

CANDIDATE
NAME

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CENTRE
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BIOLOGY

9700/22

Paper 2 AS Level Structured Questions

October/November 2017

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

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

DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.

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

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

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

This document consists of **16** printed pages.



Answer **all** questions.

1 The root apical meristem is a region of undifferentiated cells in the root tips of plants. Mitosis occurs in this region.

(a) Fig. 1.1 is an image of the root tip of *Allium* as observed using a microscope with a low-power objective lens.

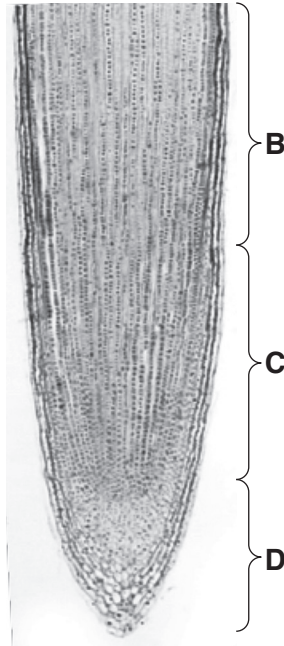


Fig. 1.1

State which region, **B**, **C**, or **D**, should be chosen in order to observe the highest proportion of cells in stages of mitosis.

.....[1]

(b) (i) Draw a labelled diagram to show the structure of a chromosome at late prophase of mitosis.

[3]

(ii) Describe the behaviour of the nuclear envelope during mitosis.

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..... [2]

[Total: 6]

3 Hydrolytic enzymes can function within the cell or can be secreted by the cell, where they are able to catalyse reactions.

(a) State the term used to describe an enzyme that functions within the cell.

.....[1]

(b) The rates of reaction of two different hydrolytic enzymes, enzyme **G** and enzyme **H**, were measured at different substrate concentrations. The results are shown in Fig. 3.1.

The two enzymes have different values of the Michaelis–Menten constant (K_m).

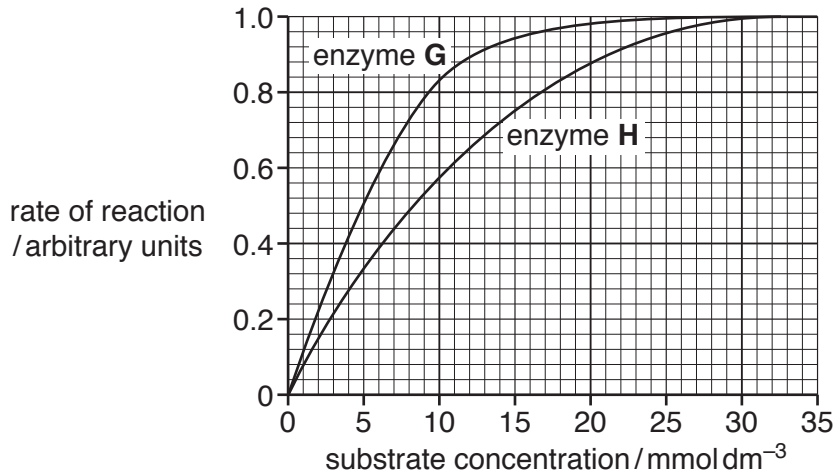


Fig. 3.1

(i) The K_m value of enzyme **G** is 5 mmol dm^{-3} .

Use Fig. 3.1 to derive the K_m value for enzyme **H**.

Show your working.

.....

[2]

(ii) With reference to Fig. 3.1, explain how the values of K_m for these enzymes provide information about the relationship between the enzyme and their substrates.

.....

[2]

Cells can break down an old or damaged organelle, such as a mitochondrion, by enclosing the organelle in a membrane formed from the endoplasmic reticulum. This forms a vacuole. Vesicles containing hydrolytic enzymes fuse with the vacuole and the organelle is then digested.

(c) Name the vesicles in the cell that contain hydrolytic enzymes.

.....[1]

(d) The cell has internal chemical messengers that signal when an old or damaged mitochondrion should be broken down.

