



Paya Lebar Methodist Girls' School (Secondary)
Preliminary Examination 2025
Secondary 4 Express / G3

CANDIDATE NAME		CLASS		CLASS INDEX NUMBER	
		TG			

CENTRE NUMBER				
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INDEX NUMBER				
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SCIENCE (BIOLOGY)

5088/4

Paper 4 Biology

22 August 2025

No additional materials are required.

1 hour 15 minutes

READ THESE INSTRUCTIONS FIRST

Write your name, class and class index number on the front cover.

Write in dark blue or black pen.

You may use a soft pencil for any diagrams or graphs.

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

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

Section A (55 marks)

Answer **all** questions.

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

Section B (10 marks)

There are two questions in this section. Answer only **one** question.

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

At the end of the test, fasten all your work securely together, if applicable. The number of marks is given in brackets [] at the end of each question or part question.

For Examiner's Use	
Section A	55
Section B	10
9	
10	
Total	65

Section A (55 marks)

Answer all the questions in the spaces provided.

- 1 Fig. 1.1 shows the cell membrane of an animal and a plant cell.

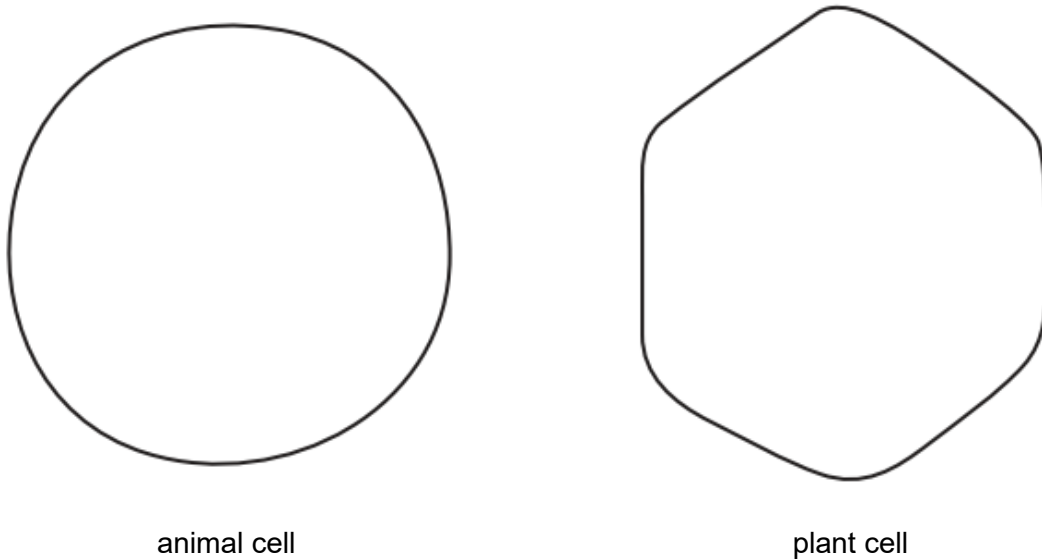


Fig. 1.1

- (a) On Fig. 1.1, draw and label

- (i) one other structural feature that is found in **both** cells,
- (ii) **two** features found in a plant cell but **not** in an animal cell.

[2]

Table 1.1 shows the average amount of protein, fat and carbohydrate found in some plant and animal tissues.

Table 1.1

tissues	percentage of protein	percentage of fat	percentage of carbohydrate
plant	5	1	30
animal	20	15	1

(b) (i) Explain why there is a high percentage of carbohydrate in the plant tissues.

.....

..... [1]

(ii) Name an animal tissue that would have more than the 1% of carbohydrate shown in Table 1.1. Explain your answer.

tissue

explanation

.....

..... [2]

(iii) Describe the functions of proteins and fats found in plant and animal tissues.

proteins

.....

fats.....

..... [2]

[Total: 7 marks]

[Turn over]

- 2 (a)** Define the term *osmosis*.

.....

.....

.....

..... [2]

- (b)** Explain how water molecules move from the large intestine into the blood.

.....

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.....

.....

.....

..... [3]

- (c) A student investigated the effect of surface area to volume ratio on the rate of diffusion of a substance into a cube.

Table 2.1 shows the results of the investigation.

- (i) Complete Table 2.1. One of the rows has been done for you.

Table 2.1

length of side of cube / mm	time taken for substance to diffuse to centre of cube / s	surface area of cube / mm ² (total of 6 sides)	volume of cube / mm ³	surface to volume ratio
1	20	6	1	6 : 1
2	41			
3	76			

[2]

- (ii) Suggest how surface area to volume ratio affects the rate of diffusion.

.....

.....

