



**BEDOK SOUTH SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2018**

4EXP

CANDIDATE
NAME

CLASS

REGISTER
NUMBER

SCIENCE (BIOLOGY, CHEMISTRY)

Paper 4 Biology

5078/04

2 August 2018

1 hour 15 minutes

Candidates answer on the Question Booklet.
No Additional Materials are required

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name on the work you hand in.
Write in dark blue or black ink on both sides of the paper.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A (45 marks)

Answer **all** questions.

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

Section B (20 marks)

Answer any **two** questions. Write your answers on the question paper.

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

Setter: Ms. Denise Wong

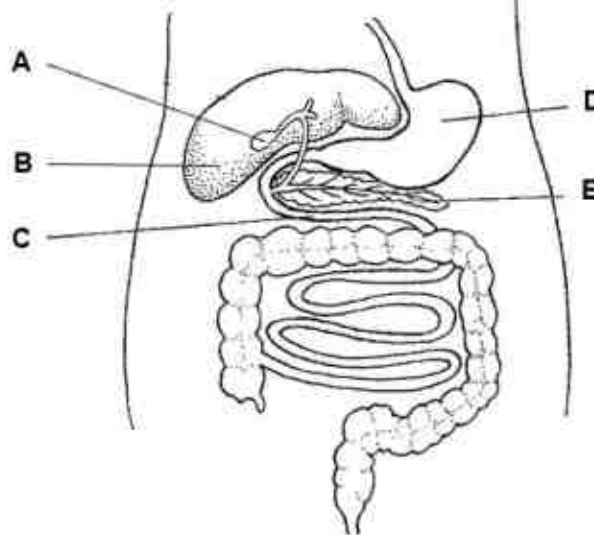
For Examiner's Use	
Paper 1	
P4 Section A	
P4 Section B	
Paper 5	
Total	

This document consists of **16** printed pages including this cover page.

[Turn Over

SECTION A (45 marks)Answer **all** questions in the spaces provided.For
Examiner's
Use

- 1 (a) Fig. 1.1 shows part of the human digestive system.

**Fig. 1.1**

- (i) Table 1.1 lists some processes that occur in the human body. Complete the table by using letters from Fig. 1.1 to show where each process occurs.

Table 1.1

process	where process occurs
protein is first digested	
bile is stored	

[2]

- (ii) A patient had surgery to remove part of organ **C**. Explain why the patient experienced weight loss in the weeks after the surgery.

.....

.....

.....

.....

[2]

[Turn Over]

(b) Fig. 1.2 shows the blood vessels associated with organs **B** and **C**.

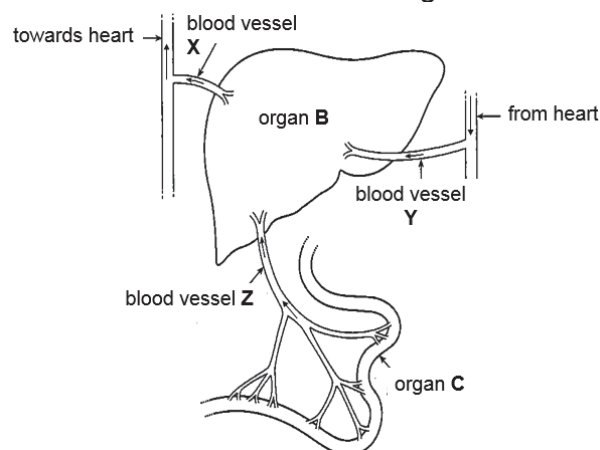


Fig. 1.2

(i) Identify blood vessels **Y** and **Z**.

Y

Z

[2]

(ii) Describe **one** structural difference between blood vessel **Y** and blood vessel **Z**. Explain how this difference helps blood vessel **Y** to perform its functions.

.....

[2]

(iii) Explain why the concentration of glucose varies in blood vessel **Z** throughout the day while the concentration of glucose remains relatively constant in blood vessel **X**.

.....

[3]

[Total: 11]

[Turn Over]

- 2 Rennin is an enzyme found in the human alimentary canal that curdles milk by converting soluble milk proteins into insoluble milk proteins. An experiment was carried out to determine the effect of pH on the activity of rennin at 30 °C. Table 2.1 shows the results of the experiment.

Table 2.1

pH	time taken for milk to curdle / min	rate of reaction / min ⁻¹
1	4	0.25
2	2	0.50
3	3	0.33
4	7	0.14
5	13	

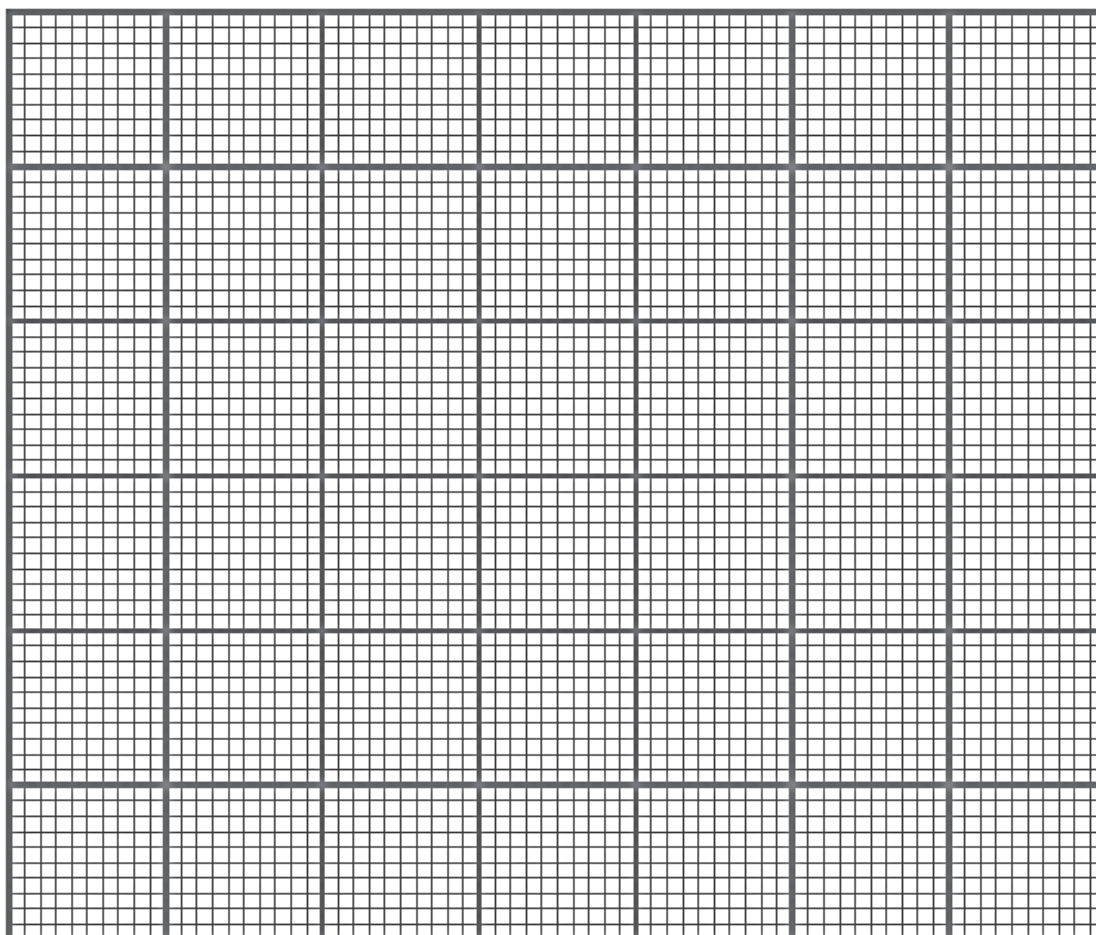
- (a) (i) Calculate the rate of reaction for pH 5. Show your working.

rate of reaction = min⁻¹ [1]

- (ii) On the grid provided on the next page, plot a graph of rate of reaction against pH. Use the results in Table 2.1 and your answer to (ai).

On your graph, use appropriate scales, label the axes and draw a line of best fit. [3]

[Turn Over



(iii) From your graph, state the pH where rennin is the most active.

..... [1]

(b) Describe the test that can be done to conclusively prove that rennin is protein in nature. State the results of the test.

.....

 [2]

[Turn Over

- (c) In another experiment, rennin was boiled and cooled down to 30 °C before it was added to milk. Using your knowledge of the lock and key hypothesis, explain why the milk did not curdle.

For
Examiner's
Use

.....

.....

.....

.....

.....

.....

[3]

[Total: 10]

- 3 Fig. 3.1 shows an experiment set up to investigate the change in the mass of plants **A** and **B** potted in damp soil over a period of time.

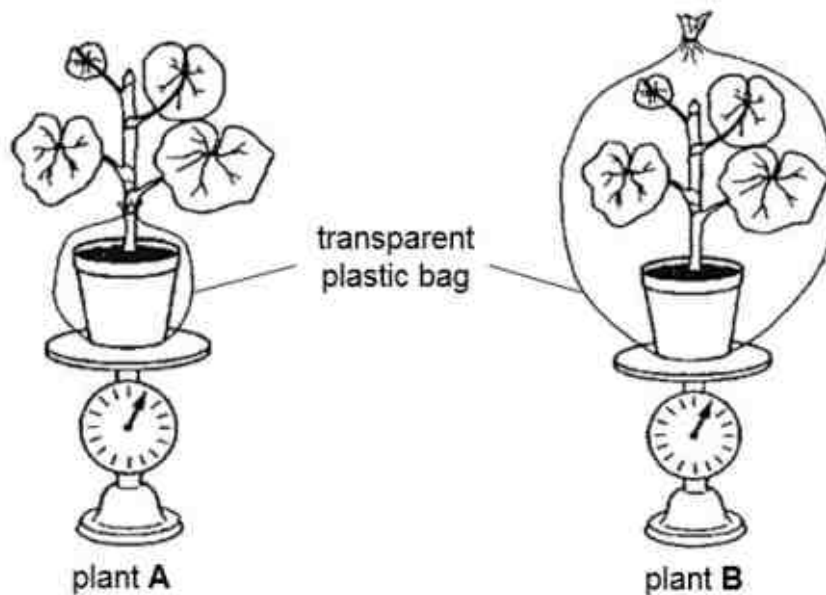


Fig. 3.1

The loss in mass was measured over a period of five days and the results are shown in Fig. 3.2.

[Turn Over

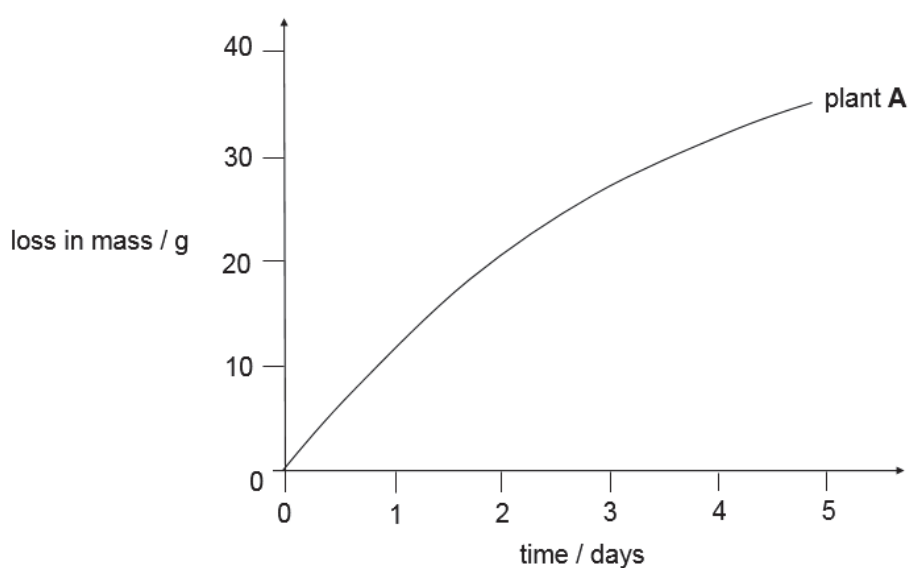


Fig. 3.2

- (a) Define the process that caused the loss in mass observed in plant **A**.

.....
 [1]

- (b) (i) On Fig. 3.2, sketch a curve to show the results obtained for plant **B**. [1]

- (ii) Explain the curve drawn in (bi).

.....

 [2]

- (c) Explain why the rate of photosynthesis in plant **B** was found to decrease after 3 days.

.....

 [2]

[Total: 6]

[Turn Over

- 4 Fig. 4.1 shows the pressure changes in the aorta and chambers **X** and **Y** on the left side of the heart during one cardiac cycle in a healthy person.

For
Examiner's
Use

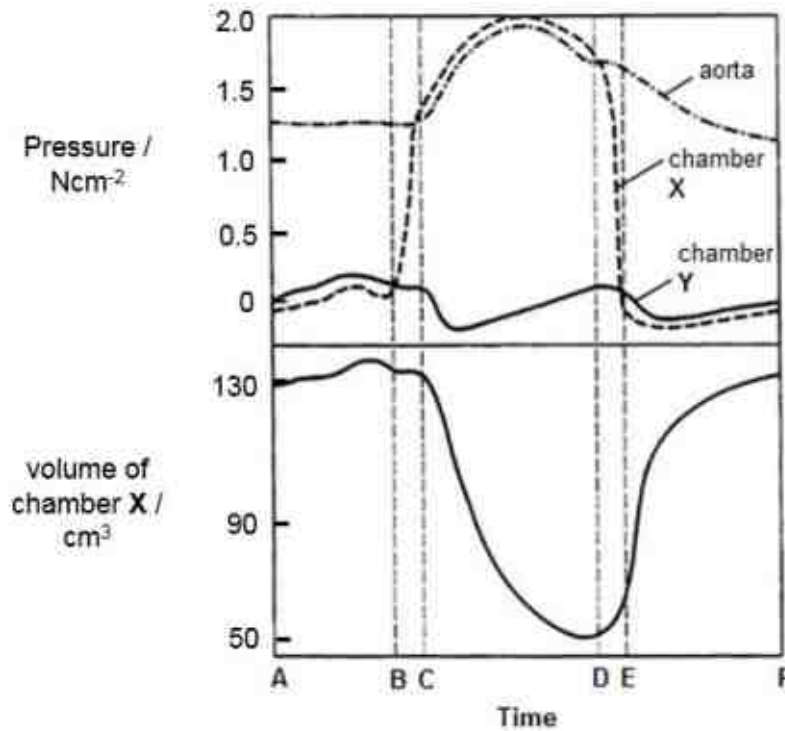


Fig. 4.1

- (a) Identify chamber **X**. Explain how you arrived at your answer.

.....

.....

.....

..... [2]

- (b) Describe and explain how the volume of the chamber **X** changes with pressure in chamber **X** from time **B** to **D**.

.....

.....

.....

..... [2]

[Turn Over

- (c) State the function of the valve that closes at **D**.

.....

.....

[1]

- (d) It was observed that the increase in pressure in chamber **X** was greater in smokers than in healthy persons. By naming a component in cigarette smoke, explain this observation.

component

explanation

.....

[2]

[Total: 7]

*For
Examiner's
Use*

[Turn Over]

- 5 Colour blindness is controlled by a pair of alleles. The allele for normal vision (B) is dominant to the allele for colour blindness (b).

Fig. 5.1 shows the chromosomes found in the normal cells of a father and mother.

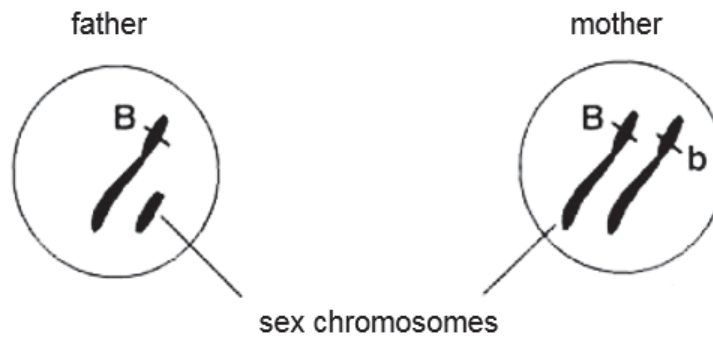


Fig. 5.1

- (a) The genotype of the father is X^BY and that of the mother by X^BX^b . Use the genetic diagram in Fig. 5.2 to explain why colour blindness occurs more frequently in males than females.

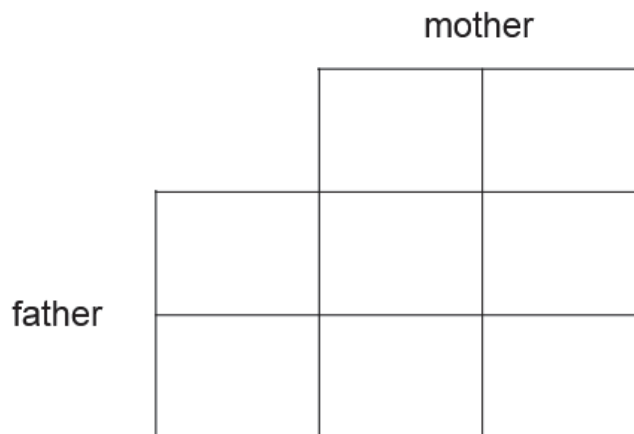


Fig. 5.2

.....

