Rewarding Learning

Centre Number	
71	

Candidate Number

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2009

Biology

Assessment Unit AS 1

assessing

Module 1: Cell Biology

[ASB11]

ASB11

MONDAY 1 JUNE, AFTERNOON

TIME

1 hour.

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.
Write your answer to Section B on the lined paper at the end of this booklet.
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 55.
Section A carries 43 marks.
Section B carries 12 marks.
You should spend approximately **15 minutes** on Section B.
You are expected to answer Section B in continuous prose.
Quality of written communication will be assessed in **Section B**.
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	

Section A

1 The statements in the table below refer to different processes by which molecules may be moved across the cell-surface membrane.

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

	Active transport	**Diffusion**	**Facilitated diffusion**
Involves carrier molecules			
Involves energy expenditure			
Occurs against a concentration gradient			

[3]

2 Glucose molecules can be linked together to form polysaccharides.

- α-glucose molecules form the helical and branched polysaccharide, amylopectin.
- β-glucose molecules form straight, unbranched cellulose chains found within bundles of straight chains held together by many hydrogen bonds along their lengths.

(a) State what type of reaction occurs when one glucose molecule bonds with another glucose molecule.

_____ [1]

(b) State which carbon atoms in adjacent glucose molecules are linked to produce a branch in amylopectin.

_____ [1]

(c) Describe an advantage of amylopectin having many branches.

_____

_____ [1]

(d) Name another branched polysaccharide.

_____ [1]

(e) Explain why cellulose is difficult to break down.

_____

_____ [1]

3 **Photograph 1.3** is an electron micrograph showing part of two neighbouring plant cells.

(a) Identify the features labelled **A** to **D**.

