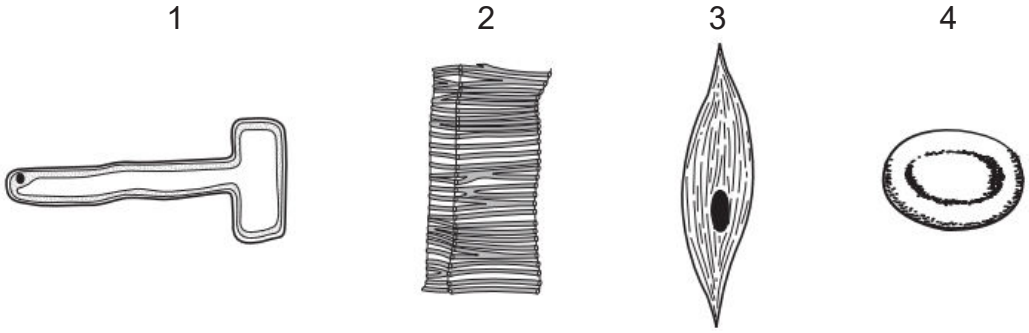
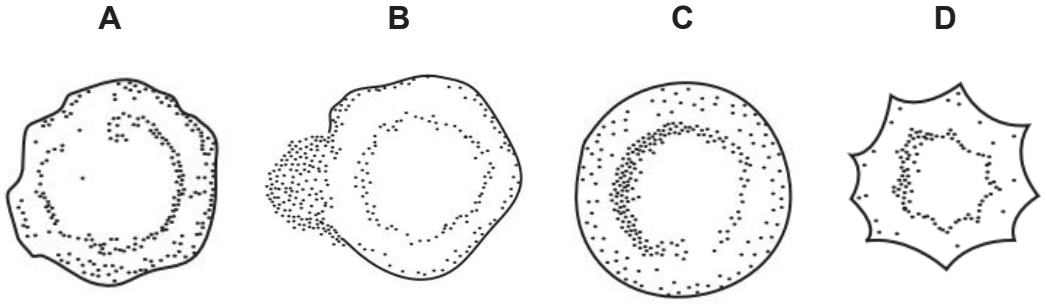
21 The diagram shows four cells.



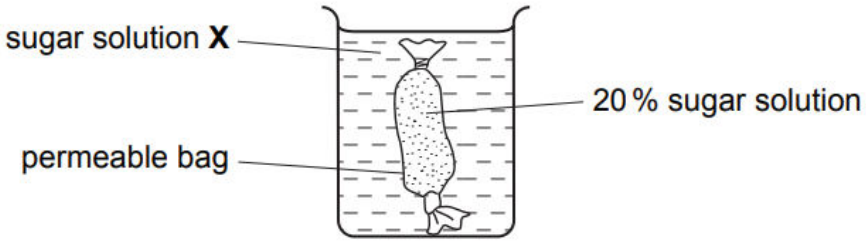
Which cells are involved in transport?

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

22 Some red blood cells were placed in distilled water and others were placed in three salt solutions of different concentrations.
Which diagram shows the appearance of a cell after being placed in a solution of higher water potential for a short time?



23 The diagram shows an experiment on diffusion.



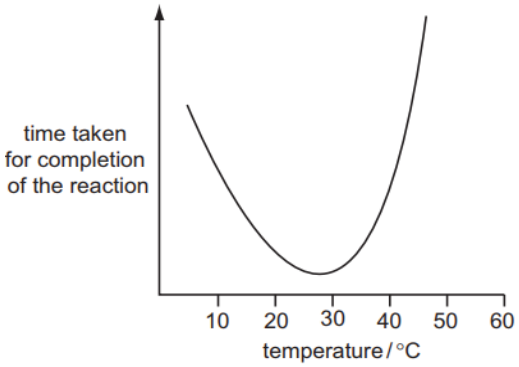
More sugar diffuses out of the bag than diffuses in.
What is the concentration of sugar in solution **X**?

A 10% **B** 20% **C** 30% **D** 40%

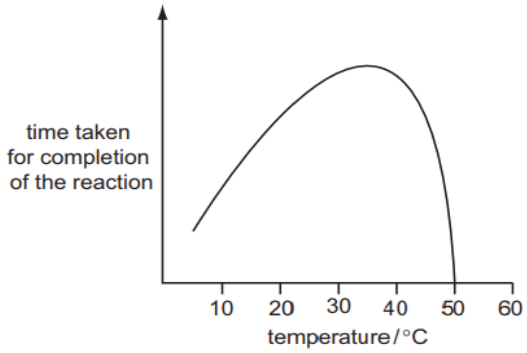
24 An enzyme is completely denatured at 50°C. A fixed concentration of this enzyme is added to a fixed concentration of its substrate. The time taken for completion of the reaction is measured at different temperatures.

Which graph shows the results?

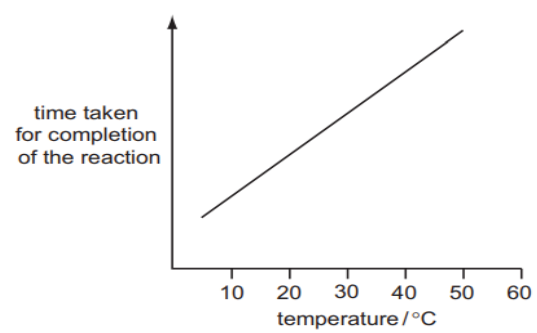
A



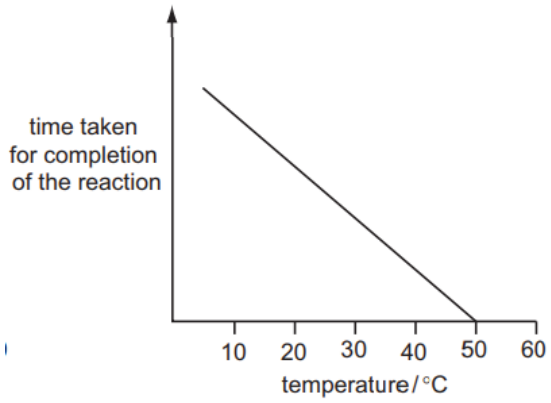
B



C

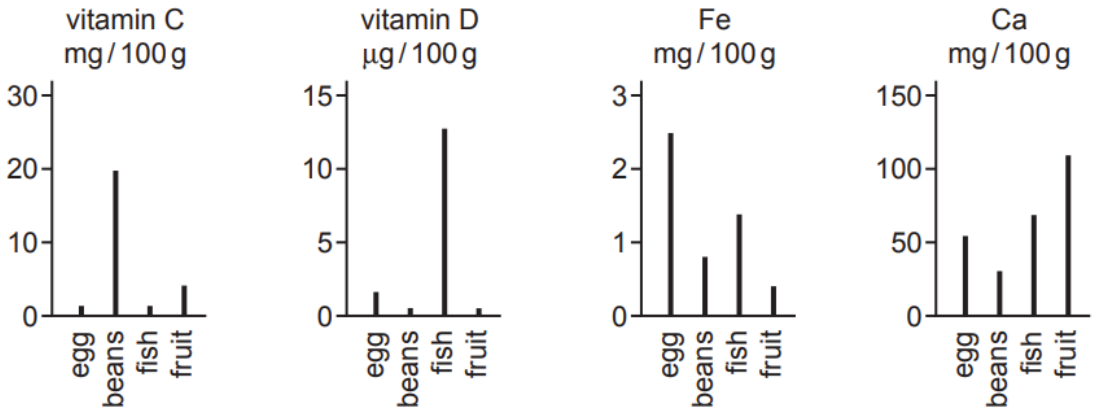


D



[Turn Over

25 The graphs show the quantities of selected vitamins and minerals in four foods.



Which food is the richest source of the vitamin or mineral essential for the transport of oxygen by the blood?

