| Name | Register Number | Class |
|---|---|---|
| | | |

# GREENRIDGE SECONDARY SCHOOL
## MID-YEAR EXAMINATION 2019
## Secondary 3 Express

**BIOLOGY** **6093**

**9 May 2019**
Thursday

**2 hours**
0800 – 1000

Additional Materials: OTAS

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**READ THESE INSTRUCTIONS FIRST**

Write your name, register number and class on this cover and all the work you hand in.
Write in blue pen or black pen.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, glue or correction fluid.
The use of an approved scientific calculator is expected, where appropriate.

**Section A**
Answer **all** questions in soft pencil on the OTAS.

**Section B and C**
Answer **all** questions in the spaces provided.

At the end of the examination, hand in the OTAS and question paper separately.

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 | |
| Section C | |
| Total | / 90 |

This paper consists of **25** printed pages, including this cover page.


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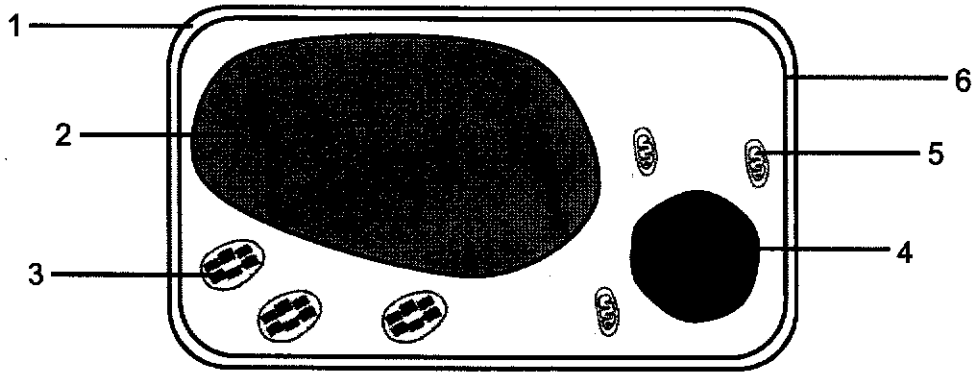
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**Section A**
This section carries 25 marks.
Answer **all** questions in soft pencil on the OTAS.

**1** Which cell structure is surrounded by a double membrane?

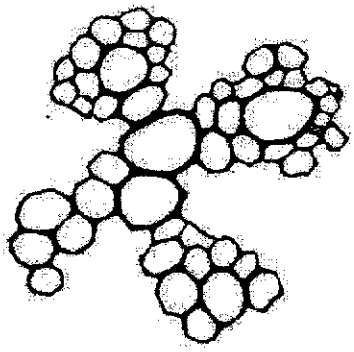
**A** Golgi body
**B** mitochondrion
**C** smooth endoplasmic reticulum
**D** rough endoplasmic reticulum

**2** Which structures are distinguishing features in a plant cell?




**A** 1, 2 and 3
**B** 1, 2 and 5
**C** 3, 4 and 6
**D** 3, 5 and 6

**3** The diagram shows a photomicrograph of xylem vessels from a leaf.



Which structure(s) can be seen in the photomicrograph?

**A** cell membrane and cytoplasm only
**B** cell membrane only
**C** cell wall only
**D** cell wall, cell membrane and cytoplasm only



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4 Which row correctly identifies these body components?

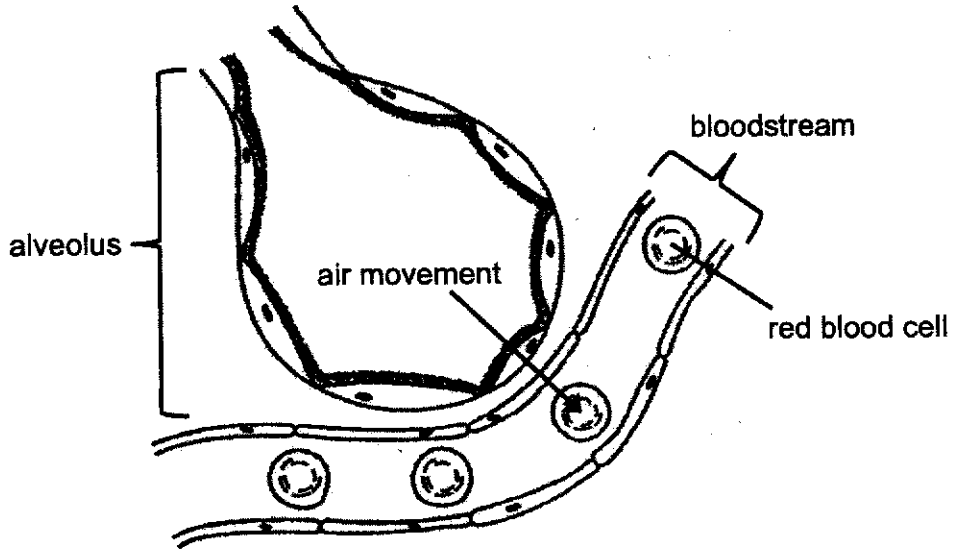
1 blood

2 brain, spinal cord and nerves

3 lungs

| | tissue | organ | organ system |
|---|---|---|---|
| **A** | 1 | 2 | 3 |
| **B** | 1 | 3 | 2 |
| **C** | 2 | 1 | 3 |
| **D** | 3 | 1 | 2 |

5 The diagram shows the movement of air from the alveolus in the lung into the red blood cells in the bloodstream.




Which statement is correct?

**A** Carbon dioxide diffuses into the red blood cells because the concentration is lower inside.

**B** Carbon dioxide diffuses into the red blood cells because the concentration is higher inside.

**C** Oxygen diffuses into the red blood cells because the concentration is lower inside.

**D** Oxygen diffuses into the red blood cells because the concentration is higher inside.



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6 Four strips of potato tissue was freshly cut, each had the same thickness but different lengths. Each strip was placed into salt solutions of different concentrations.

