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Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2010

Biology

Assessment Unit AS 1
assessing
Module 1: Molecules and Cells

AB111

[AB111]

THURSDAY 3 JUNE, AFTERNOON

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	

5456

Section A

1 The cell surface membrane is mainly composed of phospholipids and proteins.

(a) The symbol below represents a phospholipid molecule.
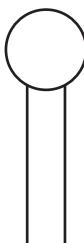
In the space below, and using the symbol above, draw a diagram to show how phospholipids are arranged in a cell surface (plasma) membrane.

[2]

**(b)** Describe **two** roles for proteins in the cell surface membrane.

1. _____

_____

2. _____

_____ [2]

(c) Name **one** other component of the cell surface membrane.

_____ [1]

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2

2 The diagrams below represent some important stages (labelled **A** to **D**) during mitotic cell cycle in an animal cell.
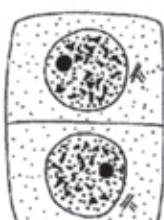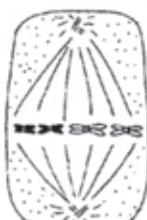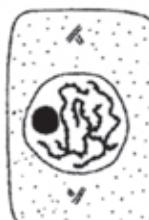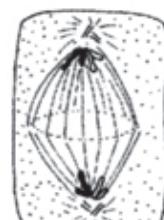
A   **B**   **C**   **D**

(a) Identify stage **B**.

_____ [1]

(b) The diagrams are not in the correct sequence. Rearrange the letters to illustrate the correct sequence of the stages.

_____ [1]

(c) Give **one** piece of evidence which suggests that the diagrams represent animal cells and not plant cells.

_____ [1]

(d) Give **two** pieces of evidence from the diagrams which suggest that the stages take place during mitosis and not meiosis.

1. _____

_____

2. _____

_____ [2]

[Turn over

3 The diagram below shows the tissues present in a mesophytic leaf.
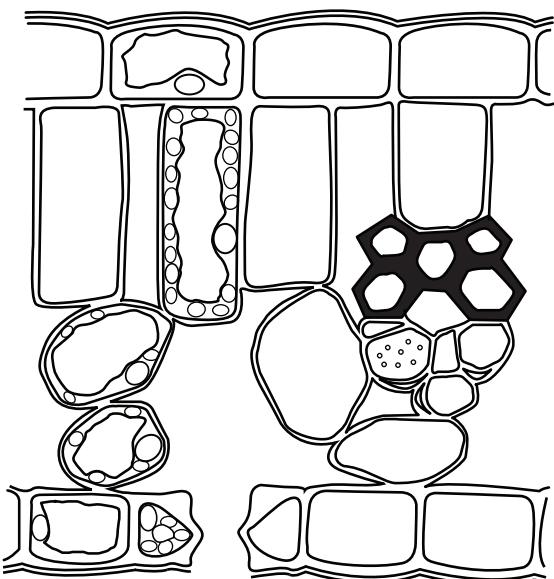
The leaf is an organ with adaptations for maximising photosynthesis while minimising transpiration. Describe these adaptations for

• maximising photosynthesis

_____

_____

_____

_____

_____

_____ [3]

• minimising transpiration

_____

_____

_____

_____ [2]

4 **Photograph 1.4** is an electron micrograph of part of a mammalian liver cell.

(a) Identify the structures labelled **A** to **C**.

A _____

B _____

C _____ [3]

(b) Using the scale bar on the photograph, calculate the magnification of the electron micrograph. (Show your working.)

Answer _____ [3]

The storage polysaccharide glycogen is labelled on the electron micrograph.

(c) Apart from liver cells, in which other mammalian tissue would glycogen stores be located?

_____ [1]

(d) Describe **two** ways in which glycogen is adapted to its function as a storage polysaccharide.

1. _____

_____

2. _____

_____ [2]

(e) Name the equivalent storage polysaccharide in plant cells.

