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|---|------------------------------------|
| Write your name here  |                                    |
| Surname   | Other names                        |
| Centre Number   | Candidate Number                   |
| <input type="text"/>  | <input type="text"/>               |
| <b>Edexcel GCE</b>  |                                    |
| <b>Biology</b>  |                                    |
| <b>Advanced Subsidiary</b>  |                                    |
| <b>Unit Test 2: Development, Plants &amp; the Environment</b>           |                                    |
| Wednesday 14 January 2009 – Afternoon<br><b>Time: 1 hour 15 minutes</b> | Paper Reference<br><b>6BI02/01</b> |
| <b>You do not need any other materials.</b>                             | Total Marks                        |
| <input type="text"/>  | <input type="text"/>               |

### Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided  
– *there may be more space than you need.*

### Information

- The total mark for this paper is 80.
- The marks for **each** question are shown in brackets  
– *use this as a guide as to how much time to spend on each question.*
- You will be assessed on your ability to organise and present information, ideas, descriptions and arguments clearly and logically, including your use of grammar, punctuation and spelling.
- Candidates may use a calculator.

### Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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Answer ALL questions.

Some questions must be answered with a cross . If you change your mind about an answer, put a line through the box  and then mark your new answer with a cross .

- 1 The photograph below shows some human epithelial tissue, as seen using an electron microscope. The tissue includes a goblet cell which contains a large number of Golgi apparatus.



goblet cell

magnification  $\times 5000$

- (a) Explain the meaning of the term **tissue**.

(2)

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(b) The Golgi apparatus of a goblet cell is involved in receiving protein, modifying it and then packaging the modified protein into vesicles.

- (i) In the space below, draw a diagram of a Golgi apparatus. Add an arrow to your drawing to show the direction of movement of the protein material as it moves through the Golgi apparatus.

(3)

- (ii) Proteins in a cell can be made radioactive by supplying the cell with radioactive amino acids. The movement of the radioactive protein within the cell can be traced over time.

In an investigation, it was found that the quantity of radioactivity in the protein that entered the Golgi apparatus was less than that supplied to the cell.

Suggest **three** reasons for this difference.

(3)

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(Total for Question 1 = 8 marks)



2 In a study of plant structure, a leaf cell and a cell from a root tip were observed.

(a) Name **one** structure that may be found in a leaf cell that identifies it as **both** a eukaryotic cell **and** a plant cell.

(1)

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(b) The cell from the root tip was observed to be undergoing anaphase of mitosis.

(i) Describe **anaphase** of mitosis.

(3)

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(ii) During anaphase, the cell from the root tip did not have a nucleus but was still considered to be eukaryotic. Suggest **two** reasons why this cell was still considered to be eukaryotic.

(2)

1 .....

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2 .....

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(c) The table below shows the number of cells at each stage of the cell cycle in one sample of tissue taken from the growing region of a plant root.

| Stage of the cell cycle | Number of cells in each stage | Percentage of cells in each stage (%) |
|-------------------------|-------------------------------|---------------------------------------|
| Interphase              | 47                            | 78.3                                  |
| Prophase                | 3                             | 5.0                                   |
| Metaphase               |                               | 3.3                                   |
| Anaphase                | 1                             | 1.7                                   |
| Telophase               | 3                             | 5.0                                   |
| Cytokinesis             |                               | 6.7                                   |
| <b>TOTAL</b>            | <b>60</b>                     | <b>100</b>                            |

- (i) Complete the table by calculating the number of cells undergoing metaphase and cytokinesis. Give your answer to the nearest whole number. (2)
- (ii) Using the table above, suggest which stage of the cell cycle takes the longest. Give a reason for your answer. (2)

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- (iii) Suggest **one** reason why your answer to (c)(ii) may be unreliable. (1)

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(Total for Question 2 = 11 marks)

