Rewarding Learning

Centre Number

71

Candidate Number

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
January 2010

Biology

Assessment Unit AS 1

assessing

Module 1: Molecules and Cells

[AB111]

AB111

TUESDAY 12 JANUARY, MORNING

TIME

1 hour 30 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all eight** questions.
You are provided with **Photograph 1.4** for use with Question 4 in this paper.
Do not write your answers on this photograph.

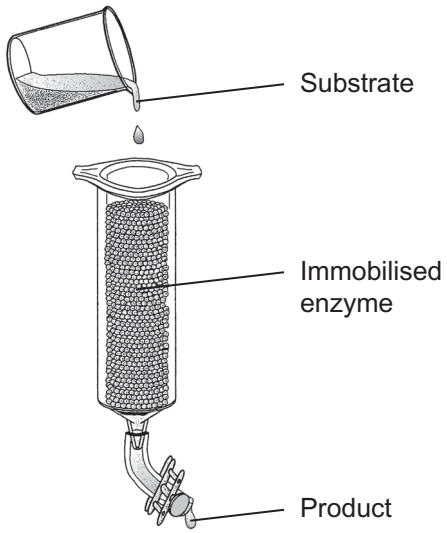
INFORMATION FOR CANDIDATES

The total mark for this paper is 75.
Section A carries 60 marks. Section B carries 15 marks.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
You are reminded of the need for good English and clear presentation in your answers.
Use accurate scientific terminology in all answers.
You should spend approximately **20 minutes** on Section B.
You are expected to answer Section B in continuous prose.
Quality of written communication will be assessed in **Section B**, and awarded a maximum of 2 marks.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
Total Marks	

Section A

1 The diagram below shows a continuous flow reactor containing an immobilised enzyme. Substrate is poured into the reactor and product emerges at the other end.



(a) State what must be added with the substrate to control the pH during the process.

_____ [1]

(b) The product is checked for contamination by protein. Describe a biochemical test for the presence of protein. Your method must include a description of a positive result.

_____

_____

_____

_____

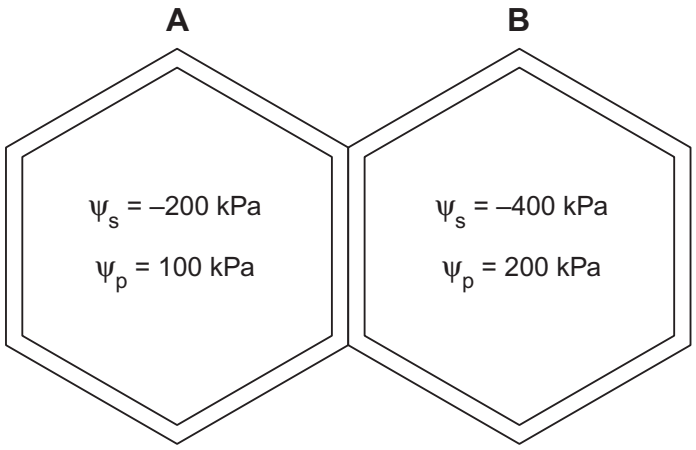
_____

_____ [3]

(c) The product is a reducing sugar. State what reagent you would use to confirm a sugar has been produced.

_____ [1]

2 The diagram below shows two adjacent plant cells, **A** and **B**. The solute potential (ψ_s) and pressure potential (ψ_p) of both cells are given.



(a) Write an equation which summarises the relationship between solute potential (ψ_s), pressure potential (ψ_p) and water potential (ψ_{cell}) of a plant cell.

_____ [1]

(b) Water movement will take place between the two cells. In which direction will this movement take place? Explain your answer.

_____

_____

_____

_____

_____

_____ [3]

(c) The pressure potential of cell **B** is higher than the pressure potential of cell **A**. Suggest **one** reason for the difference in the pressure potentials of the two cells.

_____

_____ [1]

3 The technique of DNA fingerprinting is based on the uniqueness of each person's genetic make-up. Enzymes are used to cut the DNA at specific points to create different sized fragments, e.g. *Eco*R1 recognises the base sequence GAATTC. These DNA fragments are separated by gel electrophoresis to create a series of bands. Because each person's DNA is different, each person's DNA will produce a different series of bands.

(a) (i) Name the type of enzyme used to cut DNA into fragments.

