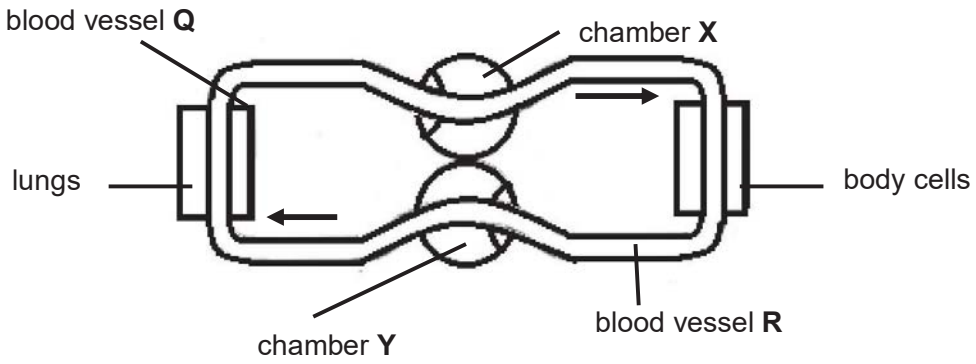


Fig. 4.1

Key:

⟶ direction of blood flow

(a) Identify

(i) blood vessels:

Q: .....

R: ..... [1]

(ii) chambers

X: .....

Y: ..... [1]

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(b) The cells in the body, example muscle cells, undergo anaerobic respiration under vigorous exercise.

(i) Define anaerobic respiration in humans.

.....

..... [1]

(ii) State the word equation for anaerobic respiration in humans.

.....

..... [1]

(c) Table 4.1 shows the amount of lactic acid in the muscle cells of an athlete at a 400m sprint event.

Table 4.1

position	amount of lactic acid / $mgdm^{-3}$
resting	0.0
immediately after sprint	20.0

Using information in Table 4.1, describe the effects of lactic acid observed in the body cells during the sprint.

.....

.....

.....

..... [2]

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5 The maintenance of the blood glucose at normal levels is brought about by an efficient regulatory mechanism controlled by the endocrine system.

(a) Identify the various components of the regulatory mechanism that lowers blood glucose levels back to the norm after a carbohydrate-rich meal.

stimulus	rise in concentration of glucose in the blood
receptor of stimulus	
endocrine gland	
hormone	insulin
transport medium of hormone	
target cells	liver / muscles
chemical response in target cells	

[2]

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(b) Fig 5.1 shows the changes in blood glucose and insulin levels in the blood over a 12 hour period.

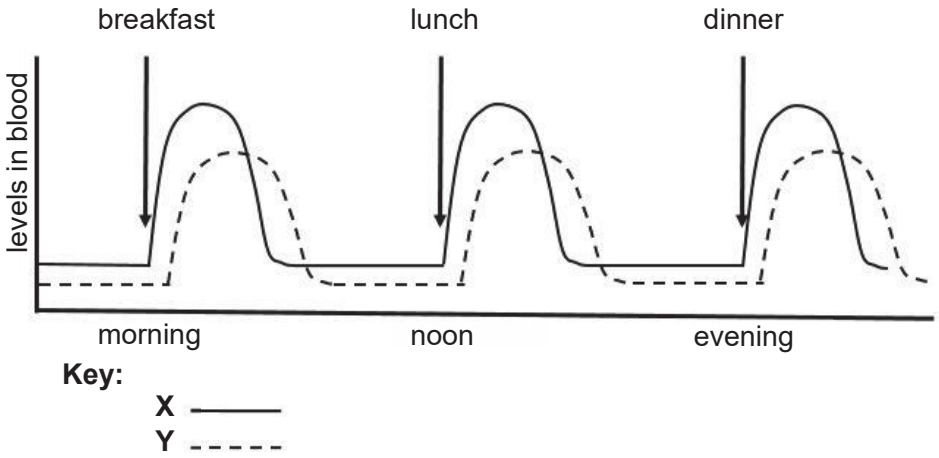


Fig 5.1

Which line (**X** or **Y**) represents the changes in levels of insulin?

Explain your answer.

.....

.....

.....

