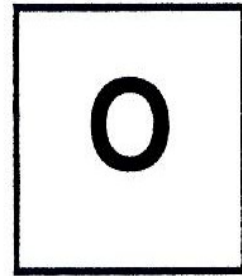




**NAVAL BASE SECONDARY SCHOOL
PRELIMINARY EXAMINATION 1, 2017**



Name: _____ () Class: _____

SCIENCE (BIOLOGY)

5078/04

Paper 4

**5 May 2017
1 hour 15 minutes**

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class at the top of the page and on all the work you hand in. Write in dark blue or black pen.

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

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

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

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 spaces provided and, if necessary, continue on separate answer paper.

For Examiner's Use	
Section A	45
Section B	
Q	10
Q	10
Total	65

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

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

Parent's/Guardian's Signature

This document consists of **19** printed pages and **1** blank page.

Section A

Answer all questions in the spaces provided.

- 1 Fig. 1.1 shows two different cells (not drawn to scale) found in the human alimentary canal.

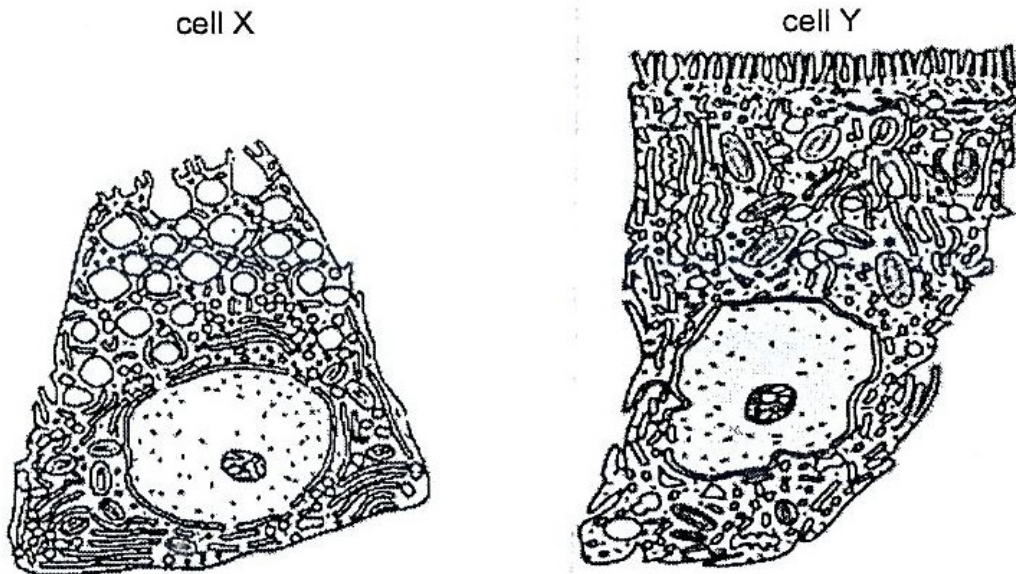


Fig. 1.1

Cell X secretes a large amount of enzyme into the stomach.
Cell Y is responsible for the uptake of soluble products of digestion.

- (a) Name the organ in which cell Y is found.

..... [1]

- (b) Describe two structural differences between cell X and cell Y.

.....

 [2]

(c) With reference to Fig. 11, explain how cell Y is adapted for its function.

.....

.....

.....

.....

[2]

[total: 5 m]

- 2 Six identical cylinders of fresh potato (A to F), each weighing 10 g, were immersed in salt solutions of different concentrations for two hours. They were removed and reweighed.

The change in mass of each potato cylinder was recorded in a bar graph as shown in Fig. 2.1.

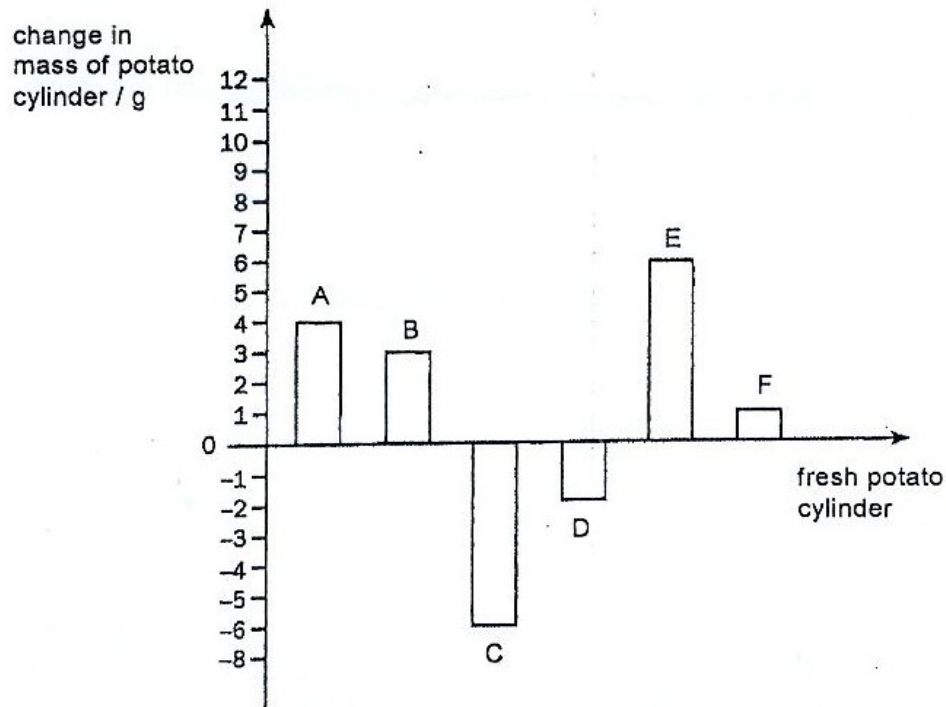


Fig. 2.1

- (a) Identify the process that results in the changes observed in Fig. 2.1.

..... [1]

(b) With reference to Fig. 2.1, identify and explain which potato cylinder has been immersed in

(i) distilled water,

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

(ii) concentrated salt solution.

.....
.....
.....
..... [4]

(c) Suggest what would happen if the potato cylinders were boiled before the experiment. Explain your answer.

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

[total: 7 m]

- 3 An investigation was conducted to find out the effect of temperature on lipase activity. The enzyme lipase was extracted from digestive juices produced by organ X, and organ X is part of the human alimentary canal. A mixture of vegetable oil, lipase and a pH indicator was put into a test-tube. The tube was placed in water bath of 35 °C and the colour of the mixture was recorded at 5-minute intervals. The pH indicator changes from blue to yellow at pH 5 or less. The investigation was repeated at other temperatures and the results are shown in Table 3.1.

Table 3.1

time / minutes	water bath temperature / °C					
	5	15	25	35	45	55
5	blue	blue	blue	blue	blue	blue
10	blue	blue	blue	yellow	blue	blue
15	blue	blue	yellow	yellow	blue	blue
20	blue	yellow	yellow	yellow	yellow	blue
25	blue	yellow	yellow	yellow	yellow	blue

- (a) (i) Identify organ X.

..... [1]

- (ii) Explain for the change in colour of the pH indicator.

.....

 [2]

- (b) With reference to Table 3.1, describe and explain the results in the tubes that were placed in 15 °C and 35 °C.

.....

.....

.....

.....

.....

.....

..... [4]

- (c) After 25 minutes, the tubes originally incubated at 5 °C and 55 °C were then incubated at 30 °C for a further 20 minutes.
The final colour seen in these test tubes is recorded in Table 3.2.

Table 3.2

	results after 25 minutes at original temperature	results after a further 20 minutes at 30 °C
tube originally at 5 °C	blue	yellow
tube originally at 55 °C	blue	blue

Explain why the tube incubated at 55 °C did not turn yellow in the end.

.....

.....

..... [2]

[total: 9 m]

4 Fig. 4.1 shows an experiment setup to investigate photosynthesis.

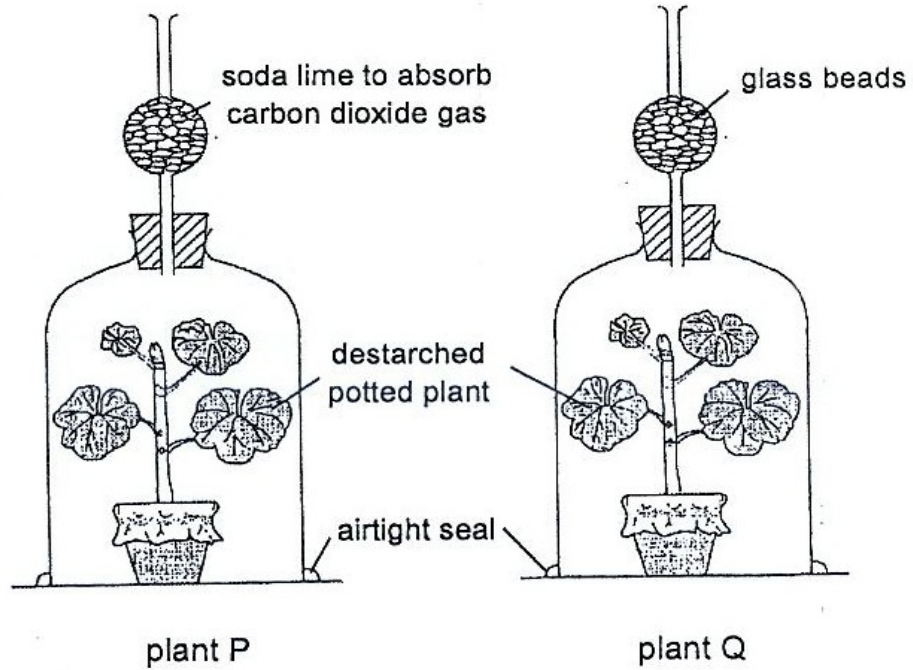


Fig. 4.1

(a) Both plants were destarched before the experiment started. Explain why this step is necessary.

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

(b) Describe the function of plant Q in the experiment.

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

(c) Both plants were left out in the sunlight for 12 hours. After that, a leaf was taken from each plant and iodine test was performed on the leaves. Describe and explain the results obtained from each plant.

.....

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.....

.....

.....

.....

.....

.....

[3]

(d) List one other factor that affected the rate of photosynthesis.

.....

[1]

[total: 6 m]

- 5 (a) Write the word equation for aerobic respiration.

..... [1]

- (b) Table 5.1 shows the effect of breathing air containing different concentrations of carbon dioxide.

Table 5.1

percentage of carbon dioxide in inhaled air / %	volume of each breath / cm ³	breathing rate / breath per minute
0.03	520	14
1.00	750	16
3.00	1200	18
5.00	2200	25

- (i) Calculate the total volume of air entering the lungs per minute when breathing in air containing 3% carbon dioxide. Show your working.

..... [2]

- (ii) Describe and explain the effects of breathing air containing different concentration of carbon dioxide.

.....

 [3]

(c) Describe how the alveolus is adapted to enable gases exchange to take place efficiently.

.....

.....

.....

.....

.....

[2]

[total: 8 m]

- 6 (a) Compare the difference between how a reflex action differs from a voluntary action.

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

- (b) (i) Karen woke up in the middle of the night, she turned on the lights. Describe how her eyes respond when bright light is shone into them.

.....
.....
.....
..... [3]

- (ii) Give a reason why her eyes responded the way described in (b)(i).

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

[total: 6 m]

7 Fig. 7.1 shows a food chain in a temperate forest.

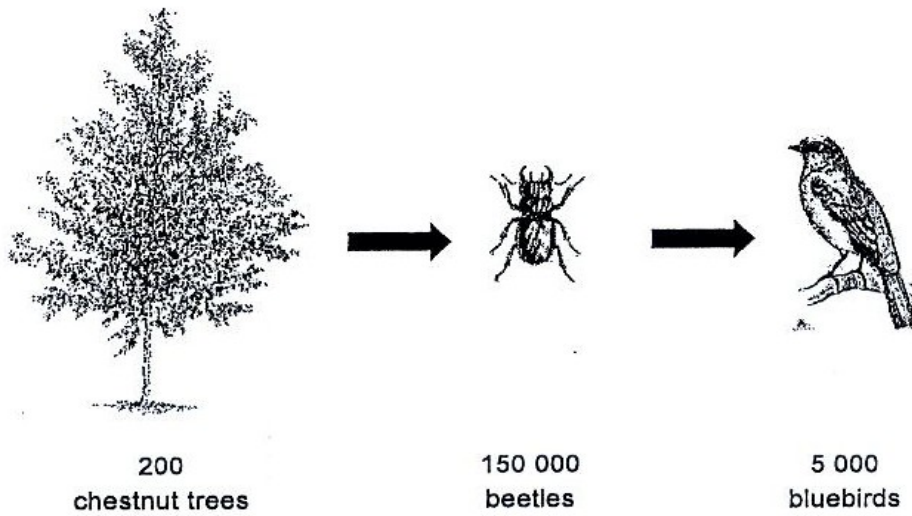


Fig. 7.1

(a) Draw and label a pyramid of numbers for the food chain shown in Fig. 7.1.

[2]

(b) Explain why not all of the energy in the primary consumers is passed on to the secondary consumers.

.....

.....

.....

.....

[2]

[total: 4 m]

(b) Explain why the graph for sugar concentration in the stem has a similar shape as the graph representing sugar concentration in leaves.

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

[2]

(c) How will the sugar, being transported by the stem, be used?

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

[2]

[total: 10 m]

- (ii) If the ovum is not fertilised, describe and explain what happens to the unfertilised ovum and make reference to the hormones involved.

.....

.....

.....

..... [2]

- (b) The process of fertilisation takes place in both plants and humans in order to produce offspring.
Explain how the process is different in plants and in humans.

.....

.....

.....

..... [2]

[total: 10 m]

- (i) Explain why two tabbies with blotched stripes cannot produce a kitten with parallel stripes.

.....

.....

.....

..... [2]

- (ii) Draw a genetic diagram to show the probability of getting a kitten with blotched stripes when two parallel heterozygous cats were mated.

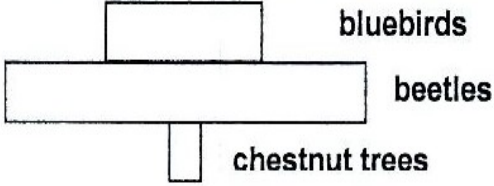
[4]

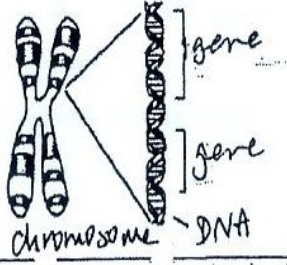
[total: 10 m]

End of Paper

4E5N Sci Biology Prelim 1 2017		
Qn	Answer	Marks/remarks
1a	small intestine/ ileum	1
1b	Cell Y has a lot of mitochondria while cell X has lesser mitochondria; Cell X does not have microvilli while Cell Y has many microvilli present; Cell X has many vacuoles while Cell Y has very few vacuoles.	any two 1 1
1c	Cell Y has microvilli. To <u>increase the surface area</u> for <u>absorption</u> of digested food.	1, 1
2a	osmosis	1
2bi	E. The diluted salt solution will have a <u>higher water potential</u> than the potato cells. Water molecules <u>diffused into</u> the potato cells by osmosis. The mass of the potato cylinder <u>increases</u> .	0.5 0.5 0.5 0.5
2bii	C. The concentrated salt solution will have a <u>lower water potential</u> than the potato cells. Water molecules <u>diffused out</u> of the potato cells by osmosis. The mass of the potato cylinder <u>decreases</u> .	0.5 0.5 0.5 0.5
2c	boiling <u>destroys partially permeable membrane</u> and thus there will be <u>no osmosis</u> / no net movement of water molecules	1 1 rej: mass remains the same
3ai	duodenum /small intestine;	1
3aaii	lipase had digested the oil into <u>fatty acids and glycerol</u> ; fatty acids lower the pH/ more acidic	1 1
3b	At <u>15 °C</u> , the time taken for the tube to turn yellow, took <u>20</u> min, enzymes/lipase are <u>less active/inactive</u> . At <u>35 °C</u> (optimum temperature), the time taken for the tube to turn yellow, took <u>10</u> min, enzymes/lipase are the <u>very active</u> .	Must QD 1 1 0.5 1 1 (max 4)
3c	Lipase's <u>active site is destroyed</u> and the lipase is <u>denatured</u> at 55°C;	1, 1
4a	Destarching removes all starch from the leaves to ensure <u>accurate</u> results/ ensure that starch formed during the experiment is accurately recorded	1
4b	Serves as a control, to show that carbon dioxide is required for photosynthesis.	control – 0.5 1

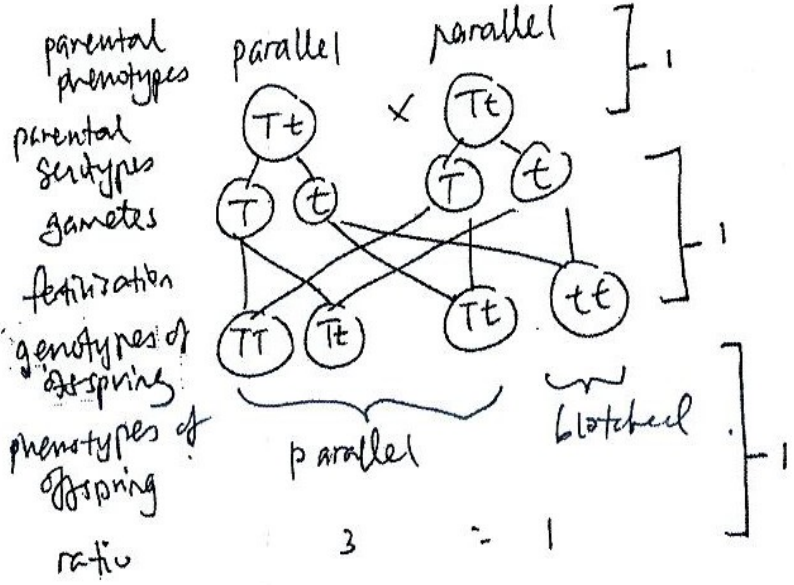
4c	<p>The leaf from plant P - iodine solution remains brown; As carbon dioxide is absorbed by the soda lime, none is available to the plant, so no photosynthesis occurs.</p> <p>The leaf from plant Q - iodine solution turns blue-black ; All the materials and conditions required for photosynthesis are available, so the plant is able to produce glucose which is converted to starch.</p>	0.5 1 (must show relationship) 0.5 1 (must show relationship)								
4d	temperature / light intensity / amount of chlorophyll	1								
5a	glucose + oxygen → carbon dioxide + water + (large amount of energy)	1								
5bi	Total volume= 1200 x 18 = 21 600 cm ³	1 1								
5bii	<p>Increasing carbon dioxide concentration increases the rate of breathing per minute. OR</p> <p>Increasing carbon dioxide concentration increases the volume of breath taken / deeper breaths</p> <p>Breathing deepens - Take in more air (oxygen) into lungs</p> <p>Breathing rate increases – helps to remove carbon dioxide</p>	1 1 1 1								
5c	<p>One cell thick epithelium → Short distance for fast gaseous exchange</p> <p>A layer of moisture lining the alveolus → for oxygen gas to dissolve before diffusing into the blood</p> <p>Richly supplied with blood capillaries → to maintain a (steep) concentration gradient for fast diffusion of gases</p>	<p>must have corresponding structure and function</p> <p>1 x 2</p>								
6a	<table border="1"> <thead> <tr> <th>Reflex action</th> <th>Voluntary action</th> </tr> </thead> <tbody> <tr> <td>immediate response</td> <td>takes a longer time to complete</td> </tr> <tr> <td>takes place with a stimulus</td> <td>takes place with or without a stimulus</td> </tr> <tr> <td>does not involve conscious thought</td> <td>involves conscious thought</td> </tr> </tbody> </table>	Reflex action	Voluntary action	immediate response	takes a longer time to complete	takes place with a stimulus	takes place with or without a stimulus	does not involve conscious thought	involves conscious thought	<p>any 2</p> <p>1 x 2</p> <p>no 0.5 m</p>
Reflex action	Voluntary action									
immediate response	takes a longer time to complete									
takes place with a stimulus	takes place with or without a stimulus									
does not involve conscious thought	involves conscious thought									
6bi	<p>When bright light is shone into the eye, the <u>circular muscles of the iris will contract</u>, while the <u>radial muscles of the iris will relax</u>.</p> <p>This helps to <u>constrict the pupil</u>, to reduce the amount of light entering the eyes.</p>	1 1 1								
6bii	This helps to prevent excessive light from entering the eye and <u>damaging the retina</u> .	1								

7a		drawing – 1 label -1 (must be drawn to scale)
7b	<p>Energy can be lost in the following ways:</p> <ul style="list-style-type: none"> • as <u>heat during respiration</u> at every trophic level • in uneaten body parts • through undigested matter egested by consumers • through waste products excreted by consumers (E.g. urea) 	Any 3 1 x 3
8a	<p>From 0000 to 0600 h, sugar concentration in the leaves decreases. No sunlight during the period, photosynthesis did not occur/ sugar in the leaves was oxidised/ used during respiration.</p> <p>From 0600 to 1500 h, sugar concentration in the leaves increases to <u>maximum of 20 units/</u> highest.</p> <p>As light intensity increases to noon, the rate of photosynthesis increases. Thus, more sugar is produced.</p> <p>From 1500 to 2400 h, sugar concentration in the leaves decreases. Light intensity decreases in the night, rate of photosynthesis decreases. Thus, lesser sugar is produced.</p>	1 1 (either 1) 1 1 (must show relationship) 1 1 (must show relationship)
8b	<p>When more sugar is made in the leaves, more sugar will be present in the stem.</p> <p>More sugar will be <u>translocated/transported</u> to other parts of the stems through the <u>phloem</u> in the stem. This causes the increase in the sugar in stem.</p>	1 1
8c	<ul style="list-style-type: none"> - oxidised to released <u>energy during respiration</u> - component of cellulose cell walls - combined with mineral salts to form amino acids - stored as starch 	any 2 1 x 2

9ai	<p><u>Oestrogen</u> is important for the <u>repair and growth</u> of the uterine lining.</p> <p>High levels of <u>oestrogen stimulates ovulation</u>.</p> <p><u>Progesterone</u> increases to <u>stop ovulation</u> and maintains the uterine lining by <u>further thickening</u> to prepare for <u>implantation</u> of the ovum.</p> <p>(must show relationship btw hormone and events)</p>	<p>1</p> <p>1</p> <p>1</p> <p>1, 1 (max 2 for progesterone)</p> <p>hormone 1 x 2</p>
9aii	<p>If ovum is not fertilised, the levels of the <u>oestrogen and progesterone will decrease</u> resulting in the <u>next menstrual cycle/menstruation</u> to occur.</p>	<p>1</p> <p>1</p>
9b	<p>Any one</p> <p>In plants, the pollen grain reaches the ovum via the <u>growth of a pollen tube</u>. In humans, the <u>sperms are motile and they swim</u> towards the ovum.</p> <p>In plants, site of fertilisation is in the <u>ovule</u> which is <u>within the ovary</u>.</p> <p>In humans, site of fertilisation is in the <u>oviduct</u> which is <u>not within the ovary</u>.</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>must show comparisons</p>
10a	<p>A chromosome is a <u>DNA that is highly coiled</u> and condensed around proteins.</p> <p>A DNA is a <u>double-helix</u> made of 2 strands of polynucleotides.</p> <p>A gene is a <u>short segment of DNA</u> that codes for a <u>specific polypeptide</u>.</p> 	<p>1</p> <p>1</p> <p>1</p> <p>diagram – 1</p>
10b	<p>Both tabbies with blotched stripes are <u>homozygous recessive</u> and carry only the recessive allele for blotched stripes.</p> <p>They are <u>unable to contribute any dominant allele for parallel stripes</u>.</p>	<p>1</p> <p>1</p>

10c

Correct labels



probability = 1/4 or 0.25

genetic diagram - 3

probability - 1

Label wrong - deduct 1 m

nv circle - deduct 1 m

nv draw the cross - deduct 0.5 m



康 柏 中 学

**COMPASSVALE SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2017
SCIENCE (BIOLOGY) 5078/04
Paper 4 Theory
Secondary 4 Express / 5 Normal (Academic)**

Name : _____

Duration: 1 h 15 min

Index No : _____

Date: 24 Aug 2017

Class : _____

Marks: _____ / 65

READ THESE INSTRUCTIONS FIRST

Write your full name, class and index number in the spaces provided on the question paper and on all separate answer paper used.

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

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

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

Answer **all** questions in Section A and any **two** questions in Section B.

Enter the numbers of the Section B questions you have answered on the dotted lines in the grid below.

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

	For Examiner's Use
Section A	
Section B	
.....	
.....	
Total	

This paper consists of 15 printed pages including this page.

Section A [45 marks]

Answer **all** questions. Write your answer in the spaces provided on the question paper.

- 1 An experiment was carried out to investigate the effects of sugar solutions on onions.
- 5 pieces of onion rings of similar sizes were obtained from the outermost layer of an onion bulb.
 - Each onion ring was 2 mm thick.
 - The onion rings were placed in petri dishes containing solutions of different sugar concentration.
 - The vertical internal diameter of the onion rings were measured and recorded at the start of the experiment and after 30 minutes of being immersed in the solutions.

Fig. 1.1 shows one of the onion rings.

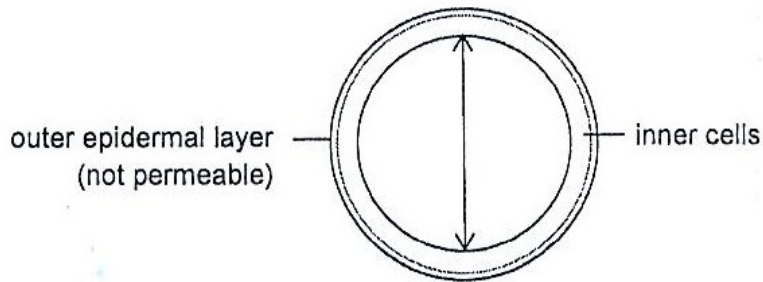


Fig. 1.1

Table 1.2 shows the measurements taken.

Table 1.2

concentration of sugar solution / %	initial diameter / cm	final diameter / cm	change in diameter / cm	percentage change in diameter / %
0	6.3	6.9	+ 0.6	+ 9.52
10	6.1	6.5	+ 0.4	+ 6.56
20	6.0	6.2	+ 0.2	+ 3.33
30	6.0	5.9	- 0.1	- 1.67
40	6.1	5.8	- 0.3	- 4.92

- (a) Name the process that resulted in the changes in diameter of the onion rings.
 [1]
- (b) State one condition needed for the process in (a) to occur.
 [1]

(c) Explain why some of the onion rings had a positive change while some had a negative change in diameter.

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

(d) Another student carried out a similar experiment, but using onion rings that were cut into two. Instead of measuring the diameter, he only observed the change in appearance. Fig. 1.3 shows the cut onion rings before the experiment.

