Rewarding Learning

Centre Number

71	

Candidate Number

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
January 2011

Biology

Assessment Unit AS 1

assessing

Molecules and Cells

[AB111]

AB111

TUESDAY 11 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

Examiner Only	
Marks	Remark

1 The statements in the table below refer to some of the features found in prokaryotic and eukaryotic cells. Some features may be found only in one type of cell or in both cell types.

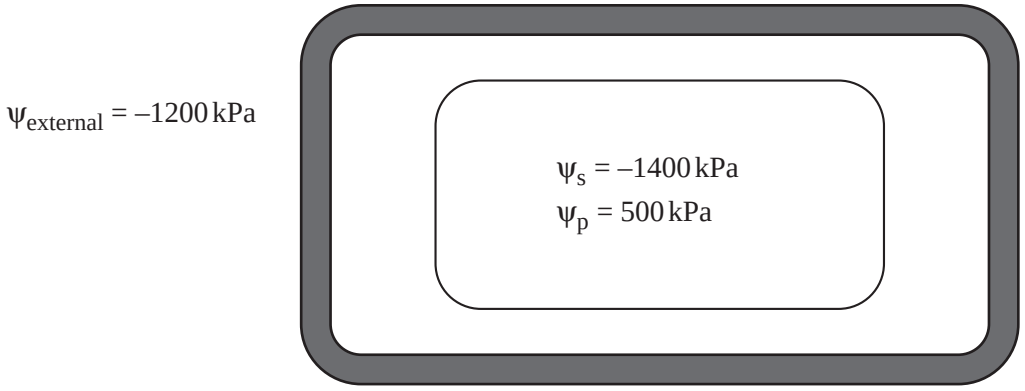
If a feature is present, place a tick (✓) in the appropriate box and, if the feature is absent, place a cross (✗) in the appropriate box. (Do not leave any boxes empty.)

Feature	Prokaryotic cell	Eukaryotic cell
Plasmid		
Ribosome		
Golgi apparatus		

[3]

Examiner Only	
Marks	Remark

2 The diagram below represents a plant cell immersed in a bathing solution with a solute potential of –1200 kPa ($\psi_{external}$). The solute potential (ψ_s) and pressure potential (ψ_p) of the cell are also shown.



(a) Calculate the water potential (ψ_{cell}) of the cell.

Answer _____ [1]

(b) Describe and explain the movement of water between the cell and its bathing solution.

_____

_____

_____

_____ [2]

(c) Draw a diagram of the cell to show its final appearance in the bathing solution.

[2]

Examiner Only	
Marks	Remark

3 **(a)** Read the following passage which describes the primary structure of a protein and write the most appropriate word(s) in the blank spaces to complete the account.

Proteins are polymers, consisting of long chains of

_____ joined together by _____

reactions to form numerous _____ bonds. The

sequence of monomers in a protein is known as its primary structure

and is encoded in the _____ of an organism. [4]

(b) Proteins are complex molecules with a level of organisation beyond the primary structure. Describe how a final overall shape is produced in a protein.

_____

_____

_____

_____

_____

_____

_____

_____

_____ [4]

(c) Describe the colour change which indicates the presence of protein in a food sample when it is tested with Biuret reagent.

_____ [1]

Examiner Only	
Marks	Remark

4 **Photograph 1.4** is an electromicrograph of parts of two adjacent spongy mesophyll cells found in the leaf of a geranium plant.

(a) **(i)** Identify the structures labelled **A** to **D**.

A _____

B _____

C _____

D _____ [4]

(ii) Explain the position of the nuclei in these mesophyll cells.

_____

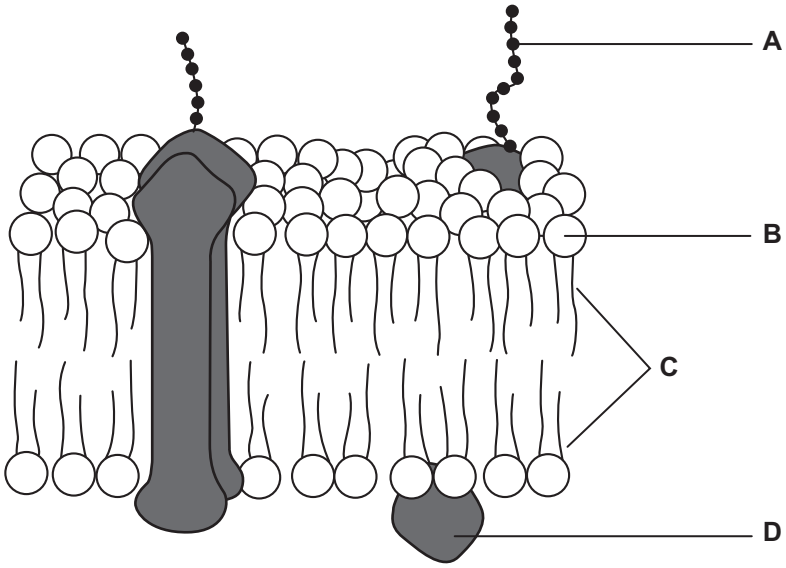
_____ [1]

(b) Use the scale bar to calculate the magnification of this electronmicrograph. (Show your working)

Answer _____ [3]

Examiner Only	
Marks	Remark

5 **(a)** The diagram below represents the fluid mosaic model of the cell surface membrane.