..... [2]

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6 Fig 6.1 shows the carpel of a flower after pollination as occurred.

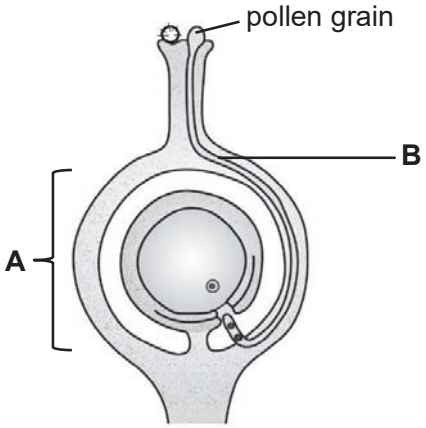


Fig. 6.1

(a) Explain how structure **B** reaches the female gamete of a flower.

.....

.....

.....

.....

.....

..... [3]

(b) State one difference between the carpel shown in Fig 6.1 and the carpel of a wind-pollinated flower.

..... [1]

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7 Fig. 7.1 shows the changes in the uterine lining of a woman over a period of time.

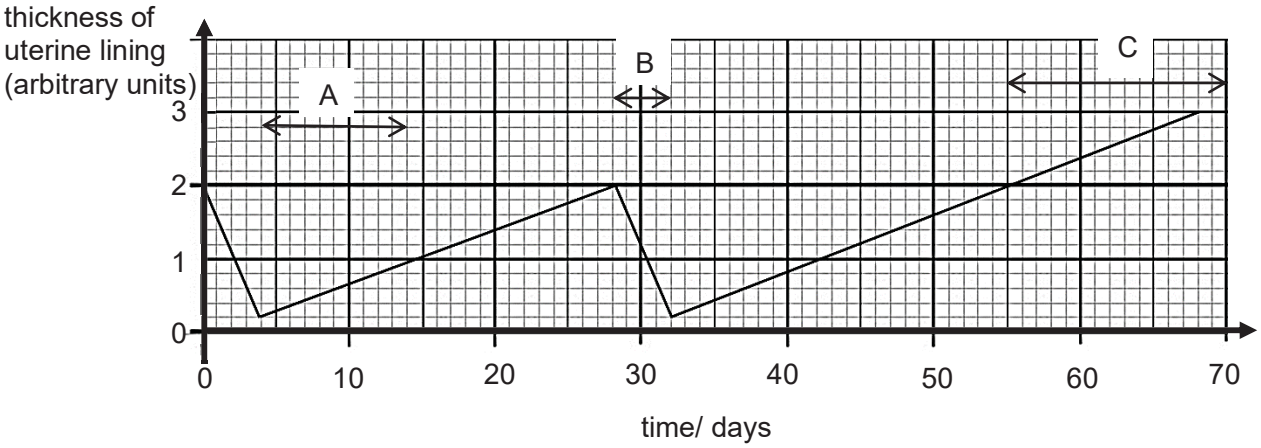


Fig. 7.1

(a) With reference to Fig. 7.1,

(i) What is the event that is occurring in period **B**?

.....[1]

(ii) What are the day(s) on which ovulation occurs?

.....[1]

(b) **(i)** Identify the hormone responsible for the change in thickness of the uterine lining in period **A**.

.....[1]

(ii) Explain the change in thickness of the uterine lining in period **A**.

.....

.....

.....

.....[2]

(c) State the most likely day during which fertilization has taken place.

.....[1]

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8 Warfarin is a poison used to kill rats. A mutation caused some rats to become resistant. These rats are not killed by the poison. This resistance is controlled by a dominant allele.

(a) Explain what is meant by the terms

(i) allele

.....[1]

(ii) mutation

.....

.....[1]

(b) Warfarin is still used to kill rats, since not all rats are resistant to the poison.

In Fig. 8.1 provided, show how a male rat and a female rat, both not affected by the poison, can produce offspring that are killed by the poison.

Use '**R**' to represent the dominant allele and '**r**' the recessive allele.