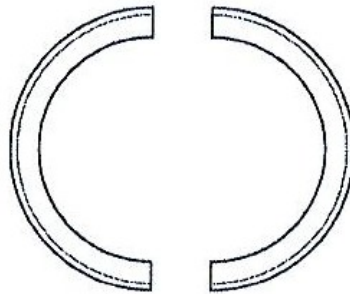


Fig. 1.3

Besides the change in size, suggest and draw how the shape of the cut piece of onion ring had changed after 30 minutes, for the pieces that were placed in 0% and 40% sugar solution.

shape of the cut piece of onion ring placed in 0 % sugar solution	shape of the cut piece of onion ring placed in 40 % sugar solution

[2]

- (e) A small piece of the outer epidermal layer of the onion was peeled off and observed under a light microscope. Fig. 1.4 shows the cells as seen under the microscope.

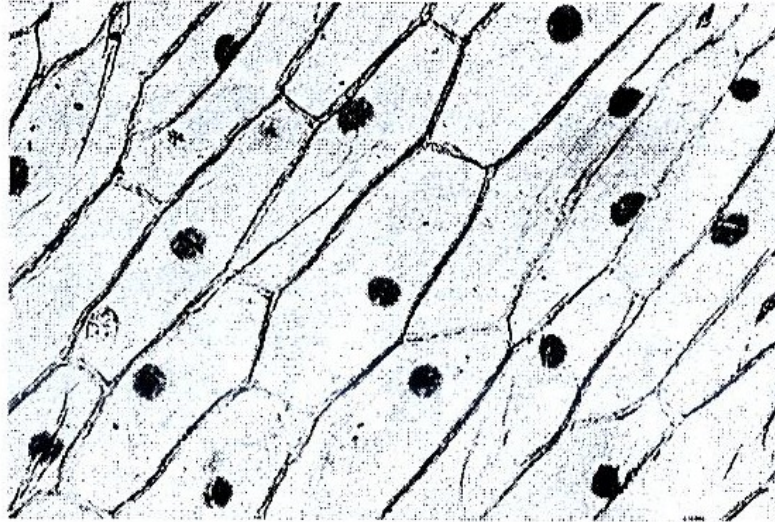


Fig. 1.4

On Fig. 1.4, identify

- (i) a structure in these cells that cannot be found in animal cells.
Label this structure as X and name it. [1]
- (ii) a structure in these cells that can also be found in animal cells.
Label this structure as Y and name it. [1]

[Total: 8]

2 Fig. 2.1 is a flow diagram showing the pathways taken by oxygen and carbohydrates from their absorption into a mammal's blood to their use in the liver.

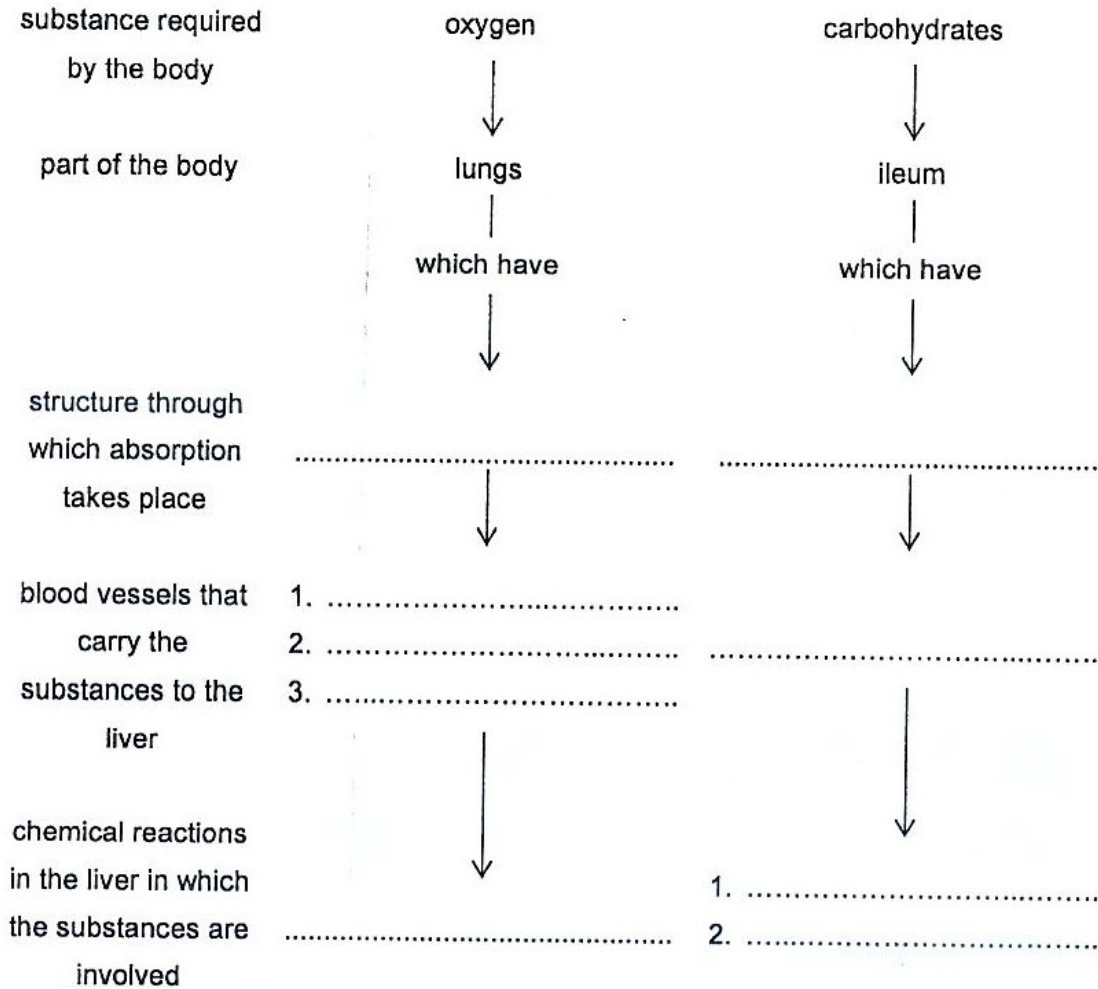


Fig. 2.1

- (a) Fill in the spaces in Fig. 2.1 to state
- the structures involved
 - the blood vessels used
 - what happens in the liver cells

[4]

[Total: 4]

- 3 During heart transplant procedures, it is possible to keep the heart beating while it is being transported many miles from the donor to the patient. Fig. 3.1 shows diagrammatically how the heart is kept beating during transportation.

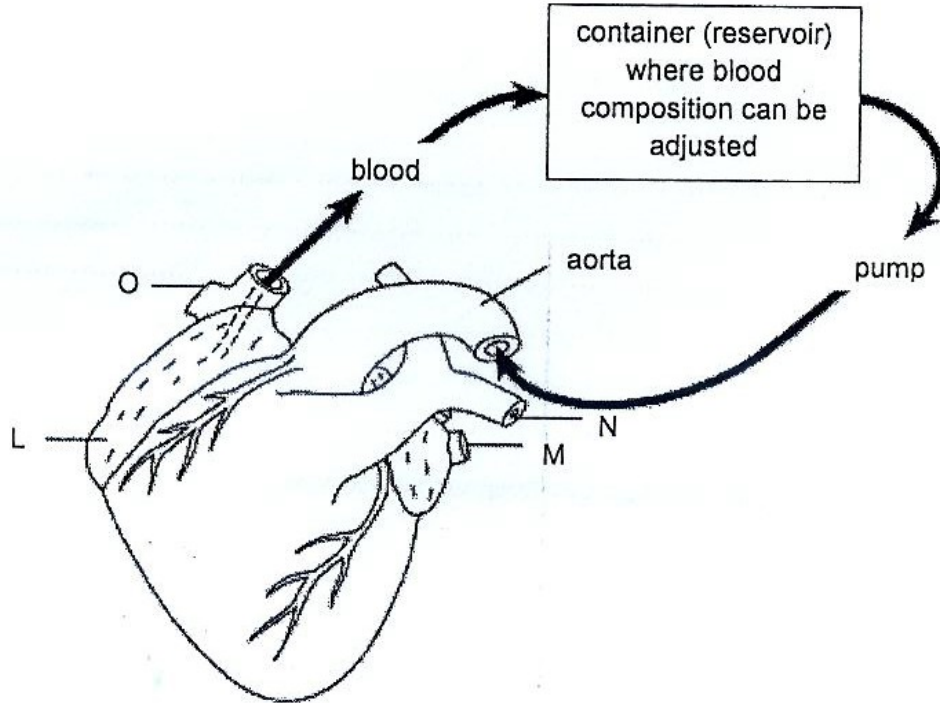


Fig. 3.1

- (a) Name structures L, M, N and O.

chamber L	.....	blood vessel M	.....
blood vessel N	.....	blood vessel O	.....

[2]

- (b) Suggest a substance that must be added to the blood in the reservoir and explain your suggestion.

substance

explanation

.....

..... [2]

(c) Using your knowledge of blood vessels and the structure of the heart, explain why blood entering the aorta from the reservoir flows into the heart muscle and **not** into the left ventricle.

.....

.....

.....

.....

.....

.....

[3]

[Total: 7]

4 The bar chart in Fig. 4.1 shows the percentage of energy released by aerobic and anaerobic respiration during races run by athletes over different distances.

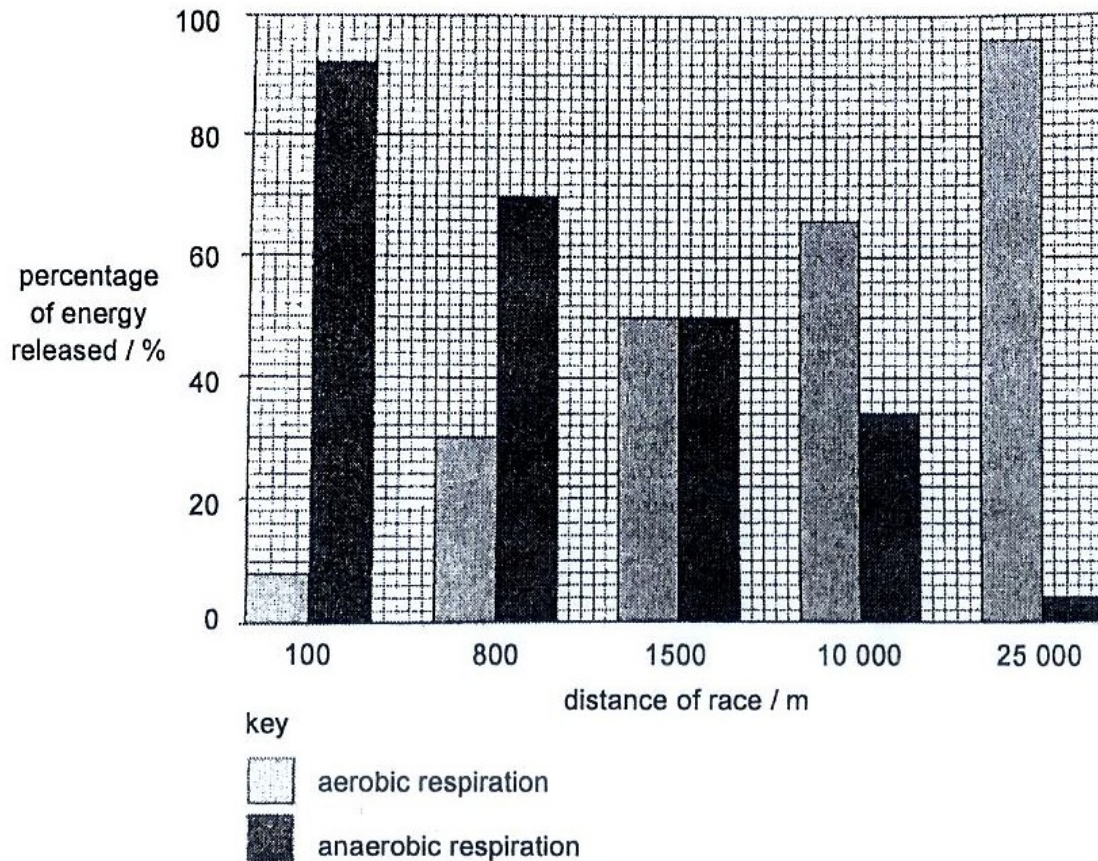


Fig. 4.1

(a) State the word equation for:
aerobic respiration

.....

anaerobic respiration

.....

[2]

(b) Compare the effect of distance of race on the percentage of energy released by different types of respiration.

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

(c) Explain why anaerobic respiration occurs during a race.

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

(d) With reference to the information given in Fig. 4.1, describe how sprinters and marathon runners obtain most of their energy for their races. Suggest an explanation for your answer.

.....
.....
.....
.....
.....
..... [3]

(e) Suggest and explain one way how smoking can affect an athlete's performance.

.....
.....
.....
.....
.....
..... [3]

[Total: 12]

- 5 Fig. 5.1 shows a method used by a student to understand how traits are inherited. Both cubes had three of their faces marked with the letter T and three with the letter t.

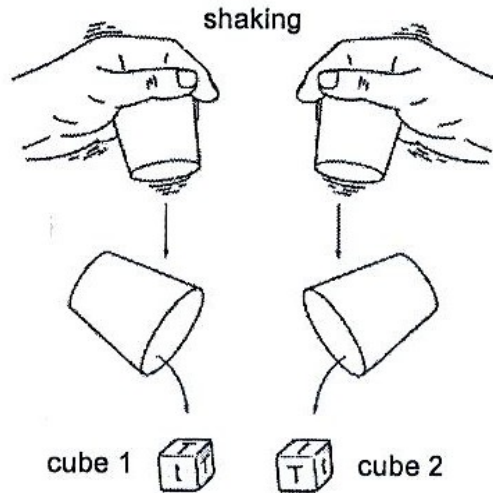


Fig. 5.1

In this example, the letters appearing on the upper faces are Tt.

The student shook each container and then flipped both cubes out at the same time and recorded the letters appearing on the upper faces of the cubes.

The student tipped both cubes out a total of 405 times.

- (a) (i) Complete Table 5.2 to show the results obtained.

Table 5.2

letters appearing on the upper faces of the cubes	tt	TT	Tt
number of times each pair of letters appeared	98	.....	202

[1]

- (ii) State what the letters on the faces of the cubes represent.

..... [1]

- (ii) Suggest the reason for shaking the containers.

..... [1]

- (b) In humans, T and t control the type of ear lobes. A person will have attached earlobes only if he is homozygous for this trait.

The pedigree in Fig. 5.3 shows the inheritance of this trait in a particular family.

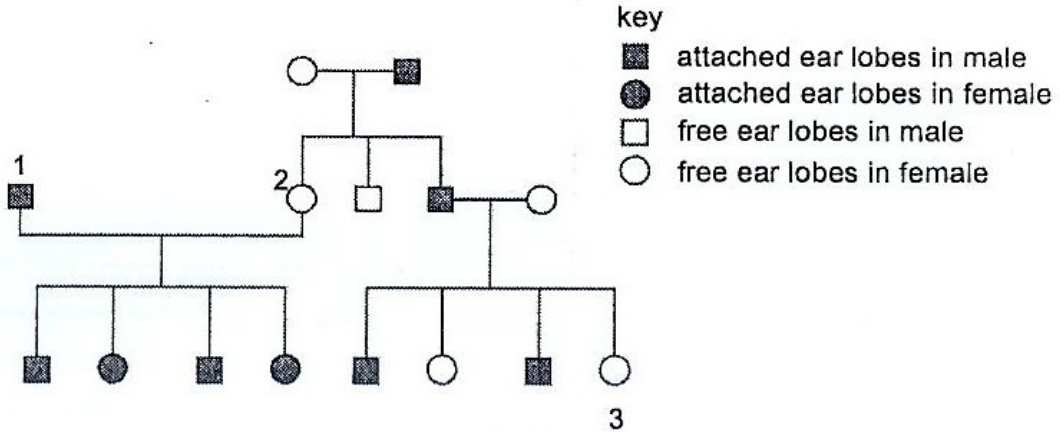


Fig. 5.3

- (i) State and explain the genotype of individual 3.

.....

 [2]

- (ii) Complete the Punnett square below to show the probability of individual 1 and 2 having a child with attached ear lobes.

		individual 1 gametes	
individual 2 gametes			

[2]

- (iii) Compare your answer in (ii) to the four children of individual 1 and 2 in Fig. 5.3. Suggest reasons for the difference.

.....

 [2]

- (iv) State the type of variation shown in ear lobes and draw an appropriate diagram to show its distribution in this particular family.

type of variation [2]

[Total: 11]

- 6 The release of intestinal juice as a result of tasting food in the mouth is a reflex action. This reflex action is similar to that of the pupil of the eye in response to bright light. Use the terms motor neurone, relay neurone and sensory neurone to describe the reflex action occurring in the small intestine as a result of tasting food in the mouth.

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

[3]

[Total: 3]

- (b) Fig. 7.2 shows the amount of oxygen in the same lake before time B. Complete the graph to show how the oxygen concentration will change over the same time period shown in Fig. 7.1.

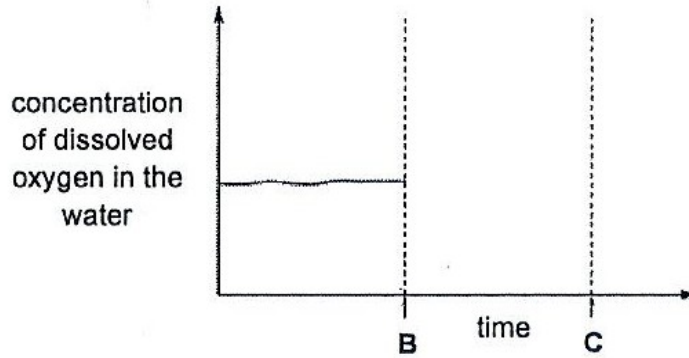


Fig. 7.2

[1]

- (c) Describe the role of:

(i) bacteria in sewage treatment

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

(ii) oceans as carbon sink

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

[4]

[Total: 10]

- 8 (a) With reference to the organelles in plant cells, describe how plants use light energy from the sun and release the energy back into the atmosphere.

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..... [4]

- (b) Fig. 8.1 shows the Flower Dome at Singapore Gardens by the Bay. It is a large glass greenhouse that displays various plants from different countries.

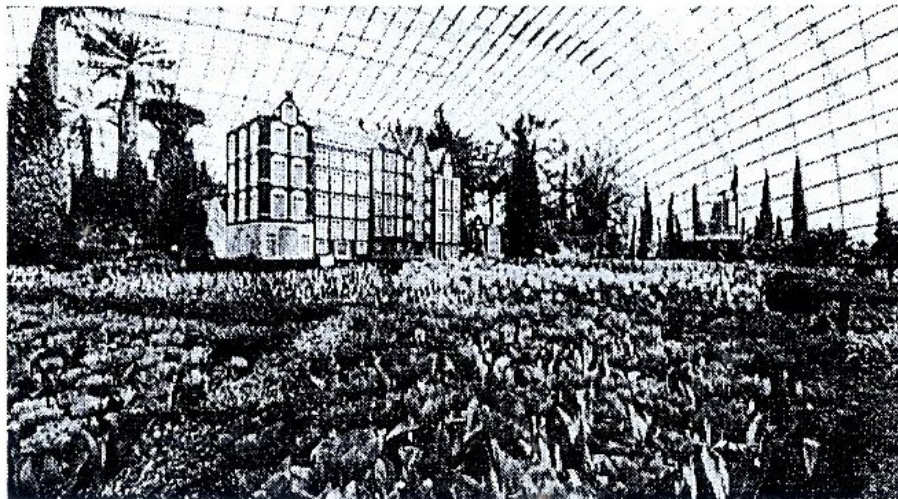


Fig. 8.1

State the conditions in the glasshouse that must be controlled to ensure maximum growth of the plants. Suggest how these conditions can be controlled.

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..... [6]

[Total: 10]

9 (a) Define *hormones*.

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.....
.....
..... [3]

(b) Describe how insulin is transported from the site of production to its target organ.

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.....
..... [5]

(c) Suggest an explanation why hormones are usually produced in the form of small molecules.

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..... [2]

[Total: 10]

End of Paper

Answer Scheme

Paper 4

1a osmosis

B partially permeable membrane/difference in water potential between two regions/water potential gradient

C the onion cells in 0, 10 and 20 % sugar solution had a lower water potential than the sugar solution (0.5). thus, water molecules moved into the onion cells (0.5) resulting in positive change in diameter.

the onion cells in 30 and 40 % sugar solution had a higher water potential than the sugar solution (0.5). thus, water molecules moved out of the onion cells (0.5) resulting in negative change in diameter.

D

shape of the cut piece of onion ring placed in 0 % sugar solution	shape of the cut piece of onion ring placed in 40 % sugar solution
Become less curved/ or curved outwards	Become more curved

Ei cell wall ;

ii nucleus/cytoplasm/cell membrane (if its clearly different from cell wall labelled in ei) ;

2a structure through which absorption takes place : alveolus / villus

Blood vessels: pulmonary vein, aorta, hepatic artery/hepatic portal vein

Chemical reactions: aerobic respiration/respiration, conversion to glycogen

All correct : 4m 6 to 8 correct : 3m 4 to 5 correct : 2 m 2 to 3 correct : 1m

1 correct: 0m

3a L: right atrium M: pulmonary vein M: pulmonary artery O: vena cava (0.5 each)

B glucose/oxygen (0.5)

It is needed for heart muscles cells to respire (0.5) to release energy (0.5) for muscle contraction (0.5)

C there are valves in the aorta that prevents the backflow of blood back into the ventricles (1). Thus, blood in the aorta enters the coronary artery that branches from the aorta (1). coronary artery transports blood to the heart muscle cells (1).

4a aerobic: glucose + oxygen → carbon dioxide + water + energy ;

anaerobic: glucose → lactic acid + small amount of energy ;

- b as the distance of race increases, the percentage energy released by aerobic respiration increases (1) but the percentage energy released by anaerobic respiration decreases (1)
- c during a race, insufficient oxygen (0.5) is supplied to the muscle cells (0.5) to meet the energy demand/for aerobic respiration to release enough energy (0.5) thus, anaerobic respiration occurs to release extra energy (0.5)
- d sprinters obtain most of their energy from anaerobic respiration (0.5) and marathon runners obtain most of their energy from aerobic respiration (0.5). this is because, during a sprint, the energy demand increases rapidly over a short time (0.5). the athlete cannot breathe faster/deeper to take in more oxygen (0.5). however, during a marathon, energy demand increases more gradually over a longer period of time (0.5). thus, the athlete can breathe faster/deeper to take in more oxygen (0.5),
- e carbon monoxide in cigarette smoke binds irreversibly to haemoglobin (0.5). less oxygen can bind to haemoglobin (0.5) and transported to muscle cells . muscle cells respire less, releasing less energy (0.5), decreasing athlete's performance (0.5)

OR

Tar paralyses cilia (0.5). mucus/dirt not able to be swept up, blocking airways (0.5). this results in breathlessness/difficulty in breathing (0.5). less oxygen for muscle cells to respire and release energy (0.5), decreasing athlete's performance (0.5) max 2m

5ai 105

aii alleles

aiii to ensure that the result is random

bi heterozygous/Tt (0.5). His father is homozygous recessive (0.5) and his mother is heterozygous (0.5). thus she inherited a recessive allele from the father and the dominant allele from the mother. (0.5)

ii

		individual 1	
		t	t
individual 2	T	Tt	Tt
	t	tt	tt

iii even though there is a 50% chance (0.5) for each of their child to have attached/free earlobes, all four children have attached earlobes (0.5) due to random fusion of gametes (0.5) and small sample size (0.5)

v bar chart (axis – 0.5, labelled bars + correct trend 0.5)

discontinuous variation (1)

- 6 tasting of food in the mouth will stimulate the receptors on the tongue/mouth (0.5) and produce nerve impulses which is sent to the brain (0.5) via the sensory neurone (0.5). the nerve impulses is then transmitted across a synapse to the relay neurone (0.5) and across another synapse to the motor neurone (0.5). The motor neurone will then transmit the nerve impulses to the effector which is the intestinal glands (0.5) to secrete the intestinal juice.
- 7a eutrophication occurs (0.5). excess nitrates and phosphates causes rapid algae growth (0.5) on the surface of the lake. submerged plants cannot get sunlight to photosynthesize (0.5). plants population decreases (0.5) as they die and decomposed by bacteria (0.5). bacteria multiplies rapidly (0.5) and increases in population (0.5). bacteria use up more oxygen for respiration (0.5). lack of oxygen causes fishes to die (0.5) and decrease in population (0.5).
- B oxygen concentrations will change in a similar way to graph for plants. (1)
- C bacteria is used in aeration tanks (0.5) where they respire aerobically (0.5) and release enzymes (0.5) to break down harmful substances to harmless substances (0.5).
- D when organisms in the oceans die, they are buried in the seabed (0.5) and form fossil fuels (0.5). These fossil fuels contain carbon (0.5). Thus the ocean will store carbon more than it releases /stores carbon for an infinite period of time (0.5)
- 8a the chloroplasts (0.5) contain chlorophyll (0.5) which will trap light energy from the sun (0.5) and converts it to chemical energy (0.5) which is stored in glucose during photosynthesis (0.5). the mitochondria (0.5) then break down the glucose produced (0.5) during respiration (0.5) to release energy back into the atmosphere.
- B carbon dioxide concentration (1) – air pump (0.5) to ensure that carbon dioxide concentration remains high (0.5) OR carbon monoxide sensor (0.5) to monitor carbon dioxide concentration (0.5)
- Light intensity (1) – glass panels (0.5) that can regulate the amount of light passing through (0.5)
- Temperature (1) – temperature sensors (0.5) to monitor temperature (0.5) / thermoregulators (0.5) to maintain optimum temperature (0.5) / insulating material (0.5) to prevent too much heat loss or gained (0.5)
- Relating suggestions to allow for maximum rate of photosynthesis (0.5m)
- Max 6 m
- 9a hormones are chemical substances (0.5) produced by endocrine glands (0.5), secreted directly into bloodstream (0.5) and affects one or more target organs (0.5). it is destroyed by the liver (1).
- B insulin is produced by the islets of Langerhans/pancreas (0.5) and released directly into the bloodstream/capillaries (0.5). it is dissolved (0.5) and transported by the plasma (0.5). it is transported back to the heart (0.5) via the vena cava (0.5) and out of the heart (0.5) via the aorta (0.5). it is then transported to the liver, its target organ (0.5) via hepatic artery (0.5) .

C to pass through the partially permeable (1) membrane of the capillaries (0.5) and the cells of their target organs (0..5)

NAME: _____ () CLASS: SEC 4E _____



HOUGANG SECONDARY SCHOOL

PRELIMINARY EXAMINATION 1 / 2017

SCIENCE (BIOLOGY) 5078/01
Paper 1 Multiple Choice

SECONDARY FOUR EXPRESS / FIVE NORMAL (ACADEMIC)

Friday, 30 June 2017

Total duration for paper 1 and 4
1 hour 45 minutes

MAKE THE DIFFERENCE RESPECT OURSELVES RESPECT OTHERS MAKE THE DIFFERENCE RESPECT OURSELVES RESPECT OTHERS MAKE THE DIFFERENCE
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READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your name, register number and class on the Answer 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 Answer Sheet. (OTAS)

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.