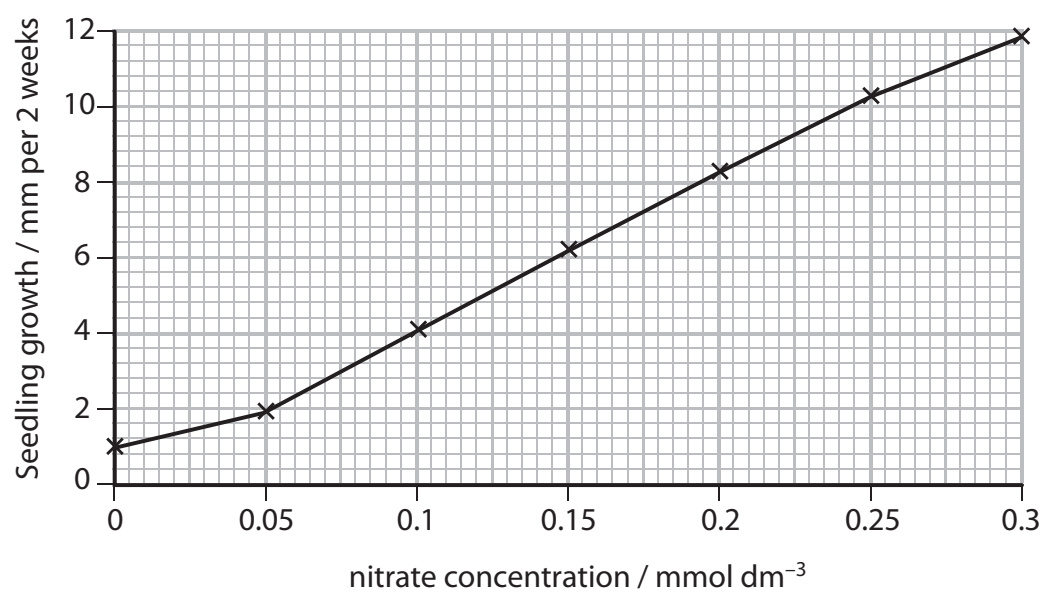


- 3 A student investigated the effect of nitrate ion concentration on the growth of wheat seedlings.

She took seven wheat seedlings and measured the length from the shoot tip to the root tip of each seedling. She placed each seedling in a different test tube so that its roots were in a mineral ion solution. Each tube contained a mineral ion solution with a different concentration of nitrate ions.

She left the seedlings on a window sill for two weeks and then measured the new length between the shoot tip and the root tip of each seedling. She then calculated the difference between the final length and initial length of each wheat seedling.

The results are shown in the graph below.



- (a) After her investigation, she said "I conclude that nitrates are needed for seedling growth and the higher the nitrate concentration the greater the growth."

(i) Give **one** piece of evidence from the graph that supports her conclusion.

(1)

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(ii) Give **one** piece of evidence from the graph that does not support her conclusion

(1)

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(iii) State the nitrate ion concentration of the solution that acted as the control. (1)

..... mmol dm<sup>-3</sup>

(iv) Explain why it is better to use the difference in length as the measure of seedling growth rather than just the final length. (1)

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(v) Suggest why calculating the difference between final mass and initial mass of each seedling may be an even better indicator of growth than measuring length. (1)

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(vi) Suggest **three** variables that the student would need to keep constant to ensure the reliability of her data. (3)

1 .....  
2 .....  
3 .....

(b) The student repeated the investigation using another wheat seedling. However, she replaced the mineral ion solution with soil from her garden. After two weeks the wheat seedlings had grown. She found the total increase in length to be 5.2 mm.

Use the graph to estimate the nitrate ion concentration of her soil. (2)

Answer .....



(c) Inorganic ions are used by plants to make molecules. The table below refers to two inorganic ions, the molecules made and the main role of these molecules in a plant. Complete the table by writing the most appropriate word or words in each of the empty boxes.

(2)

| Inorganic ion | Molecule made            | Main role of the molecule in a plant |
|---------------|--------------------------|--------------------------------------|
| Nitrate       |                          | Plant growth                         |
| Calcium       | Calcium pectate (pectin) |                                      |

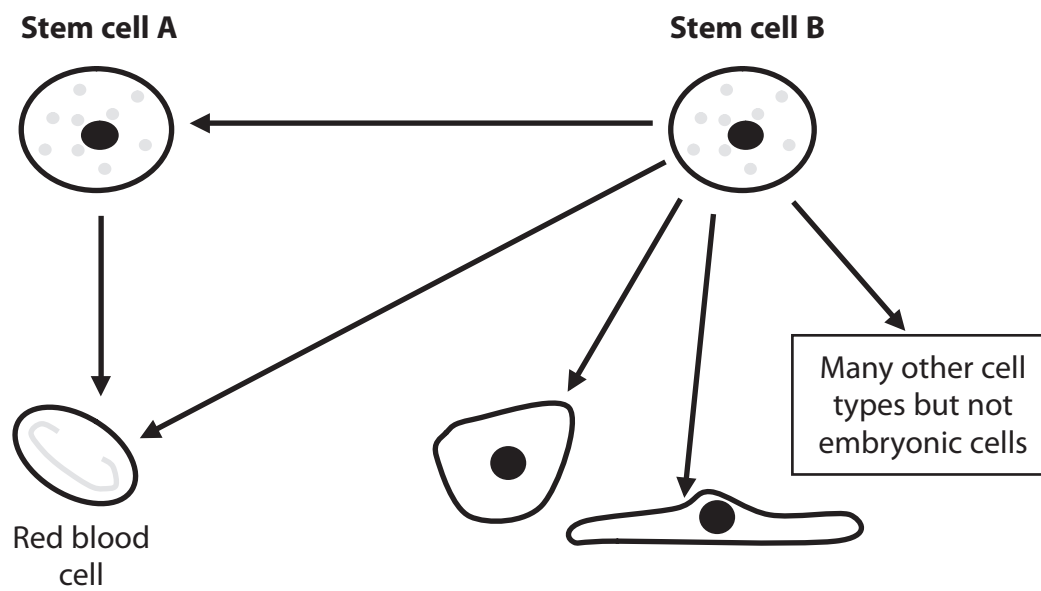
(Total for Question 3 = 12 marks)