A beans
B eggs
C fish
D fruit

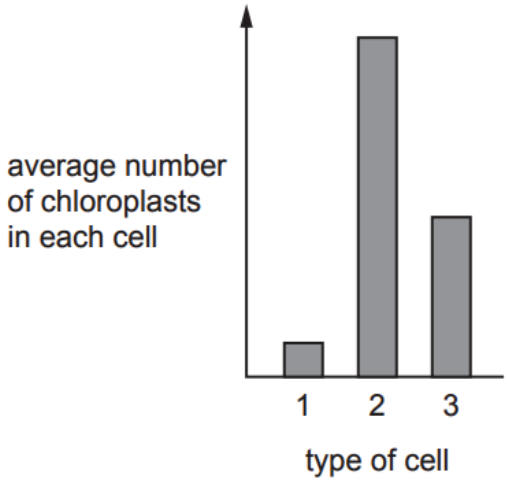
26 A student set up a test-tube containing starch, water and salivary amylase.
How could the student test whether the amylase had catalysed the digestion of all the starch?

A Add Biuret solution.
B Add dilute hydrochloric acid.
C Add iodine solution.
D Weigh the test-tubes and contents before and after the experiment.

27 A person has his gall bladder removed.
Which statement is correct?

A He cannot eat carbohydrates.
B He can eat fat only in small amounts.
C He can eat only liquid food.
D He must not eat more than one large meal a day.

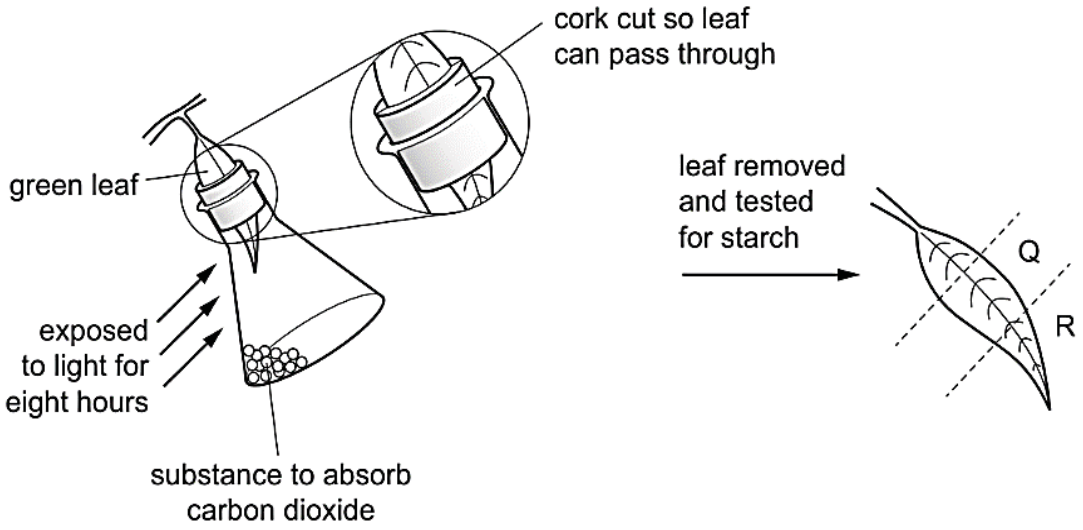
28 The bar chart shows the average number of chloroplasts in each of three different types of leaf cell.



What are the three types of cell?

	1	2	3
A	guard cell	palisade mesophyll cell	spongy mesophyll cell
B	palisade mesophyll cell	spongy mesophyll cell	guard cell
C	spongy mesophyll cell	guard cell	palisade mesophyll cell
D	spongy mesophyll cell	palisade mesophyll cell	guard cell

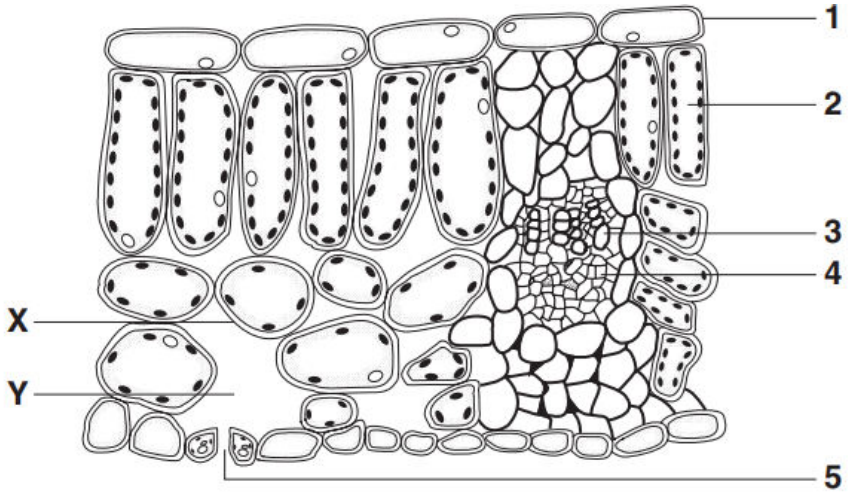
29 A plant is kept in the dark for two days. One of its leaves is used in an experiment to investigate photosynthesis as shown in the diagram.



What are the colours of **Q** and **R**, when the leaf is tested for starch using iodine solution?

	Q	R
A	blueblack	brown
B	brown	blueblack
C	blueblack	blueblack
D	brown	brown

Use the diagram below, which shows a section through a leaf, to answer questions 30 and 31.