_____ [1]

(ii) Explain how different sized fragments are produced after this type of enzyme cuts the DNA.

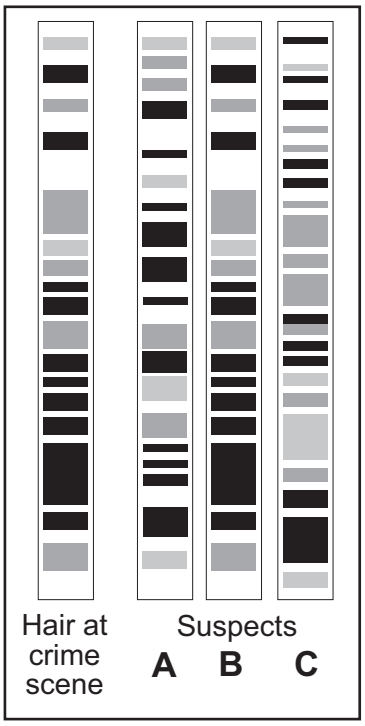
_____

_____

_____

_____ [2]

The results of a DNA fingerprint can be used as evidence to link a suspect with a crime. The DNA fingerprints below show the bands obtained from DNA on a hair found at the crime scene along with those obtained from the DNA of three different suspects.



(b) Which suspect is most likely to have committed the crime? Explain your choice.

_____

_____

_____

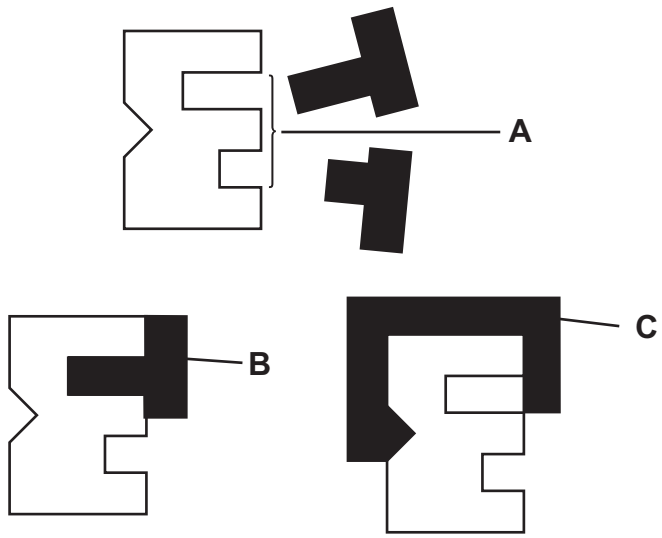
_____ [2]

4 **Photograph 1.4** is a section through the wall of a mammalian ileum.

In the space below, draw a block diagram to show the tissue layers in the ileum wall as shown in the photograph. Label the drawing to identify at least **five** structures.

[10]

5 The diagrams below represent the structure of an enzyme with its associated substrates and the same enzyme after the addition of both a competitive and a non-competitive inhibitor.



(a) Identify the part of the enzyme labelled **A**.

_____ [1]

(b) **(i)** Which of the two inhibitors, **B** or **C**, is a competitive inhibitor?

_____ [1]

(ii) Explain your reasoning for your answer in part **(i)**.