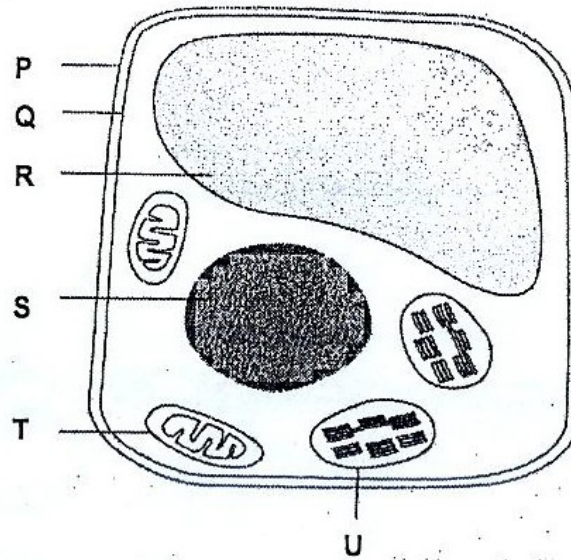
Total marks for Paper 1 and 4 is 85.

Hand in Paper 1, Paper 4 and OTAS separately.

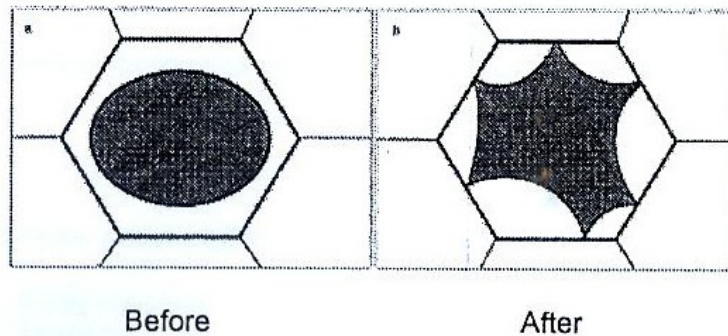
This document consists of 9 printed pages (including this cover page).

[Turn over

- 1 Which structures show that the cell shown below is a plant cell and not an animal cell?



- A P, Q and S only
 B P, R and T only
 C P, R and U only
 D P and U only
- 2 The diagram below shows a plant cell before and after it is placed in liquid X for twenty minutes.



Based on the diagram, which of the following statements is incorrect?

- A Liquid X has a lower water potential than the cell sap.
 B Only the central vacuole of the plant cell has changed in volume.
 C The movement of water does not require energy.
 D The volume of liquid X was higher at the end of the twenty minutes.

- 3 A student is tasked to determine if a food sample contains carbohydrates.

Which of the following food test(s) should he carry out?

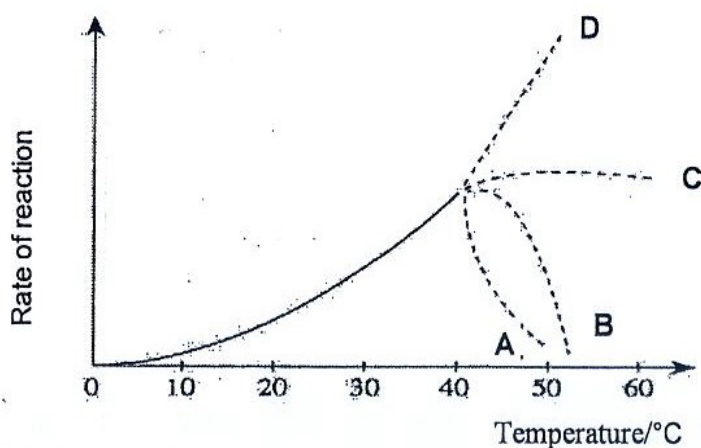
- I Benedict's test
- II Biuret test
- III Ethanol-emulsion test
- IV Iodine test

- A I only B I & II only C I & IV only D II & III only

- 4 A student is investigating the activity of enzyme Q which is typically found in organisms that live in the vent of hot springs (about 120 °C).

The graph shows how activity of the enzyme changes with temperature.

Which line correctly shows the activity of the enzyme after 40 °C?



- 5 After a student chews on a piece of bread for some time, a sweet taste develops in her mouth.

What is the best explanation for this?

- A Bacteria in the mouth feed on starch and produce sugar.
- B Enzymes in the saliva digest the starch into maltose, which is a sugar.
- C Sugar in the bread diffuses into her mouth.
- D There is a greater secretion of saliva into sugar.

6 In the event of liver failure, which of the following would be affected in terms of their digestion and assimilation?

- I alcohol
- II fat
- III proteins
- IV starch

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

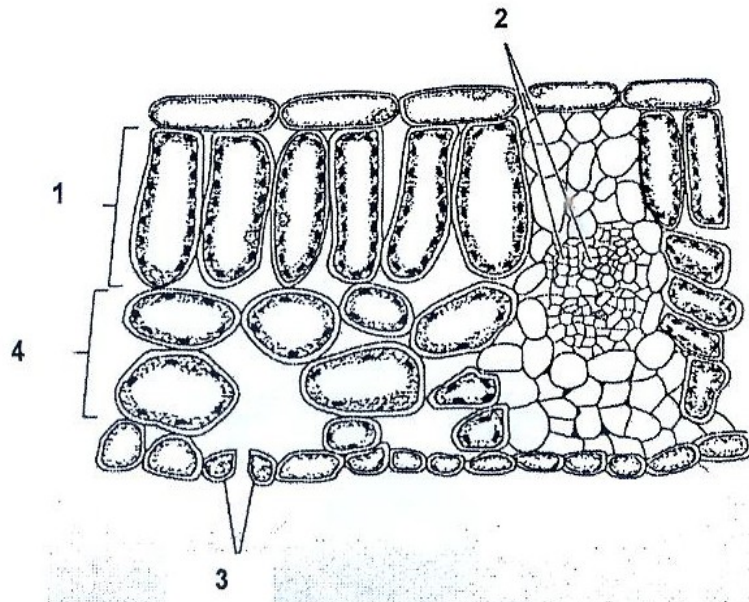
7 Below shows the list of the different parts of human digestive system.

- I mouth
- II pancreas
- III stomach
- IV small intestine

In which part(s) of the human digestive system is/are proteins digested?

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

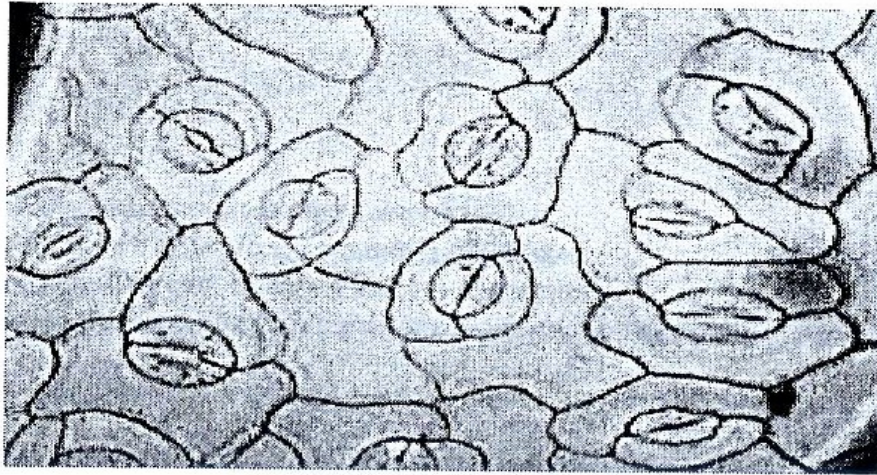
8 The diagram shows a section through part of a green leaf.



Which region(s) has/have the **highest** rate of photosynthesis?

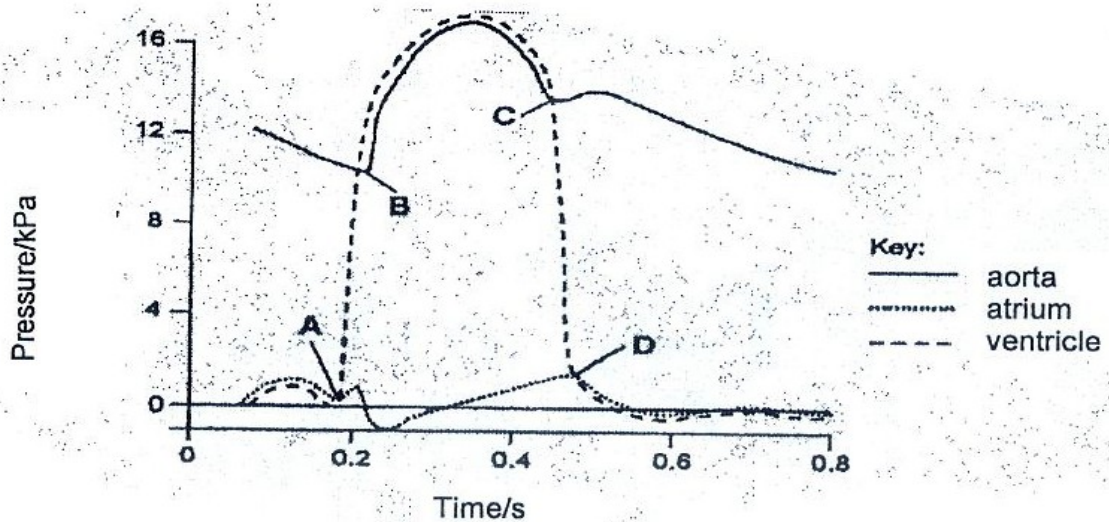
- A 1 only
- B 1 and 2 only
- C 1 and 3 only
- D 1, 3 and 4 only

- 9 The photograph below shows part of a green plant under 50X magnification.



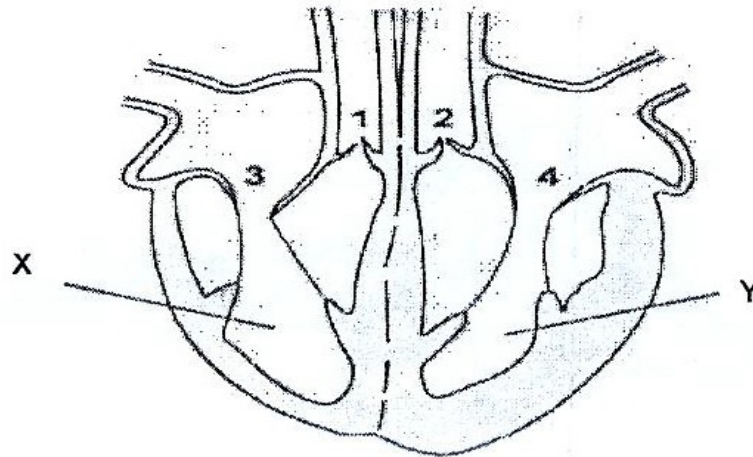
Which part of the green plant cell was the photograph taken from?

- A lower epidermis of the leaf
 - B palisade mesophyll
 - C spongy mesophyll
 - D upper epidermis of the leaf
- 10 The diagram below shows information on blood pressure in the aorta, left atrium and left ventricle during a cardiac cycle.



At which labelled point is the semi-lunar valve of the aorta pushed open?

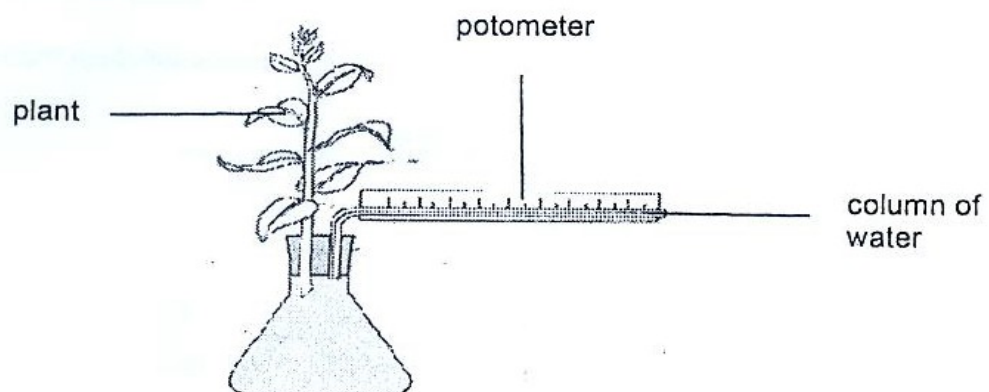
- 11 The diagram shows a section through the human heart.



Which of the following shows the correct state of the valves when chambers X and Y contract?

	valves 1 and 2	valves 3 and 4
A	closed	closed
B	closed	opened
C	opened	closed
D	opened	opened

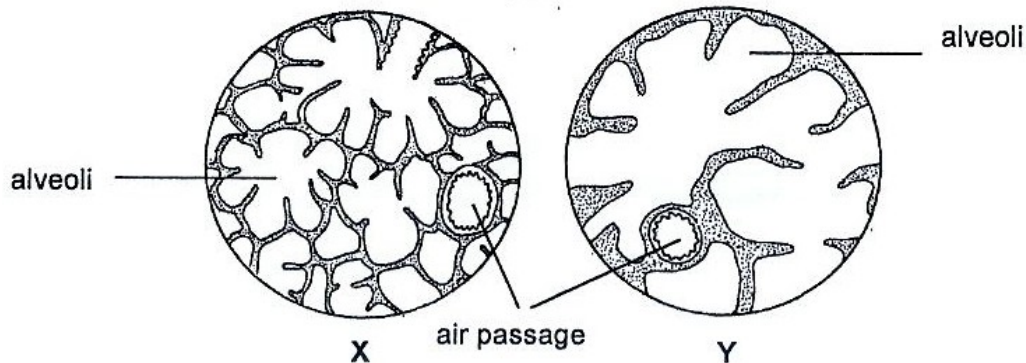
- 12 The diagram shows a potometer used to measure the rate of uptake of water up a plant.



Which of the following conditions is least likely to move the column of water in the potometer to the left?

- A a rise in temperature B an increase in humidity
C increased air movement D increased sunlight

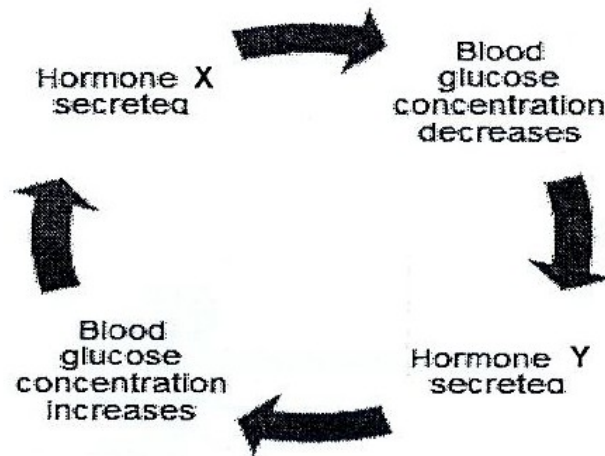
- 13 Diagram X represents a microscopic section through a healthy lung to show an air passage and alveoli. Diagram Y represents a similar section taken from a patient with a disease.



What disease is the patient suffering from?

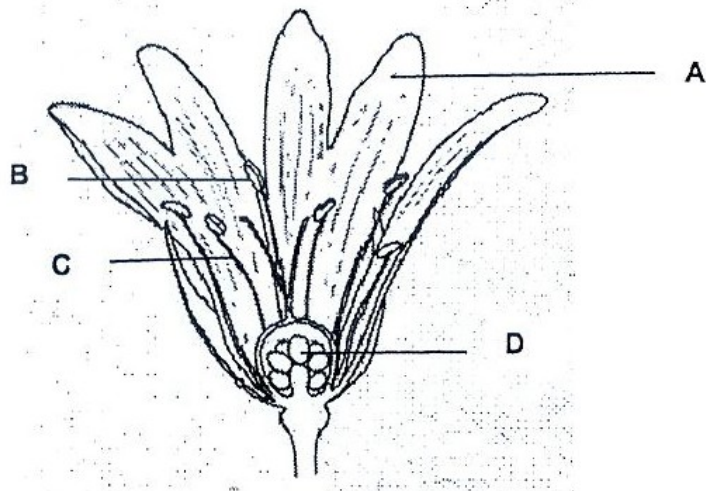
- A bronchitis
 B cancer
 C emphysema
 D hormonal imbalance
- 14 After a student touches a hot kettle, he immediately withdraws his hand.
 Which of the following best explains the role of the relay neurone in this process?
- A It releases neurotransmitters to transmit the nerve impulses.
 B It stimulates the muscles in the arm to contract so that it moves away.
 C It transmits nerve impulses from the sensory neurone to the motor neurone.
 D It transmits nerve impulses to the brain so that the movement of the arm can be initiated.
- 15 Mydriasis is the condition in which the pupil is excessively dilated.
 Which of the following would result from a person having this condition?
- A After exposure to bright light, he will not be able to see anything temporarily.
 B The circular muscles of his iris will be contracted.
 C The cones will not be able to function optimally.
 D The image formed on the retina will be larger.

- 16 The diagram shows how blood glucose is controlled in human.

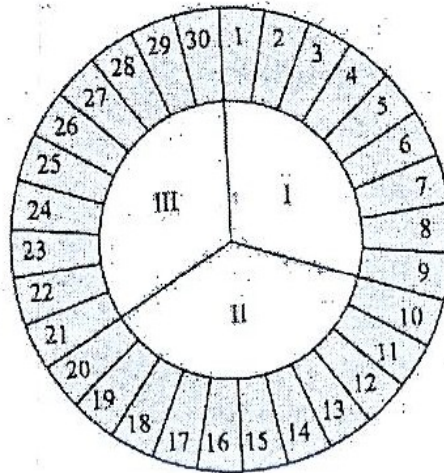


Based on the diagram above, a lack of hormone Y would mean that

- A blood glucose levels cannot rise back to normal after a period of low glucose levels.
 - B blood glucose levels will always be low.
 - C hormone X will not be produced.
 - D levels of stored glycogen will be low.
- 17 Which of the following statements about flowering plants is correct?
- A Fertilisation can take place without pollination.
 - B Pollination and fertilisation are the same.
 - C Pollination and fertilisation must occur at the same time.
 - D Pollination can take place without fertilisation.
- 18 Where does fertilisation take place in the flower shown below?



- 19 The diagram below shows a 30-day menstrual cycle.



During which of the labelled phases will an ovum be released into an oviduct and the uterine lining breaks down?

	ovum released into oviduct	uterine lining breaks down
A	phase I	phase II
B	phase I	phase III
C	phase II	phase I
D	phase II	phase III

- 20 Non-identical twins, otherwise known as fraternal twins, are twins that are genetically different from each other. How are fraternal twins formed during reproduction?
- A One zygote divides into two cells and each cell develops into a foetus.
 - B Two eggs being fertilised by one sperm cell.
 - C Two sperm cells fertilise the same egg.
 - D Two sperm cells fertilise two separate eggs.

End of Paper 1

NAME: _____ () CLASS: SEC 4E _____



HOUGANG SECONDARY SCHOOL

PRELIMINARY EXAMINATION 1 / 2017

**SCIENCE (BIOLOGY) 5078/04
PAPER 4**

SECONDARY FOUR EXPRESS

Friday, 30 June 2017

Total duration for paper 1 and 4
1 hour 45 minutes

MAKE THE DIFFERENCE RESPECT OURSELVES RESPECT OTHERS MAKE THE DIFFERENCE RESPECT OURSELVES RESPECT OTHERS MAKE THE DIFFERENCE RESPECT OURSELVES RESPECT OTHERS MAKE THE DIFFERENCE
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READ THESE INSTRUCTIONS FIRST

Write your name, register number and class on all the work you hand in.
You may use a pencil for any diagrams, graphs, tables or rough working.
Write in dark blue or black pen.
Do not use staples, paper clips, glue or correction fluid.

The use of an approved scientific calculator is expected, where appropriate.
You may lose marks if you do not show your working or if you do not use appropriate units.

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.

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

Total marks for Paper 1 and 4 is 85.

Hand in Paper 1, Paper 4 and OTAS separately.

Information for pupils

Electronic calculators may be used in this paper.

FOR EXAMINER'S USE		
Paper 1		/ 20
Paper 4		
Section A		/ 45
Section B		/ 20
Target		
/ 85	Total	/ 85

This document consists of 14 printed pages (including this cover page).

[Turn over

Section A

Answer all the questions in the spaces provided.

- 1 (a) Table 1.1 gives some information about human enzymes.
Complete Table 1.1.

Table 1.1

name of enzyme	source of enzyme	substrate	product
	salivary glands	starch	maltose
maltase	small intestine	maltose	glucose
protease	stomach	protein	
lipase		fats/lipids	fatty acids and glycerol

[3]

- (b)(i) Fig. 1.1 shows the activity of three human enzymes, P, Q and R.

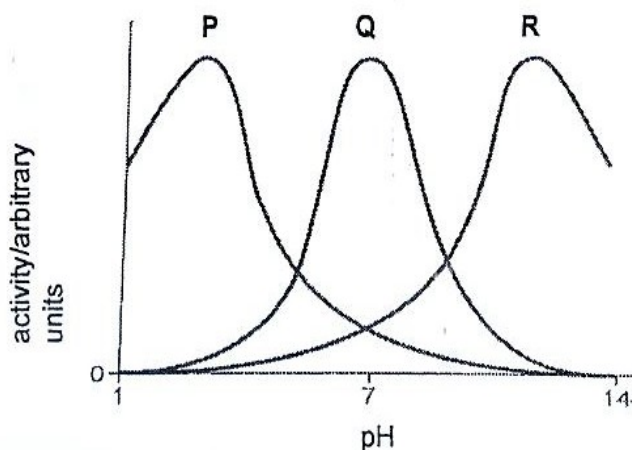


Fig. 1.1

State which enzyme, P, Q or R is found in the mouth and which is found in the stomach.
Give a reason for each answer.

enzyme in mouth

reason

enzyme in stomach

reason.....[4]

(ii) The pancreas produces three types of enzyme.
Identify the three enzymes and their products of digestion.

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.....[3]

2 Fig. 2.1 is a section of a dicotyledonous stem.

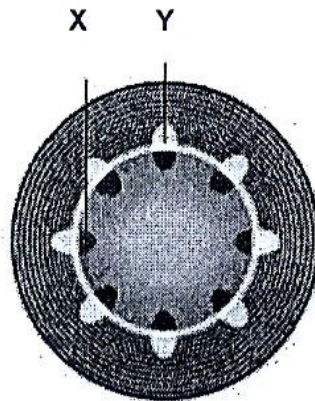


Fig. 2.1

(a) Name tissues X and Y and describe their functions.

X : [1]

Function : [1]

Y : [1]

Function : [1]

(b)(i) Some plant cells carry out photosynthesis.

State **three** factors that a plant cell needs from the environment to carry out photosynthesis.

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

(ii) Describe **two** ways in which a dicotyledonous leaf is adapted for photosynthesis.

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

(iii) State and describe a difference in function between the root and a leaf.

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.....[2]

3 Fig 3.1 shows the human respiratory system.

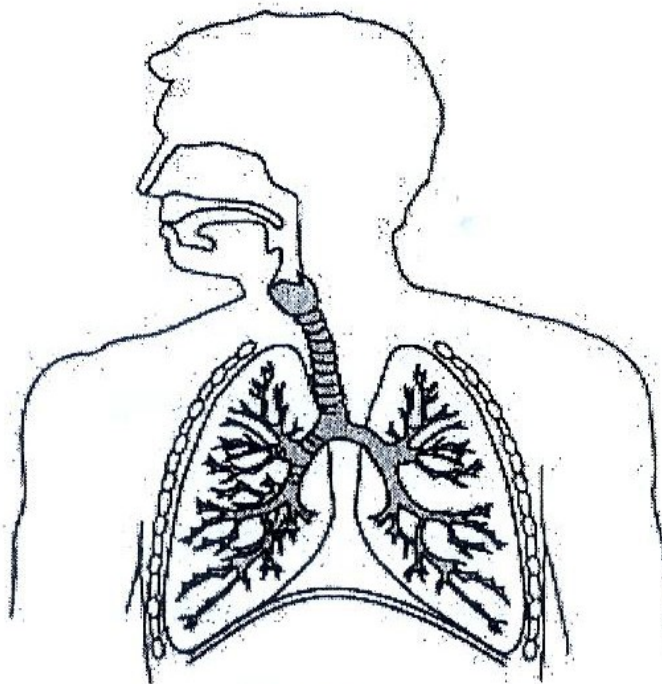


Fig 3.1

(a) On Fig. 3.1, use label lines to identify:

- (i) a bronchiole
- (ii) the larynx
- (iii) the trachea

[3]

4 Fig. 4.1 shows a section through a human eye.

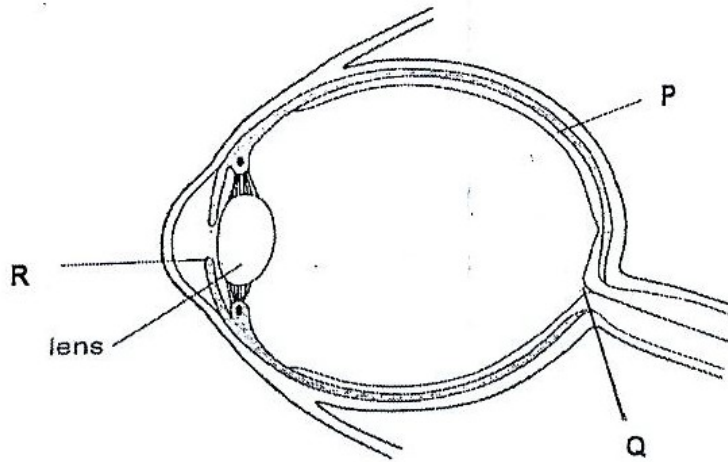


Fig. 4.1

(a) Name the parts labelled P, Q and R.

P

Q

R

[3]

(b) Describe what happens to the ciliary muscle, suspensory ligament, focal length and the shape of the lens when someone looks up from reading a book to focus on a distant object.

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..... [4]

5 Fig. 5.1 shows a grass flower that is wind pollinated.

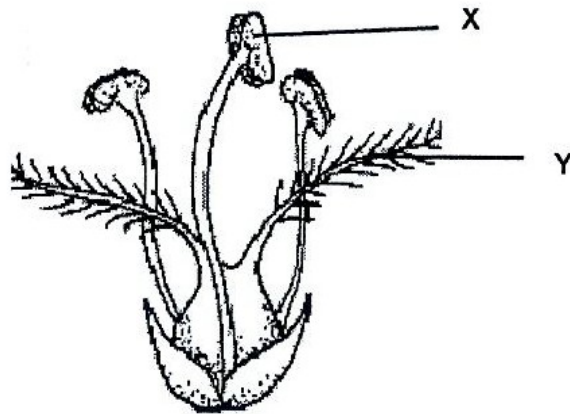


Fig. 5.1

(a)(i) Name structures X and Y.

X

Y

[2]

(ii) Explain, with a feature shown in Fig. 5.1, which suggests that the flower is wind pollinated.

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

(b) Suggest two physical features of an insect-pollinated flower.