_____ [1]

5 The diagram below summarises the polymerase chain reaction (PCR).

Copies of
sample DNA
removed

Step 1
Heat to 94 °C

Step 4

Sample DNA –
double-stranded

DNA polymerase
starts copying

AGTGC   TTGAC

TCACG   AACTG

GAC   Primers

Step 2
Cool to 46–65 °C

G

TCAC ✖

AGTGC   TTGAC

TCACG   AACTG

✖ TGAC
T

Step 3

TCA
AGTGC   TTGAC

TCACG   AACTG
GAC

✖ DNA polymerase
plus   C T C
          A   Nucleotides
          T G A
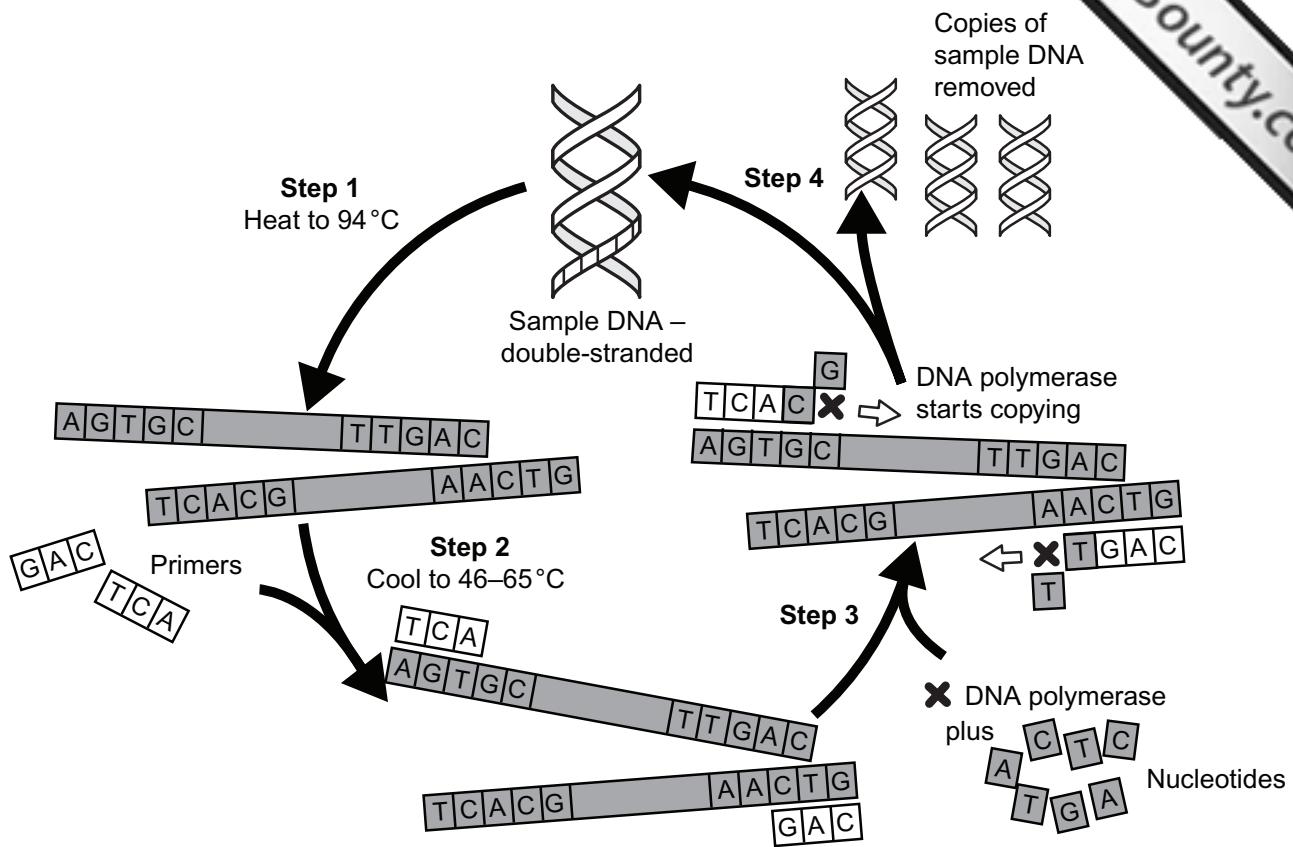
(a) (i) Explain the role of heating the sample DNA to 94 ºC in **step 1**.

_____

_____

_____

_____ [2]

(ii) State **one** function of the primers added in **step 2**.

_____

_____ [1]

(iii) Explain why the DNA sample is cooled during the addition of the
primers in **step 2**.

_____

_____ [1]

(b) Describe the structure of the nucleotides added in **step 3**.

_____

_____

_____

_____ [2]

(c) Restriction endonuclease enzyme cuts DNA into fragments. The restriction endonuclease enzyme *Eco*R1 recognises the sequence of bases GAATTC (from the 5′ end to the 3′ end) in a DNA molecule and cuts the DNA between G and A bases.

(i) Show the position of the cuts in the seqence of bases in the diagram below.

