Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2015

Centre Number

Candidate Number

Biology

Assessment Unit AS 1
assessing
Molecules and Cells

AB111

[AB111]
MONDAY 8 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.
There is an extra lined page at the end of the paper if required.
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.
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	

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Section A

Examiner Only	
Marks	Remark

1 The descriptions in the following table relate to transport across a cell membrane.

Complete the table, identifying the mechanism of transport described.

Description	Mechanism of transport
Substances moved across a cell membrane against a concentration gradient	
Process by which substances taken into a cell cause the cell membrane to enclose the material in a vesicle	
Removal or secretion of substances from a cell by the fusion of a vesicle with the cell membrane	
Movement of substances across a cell membrane from higher to lower concentration, using protein carriers in the membrane	
Movement of substances across a cell membrane from higher to lower concentration, directly through the phospholipid layer	

[5]

Examiner Only	
Marks	Remark

2 Cell surface membranes are composed mainly of phospholipids and proteins.

(a) A phospholipid can be represented by the symbol below.

Using this symbol, draw a diagram in the space below to show how phospholipids are arranged in the cell surface membrane.

[2]

(b) Suggest why the cell surface membrane is described as having a 'fluid mosaic' structure.

_____

_____

_____

_____

_____

_____ [2]

(c) Cholesterol is another molecule found in the cell surface membrane of animal cells.

Describe the function of cholesterol in the membrane.

_____

_____ [1]

Examiner Only	
Marks	Remark

3 **Photograph 1.3** is an electron micrograph of part of a plant cell.

(a) **(i)** State the **functions** of structures **A** and **B**.

A _____

B _____ [2]

(ii) Identify the structures labelled **C**, **D** and **E**.

C _____

D _____

E _____ [3]

(b) **(i)** Identify the structures labelled **F** and state their precise function in the cell.

Identification _____

Function _____

_____ [2]

(ii) Suggest why the two structures labelled **F** look different in this micrograph.

_____

_____ [1]

(c) Using the scale bar on **Photograph 1.3**, calculate the magnification of this electron micrograph. (Show your working.)

Answer _____ [3]

Examiner Only	
Marks	Remark

4 **(a)** Describe the process of DNA replication in cells.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ [4]

(b) The process of PCR is used to amplify sections of DNA for analysis. PCR involves DNA replication outside of the cell.

Other than location, state **two** ways in which replication of DNA by PCR differs from DNA replication inside cells.

1. _____

_____

_____

2. _____

_____

_____ [2]

Examiner Only	
Marks	Remark

(c) Cancer occurs when cells divide more frequently than normal, resulting in a mass of cells called a tumour. One type of treatment for cancer is chemotherapy, which involves drugs which interfere with the cell cycle in cancer cells.

Two chemotherapy drugs, **A** and **B**, are effective because they prevent DNA replication within the cancer cells. This reduces the rate of cell division within a tumour.

Drug **A** contains platinum, a metallic element, that forms strong cross-links between the two strands in a DNA molecule.

Drug **B** is similar in structure to a nucleotide but contains three phosphates instead of one.

(i) Suggest how drug **A** and drug **B** prevent DNA replication within the cancer cells.

Drug **A**_____

_____

_____

Drug **B**_____

_____

_____ [2]

(ii) Identify the precise stage of the cell cycle which is affected by both these drugs.

_____ [1]

Examiner Only	
Marks	Remark

5 **(a)** Plant cells contain a variety of carbohydrate molecules, including starch and cellulose.

(i) Name the type of bond which is found between the monomers (subunits) in both starch and cellulose.

_____ [1]

(ii) Complete the table below to show the function of each of these molecules, and their location within a cell.

Carbohydrate	Function	Location in cell
Starch		
Cellulose		

[4]

(b) Sucrose is another carbohydrate found in plants and is abundant in nectar. Honeybees collect nectar and take it back to their hive, where they convert it into honey. This process involves the breakdown of some of the sucrose into its monomers.

(i) State precisely the carbohydrate group to which sucrose belongs.

_____ [1]

(ii) Name the type of reaction involved in the breakdown of sucrose into its monomers.

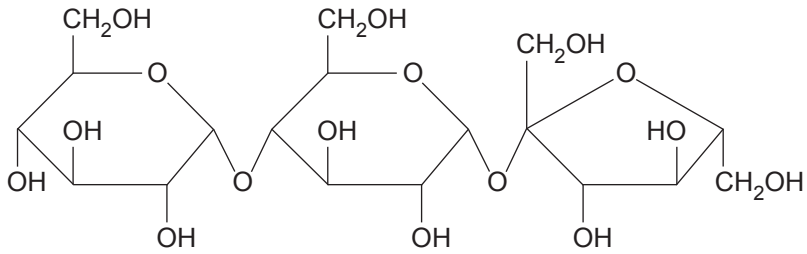
_____ [1]

(iii) Identify the products of this reaction.