1.....

2.....[2]

- (c) Table 5.1 shows the names of the parts of a flower and their functions. Complete the table by filling in the four blank spaces.

Table 5.1

part of flower	function
stigma	
	attracts insects
stamen	
	protects the flower bud

[4]

- (d) In some plants, 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?

.....
[1]

Section B

Answer any two questions from this section.

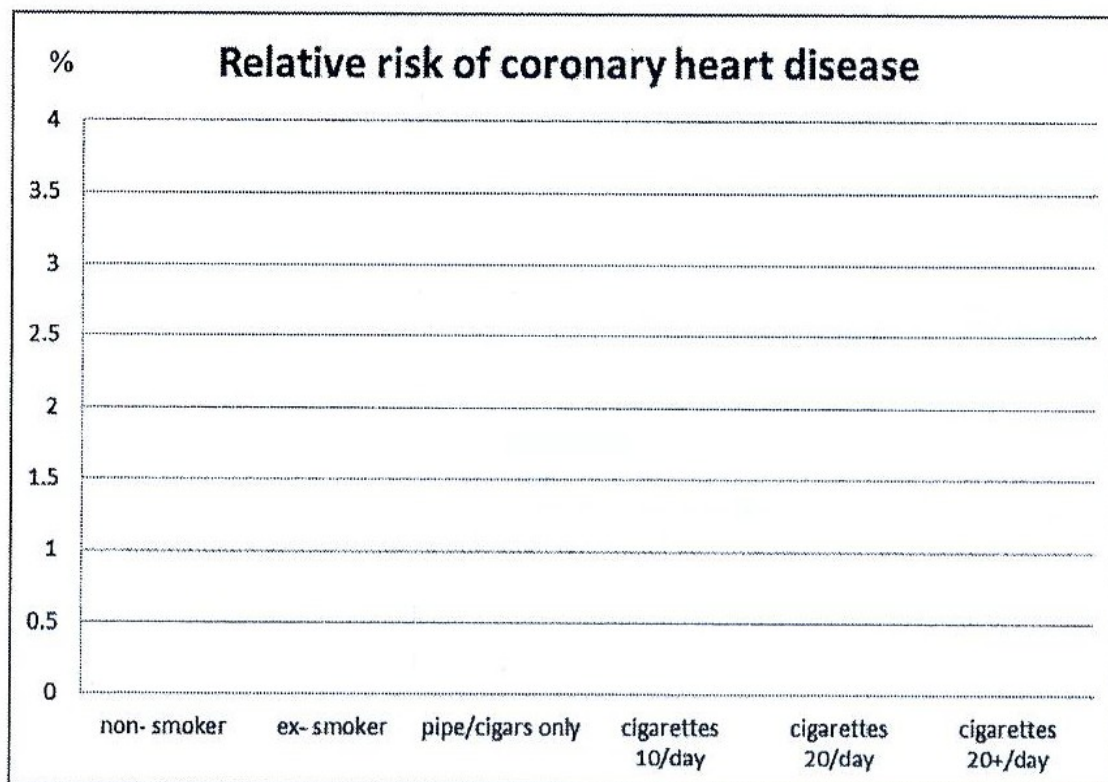
Write your answers in the spaces provided.

- 6 The following table shows the combined results of eight American studies involving nearly 7000 men aged 40 to 59.

smoking category	relative risk of coronary heart disease (%)
Non-smoker	1.0
Ex-smoker	1.2
Pipe/cigars only	1.3
Cigarettes:10/day	1.9
Cigarettes:20/day	2.2
Cigarettes:20+/day	3.4

- (a) Plot these results on the bar graph below.

[3]



(b)(i) Using the bar chart in (a), describe and explain the relationship between smoking and coronary heart diseases.

.....

.....

.....

.....

.....[4]

(ii) Imagine you are appointed as the health governor of a town.
Suggest how you will help to reduce the risk of coronary heart diseases in your town.

.....

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.....[3]

- 7 It is possible to insert thin electrodes into a nerve fibre, pick up the electrical discharge produced by a nerve impulse, amplify it and display it on an oscilloscope. A single stimulus usually produces a burst of impulses.

Fig. 7.1 below represents an oscilloscope record from a sensory nerve fibre at rest and after stimulation.

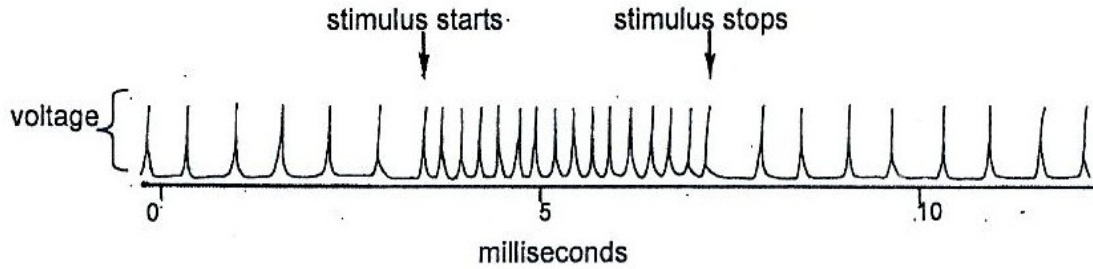


Fig. 7.1

- (a)(i) Using an example, describe a difference between voluntary and involuntary action.

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

- (ii) What is a reflex action and why is it so important?

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

- (b) Base on your understanding of nervous pathway, describe the neurons involved and the pathway of nervous impulse taken, from the moment a person touches a sharp object to the moment the hand is withdrawn from it.

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..... [6]

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.....[8]

(b) Define sexual reproduction and explain why is it beneficial to human beings.

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

End of Paper 4

Sci (Bio) 2017 Prelim 1 Answer:

Paper 1

1	C	6	D	11	C	16	A
2	B	7	B	12	B	17	D
3	C	8	A	13	C	18	D
4	D	9	A	14	C	19	C
5	B	10	B	15	B	20	D

Paper 4 Section A

1 (a)

name of enzyme	source of enzyme	substrate	product
Salivary amylase	salivary glands	starch	maltose
maltase	small intestine	maltose	glucose
protease	stomach	protein	polypeptides
lipase	Small Intestine	fats/lipids	fatty acids and glycerol

[3]

(b)(i) enzyme in mouth: **B** [1]

Reason: Salivary amylase works best at pH 7 [1]

enzyme in stomach: **A** [1]

reason: Protease needs an acidic medium to function optimally./ stomach contains HCl.[1]

(ii) The pancreas produces three types of enzyme.
Identify the three enzymes and their products of digestion.

Enzyme	Products
- Pancreatic amylase	maltose
- trypsin	polypeptides
- lipase	Fatty acids and glycerol

[3]

2(a) X: Xylem [1]

Transport dissolved mineral salts and water up the plant [1]

Y: Phloem [1]

Transport sucrose from the leaves to the rest of the plant. [1]

(b)(i) carbon dioxide

Sunlight

Water [All 3 correct, 2m, Any 2 correct, 1m]

(ii) large leaf blade/lamina/surface area to capture maximum amount of sunlight/

thin lamina allows carbon dioxide and sunlight to reach the inner mesophyll cells rapidly./

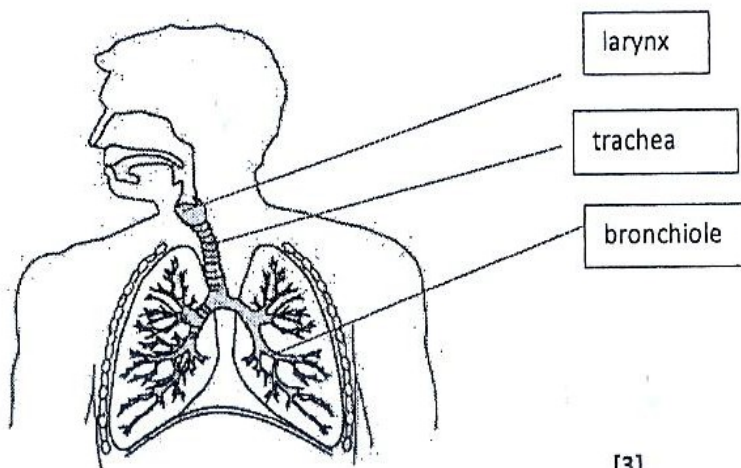
more chloroplasts on the upper palisade cells to trap light energy and convert to chemical energy.

[Any 2, 2m]

(iii) Difference in function: Function of root is absorption but function of leaf is photosynthesis [1]

Explain: The root absorbs water and mineral salts up the plant but the leaf is involved in photosynthesis, where it traps light energy and converts it to chemical energy. [1]

3(a)



[3]

(b) The walls of the alveoli and blood capillaries are one- cell thick to decrease the diffusion distance to increase efficiency of gaseous exchange. [1]

A thin film of moisture covers the surface of the alveolus allows oxygen to dissolve in it and diffuse into the blood capillary [1]

The walls of the alveoli are richly supplied with blood capillaries so that the flow of blood maintains the diffusion gradient of gases. [1]

4(a) P: sclera [1]

Q: fovea [1]

R: iris [1]

(b) The ciliary muscles relax, increasing the pull on suspensory ligaments. [1]

The suspensory ligaments become more taut and increase the pull on the edge of the lens. [1]

The lens becomes less convex and thinner [1]

The focal length increases [1]

5(a)(i) X: anther [1]

Y: stigma [1]

(ii) The stigma is large and feathery and protrude out [1]

so that they can provide a large surface area to catch the pollen. [1]

Or Stamens have long and pendulous filaments that sway in the wind. Thus, pollen grains are easily shaken out from the anthers.

(b) No large petals/ large stigma/ pendulous filaments [Any 2, 2m]

(c)

part of flower	function
stigma	<u>receives pollen grains</u>
<u>petal</u>	attracts insects
stamen	<u>Contains anthers and filaments</u>
<u>sepal</u>	protects the flower bud

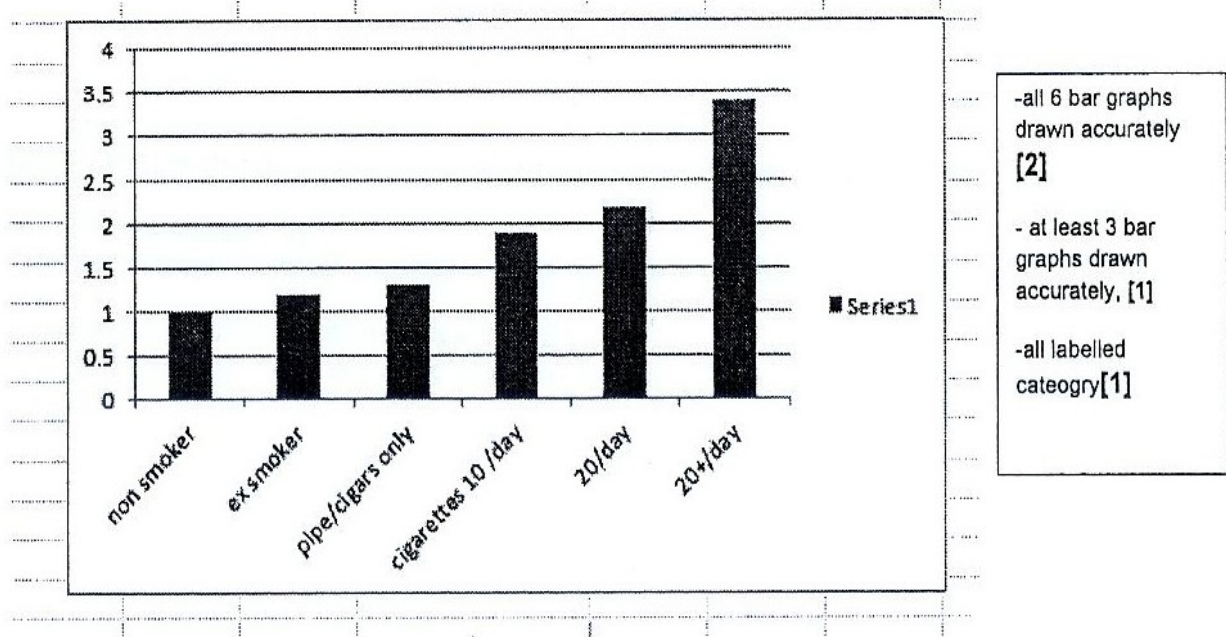
[4]

(d)(i) To allow for cross pollination./To prevent self-pollination. [1]

(ii) Only one parent is needed/ The offspring inherits the genes from the parent, thus beneficial qualities of the parent are likely to be passed down to the offsprings. [1]

Section B

6(a)



-all 6 bar graphs drawn accurately [2]
 - at least 3 bar graphs drawn accurately, [1]
 -all labelled category[1]

6(b)(i)	<p>Describe:</p> <ol style="list-style-type: none"> The risk of coronary heart disease increases as the number of cigarettes smoked increases. [1] The risk of coronary heart disease for non-smoker is 1% but increases to 3.4% for a person who smokes 20 plus cigarettes a day. [1] <p>Explain:</p> <ol style="list-style-type: none"> Cigarette smoke contains nicotine that increased heartbeat and blood pressure and increased risk of blood clots in blood vessels. [1] Cigarette smoke contains carbon monoxide that increases rate of fatty deposits on the inner artery walls and hence increased risk of atherosclerosis. [1] 	
(ii)	<ol style="list-style-type: none"> The government can enforce laws to fine smokers who smoke at public places. [1] The government can tax the cigarettes more to deter people from buying cigarettes. [1] The government can educate the public through advertisements and schools to deter people from smoking. [1] <p>- Can accept answer related to coronary heart diseases that is contributed by diet, stress and lifestyle.</p>	
7(a)(i)	<p>-Voluntary action is action initiated by the will and can be controlled. E.g. raising hand to answer a question. [1]</p> <p>- Involuntary action is an immediate action or response to a stimulus without conscious control E.g. Lifting of hand away from a hot kettle when the hand touches the kettle. [1]</p>	
(ii)	<p>A reflex action is an immediate response to a specific stimulus without conscious control. [1]</p> <p>Importance- Remove the body from danger. [1]</p>	

(b)	1. Stimulus is the sharp object that was in contact with the skin. [1] 2. The receptors under the skin are stimulated and nervous impulses are produced. [1] 3. Nervous impulses are transmitted along the sensory neurone via a synapse to the relay neurone in the spinal cord. [1] 4. The impulses are then transmitted across another synapse from relay neurone to the motor neurone. [1] 5. Impulses are transmitted from motor neurones to effectors. [1] 6. The muscles contract and the hand is withdrawn from the sharp object. [1]	
8(a)	-P: <u>Ovulation</u> (the release of mature <u>egg</u> from the ovary) occurs. [1] -Q: The ovum travels into the <u>oviduct</u> [1] -R: <u>Fertilisation occurs at the oviduct when the sperm fuses with the ovum.</u> [1] -S: The zygote is swept by the <u>cilia lining</u> along the oviduct towards the uterus. [1] - zygote divides to form an <u>embryo</u> . [1] - The embryo takes five days to <u>reach the uterus</u> [1] - <u>embryo is implanted</u> into the uterine lining about seven days after fertilization. [1] -T: Embryo continues to grow into a <u>foetus</u> about 10-12 weeks after fertilization. [1]	
(b)	Sexual reproduction is the <u>fusion of a male gamete (sperm) and a female gamete (ovum)</u> is known as to form a fertilised ovum (egg) is known as the <u>zygote</u> . [1] It is beneficial as it ensures the continuation of species/Prevent extinction. [1]	



Jurong West Secondary School

Preliminary Examinations 2017

SCIENCE (CHEMISTRY/BIOLOGY)

5078/01

Secondary Four Express / Five Normal (Academic)

18 August 2017

Paper 1 Multiple Choice

1030 – 1130

1 hour

Candidates answer on the Multiple Choice Answer Sheet.

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

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

Write in soft pencil.

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

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

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

You may lose marks if you do not show your working or if you do not use appropriate units.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**. Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet. **Read the instructions on the Answer Sheet very carefully**. Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this question paper.

A copy of the Data Sheet is printed on page 19.

A copy of the Periodic Table is printed on page 20.

After checking of answer script		
Checked by Student	Signature	Date

This document consists of 20 printed pages.

- 21 Which of the following options correctly classifies the body components?

	Cell	Tissue	Organ	Organ System
A	Blood	Stomach	Neurone	Heart, blood and blood vessels
B	Neurone	Heart, blood and blood vessels	Blood	Stomach
C	Neurone	Blood	Stomach	Heart, blood and blood vessels
D	Blood	Neurone	Stomach	Heart, blood and blood vessels

- 22 A student placed equal-sized pieces of potato in solutions of different sugar concentrations. She measured the change in length of each piece after 30 minutes. Her results are shown in the table.

sugar concentration (%)	change in length (mm)
0	+4.0
5	+2.2
10	+0.5
15	-1.2
20	-3.0

The student used the results to predict which concentration of sugar would not change the length of a potato strip.

At which concentration would the change in length be 0mm?

- A 9%
- B 10%
- C 11%
- D 25%

23 Which statement explains why, even when athletes have finished a race, they still carry on breathing more quickly and deeply than normal for several minutes?

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

24 The table shows the average daily energy needed for adult males and females involved in different activities.

activities	energy needed in MJ	
	males	females
lying in bed	7	6
watching TV	8	7
light work	11	9
heavy work	15	13

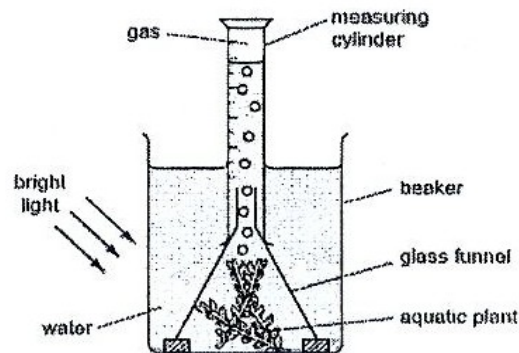
What can be concluded from these data?

- A Males do more work than females.
 - B Males need more energy than females to do the same activity.
 - C The energy requirement depends only upon the activity.
 - D The energy requirement depends only upon the person's gender.
- 25 An antelope is grazing under a tree. It hears men shouting in the distance.

Which changes take place in the antelope's eyes as it raises its head to look at the men?

	ciliary body	suspensory ligament	lens
A	contracts	becomes taut	becomes more convex
B	contracts	becomes slack	becomes less convex
C	relaxes	becomes taut	becomes less convex
D	relaxes	becomes slack	becomes more convex

- 26 The diagram shows the apparatus used in an investigation to measure the rate of oxygen production during photosynthesis.



The investigation was repeated several times and the average amount of gas collected was calculated.

Which two factors must be kept constant during this investigation?

- A The amount of water in the beaker and the height of the measuring cylinder.
- B The size of aquatic plant and the amount of gas in the measuring cylinder.
- C The size of aquatic plant and the duration of exposure to light.
- D The sizes of the beaker and funnel.
- 27 Which of the following is likely to form an enzyme-substrate complex?
- A amino acids/ protease
- B cellulose/ cellulase
- C disaccharides/ lipase
- D starch/ sucrase
- 28 Which of the following is not a function of the liver?
- A Detoxification
- B Excretion of urea
- C Production of bile
- D Breakdown of alcohol

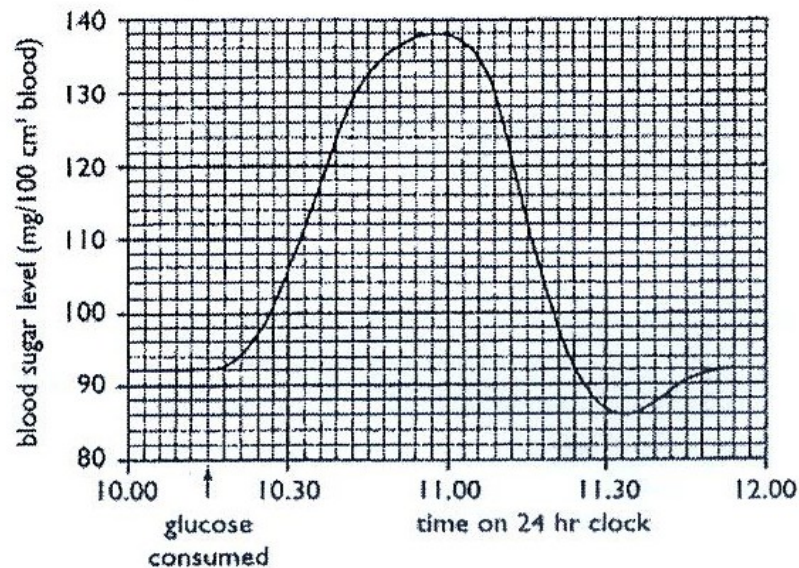
29 Three directions in which nerve impulses can travel in the nervous system are listed.

- 1 away from the central nervous system
- 2 towards the central nervous system
- 3 within the central nervous system

In which direction do impulses in motor neurones and relay (intermediate) neurones travel?

	motor neurone	relay neurone
A	1	2
B	1	3
C	2	1
D	2	3

30 The graph below shows the blood sugar level of a person who has consumed 50g of glucose at the time indicated.

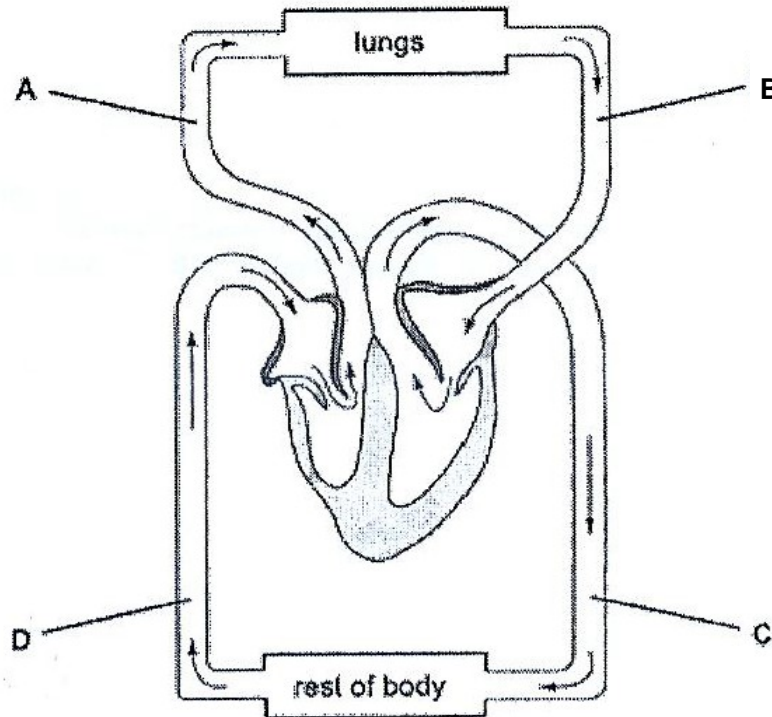


At which time would insulin and glucagon be produced, respectively?

- A 10.00, 11.00
- B 10.45, 11.30
- C 11.00, 10.30
- D 11.30, 11.00

31 The diagram shows the circulatory system.

In which vessel is the blood pressure highest?

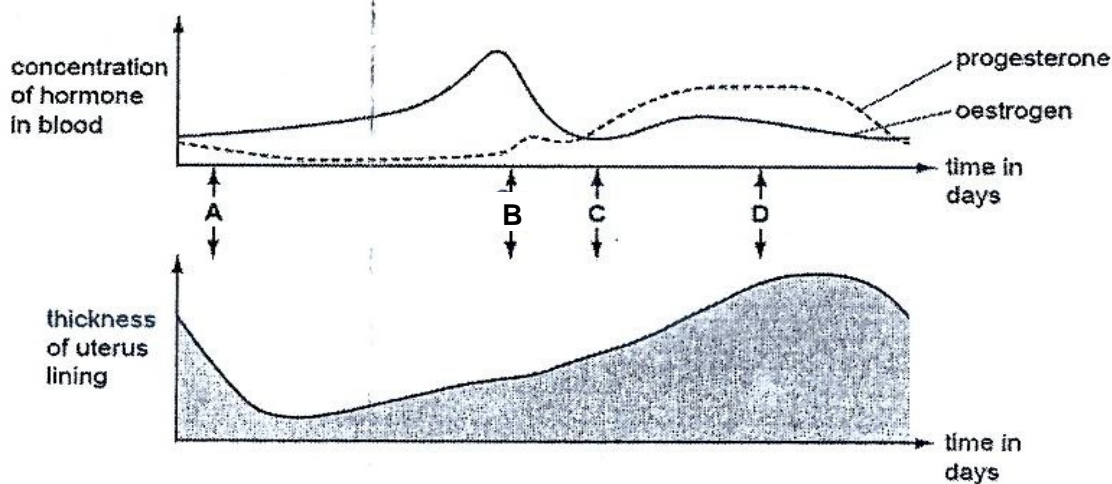


32 How many chromosomes are there in a zygote which develops into a Down's syndrome baby?

- A 23
- B 24
- C 46
- D 47

- 33 The diagram shows the thickness of the uterus lining and the concentrations of oestrogen and progesterone, throughout one menstrual cycle.

On which day does ovulation occur?

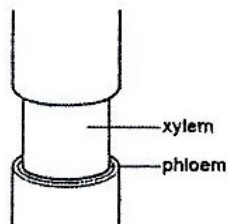


- 34 A mango tree can be reproduced by seed and by asexual reproduction. Trees produced by each of these methods produce mango fruits.

When comparing these fruits genetically, what is the correct result?

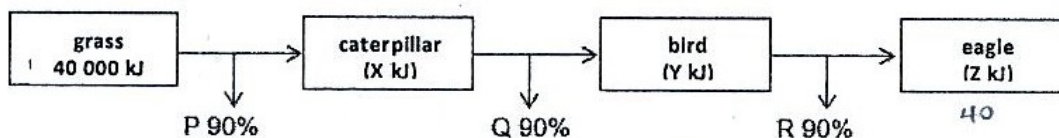
	Fruits of trees grown from seeds	Fruits of trees produced by asexual reproduction
A	Identical	Identical
B	Identical	Non-identical
C	Non-identical	Identical
D	Non-identical	Non-identical

- 35 The diagram shows the stem of a plant. A strip of the outer tissue including the phloem has been removed.



How is transport in the plant affected?

- A Water cannot pass to the roots.
 B Water cannot pass to the leaves.
 C Dissolved salts cannot pass to the leaves.
 D Amino acids and sucrose cannot pass to the roots.
- 36 The diagram shows the total energy transferred through four trophic levels.



