Name: …….. ( ) Class: Sec 4 SG2

Queenstown Secondary School

Preliminary Examination 2024
Secondary Four Express
Science (Biology)
5087/04

27 August 2024
Tuesday

Time: 1045 – 1200 h
Duration: 1 hour 15 minutes

Setter:

Additional Materials: Candidates answer on the Question Paper.
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on all the work you hand in.
You may use an HB 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 **one** question.
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.

Examiner's Use	
Section A	/55
Section B	/10
Q10	
Q11	
TOTAL	**/65**

Section A

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

1 Beetroot cells contain a purple pigment in their cytoplasm. In an experiment, 6 strips of similar size were cut from a beetroot and thoroughly washed with water until the water was clear.

Two strips each were weighed and then put into 3 different test tubes **A** to **C** as shown in Fig. 1.1. The setups were then left for 30 minutes.

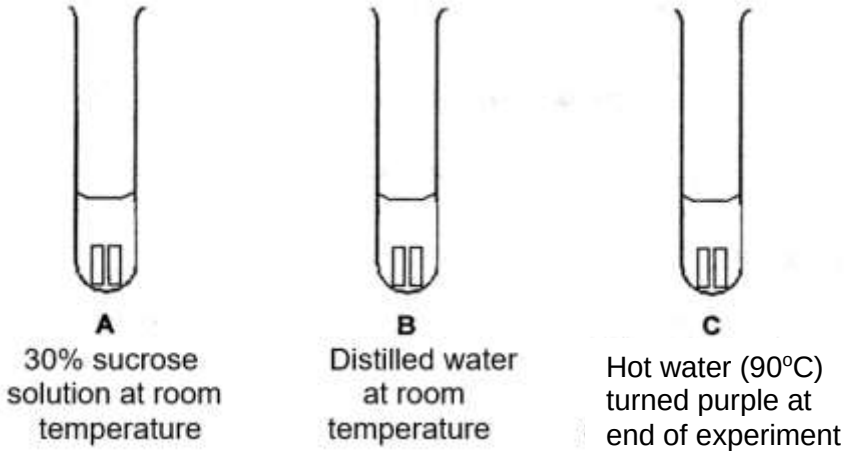

Fig. 1.1

(a) State and explain the change in mass of the beetroot strips in test-tube **A** at the end of the experiment.

change in mass of beet root strips in **A**: ……..……...……

……...……

explanation: ……..……..……...……

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……...…… [3]

(b) **(i)** The liquid in test-tube **C** appears purple at the end of the experiment. State the reason for the change in the colour of the liquid in test-tube **C**.

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…… [1]

(ii) Predict, with an explanation, the appearance of the liquid in test-tube **B** at the end of experiment.

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…… [2]

[Total: 6]

2 An experiment was conducted to study the effect of temperature on the action of pepsin using albumen (egg white). Pepsin is a protease which digests protein present in the albumen.

Table 2.1 below shows the contents of test tubes **A**, **B**, **C** and **D** as well as the respective temperatures. The data obtained is shown in Fig. 2.2 below. The volume and concentration of the substances were the same in all the test tubes.

Table 2.1

test tube	contents	temperature /˚C
A	Albumen + pepsin	10
B	Albumen + pepsin	20
C	Albumen + pepsin	37
D	Albumen + pepsin that has been boiled	37