..... [1]

- (d) Describe and explain two ways the lungs of a mammal are adapted to increase the rate of diffusion of oxygen from the alveoli to the blood.

1

.....

2

..... [2]

[Total: 10 marks]

[Turn over]

- 3** Cystic fibrosis is a genetic condition in humans that results from inheriting a recessive allele of a gene.

(a) State where genes are found in a cell.

..... [1]

- (b) (i)** Use a fully labelled genetic diagram to show how cystic fibrosis is inherited by the children of two heterozygous parents.

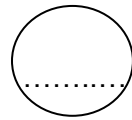
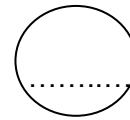
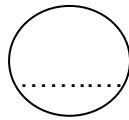
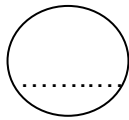
Use the letter **D** to represent the dominant allele and **d** to represent the recessive allele.

genotype of
parents

.....

.....

gametes



genotype of
offspring

.....

.....

.....

.....

phenotype of
offspring

.....

.....

.....

.....

[3]

- (ii)** State the expected ratio of phenotypes in the children.

..... [1]

- (c) Fig. 3.1 shows some of the main regions of the alimentary canal in a person.

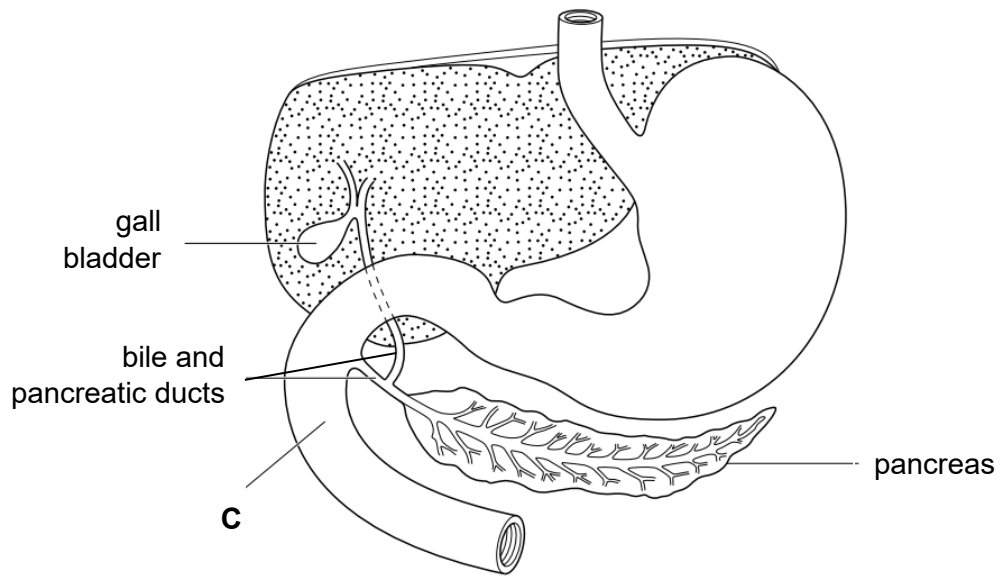


Fig. 3.1

- (i) State the name of region **C**.

..... [1]

- (ii) One effect of cystic fibrosis is that the bile and pancreatic ducts become blocked with mucus.

Suggest why a person whose bile and pancreatic ducts are blocked may find it difficult to gain weight despite eating a high-fat diet.

.....

.....

.....

.....

.....

..... [3]

[Total: 9 marks]

[Turn over]

- 4 (a) (i) State the **type** of pathogen that can be treated with antibiotics.

..... [1]

- (ii) State the **name** of the pathogen that can lead to Acquired Immune Deficiency Syndrome (AIDS).

..... [1]

Many pathogens have developed resistance to some antibiotics. A study took samples of pathogens and tested them for resistance to various types of antibiotics.

Fig. 4.1 shows the percentage of pathogens sampled that were resistant to various antibiotics. The samples were taken between 2000 and 2013.