4





- 4 (a) The diagram below shows two different stem cells and the differentiated cells that they can form.



- (i) Use the diagram to explain why stem cell B is described as **pluripotent**. (2)

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- (ii) Suggest **one** site where stem cell A may be found in an **adult** human. (1)

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(iii) All the differentiated cells derived from stem cell B have the same genotype but have very different structures and functions. This is due to differential gene expression.

Explain how **differential gene expression** can enable cells which have the same genetic material to have very different structures and functions.

(3)

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(b) Three examples of how temperature affects organisms are given below. If the example is due to differential gene expression, place a cross (☒) in the box to the right of that example.

(1)

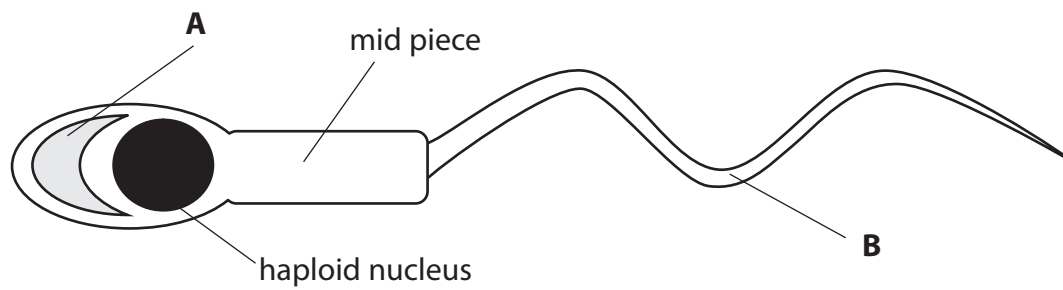
| Examples   |                          |
|--|--------------------------|
| The rate of protein synthesis within a plant is temperature dependent.                           | <input type="checkbox"/> |
| The gender of turtles is determined by the temperature of the ground in which the eggs are laid. | <input type="checkbox"/> |
| Asexual reproduction is more rapid in bacteria if the temperature is higher.                     | <input type="checkbox"/> |

(Total for Question 4 = 7 marks)



5 Fertilisation involves the fusion of haploid nuclei.

(a) The diagram below shows a human sperm cell.



(i) Name the structures labelled **A** and **B**.

(2)

**A** .....

**B** .....

(ii) Explain why it is important that the sperm has a nucleus that is haploid.

(2)

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(iii) Describe the changes in the female gamete from the point when a sperm releases its digestive enzymes to the point when the two nuclei fuse.

(3)

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(b) An investigation into the effect of temperature on pollen tube growth was carried out. Two different varieties of cotton pollen grain were used, variety A and variety B.

Twenty newly-germinated cotton pollen grains of variety A were placed on growth medium in a Petri dish and incubated in the dark for 24 hours at 15 °C. After this time, the length of each pollen tube was measured and the mean calculated. This was repeated at 5 different temperatures.

The investigation was then repeated using variety B. The results are shown in the table below.

| Incubation temperature / °C | Mean length of pollen tube after 24 hours incubation / mm |           |
|-----------------------------|---|-----------|
|                             | variety A   | variety B |
| 15                          | 0.18  | 0.19      |
| 20                          | 0.35  | 0.48      |
| 25                          | 0.53  | 0.83      |
| 30                          | 0.60  | 0.90      |
| 35                          | 0.57  | 0.60      |
| 40                          | 0.10  | 0.10      |



(i) Describe the effect of temperature on the mean length of pollen tubes for variety A.

(2)

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(ii) Compare the effect of temperature on the mean length of pollen tubes in variety A with variety B, between 15 °C and 30 °C.

(2)

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(iii) Suggest an explanation for the change in the mean length of pollen tubes when the temperature increased from 35 °C to 40 °C.

