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General Certificate of Education
January 2009

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Centre Number
71

Candidate Number

Biology

Assessment Unit AS1

assessing

Module 1: Cell Biology

[AB111]



AB111

WEDNESDAY 14 JANUARY, 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 1.3** for use with Question 3 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.

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.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

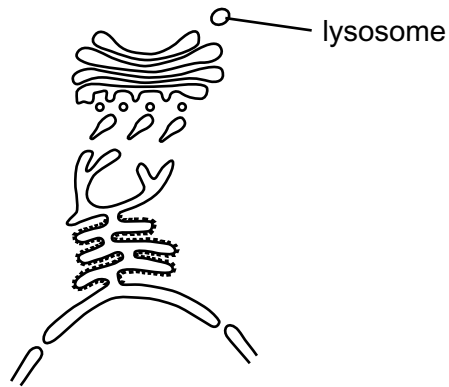
For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	

Total Marks	
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Section A

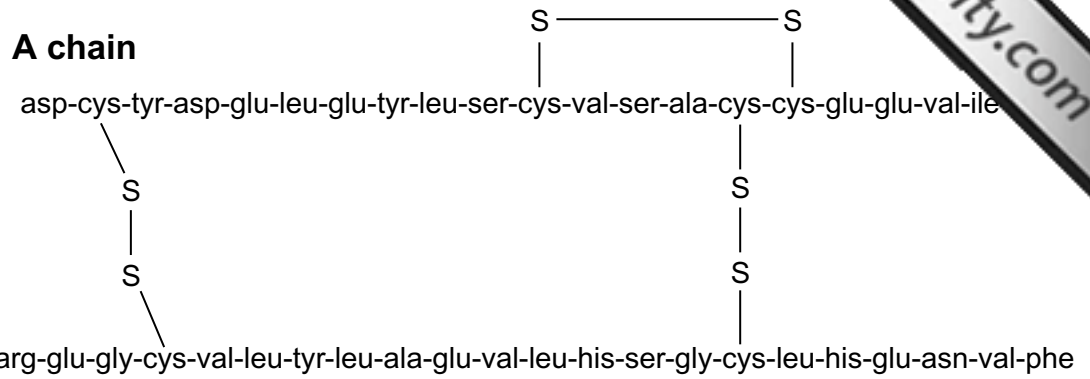
- 1 A lysosome and other cellular structures are shown in the diagram below. The lysosome may contain over 40 different hydrolytic enzymes.



Describe the sequence of events which occur from the initial synthesis of the enzymes until their encapsulation within the lysosome.

[3]

2 The diagram below shows the amino acids in each of the two polypeptide chains in human insulin.



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(a) Explain what is meant by the primary structure of a protein.

_____ [1]

(b) Explain the role of the sulphur-containing amino acid, cysteine (cys), in the formation of the tertiary and quaternary structure of the insulin molecule.

_____ [4]

(c) In which part of the cysteine molecule would you expect to find sulphur?

_____ [1]

Examiner Only	
Marks	Remark

3 (a) Photographs 1.3 A to D show light micrographs of bluebell cells at different stages of mitosis.

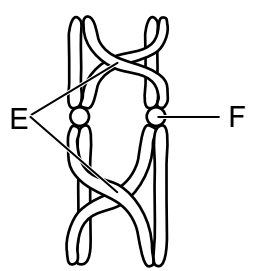
(i) Identify the stage of mitosis shown by each of the cells A to D.

- A _____
- B _____
- C _____
- D _____ [4]

(ii) Arrange the letters A to D to give the correct sequence of stages during mitosis.

_____ [1]

(b) The diagram below shows an homologous pair of chromosomes (bivalent) during prophase I of meiosis.