(i) Identify the structures labelled **A** to **D**.

A _____

B _____

C _____

D _____ [4]

(ii) Place an **X on the diagram** to indicate the outer surface of the membrane. Give a reason for your answer.

_____

_____ [1]

(b) The table below shows the effect of changing conditions on three different mechanisms of membrane transport.

	Effect of changing conditions on rate of movement		
Change in conditions	**Mechanism 1**	**Mechanism 2**	**Mechanism 3**
Increased oxygen levels	Rate increases significantly	No effect on rate	No effect on rate
Addition of cyanide (a respiratory poison)	Rate decreases significantly	No effect on rate	No effect on rate
Increased numbers of membrane carriers	Rate increases	Rate increases	No effect on rate

Using the information in the table, identify each mechanism of membrane transport and, in each case, give a reason for your identification.

(i) Mechanism **1**

Identification _____

Reason _____

_____ [2]

(ii) Mechanism **2**

Identification _____

Reason _____

_____ [2]

(iii) Mechanism **3**

Identification _____

Reason _____

_____ [2]

Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

6 **(a)** The enzyme *Bam*HI is a restriction endonuclease with the recognition site GGATCC cutting DNA into fragments between the bases GG.

The bases on one strand of a length of DNA, 120 nucleotides, is represented in the three lines below.

AATGGGTACGCACAGTGGATCCACGTAGTATGCGATGCGT

AGTTGATAGATAGATAGATAGATAGATAGATATTTTATCG

TGCTGTACGGATCCGGAAGTGGCGATGAGGATCCATGCAA

(i) How many fragments would be produced if this length of DNA was cut with the restriction endonuclease *Bam*HI?

Answer _____ [1]

(ii) The DNA strand above contains a microsatellite repeat sequence (MRS). Identify the sequence and state the number of repeats.

- Microsatellite repeat sequence _____
- Number of repeats _____ [2]

(iii) Explain why microsatellite repeat sequences are useful for forensic analysis of DNA.

_____

_____ [1]

Examiner Only	
Marks	Remark

(b) DNA samples from the members of a particular family were analysed for restriction fragment length polymorphisms (RFLPs). The dark bands in the autoradiograph below represent RFLP markers. The autoradiograph has 15 lanes many of which are used for comparison.

Image of DNA samples has been removed due to copyright issues.

15 lanes contain samples from the following sources.

- Lanes 8, 9, 10, 12, 13 and 14 are from members of the same family
- Lanes 1, 2, 7, 11 and 15 contain a series of DNA fragments of different length used for calibration
- Lane 3 is a control containing known RFLP markers (producing bands at the same locations each time)
- Lanes 4, 5 and 6 are from unrelated individuals

(i) Explain why the son and daughter have different RFLP markers.

_____

_____ [1]

(ii) Using the information in the autoradiograph, identify the grandparents as the wife's parents (maternal) or the husband's parents (paternal). Explain the evidence for your choice.

_____

_____

_____

_____ [2]

(iii) Use the autoradiograph to identify matches with any of the unrelated individuals (4, 5 and 6) and any of the family members.

_____

_____ [1]

(iv) Explain why RFLP matches may be found between unrelated individuals.

_____

_____ [1]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

7 This question is about the digestion of jelly by protein-digesting enzymes.

(a) Jelly contains the protein gelatine, which is broken down to amino acids by protein-digesting enzymes. State the type of reaction which takes place during digestion.

_____ [1]

(b) The procedure used for an investigation of the effect of pH on the activity of two protein-digesting enzymes is outlined below.

1. Five buffer solutions were prepared at pH 4, 6.4, 7.4, 8, and 9.
2. 10 strips of jelly were cut from a jelly block. Each strip was approximately 1 to 2 mm in thickness.
3. Each strip was trimmed to a rectangle of 10 by 20 mm and the surplus jelly discarded. Trimmed strips were placed in separate Petri dishes.
4. 10 cm^3 of each of the five buffer solutions was added to two of the Petri dishes, so that two Petri dishes had pH 4, two had pH 6.4, etc. The Petri dishes were divided into two sets, each set having one dish at each pH.
5. 10 cm^3 of enzyme A was added to one set of the Petri dishes and 10 cm^3 of enzyme B was added to the second set of Petri dishes.
6. All Petri dishes were left at room temperature for 90 minutes.
7. The area of the jelly remaining was measured and the results are shown in the table below.

	Area of jelly remaining/mm^2	
pH	**Enzyme A**	**Enzyme B**
4	0	200
6.4	100	190
7.4	171	98
8	190	48
9	200	0

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

(ii) Describe the trends evident in the graph.