.....

.....

.....

[4]

For
Examiner's
Use

[Turn Over

- (b) Fig. 5.3 shows part of the nucleotide sequence of alleles B and b.

allele B	GGA TCG TCT AGC
allele b	GGA TCG GTT AGC

Fig. 5.3

Using your knowledge of how protein synthesis occurs in cells, explain why the differences in nucleotide sequence results in different phenotypes observed.

.....

.....

.....

.....

[2]

[Total: 6]

- 6 Fig. 6.1 shows the flow of energy through a food chain.

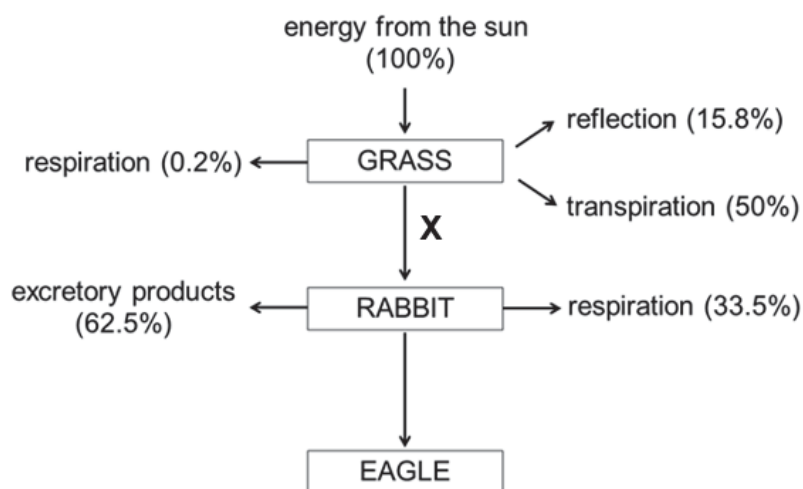


Fig. 6.1

- (a) The arrow **X** represents the percentage of energy transferred from the grass to the rabbit.

Calculate the value of **X**. Show your working clearly.

[1]

[Turn Over]

- (b) With reference to Fig. 6.1, explain why the flow of energy in the food chain is non-cyclical.

.....

.....

.....

.....

[2]

- (c) Explain why most food chains are unable to support more than four trophic levels.

.....

.....

.....

.....

[2]

[Total: 5]

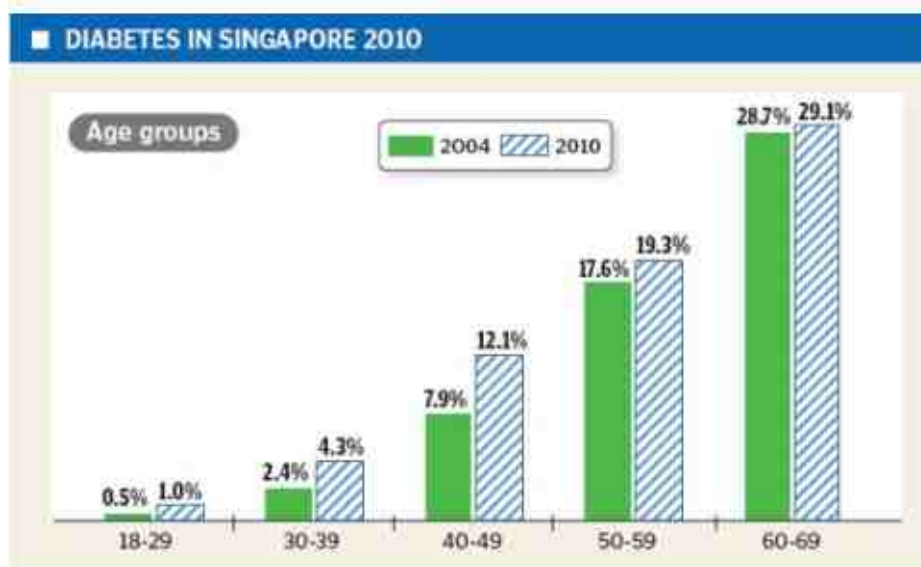
- End of Section A -

[Turn Over

SECTION B (20 marks)

Answer any **two** questions in this section. Each question carries 10 marks.
Write your answers on the spaces provided.

- 7 Fig. 7.1 shows some statistics on the incidences of diabetes in Singapore in 2004 and 2010.



Adapted from The Straits Times, 24 February 2012

Fig. 7.1

- (a) Use the data shown in Fig. 7.1 to describe the trends shown in the data.

Briefly suggest a reason to account for these trends.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[6]

[Turn Over

For
Examiner's
Use

(b) Diabetes can be treated by introducing the protein insulin into the body.

- (i)** Explain why insulin cannot be administered as an oral medication that is consumed.

.....
.....

[1]

- (ii)** A nasal spray containing insulin has been recently developed as an alternative way of administering insulin. Insulin is inhaled into the lungs as a spray before it is absorbed into the bloodstream. Outline the pathway the insulin spray would take from the nose till it enters the bloodstream.

.....
.....
.....
.....
.....
.....

[3]

[Total: 10]

[Turn Over]

[illegible][illegible]

[Total: 10]

65

- 9** With reference to the organelles in plant cells and events in the carbon cycle, explain
(a) why most life forms are dependent on living plants.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[5]

- (b)** Destruction of the world's forests are increasing. Explain how this has affected the ecosystem and suggest reasons why it is important to conserve our forests.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[5]

[Total: 10]

- END OF PAPER -

BEDOK SOUTH SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2018
Secondary 4 Express
Science (Biology) 5078/1 and 5078/4
Marking Scheme

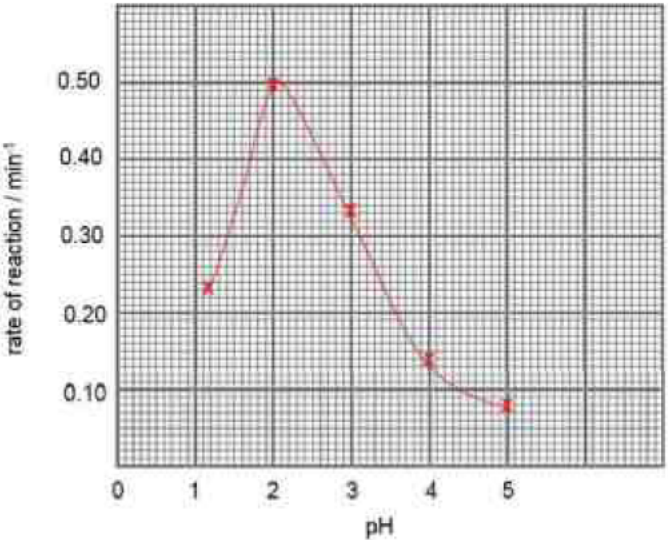
Paper 1

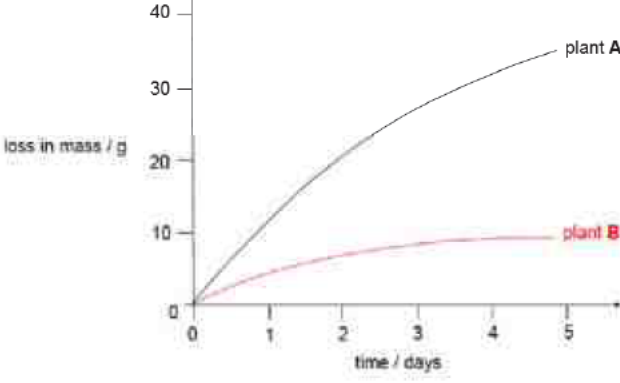
Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30
B	D	D	A	B	C	B	D	D	C
Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40
B	C	A	B	C	D	A	B	B	C

Paper 4

Qn no.	Suggested answer		Comments to markers	Marks
1	a (i)	process	where process occurs	2
		protein is first digested	D [1]	
		bile is stored	A [1]	
	• Many chose liver (B) for storage of bile			
	a (ii)	Max 2 marks: - There will be less secretion of intestinal juice that contains digestive enzymes, reducing the efficiency of digestion. [1] - The digested food substances also cannot be efficiently absorbed by the villi in the small intestine. [1] - Thus, without absorption, assimilation of digested food substances to build new cells cannot occur effectively, resulting in weight loss. [1]		[1] less efficient digestion [1] less efficient absorption
• Many could not interpret the question in terms of functions of the small intestine – digestion and absorption				
• While those who answered in terms of function, many left out digestion and focused on absorption only				
• Common errors: writing that C was for transport of food to small intestine and not recognizing that C is the small intestine, writing about absorption of food (should be digested food), faster food digestion as length of intestine is shorter				
b (i)	• Y: hepatic artery [1]		A: minor spelling errors	2
	• Z: hepatic portal vein [1]			
• Names of the blood vessels were not well learnt with many writing aorta / veins / capillaries or leaving out the term 'hepatic'				
b (ii)	Any 1 structural point + correct comparison: - Blood vessel Y (hepatic artery) has thicker, more muscular walls than blood vessel Z (hepatic portal vein). [1] - This allows the hepatic artery to withstand the high pressure of the blood being pumped out of the heart. [1]		R: thicker walls No ECF (should be able to tell artery / vein as	2

		- Blood vessel Y (hepatic artery) has elastic walls than blood vessel Z (hepatic portal vein). [1] - This allows the hepatic artery to stretch and recoil, helping to push the blood along the artery in spurts through further distances away from the heart. [1]	direction was given)	
		- Many students write in terms of 'need to' but should take note that structure leads to effects which determines function (and not the other way round) - Explanation for the effect of muscular was not well crafted - Common error: writing that blood vessel is one cell thick focusing explanation on what Z has (valves) when question focus is on Y.		
	b (iii)	Max 3 marks: - Glucose is absorbed into the blood capillaries at the ileum and transported by blood vessel Z (hepatic portal vein) to the liver [1]. - When carbohydrates are consumed and digested, more glucose will be absorbed and transported by the hepatic portal vein / When no carbohydrates are consumed, the level of glucose in the hepatic portal vein will decrease. [1] - However, the concentration of glucose remains constant in blood vessel X (hepatic vein) because of the action of insulin and glucagon. [1] - When glucose concentration is high, insulin is released to stimulate the conversion of excess glucose into glycogen / When glucose concentration is low, glucagon is released to stimulate the conversion of glycogen into glucose. [1]	A: varies depending on glucose intake	3
		- Many students gained 1m for the concept that glucose concentration varies depending on food digested / absorbed - Most did not identify that glucose is absorbed into the blood at the villi - Some also did not explain that the glucose concentration remains constant due to the action of the hormones - Students to note that glucose concentration does not only increase due to glucose intake		
2	a (i)	Rate of reaction = $1 / 13 = 0.08 \text{ min}^{-1}$ [1]	R: fractions No [½] mark	1
		Common error: round of errors (not following 2 dp given in table)		

a (ii)	 • Accurate data points [1] • Correct axes labels [1] • Line of best fit [1]	[1] penalty for accuracy if graph does not occupy more than half the given graph space A: one inaccurate / missing data point / missing units on axes Cannot award best fit line if points are missing	3
	• Most were penalised for best fit line (straight line / extrapolate) • Common error: plotting time taken instead of reaction rate (not reading question), interchanging axes		
a (iii)	• pH 2 [1]	A: ECF	1
b	• Add 2 cm³ of Biuret solution to 2 cm³ of rennin solution and shake well to mix. [1] • If Biuret solution turns from blue to violet, protein is present. [1]	A: equal volume / purple	1
	Common errors: not describing test but stating name of test, missing out 'equal volume', Benedict's test		
c	• Enzymes (lock) have a specific shape of the active site such that only a substrate (key) with the complementary shape can bind to it. [1] • Boiling rennin (lock) would denature it so that the active site shape is altered. [1] • Hence, the milk protein substrates (key) that have a complementary shape to the active site cannot bind to it to cause curdling. [1]	[1] enzyme (lock) + substrate (key) + complementary [1] denaturation changes complementary active site shape [1] binding of enzyme to substrate	3
	• Most could explain denaturation and subsequent inability to bind well but did not identify the lock and key		

3	a	Transpiration is the loss of water vapour from the aerial parts of the plant, especially through the stomata. [1]		1
		- Many did not define but wrote the name of the process - A few also wrote photosynthesis - Definition also not well learnt with many leaving out key terms such as 'water vapour' or 'stomata'		
	b (i)			1
		Many drew the graph such that the different between A and B was not significant even though plant B had a slower rate of mass loss		
	b (ii)	- The transparent plastic bag increases the humidity of the air around the leaves of plant B. - Increasing the humidity of the air will decrease the water vapour concentration gradient between the intercellular air spaces in the leaf and the atmosphere. [1] Rate of transpiration decreases so leaves of plant B lose less water vapour than leaves of plant A. [1]		2
		- Most students could not give clear explanations based on the concept of water vapour concentration gradient and linking it to the reduced transpiration rate - Conceptual understanding of factors affecting transpiration is weak - Some students thought that the loss of mass will not be significant since water loss is trapped in the bag (but the bag is porous and some vapour will still escape)		
	c	A reduced transpiration rate results in less transpiration pull [1], hence less water absorbed for photosynthesis. [1]		2
		- Most students wrote about the lack of availability of carbon dioxide the bag directly limits the plant from obtaining carbon dioxide (which is not true as it can be produced by the plant during respiration) - Some identified the lack of water but were unable to explain exactly why it is limiting (conceptual understanding of how water is absorbed by the plant is lacking – thinking that the bag directly limits the plant from obtaining water)		
4	a	- Left ventricle [1] - The ventricular pressure is higher than atrial pressure [1] as the thicker more muscular walls of the ventricles generate a larger force to push blood out of the heart over a longer distance to the rest of the body.	A: ventricle A: ventricle pressure follows aorta pressure	2
		Many were able to identify highest / higher pressure but need to realise to avoid		

	writing that ventricle 'needs' to have higher pressure. Structure leads to effect which leads to function													
b	- As the pressure in chamber X increases from 0 to 2.0 Ncm⁻² from B to D, the volume in chamber X decreases from 130 to 50 cm³. [1] - As the left ventricle contracts during systole, the increase in left ventricular pressure forces blood out of the left ventricle into the aorta, decreasing the volume within the ventricle. [1]	R: if no figures are quoted	2											
	- Descriptions were provided without quotes - Many also did not know how to express the relationship between pressure and volume and thus wrote from memory irrelevant points about the action of the valves													
c	It prevents the backflow of blood from the aorta back into the left ventricle. [1]	A: prevent backflow of blood (even if direction or ID of valve is incorrect)	1											
	Most could not deduce that the valve closing is the semilunar valve and did not state the direction of backflow													
d	<u>Any 1 component + correct explanation:</u> - Carbon monoxide [1] - Carbon monoxide reduces the oxygen-carrying ability of red blood cells / increases the risk of atherosclerosis such that the heart compensates by pumping harder with greater force. [1] - Nicotine [1] - Nicotine increases risk of blood clots in blood vessels / increase rate of fatty deposits in blood vessels / diameter reduction of blood vessel such that the heart compensates by pumping harder with greater force. [1]		1											
	- Most could name a correct component of cigarette smoke but could not clearly link the effects of the component to an increase in PRESSURE e.g. writing about nicotine causing increased heart rate - Common error: tar (carcinogen, cilia paralysis)													
5	a	mother <table border="1" style="margin: auto;"><tr><td></td><td>X^B</td><td>X^b</td></tr><tr><td rowspan="2" style="text-align: center;">father</td><td>X^B</td><td>X^B X^B</td><td>X^B X^b</td></tr><tr><td>Y</td><td>X^B Y</td><td>X^b Y</td></tr></table> - Punnett square: correct separation of allele in parental gametes [1], correct combination [1] - Males have the Y chromosome that doesn't carry the allele for		X ^B	X ^b	father	X ^B	X ^B X ^B	X ^B X ^b	Y	X ^B Y	X ^b Y	A: X chromosome carries the alleles	4
	X ^B	X ^b												
father	X ^B	X ^B X ^B	X ^B X ^b											
	Y	X ^B Y	X ^b Y											

		colour vision. [1] Hence, inheriting one copy of the recessive allele X^b from the mother is sufficient to result in colour blindness. [1]		
		<i>Some were unable to complete the Punnett square with the correct symbols even though genotype was given to them (unable to transfer knowledge)</i> <i>Most also could not explain clearly that inheritance of one copy in males is more detrimental and hence more common (focus on the answer should be on males not females)</i> <i>To remind students that alleles (recessive / dominant) are found on chromosomes (entire chromosomes cannot be recessive / dominant)</i>		
	b	- Differences in nucleotide sequence between the alleles results a difference in the codons that code for one amino acid. [1] - Hence, during translation, a difference in the codons would result in a different sequence of amino acids that result in the formation of a different protein responsible for the phenotype. [1]		2
		<i>Many could not explain that difference in codon sequence results in different sequence of amino acids and hence different protein (phenotype)</i> <i>Many mentioned what genes are which is irrelevant to this question</i> <i>Many also just simply rewrote what was given in the question – that different in nucleotide sequence results in different phenotypes (conceptual understanding is weak)</i> <i>Usage of imprecise terms e.g. each protein consists of 3 nucleotides</i>		
6	a	$X = 100 - 15.8 - 0.2 - 50 = 34\%$ [1]		1
		<i>Many made calculation errors e.g. using 10 % rule (3.4%)</i>		
	b	- As energy flows from the Sun to the producers and consumers, some of the energy is lost to the environment in e.g. the form of heat released during respiration (0.2 % or 38.5 %) / reflection (15.8 %) / transpiration (50 %) / excretory products (62.5 %). [1] - This energy lost as heat cannot be recycled / used again by the producers or consumers. [1]		2
		<i>Most did not quote the figures as required by the question (with reference to 6.1)</i> <i>Many also did not remember how to explain the non-cyclical flow and wrote about less energy available</i>		
	c	- About 10 % of the energy stored at one trophic level is transferred to the next trophic level in the form of biomass / About 90 % of energy is lost to the environment. [1] - Hence, there will not be enough energy available to support the final consumers in long food chains. [1]		2
		<i>Common errors: not quoting the percentage of energy lost / transferred, not writing about the FINAL consumers</i>		