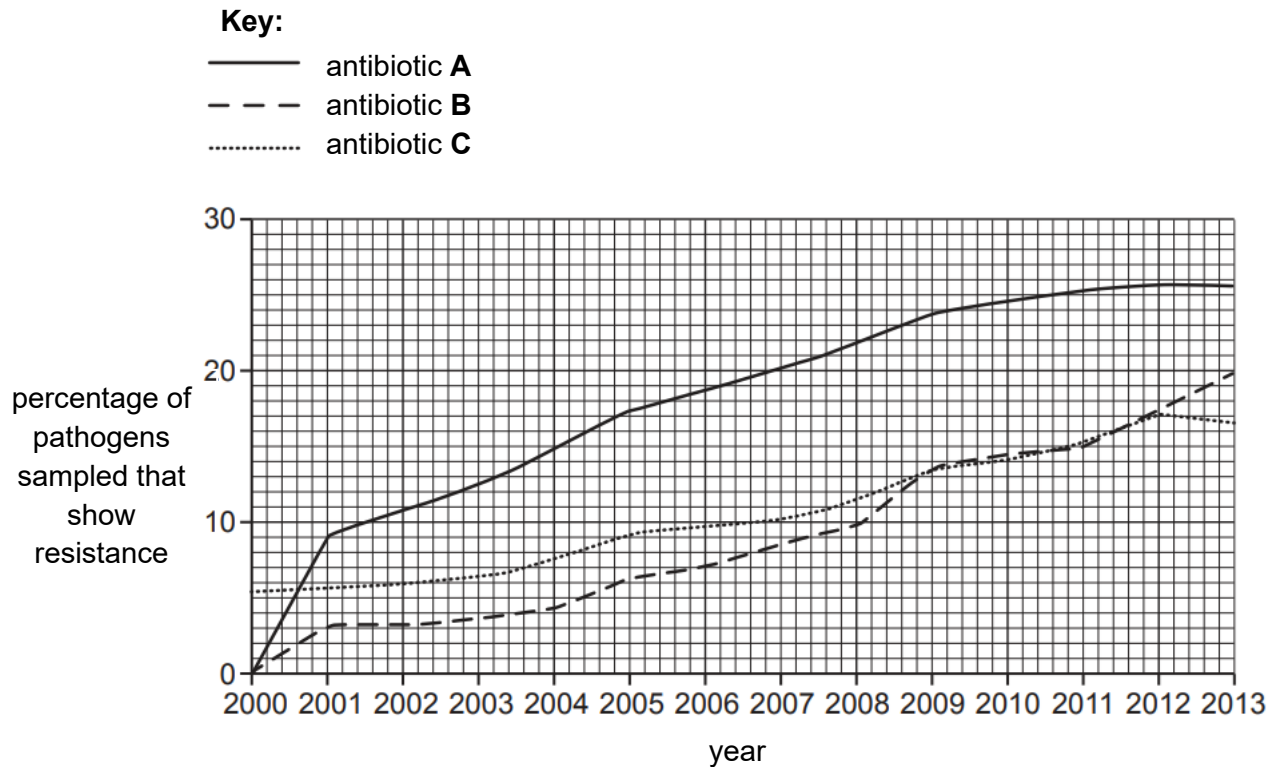


Fig. 4.1

- (b) Use data from Fig. 4.1 to describe the trend of resistance for the three antibiotics from 2000 to 2013.

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..... [3]

- (c) State **one** way by which bacteria develop resistance to antibiotics.

.....

.....

..... [1]

- (d) Explain why antibiotics are ineffective against viruses.

.....

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..... [1]

[Total: 7 marks]

[Turn over]