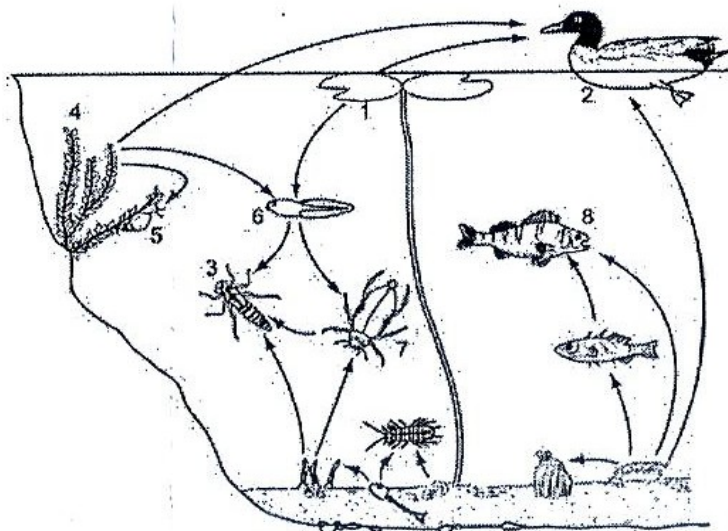
The arrows P, Q and R show the percentage of energy lost from the organism to the environment. Calculate the energy value of z.

- A 40 kJ
 B 360 kJ
 C 720 kJ
 D 800 kJ
- 37 A recessive allele in cats causes kittens to develop six toes instead of the normal five. A cat heterozygous for this gene was crossed with a homozygous recessive individual.

What is the chance of any of their kittens having six toes?

- A 25%
 B 50%
 C 75%
 D 100%

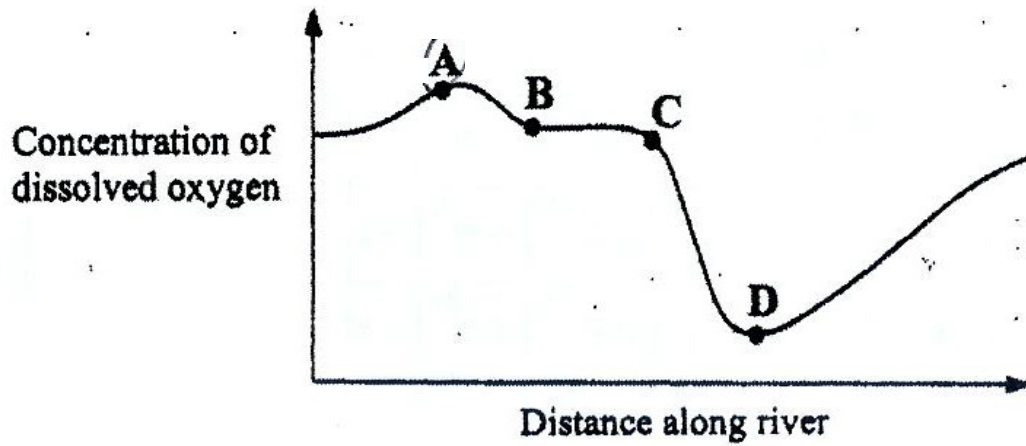
- 38 A DNA molecule consists of two strands in which
- A the percentage of adenine is the same in each strand.
 - B the percentage of adenine is the same as that of thymine in each strand.
 - C the percentage of adenine is the same as that of thymine in the whole molecule.
 - D the percentage of the sum of adenine and thymine is the same as that of the sum of cytosine and guanine in the whole molecule.
- 39 The diagram shows a food web in a freshwater pond.



Which of the organisms is a producer, a herbivore or a carnivore?

	producer	herbivore	carnivore
A	1	6	7
B	2	4	5
C	4	2	6
D	7	3	8

- 40 The graph shows the concentration of dissolved oxygen along a river. At which point is sewage emptied into the river?



END OF PAPER

Section A (45 marks)

Answer all the questions in this section in the spaces provided.

Fig. 1.1 shows the human respiratory system.

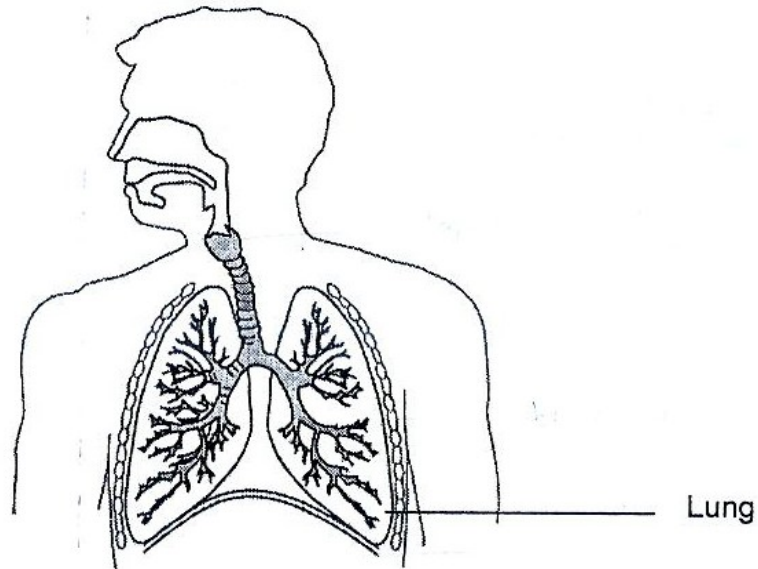


Fig. 1.1

- (a) On Fig. 1.1 use label lines to identify:
- a bronchiole;
 - the larynx;
 - the diaphragm.

[3]

- (b) Fig. 1.2 shows a section through a group of gas exchanging surfaces (alveoli) in a lung.
Part of the wall of an alveolus and the capillary next to it has been magnified.

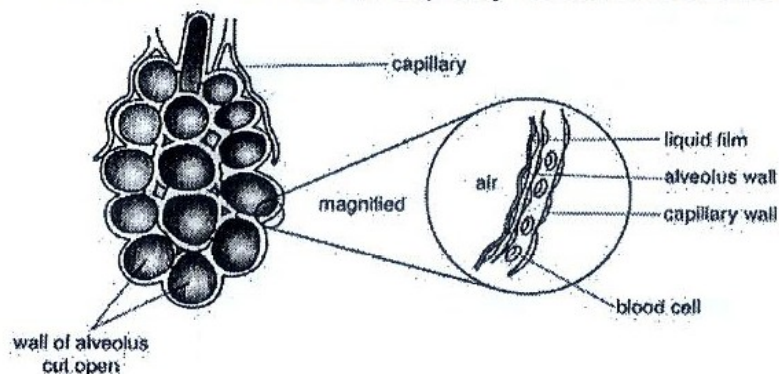


Fig. 1.2

Use Fig. 1.2 .to describe three adaptations of the gas exchange surfaces in animals.

- 1.
 - 2.
 - 3.
- [3]

(c) In an experiment, the volume of air taken in at each breath and the number of breaths per minute were measured whilst a teenager was performing a number of activities. The results are shown in Table 1.3

Activity	Volume of air per breath (cm ³)	Breaths per minute
Sleeping	500	20
Standing	550	22
Walking	700	28
Running	1000	40

Table 1.3

Why does the volume of air breathed per minute need to increase when a person changes from walking to running?

-
-
- [2]

- 2 An experiment is carried out to investigate the effect of changing light intensity on the rate of photosynthesis. The light intensity is changed by changing the distance between the lamp and the plant. The apparatus is shown in Fig. 2.1

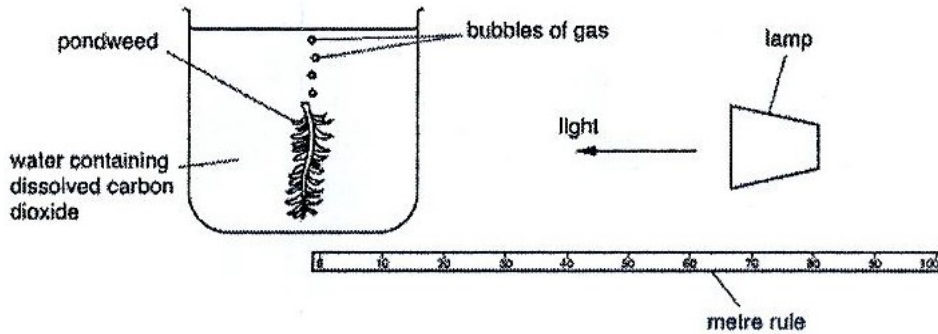
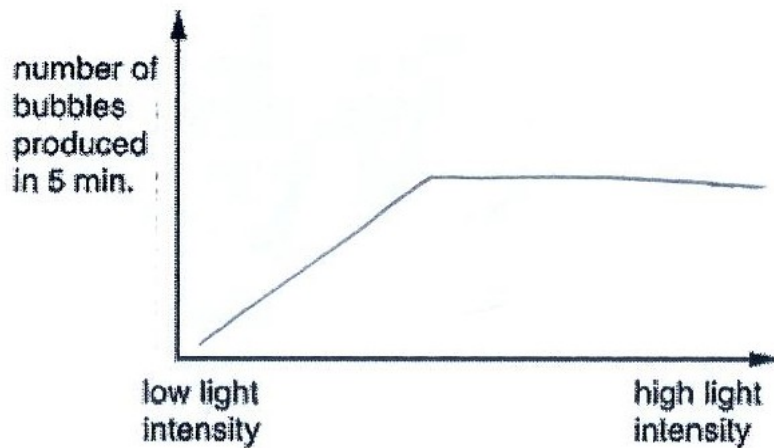


Fig. 2.1

- (a) (i) Suggest one condition that should be kept constant in this experiment.
 [1]
- (ii) Suggest a way to measure the rate of photosynthesis.
 [1]
- (b) (i) On the axes below, sketch a curve to show the results expected from this experiment.



[1]

(ii) Explaining why changing light intensity has this effect on the amount of oxygen given off by the pondweed.

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

(c) The concentration of carbon dioxide was kept constant during the investigation.

Predict and explain the effect of increasing carbon dioxide concentration has on the rate of photosynthesis.

.....
.....
.....
.....
.....
..... [3]

3 Fig. 3.1 shows some of the top ten causes of death in parts of the world during 2014.

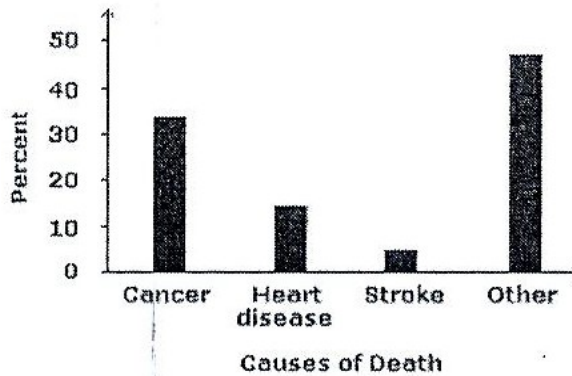


Fig. 3.1

(a) Calculate the percentage of people dying from other causes. Show your working.

.....% [1]

(b) Being overweight is a contributory factor to the development of heart disease.

(i) Describe coronary heart disease.

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

(ii) Use data from Fig. 3.1 to suggest the occurrence of heart disease in the human population.

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

- (c) According to Fig. 3.1, close to 30% of the people die from cancer. Leukemia is the cancer of the blood. Fig. 3.2 shows a diagram of the difference in normal blood and diseased blood (leukemia).

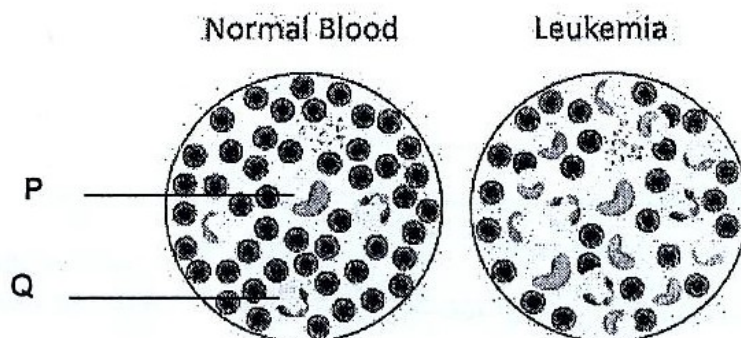


Fig. 3.2

- (i) Describe the difference observed in normal blood and blood with Leukemia as seen in Fig. 3.2.

.....
 [1]

- (ii) Identify P and Q.

P:

Q: [2]

- (iii) State the role P and Q play in protecting the body.

.....

 [2]

4 Fig. 4.1 shows an experiment conducted to investigate the osmosis process.

At the beginning, the potato cylinders were exactly balanced. A student immersed the cylinders into the liquids for 4 hours, after which the cylinders were lifted out of the liquids.

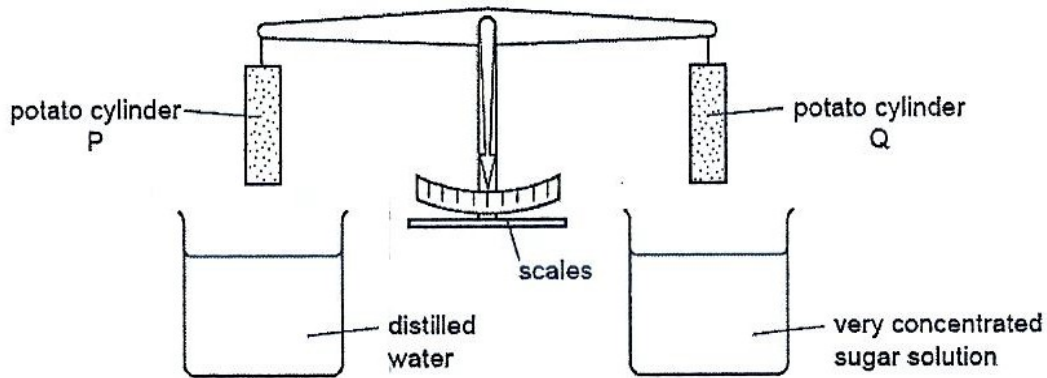


Fig. 4.1

(a) Define osmosis.

.....
 [2]

(b) (i) Predict the results of this investigation.

..... [1]

(ii) Use ideas about osmosis to suggest an explanation for the results predicted in (b) (i).

.....

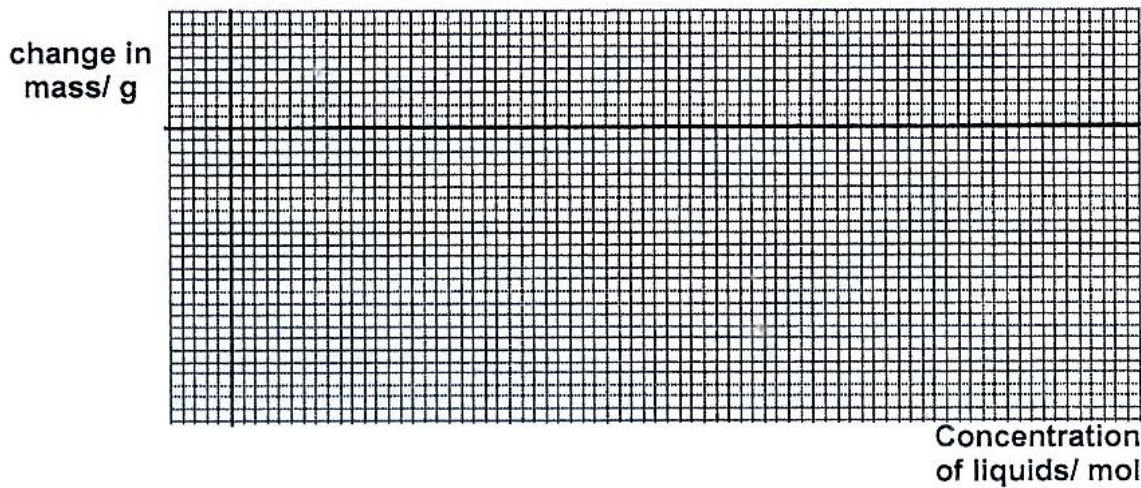
 [3]

(c) Table 4.2 shows the results of the above experiment that was extended to investigate the concentration of the potato cylinder by inserting them into solutions of different concentrations.

Concentration of liquids/ mol	Initial mass (g)	Final mass (g)	Change in mass/ g
0.2	1.6	1.8	+0.2
0.4	1.7	1.2	-0.5
0.6	1.6	1.5	-0.1
0.8	1.6	1.2	-0.4
1.0	1.6	0.9	-0.7

Table 4.2

(i) Plot the results from Table 4.2 on the grid provided. Draw a curve of best fit.



[2]

(ii) From the graph, predict the concentration of the potato cell sap. Explain your answer.

.....

.....

.....

[2]

- 5 A doctor tapped the knee cap of his patient as shown in Fig. 5.1 to test his response.

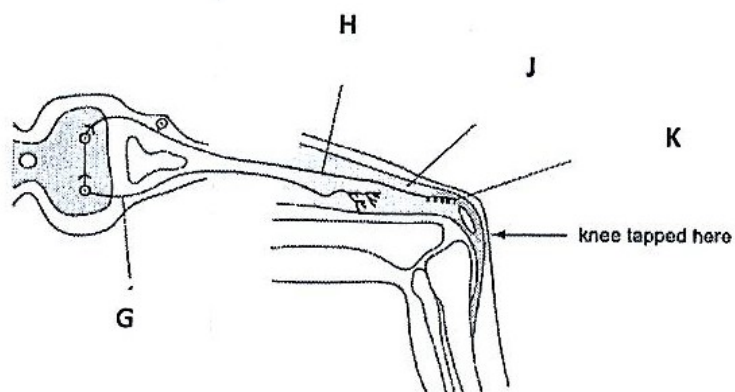


Fig. 5.1

- (a) State the role of structures G, H, J and K to enable a response by completing the blanks.

Letter	Name of the part corresponding to the letter	Function
G		
H		
J		
K		

[3]

(b) Fig. 5.2 shows the blood glucose concentration of a boy over 14 hours.

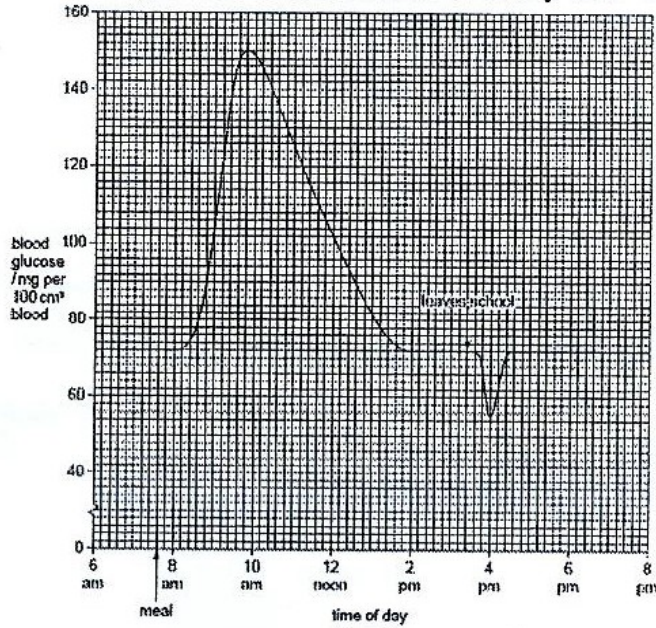


Fig. 5.2

(i) What is a hormone?

.....
 [2]

(ii) Use information from the figure to help you describe and explain what happened to the blood glucose concentration from 8 a.m. and 2 p.m..

.....

 [4]

Section B (20 marks)

Answer any **TWO** questions in this section in the space provided.

6 Fig. 6.1 shows a food web that is part of an ecosystem in the Amazon rainforest.

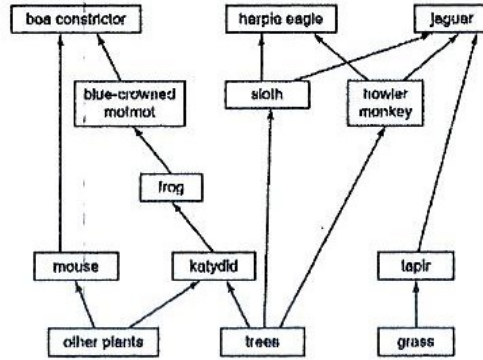


Fig. 6.1

(a) Explain why the whole food web depends on the producers such as the grass and trees.

.....

.....

.....

.....

.....

..... [4]

(b) In the 1970s, the American ecologist Paul Colinvaux investigated the energy flow between katydid and boa constrictors.

Explain why the number of boa constrictors in the Amazon rainforest has never risen above 50 while the highest number of katydid recorded is 2450.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [6]

- (b) Silkie, shown in Fig. 8.2 inherited its thick feathers from its parents. The feathers helped it survive in hostile environment. Thick feather is determined by the recessive allele.

Show, using a genetic diagram, how Silkie inherited this phenotype from both parents which are bald.

Use H to represent dominant allele and h to represent recessive allele. [5]

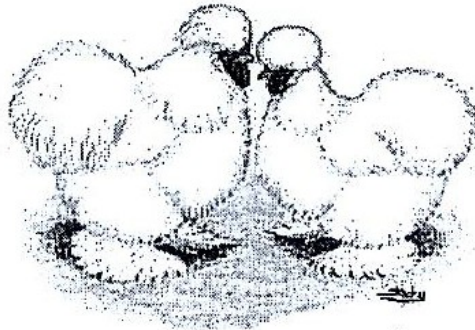
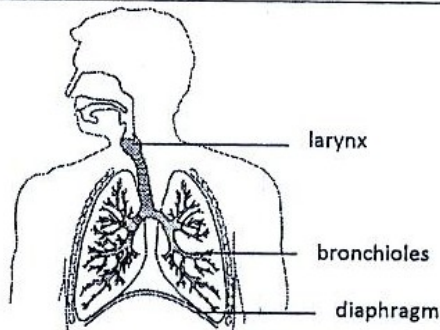


Fig. 8.2

End of Paper

JURONG WEST SECONDARY SCHOOL
Preliminary EXAMINATIONS 2017
SECONDARY 4E5NA SCIENCE BIOLOGY
Answer Scheme_With MR

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

Possible Answers		Marks	MR
1	a	3	
			
	b		
large surface area (per volume) ; thin / small diffusion distance ; moist / wet / liquid film ; (alveolar) wall permeable ; well ventilated / diffusion gradient maintained ; well supplied with capillaries / diffusion gradient maintained ;			
	c	2	
More energy is required; Volume of air increased to supply more oxygen for respiration to supply the energy;			
2	ai	1	
The size of the pond weed/ The amount of carbon dioxide/ The voltage of the lamp/ The location of the experiment			
	aii	1	
By counting the number of bubbles given off in 1 minute (stated time)			

	bi	<p>number of bubbles produced in 5 min.</p> <p>low light intensity high light intensity</p>	1	
	bii	<p>Light intensity affects rate of photosynthesis;/ As the light intensity increase, the rate of photosynthesis increase;</p> <p>More oxygen is release;</p>		
	c	<p>Carbon dioxide is a raw material for photosynthesis;</p> <p>As the carbon dioxide concentration increase, the rate of photosynthesis increases until CO₂ concentration is no longer a limiting factor;</p> <p>More oxygen is release;</p>	3	
3	a	$100 - 30 - 15 - 5 = 50\%$	<p>[1] accept +/- 5 %</p> <p>45% or 55%</p>	
	bi	<p>Coronary heart disease occurs when the arteries that supply blood to the heart muscle, the coronary arteries become hardened and narrow;</p> <p>This results in a reduced supply of oxygen to the cardiac muscles.</p>	2	
	bii	<p>The occurrence of heart disease is 15%;</p> <p>This may be due to the lack of exercise/ the intake of junk food/ stress</p>	2	
	ci	<p>P is the lymphocyte – IT engulf and digest foreign particles</p> <p>Q is the phagocytes which is responsible for the production of antibodies for the destruction of foreign particles.</p>	<p>Correct identification [1]</p> <p>[1] each for function</p>	
	cii	<p>Too many WBC in the blood may result in reduction in the number of RBC, the amount of oxygen may be insufficient to keep the person alive.</p>	1	


4	a	Osmosis is the net movement of water molecules from a region of higher water potential to a region of lower water potential across a partially permeable membrane.	[1] [1]																
	bi	P will get heavier/ The scale will tilt towards P;	[1]																
	bii	Distilled water has higher water potential than the cell sap of potato; Water molecules moves into the cell sap from a region of higher water potential to a region of lower water potential; P gain mass; The scale tilts.	3																
	ci	Correct plots; Correct scales; Best fit line;	2																
	cii	At this concentration, there is no net gain in water molecules as the solution is isotonic to the cell sap of the potato.	2																
5	a	<table border="1"> <thead> <tr> <th>Letter</th> <th>Name of the part corresponding to the letter</th> <th>Function</th> </tr> </thead> <tbody> <tr> <td>G</td> <td>Motor neurone</td> <td>Nerve impulses is transmitted along motor neurones to the effector</td> </tr> <tr> <td>H</td> <td>Sensory neurone</td> <td>Nerve impulses generated and is transmitted along sensory neurons to the spinal cord</td> </tr> <tr> <td>J</td> <td>Muscle</td> <td>Is the effector which will respond</td> </tr> <tr> <td>K</td> <td>Receptor</td> <td>It is on skin to detect the pressure (stimulus) at the knee;</td> </tr> </tbody> </table>	Letter	Name of the part corresponding to the letter	Function	G	Motor neurone	Nerve impulses is transmitted along motor neurones to the effector	H	Sensory neurone	Nerve impulses generated and is transmitted along sensory neurons to the spinal cord	J	Muscle	Is the effector which will respond	K	Receptor	It is on skin to detect the pressure (stimulus) at the knee;	3	Any 3 pairs of answer correct, 3 marks
Letter	Name of the part corresponding to the letter	Function																	
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J	Muscle	Is the effector which will respond																	
K	Receptor	It is on skin to detect the pressure (stimulus) at the knee;																	

	bi	Hormones are <u>chemical substances produce by the endocrine glands;</u> <u>They alter the activities of one or more target organs and is destroyed in the liver;</u>	2	
	bii	Describe: The blood glucose /mg per 100cm ³ blood increases from 72 mg at 8 a.m. to 150 mg by 10a.m; By 2p.m. the level decreases back to normal at 72 mg; Explain: When the blood glucose level increase, this acts as a stimulus for islet of Langerhans in pancreas to release insulin; Insulin causes the conversion of excess glucose to glycogen to be stored in liver and muscles/ It also causes higher uptake of glucose in the cells for respiration. This reduces the blood glucose back to norma;	4	
6	a	1 (only) organisms that can photosynthesise; 2 incorporate / trap energy into system; 3 convert light energy into chemical energy; 4 provide energy / food for all other species / rest of food chain / web		
	b	energy is lost, between/within, trophic levels/along food chain ; A from katydid to boa energy lost, in respiration/as heat/in metabolism; energy used in maintaining body temperature ; energy lost in movement; energy used in muscle contraction ; energy in food, not eaten/egested/passed out in faeces; energy lost in, excretion/urine; wolves not very successful at catching prey; more energy available for katydid (than for boa) ; no other source of	6	

		food for boa;		
7	a	<p>increase in temperature will lead to faster evaporation within the leaf;</p> <p>water vapour molecules moves out of the stomata faster down a concentration gradient;</p> <p>hence increasing the rate of transpiration;</p> <p>increasing air humidity will decrease the concentration gradient;</p> <p>of water vapour between the intercellular air spaces and the surrounding air;</p> <p>hence decreasing the rate of transpiration;</p>	6	
	b	<p>sunken stomata; & hairs near the stomata;</p> <p>both increase humidity in the confined space near the stomata;</p> <p>together with the thick cuticle;</p> <p>which is waterproof;</p> <p>all these help prevent excessive water loss from the leaves</p>		
8	a	<p>Over time, the population increases very quickly for animal which reproduces sexually with the peak of the population when the environment is ideal. The population of A the starts to decline very quickly in hostile environment but they are still able to maintain quick a stable population with minor ups and downs.</p> <p>B on the other hand, because it reproduces asexually, its population declined very quickly when the environment turned hostile and eventually it became extinct.</p> <p>Sexual reproduction results in production of genetically dissimilar offspring which can help in survival in hostile environment. Since B reproduces asexually, it is unable to</p>	5	

		survive in hostile environment.		
	b	Parental phenotype: bald x bald	1	
		Parental genotype: Hh x Hh	1	
		Gametes: H h H h	1	
		F1 genotype: HH Hh Hh hh	1	
		F1 phenotype: Bald 75% Feathers 25%	1	
		Phenotypic Ratio: 3:1		

O Level Centre / Index Number /	Class	Name
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	<p>新加坡海星中学</p> <p>MARIS STELLA HIGH SCHOOL</p> <p>PRELIMINARY EXAMINATION TWO</p> <p>SECONDARY FOUR</p>
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<p>SCIENCE (BIOLOGY) 5078 / 04</p>	<p>21 August 2017</p> <p>1 hour 15 mins</p>
<p>Additional materials: Graph paper (1 sheet)</p>	

<p>INSTRUCTIONS TO CANDIDATES</p> <p>Write your class, index number and name on all the work you hand in. Write in dark blue or black pen. Do not use paper clips, glue or correction fluid. You may use a pencil for any diagrams or graphs.</p> <p>Section A Answer all questions. Write your answers in the spaces provided on the question paper.</p> <p>Section B Answer any two questions. Write your answers in the spaces provided on the question paper.</p> <p>The total number of marks for this paper is 65.</p>
--

For Examiner's Use
65

- 21 The following table shows the percentage⁹ changes in the mass of 4 groups of potato strips which have been immersed separately in 4 different solutions (I to IV) for one hour.

solution	percentage change in mass
I	+ 5%
II	- 5%
III	- 3%
IV	0%

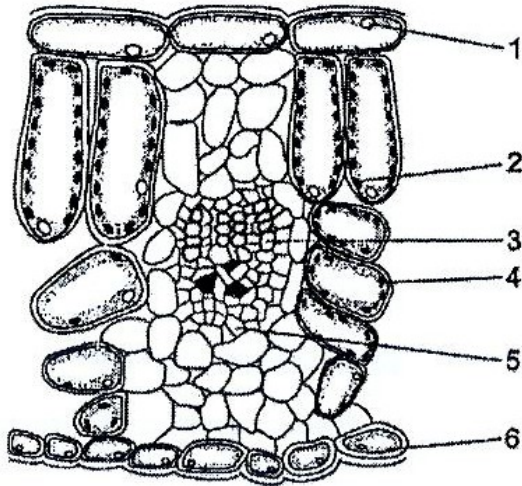
Which of the following conclusions can be drawn?

