A

**Surname** _____

**Other Names** _____

**Centre Number** _____

**Candidate Number** _____

**Candidate Signature** _____

# AS
# BIOLOGY

**Paper 2**

# 7401/2

**Monday 4 June 2018** **Afternoon**

**Time allowed: 1 hour 30 minutes**

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

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

**[Turn over]**

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## 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.**

**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]**

**[Turn over]**

**5**

**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

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

**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**

**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**

**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 / $\mu mol\ g^{-1}\ h^{-1}$ |
|---|---|---|
| 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]**

**0 3 . 5** **Explain why oxygen uptake is a measure of metabolic rate in organisms. [1 mark]**

**[Turn over]**

**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, on page 12, to explain reasons why they were unable to make a conclusion. [3 marks]**

9

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

**1** _____

_____

_____

_____

_____

_____

**2** _____

_____

_____

_____

_____

_____

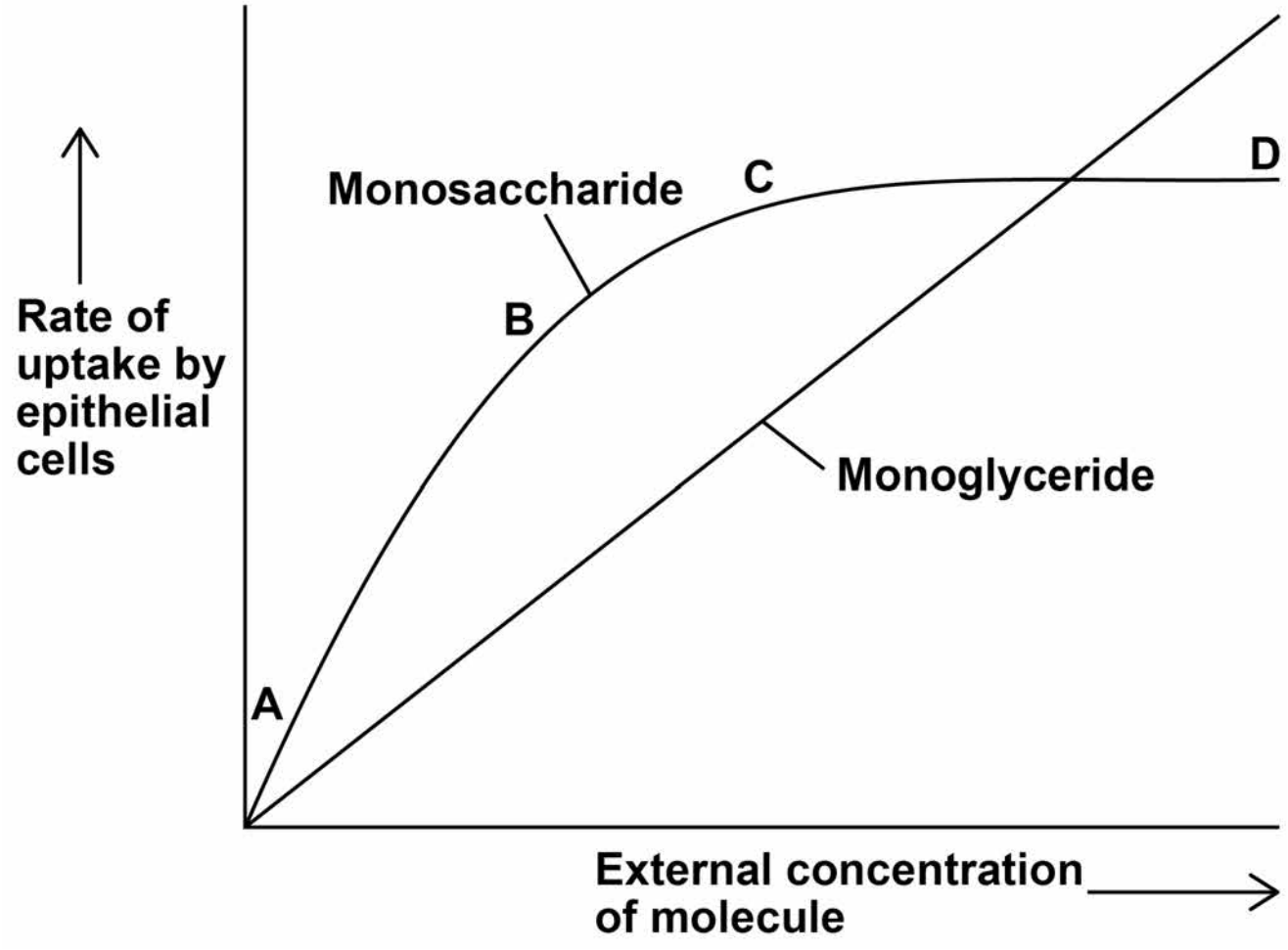
_____

**[Turn over]**

**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**



**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**

**0 4 . 3** **FIGURE 1, on page 18, is evidence for monoglycerides being lipid-soluble molecules.**

**Suggest how. [2 marks]**



7

**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]**

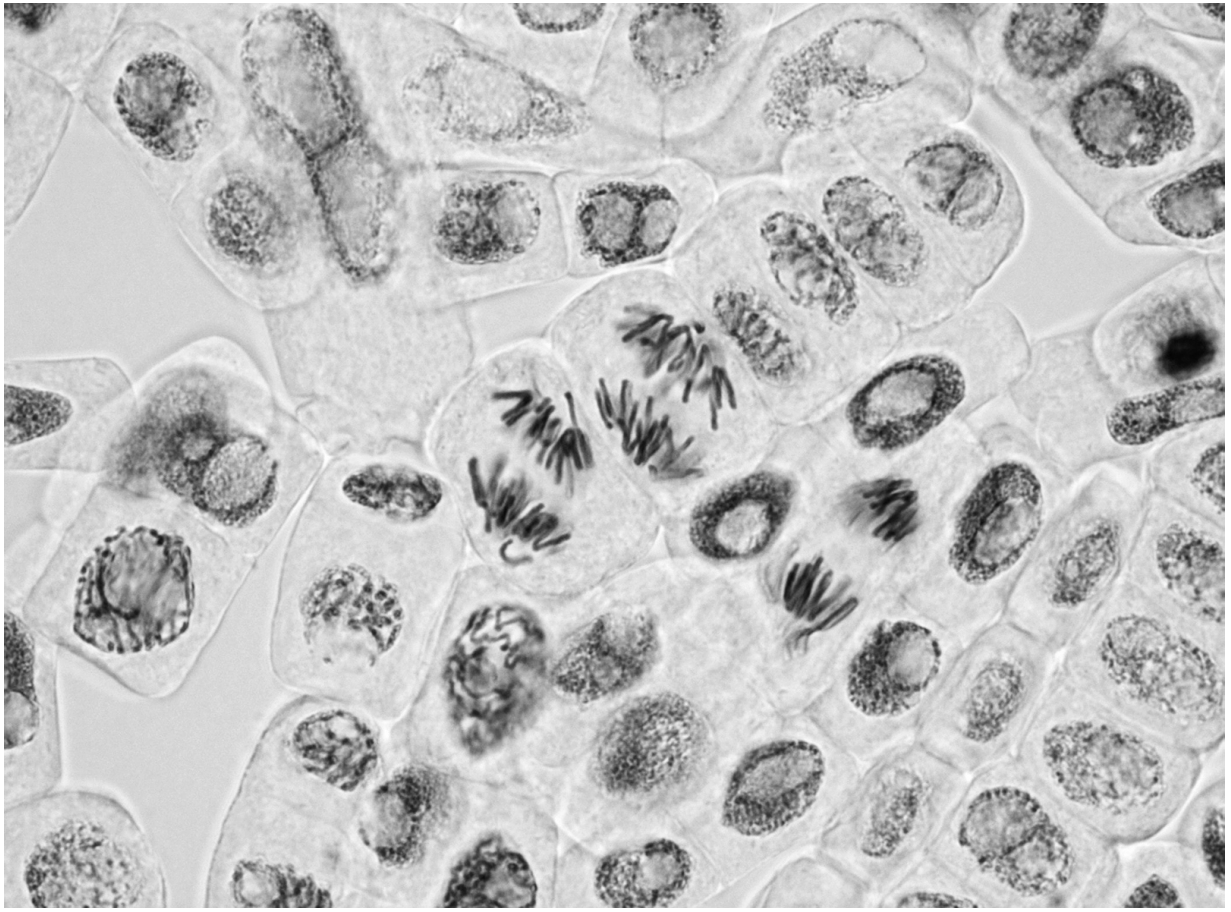
**1. used only the first 5 mm from the tip of an onion root.**

2. pressed down firmly on the cover slip.