Suggest **one** feature involving mitochondrial structure or function that could lead to the release of these internal signals.

.....

.....[1]

Question 3 continues on page 8

4 Fig. 4.1 is a transmission electron micrograph of the bacterium that causes cholera, *Vibrio cholerae*.

The flagellum shown in Fig. 4.1 allows movement of the bacterium within the gut and may also function to help it to bind to an intestinal epithelial cell. The organism does not enter the cell but the toxin it releases can enter and cause damage. Large quantities of water, chloride ions and sodium ions are lost from the cell.



Fig. 4.1

People with symptoms of cholera have severe watery diarrhoea and as a result can become very dehydrated.

(a) Explain how a loss of chloride ions and sodium ions from the intestinal epithelial cell will cause a loss of water from the cell.

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..... [2]

- (b) The main treatment for cholera is oral rehydration therapy (ORT) using oral rehydration salts (ORS). This involves drinking a solution of electrolytes (mineral ions) and glucose.

Fig. 4.2 summarises the movement of glucose and sodium ions across an intestinal epithelial cell.

Fig. 4.2 includes three different types of cell surface membrane proteins:

- SGLT1 is a cotransporter protein
- GLUT2 and Na^+/K^+ pump are two types of carrier protein.

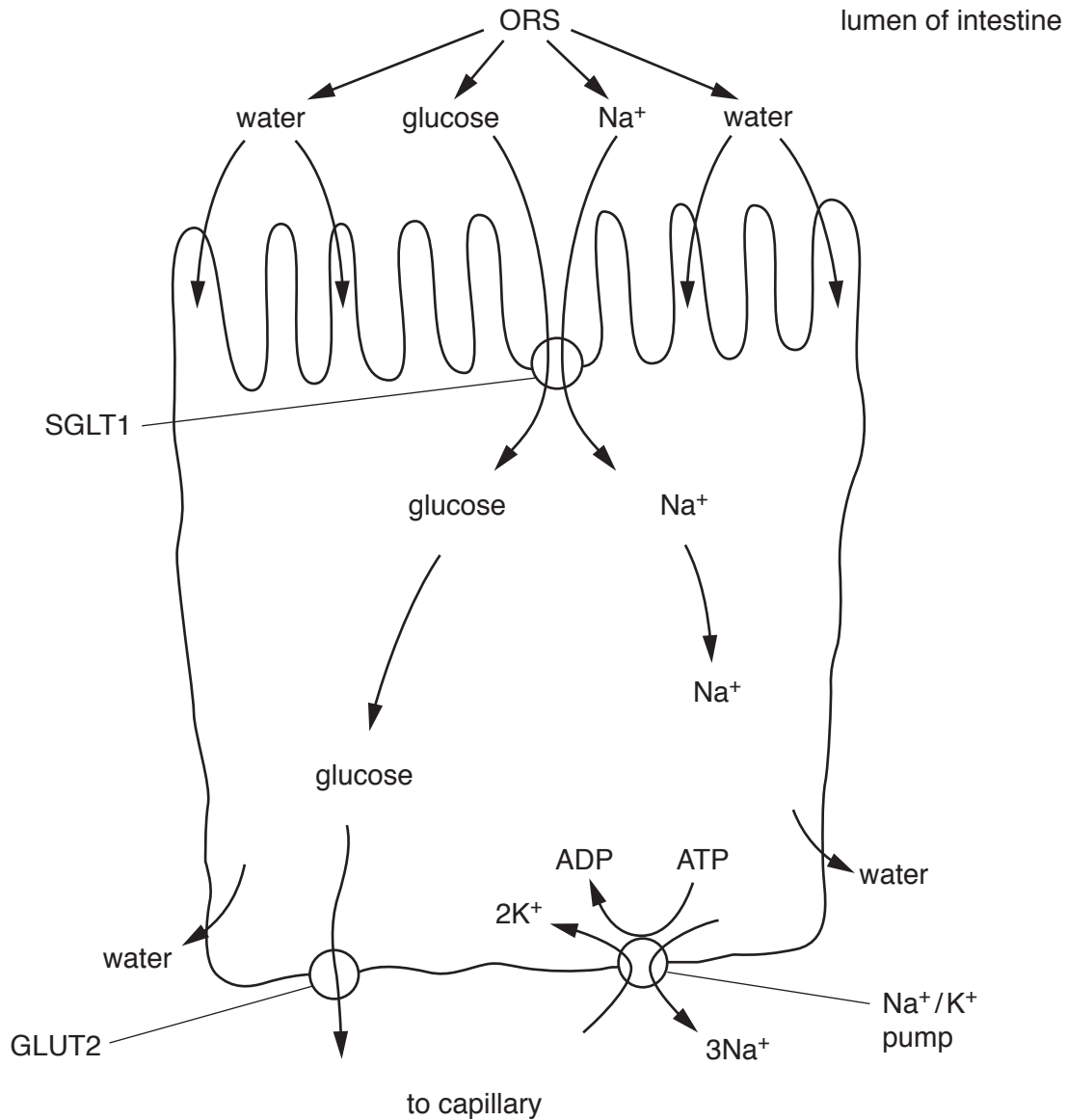


Fig. 4.2

(e) A study was carried out to compare the effectiveness of the antibiotic tetracycline in the treatment of 118 patients with cholera. The patients were divided into four different treatment groups:

- Group **A**, given one dose of 1 g tetracycline
- Group **B**, given one dose of 2 g tetracycline
- Group **C**, given a multiple dose (one dose of 500 mg tetracycline every 6 hours for 24 hours)
- Group **D**, no antibiotic given.

Following treatment, the volume of diarrhoea collected from each patient was measured every 16 hours for 128 hours. Fig. 4.3 shows the mean volume collected for each group.