5′ ———————————————————— 3′
G G C C T T G C T G G A A T T C A A
: : : : : : : : : : : : : : : : : :
C C G G A A C G A C C T T A A G T T
3′ ———————————————————— 5′

[1]
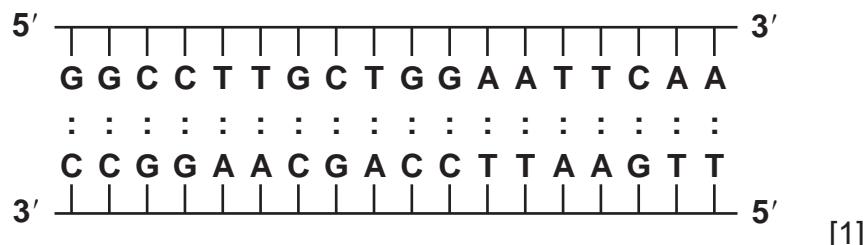
(ii) State the type of end that is produced.

_____ [1]

(d) Outline how a DNA probe is used to locate a specific DNA fragment.

_____

_____

_____

_____

_____

_____ [3]

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6 In an investigation into the effect of temperature on the movement of pigment through cell membranes, small cylinders were cut from fresh beetroot. In beetroot cells the red anthocyanin pigment occurs within the vacuoles. Each vacuole is surrounded by a tonoplast membrane and, outside this membrane, the cytoplasm is surrounded by the cell surface (plasma) membrane.

After cutting and rinsing six beetroot cylinders, each small cylinder was placed in a test tube containing water. Each of the six test tubes had been maintained at a particular temperature. Each cylinder was left for one minute during which some pigment leaked out.

After cooling, samples from each test tube were placed in cuvettes and the percentage transmission of light through each sample was measured using a colorimeter.

(a) (i) Explain why a blue filter was selected for use in the colorimeter.

_____

_____

_____

_____ [2]

(ii) State **one** precaution required, when using a colorimeter, to ensure that an accurate meter reading is obtained.

_____

_____ [1]

(iii) Explain precisely how the colorimeter is used to measure the amount of red pigment in each sample.

_____

_____

_____

_____ [2]

The results of the investigation are shown in the table below.

Temperature/ºC	Percentage transmission/%
40	90
50	90
55	80
58	25
60	20
70	15

(b) Plot the above results, using an appropriate graphical technique. (Use the graph paper opposite.) [5]

(c) (i) Identify the trends evident in the results.

_____

_____

_____

_____ [2]

(ii) Suggest explanations for the trends identified in **(i)** above.

_____

_____

_____

_____ [2]

11
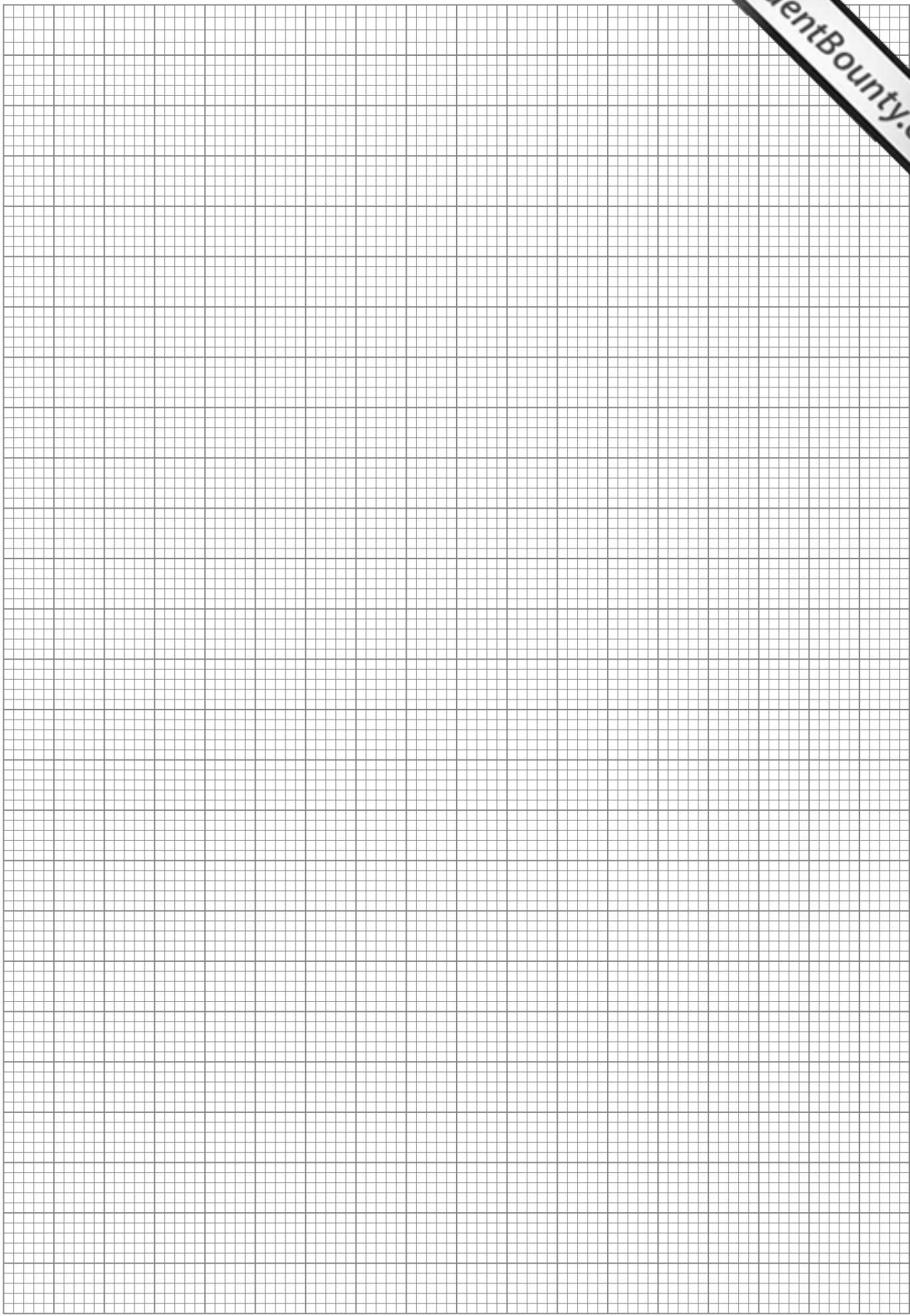
7 In an experiment to determine the solute potential (ψ_s) of leaf tissues by means of the incipient plasmolysis method, tissues from two plants were immersed in a series of sucrose solutions of different concentrations. Samples of the tissue were observed under a microscope, the total number of cells counted and the number of plasmolysed cells recorded for each sample.