(1)

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**(Total for Question 5 = 12 marks)**



6 Humans have found that plants are a valuable source of cellulose, starch and fibres.

(a) The table below lists some statements about polysaccharides.

Indicate whether each statement is true or false by placing a cross (☒) in the appropriate box.

(5)

| Statements   | True                                | False                               |
|--|-------------------------------------|-------------------------------------|
| Polymer of glucose                                       | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Molecule contains $\alpha$ and $\beta$ glucose           | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Glycosidic bonds present                                 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Molecule may have side branches                          | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Molecule can form hydrogen bonds with adjacent molecules | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |

(b) The clear window in this sandwich packaging is made from starch rather than plastic.



clear window  
made from starch

Suggest how this use of starch, rather than plastic, may contribute to **sustainability**.

(2)

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(c) Plant stems contain xylem vessels and sclerenchyma fibres.

Give **one** similarity and **one** difference between xylem vessels and sclerenchyma fibres.

(2)

Similarity .....

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Difference .....

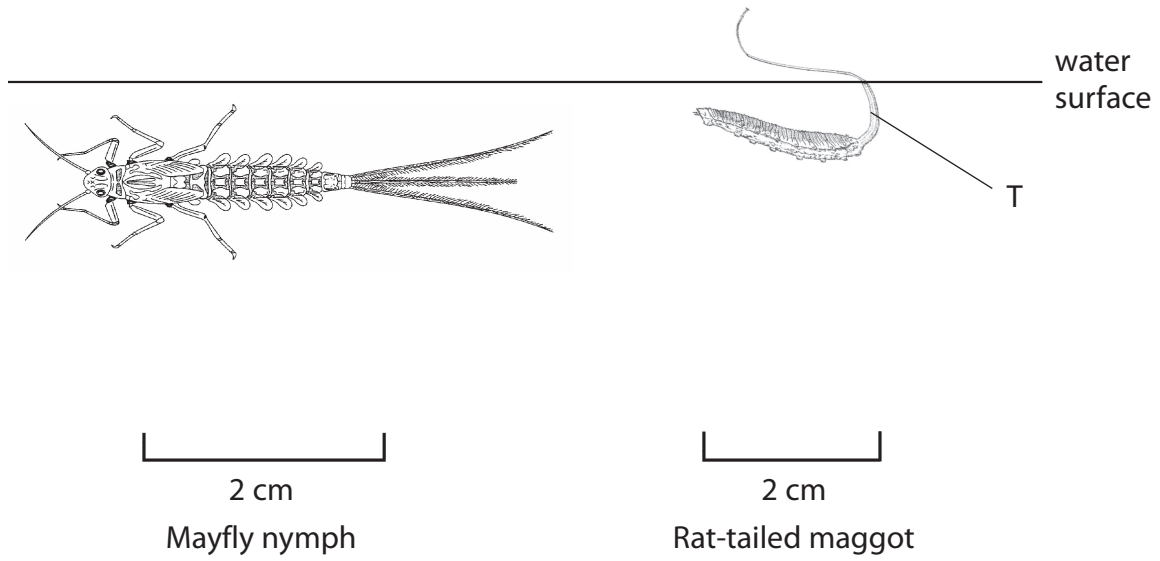
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**(Total for Question 6 = 9 marks)**



7 The process of natural selection can lead to the adaptation of organisms to their environment as well as to evolution.

(a) The diagram below shows two species of invertebrates found in freshwater.



(i) Suggest **two** features of the mayfly nymph, shown in the diagram above, that makes it well-adapted to survival in fast-flowing streams. Explain how each feature helps it to survive.

(4)

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2 .....





(ii) The rat-tailed maggot lives in water which has a low concentration of dissolved oxygen. Suggest how the structure labelled T helps it to survive in this environment.

(2)

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(b) Adaptation can occur within the same species. Leopards and panthers are members of the same species found in Africa. Leopards have spotted fur and hunt in open grasslands, whilst panthers have black fur and hunt in forests.

Suggest how natural selection has led to the evolution of these two different forms of the same species.

(4)

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**(Total for Question 7 = 10 marks)**



**8** Classification of organisms is important when trying to assess biodiversity.

(a) All organisms can be classified into one of three domains.

Name the **three** domains of organisms.

(3)

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3 .....

(b) (i) Explain what is meant by the term **species**.

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(ii) Explain the meaning of the term **genetic diversity** within a species.

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(iii) Describe how zoos maintain the genetic diversity of endangered species.

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**(Total for Question 8 = 11 marks)**

**TOTAL FOR THE PAPER = 80 MARKS**



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