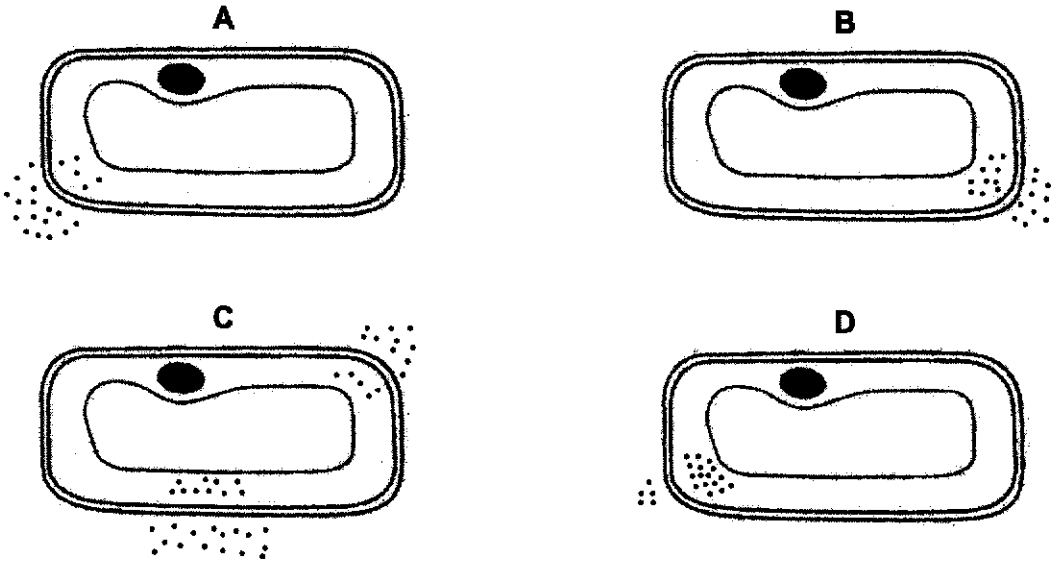
After an hour, the strips were measured again. The results are shown in the table below.

Which salt solution is the most concentrated?

| salt solution | original length of strip / mm | final length of strip / mm |
|---|---|---|
| **A** | 50 | 48 |
| **B** | 55 | 50 |
| **C** | 68 | 74 |
| **D** | 72 | 72 |

7 The diagrams show four identical cells. The dots show the concentration of a substance inside and outside of the cells.

Which cell would need the most energy to absorb the substance?






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8 A student was tasked to grow a pot of Marigold plant. She was told that in order to make the plant flower quickly, she must add fertiliser to the pot. The day after she added fertiliser, the Marigold plant wilted instead.

Which of these reasons best explains why?

**A** The concentration of fertiliser in the soil was too low to be absorbed.

**B** The fertiliser damaged the roots of the Marigold plant.

**C** There was a sharp decrease in water potential of the soil solution.

**D** There was insufficient oxygen for the fertiliser to be actively transported.

9 Which of the rows correctly states the basic units of cellulose and enzyme?

| | cellulose | enzyme |
|---|---|---|
| **A** | fructose | peptide |
| **B** | glucose | amino acid |
| **C** | glycogen | peptide |
| **D** | sucrose | amino acid |

10 A student carried out Benedict's test on three solutions. The table shows the colours observed at the end of the tests.

| solution | colour observed at the end of Benedict's test |
|---|---|
| 1 | green |
| 2 | blue |
| 3 | yellow |

Which row shows the best possible identity of the solutions?

| | solution 1 | solution 2 | solution 3 |
|---|---|---|---|
| **A** | 0.3% glucose | 0.5% glucose | 0.8% glucose |
| **B** | 0.5% fructose | 1.0% sucrose | 1.0% fructose |
| **C** | 0.5% glucose | 1.0% glucose | 1.0% sucrose |
| **D** | 1.0% sucrose | 1.0% fructose | 0.5% fructose |

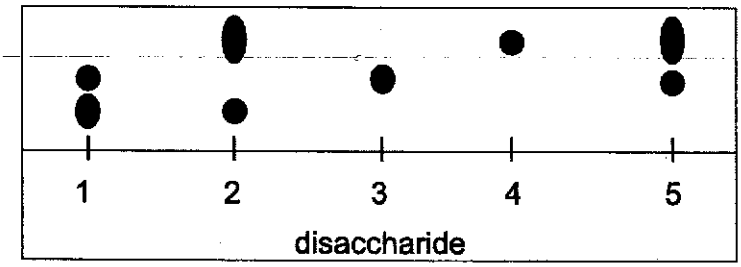


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**11** Five disaccharides were each hydrolysed and the purified products were separated by chromatography.

The results are shown in the diagram. 1 represents the result of hydrolysing lactose.




Which disaccharide represents the results of hydrolysing maltose and sucrose?

| | maltose | sucrose |
|---|---|---|
| **A** | 2 | 5 |
| **B** | 3 | 2 |
| **C** | 3 | 5 |
| **D** | 4 | 2 |

**12** Which statement(s) correctly describe(s) fats?

1 Fats are a source of energy.
2 Fats are made up of 3 molecules of fatty acids and 1 molecule of glycerol.
3 Fats contain carbon, oxygen and nitrogen.
4 Fats prevent excessive heat loss.

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

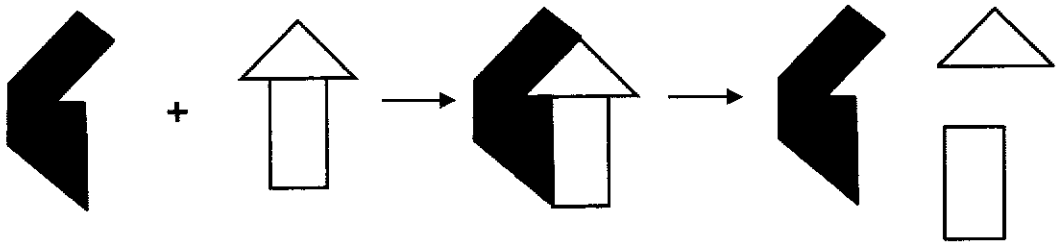


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13 The diagram represents the action of an enzyme and its substrate.



Which statement is the best conclusion that can be drawn from the diagram?

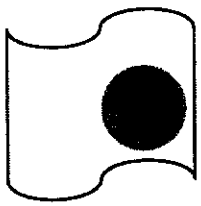
**A** Enzymes are affected by extreme pH changes.

**B** Enzymes are only involved in catabolic reactions.

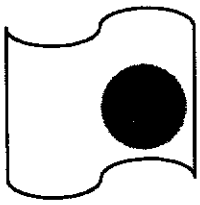
**C** Enzymes are required in small quantities.

**D** Enzymes remain unchanged at the end of the reaction.

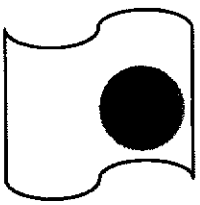
14 Three pieces of cloth were stained with the same type and amount of oil at 80°C. These cloths were then washed with detergent containing lipase, extracted from the human alimentary canal, at different temperatures.



cloth 1
washed at 20°C



cloth 2
washed at 40°C



cloth 3
washed at 80°C

Which cloth would have the least stain mark after the wash?