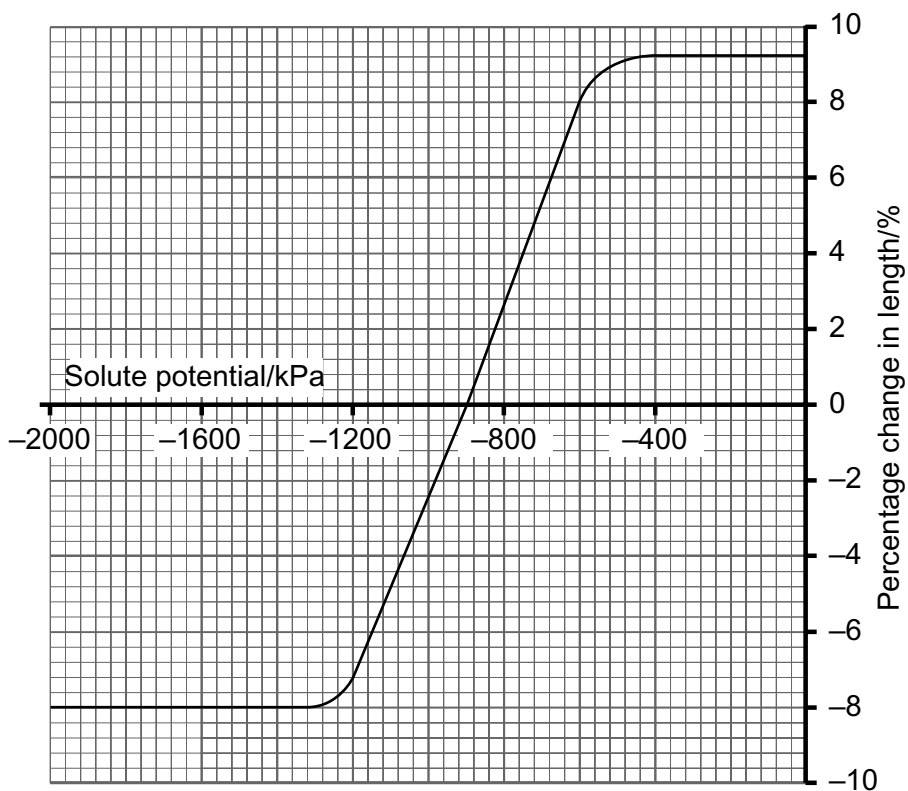
(i) Name the features labelled E and F in the diagram.

- E _____
- F _____ [2]

(ii) Explain how feature E results in genetic variation.

 _____ [2]

4 Cylinders of potato tissue were immersed in sucrose solutions, differing in solute potential, for 24 hours and the percentage change in length determined. The results are shown in the graph below.



(a) With reference to water potential, explain the change in length that occurred when the cylinder of potato tissue was immersed in a sucrose solution of solute potential -600 kPa.

[2]

(b) Using the information in the graph, determine the water potential of the potato tissue.

Explain your reasoning.

[2]

Examiner Only	
Marks	Remark

- (c) The initial length of the potato cylinder immersed in a solution of water potential -1600 kPa was 50 mm. Calculate its final length. (Show your working in the space below.)

Answer _____ [2]

- (d) Draw a potato cell as it might appear when immersed (for 24 hours) in a sucrose solution of solute potential -1200 kPa.

[1]

5 (a) Describe the structure and function of mitochondria.

[2]

(b) In a culture of actively dividing animal cells, the cell volume and number of mitochondria were measured. The results are shown in the table below.

Cell volume/ μm^3	Number of mitochondria
760	118
650	90
560	65
870	141
920	153
1030	146
1140	152