5 Fig. 5.1 shows a woodland food web.

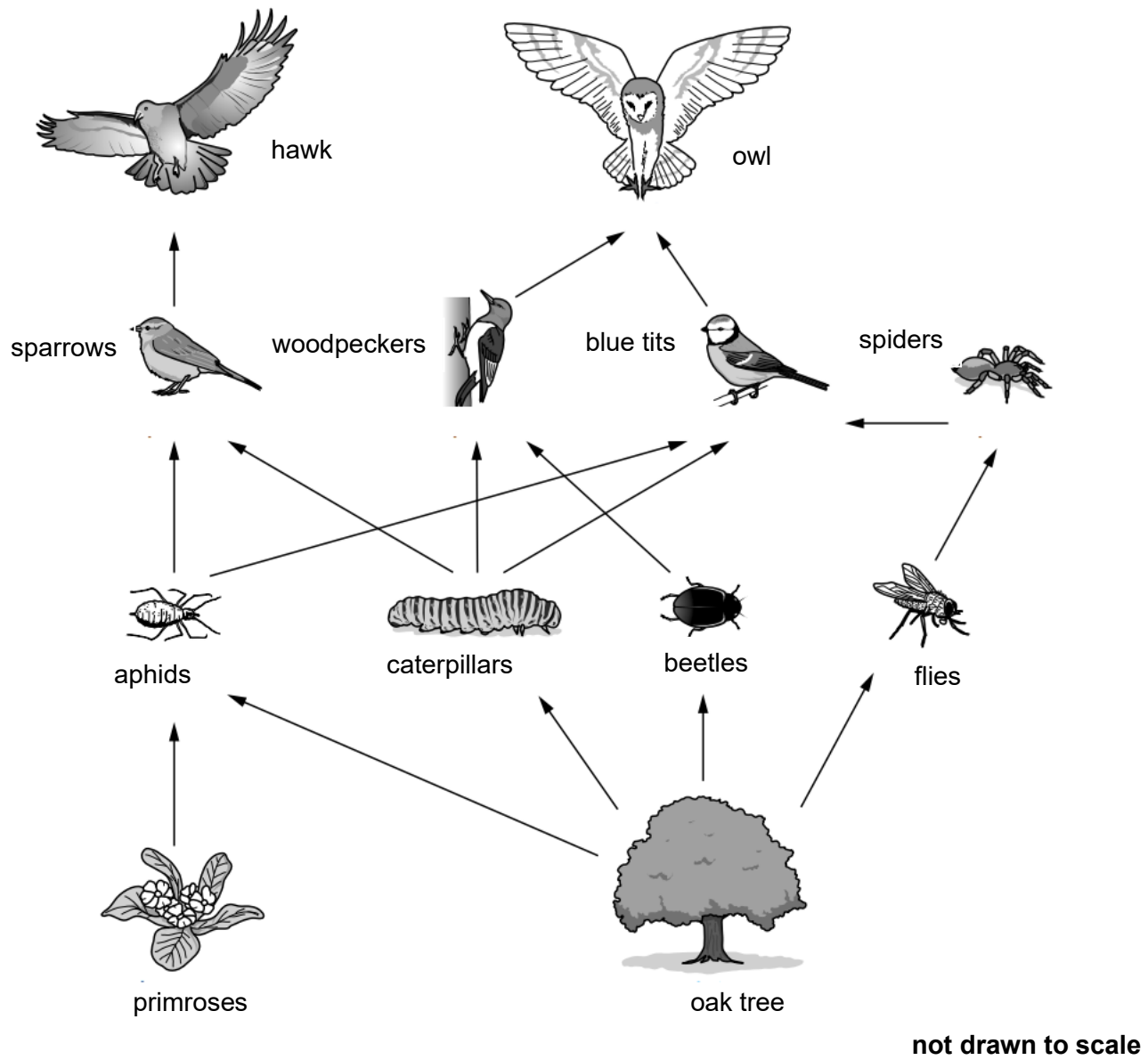
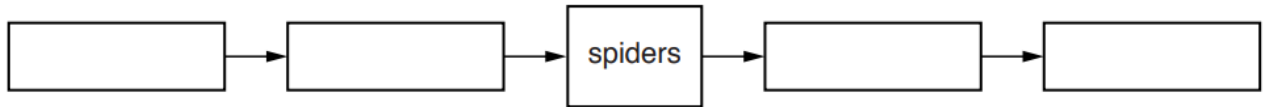


Fig. 5.1

- (a) (i) Name **one** organism in this food web which can trap light energy to produce glucose.

..... [1]

- (ii) Complete this food chain from the food web shown in Fig. 5.1. Write the name of one organism in each box.



[1]

- (b) (i) Define the term *population*.

.....

 [1]

- (ii) Define the term *trophic level*, using an example from Fig. 5.1.

.....

 [1]

- (c) Some of the leaves and fruit from the oak tree are not eaten by organisms shown in the food web. The leaves and fruit fall to the ground where they are slowly broken down.

(i) Name **one** kind of organism responsible for this break down.

..... [1]

(ii) Explain how this break down is helpful to the oak trees.

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

[Total: 7 marks]

- 6 (a) Fig. 6.1 is a diagram of the female reproduce system in humans.

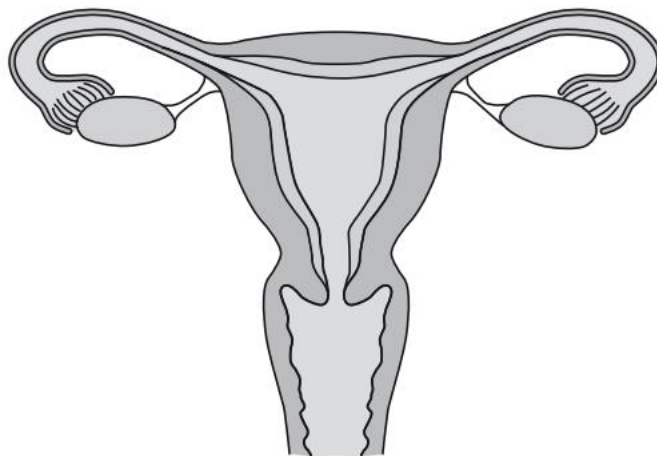


Fig. 6.1

On Fig. 6.1, draw a line and label the structure to show where

- (i) fertilisation occurs, and [1]
- (ii) hormones oestrogen and progesterone are produced. [1]

- (b) Fig. 6.2 shows the changes in the thickness of the uterine lining during a menstrual cycle.

