OCR
RECOGNISING ACHIEVEMENT

**ADVANCED SUBSIDIARY GCE** **2801**

**BIOLOGY**

Biology Foundation

**TUESDAY 3 JUNE 2008**

Morning
Time: 1 hour

Candidates answer on the question paper
**Additional materials (enclosed):** None

**Additional materials (required):**
Electronic calculator
Ruler (cm/mm)

*CUP/T40846*

| Candidate Forename | | Candidate Surname | |
|---|---|---|---|
| Centre Number | | Candidate Number | |

**INSTRUCTIONS TO CANDIDATES**

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided.

**INFORMATION FOR CANDIDATES**

- The number of marks for each question is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is **60**.
- You will be awarded marks for the quality of written communication where this is indicated in the question.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.

| FOR EXAMINER'S USE | | |
|---|---|---|
| **Qu.** | **Max.** | **Mark** |
| **1** | **6** | |
| **2** | **6** | |
| **3** | **11** | |
| **4** | **10** | |
| **5** | **16** | |
| **6** | **11** | |
| **TOTAL** | **60** | |

This document consists of **12** printed pages.

Answer **all** the questions.

**1** **(a)** State **one** function of each of the following.

**(i)** Mitochondrion.

.....[1]

**(ii)** Centriole.

.....[1]

**(iii)** Lysosome.

.....[1]

**(iv)** Chloroplast.

.....[1]

**(b)** State **one** role of each of the following ions in living organisms.

**(i)** Magnesium.

.....[1]

**(ii)** Phosphate.

.....[1]

[Total: 6]

**2** Haemophilia A is caused by a change to the gene responsible for the formation of factor VIII, a protein involved in blood clotting.

In the past, people with haemophilia depended upon blood or plasma donations as a source of factor VIII. Nowadays, biotechnology provides a better source of the protein.

**(a)** Suggest why factor VIII produced by biotechnology is a better source of the protein than blood or plasma donations.

.....

.....[1]

**(b)** Production of factor VIII by biotechnology involves transferring the gene coding for factor VIII into host cells. In this technology, enzymes are used to cut and rejoin DNA.

**(i)** Name the type of enzyme used to cut DNA.

.....[1]

**(ii)** Name the enzyme that is used to rejoin DNA.

.....[1]

**(iii)** Suggest how the gene could be transferred into a host cell.

.....

.....[1]

**(c)** Once the gene has been combined into the chromosomes of the host cells, these cells are grown in bioreactors under optimum conditions. Nutrients are supplied and carbon dioxide and other waste products are removed.

**(i)** Name the gas that needs to be supplied to the bioreactor.

.....[1]

**(ii)** Suggest why waste products need to be removed.

.....[1]

[Total: 6]