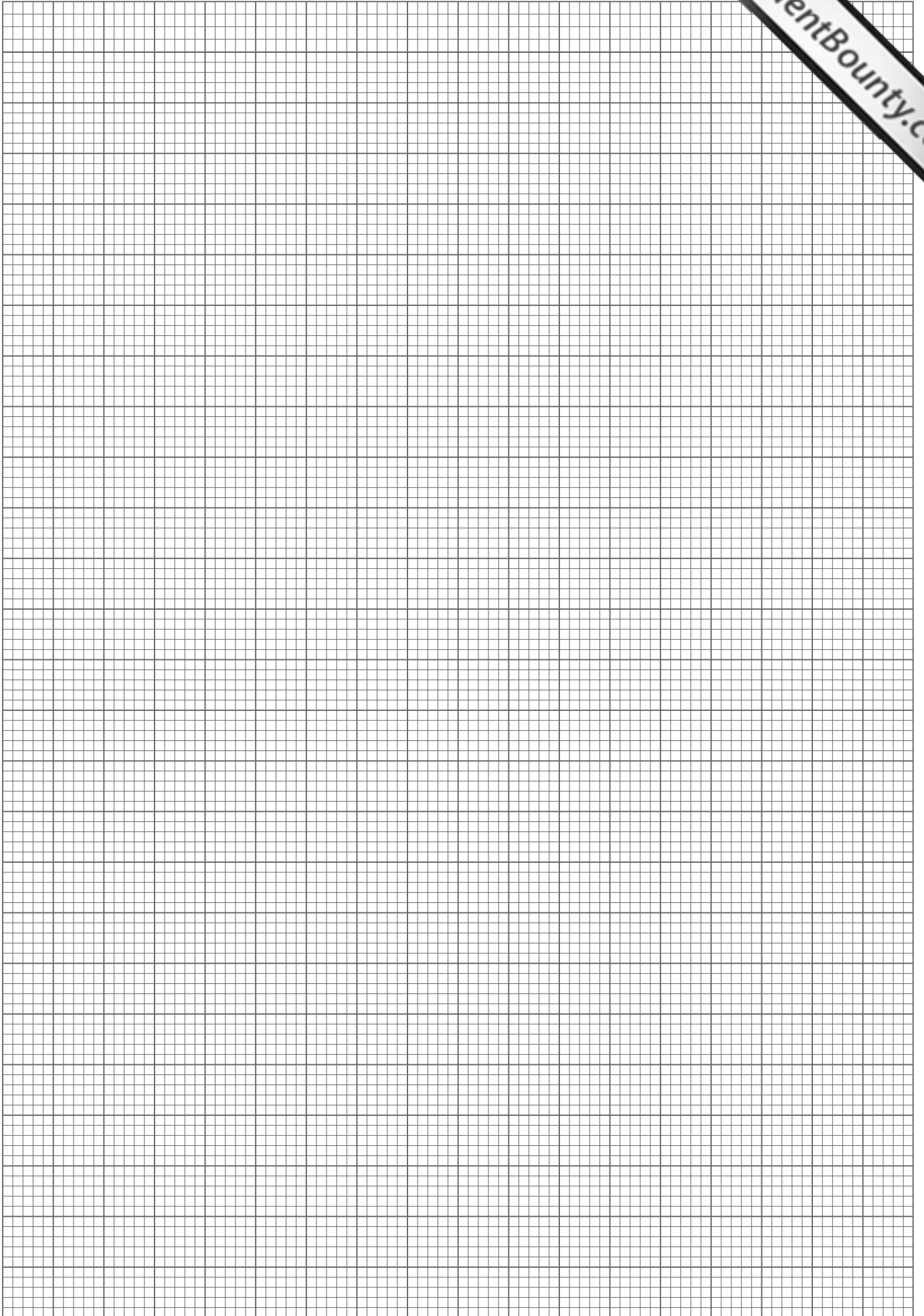
(i) Plot the above results, using an appropriate graphical technique. (Use the graph paper opposite.) [6]

(ii) Identify the major trends evident in the results.

[2]

(iii) Using your understanding of the events in the cell cycle, suggest explanations for the changes shown in the graph.

[2]



(c) Bacteria are prokaryotic cells and, as such, lack mitochondria and other membrane-bound organelles. State **two** other differences between prokaryotic cells and eukaryotic cells.

1. _____

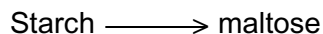
2. _____

_____ [2]

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(Questions continue overleaf)

6 The enzyme amylase catalyses the following reaction.



(a) Starch and maltose are both carbohydrates.

(i) Describe how they are similar in their molecular structure.

[1]

(ii) Describe how they are different in their molecular structure.

[2]

In an investigation of the above reaction, 0.1% amylase was added to a 1% solution of starch. The amount of starch remaining in solution was determined over time.

(b) (i) Describe a method that you would use to determine 'the amount of starch in solution over time'.

[3]

(ii) Suggest **one** possible limitation in your method.

_____ [1]

The results are shown in the table below.

Time/minutes	Amount of starch remaining in solution/%
0	1.0
0.5	0.5
1.0	0.25
2.0	0.07
3.0	0.02
4.0	0.01

(c) (i) Describe the pattern of change in the amount of starch remaining in solution over time.

_____ [2]

(ii) Explain the changes in the amount of starch remaining in solution over time.

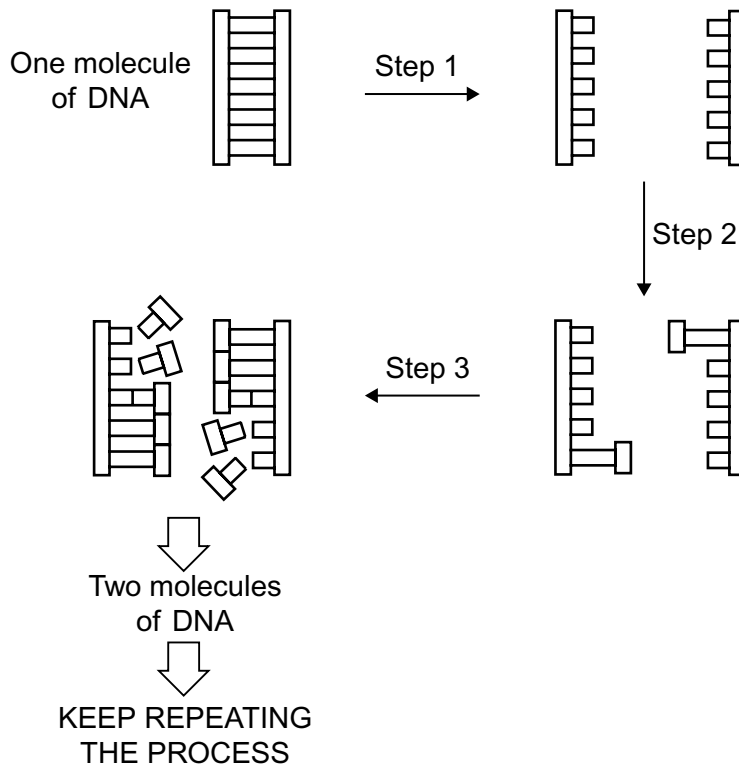
_____ [2]

