Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/12**

Paper 1 Multiple Choice **May/June 2024**

1 hour 15 minutes

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

INSTRUCTIONS

- There are **forty** questions on this paper. Answer **all** questions.
- For each question there are four possible answers **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in soft pencil on the multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.

INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark.
- Any rough working should be done on this question paper.

This document has **20** pages. Any blank pages are indicated.

IB24 06_9700_12/RP
© UCLES 2024

1 A prokaryotic cell which is 1 μm in diameter is magnified 50 000 times in an electron micrograph.

What is the diameter of the cell in the electron micrograph?

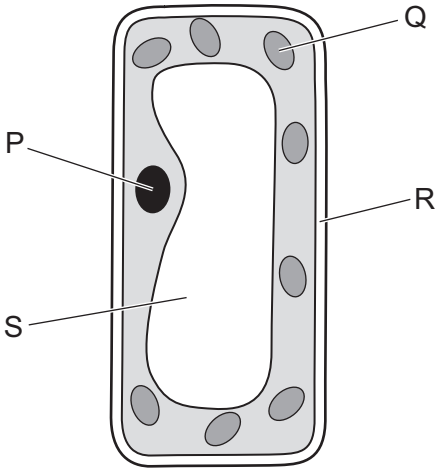
A 5×10^{-1} mm

B 5×10^{0} mm

C 5×10^{1} mm

D 5×10^{2} mm

2 The diagram shows a plant cell with some labelled structures.



Which labelled structures are bound by a double membrane?

A P and Q **B** P and S **C** R and Q **D** R and S

3 Which size of ribosome is found in mitochondria **and** typical prokaryotic cells?

A 50S **B** 60S **C** 70S **D** 80S

4 Which row about typical prokaryotic cells **and** typical animal cells is correct?

	lysosomes present for the break down of old organelles	ATP is produced by the cell
A	✓	✗
B	✓	✓
C	✗	✓
D	✗	✗

key

✓ = correct for typical prokaryotic cells **and** typical animal cells

✗ = **not** correct for both cells but correct for **either** typical prokaryotic cells **or** typical animal cells

5 Which row is correct for the structures present in typical plant cells **and** typical animal cells?

	cell structure	plant cell	animal cell
A	plasmodesmata	present	present
B	Golgi body	present	not present
C	centriole	not present	present
D	tonoplast	not present	not present

6 Which row is correct for cellulose?

	rotation of alternate monomers by 180°	shape of molecule	hydrogen bonds between molecules
A	✓	branched	✗
B	✗	branched	✓
C	✗	unbranched	✗
D	✓	unbranched	✓

key

✓ = present

✗ = not present

7 Which statements about peptide bond formation are correct?

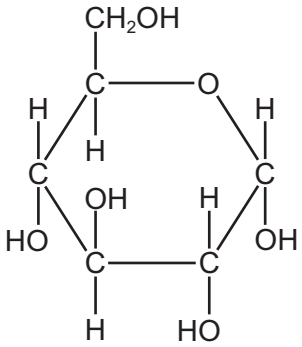
1 The bond formation occurs between a carbon of one amino acid and a nitrogen of the next amino acid after the amino acids detach from tRNA.

2 The bond formation occurs at the ribosome while the amino acids are still attached to tRNA, and is a hydrolysis reaction.

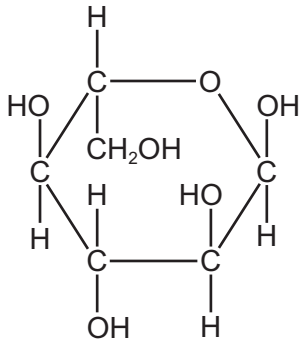
3 The bond formation is important for growth of an organism and when the bond forms, a water molecule is removed.

A 1 and 3 **B** 2 and 3 **C** 2 only **D** 3 only

8 The diagram shows naturally occurring D-glucose and a form of glucose that can be synthesised in the laboratory, known as L-glucose.



D-glucose



L-glucose

The enzyme glucose oxidase catalyses the oxidation of D-glucose. The enzyme **cannot** catalyse the oxidation of L-glucose.

Which statement about L-glucose explains this?

A L-glucose does **not** fit into the active site of glucose oxidase.

B L-glucose has a different structural formula to D-glucose.

C L-glucose is a synthetic sugar.

D L-glucose is the mirror image of D-glucose.

9 Tests for biological molecules were carried out on three solutions. Each solution contained only one type of biological molecule.