**3** **(a)** Fig. 3.1 and Fig. 3.2 are light micrographs of onion cells in various stages of mitosis.

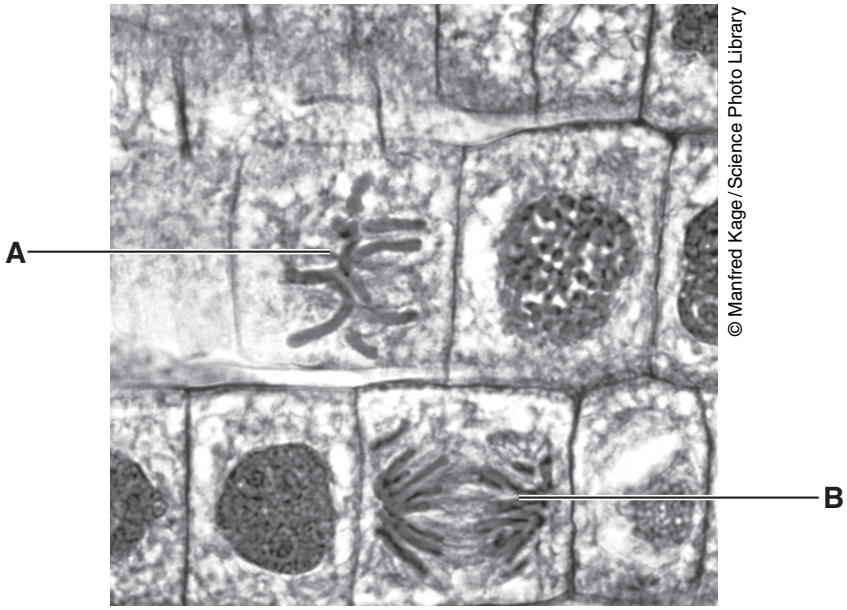



**Fig. 3.1**

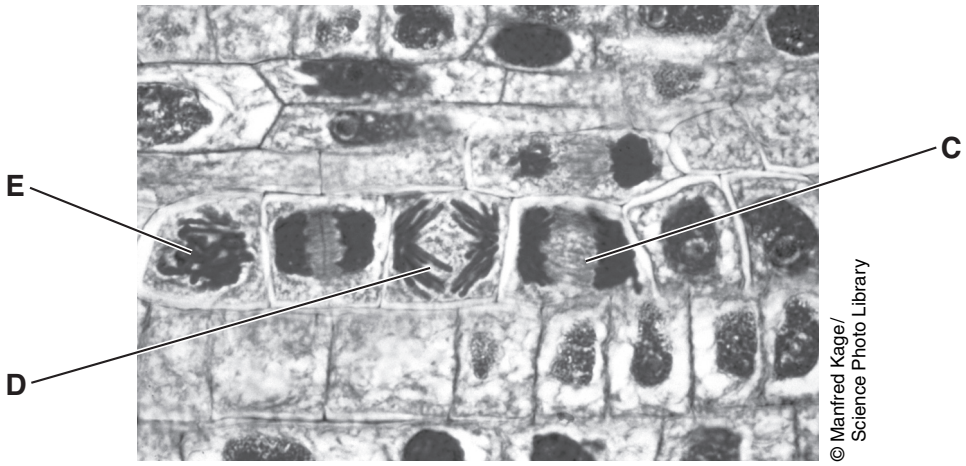



**Fig. 3.2**

**(i)** State one feature, **visible in Fig. 3.1 and Fig. 3.2**, that indicates that these cells are plant cells.

…… .....[1]

**(ii)** Using the letters **A**, **B**, **C**, **D** or **E**, identify **one** cell that is in:

anaphase .....

metaphase .....

telophase.....[3]

**(b)** A student viewed a large number of cells from an onion **root tip** under the microscope and recorded the number of cells in each stage of the mitotic cell cycle. The results are shown in Table 3.1.

**Table 3.1**

| stage of mitotic cell cycle | number of cells in stage | cells in stage as percentage of total |
|---|---|---|
| interphase | 176 | 79.7 |
| prophase | 20 | 9.1 |
| metaphase | 12 | 5.4 |
| anaphase | 6 | 2.7 |
| telophase | 7 | |
| | total = 221 | |

**(i)** Calculate the percentage of cells that were observed in **telophase**.

Show your working. Write your answer in the box in Table 3.1.

[2]

**(ii)** What conclusions can be drawn from the student's results about the relative time spent by an onion root tip cell in each stage of the mitotic cell cycle?

.....

.....

.....

.....

.....

.....[3]

**(iii)** The student then viewed cells from a different part of the onion root.

Suggest why all of the nuclei seen in this part of the root were in interphase.

.....

.....

.....

.....

.....

.....[2]

[Total: 11]

