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Centre Number	
71	

Candidate Number

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2014

Biology

Assessment Unit AS 1

assessing

Molecules and Cells

[AB111]

FRIDAY 13 JUNE, AFTERNOON

ML

TIME

1 hour 30 minutes, plus your additional time allowance.

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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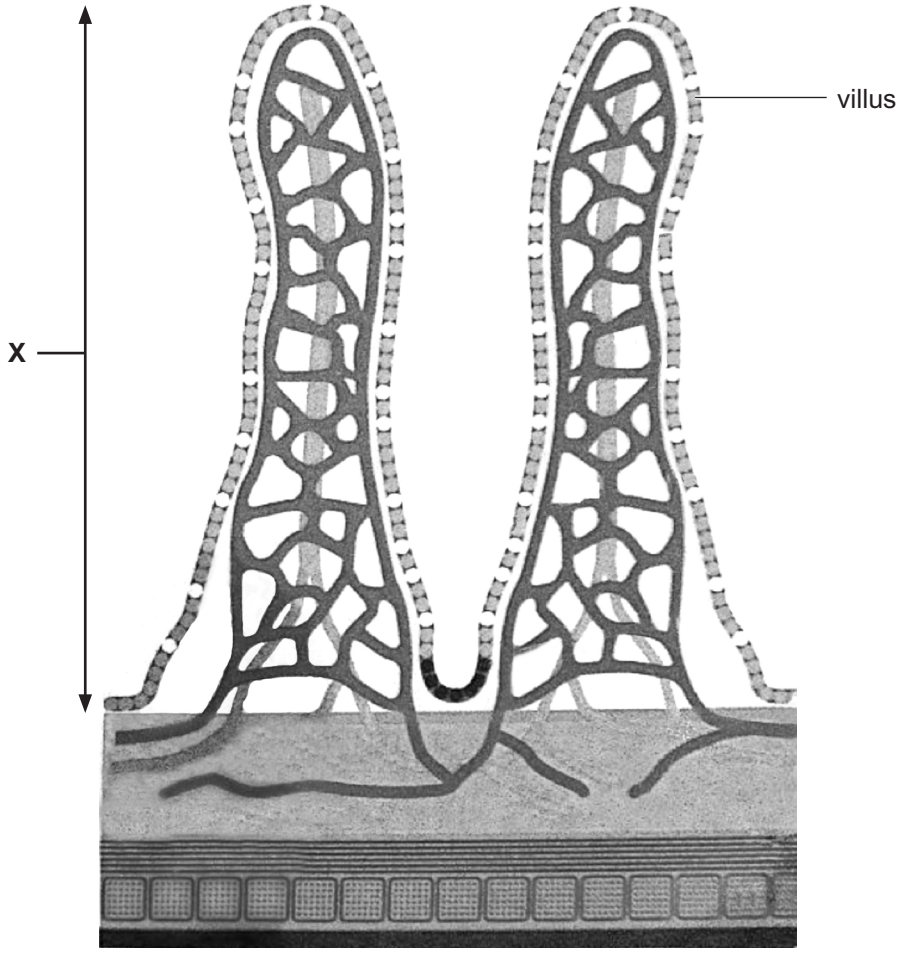
Marks	Remark

Section A

1 The wall of the ileum is made up of several tissue layers, as shown in the diagram below.



Adapted from: © Biology for CCEA AS Level by Dr J Napier, page 105, published by Colourpoint Educational, 2012. ISBN 976 1 78073 010 3

Between each villus is a region containing some actively dividing cells called stem cells. These are able to divide and develop into a variety of cell types, each of which becomes a component of the tissue layer labelled **X** in the diagram.

(a) Write down the name of tissue layer **X**.

_____ [1]

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(b) Paneth cells and goblet cells are two types of cell produced by the stem cells. Write down the functions of Paneth cells and goblet cells in the ileum.

