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AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

AS
BIOLOGY

Paper 2

Monday 4 June 2018 Afternoon Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:
- a ruler with millimetre measurements
- a scientific calculator.

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the space provided. Do not write outside the box around each page or 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.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
TOTAL	

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

0 1 . 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** 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.	

0 1 . 2 Human breast milk is produced and secreted by gland cells. These gland cells have adaptations that include many mitochondria and many Golgi vesicles. The milk contains a high concentration of protein.

Explain the role of these cell adaptations in the production and secretion of breast milk.

[2 marks]

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0 2 . 1 Describe how a peptide bond is formed between two amino acids to form a dipeptide.

[2 marks]

0 2 . 2 The secondary structure of a polypeptide is produced by bonds between amino acids.

Describe how.

[2 marks]

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0 2 . 3 Two proteins have the same number and type of amino acids but different tertiary structures.

Explain why.

[2 marks]

6

Turn over for the next question

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0 3 . 1 Describe the relationship between size and surface area to volume ratio of organisms.

[1 mark]

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0 3 . 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

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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 / μmol g^{-1} h^{-1}
Egg	2904 : 1	no information
Tadpole	336 : 1	5.7
Adult	166 : 1	1.3

0 3 . 3 The scientist used units of μmol g^{-1} h^{-1} for the rate of oxygen uptake.

Suggest why he used μmol in these units.

[1 mark]

0 3 . 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]

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0 3 . 5 Explain why oxygen uptake is a measure of metabolic rate in organisms.

[1 mark]

0 3 . 6 A student who looked at these results said that they could not make a conclusion about the relationship between stage of development and metabolic rate.

Use information in **Table 2** to explain reasons why they were unable to make a conclusion.

[3 marks]

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0 4 . 1 Give **two** similarities in the movement of substances by diffusion and by osmosis.

[2 marks]

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Question 4 continues on the next page

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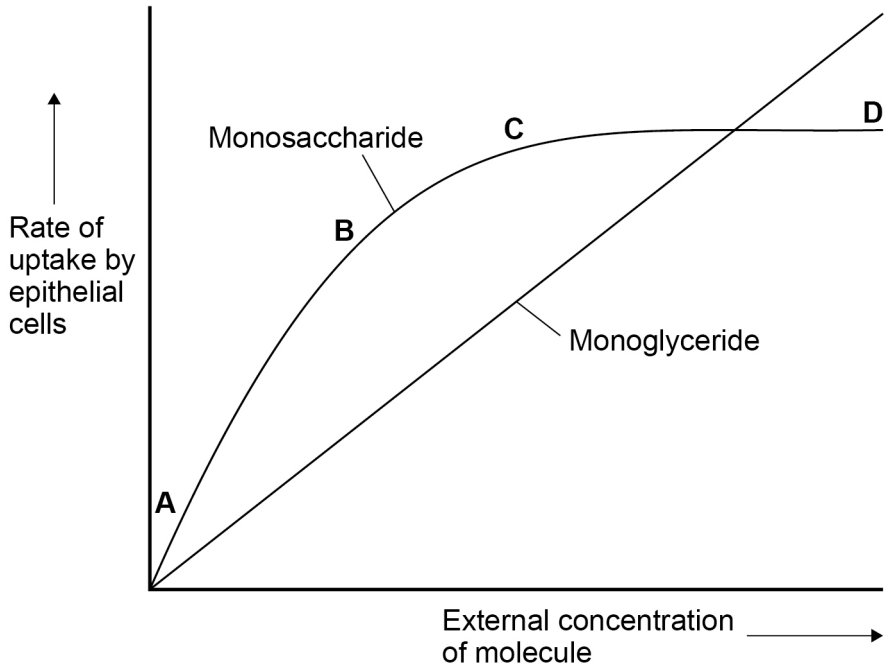
A scientist measured the rate of uptake of a monoglyceride and a monosaccharide by epithelial cells of the small intestine of mice. A monoglyceride is a molecule of glycerol with one fatty acid attached. She did this for different concentrations of monoglyceride and monosaccharide.

Her results are shown in **Figure 1**.