_____ and _____ [1]

(c) In addition to sucrose, honey also contains other carbohydrates made by honeybees. These include maltose and erlose, a molecule first discovered in honey.

The structure of erlose is shown in the diagram below.



It is thought that the honeybees use sucrose to make erlose. Describe precisely how the structure of erlose differs from that of sucrose.

_____

_____

_____

_____

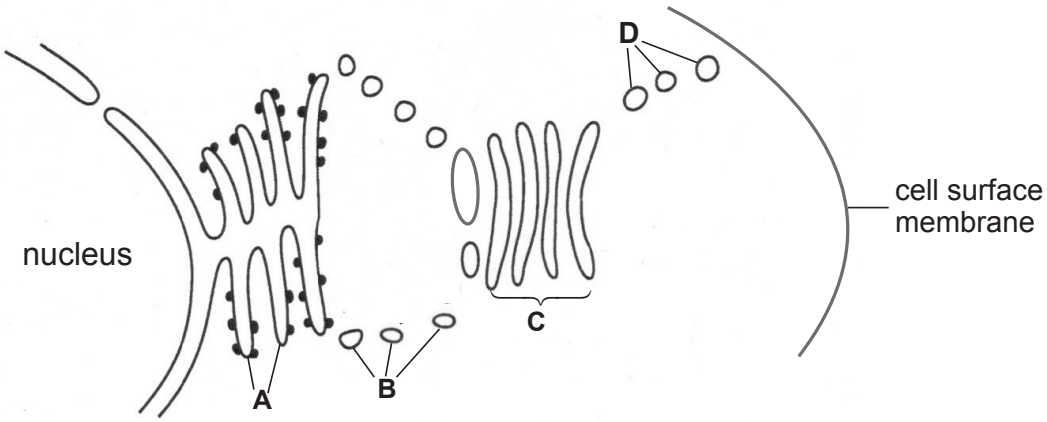
_____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

6 In plants, nitrates are absorbed from the soil and travel to the leaf in the xylem. In the leaf cells, they are used to make enzymes and other macromolecules that are needed by the leaf.

The diagram below shows some of the organelles in a leaf cell that have nitrogen-containing molecules within them.



(a) Identify the organelles represented by the letters **A – C**.

A _____

B _____

C _____ [3]

Scientists used radioactive nitrogen (^{15}N) to trace the pathway of nitrogen through the organelles in a leaf cell. They introduced nitrates containing radioactive nitrogen into the xylem. When this reached the leaf cells, the times at which radioactive nitrogen was detected in different locations were recorded.

Time after nitrates introduced to the xylem/min	Main location of radioactive nitrogen (^{15}N)
0	xylem
2	cytoplasm and nucleus
10	organelle **A**
15	organelle **B**
20	organelle **C**
25	organelle **D**
30	proteins in cell surface membrane

(b) After two minutes, molecules with radioactive nitrogen (^{15}N) were detected in both the cytoplasm and the nucleus. Suggest the identity of the first molecules containing radioactive nitrogen in each location.

Cytoplasm _____

Nucleus _____ [2]

(c) Explain concisely how each of the organelles labelled **A – D** are involved in the production and transport of the proteins which are eventually found in the cell surface membrane.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ [4]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

7 Starch is broken down by the enzyme amylase. A simple experiment involves mixing starch and amylase, after which samples are taken at intervals and tested with iodine. The time at which the iodine shows no colour change is taken as the end point of the reaction. However, this simple type of experiment gives no idea of the rate of the reaction over time.

In an alternative experiment to more accurately track the progress of the reaction, a colorimeter can be used. Iodine is added to the starch and amylase. As the reaction progresses, the amount of light transmitted through the starch-amylase-iodine mixture changes, as shown in the table below.

Time after mixing starch and amylase/min	Light transmitted through sample/%
0	2
5	38
10	72
15	86
20	94
25	98

(a) Plot the above data on the graph paper opposite, using the most appropriate graphical technique. Your graph should include a caption.

[4]

Examiner Only	
Marks	Remark

(b) The solutions used in the colorimeter experiment are more dilute than those used in the simple end-point experiment described at the start of this question. Suggest and explain a reason for this.

_____

_____

_____

_____

_____ [2]

(c) Explain precisely why a red filter should be used when measuring % transmission of light through a starch-amylase-iodine mixture.

_____

_____ [1]

(d) Apart from using the correct colour of filter, identify **one** other procedure which would lead to more accurate readings of % transmission of light.

_____

_____ [1]

(e) A calibration curve can be used with the results of the colorimeter experiment. This allows values for % transmission of light to be converted into starch concentrations.