**A** none of the cloths

**B** cloth 1

**C** cloth 2

**D** cloth 3



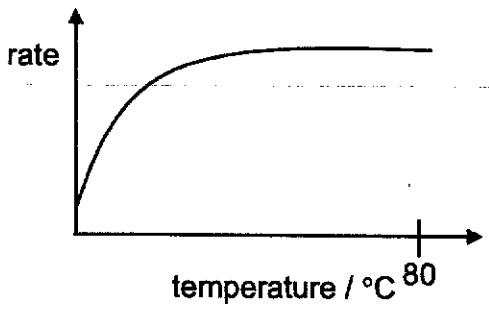
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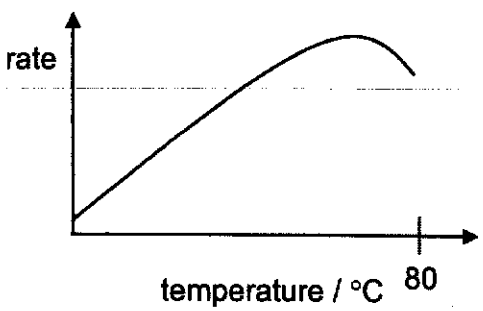
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15 Which graph shows the effect of temperature on the activity of enzymes extracted from bacteria found in the vents of hot springs where temperatures can reach up to 120°C?

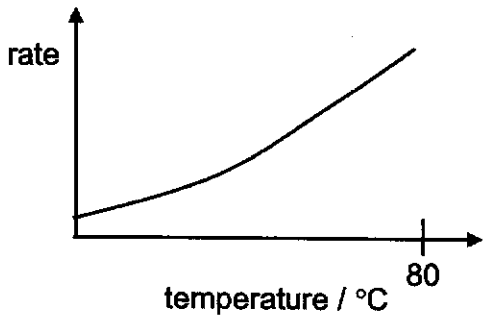
A



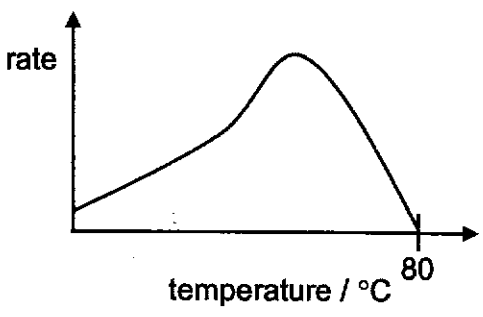

B



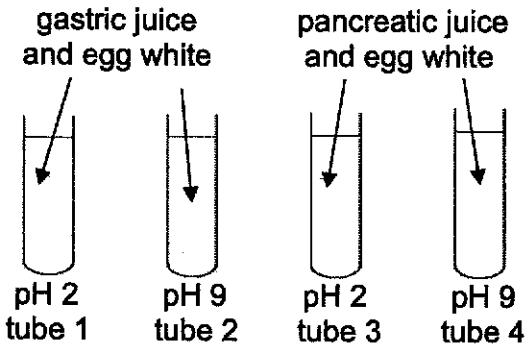

C




D




16 Four test tubes containing equal amounts of egg white were treated differently as shown in the diagram.




After an hour, a sample was taken from each test tube and tested with biuret solution. Which row shows the correct observations?

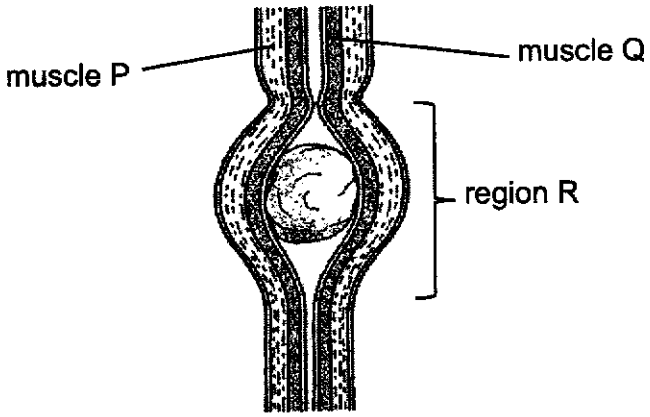
| | test tube 1 | test tube 2 | test tube 3 | test tube 4 |
|---|---|---|---|---|
| **A** | blue | violet | blue | pink |
| **B** | pink | violet | violet | pink |
| **C** | violet | blue | blue | violet |
| **D** | violet | pink | pink | violet |


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9

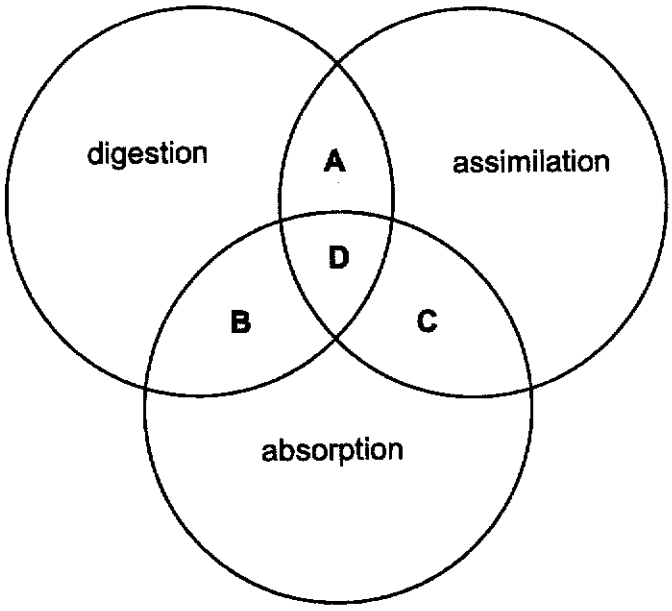
17 The diagram shows a food bolus moving down the oesophagus.




Which row identifies the muscles, P and Q, and their actions at region R?

| | muscle P | | muscle Q | |
|---|---|---|---|---|
| | muscle | action | muscle | action |
| **A** | circular | contract | longitudinal | relax |
| **B** | circular | relax | longitudinal | contract |
| **C** | longitudinal | contract | circular | relax |
| **D** | longitudinal | relax | circular | contract |

18 Which section of the diagram represents processes that take place in the small intestine?






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19 Cows are herbivores whose diet is made up of grass.

Which statement is the likely adaptation of their digestive system that supports their diet?

**A** Their gall bladder is able to release high amounts of bile.

**B** Their small intestine secretes high amounts of amylase.

**C** Their stomach has high amounts of cellulose-digesting microorganisms.

**D** Their teeth can chew grass efficiently so the nutrients can be absorbed immediately.

20 Undercooked meat may contain harmful *E. coli* bacteria, which are resistant to acids, and can survive and cause an infection in the intestines.

What is the likely consequence of an *E. coli* bacteria infection?

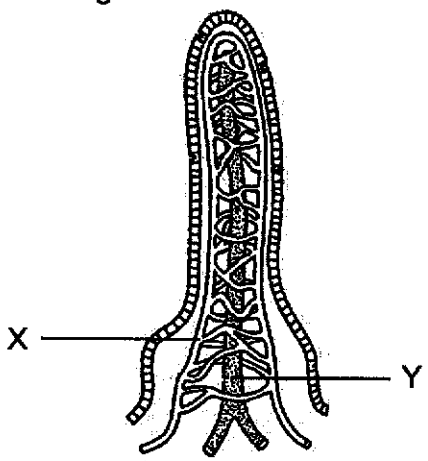
**A** constipation

**B** increased protein digestion

**C** reduced water absorption

**D** slower digestion process

21 The diagram shows a section through a villus.




What is the function of structures X and Y?