Paneth cells _____

_____

Goblet cells _____

_____ [2]

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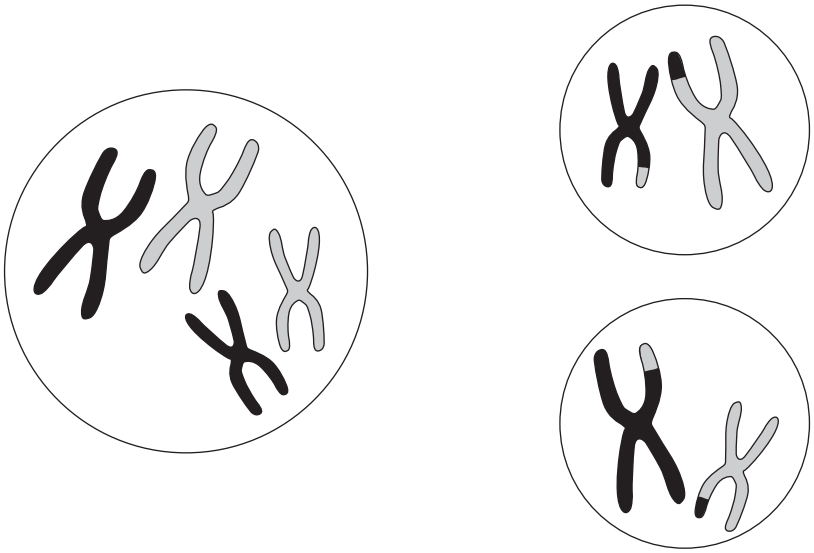
2 Look at the diagram below. It shows two stages in the process of nuclear division by meiosis. The diploid number of the cell shown in stage **A** is 4.



Stage A **Stage B**

(a) Identify stage **B**.

_____ [1]

(b) Describe the behaviour of the chromosomes between stage **A** and stage **B**.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ [4]

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Marks	Remark

3 **Look at Photograph 1.3**. It shows an electronmicrograph of a plant cell, with some parts of surrounding cells also visible. Some structures in the photograph have already been labelled.

(a) Identify the structures labelled **A, B** and **C**.

A _____

B _____

C _____ [3]

(b) The magnification of this photograph is ×7500. Calculate the width of the cell in μm along the line **X–X**.
(Show your working.)

Answer _____ μm [3]

(c) Within the chloroplast a membrane system is clearly visible. Write about how this membrane system increases the amount of light energy absorbed.

_____

_____

_____

_____

_____

_____ [2]

(d) Suggest a reason why a nucleus is not visible in the photograph.

_____

_____ [1]

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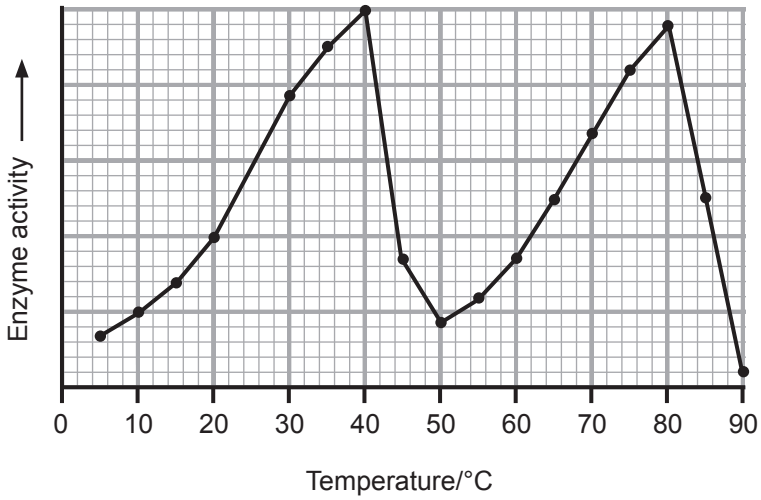
Marks	Remark

4 Biological washing powders contain enzymes which help to break down stains on fabric. The enzyme activity in a biological washing powder at a range of different temperatures was investigated. The graph below shows the results.



(a) Describe and explain the trend shown in the graph between 5 °C and 45 °C.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ [4]

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(b) **(i)** Suggest an explanation for the two different peaks observed in enzyme activity.

_____

_____

_____

_____ [2]

(ii) Suggest why such a pattern of enzyme activity would be useful in biological washing powders.