A _____

B _____

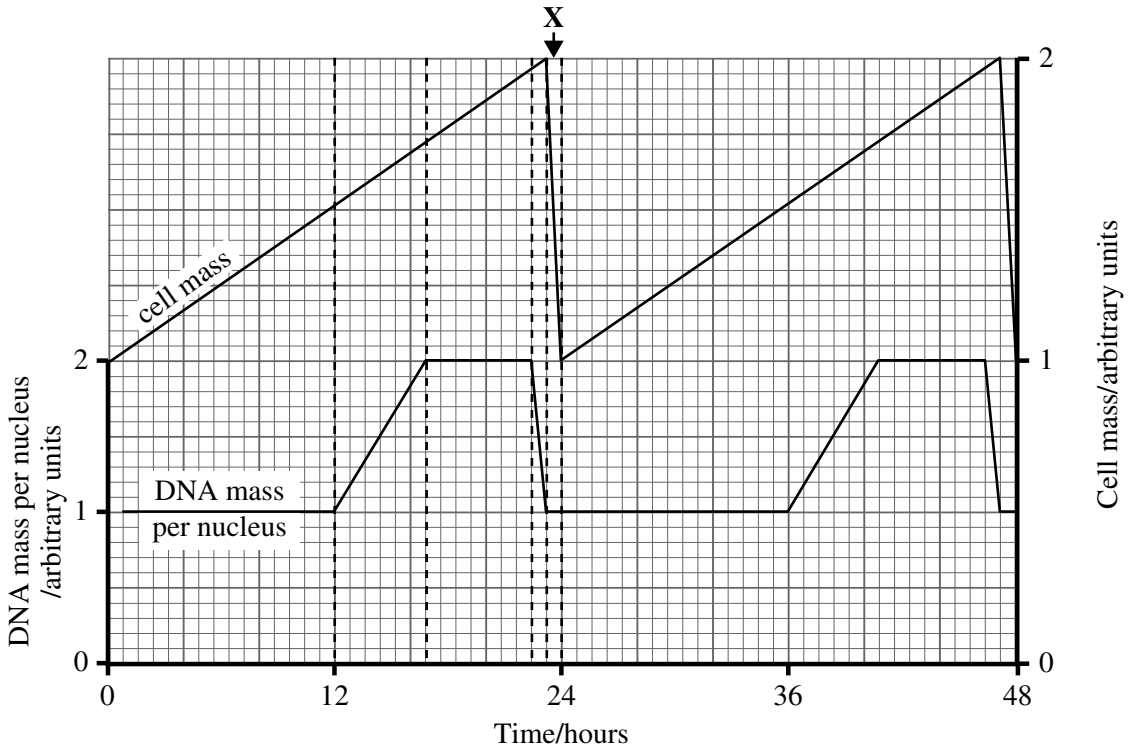
C _____

D _____ [4]

(b) The magnification of the photograph is ×32 000. Calculate the actual diameter (in μm) of the organelle along the line **XY** in the photograph. (Show your working in the space below.)

Answer _____ [2]

4 The graph below shows changes in both cell mass and DNA mass per nucleus during several mitotic cell cycles in a mammalian embryo.



(a) Between which times shown on the graph does the G1 (growth 1) phase occur during the first cell cycle?

_____ [1]

(b) State what is occurring during the phase indicated by **X** on the graph.

_____ [1]

(c) Explain the changes in the DNA mass per nucleus during one cell cycle.

_____

_____

_____

_____

_____

_____ [3]

5 **(a)** Explain why the genetic code is a three base or triplet code.

_____

_____

_____

_____ [2]

(b) The table below presents the genetic code. The position of each base in a mRNA codon may be read from the table to give the amino acid for which it codes.

		Second base					
		G	A	C	U		
First base	G	glycine glycine glycine glycine	glutamic acid glutamic acid aspartic acid aspartic acid	alanine alanine alanine alanine	valine valine valine valine	G A C U	Third base
	A	arginine arginine serine serine	lysine lysine asparagine asparagine	threonine threonine threonine threonine	Start isoleucine isoleucine isoleucine	G A C U	
	C	arginine arginine arginine arginine	glutamine glutamine histidine histidine	proline proline proline proline	leucine leucine leucine leucine	G A C U	
	U	**tryptophan** Stop cysteine cysteine	Stop Stop tyrosine tyrosine	serine serine serine serine	leucine leucine phenylalanine phenylalanine	G A C U	

(i) State the mRNA codon translated as tryptophan (shown in bold).

_____ [1]

(ii) Mutations may cause a base change in the code. Using the table opposite, state the effect of changing the three base sequence GAA to GUA.

_____

_____

_____

_____ [2]

(iii) Explain how the structure of the final protein may change as a result of this mutation.