Suggest the procedure which would be used to produce this calibration curve.

_____

_____

_____

_____

_____

_____

_____

_____ [3]

Section B

Examiner Only	
Marks	Remark

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

8 The process of meiosis results in haploid daughter cells which show genetic variation.

Give an account of the process of meiosis. Your account should include the stage at which the haploid number of chromosomes is formed and **two** ways in which the process results in genetic variation in daughter cells.

[13]

Quality of written communication [2]

Give an account of the process of meiosis. Your account should include the stage at which the haploid number of chromosomes is formed and **two** ways in which the process results in genetic variation in daughter cells.

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

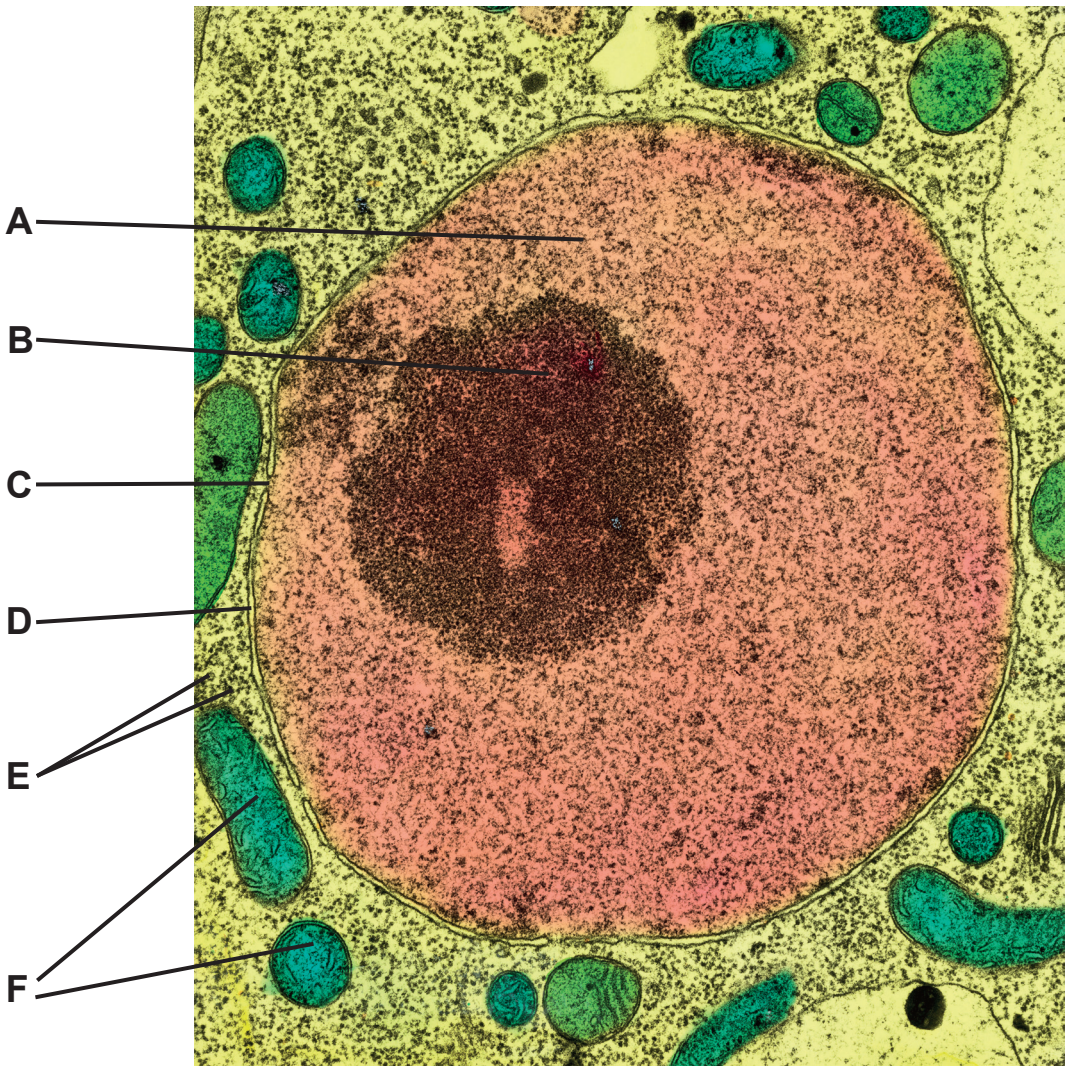
Extra lined page

Examiner Only	
Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

GCE Biology Advanced Subsidiary (AS)
Assessment Unit AS 1
Molecules and Cells
Summer 2015

Photograph 1.3
(for use with Question 3)



Scale bar
8 μm