SECTION C: Free Response Questions (20 marks)

Qn no.	Suggested answer	Comments to	Marks
--------	------------------	-------------	-------

			markers	
7	a	Max 2 descriptions with correct quoting of figures [4]: - Number of incidences of diabetes has increased in each age group from 2004 to 2010 [1] - E.g. In people aged 50 – 59, number of incidences of diabetes has increased from 17.6 % in 2004 to 19.3 % in 2010. [1] - For any particular year, number of incidences of diabetes is higher in older people than in younger people. [1] - E.g. In 2010, 1 % of people aged 18 – 29 had diabetes while 29.1% of people aged 60 – 69 had diabetes. [1] - The onset of diabetes is occurring earlier. [1] - E.g. In 2004, 7.9 % of those aged 40 to 49 had diabetes while in 2010, the number had risen to 12.1 %. [1] Max 2 marks for reasons: - Lack of exercise / less active [1] - Diet high in carbohydrates / sugar [1] - Obesity / more affluent so can eat more [1] - Slowing down of metabolism / less responsive to insulin / less healthy liver in older people [1] <i>Most are weak at identifying the trends or accurately articulating the trends and quoting appropriate figures to substantiate the trend observed</i> <i>Many were able to give 1 reason for trend observed (slowing of metabolism)</i> <i>Common error: liver produces insulin (not penalised)</i>		6
	b	Insulin will be digested in the stomach by the pepsin into polypeptides and will not function. [1] <i>Most could not make the connection given in the question that insulin is a protein and extend the understanding to the fact that it would be digested</i> <i>Common errors: it would take a long time for insulin to be digested / longer time to absorb, cannot go to the site of action in the liver, no glucose in mouth to react with insulin</i>	A: will be digested	1
	c	- The insulin spray would move from the nasal cavity into the pharynx and then trachea. [1] - From the trachea, the spray would move into the bronchus, bronchiole and alveoli. [1] - The spray would then diffuse across the alveolar wall into the plasma in the blood capillaries. [1] <i>Understanding of the structures in the respiratory system was weak</i> <i>Irrelevant responses include the movement throughout the circulatory system till the liver</i>		3
8	a	Max six marks: - From day 1 – 5, menstruation occurs due to the decrease in the levels of progesterone in the last few days of the previous cycle. [1] - During menstruation, the uterine lining breaks down and is	For each time period: [1] description of event	6

		discharged out of the vagina together with the unfertilized egg and blood. [1] - From day 6 to 13, the increase in oestrogen levels [1] stimulates the uterine lining to thicken / grow / repair and becomes vascularized. [1] - From day 15 to 24, the increase in progesterone levels [1] due to the presence of the corpus luteum maintains the thickness of / further thickens the uterine lining to prepare for possible implantation of the embryo. [1] - From day 24 to 28 (when no fertilisation occurs), the decrease in progesterone levels due to the breakdown of the corpus luteum stimulates the uterine lining to break down at the onset of menstruation. [1]	[1] explanation of role of hormone	
		<i>Days of the cycle were not always included in the answers (penalised)</i> <i>Common irrelevant responses include mention of ovulation (question's focus is on events in the uterus)</i> <i>Common errors: writing that day 15 – 28 is when progesterone levels increases, writing in a non-chronological order</i>		
	b	<u>Similarities:</u> - In both plants and humans, the haploid male gamete fuses with the female gamete to form a diploid zygote. [1] <u>Differences (point to point, both sides of comparison):</u> - The site of fertilisation in plants is the ovule [1] while the site of fertilisation in humans is in the fallopian tube / oviduct. [1] Two male gametes fuse with two nuclei during double fertilisation [1] in plants while only one male gamete fuses with the ovum to form the zygote in humans. [1] - In plants, it is possible for self-fertilisation to take place where the gametes are produced from the same parent [1] while in humans, self-fertilisation is not possible. [1]		4
		<i>Question was challenging to most who could not find the common similarity or suitable points of comparison for differences about the event of fertilisation itself</i> <i>Common irrelevant responses include writing about events leading to fertilisation e.g. pollination or writing about asexual reproduction</i> <i>Writing that plants can self-pollinate and hence self-fertilize</i>		
9	a	<u>Max 5 marks:</u> - Plants are the only organisms that can convert carbon dioxide in the atmosphere into chemical energy in the form of glucose. [1] - During photosynthesis, the chloroplasts in plant cells trap light energy from the sun and use it to convert carbon dioxide into glucose. [1] - Glucose is used by the plants to form new cells and is thus converted into biomass. [1] - During feeding, energy in the form of biomass is transferred to consumers. [1]	[1] photosynthesis	5

	In the mitochondria of living organisms, glucose is oxidized during respiration [1] to release the energy required for the organisms to carry out their activities and grow. [1]		
	<i>Question was challenging to most to integrate processes in the carbon cycle to explain that plants are the only source of glucose for most other life forms</i> <i>Irrelevant responses include production of oxygen (question's focus is on the carbon cycle)</i>		
b	<u>Max 3 points:</u> - During photosynthesis, plants remove carbon dioxide from the atmosphere and convert it into glucose. [1] - With increasing deforestation, there will be fewer trees to remove carbon dioxide from atmosphere. [1] - This will lead to an overall increase in the amount of carbon dioxide remaining in the atmosphere. [1] - Organisms living in the forests lose their habitats and source of food and shelter. [1] - This can cause imbalances to the food chain. [1] - Organisms may eventually not survive and species become extinct. [1] <u>Max 1 key point with elaboration:</u> - To maintain biodiversity by preventing the extinction of species [1] - A large gene pool is important as many wild plants and animals possess favourable genes. [1] - Plants with better resistance to diseases and drought can be produced by crossing domestic species with wild species. [1] - Many tropical plants are of great importance as they are sources of medicinal drugs. [1] - To allow for species diversity [1] - This means to have a wide variety of different species of organisms living in a given area. [1] - Each species has its role to play in maintaining the balance in the ecosystem. [1] - To maintain a stable and balanced ecosystem [1] - This prevents disruption of natural cycles such as the carbon cycle, and also prevents global warming. [1] - For economic purposes [1] - Tropical plants provide raw materials for industries. [1] - Tropical rainforests also provide food for example, rice, pineapple and banana [1] - For scientific research [1]		5

		○ The study of wildlife provides useful information to humans. [1]		
		• A number of students completely left out reasons why conservation is important • Writing about soil erosion instead of the direct impact of deforestation or explaining how erosion impacts the ecosystem (not able to understand the term 'ecosystem') • Explaining that removal of trees removes oxygen for other organisms		

- END OF PAPER -

KIASU
ExamPaper

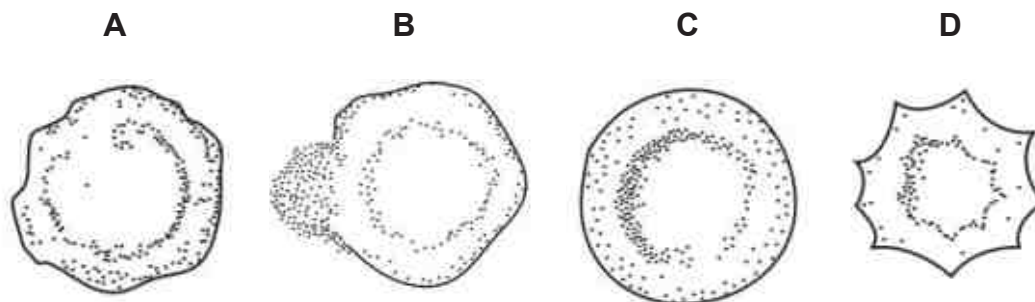
21 The diagram shows four cells.



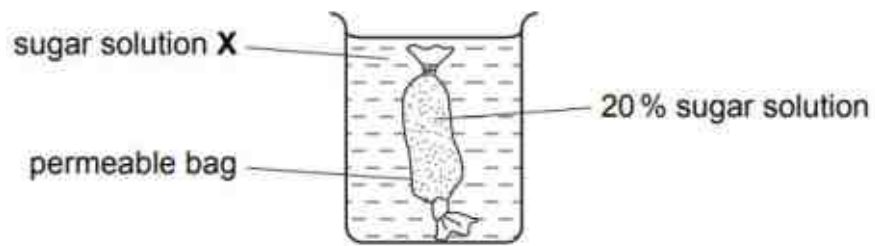
Which cells are involved in transport?

- 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.

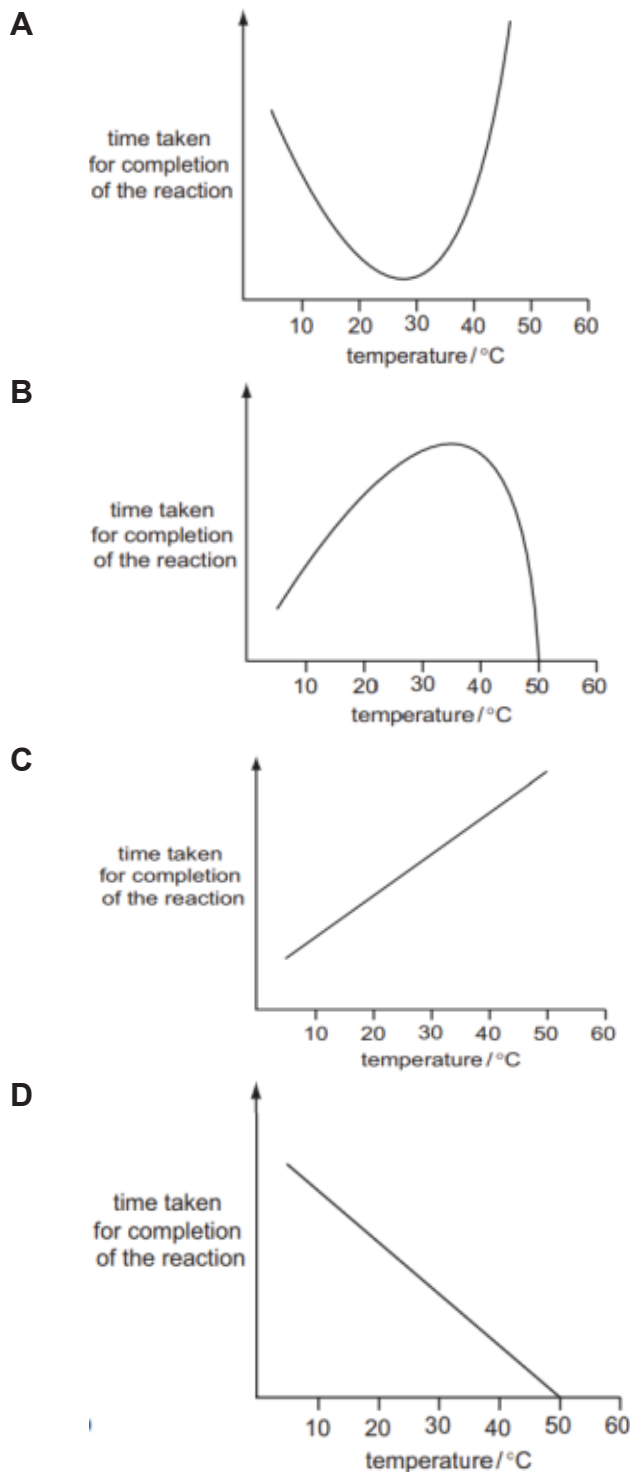


More sugar diffuses out of the bag than diffuses in.
What is the concentration of sugar in solution **X**?

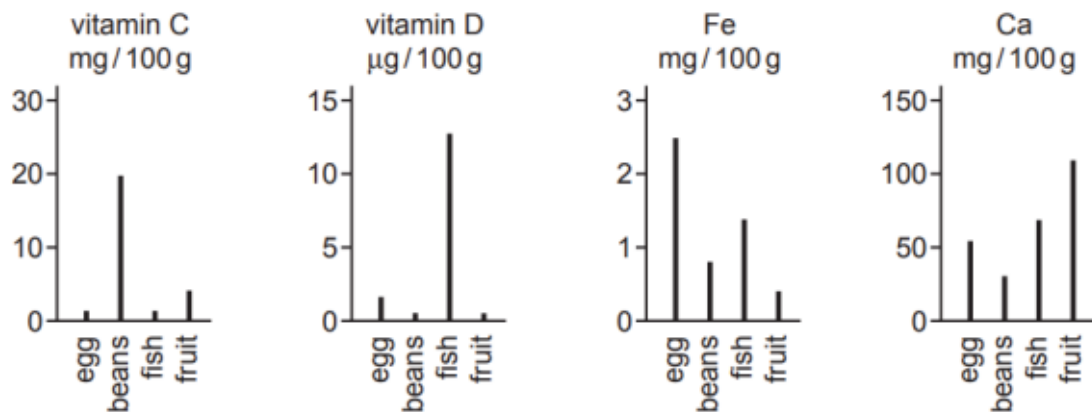
- A** 10% **B** 20% **C** 30% **D** 40%

- 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?



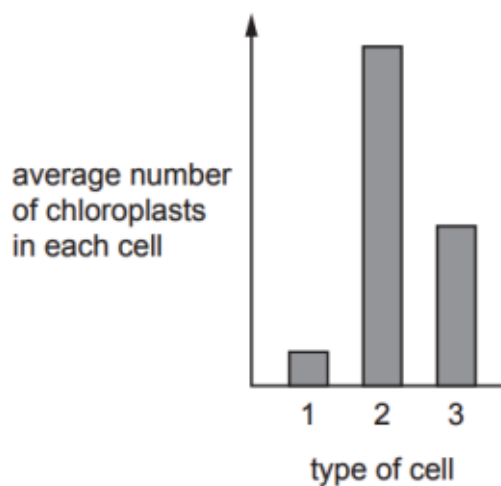
- 25 The graphs show the quantities of selected vitamins and minerals in four foods.



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.

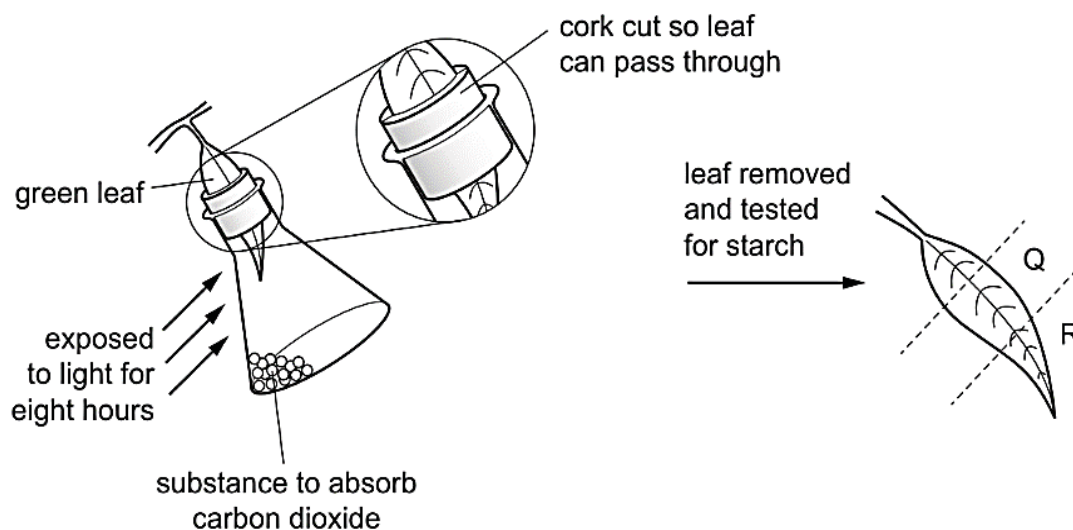
- 28 The bar chart shows the average number of chloroplasts in each of three different types of leaf cell.