- A Solution (IV) is distilled water.
 - B Solution (IV) has the lowest water potential.
 - C Solution (I) has the highest water potential.
 - D Solution (II) has a higher water potential than solution (III).
- 22 Glucose in urine can be detected using a biochemical test. When the end of a test strip, which is coated with the enzyme glucose oxidase, is dipped into urine, the development of a blue colour indicates that glucose is present.

This is a reliable test which people with diabetes can carry out at home. Which feature of the enzyme makes this test so reliable?

- A It is stable to heat.
 - B It is specific.
 - C It reacts quickly.
 - D It remains chemically unchanged at the end of a reaction.
- 23 Kate has a damaged liver. Many functions of the body will be affected. However, there are some functions which will not be affected. Which of the following function will **not** be affected?
- A formation of glycogen
 - B formation of urea
 - C production of bile
 - D secretion of digestive enzymes

24 The diagram shows a cross-section of a leaf.



Which row correctly identifies the function of the structures?

	converts light energy to chemical energy	transports water and dissolved mineral salts	Involved in the transport of food substances
A	1, 2	3	5
B	1, 6	5	3
C	2, 4	3	5
D	2, 4	5	3

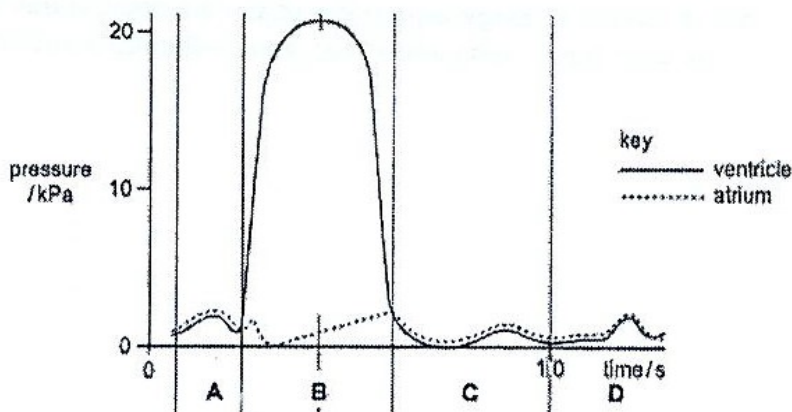
25 Which of the following environmental conditions would cause a higher rate of transpiration?

	air	light	temperature
A	damp	bright	cold
B	damp	dim	warm
C	dry	bright	warm
D	dry	dim	cold

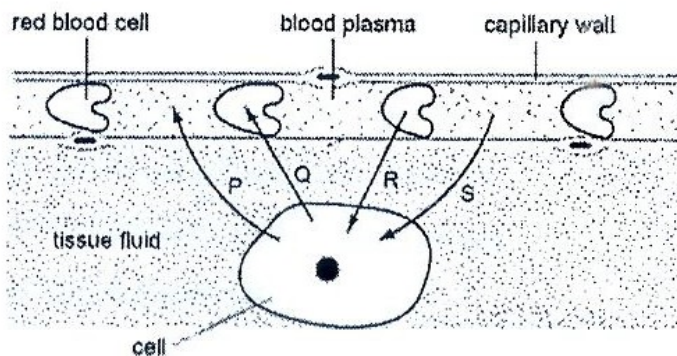
26 Into which of the following chambers of the mammalian heart does deoxygenated blood from the body enter?

- A left atrium
- B right atrium
- C left ventricle
- D right ventricle

27 The graph shows pressure changes in the left ventricle and the left atrium in one cycle of contraction of the heart. During which period of time is the ventricle contracting?



28 The diagram below represents a blood capillary with an adjacent cell. The arrows represent the transfer of substances between the capillary and the cell.



Which arrows accurately represent the transfer of the specific substances?

	glucose	carbon dioxide	oxygen
A	P	R	Q
B	Q	S	P
C	R	Q	S
D	S	P	R

- 29 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?

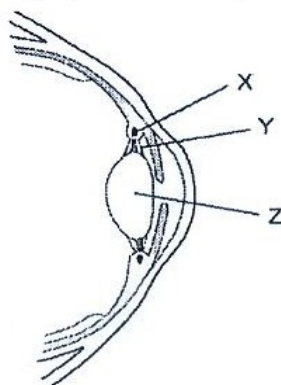
- A to remove carbon dioxide produced during anaerobic respiration
- B to remove urea produced from the breakdown of amino acids
- C to take in extra oxygen to break down lactic acid
- D to replace stored glycogen in muscles

- 30 A man injures his arm in an accident. Afterwards, he can feel objects in contact with his hand, but he cannot move his hand away from them.

What could be the cause of this?

- A Receptors in his hand are damaged.
- B The nerve connection is cut only between the receptors in his hand and his central nervous system.
- C The nerve connection is cut only between his central nervous system and the effectors in his arm.
- D The nerve connection between the receptors in the hand and his central nervous system as well as the nerve connection between the central nervous system and the effector are cut.

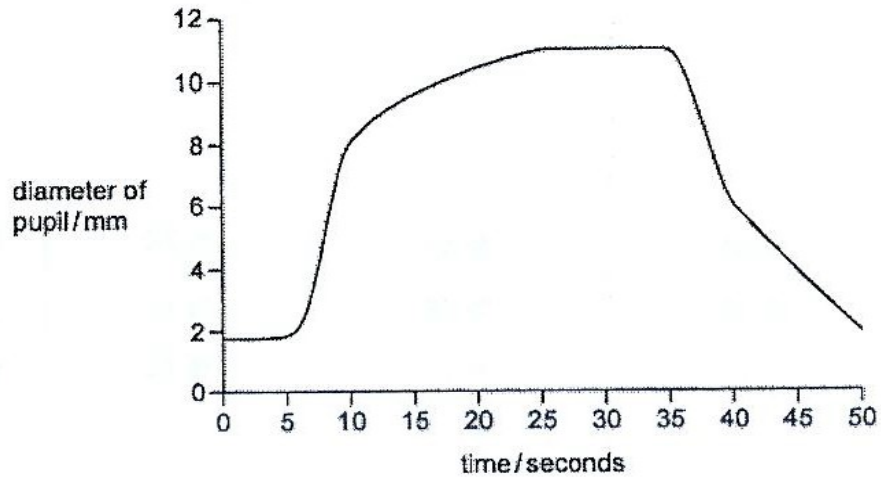
- 31 The diagram shows a section through part of the eye.



What happens to parts X, Y and Z when the eye focuses on a near object?

	X	Y	Z
A	contracts	tight	more convex
B	contracts	slack	more convex
C	relaxes	tight	less convex
D	relaxes	slack	less convex

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



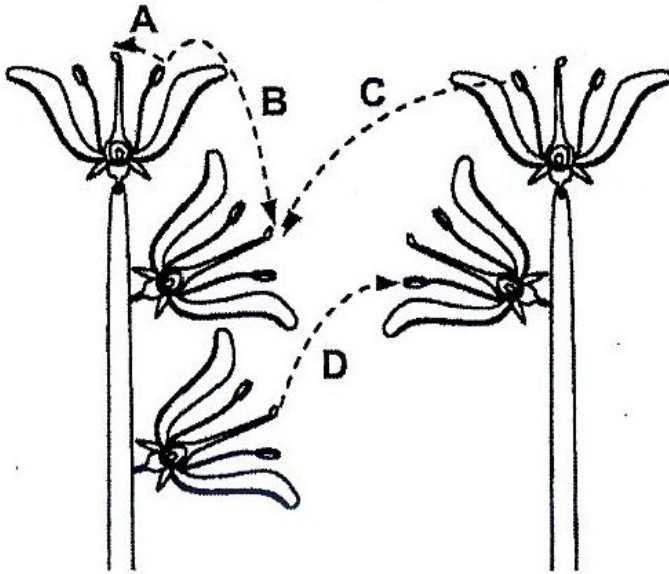
Which time period shows the light intensity increasing?

- A 5 to 10 seconds
 B 10 to 25 seconds
 C 25 to 35 seconds
 D 35 to 40 seconds
- 33 These events occur during sexual reproduction in plants.

- 1 development of fruit
- 2 fertilisation
- 3 growth of pollen tube
- 4 pollination

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

- 34 The diagram shows two plants of the same species.



Which arrow represents cross-pollination?

- 35 How does continuous variation differ from discontinuous variation?

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

- 36 A pure-breeding, red-flowered plant is crossed with a pure-breeding, white-flowered plant. All the offspring have red flowers.

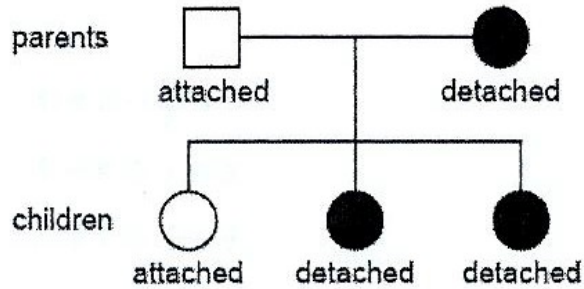
Taking R as the dominant allele for red flowers and r as the recessive allele for white flowers, what is the genotype of these offspring?

- A R
- B RR
- C Rr
- D rr

- 37 The shape of a person's earlobes is determined by a single gene. This gene has dominant and recessive alleles.

The allele for detached earlobes is dominant to the allele for attached earlobes.

The diagram shows the inheritance of earlobe shape in a family.



What is the probability of the next child from the same parents having detached earlobes?

- A 0 %
 B 25 %
 C 50 %
 D 75 %
- 38 A gene of a particular organism contains 37% Adenine (A). Which of the following would best represent the percentage distribution of the other nucleotides in this gene?

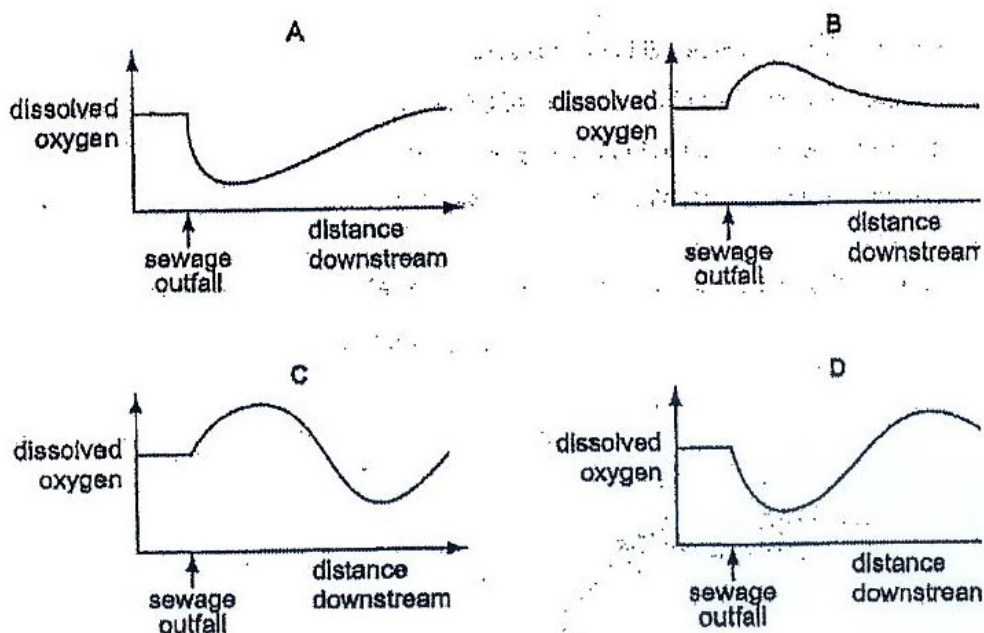
	cytosine (C)	guanine (G)	thymine (T)
A	13 %	13 %	37 %
B	13 %	37 %	13 %
C	13 %	37 %	37 %
D	37 %	13 %	13 %

- 39 The diagram below shows a food chain found in a freshwater lake that is polluted by insecticides.

single cell organisms → insect larvae → small fish → large fish

Which organisms in the food chain will accumulate the highest concentration of insecticide in their body tissues?

- A single cell organisms
 B insect larvae
 C small fish
 D large fish
- 40 Which graph shows the most likely effect of pollution by sewage on the amount of oxygen dissolved in a river?



-END OF PAPER-

Section A

Answer all the questions in the spaces provided.

- 1 Figure 1 below shows an experiment with three different set-ups involving a visking tubing and equal concentrations of different substances placed at the start of the experiment.

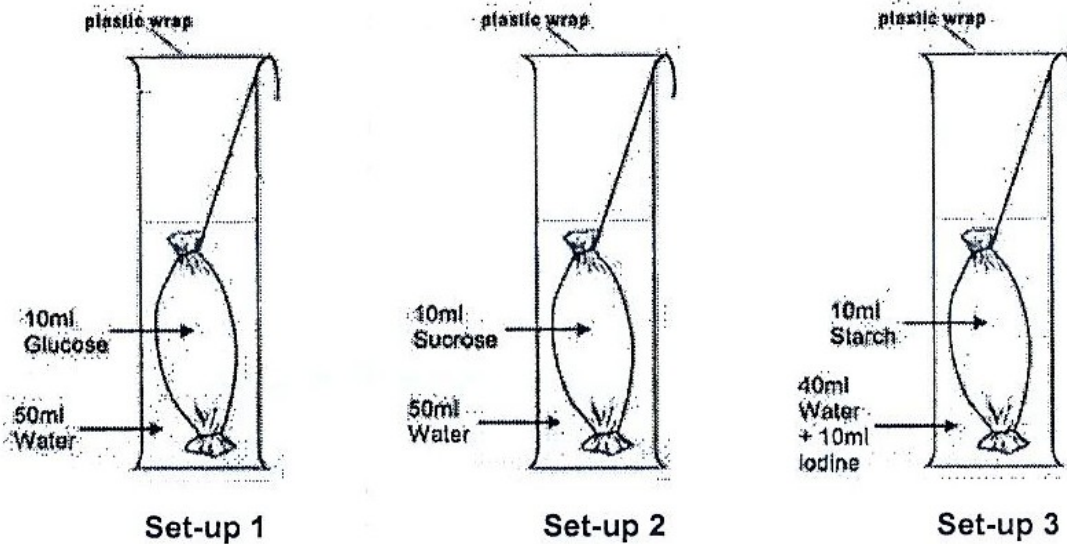


Figure 1

- a) What is the purpose of having the plastic wrap on top of the measuring cylinders?

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

- b) (i) Predict what will happen to the water level in Set-up 2 after 5 hours.

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

- (ii) Explain your prediction.

.....
.....
.....
.....[3]

c) (i) Predict what will happen to the starch in the visking tubing in Set-up 3 after 2 hours.

.....
[1]

(ii) Explain your prediction.

.....

[2]

[Total: 8]

2 Fig. 2.1 illustrates the relationship between the age of a pig and the activity of the enzymes in its digestive system.

As the pig grows older, its diet is gradually changed to grains and soya beans.

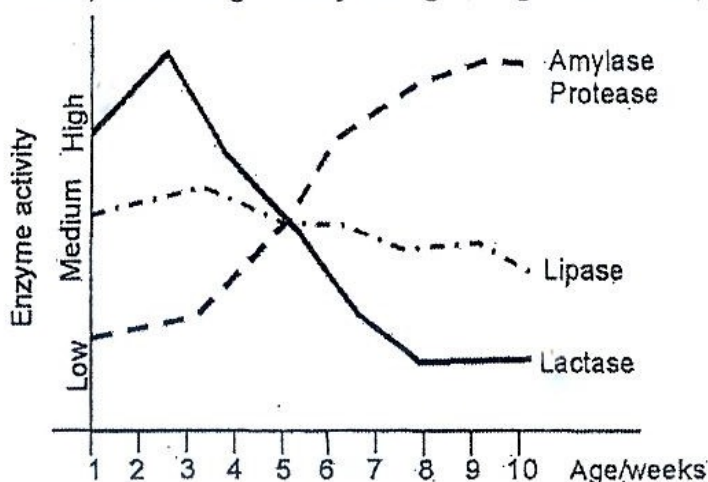


Figure 2.1

a) (i) Suggest a suitable diet for a young pig that is less than 3 weeks old.

.....
[1]

(ii) Explain your answer in (a)(i).

.....

[2]

b) (i) State the changes in the activity of lactase, protease and amylase after week 3.

.....

.....

.....

.....[3]

(ii) Explain your answer in (b)(i) with reference to the pig's diet as it grows older.

.....

.....

.....[2]

[Total: 8]

3 Fig. 3.1 below shows an experiment set up by a student to investigate the effect of varying temperature on the rate of photosynthesis.

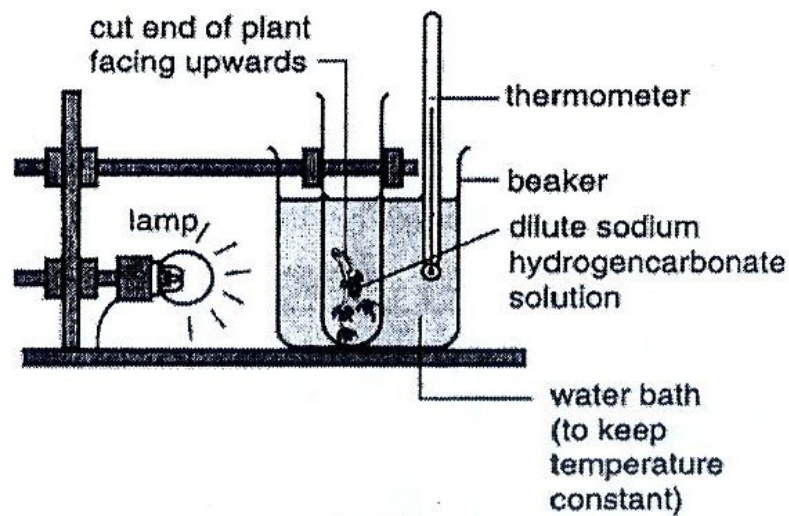


Fig. 3.1

The lamp was exactly 8.0 cm from the beaker. The temperature of the water in the bath was maintained at 35.0°C.

Next, the lamp was switched on and the number of bubbles emerging from the cut end within 1 minute was counted.

The count was repeated twice.

The experiment was repeated using water baths of 15.0°C, 25.0°C, 35.0°C, 45.0°C and 55.0°C.

- 4 Bicuspid Aortic Valve Disease (BAVD) is the most common inheritable disease of the valve, occurring in 1-2% of the population.

Fig. 4.1 below shows the difference between a normal and diseased valve.

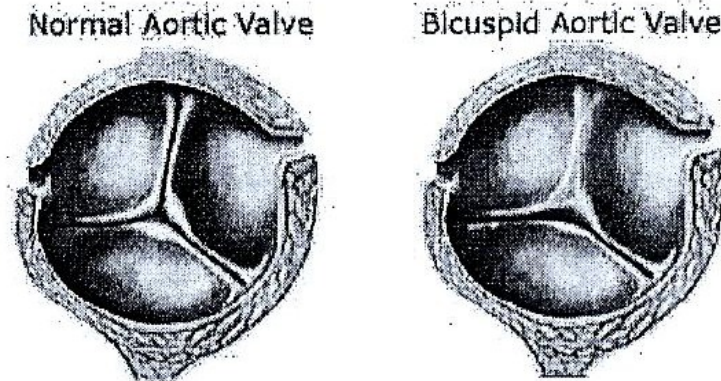


Fig. 4.1

- a) Based on Fig. 4.1, describe a key difference between a normal and diseased valve.

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

- b) Suggest how the change in the structure of the valves can cause the valves to malfunction and affect the functions of the heart or body.

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

- c) Suggest why patients of BAVD may suffer from fainting spells.

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

[Total: 5]

- 5 Albinism in humans is characterised by the complete or partial absence of pigment in the skin, hair and eyes. Albinism affects the production of melanin, the pigment that colours skin, hair and eyes.

In albinism, cells that produce melanin do not work properly because of inherited genetic mutations. There are a number of genetic mutations that can cause albinism and these are passed onto a child by their parents.

Albinism is caused by a recessive allele.

- a) Draw a genetic diagram, with clear labels and symbols drawn, when an albino mother and a non-albino father, who is a carrier of albinism, produce an offspring.

Use **A** to represent dominant allele and **a** to represent the recessive allele. [4]

- b) What is the percentage chance that a child will be born an albino?

.....[1]
 [Total: 5]

- 6 Digestive enzymes are naturally abundant in many raw fruits and vegetables, for example, apples, avocados, carrots, grapefruit, spinach and tomatoes.

There is another type of enzyme found in fruits and vegetables, which is known as peroxidase. Its function is to break down hydrogen peroxide, which is one of the toxins produced as a by-product of using oxygen for respiration.

Hydrogen peroxide is broken down to water and oxygen in the process.

Using the concept of the lock and key hypothesis, explain how peroxidase is able to break down hydrogen peroxide.

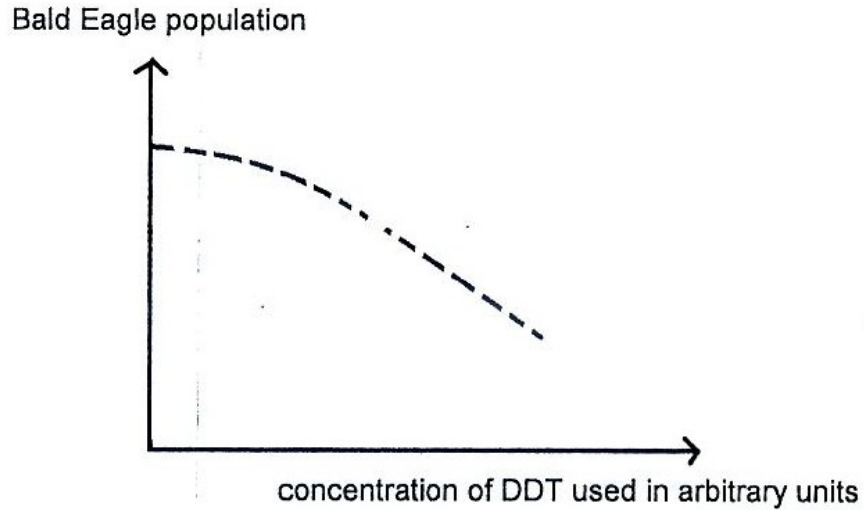
.....

[4]
 [Total: 4]

7 DDT was introduced in 1948 as an effective pest control substance for the agriculture in industry in the United States. It was widely used to solve pest problems by farmers.

However, in 1962, scientist Rachel Carson highlighted the environmental impacts that coincide with the widespread use of DDT as shown in the graph below.

Graph of Bald Eagle population against concentration of DDT used



a) State the trend of the number of Bald Eagles in the community arising from the use of DDT.

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

b) Explain how DDT can possibly impact the Bald Eagle population.

.....
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.....
.....
.....[3]

[Total: 5]

9 (a) Compare and contrast the fertilisation process in flowering plants and in humans.

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..... [4]

(b) Describe the differences between the offspring of asexual and sexual reproduction in plants and explain advantages and disadvantages of producing plants by these two methods.

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..... [6]
[Total: 10]

10 Fig. 10.1 below is a passage about the Glucose Tolerance Test.

Glucose Tolerance Test

A Glucose Tolerance Test is a diagnostic test for diabetes. After fasting overnight, you are given a concentrated sugar solution (50 to 100 grams of glucose) to drink, and your blood is sampled periodically over the next several hours to test its glucose levels. Normally, blood glucose does not rise very much and returns to normal within two to three hours. In a diabetic, the blood glucose usually rises more after the glucose solution and takes from four to six hours to come down.

Freudenrich, Ph.D., Craig. "How Diabetes Works." 22 June 2001. HowStuffWorks.com. <<http://health.howstuffworks.com/diabetes.htm>>

(a) Explain what causes the blood glucose to return to normal levels within two to three hours of the Glucose Tolerance Test for a normal (non-diabetic) person.

.....
.....
.....
.....
.....[3]

(b) Suggest a type of diet that may be advisable for diabetic patients and explain your choice.

.....
.....
.....
.....[3]

(c) Identify the type of response that takes a few hours and list three characteristics of this type of response.