The two leaf tissues were onion bulb leaves and leaves from the pondweed, *Elodea*. The onion leaf cells are modified for storage of sugars. The *Elodea* is a common freshwater aquatic plant, found in many ponds and lakes.

It was predicted that the onion cells would have a lower solute potential than the *Elodea* cells.

(a) (i) Unstained onion cells can be difficult to see under a microscope unless the light is reduced. Describe **one** method of reducing the light passing through the onion tissue.

_____

_____ [1]

(ii) Describe how you would recognise a plasmolysed onion cell under a microscope.

_____

_____ [1]

(b) Plasmolysed *Elodea* cells were identified by a clumping of chloroplasts in the centre of the cell. Explain why the chloroplasts clumped in the centre of a plasmolysed cell.

_____

_____ [1]

The results of the experiment are presented in the graph below.
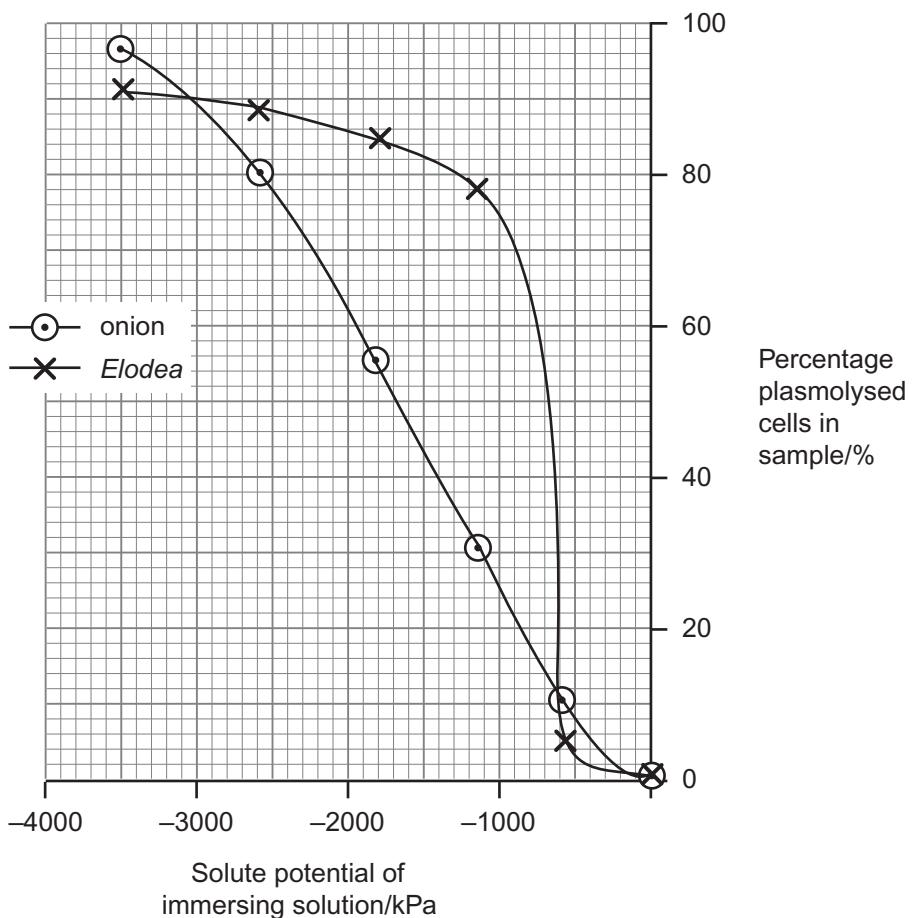
(c) (i) Use the graph to determine the solute potentials of the onion and *Elodea* cells.

