



Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education

Centre Number

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Candidate Number

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Biology

Assessment Unit AS 1

assessing

Molecules and Cells



[SBY11]

SBY11

Assessment

TIME

1 hour 30 minutes.

Assessment Level of Control:

Tick the relevant box (✓)

Controlled Conditions	
Other	

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

You must answer the questions in the spaces provided.

Do not write outside the boxed area on each page or on blank pages.

Complete in black ink only. **Do not write with a gel pen.**

Answer **all seven** questions.

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.

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24SBY1101

Section A

1 (a) Identify a type of molecule described by each of the following statements.

- monomers that make up cellulose

- disease-causing protein

- nitrogen-containing polymer

- protein containing a prosthetic group

- two sugar monomers joined by a glycosidic bond

[5]

(b) State the precise location of histone proteins in a cell.

[2]



2 (a) (i) Both light microscopes and electron microscopes can be used to examine cell structure.

State **two** advantages of using a light microscope rather than an electron microscope.

1. _____

2. _____
_____ [2]

(ii) Distinguish between the terms 'magnification' and 'resolution'.

_____ [2]

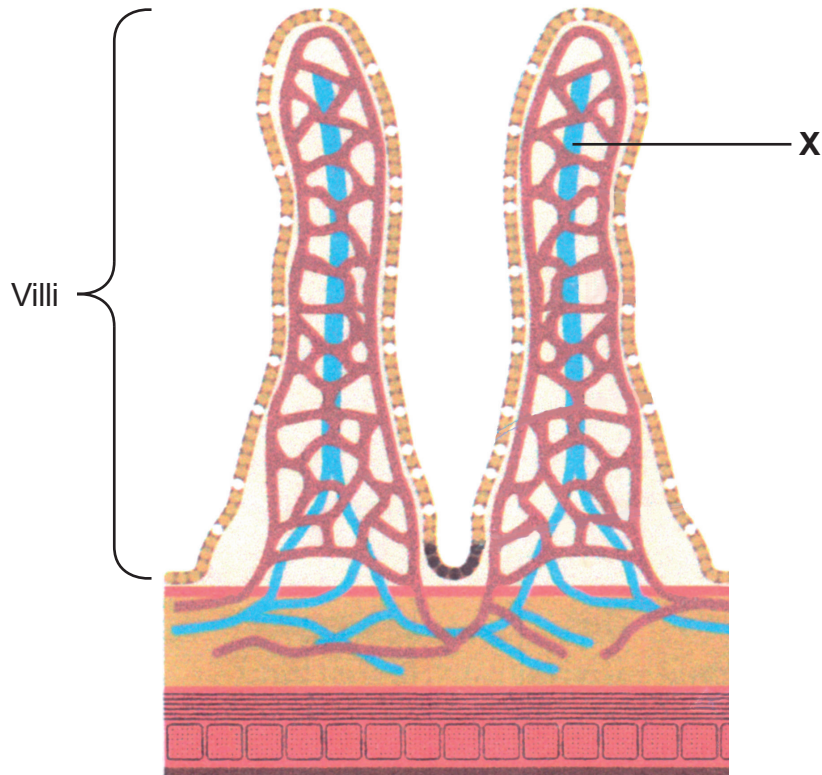
(b) Suggest which type of microscope would be most suitable for viewing the external structure of a bacterium.

_____ [1]

[Turn over



- 3 The wall of the ileum is made up of several tissue layers, as represented by the diagram below.



© Biology for CCEA AS Level First Edition, James Napier (2012)
Colourpoint Creative Limited ISBN 978-1-78073-009-7

- (a) Identify the structure labelled X and describe its function.

X _____

Function _____

_____ [2]



(b) Other than structure **X**, describe and explain **two** ways in which the structure of a villus is adapted for its function.

1. _____

2. _____

[2]

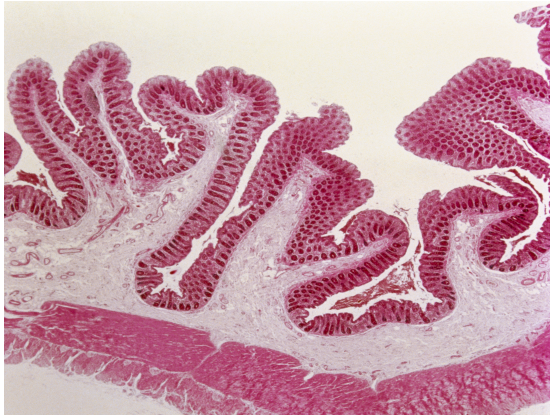
[Turn over



Conditions such as Inflammatory Bowel Disease (IBD) can affect the structure of the ileum, causing the villi to lose their characteristic shape and become blunted. The Crypts of Lieberkühn can also become reduced in size and therefore less effective.