.....
.....
.....
.....[4]
[Total: 10]

~ END OF PAPER ~

SEC 4 PRELIMINARY EXAMINATION 2

ANSWERS

MULTIPLE CHOICE QUESTIONS

Section A [20 marks]

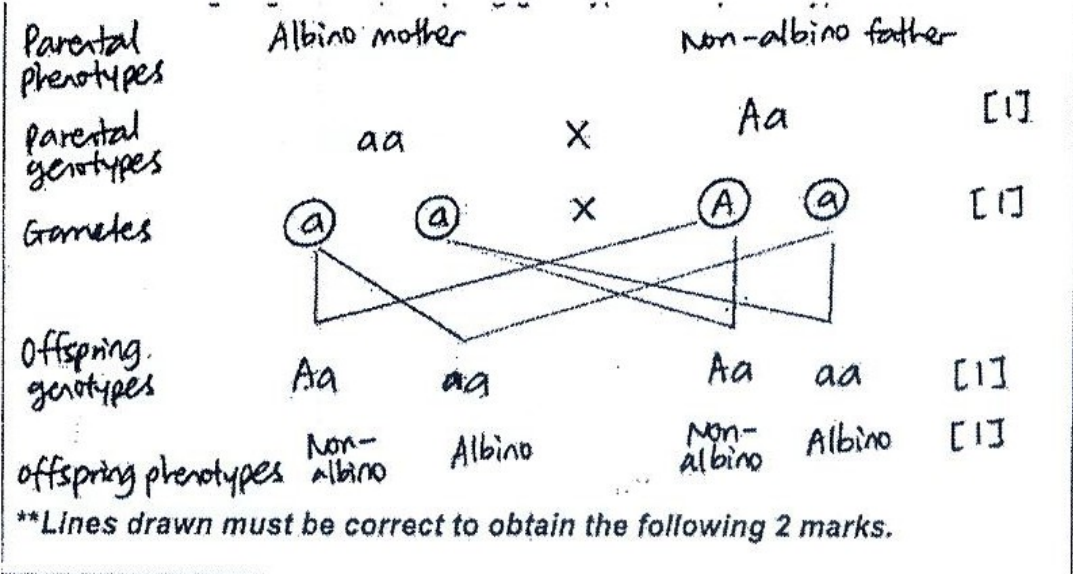
1	2	3	4	5	6	7	8	9	10
C	B	D	C	C	B	B	D	C	C
11	12	13	14	15	16	17	18	19	20
B	D	D	C	D	C	C	A	D	A

STRUCTURED QUESTIONS

Section B [45 marks]

1a)	<ul style="list-style-type: none"> To prevent the evaporation of water from the set-up OR To reduce water loss due to evaporation 	1
b)(i)	<ul style="list-style-type: none"> The water in Set-up 2 will decrease / water level will fall / drop. 	1
b)(ii)	<ul style="list-style-type: none"> There is a higher water potential outside the visking tubing [1] containing 10ml sucrose solution. Water molecules move into the visking tubing; [0.5] down a water potential gradient [0.5] There is a net movement of water molecules [0.5] Osmosis occurs [0.5] 	3
c)(i)	<ul style="list-style-type: none"> The starch will remain in the visking tubing. 	1
c)(ii)	<ul style="list-style-type: none"> The starch molecules are too large [1] to pass through the partially permeable membrane [1] of the visking tubing. OR Starch molecules (in the visking tubing) turn blue-black. [1] Iodine molecules are small enough to pass through the partially permeable membrane [1] of the visking tubing. <p style="text-align: right;"><i>Max. 2</i></p>	2
2a)(i)	<ul style="list-style-type: none"> A suitable diet will be one filled with lactose / milk 	1
a)(ii)	<ul style="list-style-type: none"> The activity of enzyme lactase is high. [1] It will be able to digest lactose products into maltose [1] for the pig's daily consumption. 	2
b)(i)	<ul style="list-style-type: none"> After Week 3, the activity of amylase starts to increase; [0.5] to a high level [0.5] After Week 3, the activity of protease also starts to increase; [0.5] to a high level [0.5] The activity of lactase starts to decrease; [0.5] 	3

2b)(ii)	<ul style="list-style-type: none"> • <u>to a low level</u> [0.5] • As the pig grows older, the <u>amylase is able to digest its diet of grains;</u> [0.5] • <u>containing starch to maltase.</u> [0.5] • The <u>protease is able to digest its diet of soya beans;</u> [0.5] • <u>containing proteins to polypeptides and subsequently into amino acids.</u> [0.5] 	2																																	
3a)	<ul style="list-style-type: none"> • The dilute hydrogencarbonate solution serves to <u>incorporate carbon dioxide</u> [0.5] into the experiment; • <u>for the plant to absorb</u> [0.5] for photosynthesis to occur. [0.5] 	1																																	
3b)	<p>Average number of bubbles evolved per minute at each temperature</p> <table border="1" data-bbox="312 748 1342 1115"> <thead> <tr> <th rowspan="2">Temperature / °C</th> <th colspan="3">Number of bubbles evolved per minute</th> <th rowspan="2">Average number of bubbles evolved per minute</th> </tr> <tr> <th>Count 1</th> <th>Count 2</th> <th>Count 3</th> </tr> </thead> <tbody> <tr> <td>15.0</td> <td>1</td> <td>2</td> <td>1</td> <td>$4/3 = 1.33$ (1)</td> </tr> <tr> <td>25.0</td> <td>2</td> <td>1</td> <td>3</td> <td>$6/3 = 2.00$ (2)</td> </tr> <tr> <td>35.0</td> <td>4</td> <td>3</td> <td>5</td> <td>$12/3 = 4.00$ (4)</td> </tr> <tr> <td>45.0</td> <td>6</td> <td>4</td> <td>8</td> <td>$18/3 = 6.00$ (6)</td> </tr> <tr> <td>55.0</td> <td>4</td> <td>3</td> <td>3</td> <td>$10/3 = 3.33$ (3)</td> </tr> </tbody> </table> <p><i>All values must be rounded off to the nearest whole number (in bold).</i></p>	Temperature / °C	Number of bubbles evolved per minute			Average number of bubbles evolved per minute	Count 1	Count 2	Count 3	15.0	1	2	1	$4/3 = 1.33$ (1)	25.0	2	1	3	$6/3 = 2.00$ (2)	35.0	4	3	5	$12/3 = 4.00$ (4)	45.0	6	4	8	$18/3 = 6.00$ (6)	55.0	4	3	3	$10/3 = 3.33$ (3)	1
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45.0	6	4	8	$18/3 = 6.00$ (6)																															
55.0	4	3	3	$10/3 = 3.33$ (3)																															
3c)	<p>Refer to the graph at the back of the answer key</p> <p>Marking points for graph:</p> <ul style="list-style-type: none"> • Appropriate X and Y axes – 0.5 • Appropriate title of graph – 0.5 • All points clearly marked and plotted – 1 • Graph is a well-drawn, smooth curve – 1 	3																																	
3d)	<ul style="list-style-type: none"> • The rate of photosynthesis is low at 15.0°C; [0.5] • The <u>enzymes in the plant are still inactive</u> [0.5] at 15.0°C. • As the <u>temperature increases to 45.0°C;</u> [0.5] • the <u>average number of bubbles evolved per minute also increases.</u> [0.5] • <u>The enzymes in the plant are becoming more active;</u> [0.5] • <u>due to an increase in kinetic energy;</u> [0.5] • <u>There are more frequent collisions between enzyme and substrate molecules;</u> [0.5] • <u>There are more enzyme-substrate complexes formed;</u> [0.5] • At 55.0°C, the average number of bubbles evolved per minute <u>starts to decrease.</u> [0.5] • <u>The enzymes in the plant are denatured at a high temperature.</u> [0.5] 	5																																	

4a)	<ul style="list-style-type: none"> A normal valve has 2 separate valves [1] beside each other, the bicuspid and the aortic valve. A diseased valve has 2 valves side by side merged together / stuck together as one single entity. [1] <p>AA: A normal valve has 3 flaps while a diseased valve has 2 flaps. [1]</p>	2
4b)	<ul style="list-style-type: none"> The diseased valve is unable to allow blood flow to the aorta efficiently. [1] This means that less blood from the left ventricle will be sent to the other parts of the body [1] 	2
4c)	<ul style="list-style-type: none"> Patients of BAVD might take a long time for the oxygenated blood to reach the brain. [1] <p>AA: Less blood reaches the brain. [1]</p>	1
5a)	<p>Full genetic diagram Must include (the marking points):</p> <ol style="list-style-type: none"> clear symbols, Aa and aa clear labels - Parental phenotypes, parental genotypes, gametes, crossing of gametes, offspring genotypes and phenotypes  <p>**Lines drawn must be correct to obtain the following 2 marks.</p>	4
5b)	<ul style="list-style-type: none"> % chance that the child will be born an albino: 50% 	1
6)	<ul style="list-style-type: none"> Peroxidase digests hydrogen peroxide into water and oxygen. Hydrogen peroxide is the substrate [0.5] (which is the key) Peroxidase is the enzyme [0.5] (which is the lock) When peroxidase binds to hydrogen peroxide at its active site; [1] forming an enzyme-substrate complex; [1] Peroxidase digests hydrogen peroxide; [0.5] into its products, water and oxygen. [0.5] 	4

7a)	<ul style="list-style-type: none"> As the concentration of DDT used increases, the number of Bald Eagles in the community decreases. 	2
7b)	<ul style="list-style-type: none"> When the plants grow, the (harmful) chemicals from the DDT are incorporated into the plants (as producers). [0.5] Primary consumers (like rabbits) feed on the plants [0.5] Chemicals are then incorporated into the body tissues of the rabbits. [0.5] as they are non-biodegradable [0.5]; They are not excreted [0.5]; Bioamplification occurs. [0.5] As Bald Eagles occupy the top of the food chain / are tertiary consumers; [0.5] Concentration of chemicals in the body tissues of the Bald Eagles is the highest. [0.5] <p style="text-align: right;"><i>Max. 3</i></p>	3

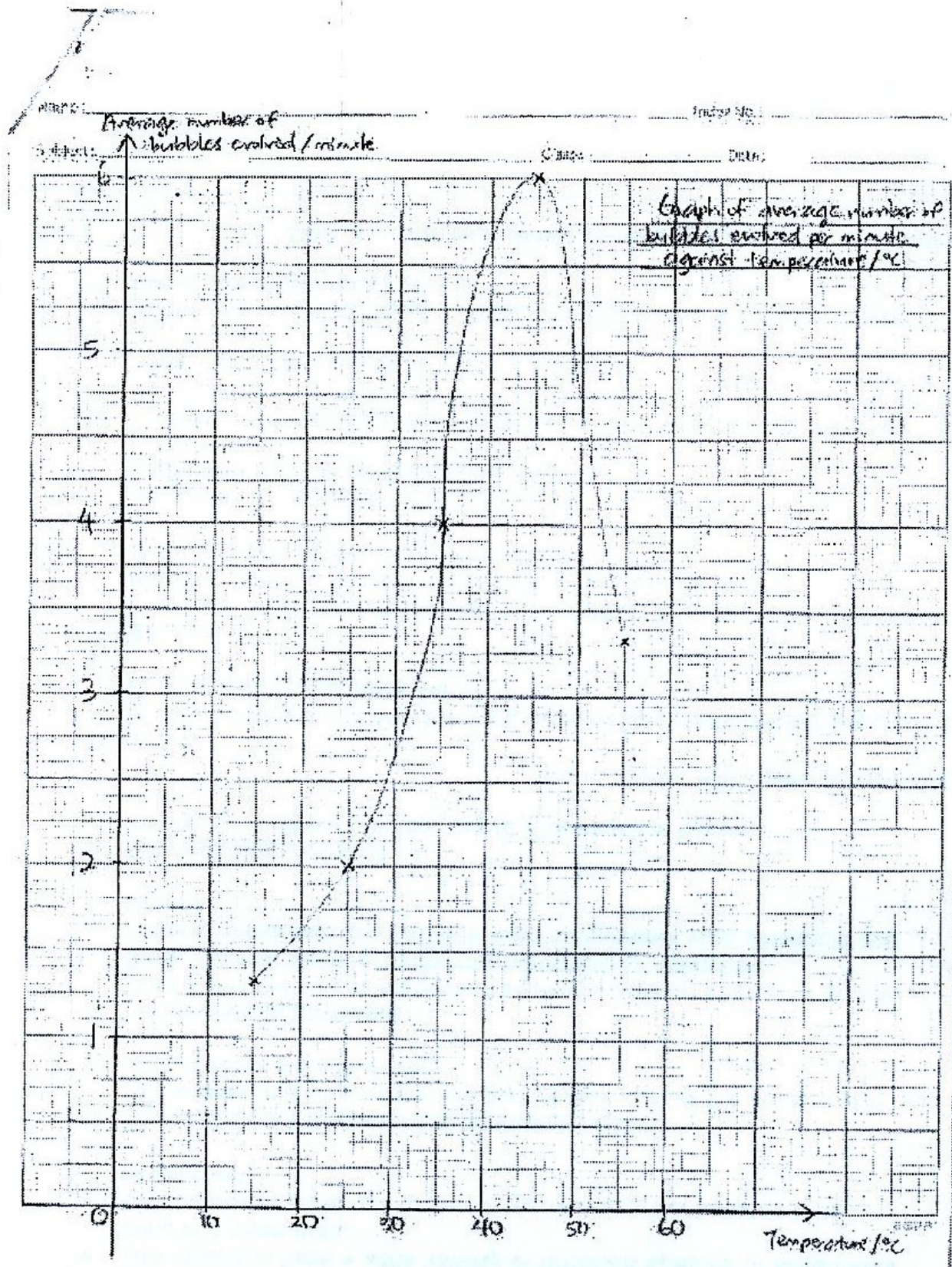
FREE RESPONSE QUESTIONS
Section C [20 marks]

8a)	<p>Specific activities of Man</p> <p>Activity 1: Overfishing [1]</p> <ul style="list-style-type: none"> Large fishing fleets are set to catch massive quantities of fish with their efficient equipment to meet the demand for fish and seafood. [0.5] When a huge net is swept across the ocean bed, the heavy rollers used to weigh down the nets are dragged along the ocean floor This destroys the habitats of many marine creatures. [0.5] Reduced marine biodiversity / gene pool [0.5] as breeding grounds are destroyed and might result in extinction of species. <p>Activity 2: Deforestation [1]</p> <ul style="list-style-type: none"> Forests are cleared for timber, paper and growing of agricultural crops [0.5] Organisms living in the forests lose their habitats and source of food and shelter [0.5] They may eventually not survive and become extinct. [0.5] 	5
b)	<p>Reasons for the importance of conservation of plant and animal species</p> <p>1. To maintain biodiversity by preventing the extinction of species</p> <ul style="list-style-type: none"> A large gene pool is important as many wild plants and animals possess favourable genes. Plants with better resistance to diseases and drought can be produced by crossing domestic species with wild species. Many tropical plants are of great importance as they are sources of medicinal drugs. 	5

	<p>2. <u>To allow for species diversity</u></p> <ul style="list-style-type: none"> • This means to have a wide variety of different species of organisms living in a given area. • Each species has its role to play in maintaining the balance in the ecosystem. <p>3. <u>To maintain a stable and balanced ecosystem</u></p> <ul style="list-style-type: none"> • This prevents disruption of natural cycles such as the carbon cycle, and also prevents global warming. <p>4. <u>For economic purposes</u></p> <ul style="list-style-type: none"> • Marine life needs to be conserved as they are major source of human food. Tropical plants provide raw materials for industries. • Tropical rainforests also provide food for example, rice, pineapple and banana <p>5. <u>For scientific research</u></p> <ul style="list-style-type: none"> • The study of wildlife provides useful information to humans. <p style="text-align: right;"><i>Max. 5 points with some elaboration</i></p>	
9a)	<p><u>Similarities</u></p> <ul style="list-style-type: none"> • In both plants and humans, the <u>male gamete fuses with the female gamete to form a diploid zygote</u>. [1] <p><u>Differences</u></p> <ul style="list-style-type: none"> • In plants, the <u>male gametes reach the ovum via the growth of the pollen tube</u>. In humans, the sperms with the <u>sweeping movement from the cilia in the fallopian tube swim towards the ovum</u>. [1] • In plants, the <u>site of fertilisation is the ovule</u>. In humans, the site of fertilisation is in the <u>fallopian tube / oviduct</u>. [1] • In plants, there are <u>two male gametes</u>. One of the gametes fuses with the ovum to form the zygote. In humans, there is <u>only one male gamete that fuses with the ovum to form the zygote</u>. [1] • In humans, a <u>film of water / liquid is needed for the sperms to swim</u>. In plants, this is <u>not required</u>. [1] <p style="text-align: right;"><i>Max. 4 points with direct comparison made for each point</i></p>	4

b)	<ul style="list-style-type: none"> • <u>Asexual reproduction produces genetically identical offspring.</u> [1] • <u>Sexual reproduction produces genetically different offspring.</u> [1] • <u>In asexual reproduction, only one parent plant</u> is required. [1] • <u>Beneficial qualities are likely to be passed down to offspring</u> [1] as genes are inherited from the parent plant. • <u>However, there is less genetic variation in the offspring.</u> [1] • The species is <u>less well adapted to changes in the environment.</u> [1] <p style="text-align: right;"><i>Max. 2 marks</i></p> <ul style="list-style-type: none"> • <u>In sexual reproduction, more varieties of offspring</u> can be produced from sexual reproduction; there is <u>greater genetic variation</u> [1] • <u>This increases the chance of the species surviving changes in the environment.</u> [1] • <u>However, two parents</u> are required instead of one. [1] • It is <u>less economical</u> as sexual reproduction need various devices to attract pollinating agents. [1] • There is always a <u>considerable waste of pollen grains</u> and <u>resources</u> [1], especially in wind-pollinated flowers. <p style="text-align: right;"><i>Max. 2 marks</i></p>	6
----	---	---

10a)	<ul style="list-style-type: none"> • The pancreas (islets of langerhans) <u>produces insulin;</u> [0.5] • It increases the <u>permeability of cell membranes</u> to glucose; [0.5] • (thus) <u>increases the rate of glucose uptake</u> by cells; [0.5] • Insulin stimulates liver to <u>convert glucose to glycogen;</u> [0.5] • to be <u>stored in the liver and muscles;</u> [0.5] • Insulin <u>increases oxidation of glucose during tissue respiration</u> [0.5] 	3
b)	<ul style="list-style-type: none"> • Fibre [1] • cannot be digested; [1] • It <u>will not increase the blood sugar level;</u> [0.5] • and <u>will be passed out as faeces / egested</u> [0.5] 	3
c)	<ul style="list-style-type: none"> • Hormonal response [1] • Hormones are transported to the target organs via the <u>bloodstream / by the blood.</u> [1] • The response may <u>affect more than one target organ.</u> [1] • Responses may be <u>short-lived or long-lived.</u> [1] • It is an <u>involuntary response / action.</u> [1] <p><i>Reject:</i> It will take a long time (already mentioned in the question)</p> <p style="text-align: right;"><i>Max. 3 for characteristics of hormonal response</i></p>	4

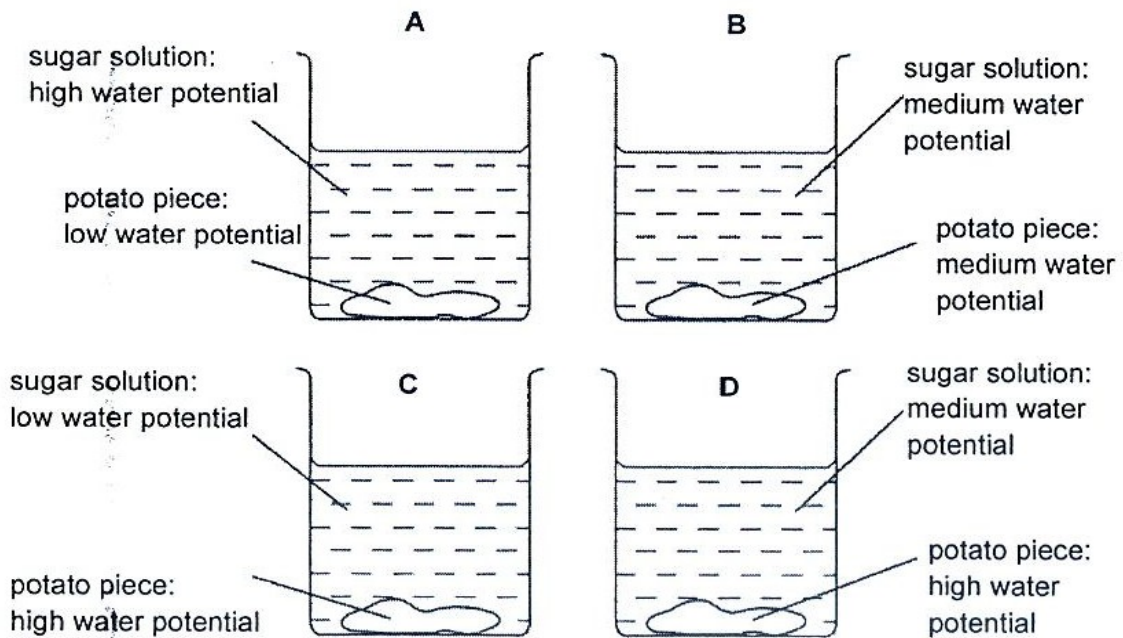


21 Which feature of a root hair cell indicates that it is from a plant and not from an animal?

- A cell membrane
- B cell wall
- C chloroplast
- D cytoplasm

22 The diagrams show some pieces of potato in four sugar solutions of different water potential.

In which solution will the potato piece take up water from the solution and swell?



23 Which of these processes require energy from respiration?

	diffusion	osmosis
A	✓	✓
B	✓	×
C	×	✓
D	×	×

- ✓ energy required
- × energy not required

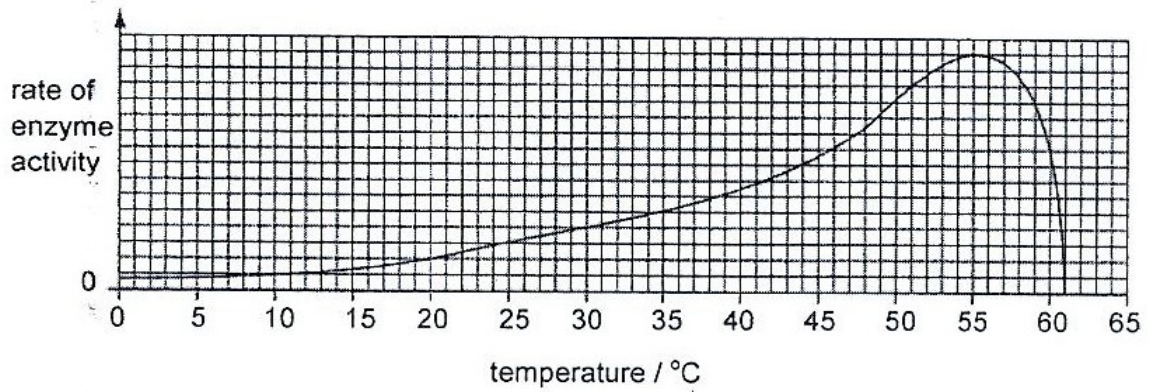
- 24 Two samples of food are tested. The results are shown in the table.

	test used		
	iodine solution	Benedict's test	biuret test
sample 1	brown	orange	blue
sample 2	blue/ black	blue	violet

What do these results show?

- A Sample 1 contains starch and sugars.
 - B Sample 1 contains starch only.
 - C Sample 2 contains starch and protein.
 - D Sample 2 contains protein only.
- 25 When an enzyme molecule has catalysed a chemical reaction in a cell, what happens to it?
- A It acts as a catalyst again.
 - B It is denatured.
 - C It is digested.
 - D It is used up by the reaction.

26 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 48 °C.
- D The rate of enzyme activity doubles when the temperature is raised from 10 °C to 20 °C.

27 Which processes are functions of the liver?

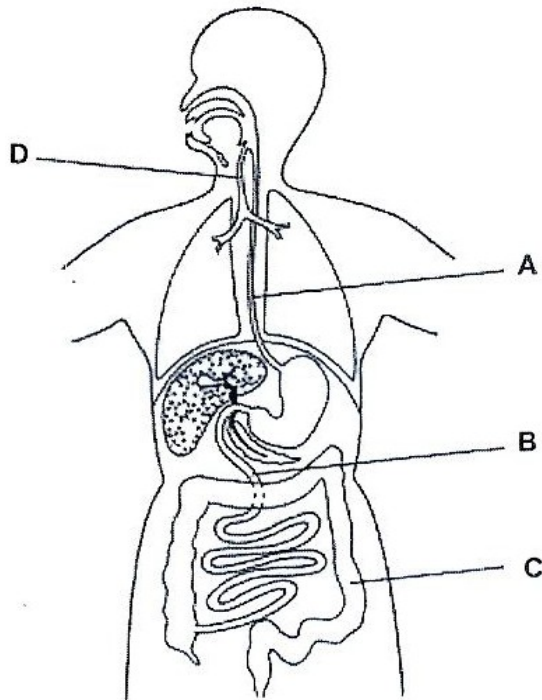
	absorbing food	assimilating food	helping with digestion of food
A	✓	✓	✓
B	✓	✓	×
C	✓	×	✓
D	×	✓	✓

key

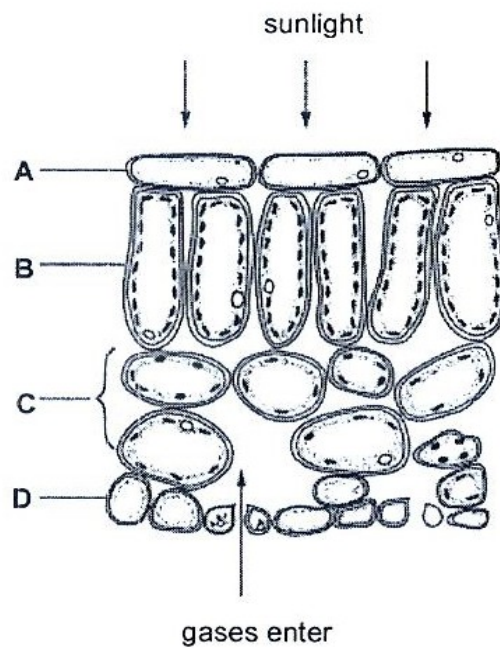
✓ = is a function

× = is not a function

- 28 The diagram shows some organs of the human body.
Which structure does **not** move its contents by peristalsis?



- 29 The diagram shows some cells in a leaf of a green plant.
In which layer of cells does most photosynthesis occur?



- 30 A plant stem was dissected into a number of different tissues. Each tissue was tested for the presence of starch, protein and reducing sugar. The results are shown in the table.

Which tissue is xylem?