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

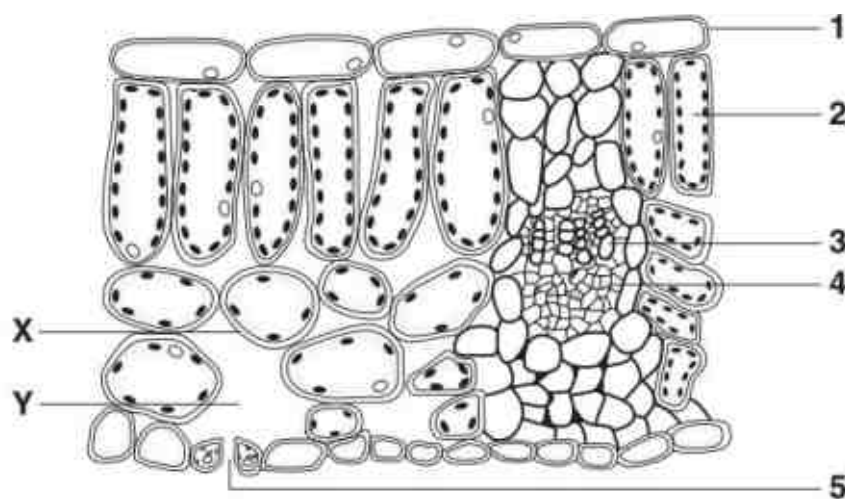
- 29 A plant is kept in the dark for two days. One of its leaves is used in an experiment to investigate photosynthesis as shown in the diagram.



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.



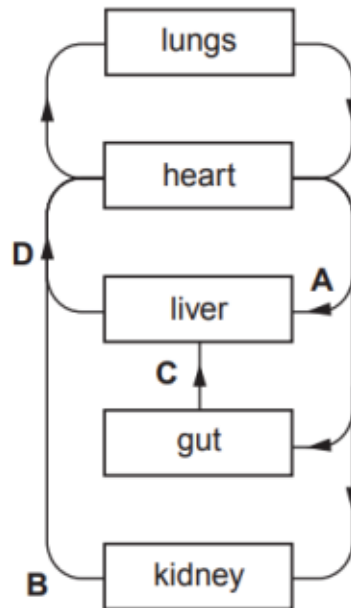
30 What takes place in the structures indicated?

	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

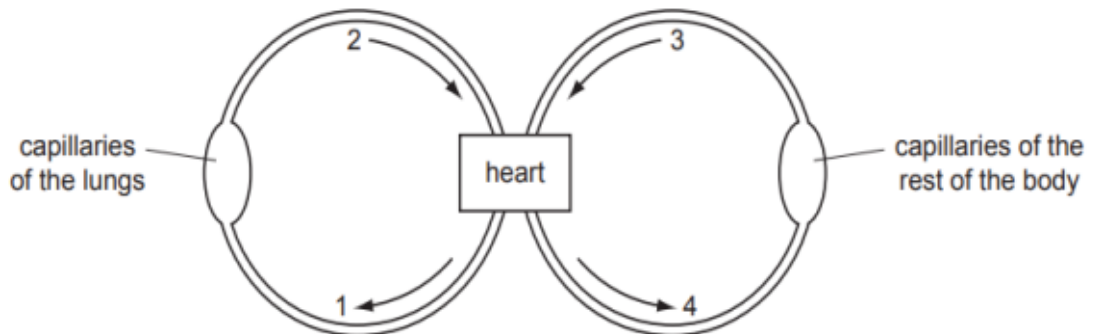
31 The leaf is losing water to the atmosphere. What processes are occurring at X and Y?

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

- 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?

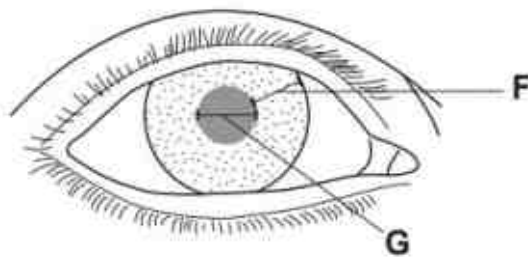
- A 1 and 2
- B 1 and 4
- C 2 and 3
- D 2 and 4

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

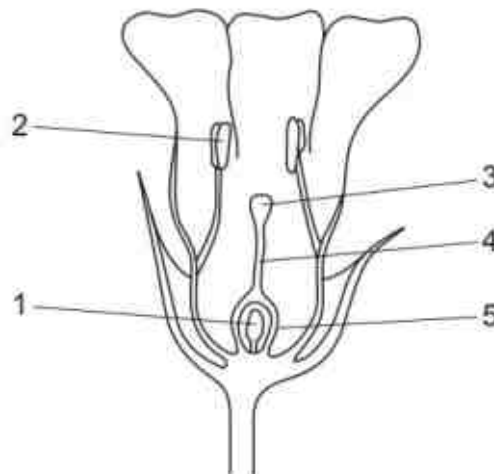
35 The diagram shows the eye of a person in a brightly-lit room.



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

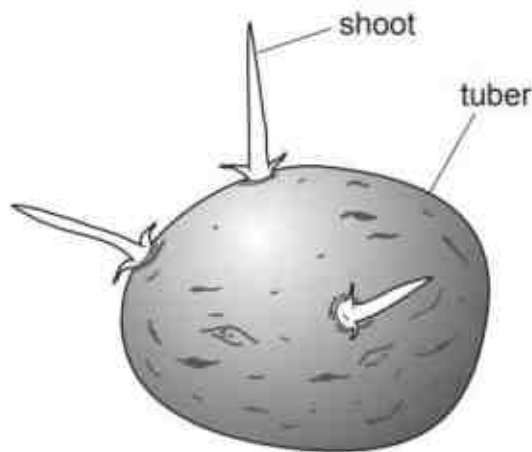
	F	G
A	increases	decreases
B	increases	increases
C	decreases	increases
D	decreases	decreases

- 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.



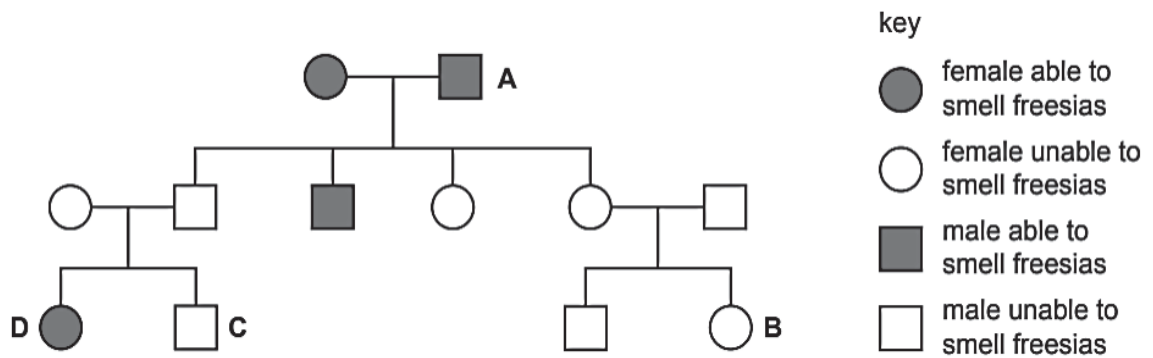
How do the genotypes of the shoots compare with the genotypes of the tuber and of the parent?

- 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.

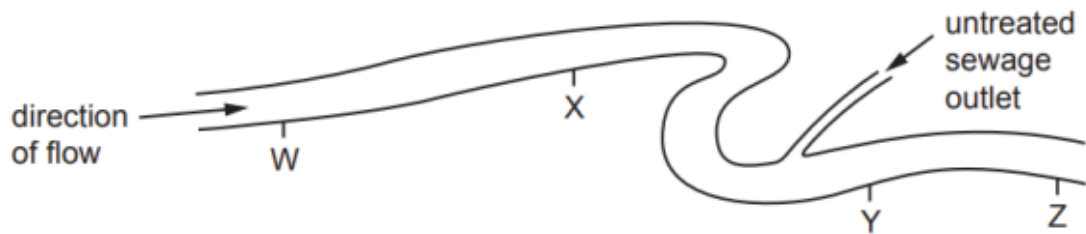
38 Which term is defined as a length of DNA that codes for a protein?

- A amino acid
- B chromosome
- C gene
- D nucleotide

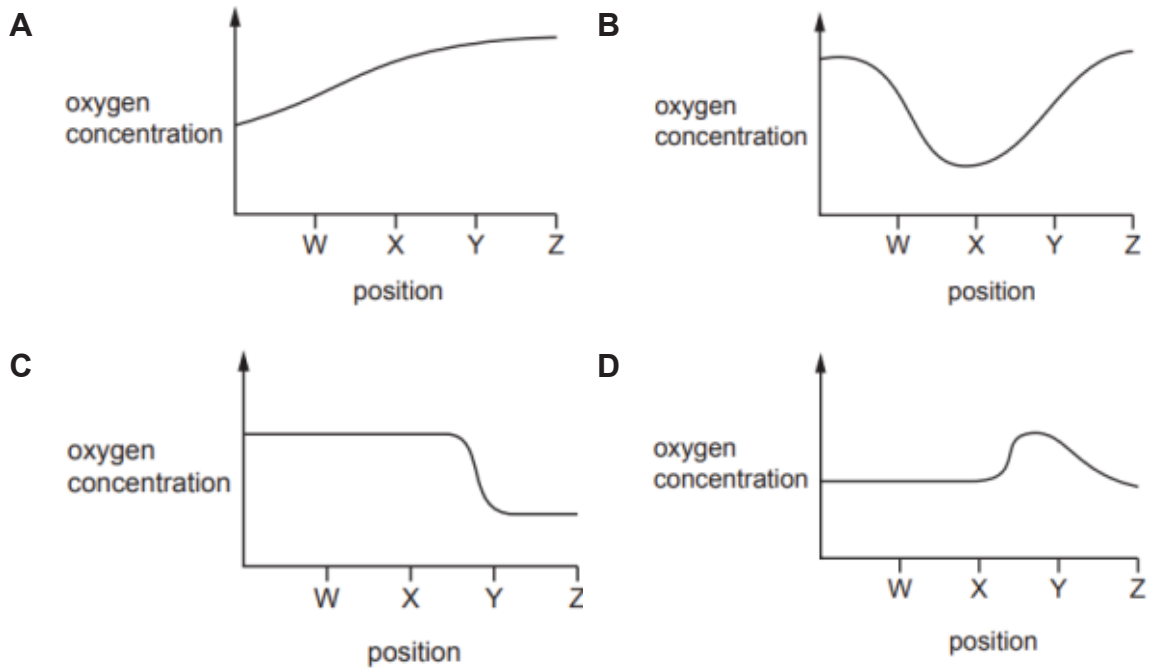
39 The family tree shows the inheritance of the ability to smell flowers called freesias. The allele for the ability to smell freesias is dominant. Which individual's symbol is not correct?



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



Which graph shows oxygen concentrations in the river?



End of paper

Index Number	Class	Name
--------------	-------	------



CHIJ ST JOSEPH'S CONVENT PRELIMINARY EXAMINATION



**Science (Biology)
Paper 4**

5078/ 04

Tuesday, 7 August 2018
1 hour 15 minutes

Secondary 4 Express / 5 Normal

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

Sec 4E5N Sci Bio/SA2/2018

[Turn Over

www.KiasuExamPaper.com

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



A detailed diagram of a leaf cross-section. At the top is the upper epidermis, a single layer of cells. Below it is the palisade mesophyll, consisting of two columns of elongated cells. A stoma, made of two guard cells, is located on the upper epidermis. Below the palisade mesophyll is the spongy mesophyll, which has large air spaces. A sub-stomatal air chamber is located just below the stoma. At the bottom is the lower epidermis, another single layer of cells. A large 'X' is drawn over the palisade mesophyll. Brackets on the right side group the layers: upper epidermis, palisade mesophyll, spongy mesophyll, and lower epidermis. Labels with leader lines point to the stoma, sub-stomatal air chamber, and the 'X'.

Fig. 1.2

(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.

.....

 [2]

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

.....

 [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.

.....

 [2]

- (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.

*For
Examiner's
Use*

.....

.....

.....

.....

[2]

[Total: 10]

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

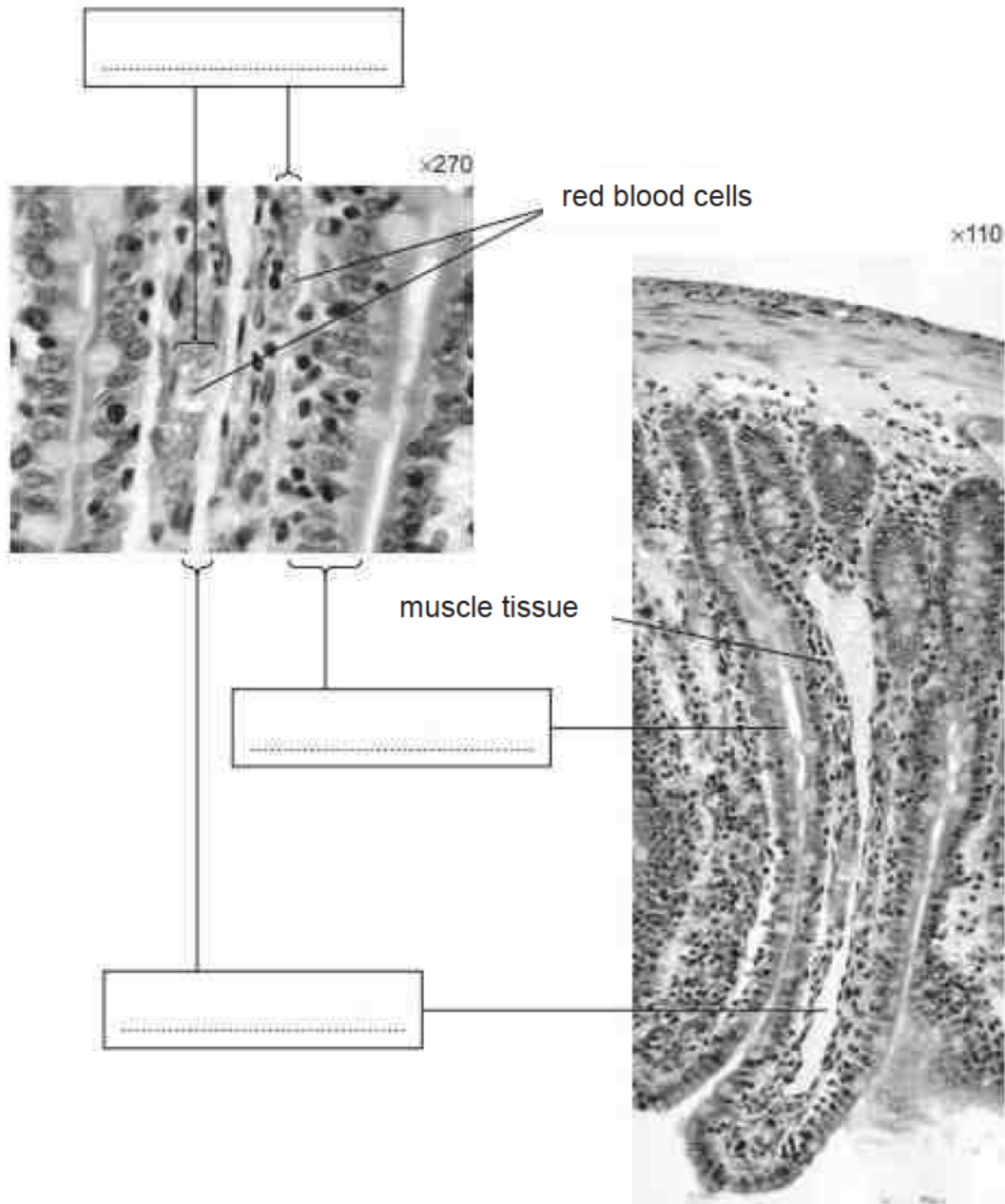


Fig. 2.1

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

[3]

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

.....

.....

.....

.....

[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.

