Rewarding Learning

Centre Number

71	

Candidate Number

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2012

Biology

Assessment Unit AS 1

assessing

Molecules and Cells

[AB111]

AB111

THURSDAY 7 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 this paper if required.
Answer **all eight** questions.
You are provided with **Photograph 1.6** for use with Question 6 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 Identify the cell structures described by the following statements.

- A rod-shaped organelle with a double membrane, the inner of which is highly folded.

  _____

- An organelle which contains genetic material and is surrounded by an envelope that contains pores.

  _____

- Finger-like extensions of the cell-surface membrane, which increase the surface area.

  _____

- A network of membrane-bound tubules and cisternae, responsible for synthesis and transport of lipid molecules.

  _____

- Layer between two plant cell walls that holds them together.

  _____ [5]

Examiner Only	
Marks	Remark

2 Iodine, Benedict's reagent, Biuret reagent and Clinistix were used in an investigation to identify certain biochemical substances.

(a) (i) Describe the colour change which indicates a positive result when using Biuret reagent. Your answer should state the initial and the final colour.

_____ [1]

(ii) Which of the reagents used in the investigation (and listed above) needs to be heated when carrying out the test?

_____ [1]

(b) The following statements indicate which tests gave positive results for four different substances.

- Substance **A** gave a positive result with Biuret reagent.
- Substance **B** gave a positive result with both Benedict's reagent and with Clinistix.
- Substance **C** initially gave a negative result with both Benedict's reagent and iodine. However after hydrolysis with hydrochloric acid it gave a positive result with both Benedict's reagent and Clinistix.
- Substance **D** gave a positive result with Benedict's reagent but a negative result with Clinistix.

Identify each of the substances.

Substance **A**: _____

Substance **B**: _____

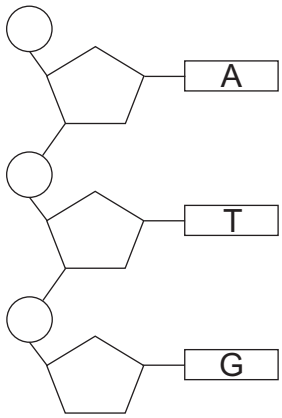
Substance **C**: _____

Substance **D**: _____ [4]

Examiner Only	
Marks	Remark

3 DNA is the molecule of the gene and has a very specific structure.

(a) The diagram below shows three nucleotides on one strand of a DNA molecule.



(i) Draw the complementary strand of this section of the DNA molecule. [2]

(ii) In an analysis of the DNA in a cell nucleus, 21% of the bases was found to be guanine. Calculate the percentage of each of the other bases in the DNA. (Show your working.)

Answers: Adenine _____ Cytosine _____ Thymine _____ [2]

Examiner Only	
Marks	Remark

In recent years our understanding of the DNA molecule and the human genome has increased rapidly, so that it is now possible to use a variety of DNA technologies to identify similarities and differences between individuals. In 1984 Professor Alec Jeffreys discovered the method known as DNA fingerprinting. He used enzymes to cut up the DNA from human tissue and then separated the fragments, to produce a banded pattern.

(b) (i) Identify the type of enzyme that Alec Jeffreys would have used to cut the DNA into fragments.

_____ [1]

(ii) State the technique he would have used to separate the fragments of DNA to produce the banded patterns.

_____ [1]

Since then, methods of identifying individuals from their DNA have been modified and refined. One such method uses a range of genetic markers based on their DNA base sequences, which can be detected by probes. These markers include RFLPs, SNPs and MRSs.

(c) Two types of genetic marker (**A** and **B**) are illustrated below for each of two individuals (*1* and *2*). The diagram below shows the base sequences on short sections of DNA with the genetic markers highlighted in bold.

Marker **A**	*Individual 1*	GTGC**ATATATATAT**CCA
	Individual 2	GTGC**ATATATATATATATAT**CCA
Marker **B**	*Individual 1*	ACCGTAC**G**GAGCCAT
	Individual 2	ACCGTAC**A**GAGCCAT

Identify the type of marker shown in each case.