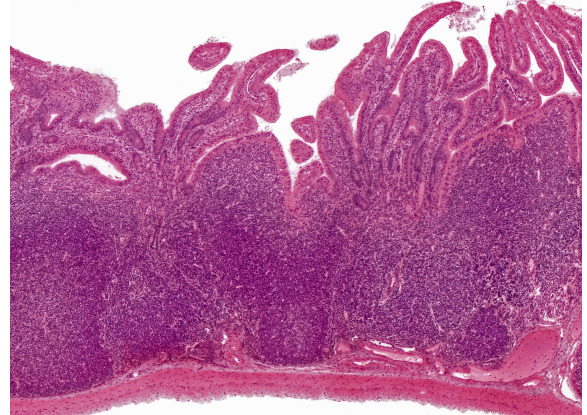
The photomicrographs below show sections of normal ileum and ileum affected by IBD. (The images are not to the same magnification.)

Normal



Sources: © Overseas / Collection CNRI / Science Photo Library

Inflammatory Bowel Disease



© Alvin Telser / Science Photo Library

(c) IBD sufferers are often nutrient-deficient. With reference to the information above, suggest explanations for this.

[3]





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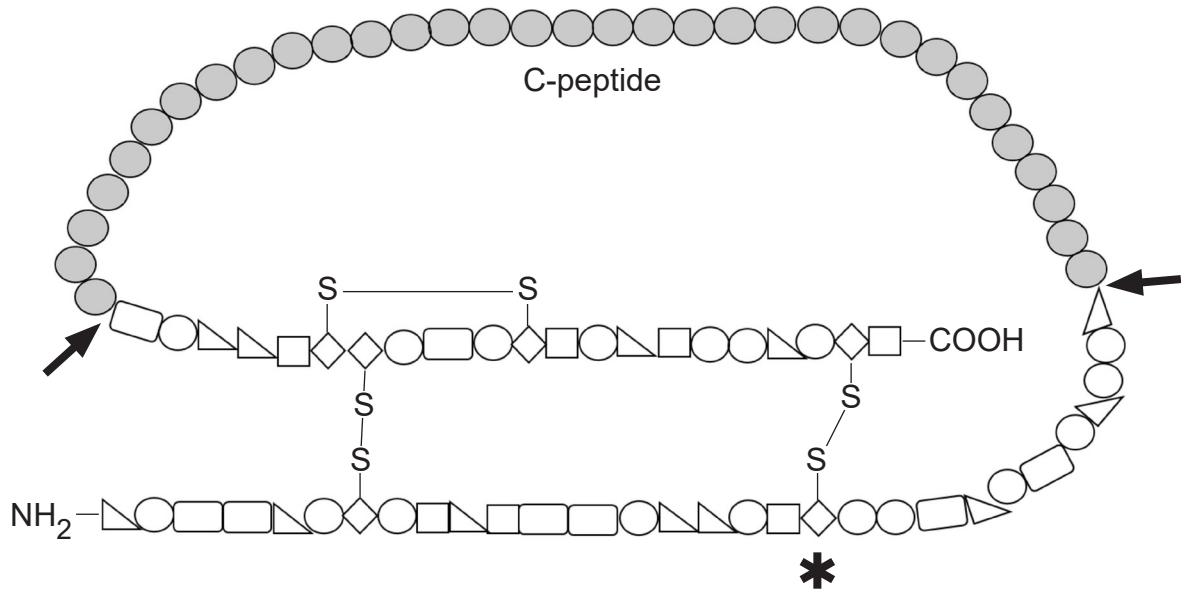
(Questions continue overleaf)

[Turn over



- 4 Polypeptides often require modification before they are fully functional. In the case of insulin, this modification involves the removal of a section of amino acids, called the C-peptide.

The diagram below represents the primary structure of insulin before modification. Two different enzymes are required to remove the C-peptide. The arrows indicate the two points of enzyme action.



Source: Principal Examiner

- (a) Define the term 'enzyme'.

[1]

- (b) (i) One type of bond (S–S) is represented on the diagram. State **two** other types of bonds that would be present within the insulin molecule.

1. _____

2. _____

[2]



(d) (i) Identify the location in a cell where polypeptide modification is most likely to occur.