[Turn over]

**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]**

25

**Answer = _____ %**

**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]**

[Turn over]

**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]**

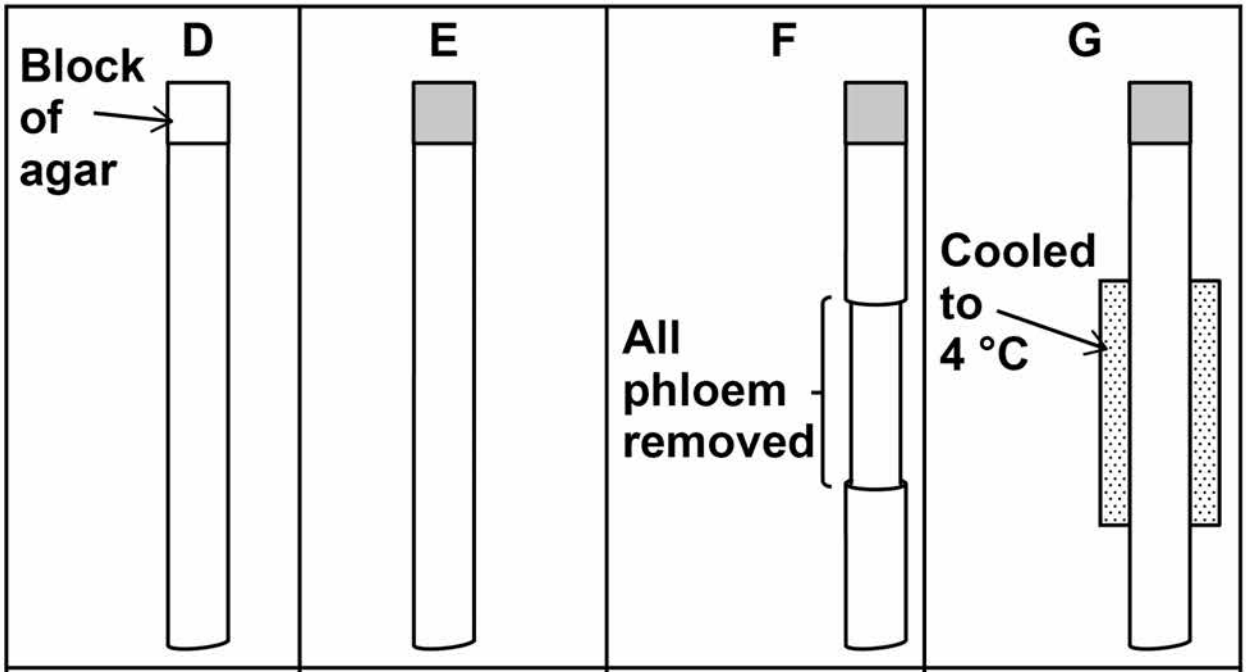
10

**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**




| | | | |
|---|---|---|---|
| No substance X in agar, middle section of stem intact | Substance X in agar, middle section of stem intact | Substance X in agar, middle section of stem ringed | Substance X in agar, middle section of stem intact and cooled to 4 °C |

**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 |

**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 on page 31 and TABLE 3 on page 32, what can you conclude from treatments D and E about root growth?**
**[3 marks]**

[Turn over]

**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]**

9

**0 7 . 1 What is digestion? [2 marks]**

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**[Turn over]**

**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]**

[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.**

**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 $min^{-1}$**

**[Turn over]**

**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**

**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]**

[Turn over]

**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 1$cm^3$ of undiluted liquid culture. [2 marks]**

**Answer = _____ Number of cells**

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**[Turn over]**

**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]**

[Turn over]

**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]**

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

**0 9 . 1** **Compare and contrast the DNA in eukaryotic cells with the DNA in prokaryotic cells.**
**[5 marks]**

**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]**

**END OF QUESTIONS**

10

# There are no questions printed on this page

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