



Surname _____

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AS

BIOLOGY

Paper 2

7401/2

Monday 4 June 2018 Afternoon

Time allowed: 1 hour 30 minutes

At the top of the page, write your surname and other names, your centre number, your candidate number and add your signature.

[Turn over]



For this paper you must have:

- **a ruler with millimetre measurements**
- **a scientific calculator.**

INSTRUCTIONS

- **Use black ink or black ball-point pen.**
- **Answer ALL questions.**
- **You must answer the questions in the space provided. Do not write on blank pages.**
- **Show all your working.**
- **Do all rough work in this book. Cross through any work you do not want to be marked.**



INFORMATION

- **The marks for the questions are shown in brackets.**
- **The maximum mark for this paper is 75.**

**DO NOT TURN OVER UNTIL TOLD
TO DO SO**



Answer ALL questions in the spaces provided.

01.1 Structures A to E are parts of a plant cell.

- A Cell Wall**
- B Chloroplast**
- C Nucleus**
- D Mitochondrion**
- E Golgi apparatus**

**Complete TABLE 1, on the opposite page, by putting the correct letter, A, B, C, D or E in the box next to each statement.
[3 marks]**

TABLE 1

STATEMENT	LETTER
Has stacked membranes arranged in parallel and contains DNA.	
Is made of polysaccharide.	
Is an organelle and is NOT surrounded by two membranes.	

[Turn over]

7

[Turn over]

<hr/>
5



03.1 Describe the relationship between size and surface area to volume ratio of organisms. [1 mark]

[Turn over]

03.2 A scientist calculated the surface area of a large number of frog eggs. He found that the mean surface area was 9.73 mm^2 . Frog eggs are spherical.

The surface area of a sphere is calculated using this equation

$$\text{Surface area} = 4\pi r^2$$

where r is the radius of a sphere

$$\pi = 3.14$$

Use this equation to calculate the mean diameter of a frog egg.

Show your working. [2 marks]

Diameter = _____ mm

[Turn over]



The scientist calculated the ratio of surface area to mass for eggs, tadpoles and frogs. He also determined the mean rate of oxygen uptake by tadpoles and frogs.

His results are shown in TABLE 2.

TABLE 2

Stage of frog development	Ratio of surface area to mass	Mean rate of oxygen uptake / $\mu\text{mol g}^{-1} \text{h}^{-1}$
Egg	2904 : 1	no information
Tadpole	336 : 1	5.7
Adult	166 : 1	1.3

03.3 The scientist used units of $\mu\text{mol g}^{-1} \text{h}^{-1}$ for the rate of oxygen uptake.

Suggest why he used μmol in these units. [1 mark]

[Turn over]

03.4 The scientist decided to use the ratio of surface area to mass, rather than the ratio of surface area to volume. He made this decision for practical reasons.

**Suggest ONE practical advantage of measuring the masses of frog eggs, tadpoles and adults, compared with measuring their volumes.
[1 mark]**

03.5 Explain why oxygen uptake is a measure of metabolic rate in organisms. [1 mark]

[Turn over]

[Turn over]

9

0 4 . 1 Give TWO similarities in the movement of substances by diffusion and by osmosis.
[2 marks]