_____

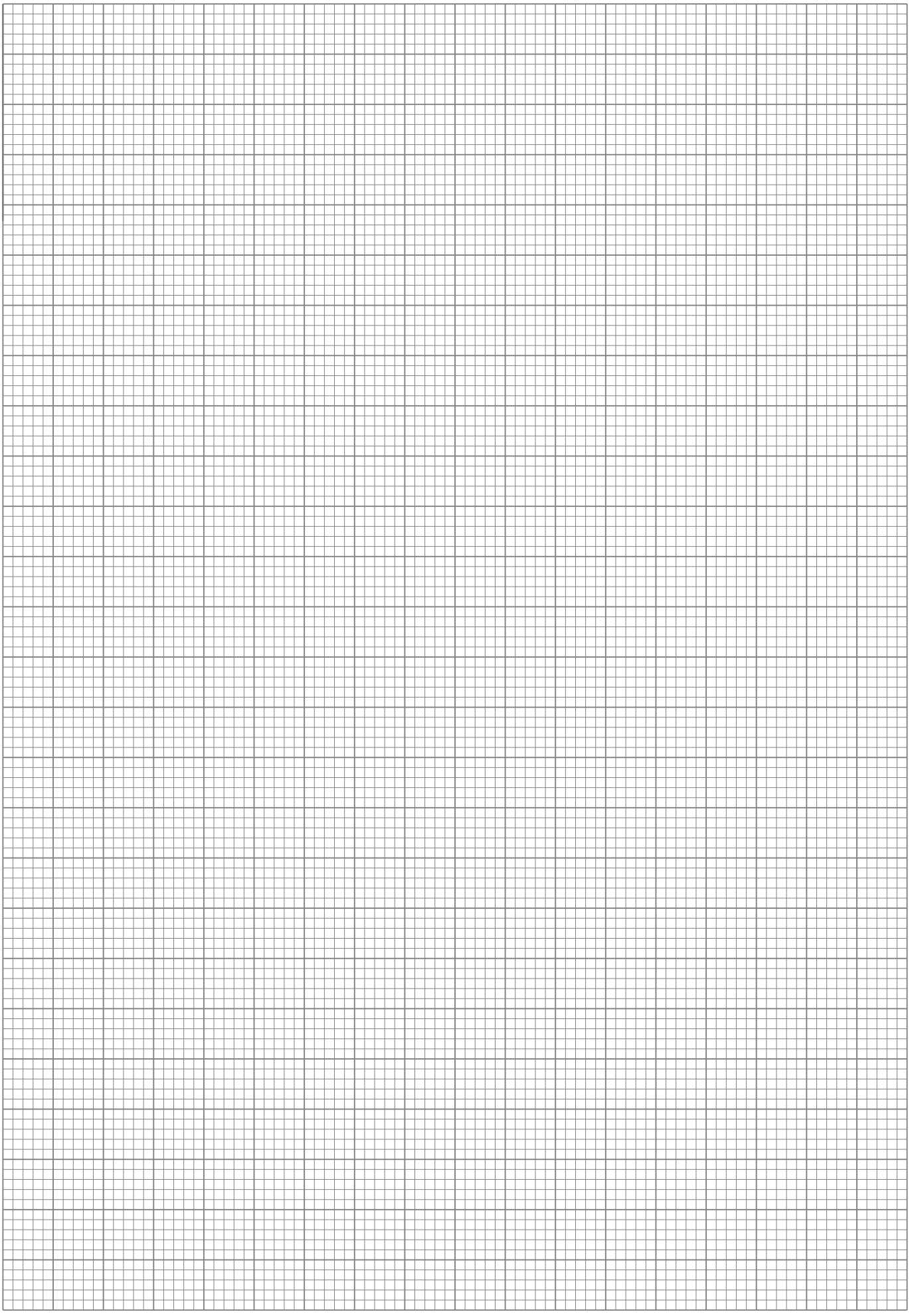
_____

_____

_____

_____

_____ [3]



(c) Explain why pH influences the activity of an enzyme.

Examiner Only

Marks	Remark

_____

_____

_____

_____ [2]

(d) There are several potential problems with the design of this experiment. Suggest **four** possible problems in the procedure used.

1. _____

_____

_____

2. _____

_____

_____

3. _____

_____

_____

4. _____

_____

_____

[4]

Section B

Examiner Only	
Marks	Remark

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

8 **(a)** Give an account of the structure of the nucleic acids, DNA and RNA. [8]

(b) Describe the process of DNA replication. [5]

(a) Give an account of the structure of the nucleic acids, DNA and RNA.

Examiner Only	
Marks	Remark

(b) Describe the process of DNA replication.

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

GCE Biology Advanced Subsidiary (AS)
Assessment Unit AS 1: Molecules and Cells
January 2011

Photograph 1.4
(For use with Question 4)