_____

_____

_____ [1]

(c) Suggest an explanation for the enzyme activity observed between 45 °C and 55 °C.

_____

_____

_____

_____

_____

_____ [2]

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5 **(a)** A student tested five solutions (**A–E**) with Benedict's reagent, Biuret reagent, iodine solution and Clinistix. The student recorded the results in the following manner:

- When tested with Benedict's reagent, solutions **A** and **C** both produced a brick-red precipitate.
- When tested with Biuret reagent, only solution **B** produced a purple colour.
- When tested with iodine solution, only solution **D** turned blue-black.
- Solution **E** produced no colour change with any of the reagents.
- When tested with Clinistix, only solution **A** gave a positive result.

(i) Construct a table of the results obtained by this student. Your table should include the following:

- appropriate column headings
- positive test results recorded with a ✓ and negative results with an ✗. All boxes should be filled.

No caption is required.
Do the table in the space below.

[3]

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(ii) Suggest a possible identification for each of the substances present in solutions **A** to **D**.

A _____

B _____

C _____

D _____ [4]

(iii) Describe how the test with Benedict's reagent would have been carried out.

_____

_____

_____ [1]

(b) After carrying out the tests outlined in **(a)**, the student wished to identify substance **E**. After hydrolysis of **E**, it was found that the resulting solution now tested positive with both Benedict's reagent and Clinistix.

Suggest which substance was originally present in solution **E** and give a reason for your answer.

Substance **E** _____

Reason _____

_____

_____ [2]

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Marks	Remark

6 Proteins are made up of a large group of organic molecules with a wide variety of functions. The specific function of a protein depends on its shape which is determined by its sequence of amino acids.

(a) **(i)** Identify the elements which are present in all proteins.

_____ [1]

(ii) Explain what is meant when a protein is said to have a quaternary structure.

_____

_____ [1]

Some features of four human proteins are described below.

Keratin is the major component of hair and nails. Its structure consists of a repeating pattern of a sequence of seven amino acids.

Trypsin is an enzyme found in the small intestine, where it is involved in the digestion of proteins in food.

Collagen is found in skin, where it maintains elasticity, and in tendons, where it provides strength.

Mucin is found in saliva, where it makes food slippery and thus assists its passage from the mouth to the stomach. Its structure includes many carbohydrate chains attached to the protein.

(b) **(i)** From the list above, select a protein which could be categorised as follows.
(Each protein may be used once, more than once, or not at all.)

- a conjugated protein _____
- a fibrous protein _____
- a globular protein _____
- a protein which catalyses hydrolysis _____ [4]

(ii) Shampoo manufacturers sometimes state that their product contains amino acids.

Suggest why amino acids in shampoo are unlikely to be of use in the production of keratin in hair.

_____

_____ [1]

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Marks	Remark

(c) Several cell structures play a role in protein synthesis. Describe the role of each of the following structures in the synthesis of a functional protein.

- Ribosomes

_____

_____

- Rough endoplasmic reticulum

_____

_____

- Golgi body

_____

_____ [3]

(d) Some proteins are secreted out of the cell in which they are produced, via vesicles which fuse with the plasma membrane.
Name this process of secretion out of a cell.

_____ [1]

(e) Research in protein biochemistry has been greatly improved by the use of molecular modelling software which allows users to view the three-dimensional structure of a protein. Often, scientists researching a particular protein will make the molecular modelling file for that protein available to download via the internet.

Suggest an advantage of this file-sharing for scientific research.