**4** Fig. 4.1 is a diagram showing the sequence of events in the production and secretion of a hormone by a cell.

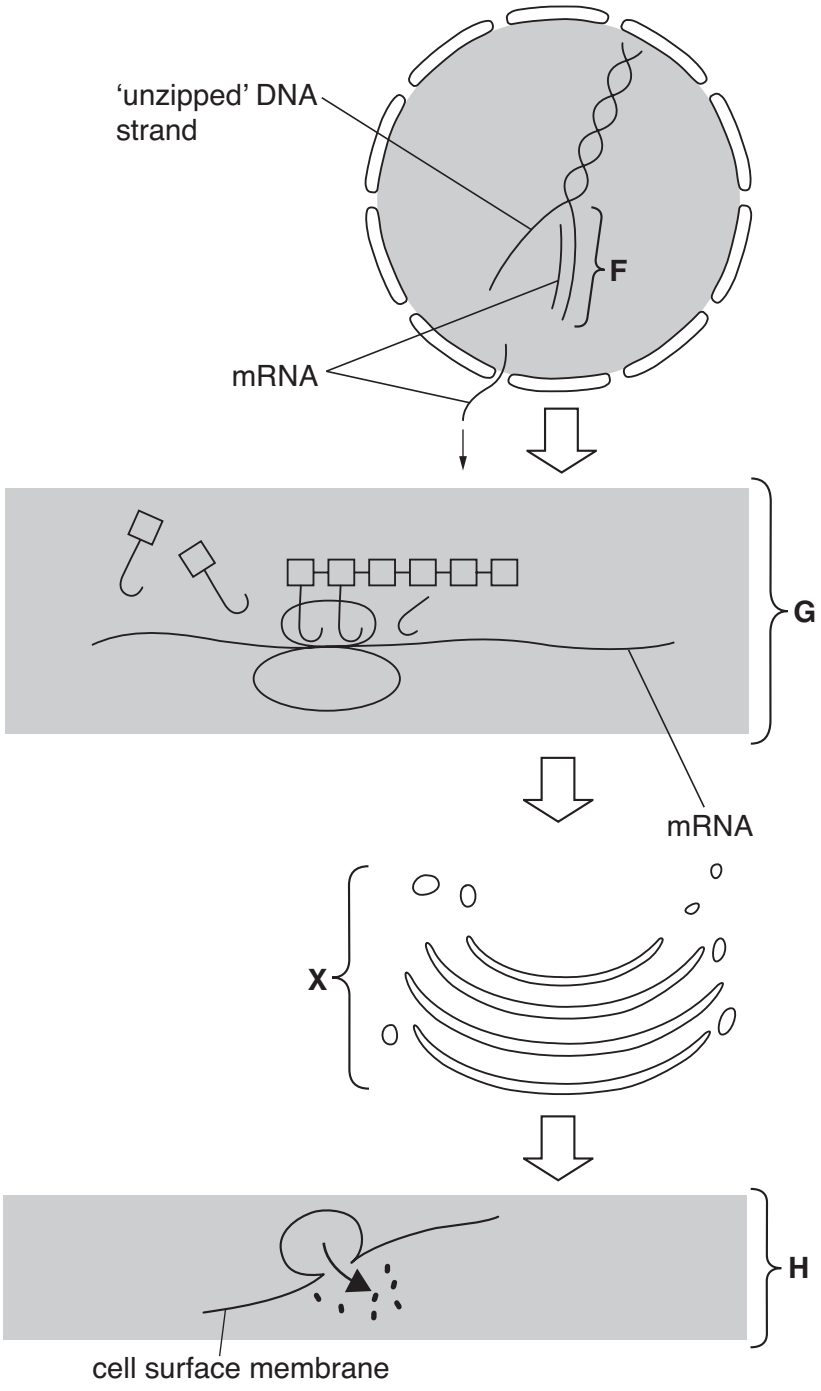



**Fig. 4.1**

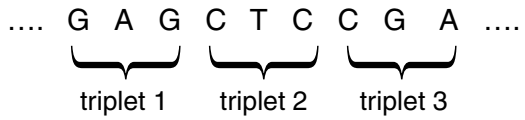
**(a)** Name the processes **F**, **G** and **H**.

**F** .....

**G** .....

**H** .....[3]

**(b)** Part of the DNA base sequence for this hormone is shown below.




**(i)** State the messenger RNA (mRNA) codon and the transfer RNA (tRNA) anticodon that correspond to each of these DNA triplets.

| | triplet 1 | triplet 2 | triplet 3 |
|---|---|---|---|
| mRNA codon | | | |
| tRNA anticodon | | | |

[2]

**(ii)** Explain the relationship between the sequence of the DNA triplets and the structure of the hormone.

.....

.....

.....

.....

.....

.....[2]

**(c)** After process **G**, the product is transferred to the structure labelled **X**, as shown in Fig. 4.1.

**(i)** Name structure **X**.

.....[1]

**(ii)** Describe what happens to the product while it is in structure **X**.

.....

.....

.....