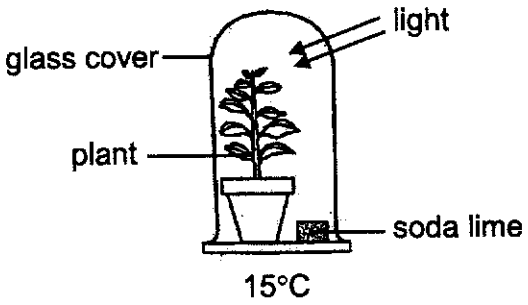
| | X | Y |
|---|---|---|
| **A** | secretes mucus | carries blood to the villus |
| **B** | secretes enzymes | peristalsis |
| **C** | transports fats | transports proteins |
| **D** | transports glucose | transports fatty acids |



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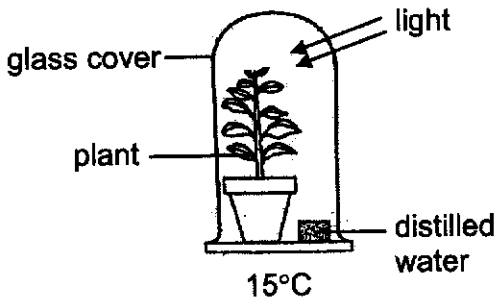
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22 The diagram shows an experiment to prove that carbon dioxide is required for photosynthesis.

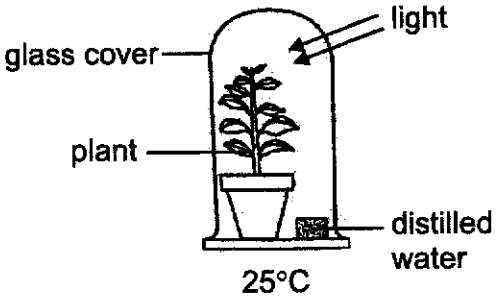



Which set up is the most suitable control for this experiment?

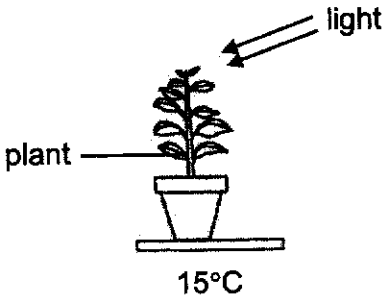
A



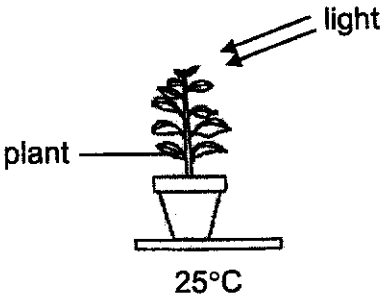

B




C




D





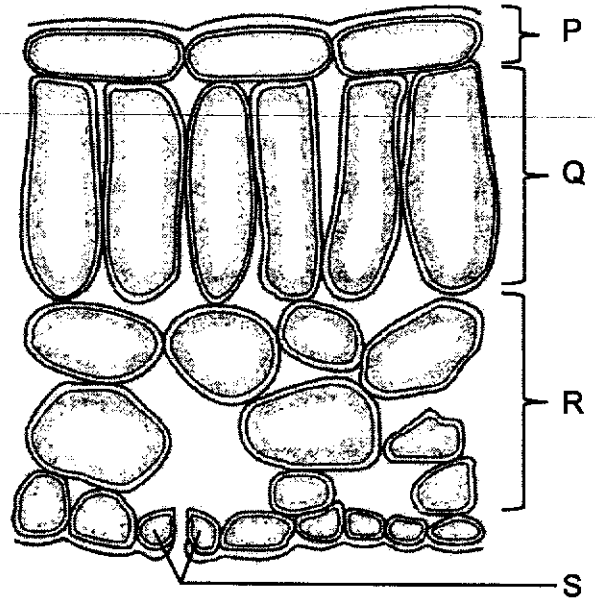

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23 The same number of cells from regions P to S were isolated from a green leaf, placed in a solution of 1.5% sodium hydrogencarbonate and exposed to the same light intensity.




Gas released by each group of cells in 30 minutes was collected and tested.

Which group(s) of cells released oxygen gas?

**A** P and R only

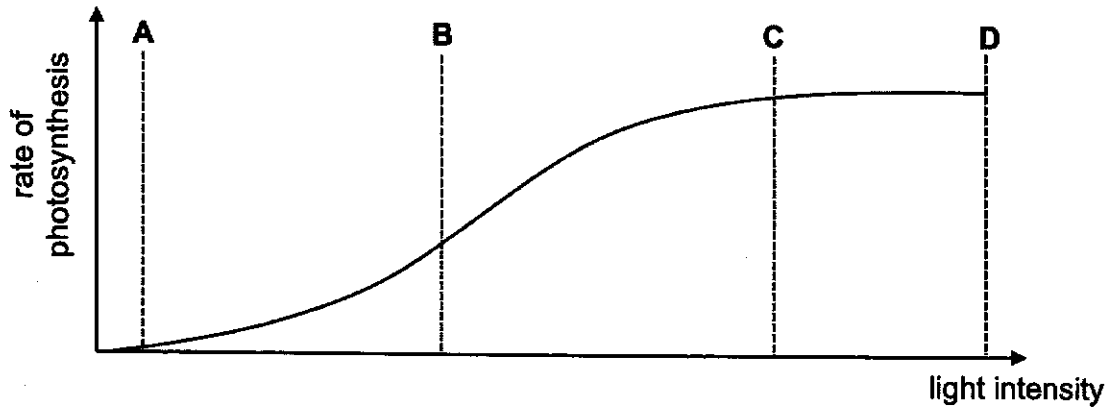
**B** P and S only

**C** Q only

**D** Q, R and S only

24 The graph shows the rate of photosynthesis in a plant exposed to normal atmospheric conditions but different light intensities.

At which part of the graph did carbon dioxide concentration become a limiting factor?

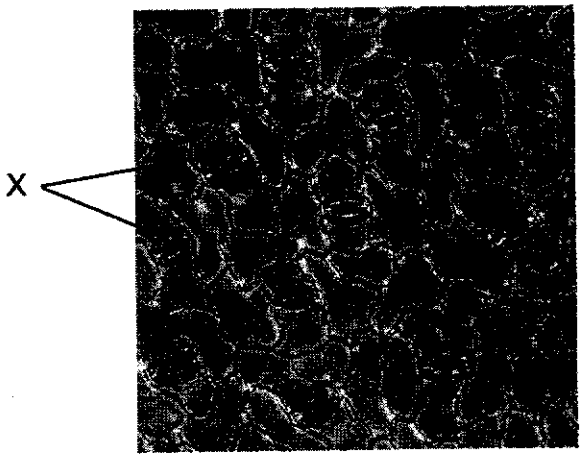





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25 The diagram shows a light micrograph of a leaf from a Plantain Lily plant.