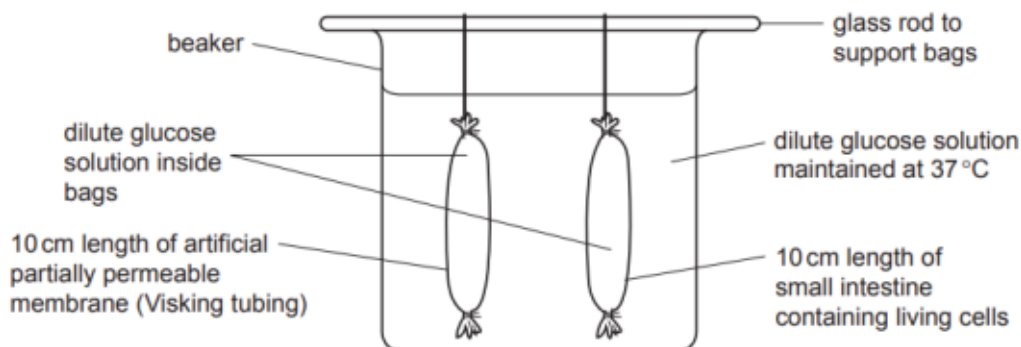


Fig. 2.2

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.

- (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.

.....

.....

.....

[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.

.....

.....

.....

.....

.....

.....

[3]

[Total: 10]

3 All organisms depend on enzymes.

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

.....

.....

.....

[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.

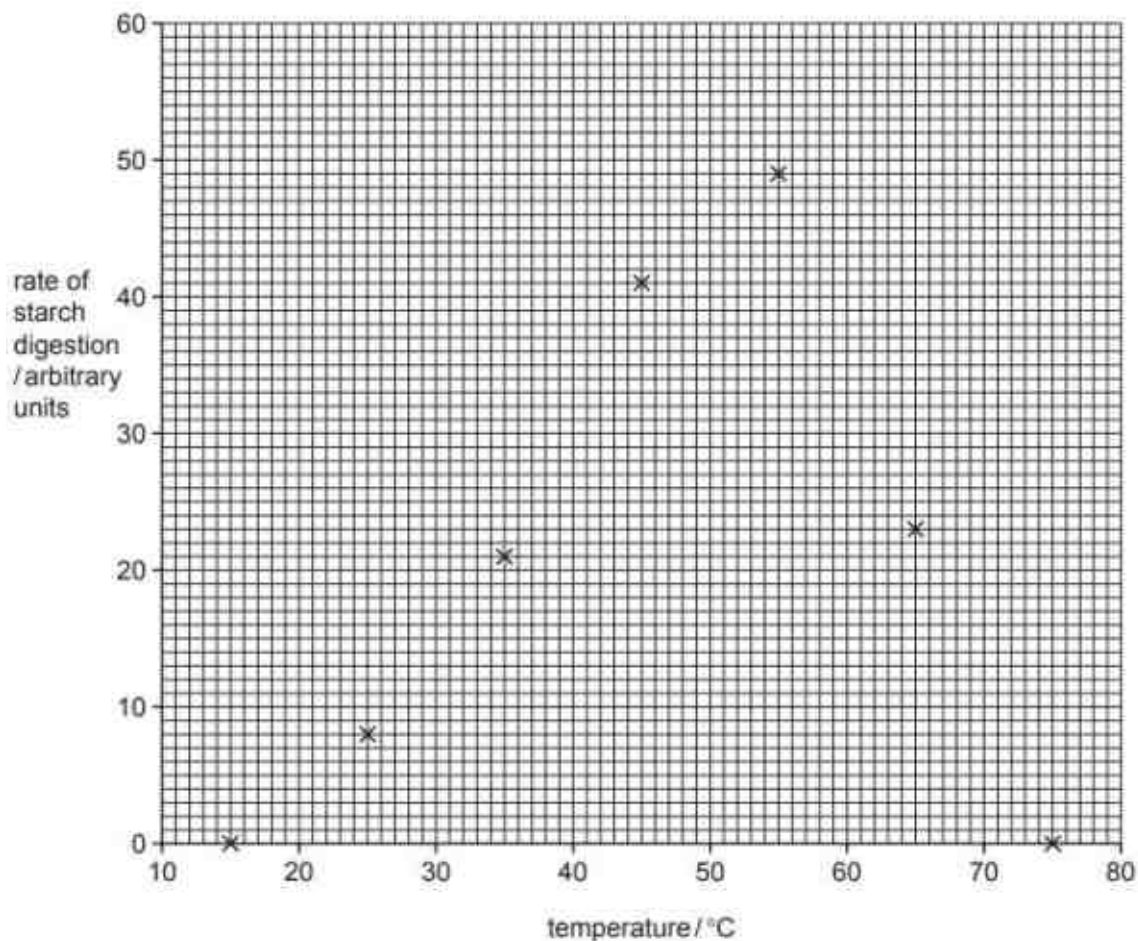


Fig. 3.1

(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]

- (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.

.....

 [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.

.....

 [3]

[Total:10]

- 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.

.....

.....

.....

.....

.....

.....

[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.

.....

.....

.....

.....

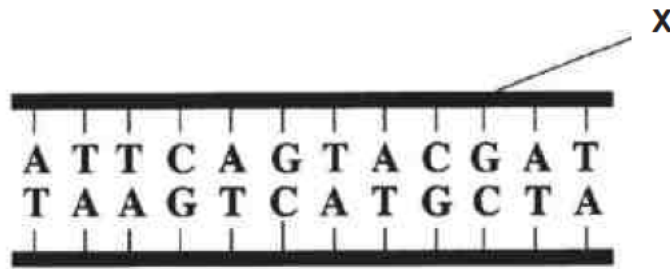
.....

.....

[4]

[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 .]

.....

 [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 *thalassaemia* 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.

.....

[Total: 8]

[1]

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.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[5]

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.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[5]

For
Examiner's
Use

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

For
Examiner's
Use

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[5]

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[5]

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

- (i) the exchange surface of alveoli

.....

.....

.....

.....

[2]

- (ii) the lining of trachea

.....

.....

.....

.....

[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.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[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

KIASU
ExamPaper

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 answer
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 candidates
2c	small intestine: a. idea that glucose, taken up by cells / moved outside bag ; b. lower water potential outside bag ; A 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 ; R '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	<u>low</u> number of <u>platelets/ alternative quote values to support</u>; [lower than normal range] platelets needed to <u>form fibrin</u>; which forms blood <u>clot</u> over the wound and <u>stops</u> the flow of blood/ <u>unable to clot to seal the wound/ slower clotting process</u>; I: abnormal number of platelets	1 1 1	- Reject platelets contains enzymes - Students often mix up thrombin, prothrombin, fibrinogen and fibrin.
4b	Cholesterol level <u>close to the upper limit/ alternative quote values to support</u>; Blockage of <u>coronary artery</u> preventing blood flow to <u>heart muscles</u>; 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.

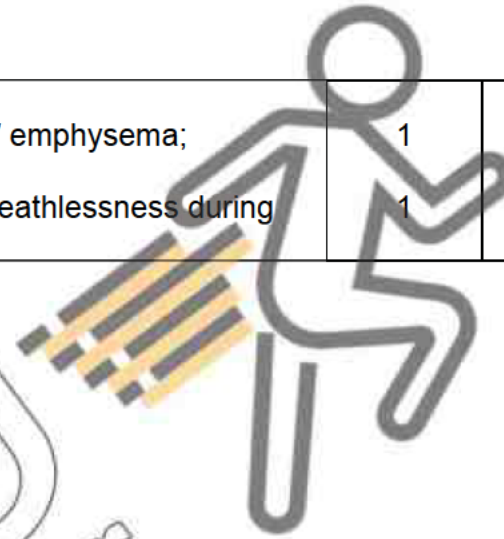
	• <u>Rule of complementary base pairing</u> : cytosine pairs with guanine Adenine pairs with cytosine;	1	
(ci)	• Recessive allele; • Parents are <u>normal</u>, they are <u>heterozygous</u> / carrier of thalassaemia allele;	1 1	• Need to explain by mentioning the phenotype and genotype of parents
(cii)	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 microorganisms, 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

	Reference to microbes/ decomposers; Uneaten parts of the organisms such as bones		Students keep repeating the same point.												
7a	- 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></table>	Self-pollination	Cross-pollination	One parent plant is required	Two parents plants are required	<u>Does not depend</u> on external factors like wind/insects	Depend on external factors like wind/insects	Higher probability of success	lower probability of success	Offspring inherit <u>beneficial qualities</u> of parent	<u>Genetic variation</u> among offspring is possible	<u>Less pollen and energy</u> is lost	Energy is invested in pollen and more energy is lost		- 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.
Self-pollination	Cross-pollination														
One parent plant is required	Two parents plants are required														
<u>Does not depend</u> on external factors like wind/insects	Depend on external factors like wind/insects														
Higher probability of success	lower probability of success														
Offspring inherit <u>beneficial qualities</u> of parent	<u>Genetic variation</u> among offspring is possible														
<u>Less pollen and energy</u> is lost	Energy is invested in pollen and more energy is lost														

7b	<u>Day 1-5, menstrual flow stage, Uterine lining breaks down</u> and flows from uterus out of the body through the <u>vagina</u>; <u>Day 6-13, (follicle stage), oestrogen causes the repair and growth of the uterine lining</u>; Oestrogen <u>prevents maturation</u> and development of <u>more ova</u>; <u>Day 14, ovulation stage, mature egg released by one ovary</u> into oviduct; Oestrogen level starts to <u>fall</u> while level of progesterone starts to <u>increase</u>; <u>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</u>; <u>Inhibits ovulation</u>;		• Loss of marks if timeline is not stated or wrongly stated. • Many cannot do this basic recall question suggest a lack of revision.
8ai	<u>Wall is one-cell thick</u> + provide <u>shorter diffusion distance</u> for gases; Inner wall has thin film of <u>moisture</u> + <u>dissolve</u> oxygen before diffusing in solution into blood;	1 1	Lack of keywords in answers
8aai	Mucous gland cells secrete <u>mucus</u> + <u>traps</u> dust and bacteria in inhaled air; <u>Cilia sweeps</u> 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	<u>Tar and irritants</u> in tobacco <u>smoke</u>; <u>Paralyses cilia</u> lining in trachea and bronchi; Mucus and dust <u>cannot be removed</u> / <u>accumulate</u>; 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

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

KIASU
Exampaper

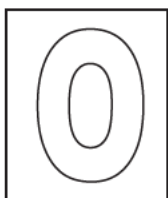


	Common errors in students' work	
4a Clotting	Soluble fibrin becomes insoluble fibrin threads	
	Clot with red blood cells	
	Not enough platelets to clot the wound	
4b CHD	High level of cholesterol as in table 4.1.	
	Fats clotted in the coronary arteries.	
	Heart muscle to pump harder to create more pressure.	
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 formhence leading to short of breath.	



KIASU
ExamPaper



FAJAR SECONDARY SCHOOL
2018 PRELIMINARY EXAMINATIONS
SECONDARY 4 EXPRESS/5 NORMAL
(ACADEMIC)

CANDIDATE
NAME

--

CLASS

--	--	--

INDEX NUMBER

--	--	--	--

SCIENCE (BIOLOGY)

5077/5078

Paper 1 Multiple Choice

Date: 13 September 2018

Setter: Ms Seah AH

Duration: 1 Hour

Additional Materials: OTAS Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your name and index number on the Question Paper and OTAS Sheet in the spaces provided.

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

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

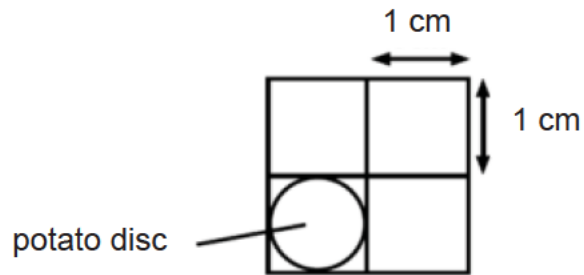
Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this booklet.

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

Do not open this document till permission is given.

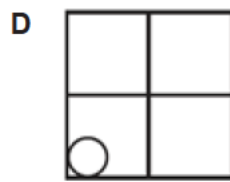
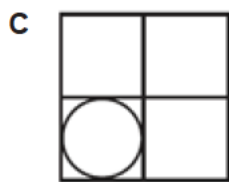
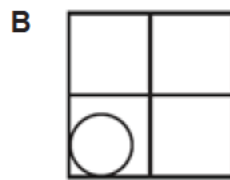
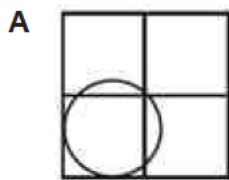
This document consists of **11** printed pages and **1** blank page.

- 1 The diagram below shows the initial diameter of a potato disc.

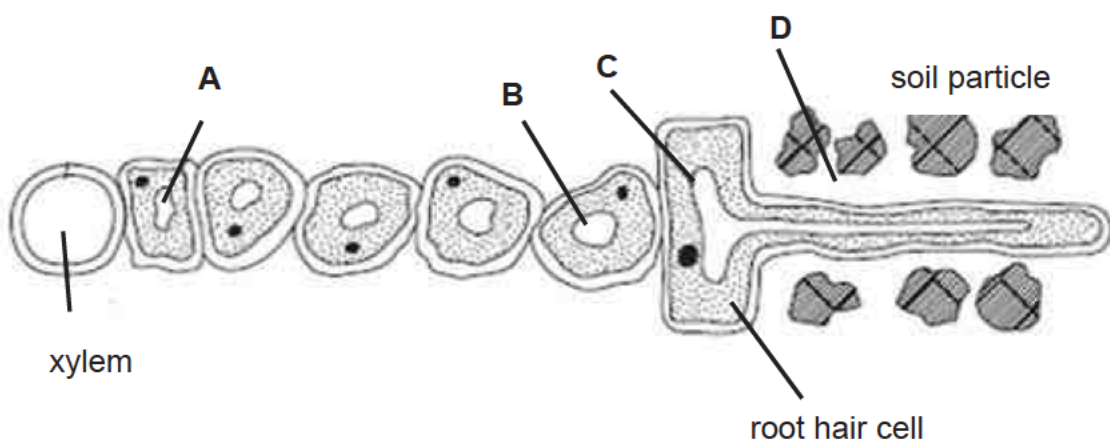


The potato disc was placed in distilled water for one hour.

Which diagram correctly shows the change in the diameter of the potato disc?



- 2 The diagram shows part of a plant root in the soil. The root is absorbing water. At which labelled point is the water potential highest?

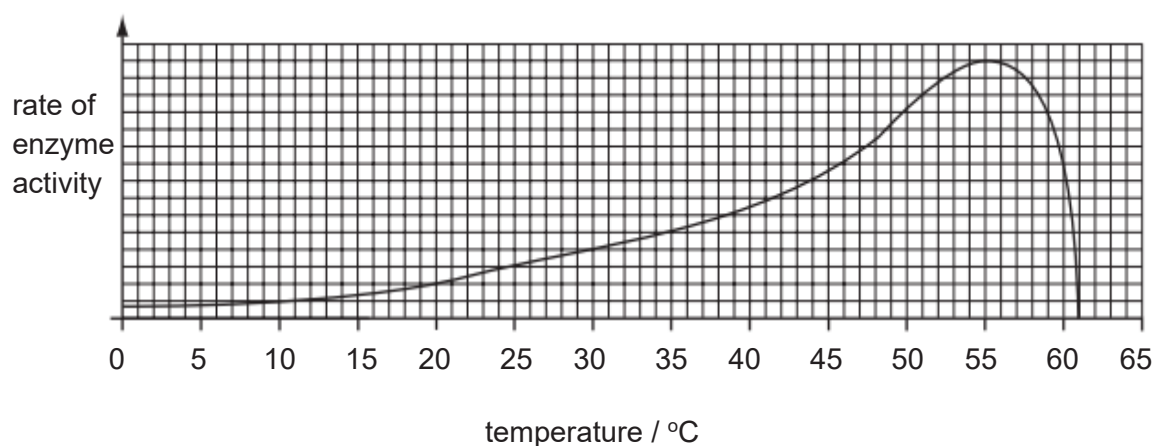


- 3 A solution gives the following results when tested.

test	observations
biuret test	solution changed from blue to violet
Benedict's test	solution changed from blue to brick red precipitate
iodine solution	solution remained yellow
ethanol emulsion test	solution remained clear

What does the solution contain?

- A** fat and protein
B protein and reducing sugar
C protein and starch
D reducing sugar and starch
- 4 The graph shows how temperature affects the rate at which an enzyme works.



What does the graph show about this enzyme?

- A** The enzyme is denatured by temperatures above 65 °C.
B The enzyme is denatured by temperatures below 8 °C.
C The enzyme works fastest at 55 °C.
D The enzyme works fastest at 61 °C.