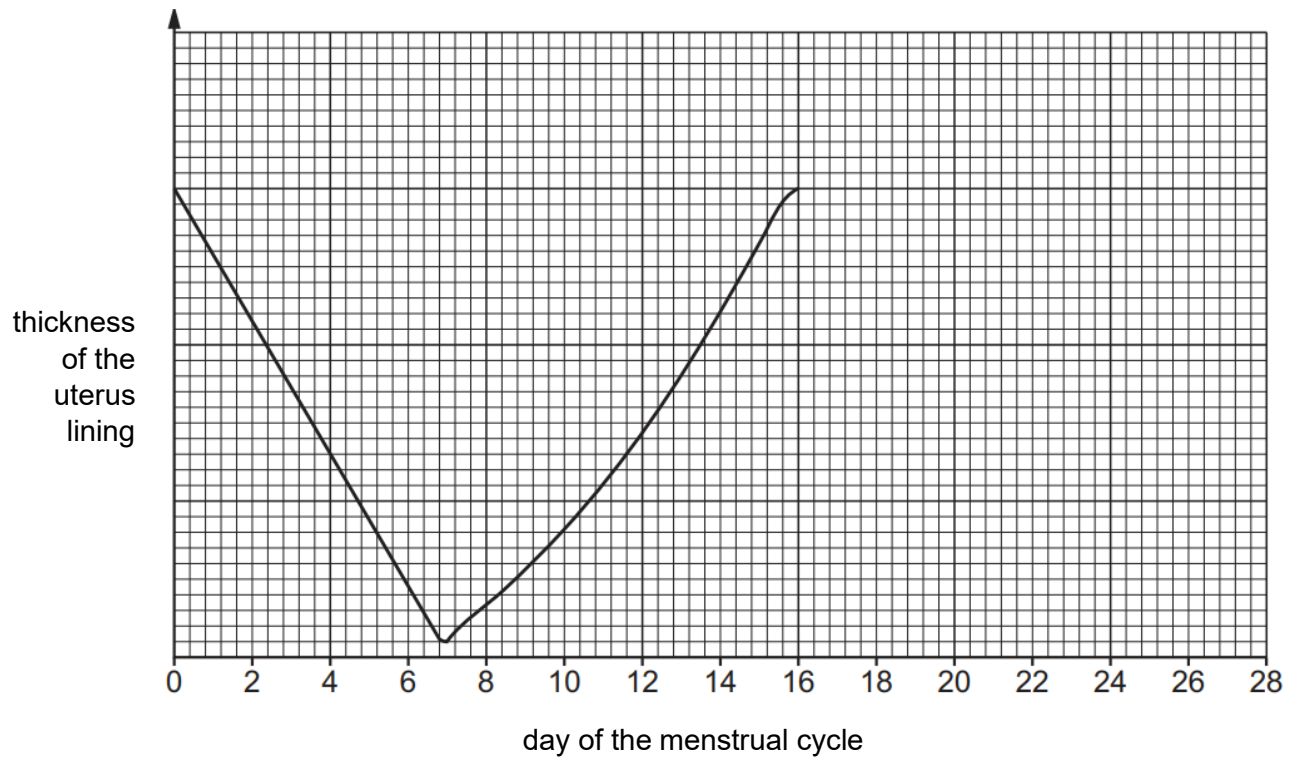


Fig. 6.2

- (i) Using the information in Fig. 6.2, state the number of days during which the uterine lining is shed.

..... [1]

- (ii) Draw a line to complete the graph in Fig. 6.2 to show the thickness of the uterine lining between day 16 and 28.

[1]

- (iii) State the day of the menstrual cycle when ova are released.

..... [1]

[Total: 5 marks]

7 The metabolism of an organism involves many processes that need energy.

(a) State the **word** equation for aerobic respiration.

..... [2]

(b) Fig. 7.1 shows changes in heart rate as metabolic rate increases during exercise.