Marker **A** _____

Marker **B** _____ [2]

Examiner Only	
Marks	Remark

4 When cells are bathed in solutions with a water potential that is different to their cell water potential, their appearance may change due to osmosis. Some cells may be able to take corrective action to counteract the effects of osmosis.

(a) Red blood cells and onion cells behave differently when immersed in dilute (hypotonic) solutions. For each cell type, describe and explain fully the appearance of the cells after 10 minutes immersion.

- a red blood cell

_____

_____

_____

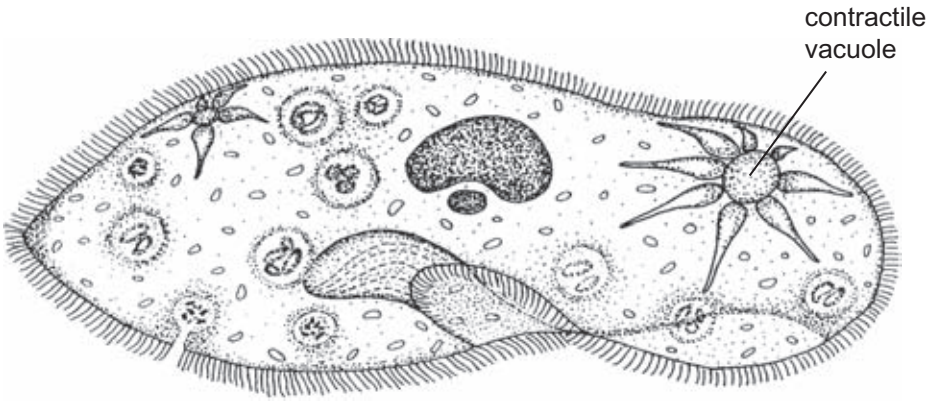
- an onion cell

_____

_____

_____ [3]

(b) *Paramecium* (shown below) is a single-celled organism, which lives in freshwater environments. Such environments cause *Paramecium* to take in water through the cell membrane by osmosis.



(i) How does the water potential inside the *Paramecium* cell compare with that of the freshwater environment?

_____ [1]

To counteract this osmotic uptake of water, *Paramecium* has structures called contractile vacuoles. Each contractile vacuole consists of a circular membrane-bound sac, surrounded by tubules. Solutes are pumped from the cytoplasm into the contractile vacuole and water is subsequently absorbed.

(ii) Explain how this pumping of solutes into the contractile vacuole causes water to move into the vacuole.

[2]

(iii) Contractile vacuoles are found in many single-celled organisms, but only in those which do not possess a cell wall. Suggest why this is the case.

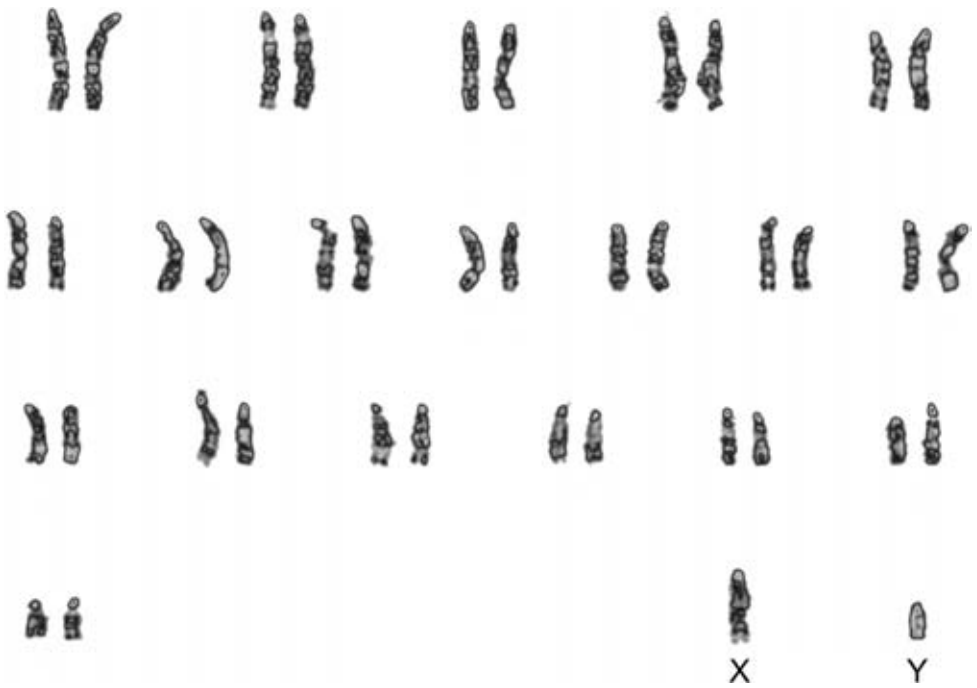
[2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