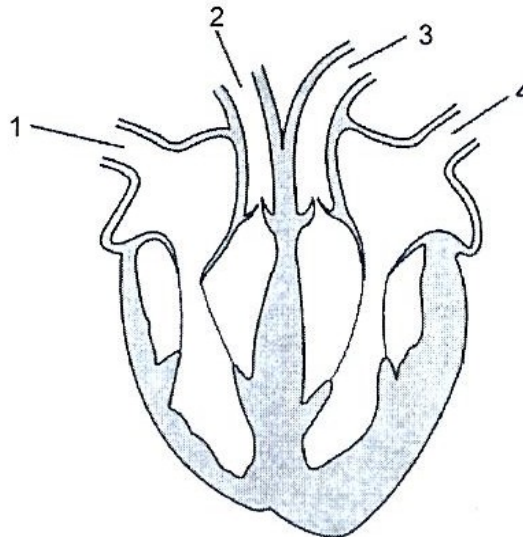
	starch	protein	sugar
A	✓	×	✓
B	✓	×	×
C	×	✓	✓
D	×	×	×

key

✓ = substance present

× = substance absent

- 31 The diagram shows a vertical section through the heart.

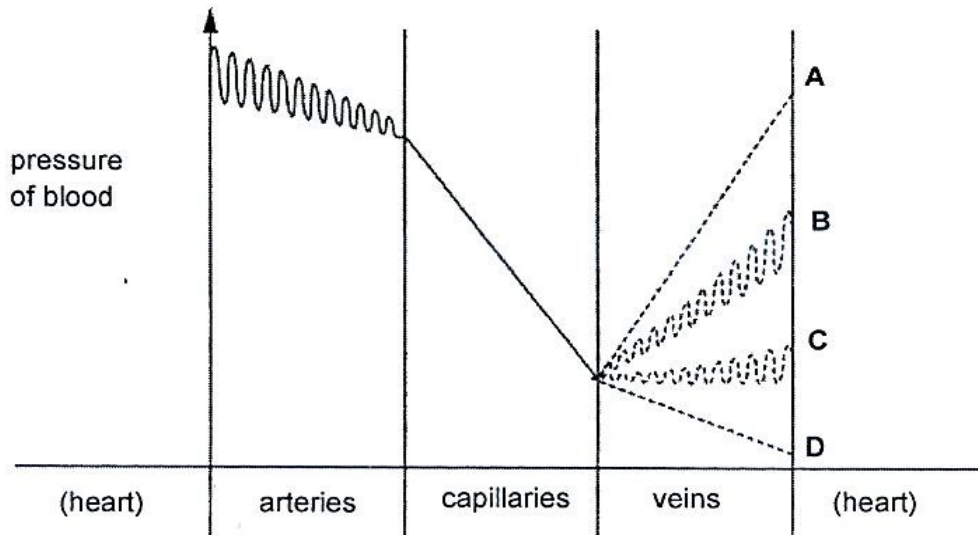


Which blood vessels contain oxygenated blood?

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

- 32 The diagram shows the pressure of blood after it leaves the heart and passes through arteries and then capillaries.

Which dotted line shows the pressure of blood as it flows through veins before returning to the heart?



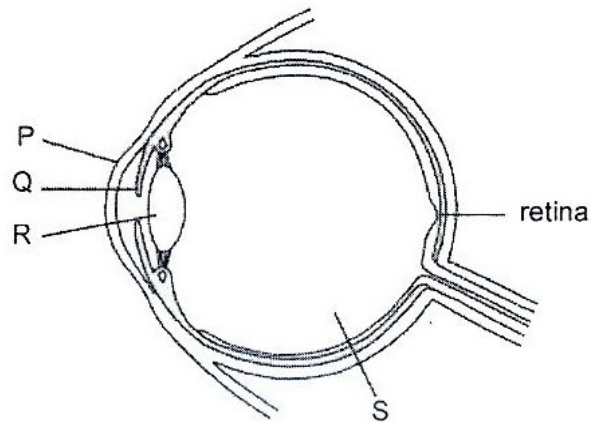
- 33 Which equation represents anaerobic respiration?

- A glucose \rightarrow lactic acid
 B glucose \rightarrow lactic acid + carbon dioxide
 C glucose \rightarrow lactic acid + water
 D glucose + oxygen \rightarrow carbon dioxide + water

- 34 After a meal containing carbohydrates, which row shows the changes in concentration of glucose and urea in the blood as it passes through the liver?

	glucose	urea
A	less	less
B	less	more
C	more	less
D	more	more

35 The diagram shows a section through the eye.



Which pair of structures focus light rays onto the retina?

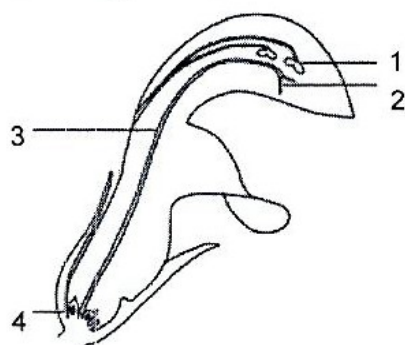
- A P and Q
- B P and R
- C Q and R
- D Q and S

36 A woman ovulates on the 7th of March.

In which week will her next menstrual period begin?

week	March						
	Sun	Mon	Tues	Wed	Thurs	Fri	Sat
	-	-	-	1	2	3	4
A	5	6	7	8	9	10	11
B	12	13	14	15	16	17	18
C	19	20	21	22	23	24	25
D	26	27	28	29	30	31	

37 The diagram shows a section through a flower.



Where do the following occur?

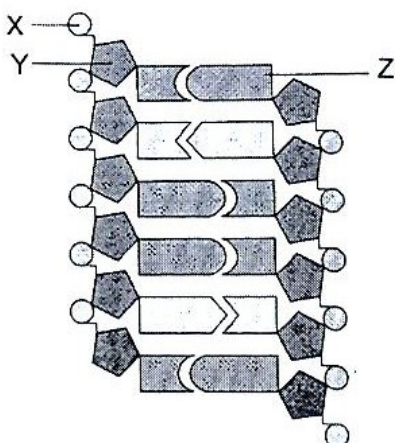
	pollination	fertilisation
A	1	2
B	2	4
C	3	1
D	4	3

38 In mice, the allele for brown fur is dominant to the allele for grey fur.

What would be the phenotypes of a cross between a mouse heterozygous for brown fur and a mouse with grey fur?

- A** 100% with brown fur
- B** 100% with grey fur
- C** 25% with brown fur and 75% with grey fur
- D** 50% with brown fur and 50% with grey fur

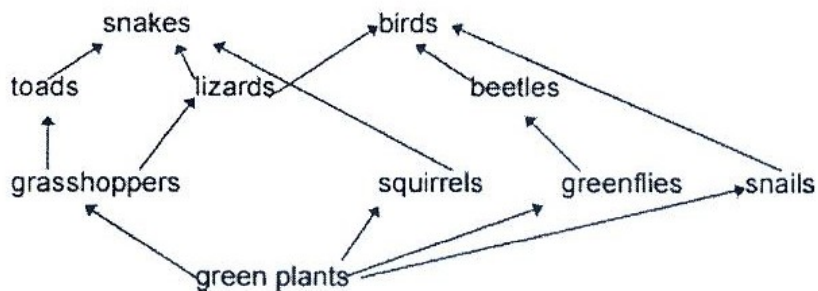
39 The following diagram shows part of a DNA molecule.



Identify X, Y and Z.

	X	Y	Z
A	deoxyribose sugar	nitrogenous base	phosphate group
B	nitrogenous base	deoxyribose sugar	phosphate group
C	phosphate group	deoxyribose sugar	nitrogenous base
D	phosphate group	nitrogenous base	deoxyribose sugar

40 The diagram shows a food web in woodland.



In this food web, a beetle is

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

*****End of Paper*****

Section A

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

For
Examiner's
Use

- 1 Fig. 1.1 shows some food just before it enters the stomach and the same food as it leaves the stomach four hours later.

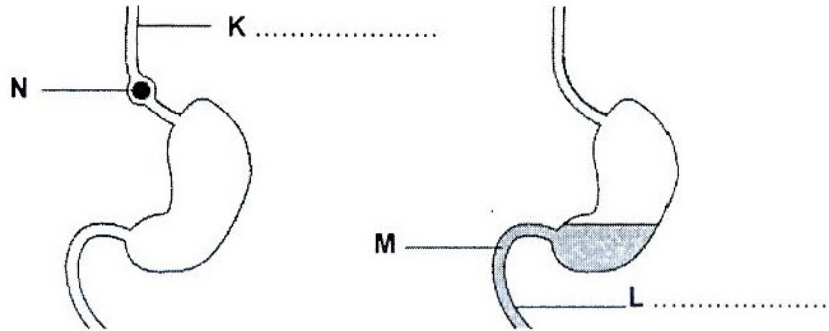


Fig. 1.1

- (a) On Fig. 1.1, label structures K and L. [2]
- (b) The food consisted solely of meat and potatoes. By placing ticks (✓) in the appropriate boxes in Table 1.2, show how the major components of the food compare at positions M and N.

Table 1.2

	more at M than at N	less at M than at N	almost the same at M and N
starch			
protein			
fibre			

[3]

Fig. 1.3 shows the same food at O, and 24 hours later, at P.

For
Examiner's
Use

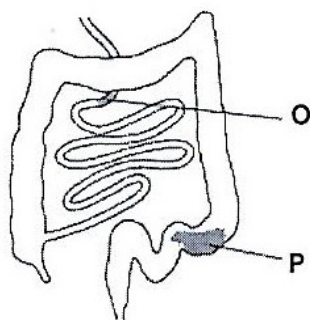


Fig. 1.3

(c) (i) Explain what has happened to the protein between O and P.

.....

.....

.....

.....

[3]

(ii) Name the region of the alimentary canal which will contain fibre in the highest proportion and give reasons for your answer.

region of alimentary canal

reasons

.....

.....

[3]

[Total: 11]

2 A plant growing in a pot was covered with a transparent polythene bag. The plant was placed in a sunny window and left there for 24 hours.

Samples of air were taken from the bag at hourly intervals. The concentration of oxygen and carbon dioxide in the air inside the bag was then measured. The results for oxygen are shown in Fig. 2.1.

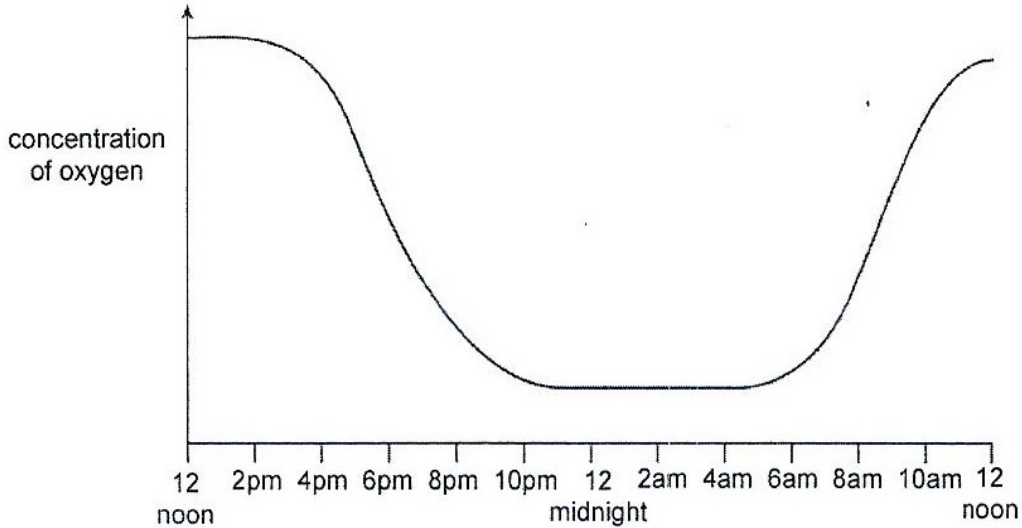


Fig. 2.1

(a) Explain why the bag covering the plant needed to be transparent.

.....

[2]

(b) With reference to photosynthesis and respiration, explain the shape of the curve in Fig. 2.1.

.....

[3]

(c) On Fig. 2.1, sketch a curve to show how the concentration of carbon dioxide inside the bag would vary during this 24 hour period.

[1]

(d) Plants are the producers in a food chain.

(i) Explain what is meant by the term *producer*.

.....
.....

{1}

(ii) Briefly describe the non-cyclical nature of energy flow.

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

{2}

[Total: 9]

For
Examiner's
Use

3 A baby girl was born with a heart condition. Fig. 3.1 shows the structure of her heart.

For
Examiner's
Use

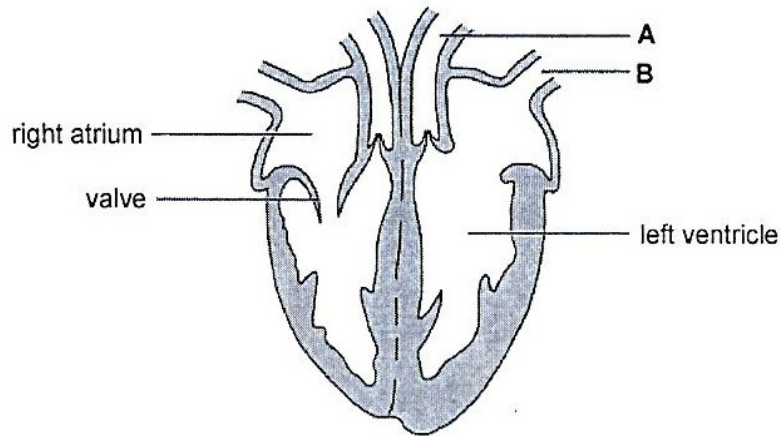


Fig. 3.1

(a) Name the parts labelled A and B.

A

B

[2]

(b) When the ventricles of the heart contract, they push on the blood so that it flows into the arteries.

Explain why this will not happen properly in the left hand side of the baby's heart.

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

[2]

(c) The heart condition means that less oxygenated blood is carried to the body tissues.

(i) Describe how the structure of the red blood cells allows it to carry out its function effectively.

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

[2]

(ii) Describe where and how the blood becomes oxygenated.

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

[2]

[Total: 8]

7
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*For
Examiner's
Use*

4 Humans carry out aerobic and anaerobic respiration.

(a) Use word equations to help you explain the differences between aerobic and anaerobic respiration in humans.

.....

[4]

(b) Athletes compete in races of different distances.

Fig. 4.1 shows the percentage of energy released by aerobic and anaerobic respiration during these races.

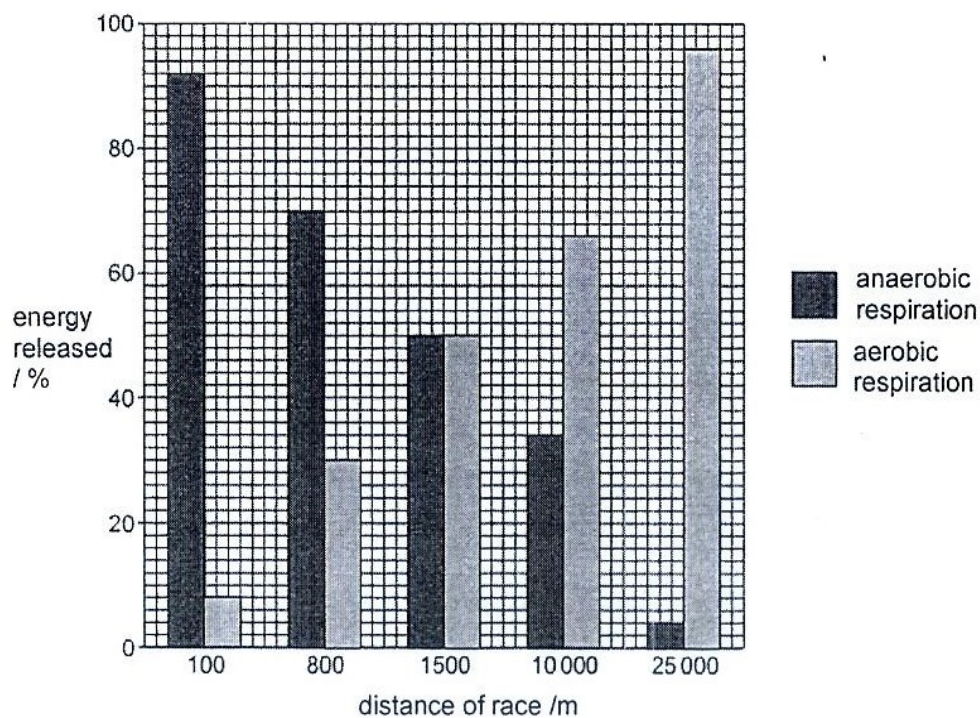


Fig. 4.1

(i) State the percentage of energy that is provided by anaerobic respiration in a 100m race

..... % [2]

(ii) State the length of race where the total energy released by each type of respiration is equal.

..... m [1]

(c) State two conclusions that can be made from the data shown in Fig. 4.1.

1

.....

2

.....

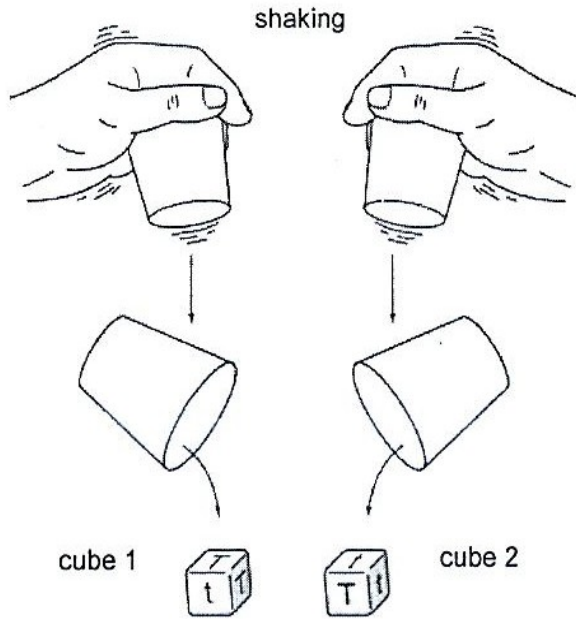
[2]

[Total: 9]

For
Examiner's
Use

- 5 Fig. 5.1 shows a method used by a student to understand how characteristics are inherited when two plants of species X are crossed. Both cubes had three of their faces marked with the letter T and three with the letter t.

For
Examiner's
Use



In this example, the letters appearing on the upper faces are Tt.

Fig. 5.1

The student shook each container and then tipped both cubes out at the same time and recorded the letters appearing on the upper faces of the cubes.

The student tipped both cubes out a total of 405 times.

- (a) (i) Complete Table 5.2 to show the results obtained.

Table 5.2

letters appearing on the upper faces of the cubes	tt	TT	Tt	
number of times each pair of letters appeared	98	.....	202	[1]

- (ii) State what the letters on the faces of the cubes represent.
 [1]
- (iii) State the reason for shaking the containers.
 [1]

13

Describe and explain the rate of water conduction in the tree, during this 24 hour period.

*For
Examiner's
Use*

.....

.....

.....

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.....

.....

.....

[4]

- 7 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.

Fig. 7.1 shows the effect of spraying pesticides against populations of this insect pest.

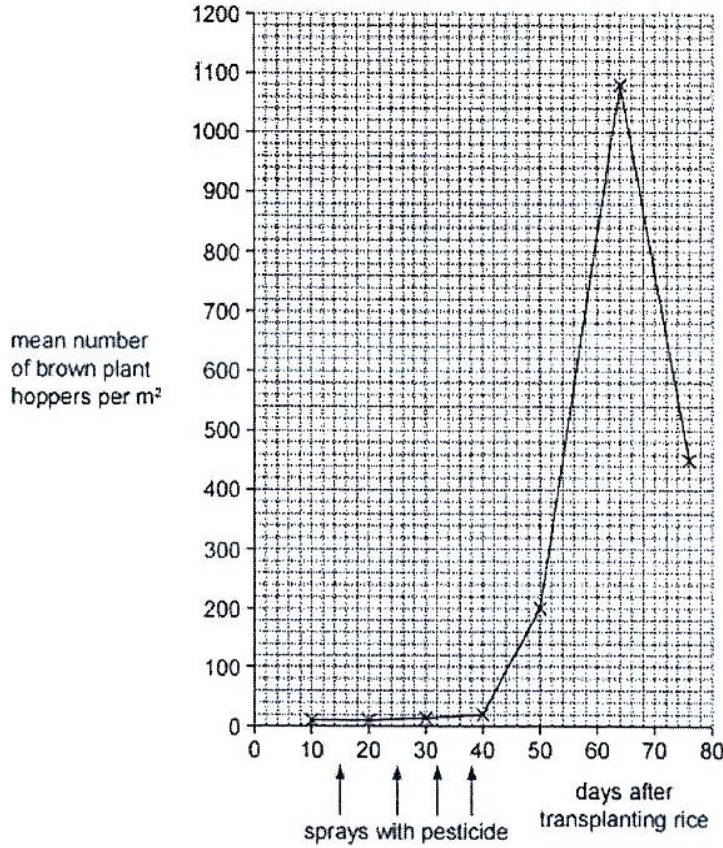


Fig. 7.1

- (a) Define the term *population*.

.....

[2]

- (b) Use Fig. 7.1 to describe the effect of pesticides on populations of the brown plant hopper.

.....

[4]

(c) Rice growing has involved the destruction of forests.

Describe the long-term effects of deforestation on the environment.

*For
Examiner's
Use*

.....

.....

.....

.....

.....

.....

.....

.....

[4]

Xinmin Secondary School
Preliminary Examination
Biology 5158
Mark Scheme

Paper 1

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

Symbols and abbreviations used in mark scheme

; – separates points for the award of a mark
 / – separates alternatives for a marking point
 ref. – makes reference to
 () – points within brackets need not be in the answer for a mark to be awarded
 cf. – compared to
 e.c.f. – error carried forward
 wrt – with respect to
 R – reject
 I – ignore/irrelevant
 A – accept
 AW – alternative wording
 ORA – or reverse argument

Paper 2

No.	Marking point	Markers' remarks
1a	<ul style="list-style-type: none"> • K- oesophagus/ gullet; • L- duodenum/ small intestine; [2] 	
1b	<ul style="list-style-type: none"> • starch- almost the same; • protein- less; • fibre- almost the same; [3] 	(A any symbols, but R more than one per line)
ci	<ul style="list-style-type: none"> • digested/ changed/ broken down/ ref. named enzyme action; • to amino acids/ polypeptides; • absorption (available only with ref. amino acids) in small intestine; [3] 	R pepsin unless mention that it is from stomach.
cii	<ul style="list-style-type: none"> • colon / rectum / large intestine; • no suitable enzyme / not digested; • ref. cellulose / lignin; • therefore no absorption / egested as faeces / used in peristalsis (A all other things, or named substances are absorbed) ; [max 3] 	
2a	<ul style="list-style-type: none"> • so light could enter / light needed; • for photosynthesis; [2] 	

No.	Marking point	Markers' remarks
2b	<ul style="list-style-type: none"> values quote from graph; highest rate of photosynthesis in the presence of light; rate of photosynthesis decreases at night + only respiration; [3] 	
2c	<ul style="list-style-type: none"> curve with peak in centre; similar lower levels at either end; + label as part (c); [1] 	
2di	<ul style="list-style-type: none"> (organism which) produces food/ produces organic substances (from inorganic; ref. to energy from sun; [max 1] 	
2dii	<ul style="list-style-type: none"> energy lost after every trophic level; (through) heat energy / uneaten body parts/ AW ; [2] 	
3a	<ul style="list-style-type: none"> A- aorta; B- pulmonary vein; [2] 	
3b	<ul style="list-style-type: none"> absence of bicuspid valve; backflow of blood into left atrium; [2] 	
3ci	<ul style="list-style-type: none"> biconcave + increase surface area to vol ratio; no nucleus + increase space for haemoglobin; [2] 	
3cii	<ul style="list-style-type: none"> in the lungs / alveoli; oxygen diffuses (from air into blood) / oxygen combines with haemoglobin; [2] 	
4a	<ul style="list-style-type: none"> aerobic: oxygen + glucose → carbon dioxide + water + large amount of energy; anaerobic: glucose → lactic acid + small amount of energy; anaerobic respiration occurs in the presence of oxygen whereas anaerobic respiration occurs in the absence of oxygen; aerobic respiration releases large amount of energy whereas anaerobic respiration release small amount of energy; [4] 	Direct comparison must be made to achieve a point
4bi	<ul style="list-style-type: none"> 92; [2] 	
4bii	<ul style="list-style-type: none"> 1500; [1] 	
4c	<ul style="list-style-type: none"> racing requires energy + energy is supplied by aerobic and anaerobic respiration; the shorter the race, (100 & 800m/ up to 1500), the less aerobic respiration/ more anaerobic respiration/ the longer the race, (more than 1500 / 1000 – 2500) the more aerobic respiration/ less anaerobic respiration; [2] 	
5ai	<ul style="list-style-type: none"> 105; [1] 	
5aaii	<ul style="list-style-type: none"> alleles; [1] 	R genotype
5aiiii	<ul style="list-style-type: none"> to ensure a random result; /AW[1] 	
5b	<ul style="list-style-type: none"> red; [1] 	
5c	<ul style="list-style-type: none"> correct parental genotype; cross done during fertilisation; correct gametes (R: not circled) using lines/ punnet square; correct genotype of offspring; ratio; [max 5] 	
6a	<ul style="list-style-type: none"> water potential, water from soil moves into root hair cell by osmosis; 	

No.	Marking point	Markers' remarks
	<ul style="list-style-type: none"> • reaches xylem vessels; • transpirational pull; • water evaporates, into airspaces (in mesophyll); • water (vapour), diffuses/passes, out through stomata; 	
6b	<ul style="list-style-type: none"> • no water conduction before 4h; • rate of water absorption more than water loss; • slow/gradual, increase from 4h to 6h/7h; • maximum water conduction rate of 2.4dm³ per hour; • due to increase in temperature in the day+ more water loss/transpiration; • slight decrease at 12h due to higher water loss than water absorption/ wilting/stomata closes to reduce transpiration; max 4 	
7a	<ul style="list-style-type: none"> • group of organisms / individuals, of same species ; • can interbreed ; • live in same area / habitat (at same time) ; [max 2] 	
7b	<ul style="list-style-type: none"> • numbers of brown plant hoppers remain low, up to 40 days / day 40 ; • low numbers when spraying occurs (days 15 to 38) ; • rapid increase when spraying stopped / AW ; • then, crash / decrease ; • any population figure with unit ; e.g. to maximum of over 1000 per m² ; [4] 	
7c	<ul style="list-style-type: none"> • decreased rainfall ; flooding ; • erosion / loss of (top)soil ; • desertification ; • loss of (plant) nutrients / soil fertility ; • disruption to food chain ; loss of habitat ; • extinction / loss of biodiversity ; • effect on carbon dioxide in the atmosphere ; 	
8a	<ul style="list-style-type: none"> • light detected by photoreceptors; • nerve impulses transmitted from sensory neurone via optic nerve to; • the relay neurone within the brain; • to motor neurone which stimulates the; • circular muscles to contract and radial muscles to relax in bright light + pupil constrict; • circular muscles relax and radial muscles contract in dim light + pupil dilate; [max 7] 	
8b	<ul style="list-style-type: none"> • pupil will not be able to constrict fast enough; • too much light entering the retina; • unable to form a clear image for awhile; [3] 	