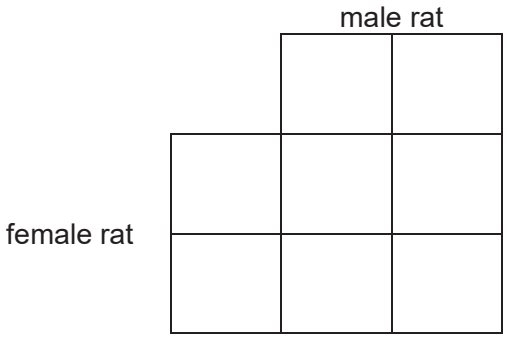


Fig. 8.1 [1]

Determine the chance in which the offspring is not resistant to the poison.

Chance in which offspring is not resistant to poison = ...[1]

(c) The DNA sequence of rats is 95% similar to humans.

Suggest why warfarin is not harmful to humans.

.....

.....[1]

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Section B (20 marks)

Answer any **two** questions from this section.

Write your answers in the spaces provided.

9 Fig. 9.1 shows a transverse section of a part of a leaf.

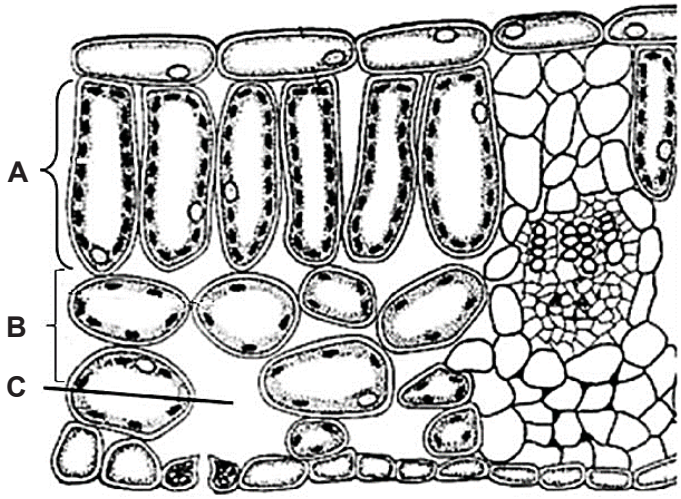


Fig. 9.1

(a) **(i)** Write a word equation for photosynthesis.

.....[1]

(ii) State one factor that affects the rate of photosynthesis.

.....[1]

(b) Describe how products of photosynthesis are removed from the leaf.

.....

.....

.....

.....[2]

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(c) Describe the features of **A** to **C** in Fig 9.1, and explain how these features are adapted for photosynthesis in the leaf.

[6]

10 **(a)** Fig. 10.1 shows the concentration of oxygen, the number of bacteria and the number of fishes in a river over a distance of 50 km, measured from point **P** which is upstream from a pollution source from untreated sewage.

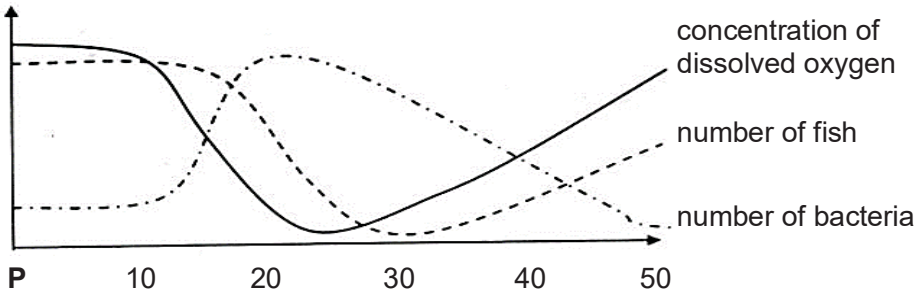


Fig. 10.1

(i) At what distance downstream from point **P** did the river become polluted?

[1]

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(ii) With reference to the three curves on Fig. 10.1, describe and explain the effects of the pollution.

[3]

(b) Explain how carbon in dead animal tissue is made available for photosynthesis.

[4]

(c) Discuss **two** ways in which biodiversity of either forests or oceans is maintained.

[2]

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11 A man in Africa underwent a liver transplant. Before the liver transplant, he was given some anti-clotting drugs.

During the liver transplant, a section of the liver was cut from a donor and transplanted into the man.

(a) **(i)** Explain the mechanism of blood clotting.