Which of the statements about the cells labelled X is correct?

**A** The cells are turgid when the plant is in the dark.

**B** The cells lack chloroplasts.

**C** The cells make up the mesophyll layer of the leaf.

**D** The cells regulate the movement of gases in and out of the leaf.



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## Section B

This section carries 45 marks.
Answer **all** questions in the spaces provided.

**1** Fig. 1.1 shows a cell from an organism.

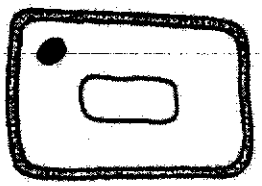


**Fig. 1.1**

The cell was placed in distilled water for 15 minutes and then transferred into concentrated salt solution for another 15 minutes.

**(a)** Draw the expected results of the cell placed into different solutions.
Label all the parts of the cell drawn.

| cell in distilled water | cell in concentrated salt solution |
|---|---|
| | |

[4]

**(b)** Explain what has happened to the cells in distilled water.

.....

.....

.....[2]

**(c)** Explain what has happened to the cells in concentrated salt solution.

.....

.....

.....[2]



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**(d)** Suggest why sports drinks have the same water potential as the cells in the body.

.....

.....

.....[2]

**2** Fig. 2.1 shows part of the human alimentary canal.

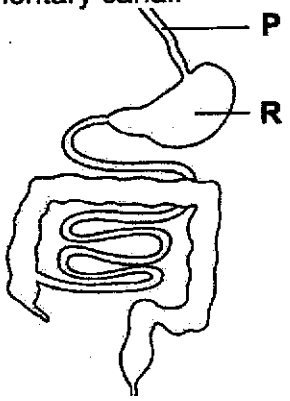



**Fig. 2.1**

**(a)** Identify organs **P** and **R**.

**P** : .....

**R** : .....[2]

Fig. 2.2 shows a medication, Drug **D**, which is designed to be released over a period of five hours after ingestion.




**Fig. 2.2**

**(b) (i)** Suggest how Drug **D** is designed to be released over a long period of time.

.....

.....[1]

**(ii)** Suggest where Drug **D** is most rapidly absorbed.

.....[1]



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A medication, Drug **E** is taken with a meal. Fig. 2.3 shows the concentration of Drug **E** in the bloodstream after it was swallowed.

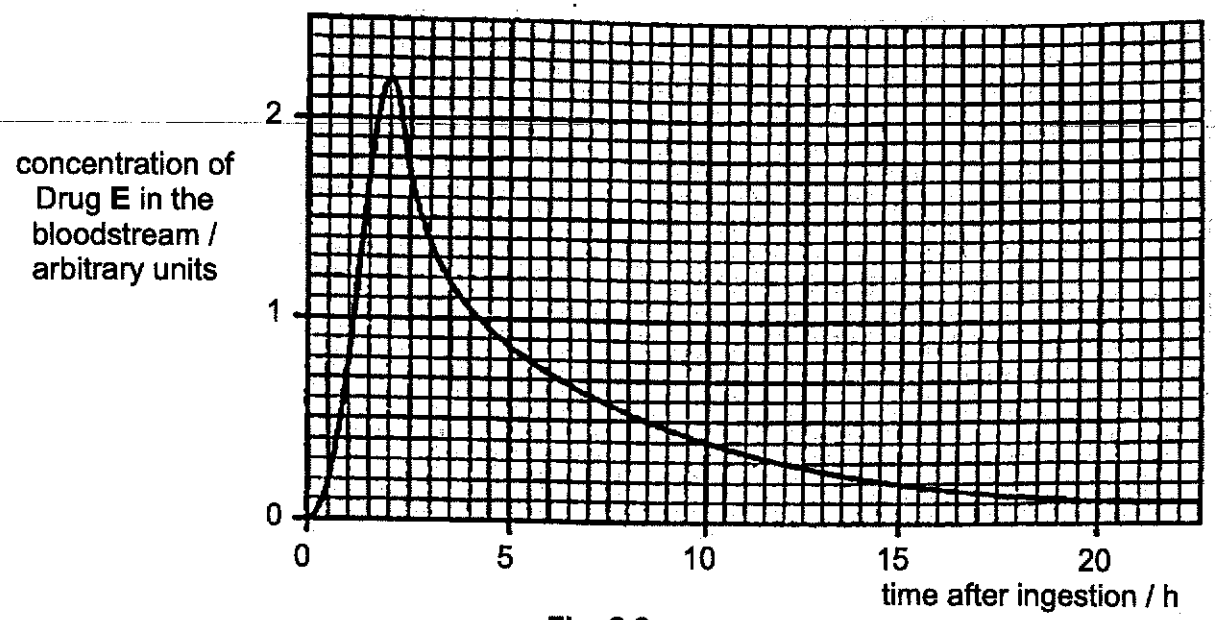



**Fig. 2.3**

**(c) (i)** Suggest which region of the alimentary canal is Drug **E** most rapidly absorbed.

Explain your answer.

.....

.....[2]

**(ii)** Suggest **one** difference in the design of Drug **D** and **E**.

.....

.....[1]



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3 Fig. 3.1 shows part of the human digestive and circulatory system.

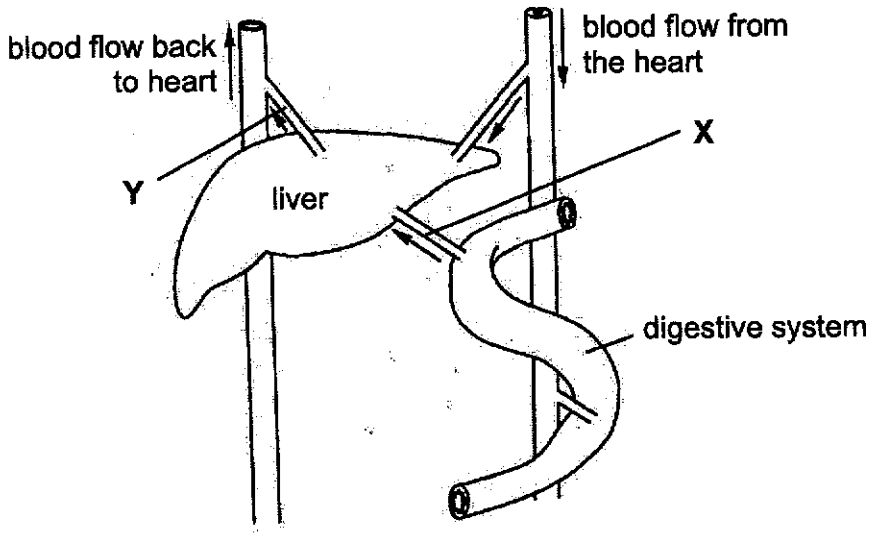



**Fig. 3.1**

**(a)** Identify blood vessel **X** and state its function.

.....