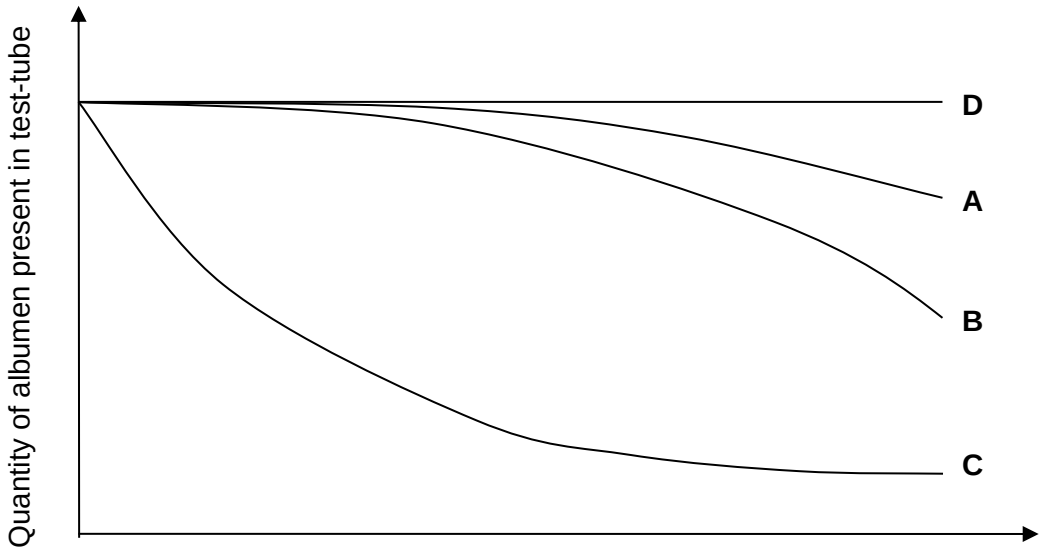

Fig. 2.2

(a) Explain the difference in results obtained for test tubes **B** and **C**.

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…… [2]

(b) Use the lock and key hypothesis to explain the effect of high temperature on the rate of digestion of albumen in test-tube **D**.

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…… [4]

(c) **(i)** State a substance (other than albumen) that is present in test tube **C** after 10 minutes.

…… [1]

(ii) Give a reason for your answer in **(c) (i)**.

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…… [1]

[Total: 8]

3 Fig. 3.1 below shows a section through the human heart.

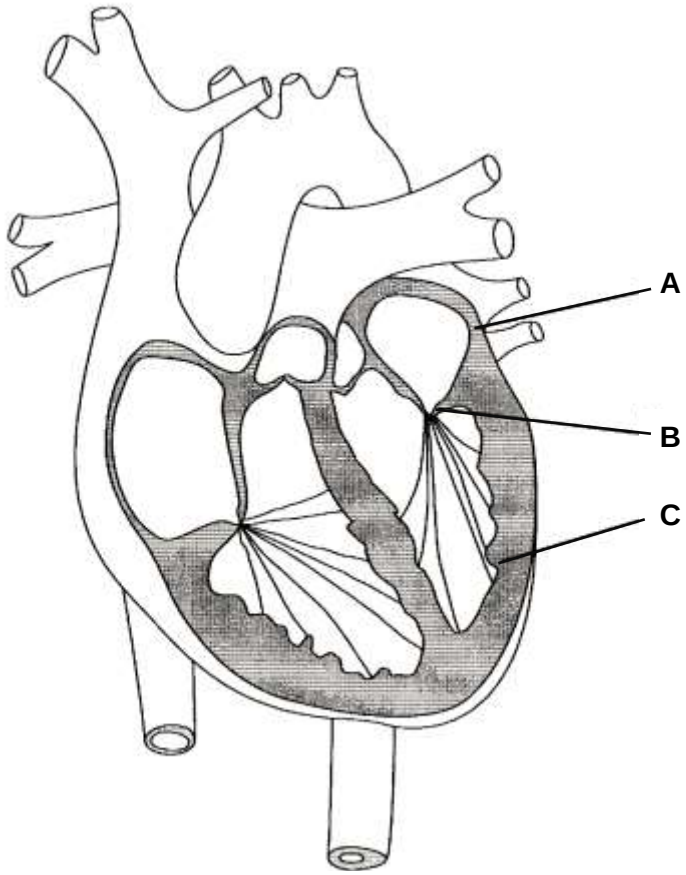

Fig. 3.1

(a) **(i)** One stage of the heart cycle is the contraction of the part labelled **A**. What is the effect of this contraction?