[4]

(ii) Suggest why anti-clotting drugs were given to the patient.

[3]

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(b) There are roughly 23.8 million human immunodeficiency virus (HIV) infected persons in all of Africa.

Discuss **one** way HIV is spread and **two** methods by which it can be controlled.

.....

.....

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.....

.....

..... [3]

End of Paper

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MYE 2018
Sec 5 SCIENCE (BIOLOGY) 5078

Answers for Section A (20 marks)

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

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

Section B: Structured Questions (45 marks)

		Marks scheme	Total Marks
1	**a**	2 correct – 1m Structure A: cytoplasm Structure B: cell membrane	[1]
	b	Controls the movement of substances entering and leaving the cell. [1]	[1]
	c	For nutrient absorption, By active transport, against a concentration gradient. [1] By diffusion, down a concentration gradient. [1] For water absorption, By osmosis, down a water potential gradient. [1]	[3]

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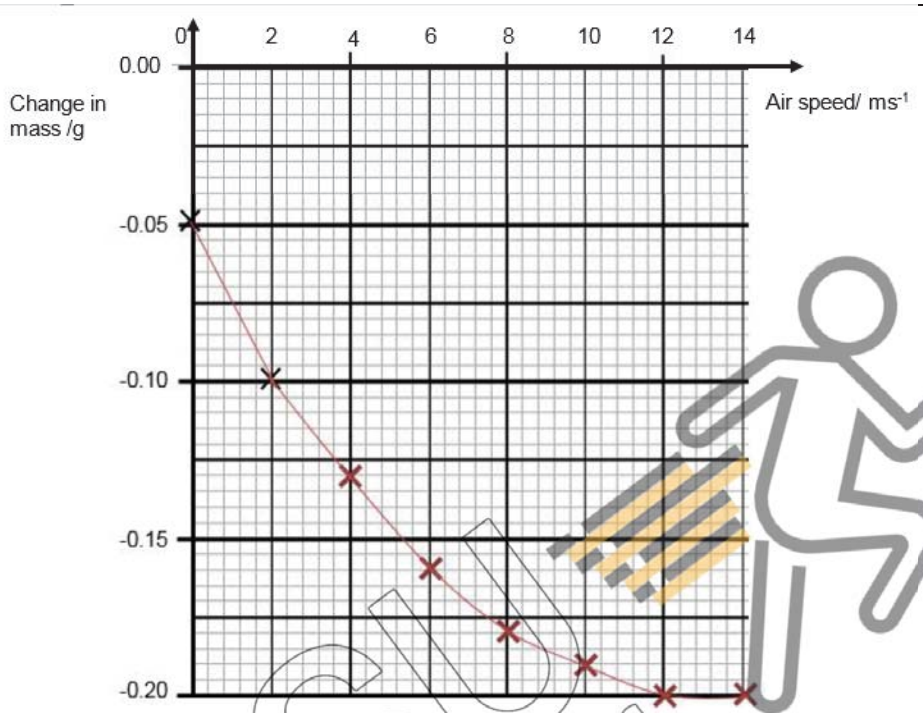
		Marks scheme	Total Marks
2	**ai**	To $2cm^3$ of sample X, add $2cm^3$ of Benedict's solution. Place in boiling water for 3 mins. [1] Brick red precipitate is observed [1]	[2]
	ii	Mouth/ small intestine/ duodenum [1]	[1]
	bi	Benedict's solution remains blue. [1]	[1]
	ii	Amylase is denatured, [1] no digestion of starch into maltose which is a reducing sugar occurs. [1]	[2]
3	**a**	Temperature/ light intensity [1]	[1]
	bi		[1]

Group	**Air speed / ms^{-1}**	**Initial total mass/ g**	**Final total mass/ g**	**Change in mass/ g**
1	0	3.00	2.95	- 0.05
2	2	3.00	2.90	- 0.10
3	4	3.00	2.87	**- 0.13**
4	6	3.00	2.84	**- 0.16**
5	8	3.00	2.82	**- 0.18**
6	10	3.00	2.81	**- 0.19**
7	12	3.00	2.80	**- 0.20**
8	14	3.00	2.80	**- 0.20**

Must have negative sign, all 2 d.p.