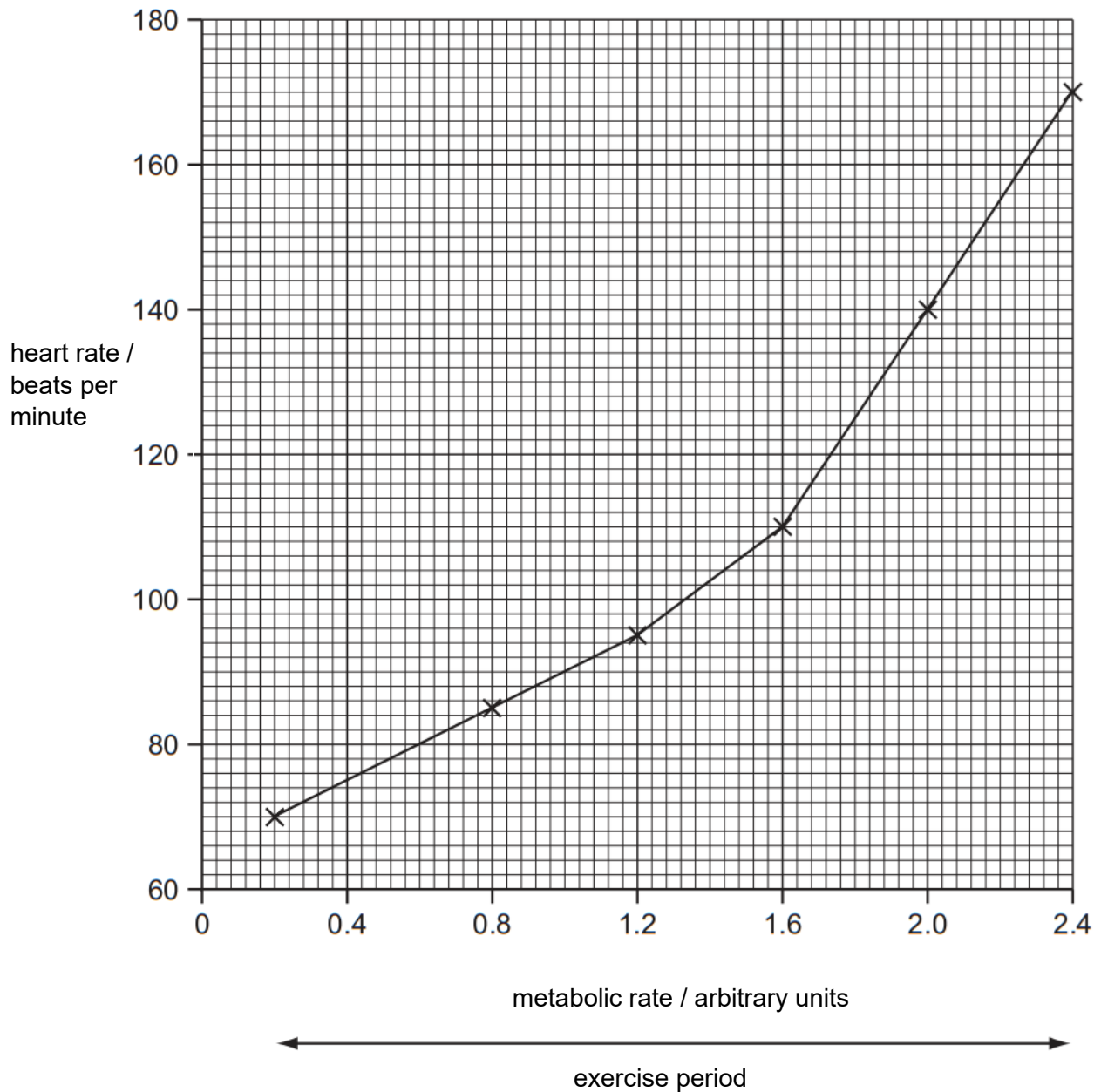


Fig. 7.1

[Turn over]

- (c) Using Fig. 7.1, state the metabolic rate before exercise started.

..... arbitrary units [1]

- (d) With reference to Fig. 7.1,

- (i) describe and explain how heart rate changes during exercise;

describe

.....

.....

.....

explain

.....

.....

..... [4]

- (ii) suggest what happens to the heart rate when exercise is finished.

.....

.....

.....

.....

.....

..... [3]

[Total: 10 marks]

End of Section A

Section B (10 marks)

Answer **one** question from this section.
Write your answers in the spaces provided.

- 8** A factory uses biotechnology to process apples.

Some of the apple juice is mixed with yeast and used to produce ethanol.

The yeast uses enzymes to produce ethanol.

- (a)** Define the term *enzyme*.

.....

.....

.....

..... [2]

Fig. 8.1 shows the apparatus used to find the optimum temperature for producing ethanol.