30 What takes place in the structures indicated?

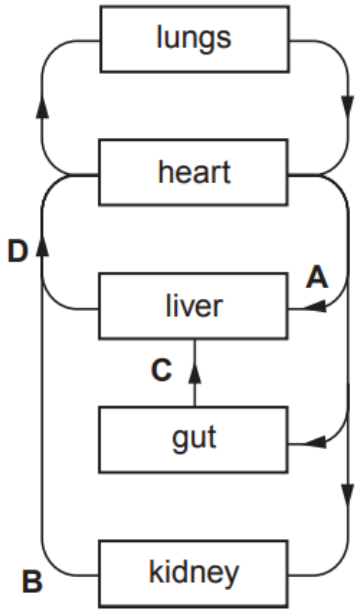
	transport of mineral ions to the cells of the leaf	transport of amino acids away from the cells of the leaf	allow the entry and exit of gases from the leaf
A	4	3	5
B	3	4	1
C	3	4	5
D	4	2	1

31 The leaf is losing water to the atmosphere. What processes are occurring at X and Y?

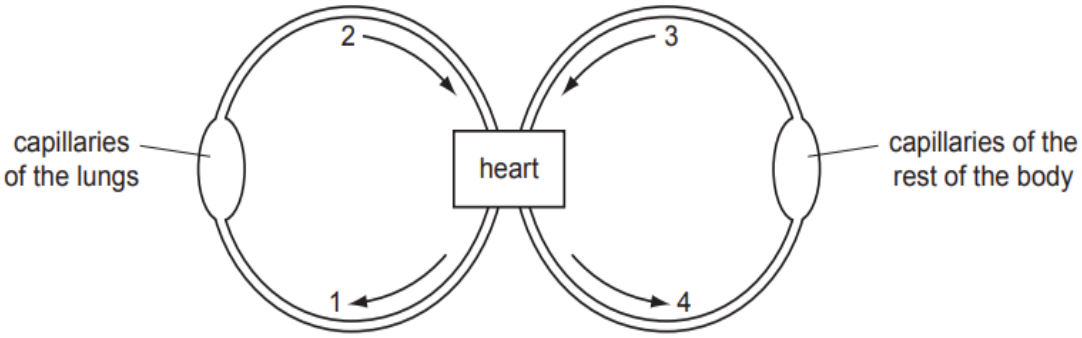
	X	**Y**
A	diffusion	evaporation
B	evaporation	diffusion
C	osmosis	transpiration
D	transpiration	osmosis

[Turn Over

32 The diagram shows a plan of part of the human circulatory system.
In which vessel are the breakdown products of alcohol first found?



33 The diagram shows a double circulatory system.



Which two vessels carry blood at the highest pressure?

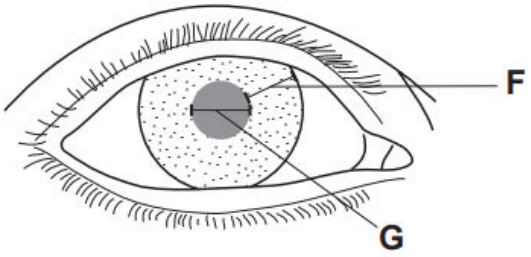
A 1 and 2
B 1 and 4
C 2 and 3
D 2 and 4

34 The table shows some of the features of respiration.

Which row is correct for anaerobic respiration in humans?

	energy remaining in products	amount of energy released	releases carbon dioxide
A	high	low	no
B	high	high	always
C	low	low	no
D	low	high	always

35 The diagram shows the eye of a person in a brightly-lit room.

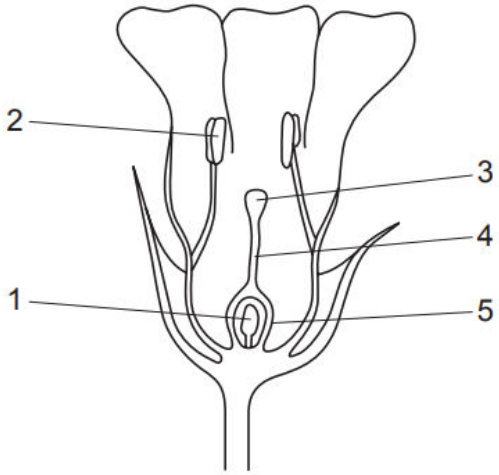


What happens to distance **F** and distance **G** when this person moves into a dimly-lit room?

	F	G
A	increases	decreases
B	increases	increases
C	decreases	increases
D	decreases	decreases

[Turn Over

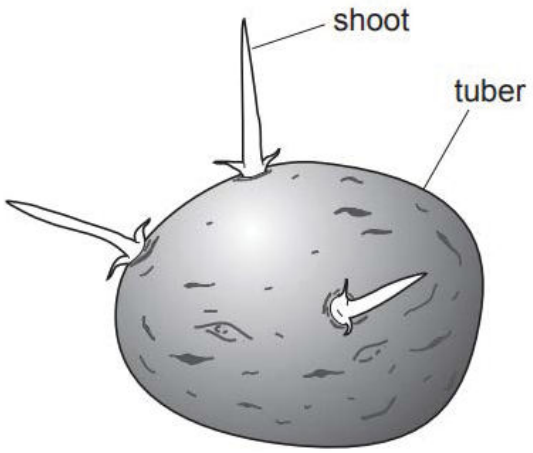
36 The diagram shows a flower in vertical section.



Which numbered parts of the flower continue to develop after fertilisation?

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

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



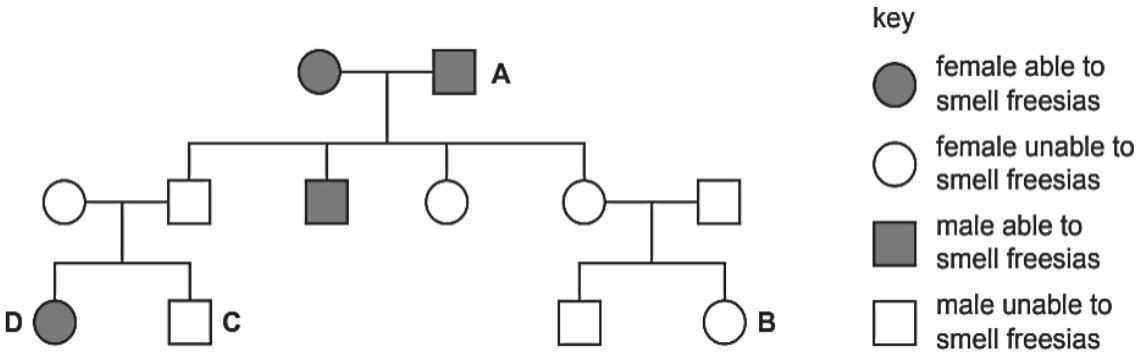
How do the genotypes of the shoots compare with the genotypes of the tuber and of the parent?

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.

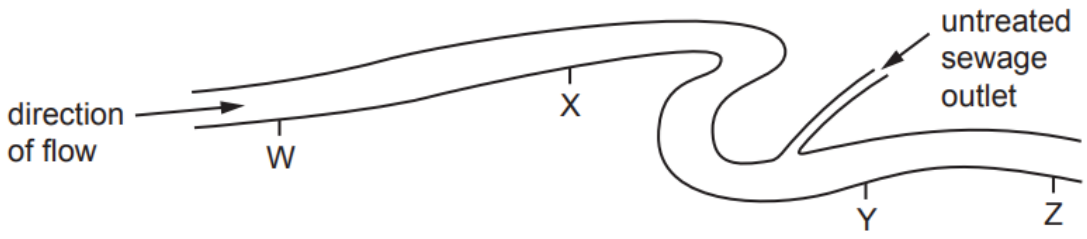
38 Which term is defined as a length of DNA that codes for a protein?