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		Marks scheme	Total Marks
	ii	 Plots – [1]; line - [1]	[2]
	ci	Units required. As air speed increases from 0 to 14 m/s, mass decreases from 0.05 to 0.20g. [1]	[1]
	ii	Change in mass = -0.17g. [1] **Units required.** Increase air speed removes the water vapour around the stomata of the leaves [1] faster, increasing the concentration gradient between the inside of the leaf and outside of the leaf [1], more transpiration occurs. [1]	[4]
4	ai	2 correct – [1] Q: pulmonary vein R:vena cava	[1]

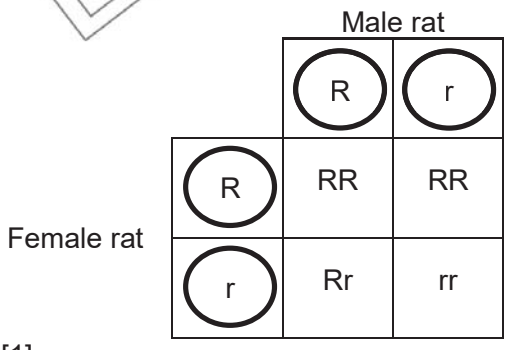
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<table>
<tr><th></th><th></th><th>Marks scheme</th><th>Total Marks</th></tr>
<tr><td></td><td>ii</td><td>2 correct – [1]
X: Left ventricle
Y: Right ventricle</td><td>[1]</td></tr>
<tr><td></td><td>bi</td><td>It is the <u>breakdown</u> of food substances in the <u>absence</u> of oxygen. [1]</td><td>[1]</td></tr>
<tr><td></td><td>ii</td><td>Glucose → lactic acid + small amount of energy [1]</td><td>[1]</td></tr>
<tr><td></td><td>c</td><td>During the sprint, there is an <u>increase</u> in lactic acid by <u>20mgdm^{-3}</u>. [1]
High amounts of lactic acid cause muscle <u>fatigue</u>. [1]</td><td>[2]</td></tr>
<tr><td>5</td><td>a</td><td>Any 1 correct – [0]
Any 2 - 3 correct – [1]
Any 4 correct – [2]
<table><tr><td>Stimulus</td><td>Rise in concentration of glucose in the blood</td></tr><tr><td>Receptor of stimulus</td><td>Pancreas</td></tr><tr><td>Endocrine gland</td><td>Islets of Langerhans</td></tr><tr><td>Hormone</td><td>Insulin</td></tr><tr><td>Transport medium of hormone</td><td>blood</td></tr><tr><td>Target cells</td><td>Liver / muscles</td></tr><tr><td>Chemical response in target cells</td><td>Excess glucose converted into glycogen</td></tr></table></td><td>[2]</td></tr>
<tr><td></td><td>b</td><td>Y [1].
Insulin levels rise and fall after blood sugar. [1]</td><td>[2]</td></tr>
</table>

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		Marks scheme	Total Marks
6	a	The growth of structure B is controlled by the pollen tube nucleus. [1] As B grows, it secretes enzymes to digest the surrounding tissue of the stigma and style. [1] The pollen tube enters the ovule/ female gamete through the micropyle. [1]	[3]
	b	Large and feathery stigma [1]	[1]
7	ai	Menstruation [1]	[1]
	ii	Day 14 and 42. [1]	[1]
	bi	A: oestrogen [1]	[1]
	ii	In period A, increasing oestrogen [1] cause growth and increasing thickness of the uterine lining. [1]	[2]
	c	Day 42. [1] (Accept a range of answers)	[1]
8	ai	Different forms of a gene. [1]	[1]
	ii	Change in the structure of a gene/ in chromosome number [1].	[1]
	b	 [1]	[2]

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		Marks scheme	Total Marks
		Chance = 0.25/ 25%/ ¼ [1]	
	c	The 5% difference in DNA sequence, results in <u>different</u> proteins/ polypeptides that are made in humans which give warfarin resistance. [1]	[1]