1

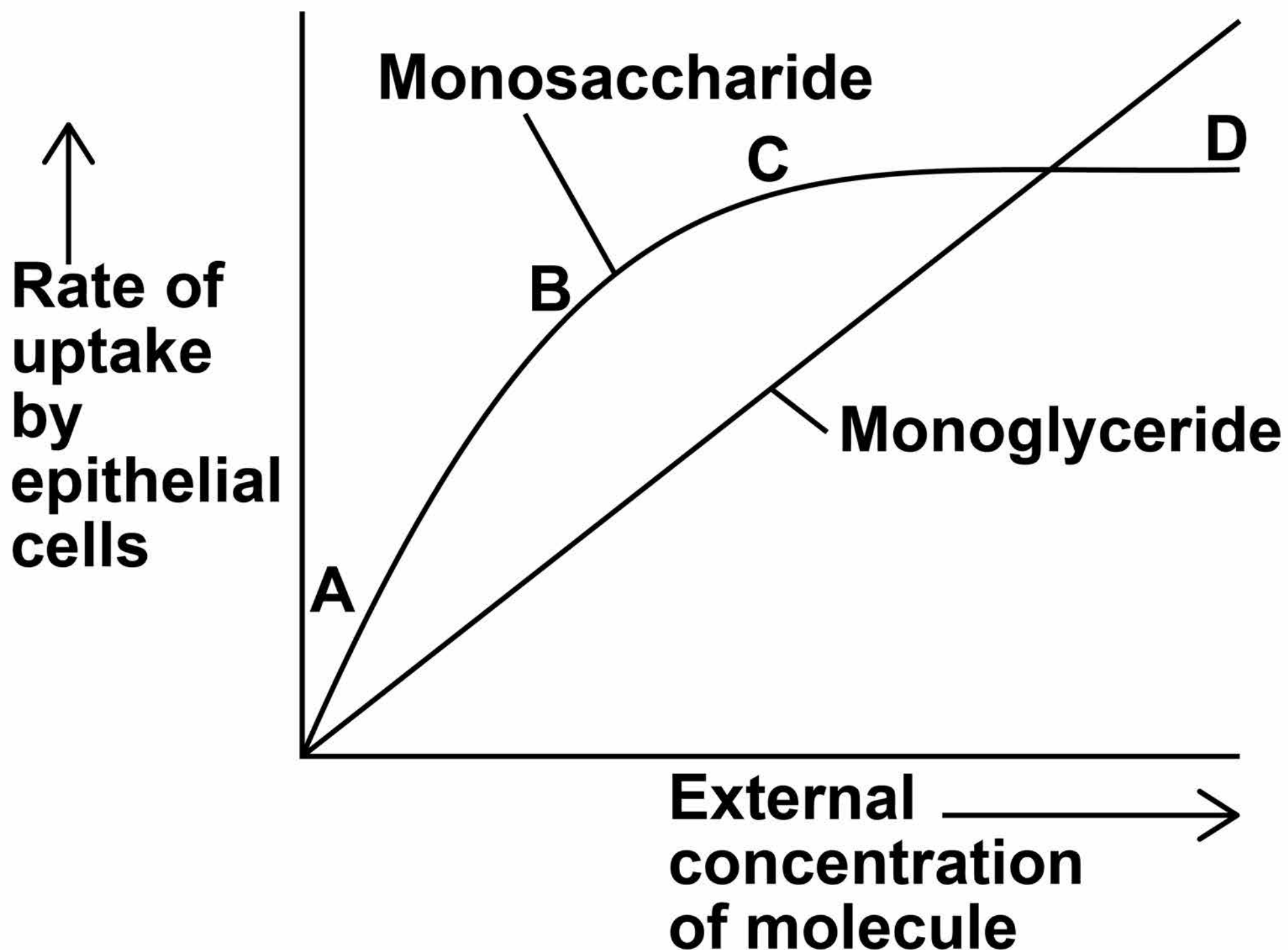
2

A scientist measured the rate of uptake of a monoglyceride and a monosaccharide by epithelial cells of the small intestine of mice. A monoglyceride is a molecule of glycerol with one fatty acid attached. She did this for different concentrations of monoglyceride and monosaccharide.

[Turn over]

Her results are shown in FIGURE 1.

FIGURE 1



- 04.2** Use your knowledge of transport across membranes to explain the shape of the curve in FIGURE 1 for uptake of monosaccharides between concentrations: [3 marks]



05.1 A student prepared a stained squash of cells from the tip of an onion root and observed it using an optical microscope.

During the preparation of the slide, he:

- **cut the first 5 mm from the tip of an onion root and placed it on a glass slide**
- **covered this tip with a drop of stain solution and a cover slip**
- **warmed the glass slide**
- **pressed down firmly on the cover slip.**

He identified and counted nuclei in different stages of the cell cycle.

[Turn over]



**Explain why the student:
[2 marks]**

**1. used only the first 5 mm
from the tip of an
onion root.**

2. pressed down firmly on the cover slip.

[Turn over]

FIGURE 2



FIGURE 2 shows the cells the student saw in one field of view. He used this field of view to calculate the length of time these onion cells spent in anaphase of mitosis.

