Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2023

Centre Number

Candidate Number

Biology

Assessment Unit AS 1
assessing
Molecules and Cells

[SBY11]

SBY11

FRIDAY 12 MAY, 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.
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 eight** 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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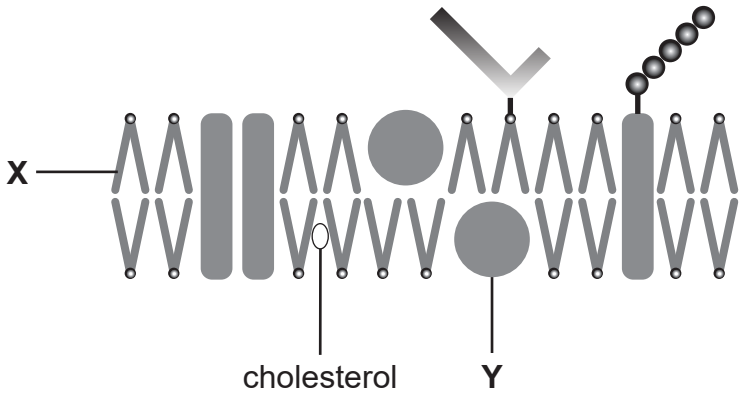
Section A

1 The diagram below represents part of a plasma membrane.



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(a) Identify molecules **X** and **Y**.

X _____

Y _____ [2]

(b) State the function of cholesterol in plasma membranes.

_____

_____ [1]

(c) Describe and explain how large, water-soluble substances cross plasma membranes.

_____

_____

_____

_____

_____

_____ [2]

[Turn over

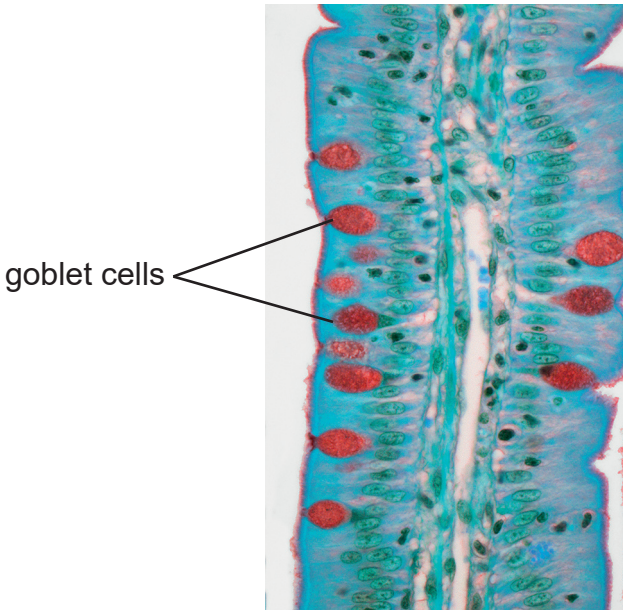
2 Many human tissues and organs are specialised for a particular function.

(a) Define the term ‘tissue’.

_____

_____ [1]

(b) The photomicrograph below shows a section through part of a human villus. Goblet cells are labelled.



Source: © Steve Gschmeissner / Science Photo Library

(i) State the role of goblet cells.

_____

_____ [1]

(ii) Name the layer of the ileum in which villi are located.

_____ [1]

(iii) Villi are lined with columnar epithelial cells which possess microvilli.
Describe and explain how microvilli aid the ileum in carrying out its role.

_____

_____

_____

_____

_____

_____ [2]

(iv) Describe and explain **two** other adaptations of a villus.

1. _____

_____

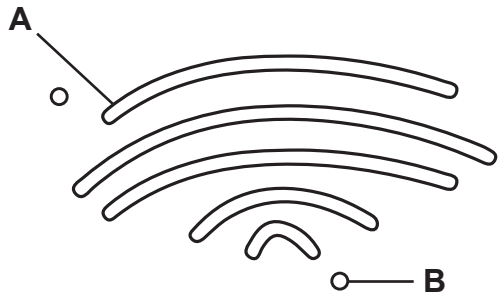
_____

2. _____

_____

_____ [4]

3 The diagram below represents a Golgi apparatus.



(a) Identify structures **A** and **B**.

A _____

B _____ [2]

(b) Describe **two** modifications which may be made to a protein as it moves through the Golgi apparatus from **A** to **B**.

1. _____

_____

_____

2. _____

_____

_____ [2]

(c) Rough endoplasmic reticulum is another membrane system in cells. Describe how rough endoplasmic reticulum differs in **structure** from a Golgi apparatus.