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…… [1]

(ii) In some people, the flaps of the part labelled **B** do not fit together properly. This causes the heart to be less efficient in pumping oxygenated blood to the organs of the body. Suggest a reason for this.

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…… [2]

(iii) Explain why the part labelled **C** is generally thicker than the walls of the rest of the heart.

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…… [1]

(b) Fig. 3.2 shows a small part of the blood supply to the walls of the heart.

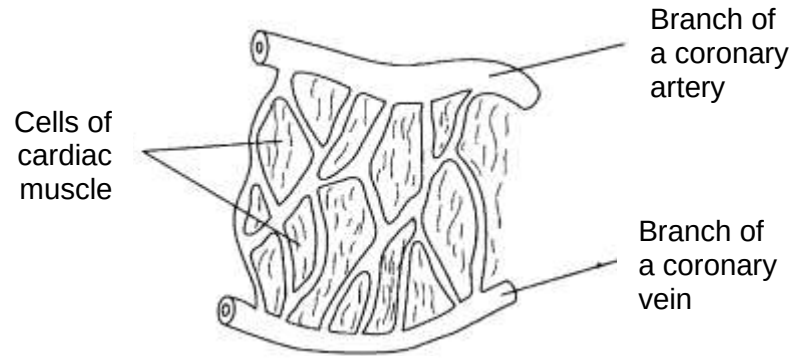

Fig. 3.2

Describe **one** difference between blood that travels through the coronary artery and the coronary vein.

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…… [1]

[Total: 5]

4 Sammy completed his 2.4 km run for his NAPFA test in 10 minutes and then rested for another 10 minutes. Fig. 4.1 shows the changes in concentration of lactic acid and muscle glucose of the student taken at different time intervals.

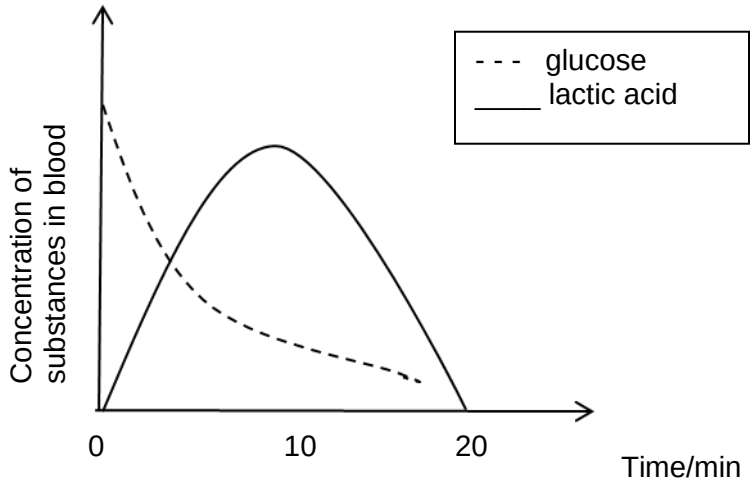

Fig. 4.1

(a) Define *anaerobic respiration*.

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…… [1]

(b) Describe and explain the trend in glucose and lactic acid concentration in Sammy's muscle during the 2.4 km run.

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…… [3]

(c) Explain the change observed in lactic acid concentration during rest.

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…… [2]

[Total: 6]