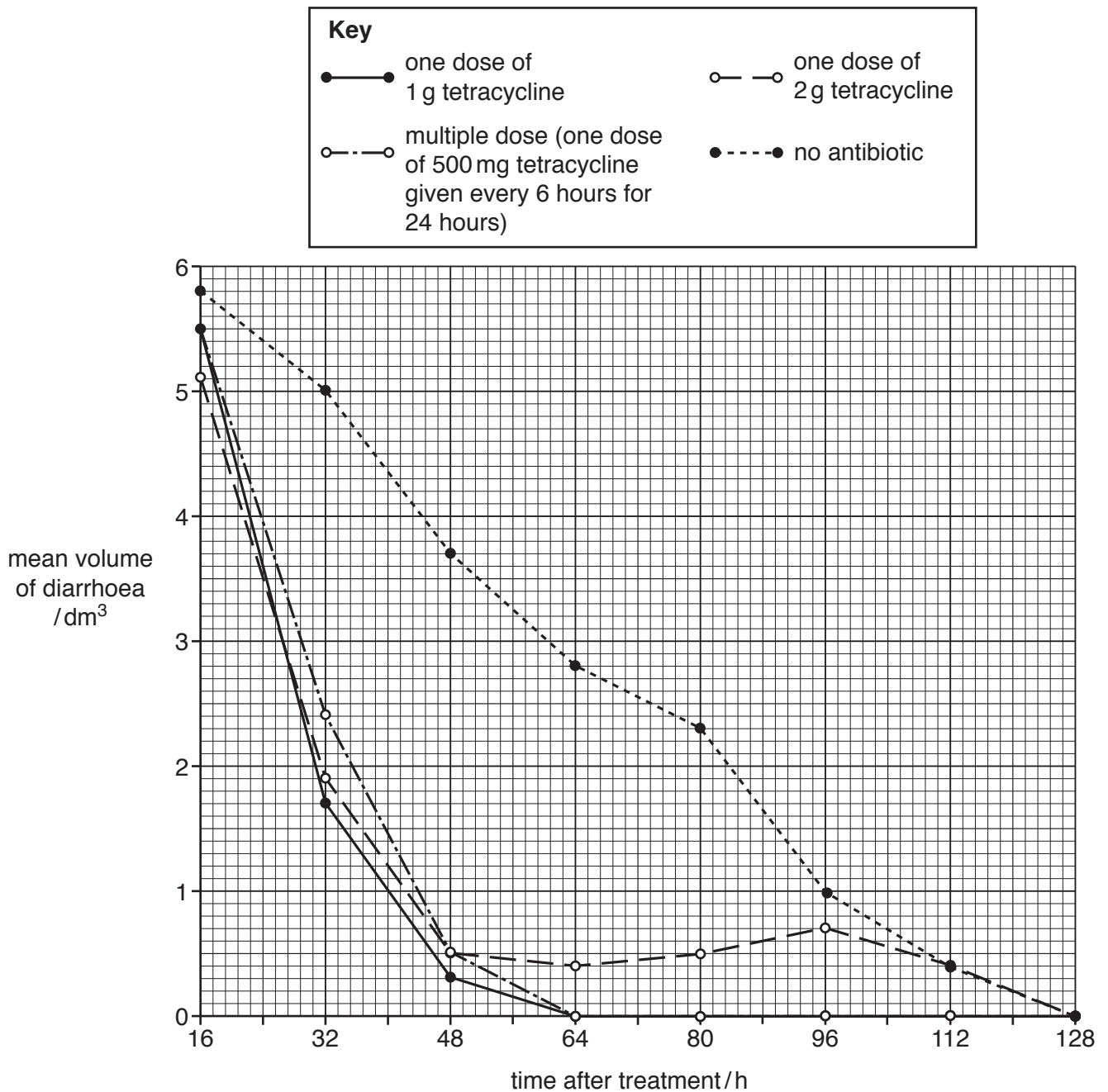


Fig. 4.3

5 (a) Descriptions **A**, **B** and **C** relate to the movement of water from the soil to the xylem in roots.

State the correct term to match each of the descriptions **A**, **B** and **C**.

A The specialised root epidermal cell that provides a large surface area for the uptake of water from the soil.

.....

B The band of suberin in the cell walls of the endodermis that prevents the movement of water by the apoplastic pathway.

.....

C The cell structures that allow water to pass from one cell to the next as part of the symplastic pathway.

.....

[3]

(b) Explain, with reference to the structure of xylem vessel elements, why water does **not** take a symplastic pathway in the xylem to the leaves.

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.....[2]