A amino acid
B chromosome
C gene
D nucleotide

39 The family tree shows the inheritance of the ability to smell flowers called freesias.
The allele for the ability to smell freesias is dominant.
Which individual's symbol is not correct?

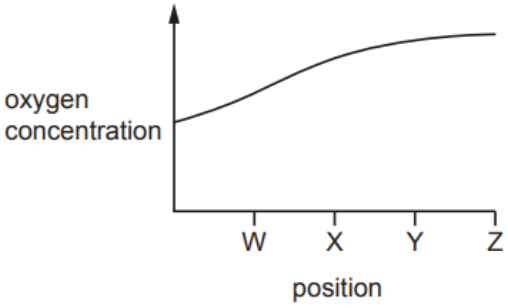


40 The diagram shows four positions on a river where water samples were taken.

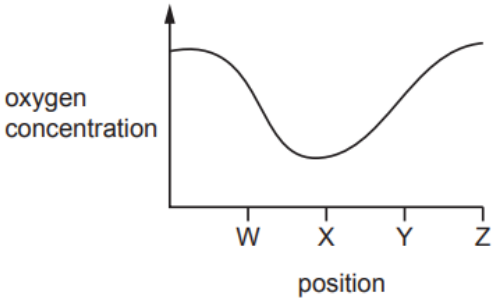


Which graph shows oxygen concentrations in the river?

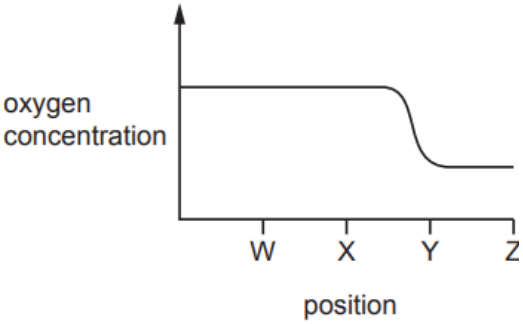
A



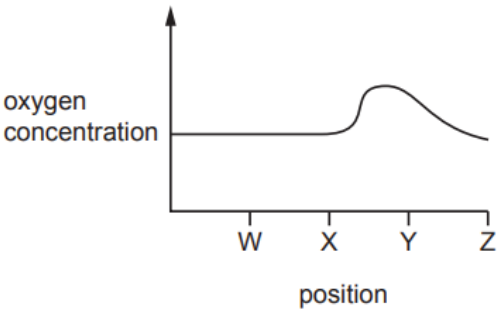
B



C



D



End of paper

Index Number	Class	Name

CHIJ ST JOSEPH'S CONVENT
PRELIMINARY EXAMINATION

O **O**

Science (Biology)
Paper 4

5078/ 04

Secondary 4 Express / 5 Normal

Tuesday, 7 August 2018
1 hour 15 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.
Write your index number, class and name on all the work you hand in.
Write in dark blue or black pen.
You may use soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, and glue or correction fluid.

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

FOR EXAMINER'S USE	
A	45
B	20
Total	65

This document consists of **17** printed pages.

Setters: Mrs Cherry Lim & Ms Koh Peony

Section A (45 marks)
Answer all questions in this section.

For Examiner's Use

1 Fig. 1.1 shows a green plant, *Nuphar lutea*, which grows in lakes.

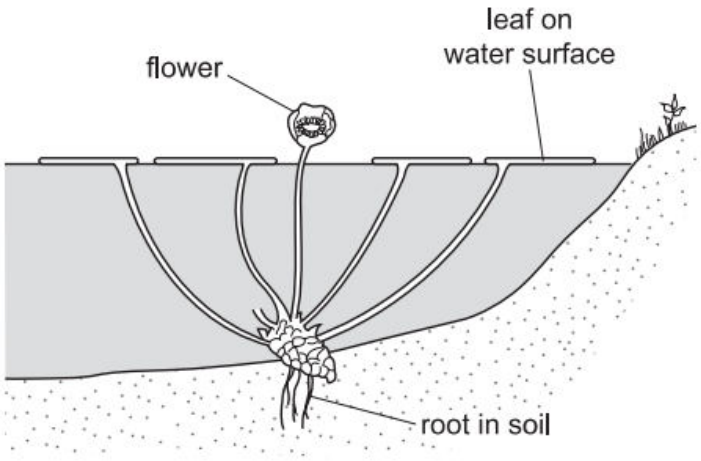


Fig. 1.1

Fig. 1.2 is a vertical section cut from one of the leaves to show its structure.

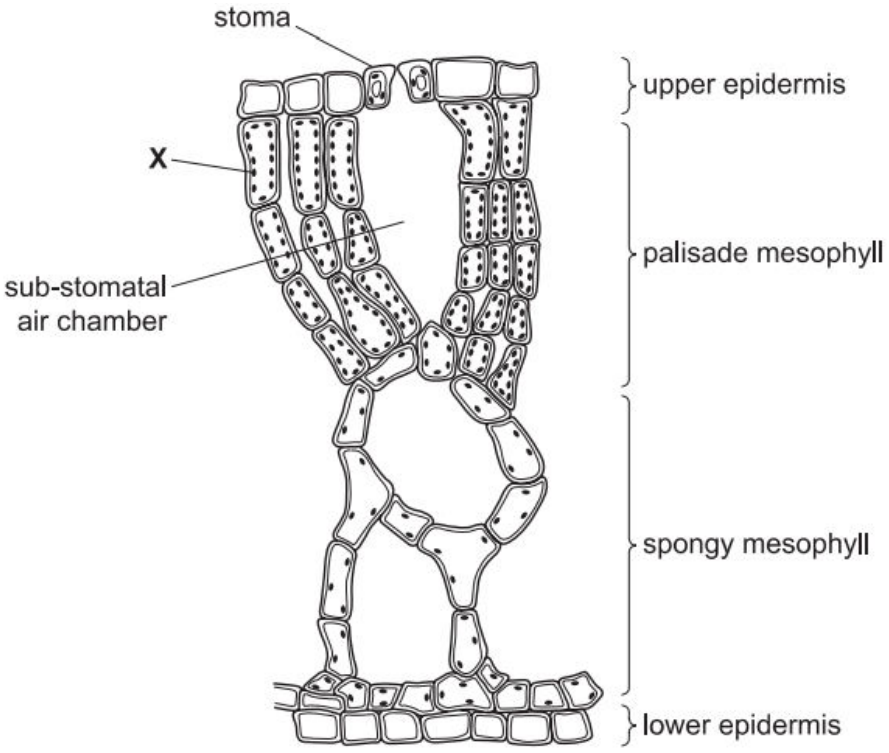


Fig. 1.2

For Examiner's Use

(a) Many of the leaf cells in **Fig. 1.2** have organelles, labelled X.

(i) Name organelle **X**.

…….. [1]

(ii) Outline the function of organelle **X**.

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…….. [2]

(iii) Describe and explain the distribution of chloroplasts in the palisade layer and the spongy layer of this leaf.