5 Study the chart below.

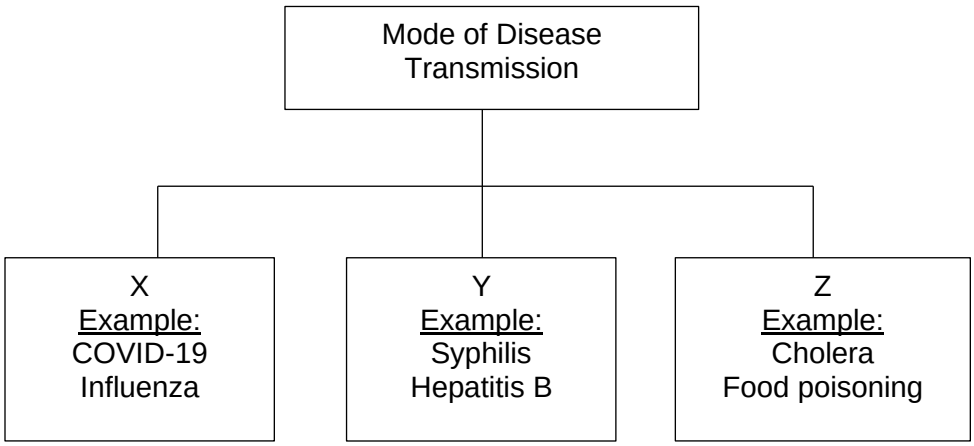

Fig. 5.1

(a) Identify the mode of transmissions labelled **X**, **Y** and **Z**.

X: ……

Y: ……

Z: …… [2]

(b) Describe **two** methods to prevent and control the spread of pneumococcal bacteria.

1: ……

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2: ……

…… [2]

(c) Larry fell ill after eating lunch. His lunch was prepared in the morning and left on the kitchen table. His aunt, who cooked his lunch and left in a hurry, had forgotten to cover it. Larry did not heat up his food before consuming it. Suggest why Larry's illness could be due to the food he ate.

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…… [2]

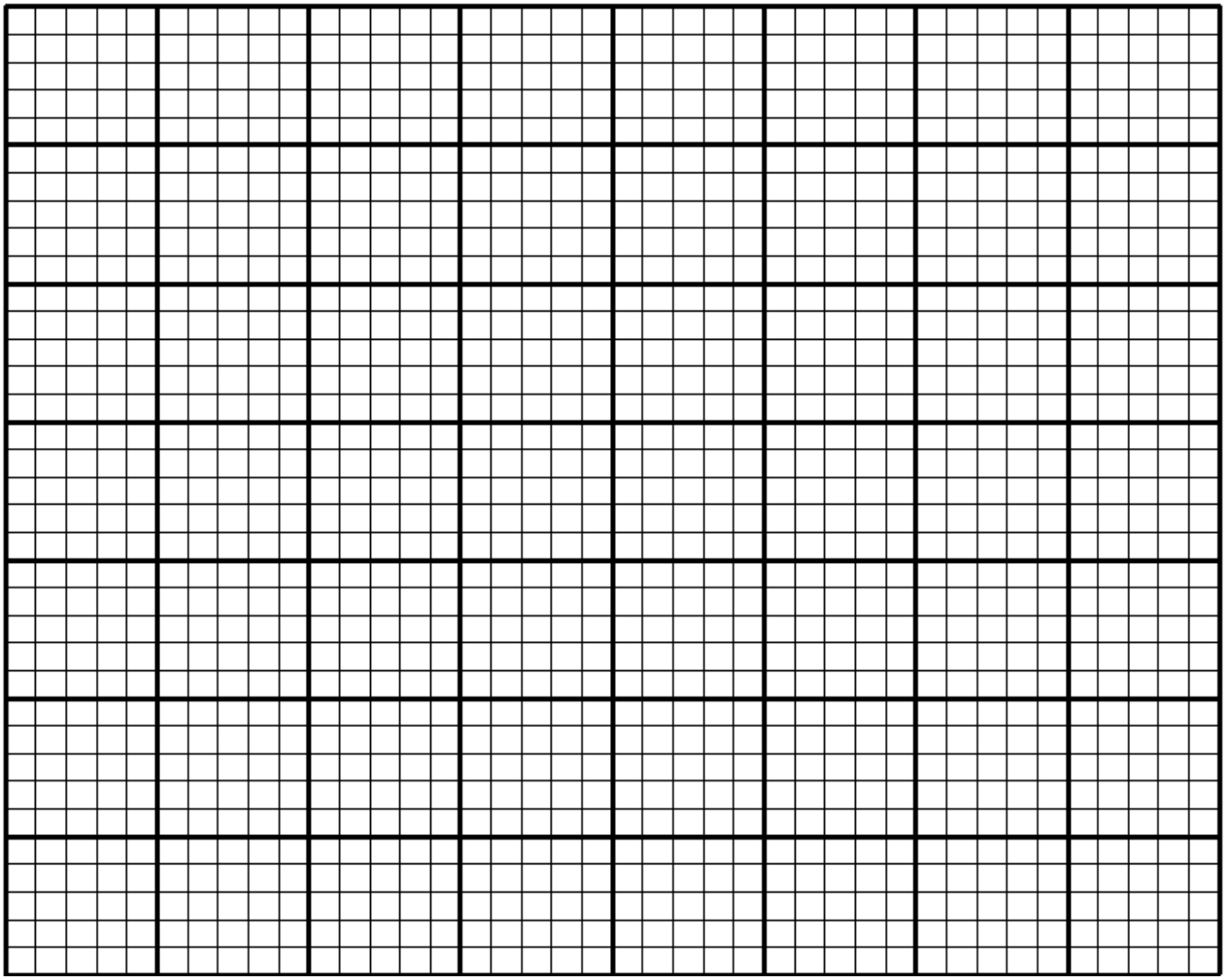
[Total:6]