Onion cells _____ kPa

Elodea cells _____ kPa   [2]

(ii) Explain the basis of the method used to determine the solute potential of the tissues.

_____

_____

_____

_____ [2]

(iii) Suggest **one** reason for the difference in the solute potentials determined in **(i)** above.

_____

_____

_____ [2]

(d) Explain why the pondweed, *Elodea*, cannot survive in seawater which has a high concentration of salts.

_____

_____ [1]

Section B

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

8   Enzymes are sensitive to a number of factors. The three graphs in this question illustrate the influence of three independent variables on the activity of an enzyme. For each of the three graphs

- identify the independent variable
- describe trends evident in the graph
- explain the trends described   [13]
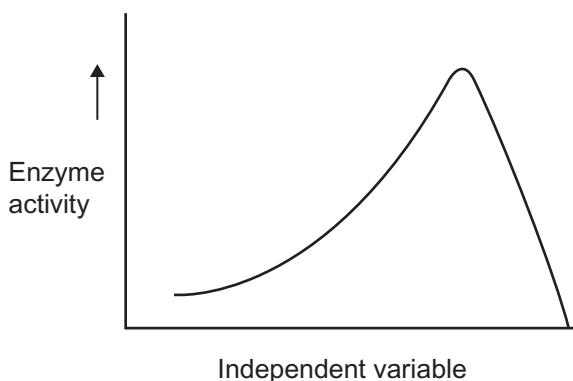
Independent variable

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

5456   **15**   **[Turn over**

- identify the independent variable
- describe trends evident in the graph
- explain the trends described

Enzyme activity

Independent variable

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

16

- identify the independent variable
- describe trends evident in the graph
- explain the trends described

_____

Enzyme activity

Independent variable

_____

_____

_____

_____

_____

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_____

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_____
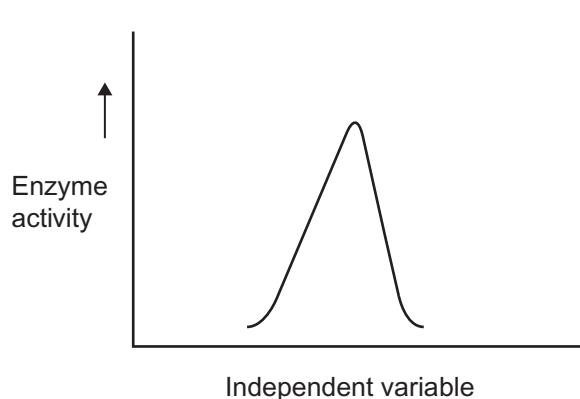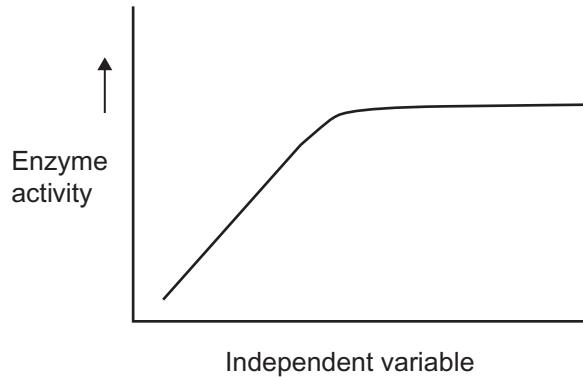
THIS IS THE END OF THE QUESTION PAPER

5456

Photograph 1.4
(for use with Question 4)

A

B

2 µm

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glycogen

C