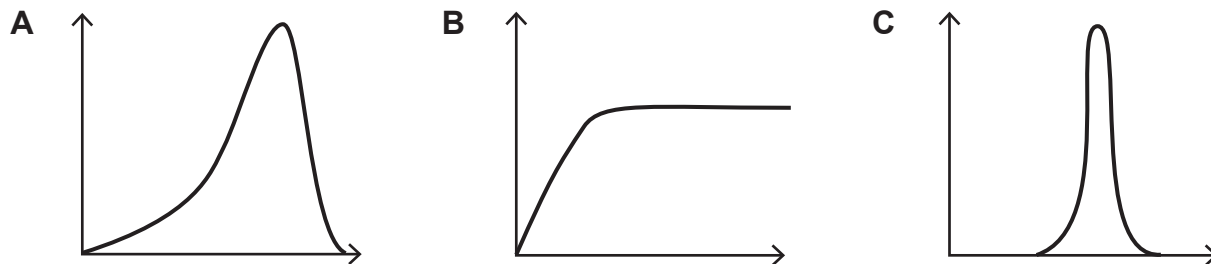
[1]

(ii) Describe how a protein such as insulin could be secreted from a cell.

[1]



Enzyme activity can be affected by small changes in temperature, pH, substrate or enzyme concentration.



(e) Identify and explain which of the graphs, **A**, **B** or **C**, represents the relationship between enzyme activity and:

(i) substrate concentration _____

Explanation

[3]

(ii) temperature _____

Explanation

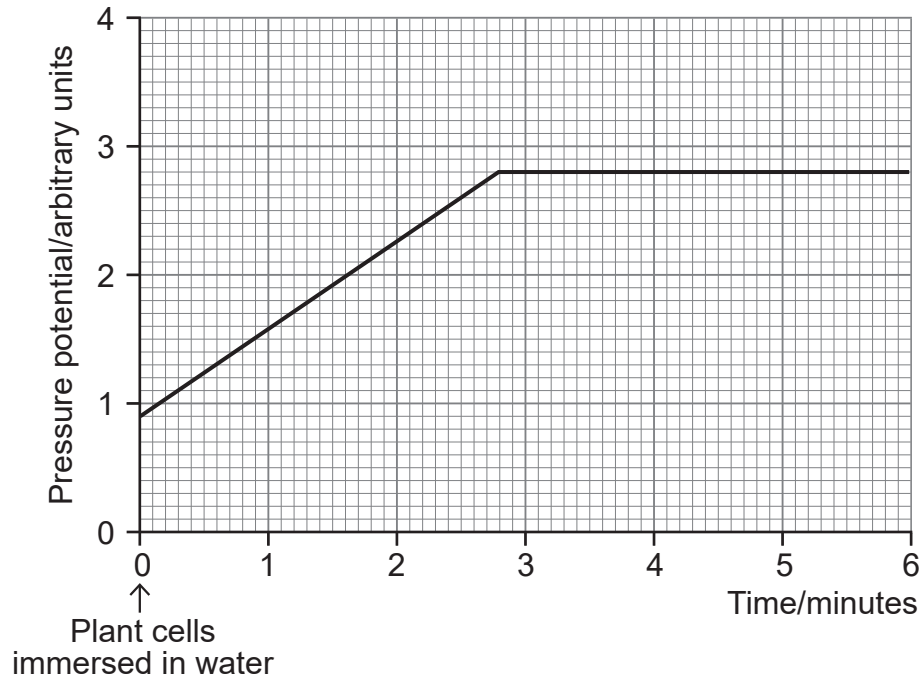
[3]

[Turn over



- 5 Osmosis is the process by which water enters and leaves plant cells. Herbaceous plants rely on turgor for support as they do not have supporting tissue such as wood, which is present in larger shrubs and trees.

As part of an investigation of turgor in plants, plant cells were immersed in water. The graph below shows how the pressure potential of the cells changed over time.



- (a) (i) State the time at which full turgor was achieved.

_____ [1]

- (ii) Explain the results shown in the graph.

_____ [2]



- (b) *Sorghum bicolor* is a commercial grain crop, and understanding the plant's response to drought can be beneficial to growers.

Scientists investigated the response of four varieties of *S. bicolor* to drought by leaving the plants unwatered for 28 days. After this time, measurements of solute potential (Ψ_s) and pressure potential (Ψ_p) were recorded.

<i>S. bicolor</i> variety	Solute potential (Ψ_s)/MPa	Pressure potential (Ψ_p)/MPa	Water potential (Ψ)/MPa
1	-2.39	0.53	-1.86
2		0.15	-2.10
3	-2.26	0.48	-1.78
4	-2.16	0.26	-1.90

- (i) State the equation which shows the relationship between water potential, pressure potential and solute potential. Use this to calculate the solute potential (Ψ_s) of variety 2.