6 Table 6.1 shows the transpiration rates of a plant grown outdoor were obtained between 0800 hrs to 1630.

Table 6.1

Time /hr	0830	0930	1030	1130	1230	1330	1430	1530	1630
Rate of transpiration in g/min	5.0	9.0	12.8	12.4	12.0	11.0	8.0	7.0	4.5

(a) Plot the graph for the rate of transpiration against time on the grid provided. [4]



(b) Describe the rate of transpiration between 0830 hrs and 1230 hrs.

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…… [2]

(c) Explain the increase in rate of transpiration between 0830 hrs and 1030 hrs.

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…… [2]

[Total: 8]

7 The diagram below shows three possible pathways by which the energy captured by plants may be passed onto humans.

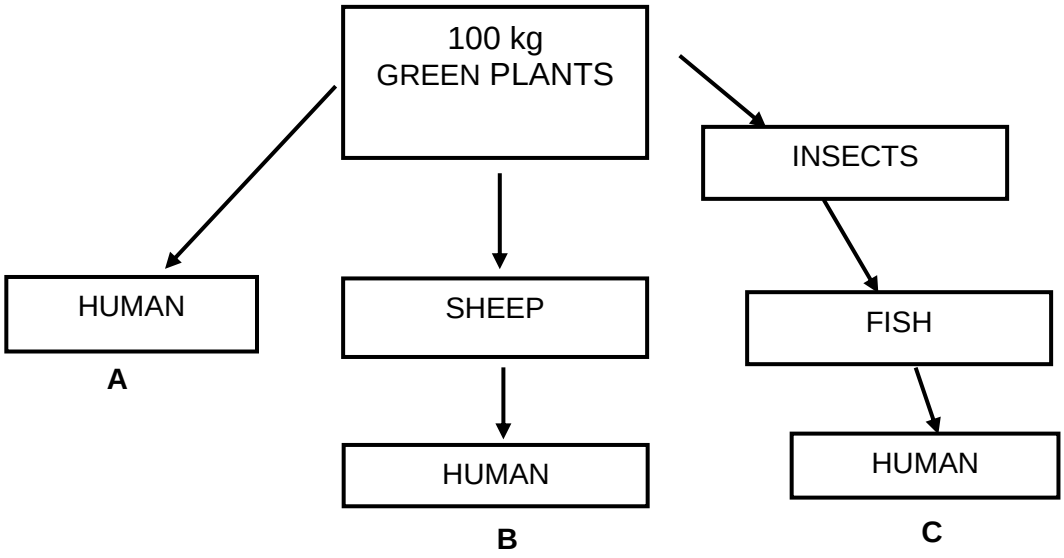

Fig. 7.1

(a) Which of the pathways **A**, **B** or **C** would allow most energy from the plants to be available to humans? Explain your answer.