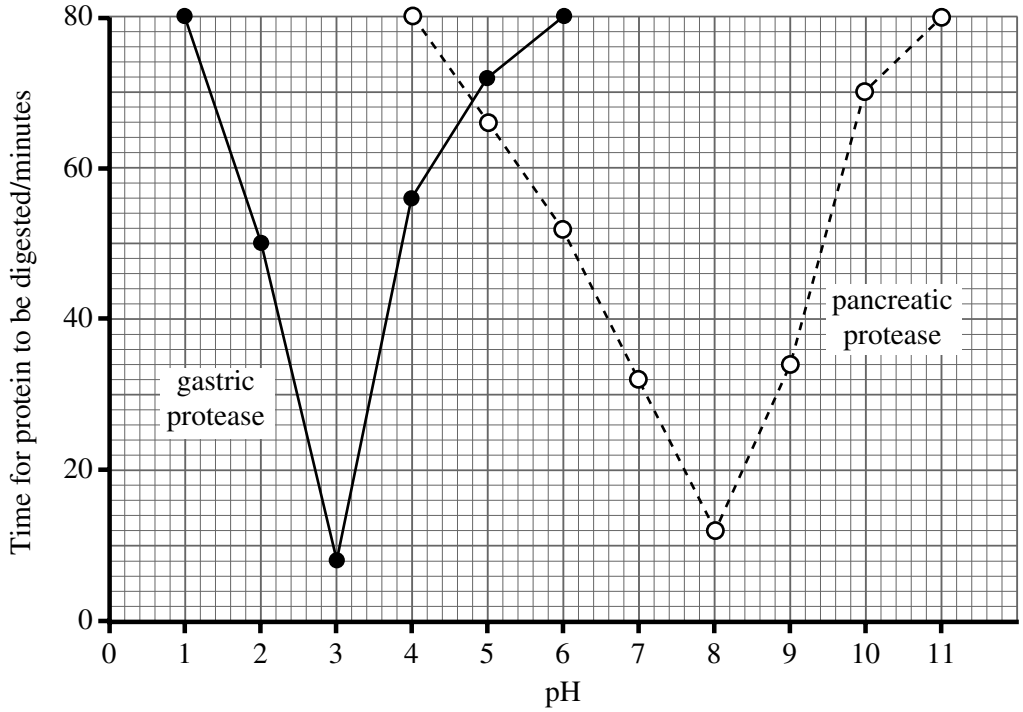
_____

_____

_____

_____ [2]

6 An experiment was undertaken to investigate the effect of pH on two proteolytic enzymes, gastric protease and pancreatic protease. Cubes of protein, each of 200 mg mass, were placed in solutions of each enzyme, at different pHs, and the time taken for the protein to be digested was measured. The results are shown in the graph below.



(a) State **one** factor that should be controlled in the experiment, and explain the influence of that factor on enzyme activity.

Factor _____

Influence _____

_____ [2]

(b) Using the information above, calculate the rate of reaction for gastric protease at pH 2 in units of mg hour^{-1}. (Show your working in the space below.)

Answer _____ [2]

(c) Describe the trends shown in the graph.

_____

_____

_____

_____

_____

_____ [3]

(d) Explain the trends described in **(c)**.

_____

_____

_____

_____ [2]

7 The human protein, insulin, is involved in the homeostatic control of blood sugar. Most artificially produced human insulin is currently produced by genetically-modified bacteria, but several companies are now investigating the possibility of producing human insulin using the safflower plant, a plant which is normally grown for its oil. This method would allow large scale production and, in theory, one large North American farm would be capable of meeting the global demand for insulin.

The first stage in this process would be the isolation and removal of the human insulin gene.

(a) State which enzyme would be used to remove the human insulin gene from a human chromosome.

_____ [1]

Once isolated, the gene is then placed into a vector. One example of such a vector is the bacterium, *Agrobacterium tumefaciens*, a relatively common soil bacterium that regularly infects plants.

(b) Describe how the human insulin gene could be inserted into the bacterium, *Agrobacterium tumefaciens.*

_____

_____

_____

_____

_____

_____

_____

_____ [4]

The genetically-modified bacterium is then allowed to infect a sample of cells extracted from the safflower plant and these infected cells can be grown on into mature plants, each being capable of producing human insulin. The human insulin produced by these plants appears to be fully effective in the treatment of diabetes. However, a patient's blood insulin cannot be raised by simply eating transgenic safflower plants.

(c) Suggest why eating safflower plants containing insulin would not result in an increase in the patient's blood insulin levels.

_____

_____

_____

_____ [2]

One possible risk of growing a genetically-modified crop in this way is that it might interbreed with wild plants. Pharmaceutical companies try to minimise such risks by growing the crop 'counter-seasonally' to reduce the chances of the insulin gene being transferred to other plants.

(d) Suggest what is meant by the term 'counter-seasonally'.