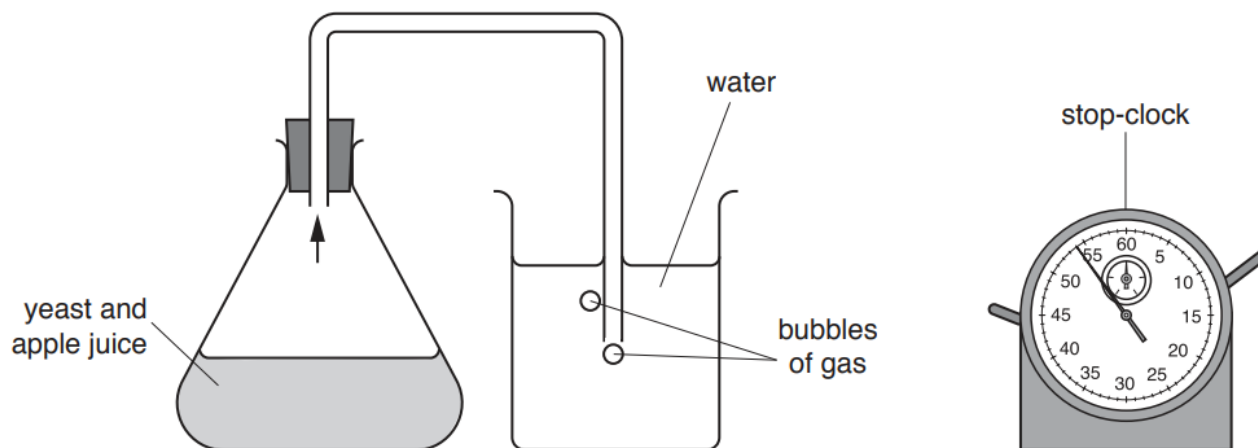


Fig. 8.1

The same apparatus was used at different temperatures.

The rate of ethanol production was compared by counting the number of bubbles of gas produced by the yeast and apple mixture per minute.

[Turn over]

Fig. 8.2 shows the results of the investigation.

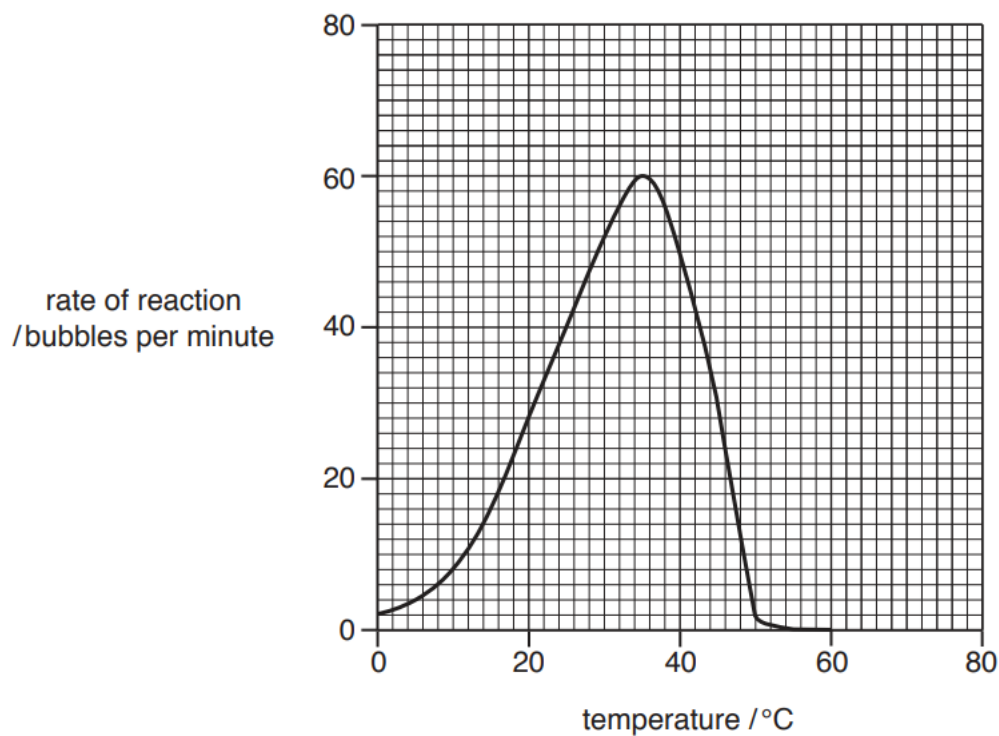


Fig. 8.2

- (b) Using Fig. 8.2, describe and explain the effect of the increase in temperature on the rate of reaction.

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.....

The cut surface of an apple usually turns brown when exposed to air. This is caused by enzymes.

Three slices of apple were given different treatments and were then exposed to air for 30 minutes.

Table 8.1 shows the treatments and appearance of the apple slices.

Table 8.1

apple slice	pH	temperature / °C	appearance of the apple slice at 0 minutes	appearance of the apple slice after 30 minutes
A	6	20	white	brown
B	2	20	white	white
C	6	4	white	white

(c) Suggest the reasons for the observations of slice **B** and slice **C** after 30 minutes.

slice **B**

.....