Figure 1



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0 4 . 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]

A and **B** _____

_____

_____

_____

_____

_____

C and **D** _____

_____

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0 4 . 3 **Figure 1** is evidence for monoglycerides being lipid-soluble molecules.

Suggest how.

[2 marks]

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0 5 . 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.

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.

Question 5 continues on the next page

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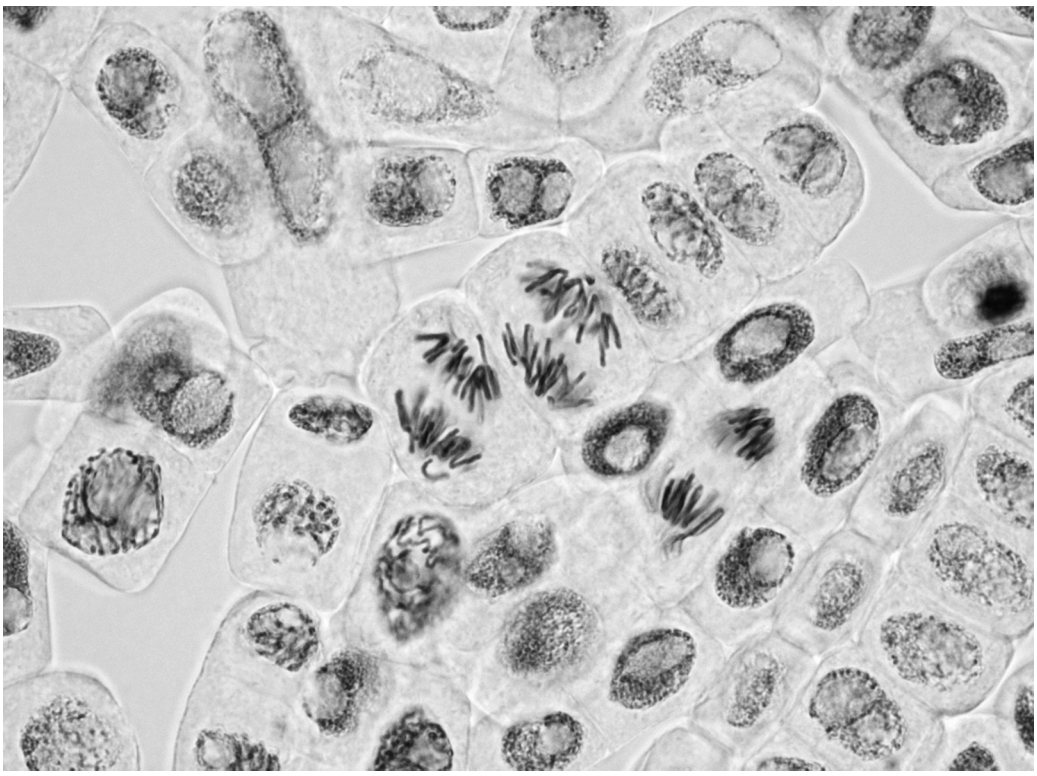
Figure 2 shows the cells the student saw in one field of view. He used this field of view to calculate the length of time these onion cells spent in anaphase of mitosis.

Figure 2



0 5 . 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**.

Use this information and **Figure 2** 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 = _____ %

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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]

Question 5 continues on the next page

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0 5 . 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

Use all of this information to suggest how the chemical stops the growth of roots.

[3 marks]