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…….. [3]

(b) **(i)** There are many large air spaces in this leaf. Suggest how these air spaces help *Nuphar lutea* to survive in its habitat.

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…….. [2]

For Examiner's Use

(ii) The stomata in this plant are all on the upper surface of the leaves. Suggest why there are no stomata on the lower surface of the leaves.

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…….. [2]

[Total: 10]

[Turn over

2 Fig. 2.1 shows a section of a villus at two different magnifications.

For Examiner's Use

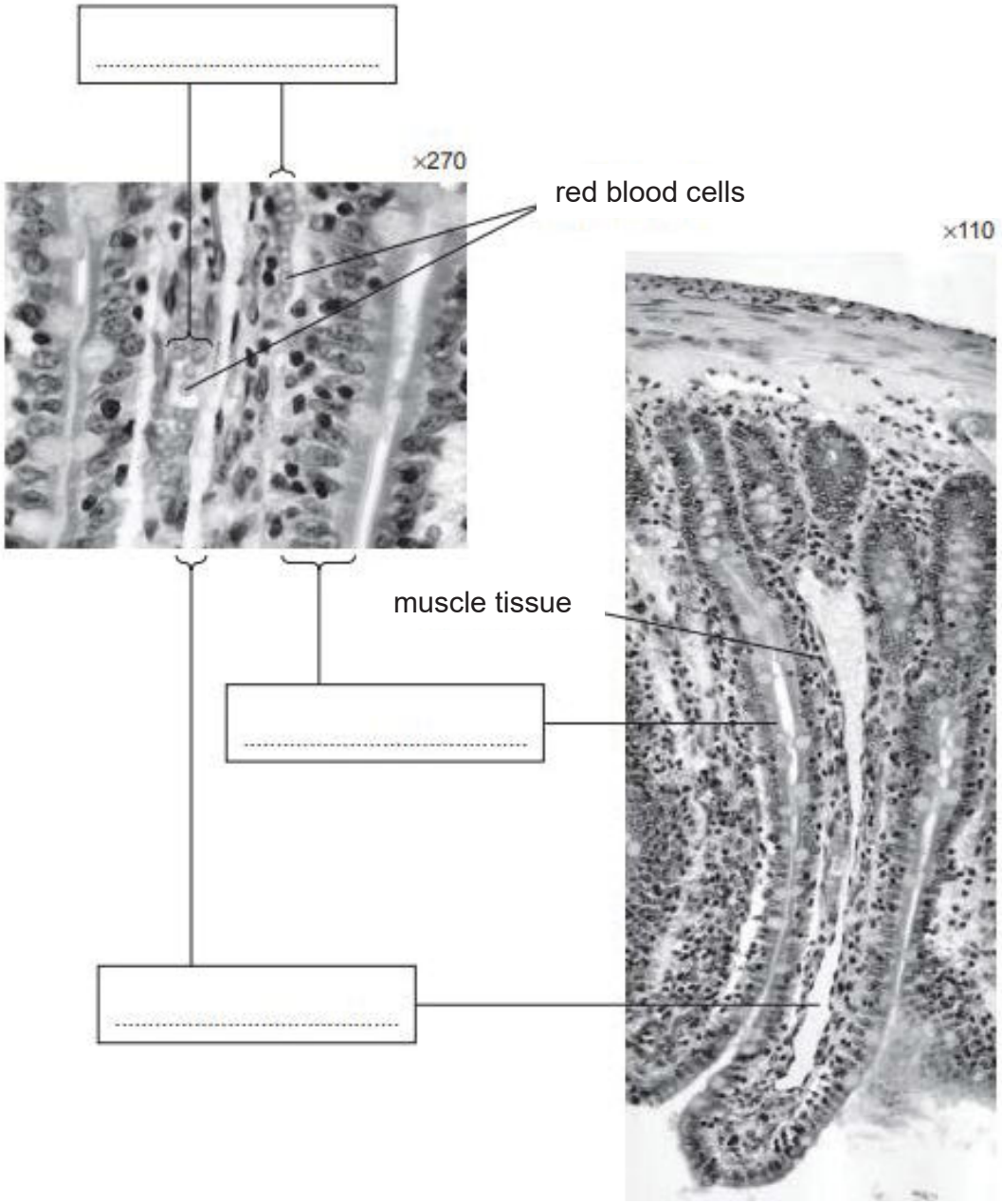

Fig. 2.1

(a) **(i)** In the boxes provided, label the structures shown in Fig. 2.1.

[3]

For Examiner's Use

(ii) The muscle tissue moves the villus from side to side. Suggest how this helps the villus in its function.

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…… [2]

(b) Fig. 2.2 shows an experiment to investigate the uptake of glucose by cells of 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.

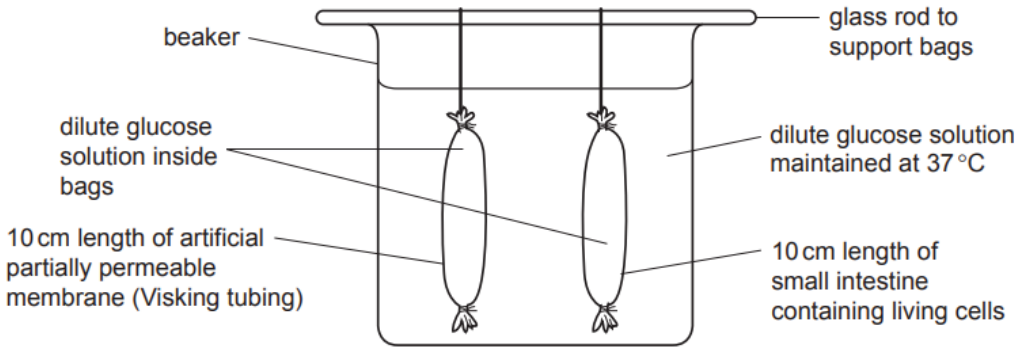

Fig. 2.2

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.

For Examiner's Use

(i) The decrease in the glucose concentration in the bag made from small intestine is due to active transport, a process that requires energy. Name and describe the process through which cells of the small intestine releases energy.

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…… [2]

(ii) After two hours there was less water in the bag made from small intestine. The volume of water in the bag made from small intestine decreased, but the volume in the bag made from Visking tubing did not change. Explain why.

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…… [3]

[Total: 10]

For Examiner's Use

3 All organisms depend on enzymes.

(a) Define the term enzyme and describe the function of enzymes in living organisms.

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..... [2]

(b) Samples of an amylase enzyme were incubated with starch at different temperatures. The rate of starch digestion in each sample was recorded and points plotted on the graph shown in Fig. 3.1.