.....

.....

slice **C**

.....

..... [3]

[Total: 10 marks]

[Turn over]

- 9 Fig. 9.1 shows the leaves of the same plant during daylight and during the hours of darkness.

in daylight

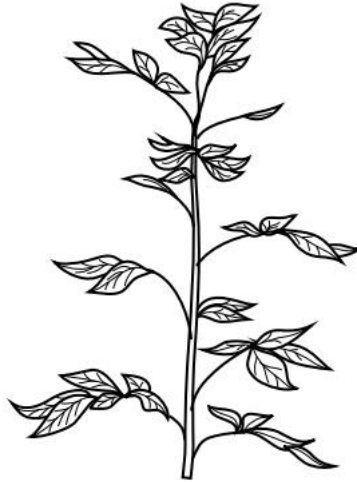


Fig. 9.1(a)

in darkness



Fig. 9.1(b)

- (a) Name a process that takes place in the plant in Fig. 9.1(a) only during daylight and explain how the leaves are adapted for this process.

process

explanation

.....

.....

.....

.....

[3]

- (b) The folding of the leaves at night, as seen in Fig. 9.1(b), is called a sleep movement.

Suggest and explain the effect of these sleep movements on the loss of water from one of these plants.

effect

explanation

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.....

.....

..... [3]

Fig. 9.2 shows the uptake and loss of oxygen by a leaf during a 24-hour period.

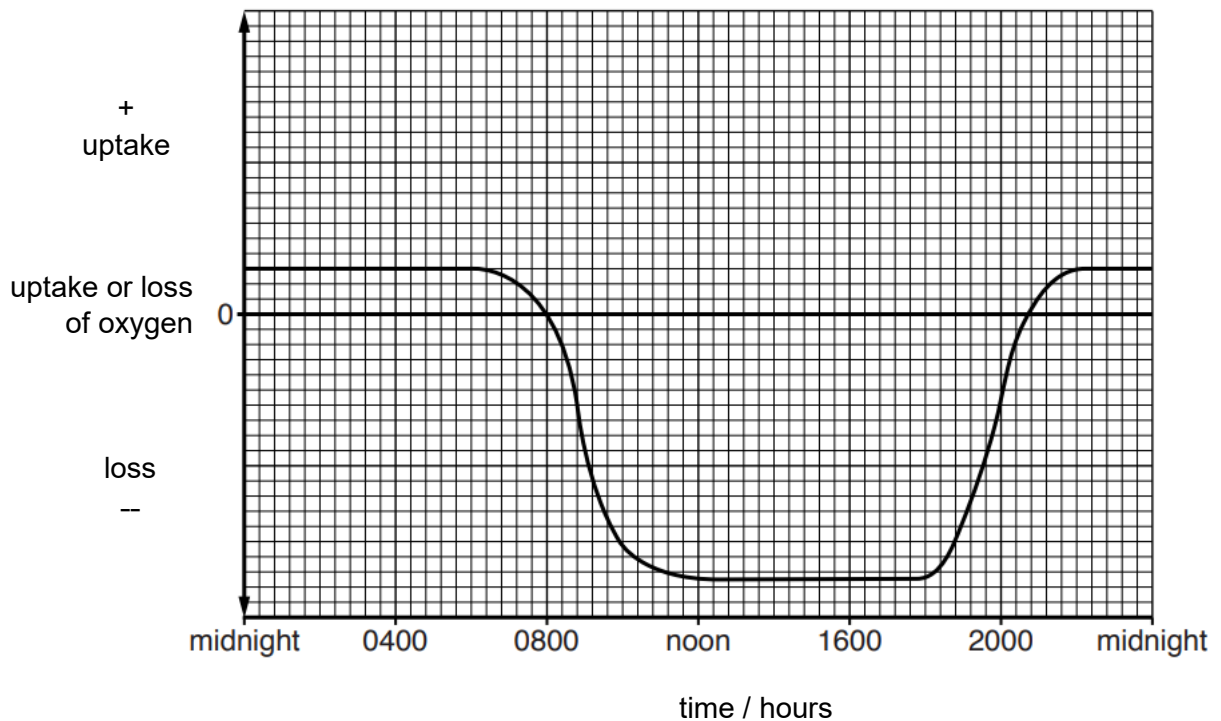


Fig. 9.2

[Turn over]

(c) Explain what is happening in the leaf at the following times:

(i) from noon to 1800 hours;

.....

.....

.....

.....

..... [2]

(ii) between 1800 hours and 2200 hours.

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..... [2]

[Total: 10 marks]

End of Section B