(c) Explain why the rate of movement of water in the xylem may slow down at night.

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.....[3]

[Total: 8]

- 6 Fig. 6.1 is a diagram of a vertical section through the mammalian heart. The labels **Q** to **X** represent valves and blood vessels of the heart.

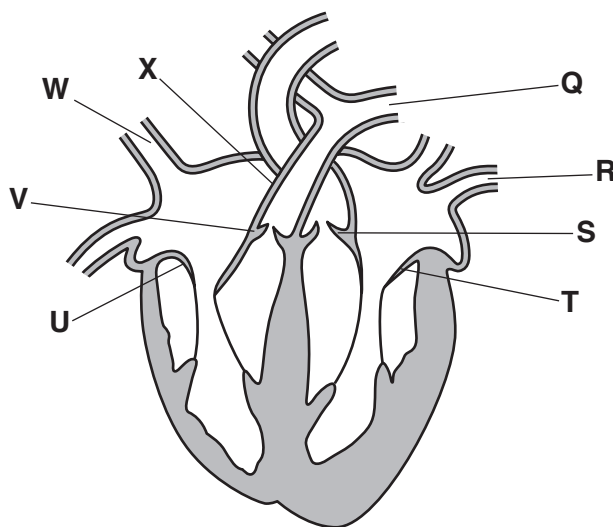


Fig. 6.1

- (a) (i) State which label represents the valve that prevents the backflow of blood from the aorta into the ventricle.

.....[1]

- (ii) Name the blood vessel that carries oxygenated blood from the lungs to the heart **and** state which label represents this blood vessel.

name

label[2]

- (b) State **precisely** where the sinoatrial node is located.

.....[1]

- (c) Explain the role of the atrioventricular node in the coordination of heart action.

.....

[2]

[Total: 6]

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