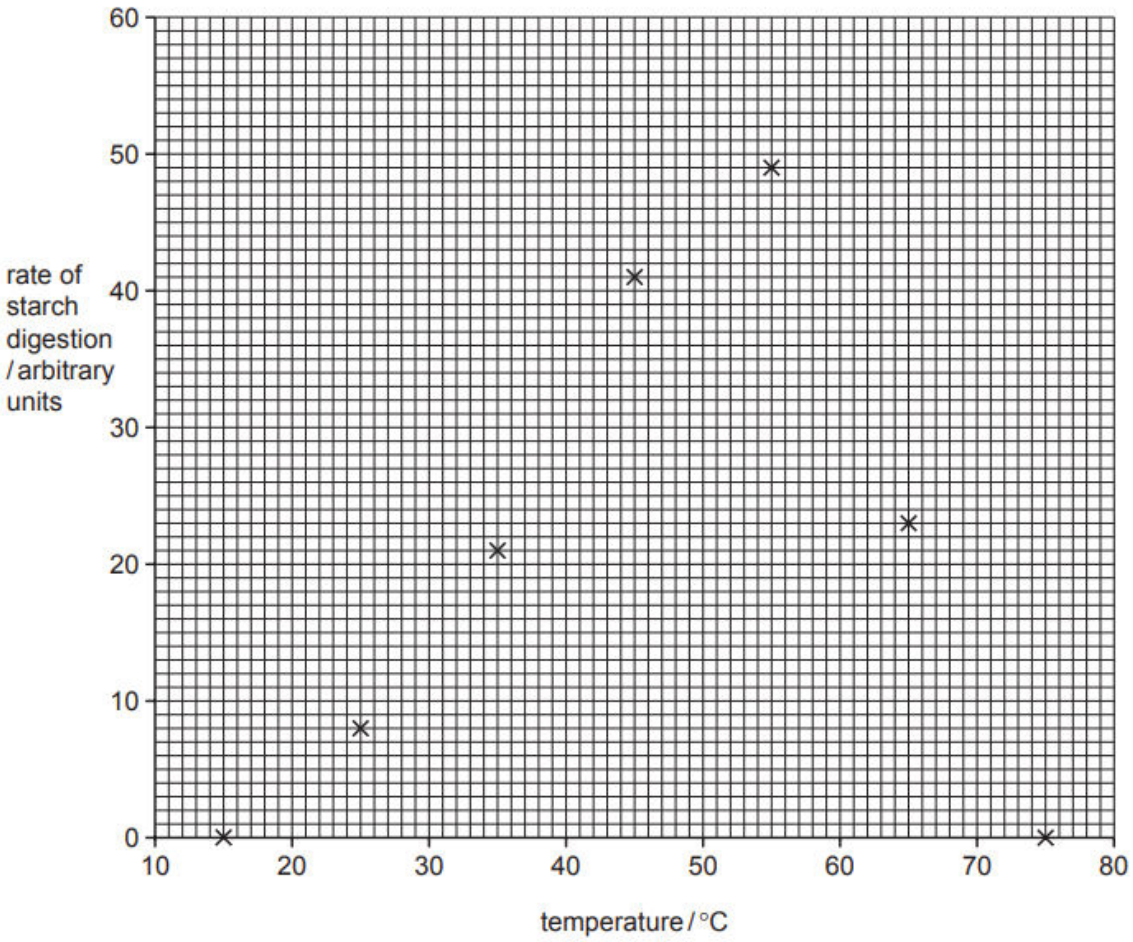

Fig. 3.1

(i) Complete this line graph to show the effect of temperature on rate of digestion of starch by the amylase enzyme by adding the most appropriate line to Fig. 3.1.

[1]

For Examiner's Use

(ii) Using your graph estimate the optimum temperature for this enzyme.

……..... [1]

(iii) Suggest the rate of starch digestion at 37 °C.

……..... [1]

(iv) Describe the effect of temperature on the rate of starch digestion.

…….....

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…….....

……..... [2]

(c) The enzymes originally incubated at 15 °C and 75 °C did not digest any starch.
These samples were later incubated at the optimum temperature.
Predict what results could be expected in each sample and suggest reasons for your predictions.

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……..... [3]

[Total:10]

For Examiner's Use

4 A man fell and had a bad cut on his arm that continued to bleed.
The man went to the hospital and had a blood test.
Table 4.1 shows the results of his blood test.

Table.4.1

test	result	normal range
platelets	98	140 – 200
cholesterol	297	112 – 328
iron	120	12 - 300
blood group	O +	

(a) Use information from Table.4.1 to explain why the man's cut does not stop bleeding.

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…… [3]

(b) The doctor informed the man he is at risk of having coronary heart disease.
Suggest and explain why the doctor said this and the lifestyle changes the man has to make to avoid heart disease.

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[4]

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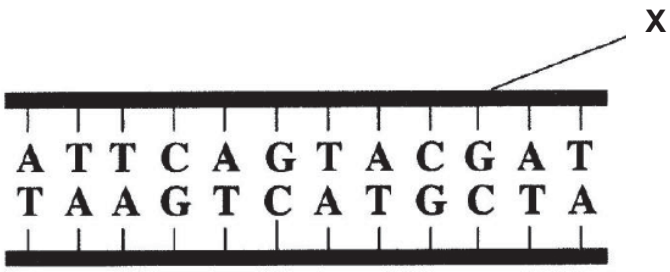
[Total:7]

5 The diagram shows part of a DNA molecule.

For Examiner's Use



(a) Name the two components of the part of DNA molecule labelled X.

……

…… [2]

(b) Scientists calculated the number of different bases in a bacterium DNA and found 14% of bases were cytosine.
What percentage of the bases in this bacterium was adenine? Explain your answer. [Show your working .]

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…… [3]

(c) A child is diagnosed with a blood disorder *thalassaemia* , which is an inherited condition in which haemoglobin in blood does not work properly.
None of his parents has *thalassaemia*.

(i) State and explain whether the allele that causes *thalasaemia* is dominant or recessive.

……

…… [2]

(ii) Using the symbols T (dominant) and t (recessive) to represent the two alleles, state the possible genotypes for a person who does not show symptoms of this condition.

For Examiner's Use

…… [1]

[Total: 8]

Section B (20 marks)
Answer any 2 questions

For Examiner's Use

6 (a) Plants, animals and microorganisms are involved in the carbon cycle.
Describe how **living plants** are involved in the carbon cycle.

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..... [5]

For Examiner's Use

6 (b) Refer to the food chain below.

heather → rabbit → stoat → fox

Only a small percentage of the Sun's energy captured by the heather is eventually incorporated into the body tissues of the fox.

Explain, as fully as you can, what happens to the rest of the energy captured by the heather.

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…… [5]

7 (a) Outline the process of pollination and compare between self-pollination and cross pollination.

For Examiner's Use

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…… [5]

(b) Describe the menstrual cycle with reference to the effects of progesterone and oestrogen.

For Examiner's Use

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…… [5]

For Examiner's Use

8 (a) Explain the importance of the structure of each of the following in relation to their functions:

(i) the exchange surface of alveoli

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…… [2]

(ii) the lining of trachea

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…… [2]

(b) People who have smoked cigarettes regularly for many years may become short of breath when they exercise. They may also have persistent cough.
Explain how smoking cigarettes could have contributed to these two effects.