05.2 Scientists have found the mean length of time spent by onion cells in anaphase of mitosis is 105 minutes. They also found the cell cycle of cells in the onion root shown in FIGURE 2 takes 1080 minutes.

32 whole cells are shown in FIGURE 2.

[Turn over]



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Use the information on page 29 and FIGURE 2 on page 28 to calculate the length of time the cells of this onion root are in anaphase AND then calculate the percentage difference between your answer and the mean length of time found by the SCIENTISTS.

Show your working. [2 marks]

Answer = _____ %

[Turn over]



0 5 . 3 Tick (✓) the name given to the division of cytoplasm during the cell cycle. [1 mark]

Binary fission

Cytokinesis

Phagocytosis

Segregation

0 5 . 4 Describe and explain what the student should have done when counting cells to make sure that the mitotic index he obtained for this root tip was accurate. [2 marks]



05.5 A scientist treated growing tips of onion roots with a chemical that stops roots growing. After 24 hours, he prepared a stained squash of these root tips.

FIGURE 3 is a drawing showing the chromosomes in a single cell observed in the squash of one of these root tips in anaphase. This cell was typical of other cells in anaphase in these root tips.

FIGURE 3



[Turn over]

0 6

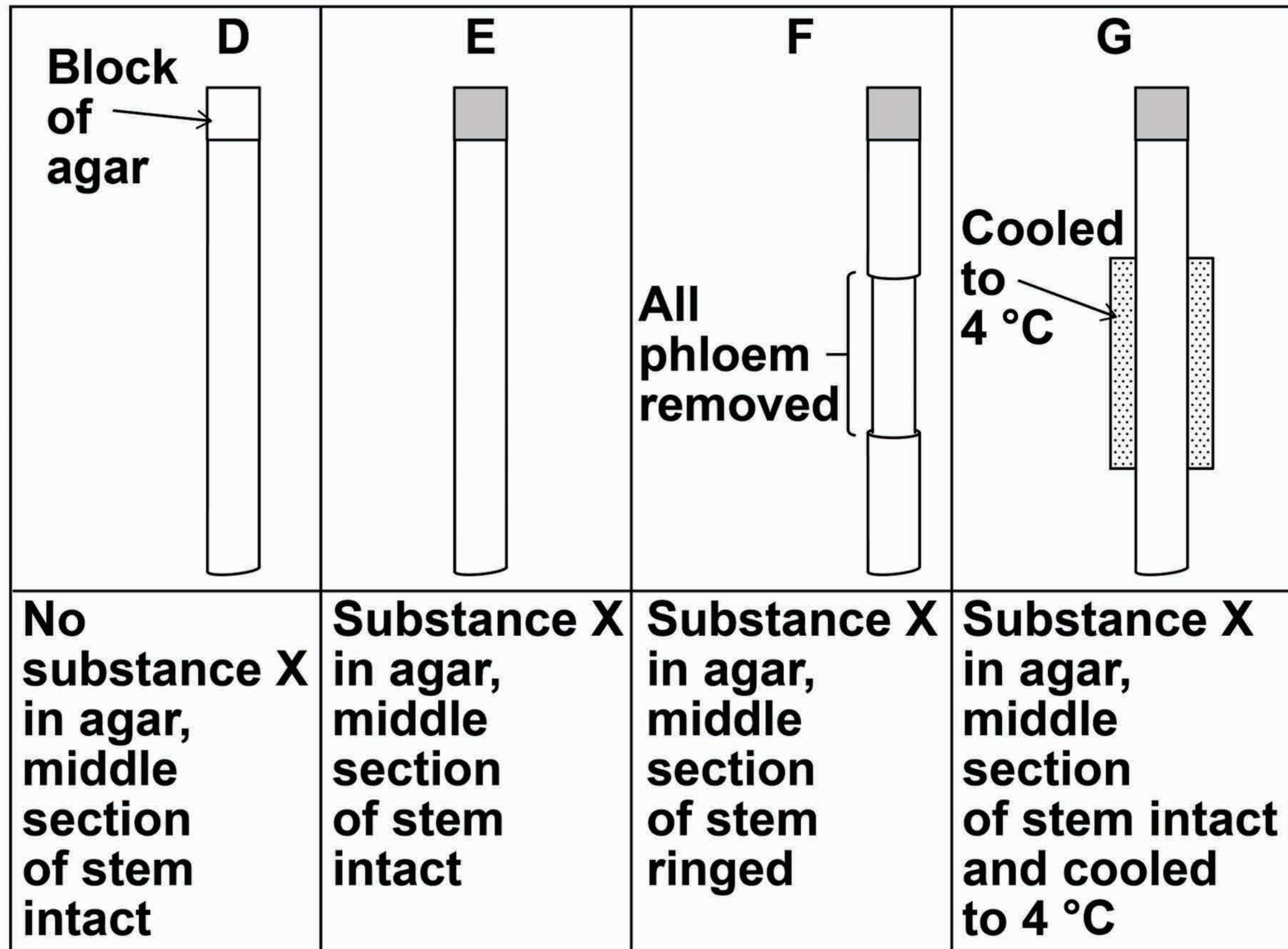
Under the correct conditions, new roots grow from the cut end of a plant stem. A scientist investigated the effect of substance X on the growth of new roots.