_____

_____ [1]

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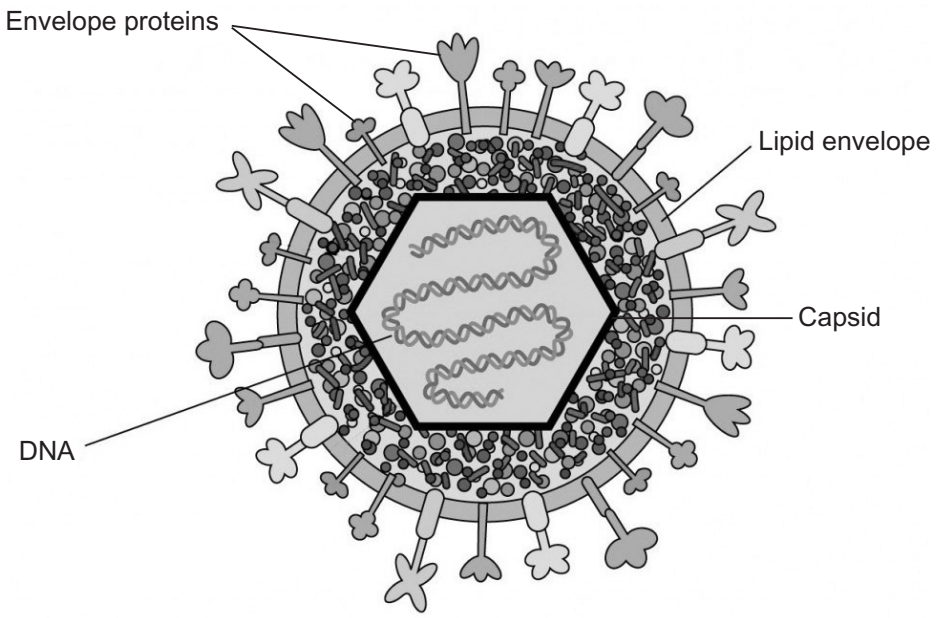
7 During the summer of 2013, it was reported that large numbers of oysters had died in Carlingford Lough in County Down. Tests on the dead oysters showed the presence of a virus called Ostreid Herpes Virus (OsHV). It is thought that the extended period of warm weather triggered increased infection rates in oyster populations.

Look at the diagram below. It shows the structure of a Herpes Virus, similar to that which infects oysters.



© TWiV – This Week in Virology with Vincent Racaniello and friends.
www.twiv.tv/virus-structure/ (adapted) Creative Commons Attribution 3.0 License

(a) Use the information in the diagram to complete the following.

- Write down **one** way in which the structure of this virus is similar to the structure of HIV

_____

_____

- Write down **one** way in which the structure of this virus is similar to the structure of a bacteriophage

_____

_____ [2]

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(b) Various methods are used to diagnose infection by this virus. Each method has been classified, according to its appropriateness and ease of use. The table below summarises this.

Table removed due to copyright issues.

The table described different methods of diagnosing infection and a classification of each method's use in OsHV diagnosis.

The methods given were:

- obvious signs (dead or open oysters) – classification c
- Light microscopy – classification b
- Electron microscopy – classification c
- PCR (and subsequent DNA analysis) – classification a

The classifications used in the table are summarised as follows:

a – the recommended method for reasons of specificity and sensitivity
b – a standard method with moderate diagnostic sensitivity and specificity
c – a method which is useful in some situations, but factors including cost and/or accuracy severely limit its application.

To start with, tissue from dead oysters is examined using a light microscope, since the virus causes changes in the appearance of the nucleus of an infected cell. Then if a viral infection is suspected, PCR can be carried out.

(i) Suggest why PCR is not carried out until tissue samples have been examined with a light microscope.

_____

_____ [1]

(ii) Suggest why 'obvious signs' is classified as **c**.

_____

_____

_____ [2]

(iii) Suggest why 'PCR' is classified as **a**.

_____

_____

_____ [2]

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(c) In order to carry out PCR, tissue from a dead oyster is ground up and mixed with buffer. It is then incubated with primers, an enzyme and deoxyribonucleotides.

(i) Name the enzyme used in PCR.

_____ [1]

(ii) How many types of deoxyribonucleotides should be included?

_____ [1]

Below are the sequences of one primer pair which can be used when testing for OsHV.

C9: 5'-GAG-GGA-AAT-TTG-CGA-GAG-AA-3'

C10: 5'-ATC-ACC-GGC-AGA-CGT-AGG-3'

(iii) Write down the base sequence to which primer **C10** would bind.

_____ [1]

(iv) Explain why primers are added in pairs.

_____

_____ [1]

(v) Knowledge of the DNA of oysters was necessary for the scientists who developed this test for OsHV. Suggest why.