7 (a) Nucleic acids are composed of nucleotides. Complete the table below to give **two** ways in which the structure of a DNA nucleotide differs from that of an RNA nucleotide.

	DNA nucleotide	RNA nucleotide
1.		
2.		

[2]

(b) The polymerase chain reaction (PCR) enables many copies of DNA to be made from a small sample. The diagram below summarises the procedure.



(i) Explain what is happening at each of the steps indicated.

• Step 1 _____

• Step 2 _____

• Step 3 _____

_____ [3]

(ii) At the end of the first cycle, there are two molecules of DNA. How many molecules will there be at the end of five cycles?

_____ [1]

(c) Explain, precisely, how restriction endonucleases cut DNA molecules into fragments.

_____ [2]

(d) A DNA fragment, consisting of 24 base pairs, was analysed for the number of different bases on each strand. The table below shows some of the results. Determine the missing values and complete the table.

	Number of bases			
	A	G	T	C
Strand 1	7	8		
Strand 2	4			

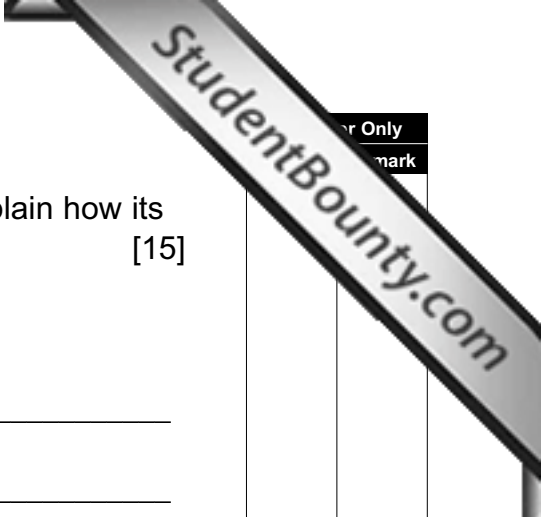
[2]

Section B

er Only
mark

8 Describe the structure of the cell surface membrane, and explain how its structure determines how molecules pass through. [15]

Structure of cell surface membrane



Passage of molecules through the membrane

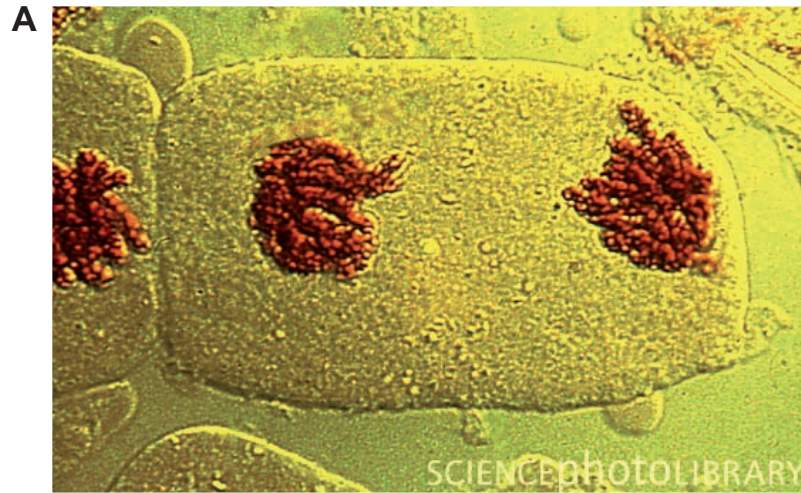
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Vertical margin box on the right side of the page.

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GCE Biology Advanced Subsidiary (AS)
Assessment Unit AS 1
Module 1: Cell Biology
January 2009

Photographs 1.3 A to D
(for use with Question 3)



Source: Pr. G. Gimenez-Martin/Science Photo Library