5 Which processes are functions of the liver?

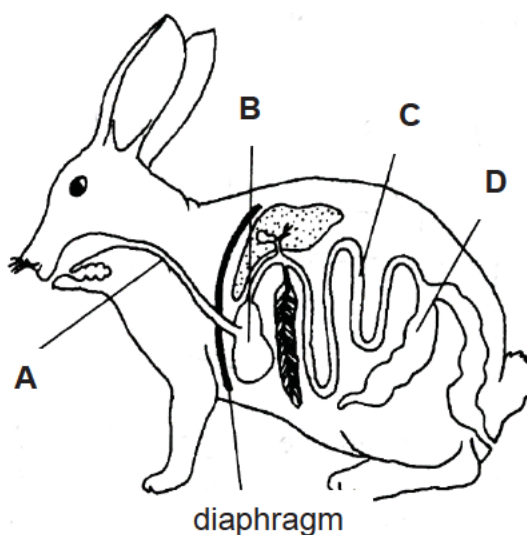
	absorbing food	assimilating food	helping with digestion of food
A	✓	✓	✓
B	✓	✓	×
C	✓	×	✓
D	×	✓	✓

key

✓ = is a function

× = is not a function

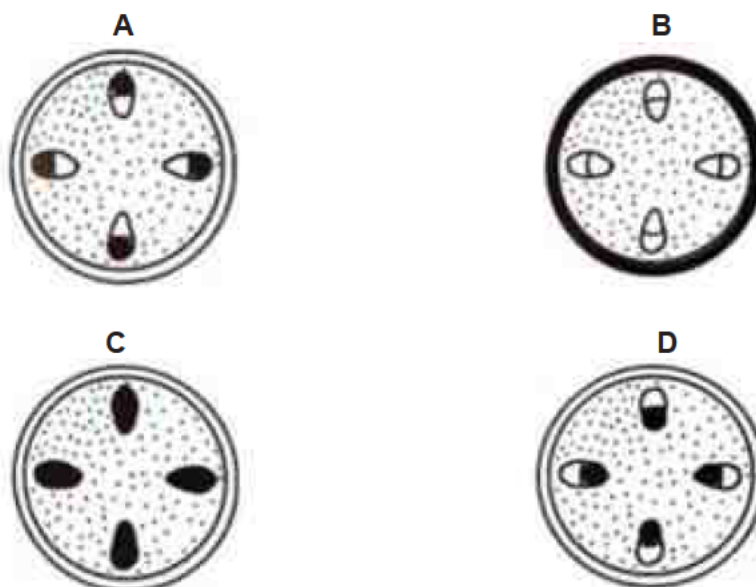
6 The diagram shows the digestive system of a rabbit.
In which structure is lipase produced?



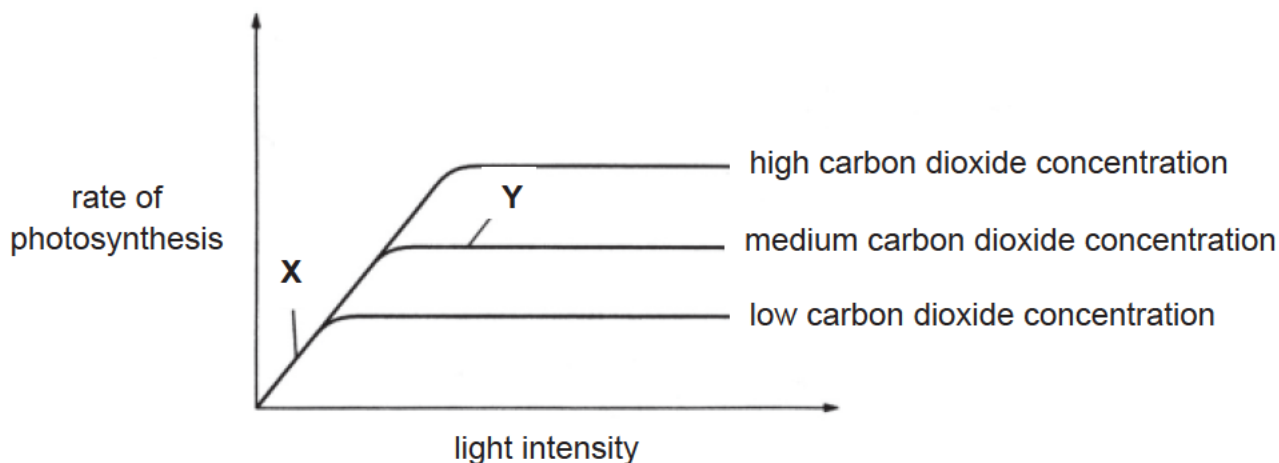
7 On a sunny day, how does water vapour move through the stomata of a leaf?

- A** into the leaf by diffusion
- B** into the leaf by respiration
- C** out of the leaf by diffusion
- D** out of the leaf by respiration

- 8 A plant was placed in a bell-jar in a brightly lit area. The air in the bell-jar contains carbon dioxide that has been radioactively labelled. After an hour, a cross-section of the plant's stem was placed on photographic film which turns black when exposed to radioactivity. Which diagram shows the area where the film becomes black?



- 9 The graph below shows the effect of light intensity on the rate of photosynthesis.



What is the factor that is limiting the rate of photosynthesis at points X and Y?

	X	Y
A	carbon dioxide concentration	light intensity
B	light intensity	carbon dioxide concentration
C	temperature	carbon dioxide concentration
D	temperature	light intensity

[Turn over

- 10** The following statements are the characteristics of blood transported by a blood vessel in the human body.

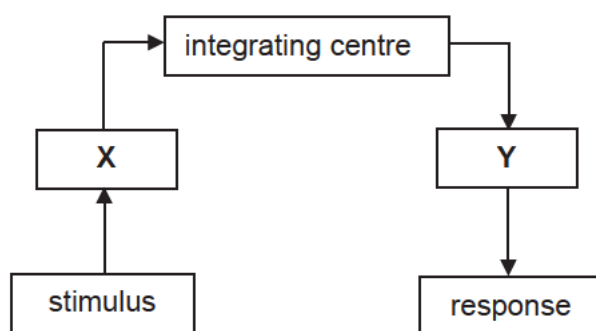
- High concentration of oxygen
- Low concentration of carbon dioxide
- Low blood pressure

What is this blood vessel?

- A** aorta
- B** vena cava
- C** pulmonary vein
- D** pulmonary artery
- 11** After finishing a race, an athlete still continues to breathe more quickly and deeply than normal for several minutes.
Which statement correctly explains this observation?

- A** to remove carbon dioxide produced during anaerobic respiration
- B** to remove urea produced from the breakdown of amino acids
- C** to take in extra oxygen to break down lactic acid
- D** to replace stored glycogen in muscles

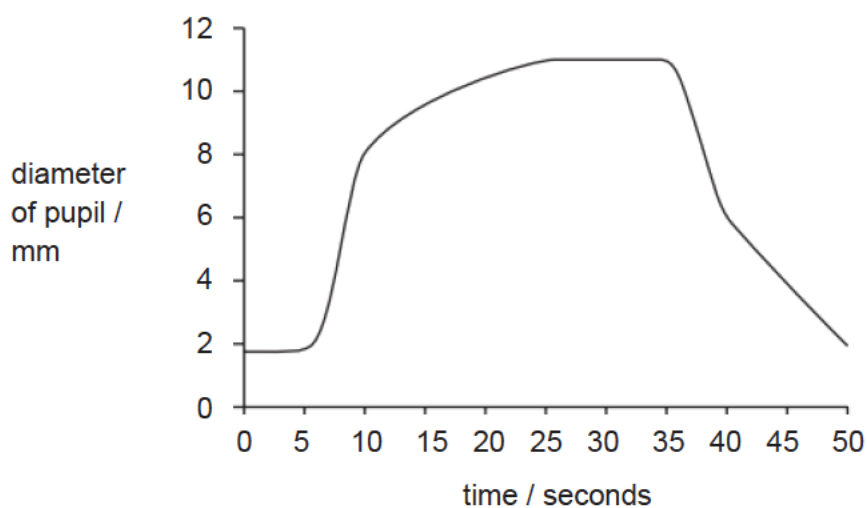
- 12 The diagram shows the main components involved in coordination and response towards stimulus.



What are represented by X and Y?

	X	Y
A	effector	receptor
B	receptor	effector
C	brain	spinal cord
D	spinal cord	brain

- 13 The graph shows the changes in the size of the pupil of the eye as the light intensity of the surroundings is changed.



Which time period shows the light intensity increasing?

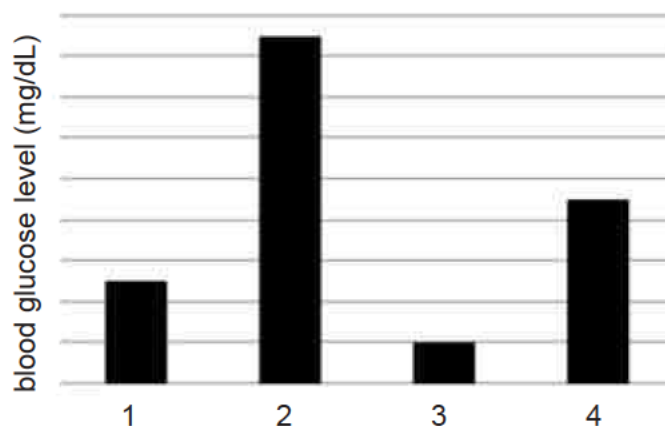
- A 5 to 10 seconds
- B 10 to 15 seconds
- C 25 to 35 seconds
- D 35 to 40 seconds

14 Four people had the following descriptions with regards to their body and dietary conditions.

- Normal, has not eaten for 24h
- Normal, before lunch
- Normal, 3h after lunch
- Diabetic, 3h after lunch

They were then tested for their blood glucose levels.

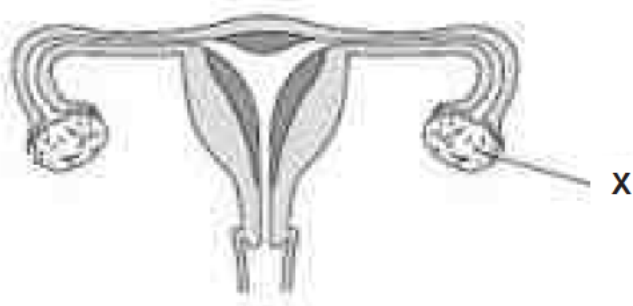
The graph shows the blood glucose levels of the 4 people.



Which row correctly describes the graph?

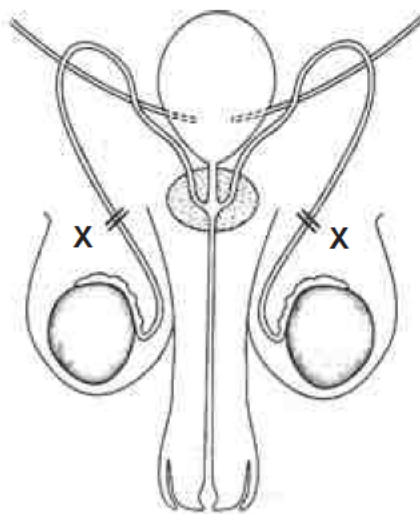
	1	2	3	4
A	normal; before lunch	normal; 3 hours after lunch	normal; has not eaten for 24 hours	diabetic; 3 hours after lunch
B	normal; before lunch	diabetic; 3 hours after lunch	normal; has not eaten for 24 hours	normal; 3 hours after lunch
C	normal; has not eaten for 24 hours	diabetic; 3 hours after lunch	normal; before lunch	normal; 3 hours after lunch
D	normal; 3 hours after lunch	diabetic; 3 hours after lunch	normal; has not eaten for 24 hours	normal; before lunch

- 15 The diagram shows the female reproductive system.



What is the function of the part labelled X?

- A gamete production and hormone secretion
 - B gamete production only
 - C hormone secretion only
 - D zygote production and hormone secretion
- 16 What would be the result of cutting the tubes marked X?

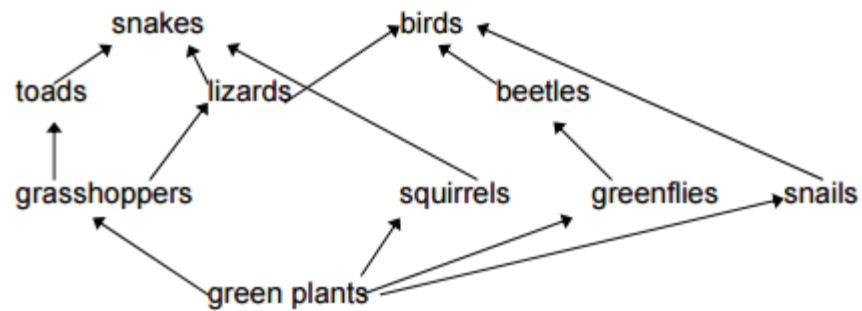


- A Male sex hormones could not reach blood.
- B The flow of urine would be prevented.
- C The production of sperm would stop.
- D The sperm could not be transported out of the urethra.

- 17 A gene of a particular organism contains 29% thymine (T). Which row would best represent the percentage distribution of the other nucleotides in this gene?

	adenine (A)	cytosine (C)	guanine (G)
A	21 %	29 %	21 %
B	21 %	21 %	29 %
C	29 %	21 %	21 %
D	29 %	21 %	29 %

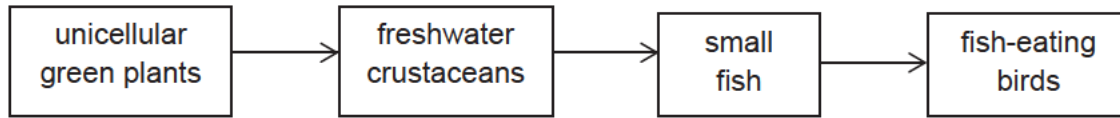
- 18 The diagram shows a food web in a woodland.



In this food web, a lizard is _____.

- A** a carnivore
- B** a decomposer
- C** a herbivore
- D** a producer

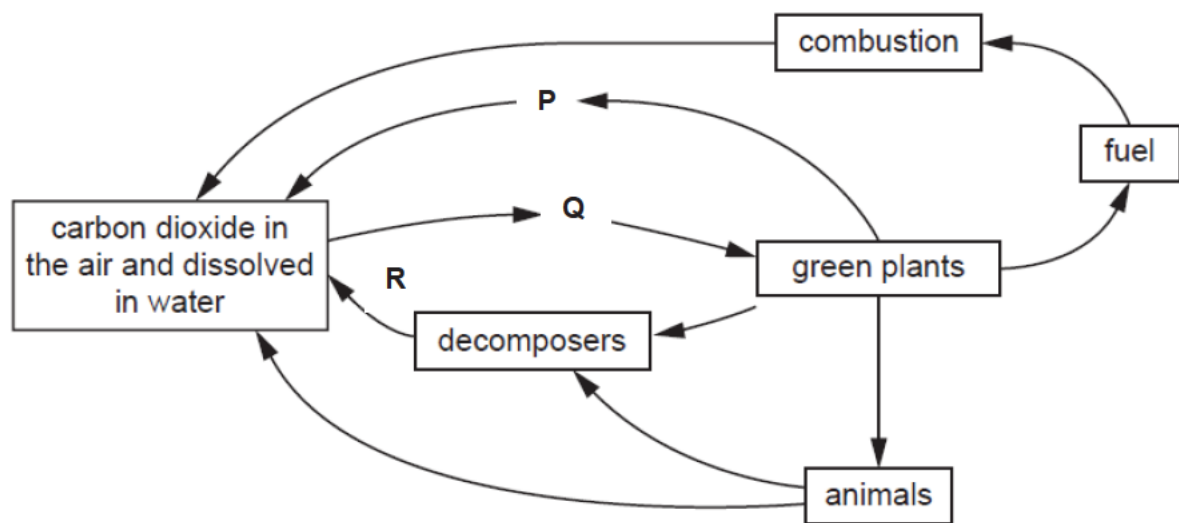
- 19 A farmer sprays insecticide on his crops for a year. The insecticide washes off into a lake where it is absorbed by the producer to enter the food chain.



Which row correctly represents the levels of insecticide in these organisms at the end of the year?
ppm = parts per million

	unicellular green plants / ppm	freshwater crustaceans / ppm	small fish / ppm	fish-eating birds / ppm
A	0.05	0.5	0.05	0.05
B	0.05	0.05	0.05	0.05
C	0.05	0.5	5.0	25.0
D	25.0	5.0	0.5	0.05

- 20 The diagram shows the carbon cycle.

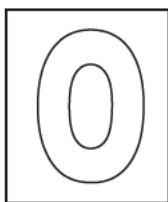


What are processes P, Q, and R?

	P	Q	R
A	photosynthesis	photosynthesis	respiration
B	respiration	respiration	photosynthesis
C	photosynthesis	respiration	photosynthesis
D	respiration	photosynthesis	respiration

--- END OF PAPER ---

BLANK PAGE



FAJAR SECONDARY SCHOOL
2018 PRELIMINARY EXAMINATIONS
SECONDARY 4 EXPRESS/5 NORMAL
(ACADEMIC)

CANDIDATE
NAME

--

CLASS

--	--	--

INDEX NUMBER

--	--	--	--

SCIENCE (BIOLOGY)

5077/5078

Paper 4

Setter: Ms Seah AH

Date: 29 August 2018

No Additional Materials Required

Duration: 1 hour 15 minutes

READ THESE INSTRUCTIONS FIRST

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

Write in dark blue or black pen.

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

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

Section A

Answer **all** questions.

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

Section B

Answer **two out of three** questions.