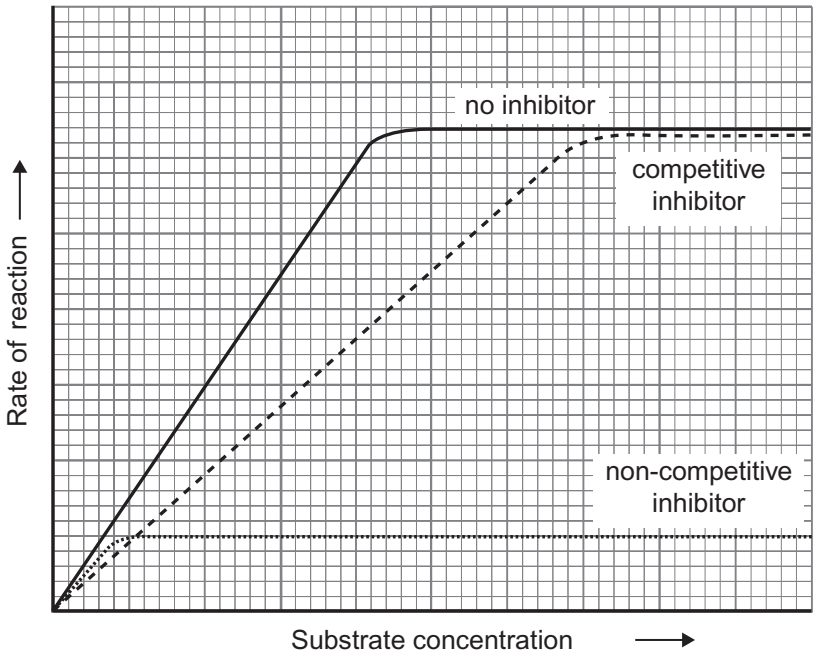
_____

_____

_____

_____ [2]

The graph below illustrates the effect of substrate concentration on the rate of an enzyme-controlled reaction with no inhibitor present. The effects of the addition of a competitive inhibitor and of a non-competitive inhibitor are also shown.



(c) Describe and explain the effect of substrate concentration on the rate of reaction for the enzyme with no inhibitor added.

_____

_____

_____

_____

_____

_____ [3]

(d) (i) Describe the effects of each of the two inhibitors.

- Competitive inhibitor

_____

_____

- Non-competitive inhibitor

_____

_____ [2]

(ii) Explain how an increase in substrate concentration influences the effect of the competitive inhibitor.

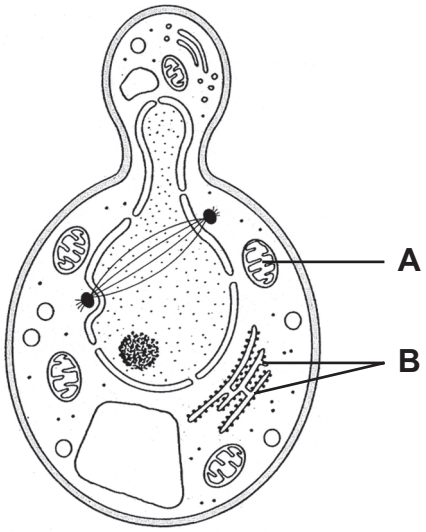
_____

_____

_____

_____ [2]

6 The diagram below shows a yeast (fungal) cell in the process of producing a daughter cell by budding.



(a) (i) Identify structures **A** and **B** in this cell.

A _____

B _____ [2]

(ii) State **two** features, other than **A** and **B**, which show that this cell is eukaryotic.

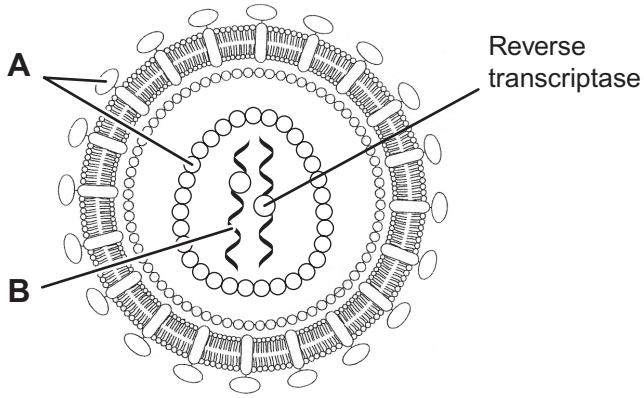
1. _____

_____

2. _____

_____ [2]

The diagram below shows features of the human immuno-deficiency virus, HIV.



(b) (i) Identify the chemical nature of the structures **A** and **B**.

A _____

B _____ [2]

(ii) State the role of the enzyme reverse transcriptase in HIV.

_____

_____

_____

_____ [2]

(c) Budding in yeast is a means by which a yeast cell reproduces.

(i) Suggest what type of nuclear division produces the genetically identical daughter cell.

_____ [1]

(ii) Suggest why it is not possible for a virus to produce a bud.