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…… [6]

End of Paper

Sec 4/5 Science Biology Paper 1 Answers

21	22	23	24	25	26	27	28	29	30
C	**B**	**A**	**A**	**B**	**C**	**B**	**A**	**D**	**C**
31	32	33	34	35	36	37	38	39	40
B	**D**	**B**	**A**	**C**	**A**	**B**	**C**	**D**	**C**

Sec 4E5N Sci Biology Preliminary Examination Paper 4 Suggested Mark Scheme

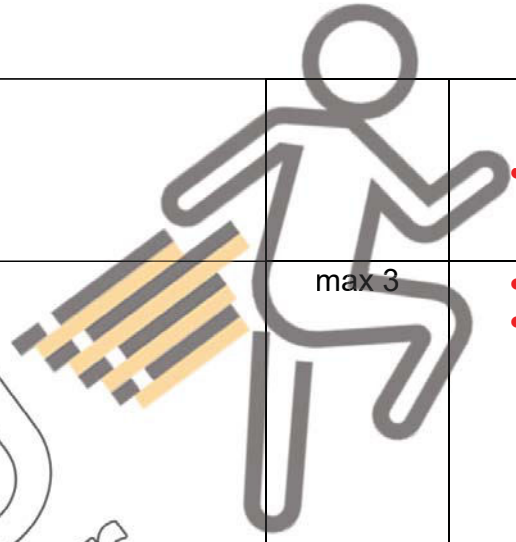
Qn	Marking Points	Mark allocation	Remarks/ comments:
1ai	chloroplast; Ⓡ chlorophyll	1	• Candidates did not read the question which requires the name of organelle many gave chlorophyll as the asnwer
1aii	a. Absorbs light / AW e.g. light energy → chemical energy; b. Photosynthesis/ equation; c. Absorption of carbon dioxide; d. For the production of glucose/ starch Ⓡ food/ sucrose Ⓐ carbohydrates	max 2	• Misconception: chloroplasts store food and mineral salts
1aiii	a. More chloroplasts in palisade than spongy layer; b. Palisade layer found below upper epidermis + exposed to more light than spongy layer; c. More chloroplasts to maximise absorption of light for photosynthesis;	3	• Poor use of language such as : chloroplasts cluster together in the palisade tissue,, • 'palisade is near the sunlight,without specifying the position of palisade in the leaf, many missed out on the word' upper ' surface of leaf.
1bi	a. Ref to enabling leaf to float/ buoyancy; b. Ref to diffusion of gases;	max 2	• Many missed out the essential point

	c. Access to CO_2; d. Access to O_2; e. Ref to better access to light;		on buoyancy of leaf • Many wrongly state the facilitation of transpiration in having intercellular air space. • Error: stores air • Intercellular air space allows plant to move around to get carbondioxide
1bii	Ⓐ ORA a. Stomata allow CO_2/ O_2/ gases to diffuse/ enter into leaf; b. If stomata on lower surface - Water enters leaf via stomata; c. Less CO_2 able to enter; d. Leaves will not float/ will sink; e. CO_2 diffuses faster through air than through water/ AW;	max 2	• Again a lot of emphasis for transpiration which is not applicable for aquatic plant • Few could state mp2
2ai	**from the top:** capillary ; epithelium/ epithelial cells; lacteal / lymph(atic) vessel / lymph(atic) capillary ;	1 1 1	Ⓘ blood vessel Ⓘ any qualification of epithelium e.g. ciliated epithelium Ⓡ lymph unqualified • Many could not get MP1 and 2
2aii	a. Function of villus – absorption of digested food; b. idea that moving exposes villus to more food / changes surface area ; c. increases / helping / AW, absorption ;	1 any 1	• MP 1 is rarely mentioned • Many did not specify the

	d. increase / maintain, diffusion / concentration, gradient ;		absorption is for digested food • Some erroneously stste that villus is for absorption of blood
2b	one mark for the name and one mark for the explanation a. name of process - aerobic respiration ; b. cells break down glucose in the presence of oxygen to release energy;	2	• 'aerobic' is missing • Some candidates did not explain what aerobic respiration means • 'produce' energy is still being used by candidiates
2c	small intestine: a. idea that glucose, taken up by cells / moved outside bag ; b. lower water potential outside bag ; Ⓐ ora c. net movement of water molecules out of the bag ; d. via osmosis ; Visking tubing: e. no difference in water potential / concentration ; f. no net movement of water molecules into or out of VT ; Ⓡ 'no diffusion'/ no osmosis	max 3	• poorly done • most candidates could not link the increase in water potential in the small intestine with the absorption of glucose molecules and subsequently the reduced water level in small intestine with osmosis. • Some stste that the glucose molecules are digested in the small intestine

			• Many associate the increase in water level in the small intestine with aerobic respiration and water is by product of respiration
3a	a. made of protein; b. are (biological) catalysts; c. that speed up chemical reactions; d. not changed by chemical reaction any two – 1 mark each	max 2	• frequently the 'chemical' is missing in the speeding up of chemical reactions •
3bi	completion of curve;	1	• Point to point drawing is frequently done even though question states most appropriate line is needed.
3bii	55 °C if point to point curve; (+/- half square) check against candidate's graph if free hand curve;	1	• Most got this correct
3biii	24°C or 25°C or check value from candidate's graph; (+/- half square)	1	• Some did not draw lines in the graph to show how they obtained the answer
3biv	a. rise in temperature increases the rate of reaction / ORA; b. (rise) above optimum temperature / 55°C rate falls;	1 1	• No explanation needed. Candidates tend

			to go on to explain • Some did not use 55 degrees C as point of reference
3c	15 °C sample – a. at optimum / higher temperature enzyme active; b. reaction occurs / starch digested; 75 °C sample – c. no reaction at optimum temp; d. enzyme denatured (by 75°C); any three – 1 mark each	max 3	• poorly done • many did not understand the question and went on to explain about the rate of reaction at 15 and 75 degrees C



4a	low number of platelets/ alternative quote values to support; [lower than normal range] platelets needed to form fibrin; which forms blood clot over the wound and stops the flow of blood/ unable to clot to seal the wound/ slower clotting process; I: abnormal number of platelets	1 1 1	• Reject platelets contains enzymes • Students often mix up thrombin, prothrombin, fibrinogen and fibrin.
4b	Cholesterol level close to the upper limit/ alternative quote values to support; Blockage of coronary artery preventing blood flow to heart muscles; Exercise regularly, less fatty diet; stop smoking; avoid stress; AVP [any 1]	1 1 1 1	• Cholesterol level is still within normal range. Hence, reject answers on high cholesterol level. • Many students did not refer to the correct artery. • Ignore answers on eating vegetables
5(a)	• Deoxyribose sugar; • Phosphate group;	1 1	• Poorly attempted • Students cannot recognise the sugar-phosphate backbone. • Common wrong answer: nitrogen containing base
(b)	• 14% cytosine = 14% guanine • Adenine + thymine = 100% - 2(14%) = 72%; • Adenine = 72/2 = 36%;	 1 1	• Calculation was well done. • However many are not able to explain by the rule of complementary base pairing.