_____

_____

_____

_____

_____

_____ [2]

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4 The table below shows the number of chromosomes present in cell nuclei of females and males of some species.

Species	Number of chromosomes per nucleus	
	Female	**Male**
Red king crab	208	208
Walking catfish	104	104
Koala	16	16
Jack jumper ants	2	1

(a) Cell division by meiosis produces gametes which show genetic variation.

With reference to processes in meiosis, explain how more genetic variation can be achieved in red king crab gametes, compared with koala gametes.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ [4]

(b) The process of reproduction in jack jumper ants is unusual. A fertilised egg develops into a female, whereas an unfertilised egg develops into a male.

Cells from males in this species cannot undergo meiosis. Using the information in the table on the previous page, suggest an explanation for this.

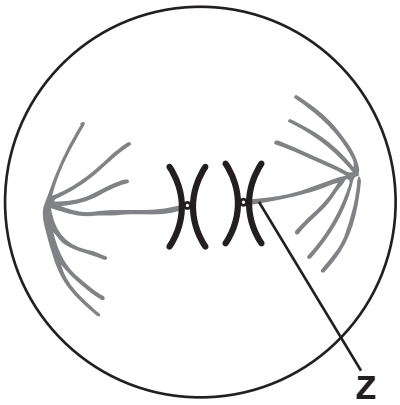
_____

_____

_____ [1]

(c) Diagram A below represents a cell of a female jack jumper ant during metaphase I of **meiosis**.

Diagram A



(i) Identify the structure labelled **Z**.

_____ [1]

(ii) Explain why the nuclear envelope is not visible at this stage.

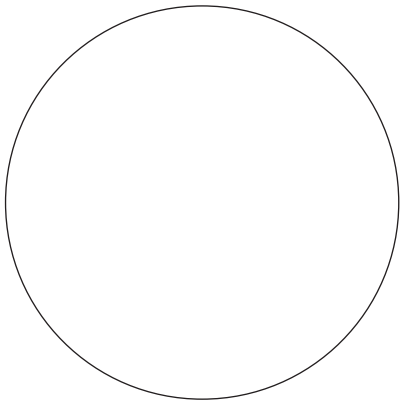
_____

_____

_____ [1]

(iii) In Diagram B, draw the chromosomes as they would appear in anaphase I of **meiosis** in a female of this species.

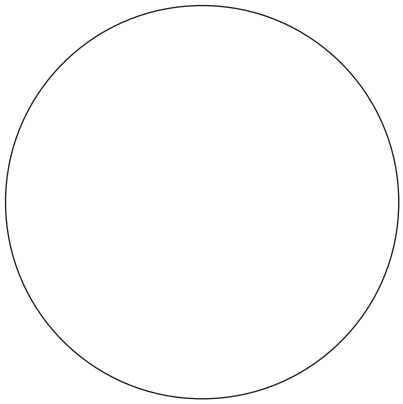
Diagram B



[1]

(iv) In Diagram C draw the chromosomes as they would appear in anaphase of **mitosis** in a female of this species.

Diagram C



[1]

5 The photomicrograph below shows onion cells which had been placed in a concentrated sugar solution for one hour.

Source: © Getty Images

(a) Describe and explain the appearance of the onion cells.

_____

_____

_____

_____

_____

_____

_____ [3]

(b) The absorption of water by cells in a seed is an important part of the first stage of plant growth, called germination.

An investigation was carried out into the effect of fertiliser concentration on the germination of some seeds. The table below shows the results of this investigation.

Concentration of fertiliser / arbitrary units	Percentage of seeds which germinated		
	Aubergine	Tomato	Chilli
0	65	67	71
5	78	81	86
10	82	92	98
15	90	94	99
20	81	90	94
25	69	85	88
30	58	64	70
35	44	60	65

(i) Describe the trends shown in the table.

_____

_____

_____

_____

_____

_____

_____

_____

_____ [3]

[Turn over

(ii) Using your knowledge and understanding of osmosis, suggest an explanation for the effect of higher concentrations of fertiliser on germination of seeds.

_____

_____

_____

_____

_____

_____ [2]

(c) **(i)** Define the term 'pressure potential'.

_____

_____

_____ [1]

(ii) Explain why pressure potential does not affect an animal cell.

_____

_____

_____ [1]

6 Collagen is a fibrous protein with quaternary structure.

(a) Define 'quaternary structure' of a protein and describe the quaternary structure of collagen.

_____

_____

_____

_____

_____

_____ [2]

Collagen is a major component of a substance called cartilage, which is found in joints such as the hip. Cartilage helps joints to move smoothly.