.....[2]

[Total: 10]

**5** Glucose is produced commercially by the enzymatic hydrolysis of starch.

**(a)** State what is meant by *hydrolysis*.

.....[1]

**(b)** Commercial production of glucose consists of two stages.

In **stage 1**, the starch is partially hydrolysed into smaller carbohydrate units, between five and ten glucose units long. Details of **stage 1** are as follows:

- The mixture is heated to about 100 °C in order to increase the solubility of the starch in water.
- The mixture is then allowed to cool and treated with enzymes for one to two hours.
- This process is repeated a few times, with fresh enzyme being added after the mixture is cooled each time.

Suggest why fresh enzyme is added after the mixture is cooled each time.

.....

.....

.....

.....[2]

**(c)** In **stage 2** of glucose production, the partially hydrolysed starch is completely hydrolysed into glucose by the enzyme glucoamylase.

An investigation was carried out into the activity of glucoamylase at different pH values. The initial concentration of partially hydrolysed starch in the reaction mixture was 32%. The final concentration was measured after two hours.

The results are shown in Fig. 5.1.

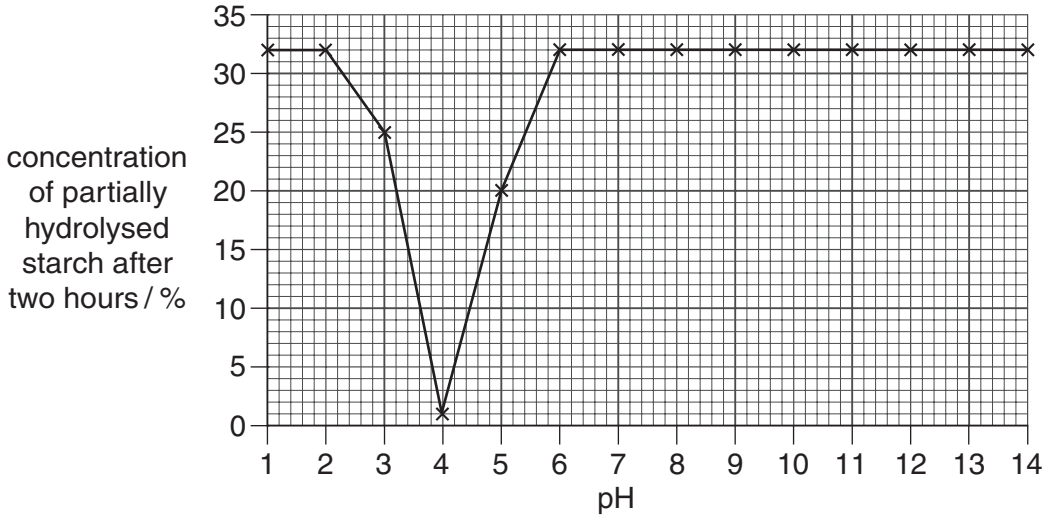



**Fig. 5.1**

Describe what is shown in Fig. 5.1 about the activity of this enzyme **as pH increases**.

.....

.....

.....

.....

.....

.....

.....

.....[4]

**(d)** In this question, one mark is available for the quality of the use and organisation of scientific terms.

Describe the molecular structure of starch **and** explain how its structure is suited to its function.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....[8]

Quality of Written Communication [1]

[Total: 16]

**6** **(a)** The table below shows terms used to describe some types of organisms found in ecosystems.

Complete the table by indicating with a tick (✓) the trophic level(s) which match each term. The first one has been done for you.

| | trophic level 1 | trophic level 2 | trophic level 3 | trophic level 4 |
|---|---|---|---|---|
| carnivore | | | ✓ | ✓ |
| herbivore | | | | |
| omnivore | | | | |
| primary consumer | | | | |
| producer | | | | |
| secondary consumer | | | | |
| tertiary consumer | | | | |

[6]

**(b)** Biology text books often state that:

- only 2–3% of the light energy reaching terrestrial ecosystems is fixed by plants;
- the energy transfer between trophic levels within an ecosystem is about 10%.

**(i)** State **two** reasons why 'only 2–3% of the light energy reaching terrestrial ecosystems is fixed by plants'.

1 .....

2 .....[2]

**(ii)** Comment on the validity of the statement that 'the energy transfer between trophic levels within an ecosystem is about 10%'.

.....

.....

.....

.....

.....

.....

.....[3]

[Total: 11]

**END OF QUESTION PAPER**

**PLEASE DO NOT WRITE ON THIS PAGE**