5 Chromosomes are visible during mitosis and meiosis in eukaryotic cells.

(a) The image below shows a karyotype of mouse chromosomes.



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(i) Using the karyotype, determine the haploid number for mouse cells.

_____ [1]

(ii) Identify the sex of the mouse, assuming that sex determination in mice and humans follows the same model.

_____ [1]

(b) Gametes in mammals are produced by meiotic cell division. Two important properties of mammalian gametes are that:

- they are haploid;
- there is genetic variation in the gametes produced by any one individual.

(i) Identify the precise phase of meiosis which results in the haploid condition and describe what happens during this phase.

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

(ii) There are two ways in which genetic variation arises. In each case, identify the precise phase of meiosis which results in genetic variation and describe what happens during the phase.

1. _____

_____

_____

2. _____

_____

_____ [3]

(c) One stage of meiosis involves sister chromatids being pulled to opposite ends of the cell. In order to allow this, a protein called cohesin, which binds sister chromatids together, must be hydrolysed by an enzyme called separase.

(i) Identify the stage of meiosis during which sister chromatids are pulled to opposite ends of the cell.

_____ [1]

(ii) Explain the term 'hydrolysed'.

_____

_____

_____

_____ [2]

(iii) State the products of the hydrolysis of cohesin.

_____ [1]

Examiner Only	
Marks	Remark

6 **Photograph 1.6** is an electron micrograph showing several cells from the mesophyll layer of a spinach leaf. A box has been drawn round one cell, identified as cell **A**, as well as parts of its neighbouring cells.

(a) In the space below, draw a diagram of cell **A** as shown in the box in the photograph. Your drawing should indicate the structures visible within the cell. It should also include the outlines of the various neighbouring cells (but should not include any detail of structures in these extra cells).

Label at least **four** structures in your diagram.

Drawing [3]

Labels [2]

(b) Identify **one** piece of evidence in the photograph to support each of the following statements.

- The cells shown are probably from the spongy mesophyll layer.

_____

_____

- The cells shown are not from the epidermis.

_____

_____ [2]

(c) Calcium and magnesium are inorganic ions that are important for the synthesis of substances in plant cells.

State the substance which each of these ions is used to produce.

- Calcium _____
- Magnesium _____ [2]

(d) State **two** ways in which fungal cells differ from plant cells.

1. _____

_____

2. _____

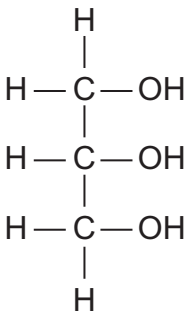
_____ [2]

Examiner Only	
Marks	Remark

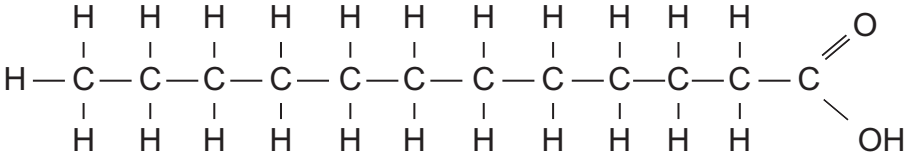
7 Lipids are a group of organic molecules which include fats and oils.

The diagram below shows two component molecules, **A** and **B,** which make up lipids.

A



B



(a) (i) Identify the type of reaction which is involved in bonding **B** to **A**.