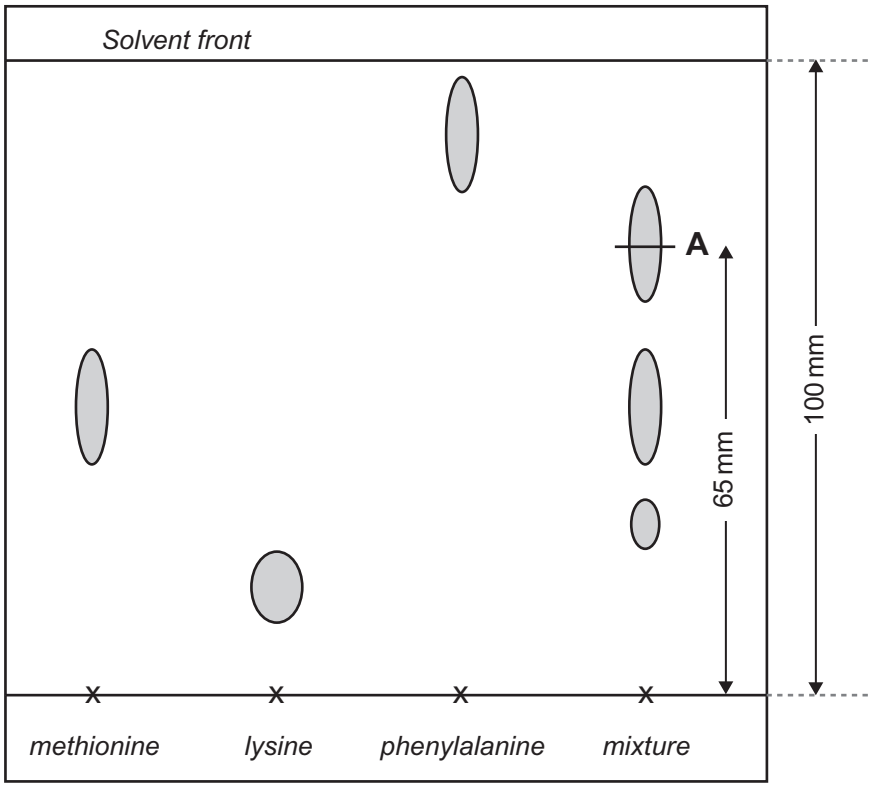
_____

_____

_____

_____ [2]

7 Paper chromatography can be used to separate a mixture of amino acids. When trypsin, a protease enzyme, was incubated with a protein, a mixture of amino acids was produced. The diagram below shows the separation of the amino acids in a chromatogram. Three known amino acids were spotted on the paper as part of the procedure.



(a) Using the information in the chromatogram answer the following:

(i) State how many different types of amino acid were present in the protein.

_____ [1]

(ii) State the identity of any of the amino acids in the mixture.

_____ [1]

(iii) Calculate the R_f value for the amino acid **A**, using the measurements shown on the chromatogram.
(Show your working.)

Answer _____ [1]

(b) Describe the procedure used to develop the chromatogram, during which the spots are stained.

_____

_____

_____

_____

_____

_____ [3]

The first biological detergent contained a protease enzyme, which removed protein-based stains, such as egg and blood.

(c) **(i)** State the type of reaction catalysed by the protease enzyme.

_____ [1]

In later years amylase and lipase were added to biological detergents to remove a wider variety of stains.

(ii) Triglycerides are removed by lipase. State the products of this reaction.

_____ [1]

(iii) Explain why it is difficult to produce a detergent containing a mixture of enzymes which includes protease.

_____

_____

_____

_____ [2]

Cellulase has been added to biological detergents as a means of restoring the fabric in clothes which contains cotton. Cellulase digests any loose and damaged cellulose microfibrils from cotton fibres restoring the original smooth surface.

(d) Using your knowledge of starch and cellulose structure, explain why a starch stain can be completely removed by amylase whereas only the loose cellulose microfibrils are removed from the surface of the cotton fibres.

_____

_____

_____

_____

_____

_____ [3]

Section B

Quality of written communication is awarded a maximum of 2 marks in this section. [2]

8 **(a)** Describe the behaviour of the chromosomal material during a cell cycle involving mitosis. [8]

(b) Describe how the behaviour of chromosomes differs during the processes of mitosis and meiosis. Explain the consequences of these differences. [5]

(a) Describe the behaviour of the chromosomal material during a cell cycle involving mitosis.

(b) Describe how the behaviour of chromosomes differs during the processes of mitosis and meiosis. Explain the consequences of these differences.

THIS IS THE END OF THE QUESTION PAPER

GCE Biology Advanced Subsidiary (AS)
Assessment Unit AS 1
Module 1: Cell Biology
January 2010

Photograph 1.4

(For use with Question 4)