.....

.....[2]

**(b) (i)** Shawn just had a heavy meal consisting of white rice.

State the difference between the concentration of glucose in vessels **X** and **Y**.

.....

.....[1]

**(ii)** Explain your answer in **(b)(i)**.

.....

.....

.....

.....[3]



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**(c)** Describe the role of the liver in alcohol detoxification.

.....

.....

.....[2]

**(d)** State **two** effects of excessive consumption of alcohol.

.....

.....

.....[2]



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4 Fig. 4.1 shows a water plant and Fig. 4.2 shows a section through one of its leaves.

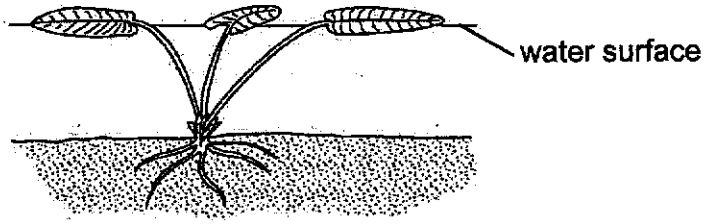



Fig. 4.1

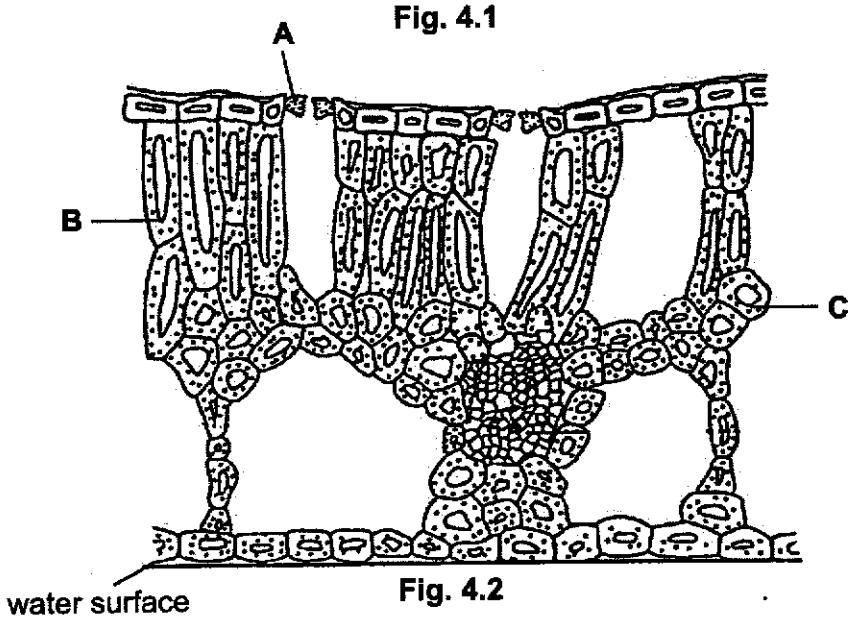



Fig. 4.2

(a) Identify cells **A**, **B** and **C**.

**A** : .....

**B** : .....

**C** : ..... [3]

(b) Describe **two** ways in which the internal structure of this leaf differs from a leaf from a typical land plant.

Explain the importance of these differences.

.....

.....

.....

.....

.....

..... [4]



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(c) Fig. 4.3 shows a plant growing on land.

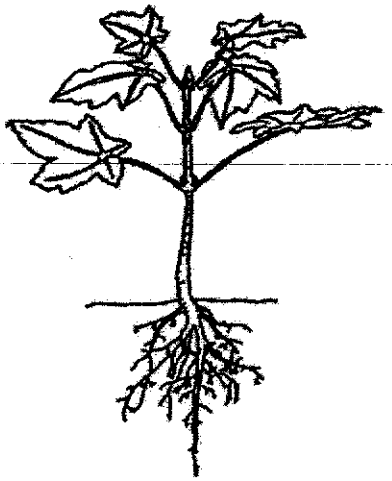


Fig. 4.3

It was found that the xylem in the leaf stalk of the land plant is more lignified than the leaf stalk of the water plant in Fig. 4.1.

Explain why.

.....

.....

.....

.....[2]



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5 Fig. 5.1 shows the effect of temperature on photosynthesis.

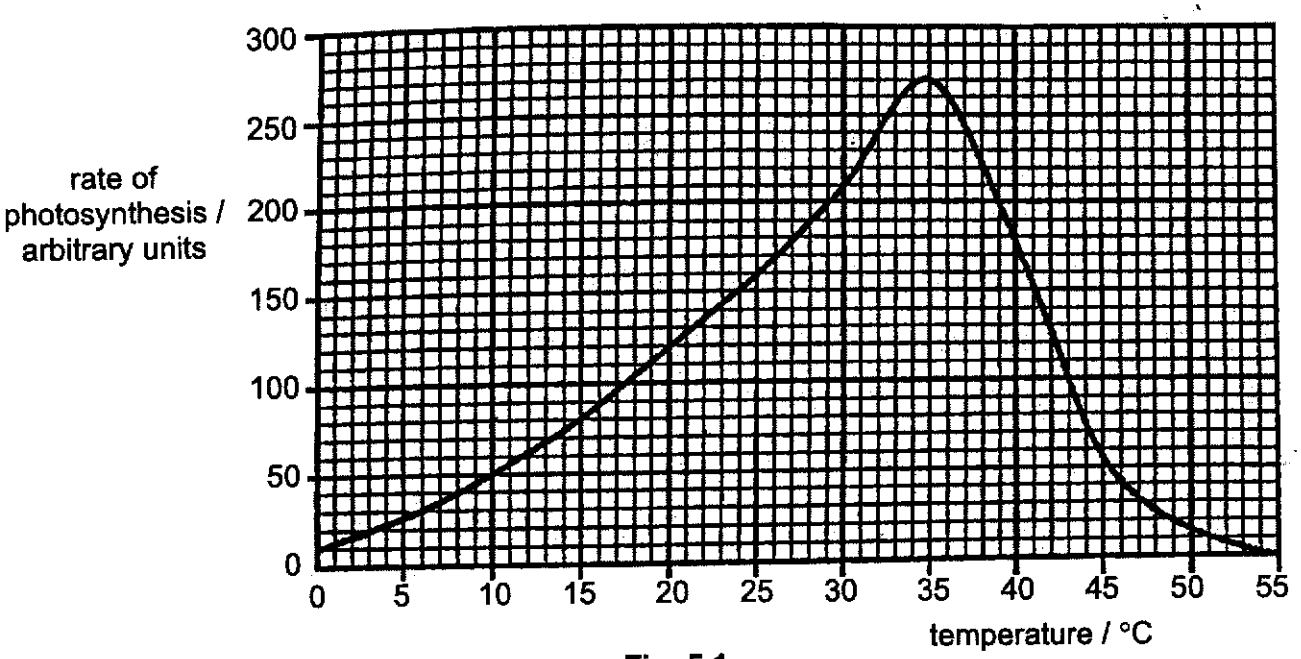



**Fig. 5.1**

**(a)** Describe and explain the relationship between temperature and photosynthesis.

.....