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

In calculations, you should show all steps in your working, giving your answer at each stage.

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

Electronic calculators can be used in this paper.

The total of the marks for this paper is 65.

For Examiner's Use	
Paper 1	20
Paper 4	
Section A	45
Section B	20
Total	85

Do not open this document till permission is given.

This document consists of **16** printed pages and **0** blank pages.

Paper 4
Section A [45 marks]

*For
Examiner's
Use*

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

- 1 Fig 1.1 shows a cell from the palisade mesophyll layer of a leaf.

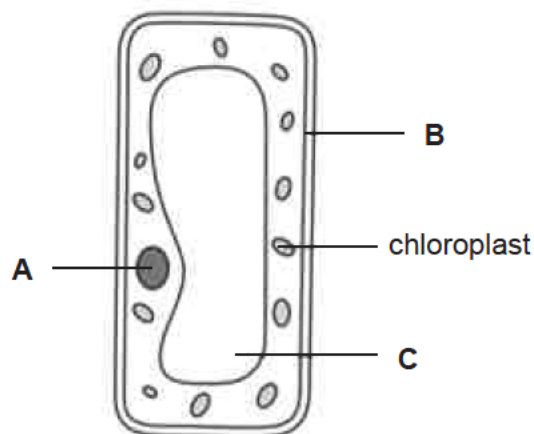


Fig. 1.1

- (a) Name the structures labelled **A**, **B** and **C**.

A

B

C [3]

- (b) Name the process carried out by the chloroplasts and explain why all animal cells depend on this process.

name of process

explanation

..... [2]

- (c) Suggest one link between the functions of chloroplasts and the function of mitochondria.

.....

.....

..... [2]

(d) State one difference you would expect to see between this plant cell and

*For
Examiner's
Use*

(i) a root hair cell,

.....

.....

[1]

(ii) a xylem cell.

.....

.....

[1]

[Total: 9]

- 2 Fig. 2.1 shows a mammalian heart with glass tubes, X and Y, securely attached to the vena cava and the pulmonary artery.

Water was poured into tube X, and rose up tube Y until both tubes were filled to the level shown.

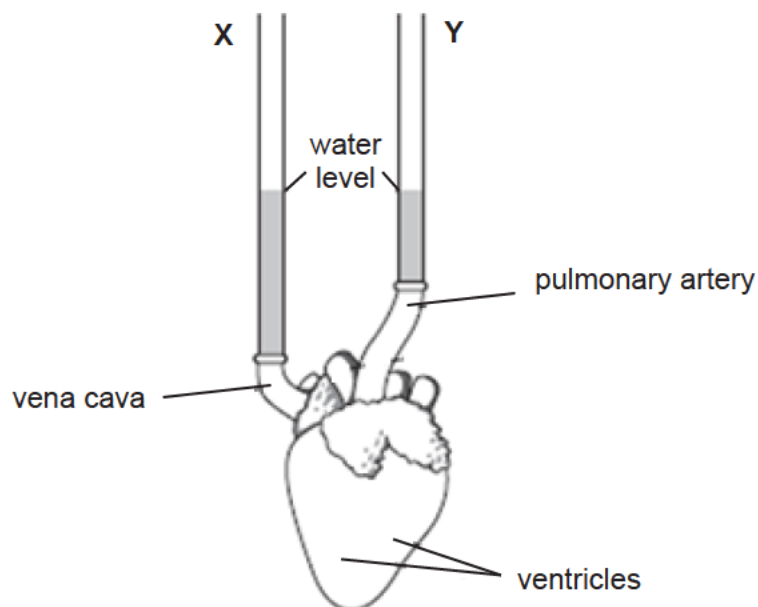


Fig. 2.1

- (a) When water was poured into tube X, two chambers in the heart were filled with water. Name these two chambers.

1

2 [2]

- (b) The ventricles were squeezed once by hand.

Suggest what would happen to the level of water in tube X and in tube Y when the ventricles were squeezed.

X

Y [1]

- (c) Fig. 2.2 shows the contraction and relaxation of the atria and ventricles during several heartbeats.
Each square represents a time of 0.1 second.

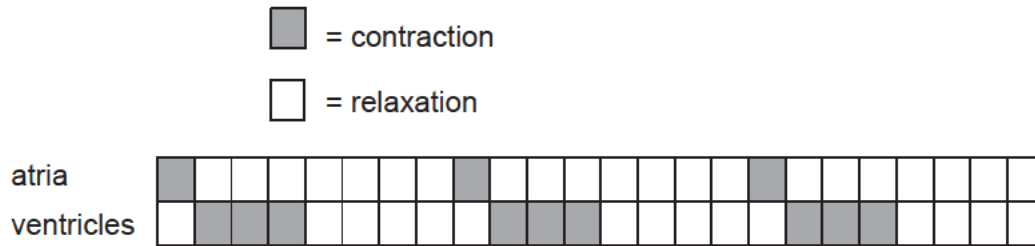


Fig. 2.2

- (i) For how long do the ventricles contract during one heartbeat?

..... second [1]

- (ii) How many heartbeats does the diagram show?

..... heartbeats [1]

- (iii) During exercise, the rate of blood flow to the heart muscles increase.
Explain the advantage of this increase in the rate of blood flow.

.....

.....

..... [2]

[Total: 7]

- 3 Fig. 3.1 shows changes in the hormones oestrogen and progesterone during a woman's menstrual cycle.

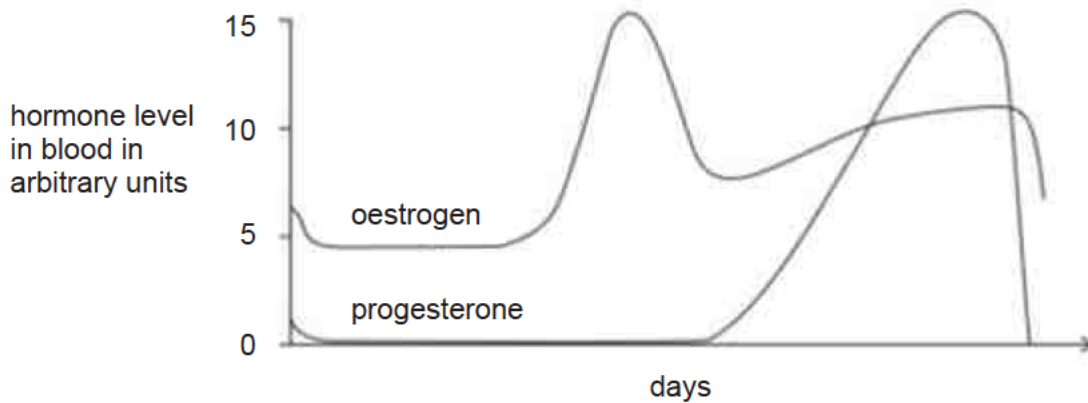


Fig. 3.1

- (a) On Fig. 3.1, indicate using

- (i) a letter **O**, the day when ovulation is most likely to occur. [1]
 (ii) a letter **M**, the day when menstruation is likely to start. [1]

- (b) Describe the effect of oestrogen on the female reproductive system.

..... [2]

- (c) Fertilisation normally takes place in the oviducts.

- (i) State what happens to the level of progesterone if fertilisation occurs. [1]

- (ii) Describe the early development of the fertilised egg. [2]

[Total: 7]

- 4 Fig. 4.1 shows part of a flower involved in sexual reproduction.
It has been separated into three sections **A**, **B** and **C**.

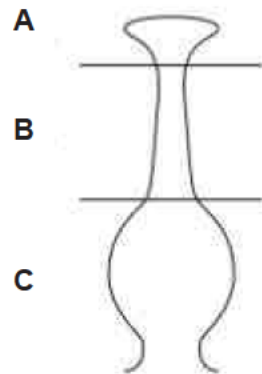


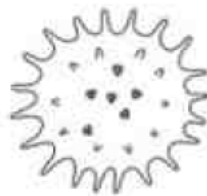
Fig. 4.1

- (a) Complete the table by giving the correct letter for the section that matches each statement.
Each letter may be used once, more than once or not at all.
The first one has been done for you.

Statement	Section letter
This is the stigma	A
This is where fertilisation occurs	
This is where the pollen grains land at pollination	
This is where most pollen tube growth occurs	
This is where a seed will develop	

[2]

- (b) The drawing shows a pollen grain from an insect-pollinated flower as seen using a microscope.



Suggest how the structure of this pollen grain shows it is from an insect-pollinated flower.

.....

.....

[1]

- (c) In this plant, pollen is produced before the carpel has finished growing.
By the time the carpel is ready for pollination, pollen production has stopped.

(i) Suggest why this happens.

.....

.....

[1]

(ii) In what way is this an advantage to the plant?

.....

.....

.....

[2]

[Total: 6]

- 5 A geneticist was asked to investigate the inheritance of acatalasia in dogs.

The normal allele is represented by **B** and the mutant allele is represented by **b**.

Fig. 5.1 to show the inheritance of acatalasia in a family of dogs. The shaded symbols indicate the dogs with acatalasia.

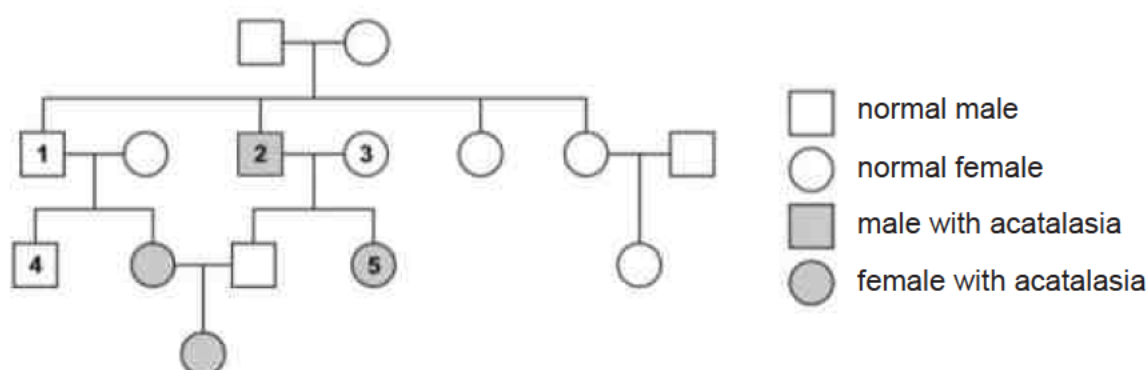


Fig. 5.1

- (a) Explain what is meant by the terms

(i) allele

.....

.....

[1]

(ii) genotype

.....

.....

[1]

[Turn over]

(b) State the genotype of the dogs identified as **1**, **2** and **3** in Fig. 5.1.

1

2

3

[3]

(c) The geneticist crossed dog **4** with dog **5**. Approximately half of the offspring had acatalasia and half the offspring did not have acatalasia.
Draw a genetic diagram to show how this is possible.

[4]

[Total: 9]

*For
Examiner's
Use*

- 6 The table shows the comparison of air breathed in and out of a person.

	% of air breathed	
	in	out
carbon dioxide	0.03	4.03
nitrogen	78	78
oxygen	20	16
others	1.97	1.97

- (a) Which two features of the alveoli help to bring about the changes?

1.

2.

[2]

- (b) (i) Name the reaction in the body which uses up oxygen and produces carbon dioxide.

.....

[1]

- (ii) Write a word equation for this reaction.

.....

[1]

- (c) State and explain the effect on the concentration of oxygen carried in the red blood cells when breathing in air containing tobacco smoke.

.....

[3]

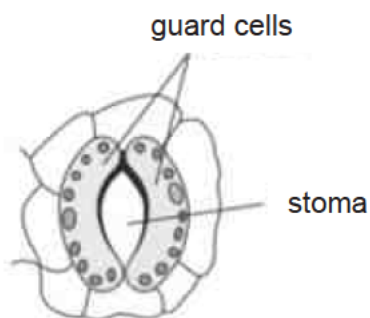
[Total: 7]

Section B [20 marks]

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

For
Examiner's
Use

- 7 Stoma is found mainly on the underside of leaves.



An experiment is carried out to examine the effect of the size of stomata on the rate of transpiration.

Table 7.1 shows the rate of transpiration in still air and in moving air.

size of stomata in μm	rate of transpiration in $\text{mg m}^{-2} \text{s}^{-1}$	
	still air	moving air
0	0	0
4	22	70
8	46	140
12	48	165
16	50	210
20	50	248
24	50	264

Table 7.1

- (a) Define the term transpiration.

.....
 [1]

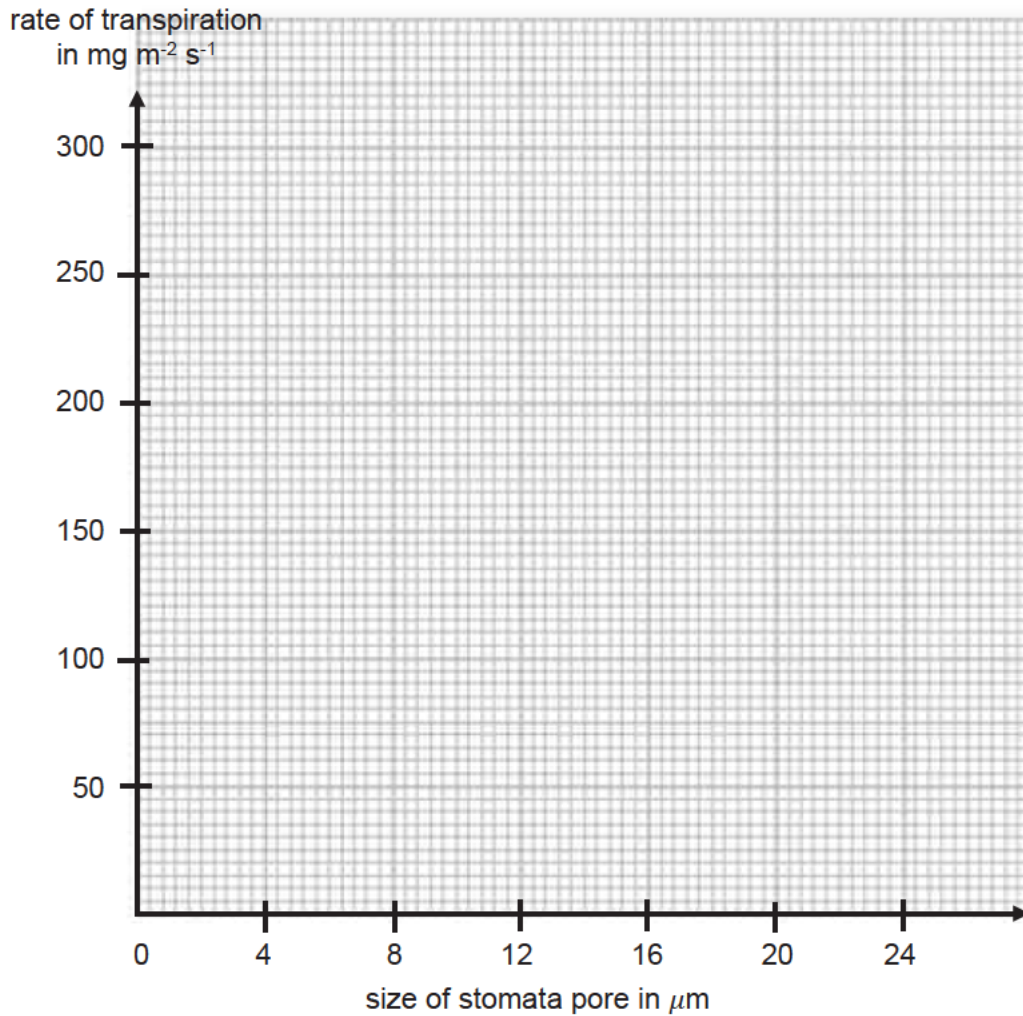
- (b) Water lilies float on the surface of ponds.
 Stoma is found on the upper surface of a water lily rather than the lower surface.
 Suggest a reason for this adaptation.

.....
 [1]

[Turn over

- (c) Plot a graph to show the effect of stomata on transpiration rate in still and moving air. Use a ruler to join your points with straight lines.

[3]

For
Examiner's
Use

- (d) Use the graph to compare the effect of increasing stomatal pore size on transpiration rate in still and moving air.

.....

.....

.....

[2]

- (e) Explain the effect that moving air has on transpiration rate.

.....

.....

.....

.....

.....

[3]

[Total: 10]

[Turn over]

- 8 The brown plant hopper is a serious insect pest of rice. Spraying with pesticides is a common way to control it. However, brown plant hoppers have become resistant to pesticides.

For
Examiner's
Use

Fig. 8.1 shows the effect of spraying pesticides against populations of this insect pest.