Rheumatoid arthritis is a disease in which the collagen in cartilage breaks down, causing pain and stiffness in the joints.

A group of protease enzymes called MMPs can act as biomarkers for rheumatoid arthritis.

(b) (i) Define 'biomarker'.

_____

_____ [1]

(ii) Suggest how protease enzymes such as MMPs may contribute to rheumatoid arthritis.

_____

_____

_____ [1]

(iii) A patient suffering from rheumatoid arthritis had their MMP levels monitored, and it was noted that MMP levels were increasing steadily. Suggest what the consequences of this may be for the patient.

_____

_____

_____ [1]

(c) A non-competitive inhibitor of MMPs has been developed as a drug for rheumatoid arthritis.

(i) Describe and explain how a non-competitive inhibitor slows the rate of an enzyme-controlled reaction.

_____

_____

_____

_____

_____

_____ [2]

(ii) Suggest how this drug could slow down the progress of rheumatoid arthritis but is not likely to relieve symptoms completely.

_____

_____

_____

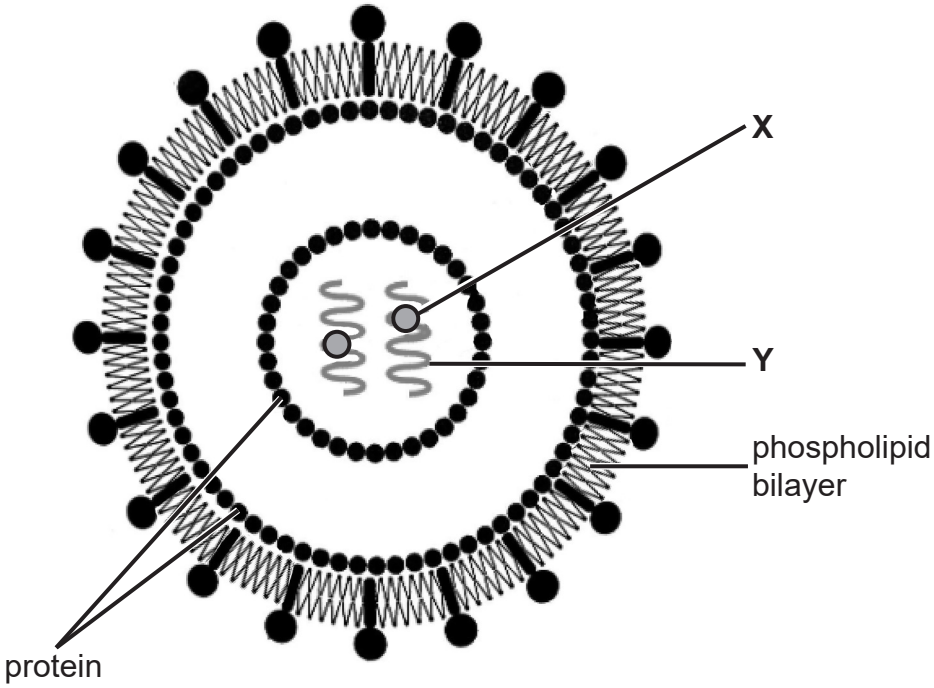
_____

_____

_____ [2]

7 HIV (human immunodeficiency virus) damages some cells of the immune system and weakens the ability to fight infections and disease.

The diagram below represents the structure of HIV.



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(a) (i) Identify the genetic material (**Y**) found in HIV.

_____ [1]

(ii) Identify enzyme **X** and explain its role in HIV.

Enzyme **X** _____

Role _____

_____ [2]

[Turn over

(b) HIV infects a type of lymphocyte (white blood cell). The infection process is summarised in the diagram below.

Stage 1: Binding to lymphocyte membrane

↓

Stage 2: Endocytosis

↓

Stage 3: Genetic material and enzyme **X** enter cell cytoplasm

↓

Stage 4: Integration of HIV DNA into host cell DNA

↓

Stage 5: Replication

↓

Stage 6: Assembly of new HIV particles

↓

Stage 7: Many new HIV particles released from lymphocytes

(i) HIV can enter lymphocytes via endocytosis. Describe the process of endocytosis.

_____

_____

_____

_____

_____

_____ [2]

(ii) Suggest how intervention at stage 1 or stage 7 could help prevent the spread of HIV throughout the body.