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…… [2]

(b) Look at the following food chain:

rose bush → aphids (greenflies) → ladybirds

Explain how the pyramid of biomass for this food chain would be of a different shape from the pyramid of numbers.

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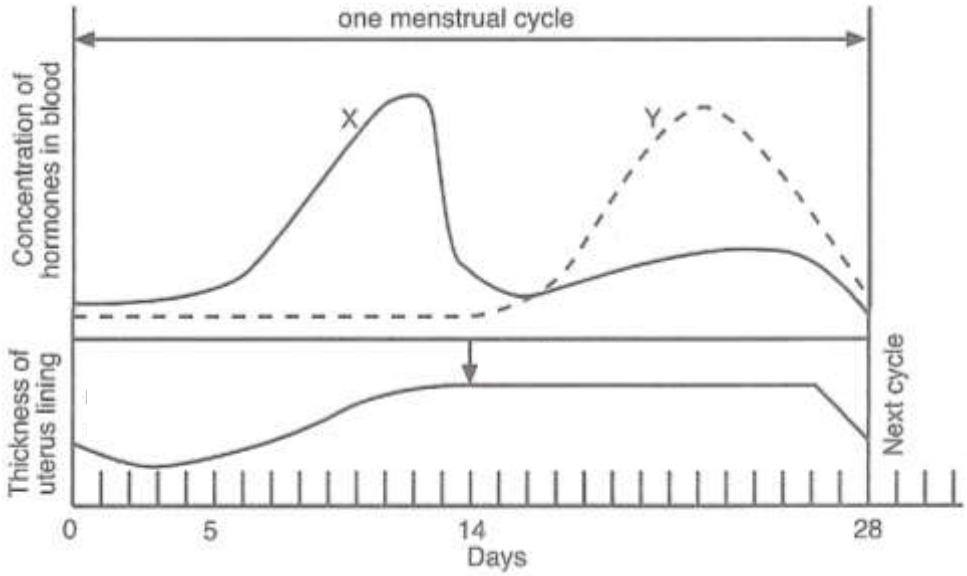
…… [2]

[Total: 4]

8 The graphs below show the main events that occur during a menstrual cycle



(a) Identify hormones **X** and **Y**.

X: ……..……..……**Y**: ……..……..…… [2]

(b) Describe the effect of **X** and **Y** on the uterus lining when the concentration is at their peaks respectively.

X:

……..……..……..……

……..……..……..……

Y:

……..……..……..……

……..……..……..……. [2]

(c) Explain what differences you would expect in the concentration of hormones **X** and **Y** if an egg is fertilised during this cycle.

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……..……..……..…… [2]

[Total:6]

9 Phenylketonuria (PKU) is a disease inherited as a recessive trait.
It is a metabolic disorder characterised by the inability to produce the enzyme phenylalanine hydroxylase.

Sufferers from this disease have to be careful not to consume food or drink which contains aspartame, an artificial sugar often added to drinks like Coke Light or Pepsi Max.

Joseph and Mary are a married couple who are normal. However, they have a son, Noah, who has PKU.

(a) Explain, in terms of inheritance, why Noah suffers from PKU even though both his parents do not have PKU.

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…… [2]

(b) Noah marries Rachel.

Rachel does not have PKU, but her mother has PKU.

With a suitable genetic diagram, determine the probability of their first child having PKU.

probability: …… % [4]

[Total: 6]

Section B

Answer **one** question from this section.

10 Fig. 10.1 shows how the concentrations of sugar in the leaves and stem of a green plant changed during a 24-hour period.