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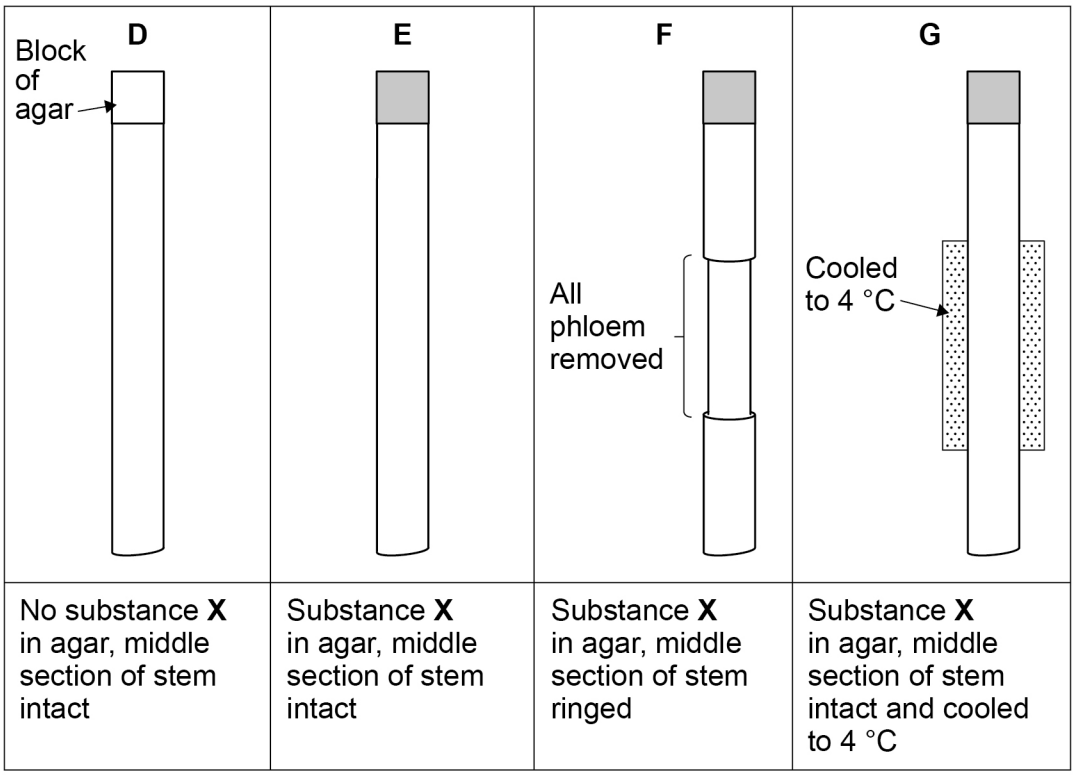
0 6 Under the correct conditions, new roots grow from the cut end of a plant stem. A scientist investigated the effect of substance **X** on the growth of new roots.

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 shows how she treated each length of stem.

Figure 4



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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0 6 . 1 Treatment **D** is a control. Explain how the measurement obtained from this control is used by the scientist.

[2 marks]

0 6 . 2 Using **Figure 4** and **Table 3**, what can you conclude from treatments **D** and **E** about root growth?

[3 marks]

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0 6 . 3 The mass flow hypothesis is used to explain the movement of substances through phloem.

Evaluate whether the information from this investigation supports this hypothesis.
Do **not** consider statistical analysis in the answer.

[4 marks]

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0 7 . 1 What is digestion?

[2 marks]

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.

0 7 . 2 Endocellulases and exocellulases act at different places on cellulose molecules.

Suggest why.

[2 marks]

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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.

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

0 7 . 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}

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0 7 . 4 The scientist used the same concentration of endocellulase and exocellulase in the mixtures. The rate of digestion of cellulose is greatest when both enzymes are present.

Suggest why.

[2 marks]

0 7 . 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]

9

Turn over for the next question

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0 8 . 1 A student used a dilution series to investigate the number of cells present in a liquid culture of bacteria.

Describe how he made a 1 in 10 dilution and then used **this** to make a 1 in 1000 dilution of the original liquid culture of bacteria.

[3 marks]

Question 8 continues on the next page

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0 8 . 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 1cm^3 of undiluted liquid culture.

[2 marks]

Answer = _____ Number of cells

0 8 . 3 The student looked at cells in the 1 in 10 dilution during his preliminary work. He decided **not** to use this dilution to determine the number of cells in the undiluted liquid culture.

Suggest an explanation for the student's decision.

[2 marks]

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0 8 . 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

Suggest and explain **one** reason why bacteria resistant to tetracycline are more common than bacteria resistant to streptomycin in these farm animals.

[2 marks]

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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]

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0 9 . 1 Compare and contrast the DNA in eukaryotic cells with the DNA in prokaryotic cells.

[5 marks]

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0 9 . 2 Haemoglobins are chemically similar molecules found in many different species.

Differences in the primary structure of haemoglobin molecules can provide evidence of phylogenetic (evolutionary) relationships between species.

Explain how.

[5 marks]

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END OF QUESTIONS

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