Stage 1 – binding to lymphocyte membrane

_____

_____

_____

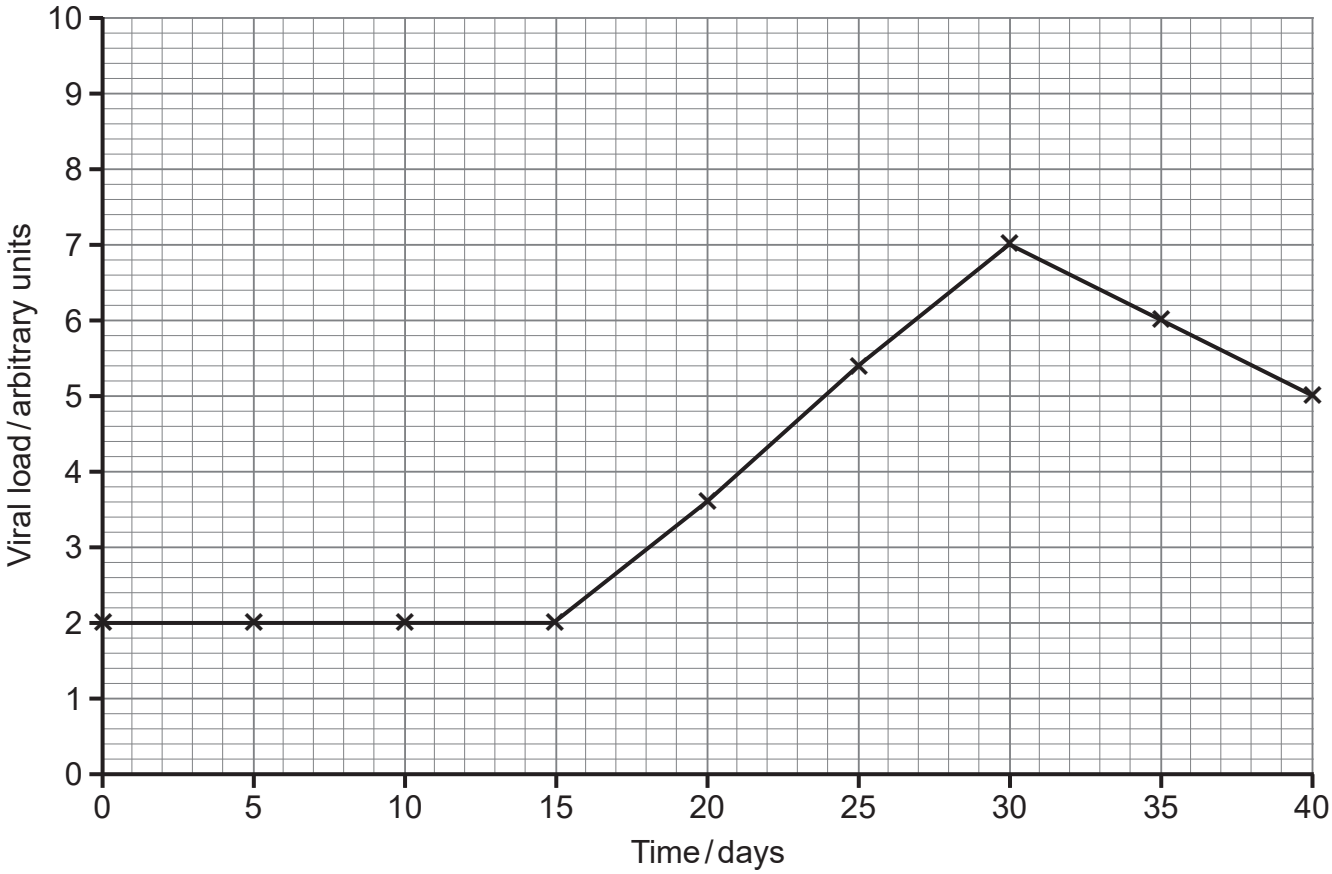
Stage 7 – release of the virus

_____

_____

_____ [2]

(c) The results of research carried out on HIV infection in a small number of people are summarised in the graph below. Viral load is a measure of the number of virus particles present in the body and was recorded over the first 40 days of infection.



(i) Describe the results of the research.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ [3]

(ii) Calculate the percentage increase in viral load from day 5 to day 25.

(Show your working.)

_____ % [2]

Section B

Quality of written communication will be assessed in this section.

8 **(a)** DNA and RNA are nucleic acids. Describe the structure of nucleic acids and describe the functions of DNA and RNA. [9]

(b) Describe the process of semi-conservative replication of DNA. [6]

(a) DNA and RNA are nucleic acids. Describe the structure of nucleic acids and describe the functions of DNA and RNA.

[Turn over

(b) Describe the process of semi-conservative replication of DNA.

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Question Number	Marks
1	
2	
3	
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Total Marks	

Examiner Number

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