_____

_____

_____ [1]

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Section B

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

8 Write an account of the process of osmosis in cells. Explain the effect of changing external solute concentrations on both animal and plant cells. [13]

Quality of written communication [2]

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Extra lined page

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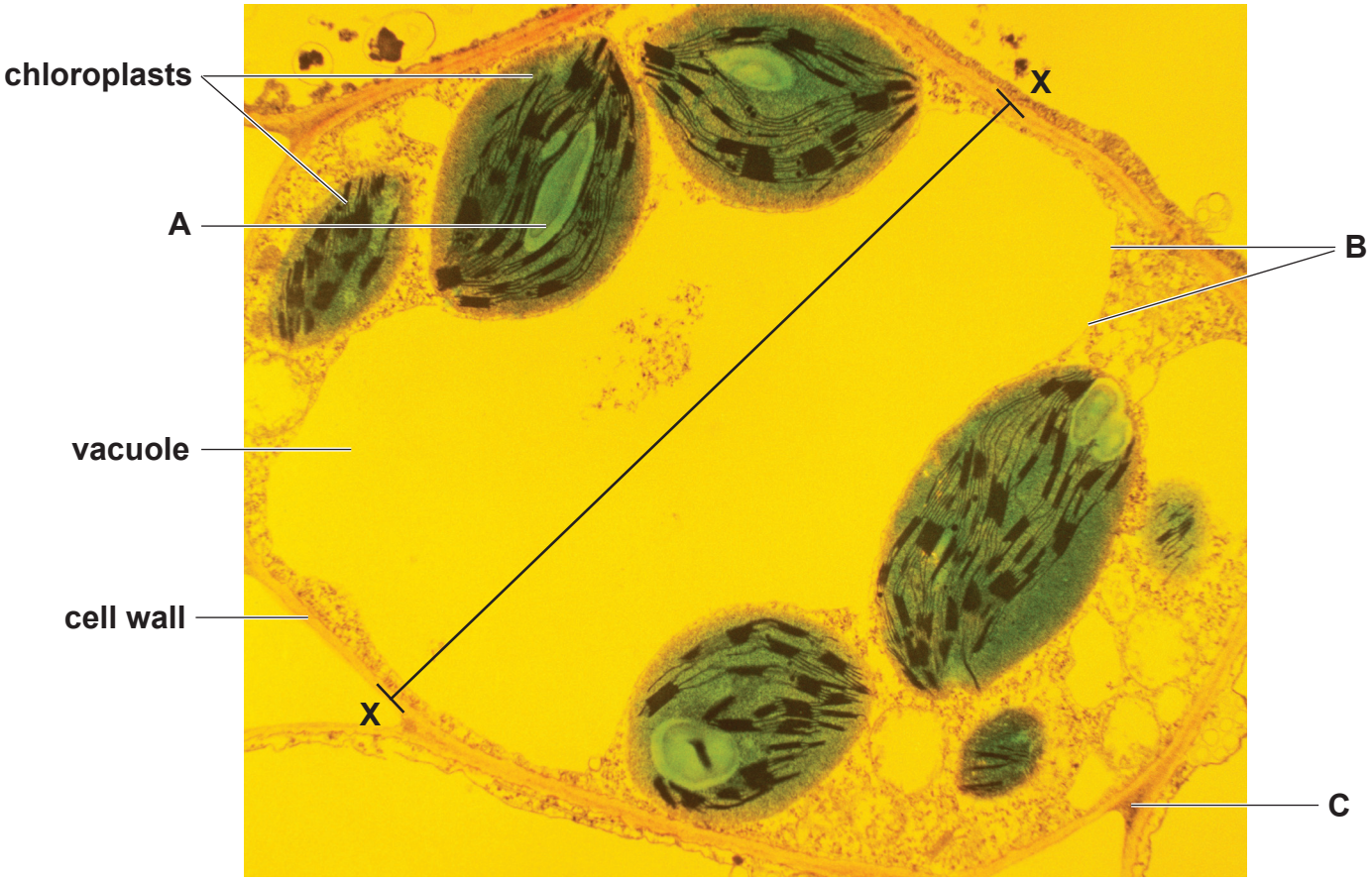
Photograph 1.3
(for use with question 3)



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