Equation

Ψ_s _____ MPa [3]

[Turn over



The scientists measured the rate at which sugar from photosynthesis was built up (assimilated) into plant tissue in drought conditions and non-drought conditions.

<i>S. bicolor</i> variety	Net assimilation rate/arbitrary units	
	Non-drought	Drought
1	9.4	7.3
2	2.9	2.2
3	3.3	2.4
4	4.3	3.9

(ii) Suggest and explain which variety growers might choose if drought conditions were likely.

[2]

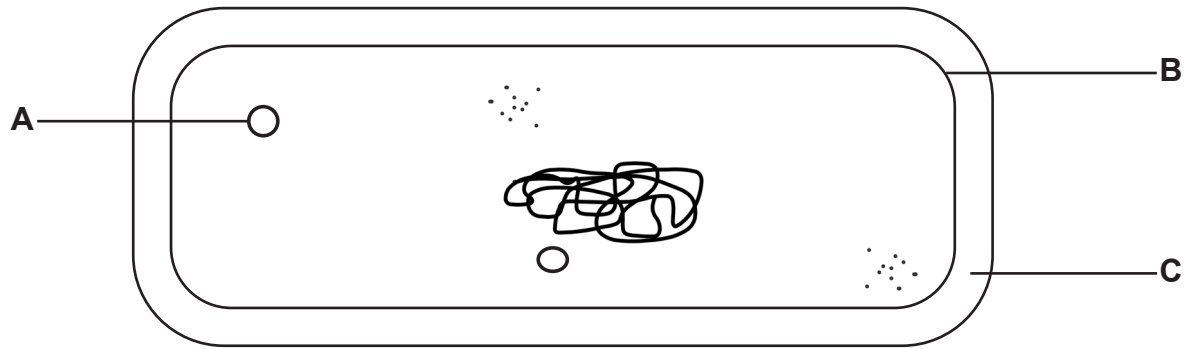
(iii) Some other plant species that grow in drought conditions retain some of the sugar produced in photosynthesis in root cells rather than assimilating it into plant tissue.

Suggest and explain a benefit of this to the plant.

[2]



6 The cells of prokaryotes such as bacteria have characteristics which distinguish them from eukaryotes. The cell of a prokaryote is represented in the diagram below.



Source: Principal Examiner

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

A _____

B _____

C _____

[3]

(ii) Using **only** features visible in the diagram, state **two** ways in which prokaryotic cells differ from eukaryotic cells.

1. _____

2. _____ [2]

An increase in bacterial cell numbers in a suspension can be estimated using a colorimeter. This measures the absorption of light by the bacteria.

(b) Describe the relationship you would expect between the absorption of light and the number of bacteria in a suspension.

 _____ [1]

[Turn over



- (c) Bacteria can cause infections in humans. Therefore, it is important to understand their growth (increase in number) and also how to stop them growing.

One way of stopping their growth involves the use of antibiotics.

The effect of antibiotics on the growth of a particular bacterial species was investigated. The table below shows how approximate numbers of bacteria (measured in colony forming units, CFU) changed over a 6-hour period when grown with and without the antibiotics, tetracycline and rifamycin.

Time/h	Without antibiotics/CFU	With tetracycline/CFU	With rifamycin/CFU
0	10^1	10^1	10^1
1	10^2	10^2	10^2
2	10^3	10^3	10^3
3	10^4	10^4	10^3
4	10^5	10^3	10^4
5	10^5	10^2	10^4
6	10^6	10^1	10^5



(d) An alternative approach investigated the use of bacteriophage viruses to stop bacterial growth. This investigation involved infecting two groups of mice.

Group 1 was infected with bacteria only.

Group 2 was infected with bacteria and bacteriophage viruses.

The bacterial infection dose was 10^7 ml^{-1} .

The bacteriophage infection dose was 10 times greater than the bacterial infection dose.

(i) Calculate the number of **bacteriophages** in the infection dose.

_____ ml^{-1} [1]



The numbers of bacteria and bacteriophages were measured 24 hours after infection.

The results are shown in the table below.

	Number of bacteria or bacteriophages / ml ⁻¹	
Mice	Bacteria	Bacteriophages
Group 1	2×10^{80}	0
Group 2	1.5×10^2	2×10^{15}

- (ii) The results indicate that bacteriophage numbers increase and bacterial numbers decrease in **Group 2** mice after 24 hours.

Suggest an explanation for this.

[3]

[Turn over





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

Total Marks	
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Examiner Number

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