She used a ringing experiment to investigate the movement of substance X in stems taken from lemon plants. She cut out a length of stem from each plant. She then put a small block of agar on the top of each length of stem. Some agar blocks contained substance X.

FIGURE 4, on the opposite page, shows how she treated each length of stem.

38

FIGURE 4



[Turn over]

She grew the lengths of stem in the same environmental conditions for 6 weeks, and then found the number of roots per length of stem. Roots grew at the other end of the stem from where the agar blocks were placed.

TABLE 3 shows the scientist's results.

TABLE 3

Treatment	Mean number of roots per length of stem
D	5
E	11
F	4
G	3



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One species of fungus digests cellulose using two types of enzyme, endocellulases and exocellulases.

Endocellulases act in the middle of the cellulose molecule and exocellulases act at the ends of the cellulose molecule.

07.2 Endocellulases and exocellulases act at different places on cellulose molecules.

Suggest why. [2 marks]

[Turn over]

A scientist prepared the following mixtures:

- **15 g cellulose with 0.2 mol dm^{-3} endocellulase**
- **15 g cellulose with 0.2 mol dm^{-3} exocellulase**
- **15 g cellulose with 0.2 mol dm^{-3} endocellulase and 0.2 mol dm^{-3} exocellulase.**

The mixtures had identical total volumes. She determined the mass of cellulose remaining after 48 hours.



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[Turn over]



Her results are shown in TABLE 4.

TABLE 4

Time / hours	Mass of cellulose remaining / g		
	Endocellulase	Exocellulase	Endocellulase + exocellulase
48	11.9	14.8	9.2

52

07.3 Use information from TABLE 4 to calculate the rate of digestion of cellulose when both enzymes are present.

Give your answer in g min^{-1} and in standard form.

Show your working. [2 marks]



Answer = _____ g min⁻¹

[Turn over]



[Turn over]



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07.5 The scientist could have expressed her results as the percentage loss in mass of cellulose.

In the space, write the equation for calculating the percentage loss in mass. [1 mark]

[Turn over]

9



08.2 Using an optical microscope, the student determined there were 15 cells in 0.004 mm^3 of the 1 in 1000 dilution of the culture.

Calculate the number of cells in 1 cm^3 of undiluted liquid culture. [2 marks]

Answer =

_____ Number of cells



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[Turn over]



[Turn over]

08.4 On some farms, animals are routinely given antibiotics in their food.

Scientists investigated whether these farm animals had antibiotic-resistant bacteria in their intestines. They tested the bacteria for resistance to two antibiotics, tetracycline and streptomycin.

Their results are shown in **TABLE 5**.

TABLE 5

Antibiotic	Percentage of antibiotic-resistant bacteria
Tetracycline	29
Streptomycin	13

0 8 . 5 In recent years, these farm animals have not been given tetracycline in their food. Despite this, the percentage of bacteria resistant to tetracycline has remained constant.

**Suggest ONE reason why.
[1 mark]**

10

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Question	Mark
1	
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