Section C

		Marks scheme	Total Marks
9	ai	$carbon\ dioxide + water \xrightarrow[chlorophyll]{light\ energy} glucose + oxygen + water$ [1]	[1]
	ii	Light intensity/ carbon dioxide concentration/ temperature [1]	[1]
	b	Glucose is converted to <u>sucrose to be transported</u> in <u>phloem</u> to other parts of the plant. [1] Oxygen <u>diffuses</u> out of the leaf through the <u>stomata</u>. [1]	[2]
	c	Chloroplasts in <u>mesophyll</u> cells. [1] Mesophyll tissue is the main site for <u>photosynthesis</u>. [1] <u>More chloroplasts</u> in palisade mesophyll cells (A) than in spongy mesophyll cells (B). [1] More light energy absorbed by palisade mesophyll at <u>leaf surface</u> than by spongy mesophyll cells. [1] Large intercellular <u>air spaces/</u> <u>(C)</u> in spongy mesophyll tissue. [1] Allow <u>fast diffusion</u> of carbon dioxide and oxygen into and out of mesophyll cells. [1]	[6]
10	ai	10 km [1]	[1]
	ii	Increase in bacteria growth due to organic waste. [1] Increase decomposition, bacteria multiply quickly cause drop in oxygen concentration. [1] Leading to fishes to die/ reduce number of fishes. [1]	[3]
	b	<u>Decomposers [1]</u> digest dead animal tissue and <u>release carbon dioxide via respiration into the atmosphere</u>. [1]	[4]

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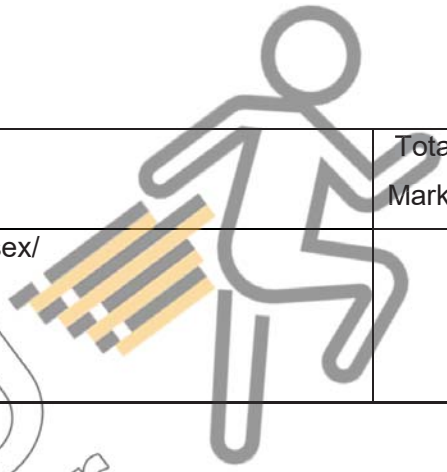
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		Marks scheme	Total Marks
		Fossil fuels such as <u>oil</u> from long dead animal tissue is <u>burnt/ combustion</u> and <u>released as carbon dioxide</u>. [1] Carbon dioxide taken up plants via <u>stomata</u> during <u>photosynthesis</u>. [1]	
	c	**2 correct points from** **Either** Conservation of forest by: • Selective tree felling, where young trees are not felled/ • New seedlings are planted in reforestation/ • Designate land as forest reserves/ • Prohibit tree felling, check trees regularly to control insects and diseases that harm them. **Or** Conservation of fishing grounds by: • Banning the use of drift nets/ • Use nets with a certain mesh size so that young fish are not caught/ • Regulating the entry of ships into fishing grounds/ • Banning the harvesting of endangered species/ • Encouraging the raising of endangered species of fish in hatcheries.	[2]
11	**ai**	<u>Damaged tissues/blood platelets</u> release <u>thrombokinase</u>. [1] Thrombokinase converts <u>prothrombin into thrombin</u> in the presence of <u>calcium</u>.[1] Thrombin catalyse the conversion of <u>soluble fibrinogen</u> to <u>insoluble fibrin threads</u>. [1] To form a <u>mesh</u> to <u>trap blood cells that form a clot</u>. [1]	[4]
	ii	Clotting will cause blood vessels of the liver to become <u>blocked</u>. [1] This will cause a <u>lack of oxygen and nutrients to the organ</u>. [1] Leading to <u>organ failure</u>. [1]	[3]
	b	**Any one way + 2 methods** HIV is transmitted by: • Sexual intercourse with an <u>infected person</u>/ sharing hypodermic needles (tattoo, acupuncture, ear-piercing)/ blood transfusion from an <u>infected person</u>/ during pregnancy, from <u>infected</u> mother to fetus/ through breast milk from <u>infected</u> mother to infant Methods for control:	[3]

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	Marks scheme	Total Marks
	• Keep to one sex partner or do not have sex/ • Wear condom/ • Do not abuse drugs/ • Do not share razors or toothbrushes/ • Make sure that needles are sterilized.	



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