_____ [1]

(ii) State the ratio of **A** to **B** in a fat.

_____ [1]

(b) Lipids are present in foods such as gravy and butter and can leave stains on clothes. Some biological washing powders may include lipase, which can help to remove such stains.

(i) Describe the mechanism of action of an enzyme such as lipase.

_____

_____

_____

_____

_____

_____

_____

_____

_____ [3]

Examiner Only	
Marks	Remark

(ii) Biological washing powders are less effective stain removers at temperatures above 60 °C. Explain precisely why this is the case.

Examiner Only

Marks	Remark

_____

_____

_____

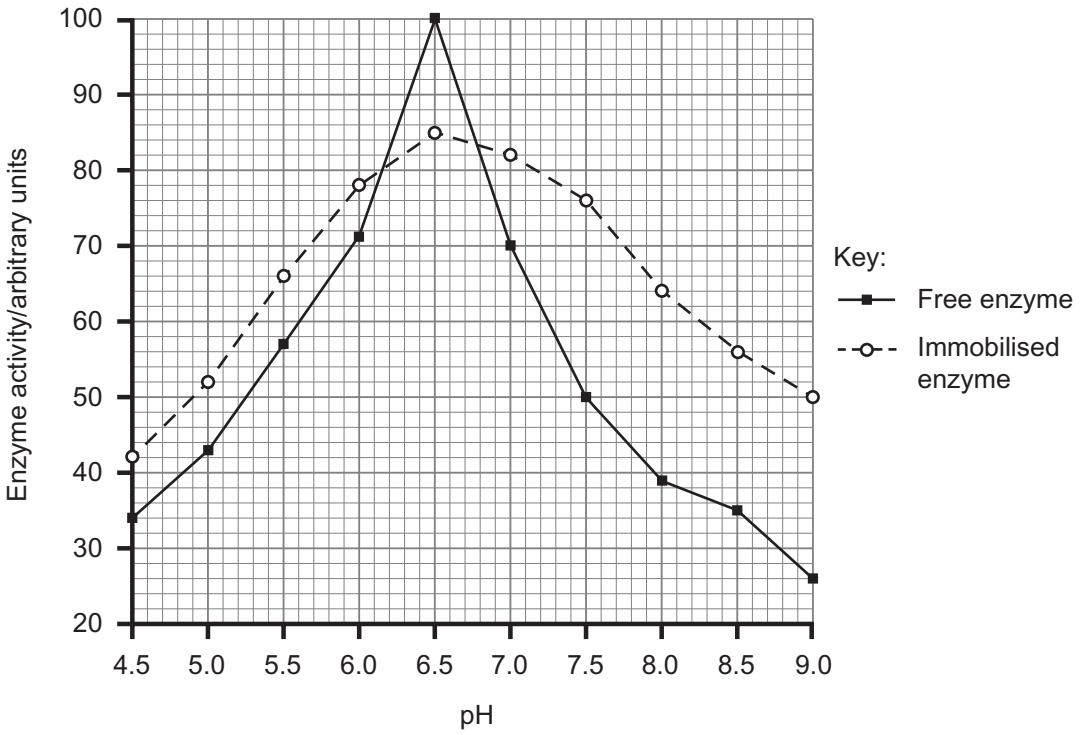
_____

_____

_____ [2]

Examiner Only	
Marks	Remark

(c) Enzymes in biological washing powders are often immobilised in beads of silica. The graph below shows the activity of one enzyme in a free and in an immobilised state, over a range of pH values.



(i) Describe the main differences in enzyme activity which result from immobilisation.

[2]

(ii) Suggest explanations for the differences shown.

[2]

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(Questions continue overleaf)

Section B

Examiner Only	
Marks	Remark

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

8 Starch, glycogen and cellulose are three polysaccharides found in living organisms. Give an account of the similarities and differences in their structure and describe their role and distribution. [13]

Quality of written communication [2]

Similarities and differences in structure between starch, glycogen and cellulose

Examiner Only	
Marks	Remark

Role and distribution of starch, glycogen and cellulose

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

June 2012

Photograph 1.6
(For use with question 6)