.....

.....

.....

.....

.....

.....

.....[4]

**(b)** Suggest **two** ways to further increase the rate of photosynthesis beyond the maximum rate shown in Fig. 5.1.

.....

.....[2]



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**(c)** The product of photosynthesis is glucose.

Describe **three** possible fates of the manufactured glucose.

.....

.....

.....

.....[3]



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## Section C

This section carries 20 marks.
Answer **all** questions in the spaces provided.

**6** An experiment was set up to investigate the effect of pH on the activity of amylase.

Amylase solution was mixed with starch solution in a test tube with a pH 2.0 buffer solution. Two drops of the sample was extracted and tested with iodine solution every 30 seconds, for up to five minutes. This procedure was repeated at pH 5.0, 6.0, 8.0, 10.0 and 11.0.

The results of the experiment are shown in Table 6.1.

**Table 6.1**

| pH buffer solution | time taken for iodine solution to remain brown / s | rate of reaction / $s^{-1}$ |
|---|---|---|
| 2.0 | – | 0.00 |
| 5.0 | 180 | 0.0056 |
| 6.0 | 150 | 0.0067 |
| 8.0 | 120 | 0.0083 |
| 10.0 | 180 | 0.0056 |
| 11.0 | 300 | 0.0033 |

**(a)** Explain why the time taken for iodine solution to remain brown is an indicator of the rate of reaction of the experiment.

.....

.....[1]



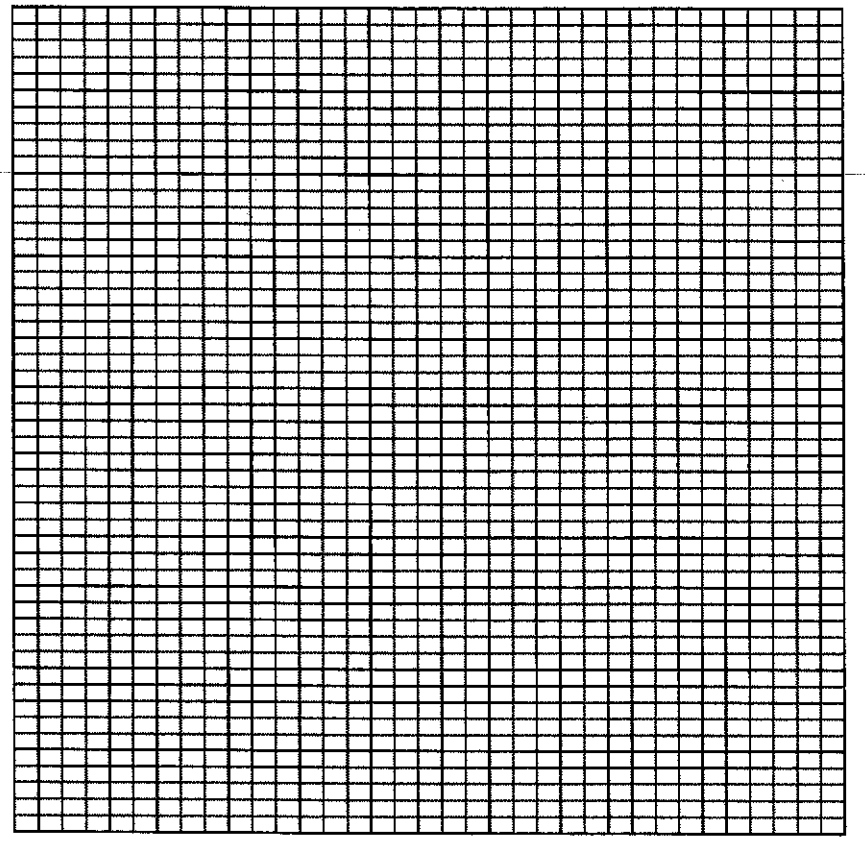
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**(b)** Plot a graph showing the rate of reaction of amylase against the pH of the mixture.



[4]

**(c)** Explain the effect of pH on the activity of amylase.

[5]



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7 (a) Describe the process of photosynthesis.

[5]

(b) Describe how carbon dioxide and water enter plants for the process of photosynthesis.

[5]

**END OF PAPER**



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**3E Biology (6093)**
**MYE 2019**

**Section A: MCQ (25 marks)**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1** | B | **6** | B | **11** | C | **16** | B | **21** | D |
| **2** | A | **7** | D | **12** | B | **17** | C | **22** | A |
| **3** | C | **8** | C | **13** | D | **18** | B | **23** | D |
| **4** | B | **9** | B | **14** | C | **19** | C | **24** | C |
| **5** | C | **10** | B | **15** | C | **20** | C | **25** | D |

**Section B: Structured Questions (45 marks)**

*avp: any valid points; owtte: or words to that effect*

| Question | Marking Point | Remarks | Marks |
|---|---|---|---|
| **1(a)** | distilled water: enlarged cell, larger vacuole, turgid cell; [1m]<br>salt solution: cell shrinks, smaller vacuole, plasmolysed cell; [1m] | 1m – correct biological drawing<br>1m – correct labels | 4 |
| **1(b)** | water potential is higher in distilled water than in cell;<br>water moves into the cell by osmosis;<br>(making it turgid) | | 2 |
| **1(c)** | water potential is higher in the cell than in salt solution;<br>water moves out of the cell by osmosis;<br>(making it flaccid) | | 2 |
| **1(d)** | Sports drinks have the same water potential as the fluid in the cells of your body so that there is no net movement of water into or out of cells.<br>The cells will not absorb water and swell nor will they lose water and dehydrate. | | 2 |
| **2(a)** | oesophagus; stomach; | | 2 |