	• Rule of complementary base pairing : cytosine pairs with guanine Adenine pairs with cytosine;	1	
(ci)	• Recessive allele; • Parents are normal, they are heterozygous / carrier of thalassaemia allele;	1 1	• Need to explain by mentioning the phenotype and genotype of parents
(cii)	Tt + TT	1	Both genotypes must be given. Read the question.
6a	• Take in carbon dioxide during photosynthesis • Make glucose • (use carbon) to make carbohydrate/ starch/ fat/ protein • Release carbon dioxide during respiration • Oxidise glucose • Store/ lock up carbon • (provide) food for animals/ transfer of carbon during feeding	Any 5	• Ignore discussion on decay, ref to micoorganisms, respiration of animals • Do not allow store carbon dioxide • Ignore combustion • Irrelevant discussion on oxygen exchange
6b	Respiration release energy; (must have) Some energy lost in animal's waste products; Some energy used in maintenance / repair; Some energy is used for movement; Energy is lost as heat to surroundings; Some energy is lost in death of organisms;	Any 5	Allow this point if given for named organism.[to gain full marks, candidates must have this point] Allow this point in named organism; • Lack of variety of answers

<table>
<tr>
<td></td>
<td>Reference to microbes/ decomposers;

Uneaten parts of the organisms such as bones</td>
<td></td>
<td>• Students keep repeating the same point.</td>
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<tr>
<td>7a</td>
<td>• Pollination is the transfer of <u>pollen grains</u> from the <u>anther</u> to the <u>stigma</u>;
• Pollination <u>bring together the male and female gametes</u> to enable <u>fertilisation</u> to take place ;

• Pollination can be brought about by <u>insects or wind</u>;

• Self-pollination is the transfer of pollen grains from the anther to the stigma of the same flower or a different flower on the <u>same plant</u> ;

• Cross-pollination involves the transfer of pollen grains to the flower of another plant of the <u>same species</u> ;

<table>
<tr><th>Self-pollination</th><th>Cross-pollination</th></tr>
<tr><td>One parent plant is required</td><td>Two parents plants are required</td></tr>
<tr><td><u>Does not depend</u> on external factors like wind/insects</td><td>Depend on external factors like wind/insects</td></tr>
<tr><td>Higher probability of success</td><td>lower probability of success</td></tr>
<tr><td>Offspring inherit <u>beneficial qualities</u> of parent</td><td><u>Genetic variation</u> among offspring is possible</td></tr>
<tr><td><u>Less pollen and energy</u> is lost</td><td>Energy is invested in pollen and more energy is lost</td></tr>
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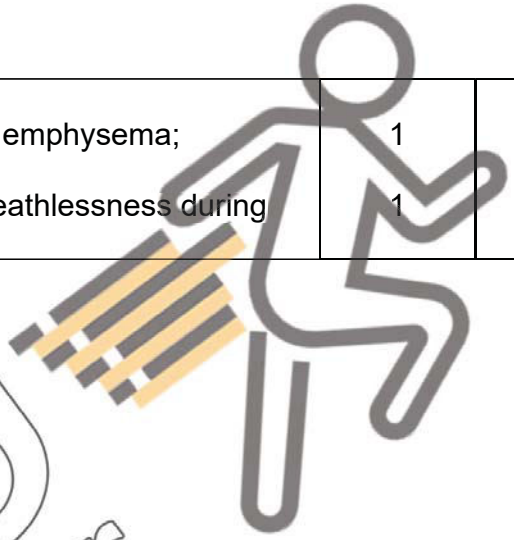
<td></td>
<td>• Misconception: self-pollination is a form of asexual reproduction
• Please note that both self and cross pollination are to facilitate sexual reproduction in flowering plants
• Students need to be precise in answers. Lack of keywords often seen.</td>
</tr>
</table>

7b	Day 1-5, menstrual flow stage, Uterine lining breaks down and flows from uterus out of the body through the vagina; Day 6-13, (follicle stage), oestrogen causes the repair and growth of the uterine lining; Oestrogen prevents maturation and development of more ova; Day 14, ovulation stage, mature egg released by one ovary into oviduct; Oestrogen level starts to fall while level of progesterone starts to increase; Day 15-28, (corpus luteum stage), progesterone maintains the uterine lining by causing it to thicken further and be richly supplied with blood capillaries, preparing it for the implantation of the embryo; Inhibits ovulation;		• Loss of marks if timeline is not stated or wrongly stated. • Many cannot do this basic recall question suggest a lack of revision.
8ai	Wall is one-cell thick + provide shorter diffusion distance for gases; Inner wall has thin film of moisture + dissolve oxygen before diffusing in solution into blood;	1 1	Lack of keywords in answers
8aii	Mucous gland cells secrete mucus + traps dust and bacteria in inhaled air; Cilia sweeps mucus towards pharynx to be coughed out / swallowed;	1 1	Many cannot recall the two types of cells that lined the inner wall of the air passage.
8b	Tar and irritants in tobacco smoke; Paralyses cilia lining in trachea and bronchi; Mucus and dust cannot be removed / accumulate; Violent coughing to expel mucus / clear air passage;	1 1 1 1	• No marks will be awarded to students who state all the components in smoke. • Reject answers on carbon monoxide

	Partition walls of alveoli breakdown and form large spaces / emphysema; Surface area for gaseous exchange is reduced results in breathlessness during exercise;	1 1	



	Common errors in students' work	
4a Clotting	Soluble fibrin becomes insoluble fibrin threads	
	Clot with red blood cells	
	Not enough platelets to clot the wound	
4b CHD	High level of cholesterol as in table 4.1.	
	Fats clotted in the coronary arteries.	
	Heart muscle to pump harder to create more pressure.	
5b DNA structure	Cytosine is 14% hence guanine must be 14%.	
	Rule of base pairing applies adenine and thymine will exist in same quantity.	
5ci explain inheritance	Parents do not have it hence impossible to pass down to children.	
6a Carbon cycle	Respiration occurs only in the absence of sunlight.	
	Plants absorb carbon dioxide and release oxygen during photosynthesis	
	Plants absorb oxygen and release carbon dioxide during respiration.	
	Plants are consumed hence they are released as excretory products.	
6b Energy loss	Excretory products such as faeces	
	During feeding, chemical energy is lost between trophic levels.	
7a Pollination	Pollination is when gametes from a male flower fuse with female flower to form an ovum.	
	Self pollination is transfer of pollen grain in the same flower. Cross pollination is the transfer of pollen grain to another flower.	
	Self pollination produces genetically identical offspring while cross pollination produces genetically dissimilar offspring.	
	Cross pollination ensures that there would be larger variation in the species as compared to self pollination.	
7b Menstrual cycle	High levels of progesterone and oestrogen trigger the release of an egg.	
	If not fertilised, it dissolves.	
8a alveoli	Alveoli structure Alveoli has a large surface area …….. Alveoli has many blood capillaries……..	

8b Smoking	Carbon monoxide in smoke combines irreversibly with haemoglobin to form ……hence leading to short of breath.