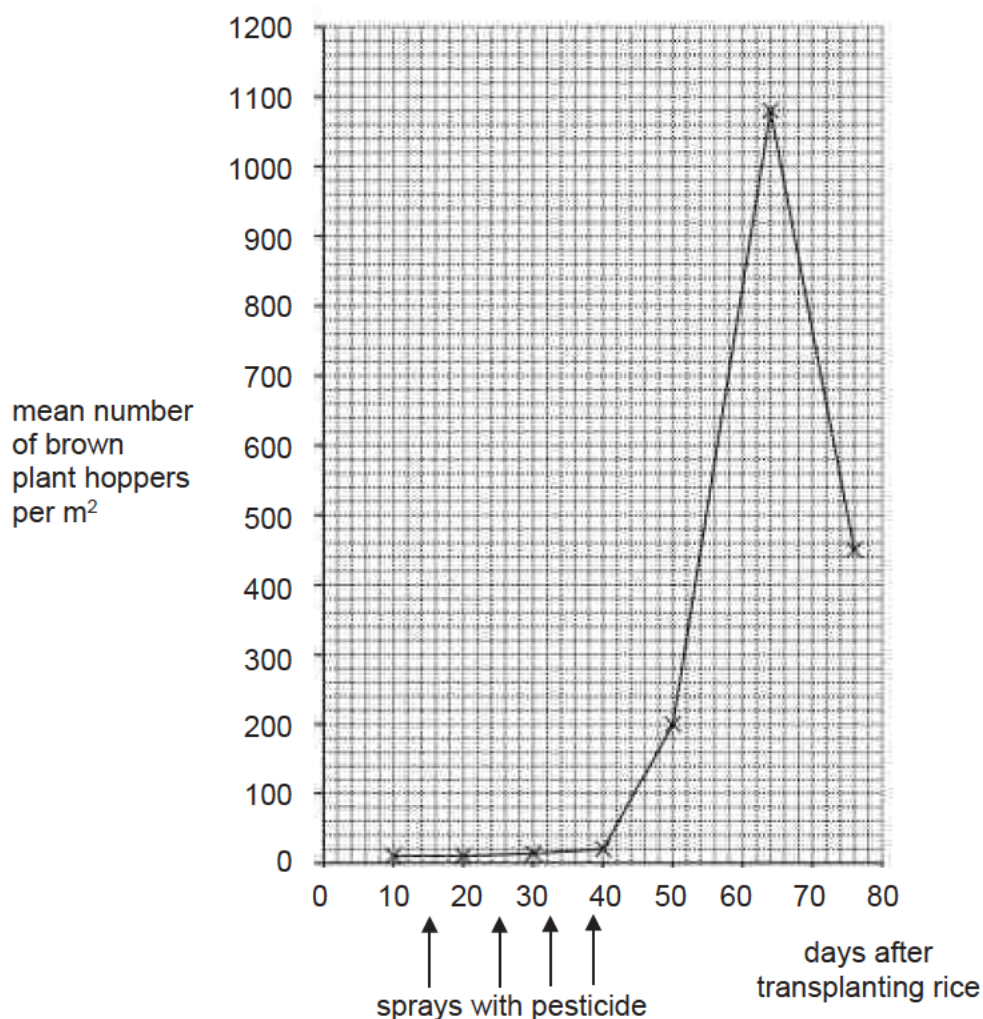


Fig. 8.1

- (a) Use Fig. 8.1 to describe the effect of pesticides on populations of the brown plant hopper.

.....

.....

.....

.....

.....

.....

.....

.....

[3]

[Turn over

- (b) (i) Rice growing has involved the destruction of forests.
Describe the long-term effects of deforestation on the environment.

.....

.....

.....

.....

.....

.....

.....

.....

[4]

- (ii) Suggest reasons for the importance of conservation of plant and animal species in the forest.

.....

.....

.....

.....

.....

.....

[3]

[Total: 10]

[Turn over]

- 9 Adam carried out an experiment on the fat content of a milk sample. Fig. 9.1 shows a sequence of steps in the experiment. The pH indicator used is colourless when the pH is 7 or less, and purple when the pH is over 7.

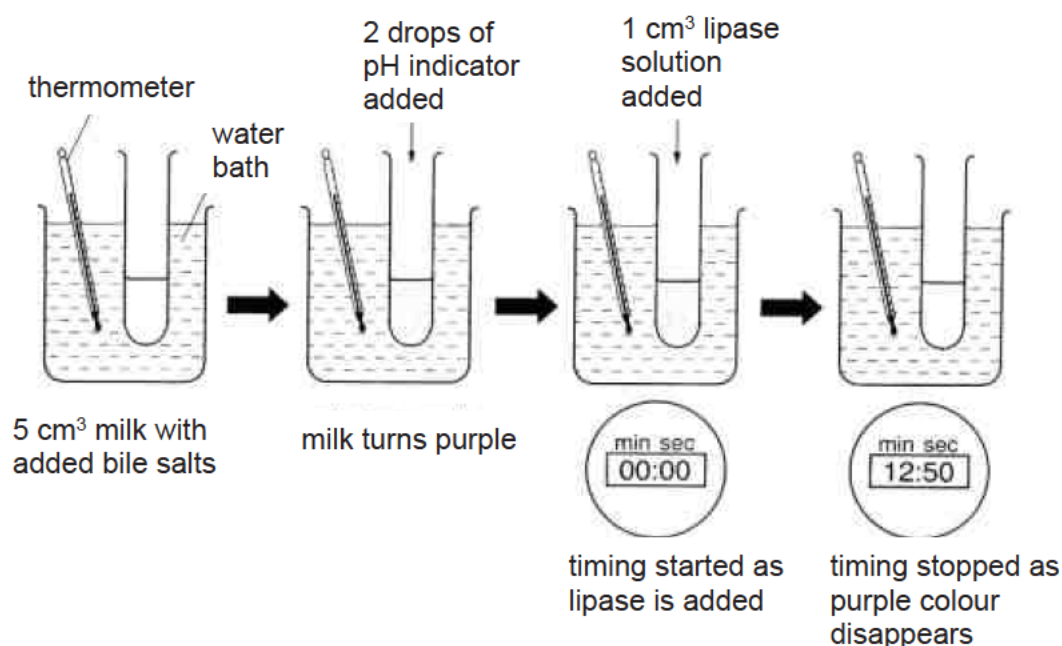


Fig. 9.1

The experiment was carried out at different temperatures. The times taken for the pH indicator to lose its colour are shown in Table 9.1.

Table 9.1

temperature / °C	0	10	20	30	40	50	60
time taken for indicator to lose its colour/min	35	21	16	9	6	31	40

- (a) Based on table 9.1, describe and explain the effect of increasing temperature on the activity of the enzyme, lipase.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[6]

[Turn over

(b) Describe the role of bile salts in the digestion of fats.

.....

.....

.....

.....

[2]

(c) Lipase will only act on fat molecules.
Use the lock and key hypothesis to explain why.

.....

.....

.....

.....

[2]

[Total: 10]

--- END OF PAPER ---

2018 4E Science Prelim Answer Scheme

Answers to Section A

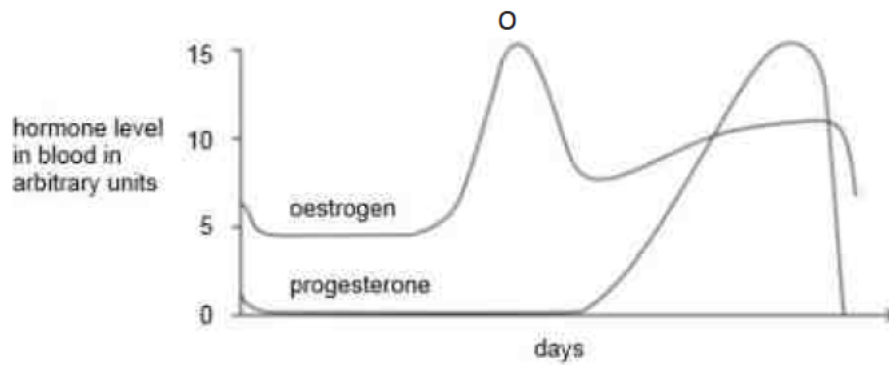
Q1	A
Q2	D
Q3	B
Q4	C
Q5	D
Q6	C
Q7	C
Q8	A
Q9	B
Q10	C

Q11	C
Q12	B
Q13	D
Q14	B
Q15	A
Q16	D
Q17	C
Q18	A
Q19	C
Q20	D

- 1 (a) A – nucleus 3
B – cell membrane
C – vacuole
[1m each]
- (b) Name of process – photosynthesis [1 m] 2
Explanation [Any suitable answer; 1 m]
 - Produce oxygen for respiration
 - Produce glucose / food
- (c)
 - During photosynthesis, glucose will be made in the chloroplasts.
 - The mitochondria will break down the glucose to release energy during respiration.
[1m each] 2
- (d) (i) The root hair cell is elongated / has a protrusion / does not have chloroplasts but the plant cell is not elongated/ does not have a protrusion / has chloroplasts 1
- (ii) The plant cell contains chloroplasts/ nucleus but the xylem does not contain chloroplasts/ nucleus. 1
- 2 (a) 1 – right atrium 2
2 – right ventricle
- (b) X – remains the same level 1
Y – increase
- (c) (i) 0.3 1
- (ii) 3 1
- (iii)
 - To transport more oxygen to the heart
 - For respiration to release more energy
2

3 (a) (i)

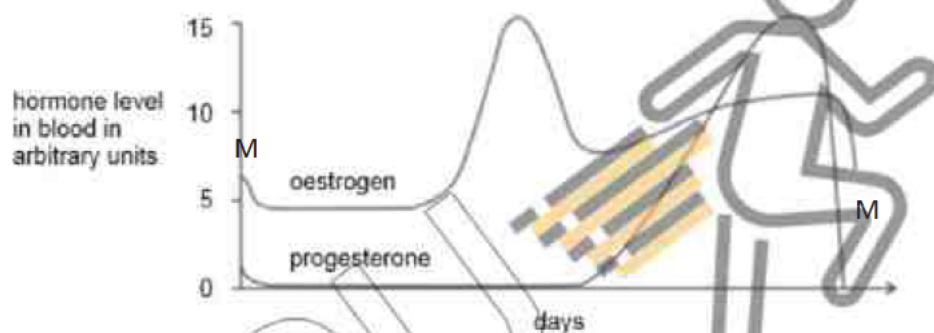
1



O from oestrogen peak to trough

(ii)

1



M from start until oestrogen line levels at start of cycle /
From where progesterone peaks to end of cycle [either one]

(b)

- Repairs and thicken the uterine lining
- Increased level of oestrogen results in ovulation

2

[1m each]

1

(c) (i)

Remains high

(ii)

- Fertilised egg divides to become embryo
- Travels to uterus and embedded into the uterine lining

2

[1m each]

4 (a)

Statement	Section letter
This is the stigma	A
This is where fertilisation occurs	C
This is where the pollen grains land at pollination	A
This is where most pollen tube growth occurs	B
This is where a seed will develop	C

2

All correct – 2 m
2/3 correct – 1 m

(b) Has a rough surface / hair-like structures / spikes to stick to insect 1

(c) (i) To prevent self-fertilisation 1

(ii)

- Greater genetic variation
- Offspring can inherit beneficial qualities from both parents

 2

[1m each]

5 (a) (i) Different forms of the same gene 1

(ii) Genetic make-up of an organism inherited from the parents 1

(b) 1 – Bb 3

2 – bb

3 – Bb

[1m each]

(c)	Parental Phenotype	Normal	x	Acatalasia	4
	Parental Genotype	Bb	x	bb	
	Gametes	 	x	 	
	F ₁ Genotype	Bb	Bb	bb	bb
	F ₁ Phenotype	Normal	Normal	Acatalasia	Acatalasia
	F ₁ Phenotypic ratio	Normal : Acatalasia 1 : 1			

1m – genotype of parents

1m – crossing

1m – genotype of F₁

1m – ratio

- 6 (a)
 - Surrounded by blood
 - One cell thick;
 - Has a thin film of moisture; 2
- (b) (i) Respiration 1
- (ii) oxygen + glucose → carbon dioxide + water + large amounts of energy 1
- (c)
 - Tobacco smoke contains carbon monoxide
 - Carbon monoxide will combine with haemoglobin in red blood cells too
 - Oxygen concentration in the red blood cells will thus decrease 3

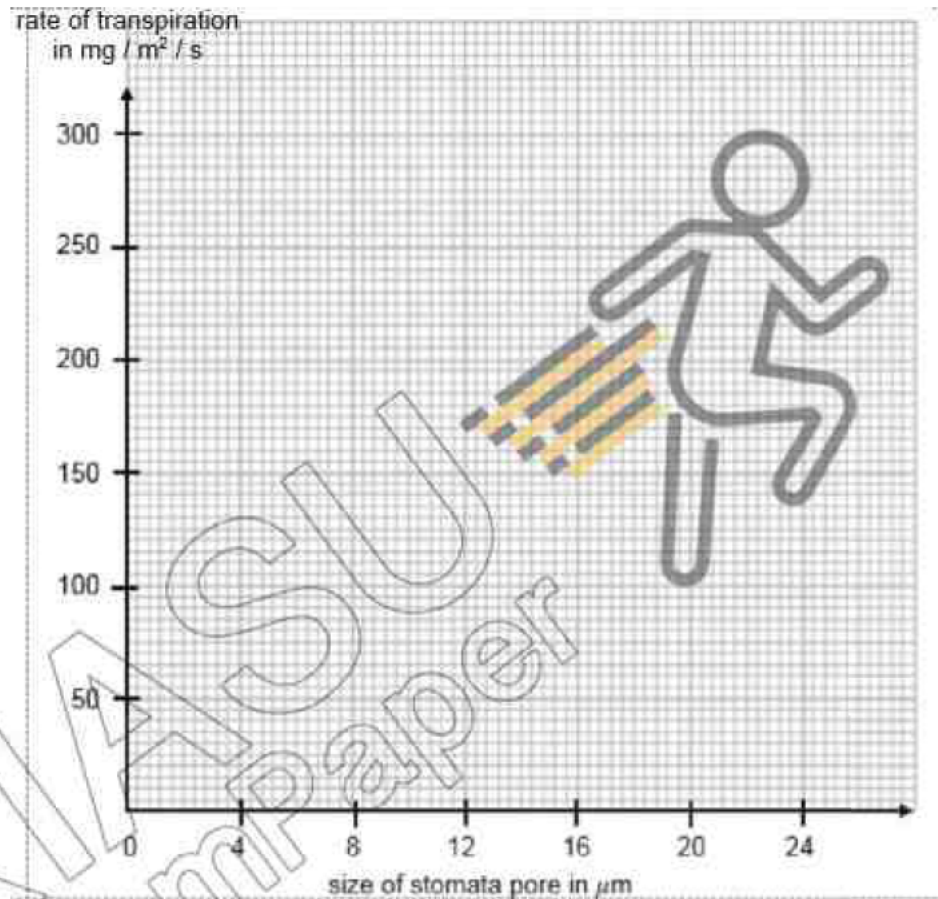
[1m each]

7 (a) Loss of water vapour from the stomata 1

- (b)
- Allow carbon dioxide in
 - Allow transpiration / water loss

[Any 1; ignore gas exchange]

(c) 3



P1 – points plotted correctly
L1 – lines drawn
K1 – Key still air and moving air

- (d)
- Level off in still air / continues to increase in moving air / more increase in moving air
 - Ref to data

[1m each]

- (e)
- Takes water vapour away / blows water vapour away / less water vapour outside
 - Increases / maintains concentration gradient
 - Diffusion occurs

[1m each]

- 8 (a)
 - numbers of brown plant hoppers remain low, up to 40 days / low numbers when spraying occurs (days 15 to 38)
 - rapid increase when spraying stopped
 - ref to numbers with unit; eg increase to maximum of over 1000 per m² 3

[1m each]

- (b) (i)
 - soil erosion - loss of topsoil
 - eroded soil resulted in flooding
 - desertification occurs – due to absence of leave canopy
 - climate change - effect on carbon dioxide in the atmosphere
 - disruption to food chain ; loss of habitat
 - extinction / loss of biodiversity 4

[1m each; any 4]

- (ii)
 - As a food source
 - Economic importance – eg rainforests are a source of raw materials for industries
 - Maintenance of biodiversity
 - Maintenance of a balanced ecosystem
 - Scientific value – studies on wildlife gives insights on human beings
 - Preservation of natural scenery and wildlife 3

[1m each; any 3]

- 9 (a)
 - At low temperature, more time is needed for indicator to change colour
 - Because the enzymes are inactive; Low kinetic energy
 - As temperature increase, less time is needed for indicator to change colour
 - More kinetic energy and higher chances of favourable collision between substrate and enzyme
 - Until the optimum temperature (40°C), least time is needed for indicator to change colour as the enzymes are most active.
 - As temperature increase, more time is needed for indicator to change colour because the enzymes are denatured. 6

[1m each]

- (b)
 - Bile emulsify fats
 - Increase surface area thus faster digestion of fats by lipase 2

[1m each]

- (c)
 - Enzymes have an active site;
 - Active site is complementary to its substrate; only the substrate is able to fit into the active site for reaction 2

[1m each]