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| | | | |
|---|---|---|---|
| **2(b)(i)** | acid-resistant coat prevents the drug from being released / absorbed in the stomach; | | 1 |
| **2(b)(ii)** | small intestine; | | 1 |
| **2(c)(I)** | stomach;<br>most rapidly absorbed after 2 hours of the meal, when food is in the stomach; | | 2 |
| **2(c)(ii)** | Drug **E** would not have an acid-resistant coat, unlike Drug **D**. | | 1 |
| **3(a)** | hepatic portal vein;<br>transport blood rich in absorbed nutrients from the small intestine to the liver; | | 2 |
| **3(b)(i)** | X would have a higher concentration of glucose than Y. | | 1 |
| **3(b)(ii)** | Glucose absorbed is high, so concentration in hepatic portal vein would be high;<br>pancreas secretes insulin;<br>stimulates liver to convert excess glucose into glycogen;<br>blood leaving liver would have lower concentration of glucose. | | any 3, max 3 |
| **3(c)** | liver cells contain alcohol dehydrogenase;<br>that breaks down toxic alcohol to harmless acetaldehyde | | 2 |
| **3(d)** | causes liver cirrhosis;<br>slows down brain function;<br>increases risk of gastric ulcers;<br>reduced self-control;<br>symptom of drunkenness; | | any 2, max 2 |
| **4(a)** | guard cell; palisade mesophyll cell; spongy mesophyll cell; | | 3 |



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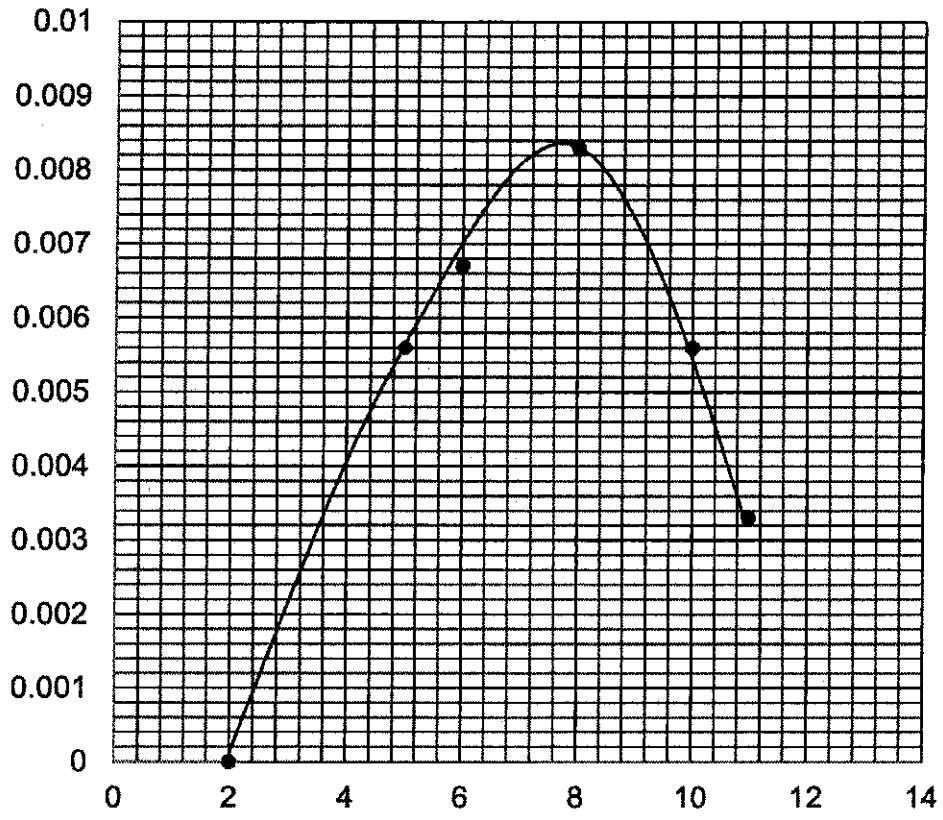
| | | | |
|---|---|---|---|
| 4(b) | air chamber in the water plant is larger than in land plants;<br>enable the leaf to better float on water;<br>for the water plant, the stomata is found mainly on the upper epidermis and none on the lower epidermis, unlike land plants which have stomata on the lower epidermis;<br>allows exposure to the air for gaseous exchange; | | 4 |
| 4(c) | water plant does not need support as the leaf is floating on water;<br>land plant's leaf stalk needs mechanical support to hold leaf in position; | | 2 |
| 5(a) | As temperature increases from 0 to 35°C, the rate of photosynthesis increases from 10 units to a maximum of 270 units.<br>As temperature increases, the kinetic energy increases, which increases the chance of collision between the substrate and enzyme to form enzyme-substrate complex and increase rate of photosynthesis.<br>The rate reaches a maximum of 270 units at the optimum temperature of 35°C.<br>Further increases after 35°C cause a decrease in the rate of photosynthesis from 270 units to 0 units at 55°C.<br>This is because enzymes involved in photosynthesis are denatured at high temperatures stopping the process of photosynthesis. | | any 4, max 4 |
| 5(b) | increase carbon dioxide concentration<br>increase light intensity | | 2 |
| 5(c) | immediately used for cellular respiration or to form cellulose cell walls;<br>excess glucose is stored as starch in the leaves;<br>converted to sucrose to be transported to storage organs;<br>reacts with nitrates and mineral salts to form proteins to synthesise new protoplasm;<br>form fats for storage; | | any 3, max 3 |



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**Section C: Free-Response Questions (20 marks)**

*avp: any valid points; owtte: or words to that effect*

| Question | Marking Point | Remarks | Marks |
|---|---|---|---|
| 6(a) | Time taken for iodine to remain brown is the time taken for all starch to be completely broken down by amylase. | | 1 |
| 6(b) |  | Scale – 1 m<br>Axis – 1 m<br>Plots – 1 m<br>Best fit – 1 m | 4 |



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| | | | |
|---|---|---|---|
| 6(c) | MP1. optimum pH is 8<br>MP2. at pH 8, amylase has an active site that is complementary to starch<br>MP3. forming an enzyme-substrate complex for starch digestion<br>MP4. pH above or below the optimum pH will denature the enzyme molecule<br>MP5. enzyme loses 3-d shape and active site | | 5 |
| | | | |
| 7(a) | MP1. Photosynthesis word equation<br>MP2. Light-dependent stage: light is absorbed by chlorophyll and converted to chemical energy.<br>MP3. This energy is used to split water into oxygen and hydrogen atoms (photolysis of water).<br>MP4. Light-independent stage: hydrogen atoms (from photolysis of water) reduces carbon dioxide to form glucose.<br>MP5. Enzymes are involved in both the light-dependent and light-independent stages of photosynthesis. | | 5 |
| 7(b) | MP1. Presence of light, when the plant photosynthesizes, carbon dioxide is rapidly used up so the concentration of carbon dioxide within leaf is lower than atmospheric air.<br>MP2. Carbon dioxide diffuses into the air spaces within the leaf through the stomata.<br>MP3. Carbon dioxide then dissolves into the moist surfaces of mesophyll cells.<br>MP4. The dissolved carbon dioxide then diffuses into the leaf mesophyll cells.<br>MP5. Xylem vessels transports water from the roots to the leaf.<br>MP6. In the leaf, water moves from the xylem vessels to the mesophyll cells of the leaf. | any 3, max 3<br>2 | 5 |



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