_____

_____ [1]

Section B

In this section you are expected to answer in continuous prose, supported, where appropriate, by diagrams. You are reminded that up to two marks in this question are awarded for the quality of written communication. [2]

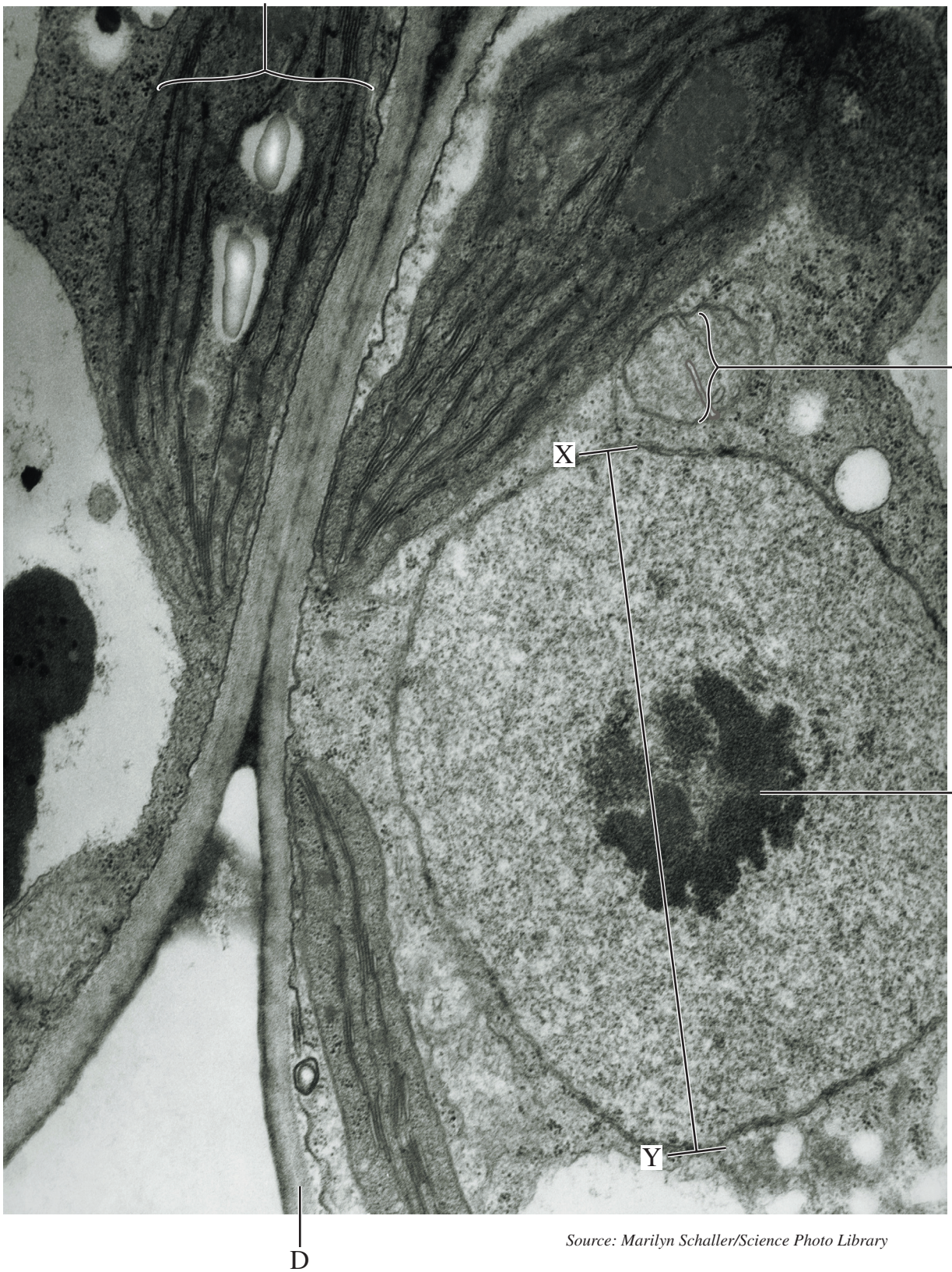
8 Give an account of the process of osmosis and its effect in animal and plant cells. [10]

THIS IS THE END OF THE QUESTION PAPER

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

Photograph 1.3

(For use with Question 3)



Source: Marilyn Schaller/Science Photo Library

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