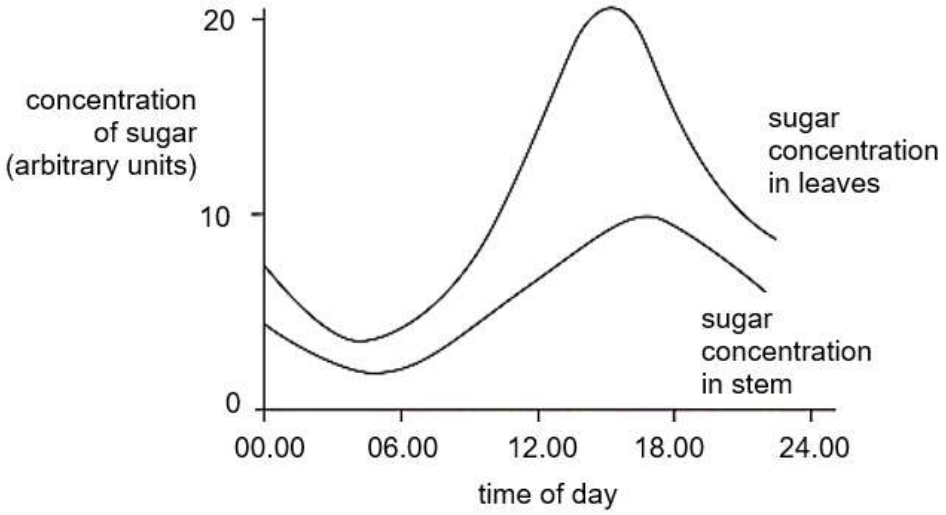

Fig. 10.1

(a) With reference to Fig. 10.1, describe and explain how the sugar concentration in the leaves varies during this 24-hour period.

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[6]

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

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…… [2]

(c) How will the sugar that is transported by the stem be used?

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…… [2]

[Total:10]

11 Fig. 11.1 shows the carbon cycle.

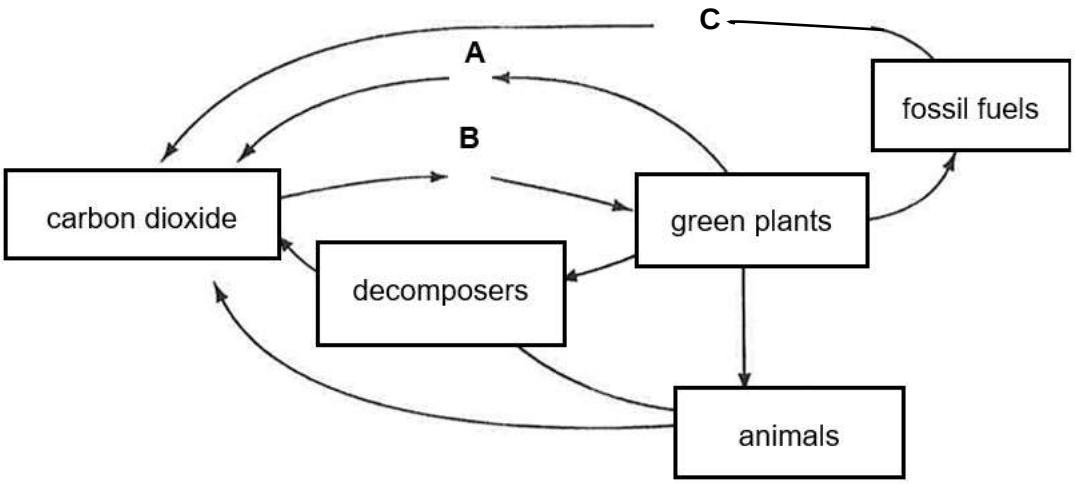

Fig. 11.1

(a) Describe how processes **A**, **B** and **C** in Fig. 11.1 affect the carbon cycle.

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…… [6]

(b) ‘Singapore’s own land use sector is currently a carbon source rather than a carbon sink. This is because the conversion of forests and vegetated areas for housing releases a lot of carbon to the atmosphere.’
[https://www.channelnewsasia.com/world/explainer-forests-carbon-sink-climate-change]
Outline the role of forests and vegetated areas as carbon sinks.

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[Total:10]

The End of Paper