The observations were as follows.

solution	test	observation
1	Benedict's test	blue to orange
2	Benedict's test after acid hydrolysis	blue to red
3	biuret test	blue to purple

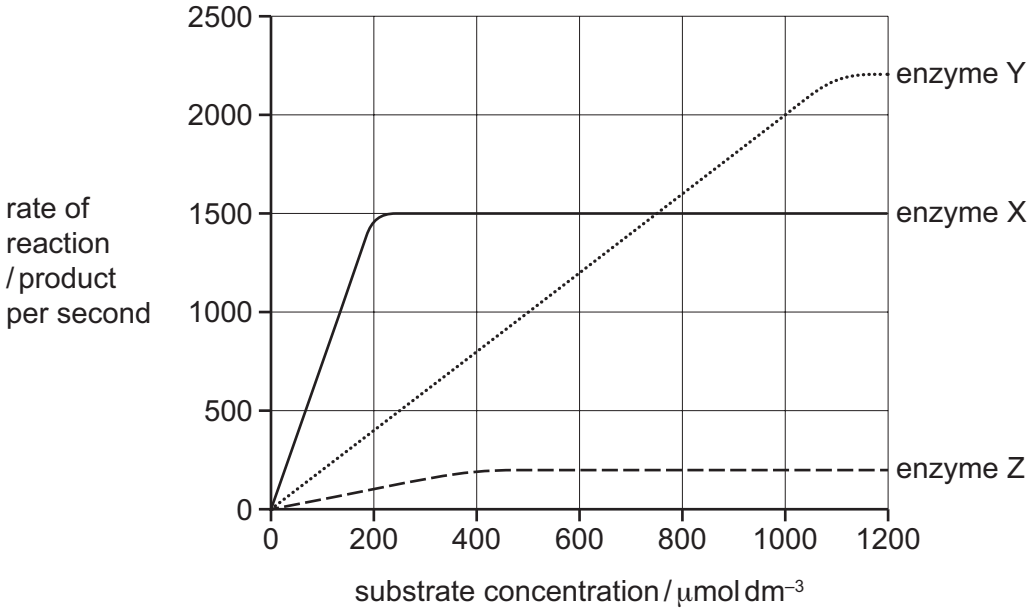
Which solutions would contain either sucrose or amylase?

A 1, 2 and 3 **B** 1 and 3 only **C** 2 and 3 only **D** 2 only

10 Which row describes the expected effect on V_{max} and K_m when a competitive reversible inhibitor is added to an enzyme-catalysed reaction?

	effect on V_{max}	substrate concentration at K_m
A	no change	increases
B	no change	no change
C	decreases	increases
D	decreases	no change

11 The graph shows the effect of substrate concentration on the rates of reaction of three enzymes, X, Y, and Z.



What is the correct order of affinity of these enzymes for their substrates, starting with the enzyme with the highest affinity?

A X → Y → Z **B** X → Z → Y **C** Y → X → Z **D** Z → X → Y

12 Which row correctly identifies the weak and strong bonds in the tertiary and quaternary structure of a typical protein?

	type of bond			
	disulfide	hydrogen	hydrophobic	ionic
A	strong	strong	weak	weak
B	strong	weak	weak	weak
C	weak	weak	strong	strong
D	weak	weak	weak	strong

13 Which row correctly describes haemoglobin?

A	four polypeptide chains, each containing a haem group	iron ions can associate with oxygen, forming oxyhaemoglobin	in each chain, hydrophobic R-groups of amino acids point towards the centre of the molecule	at 50% saturation, two oxygen molecules are transported by the molecule
B	polypeptide chains interact to produce a globular chain	each chain contains a haem group of amino acids surrounding an iron ion	consists of two identical alpha chains and two identical beta chains	each chain can transport an oxygen molecule
C	polypeptide chains interact to produce an almost spherical molecule	an iron ion is present within each haem group	quaternary structure has two alpha chains and two beta chains	each molecule can transport a total of four oxygen atoms
D	polypeptide chains produce a loose helical shape, which folds to form a spherical molecule	iron ions in the molecule can bind reversibly with oxygen	in each chain, hydrophobic R-groups of amino acids surround the iron ion	each molecule can transport a total of eight oxygen atoms

14 Which process always takes place **without** the involvement of energy from ATP?

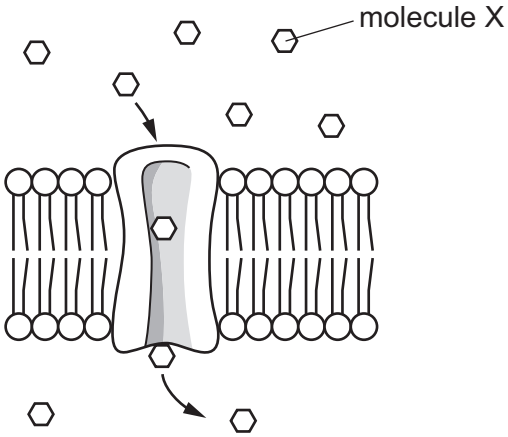
A active transport

B endocytosis

C exocytosis

D facilitated diffusion

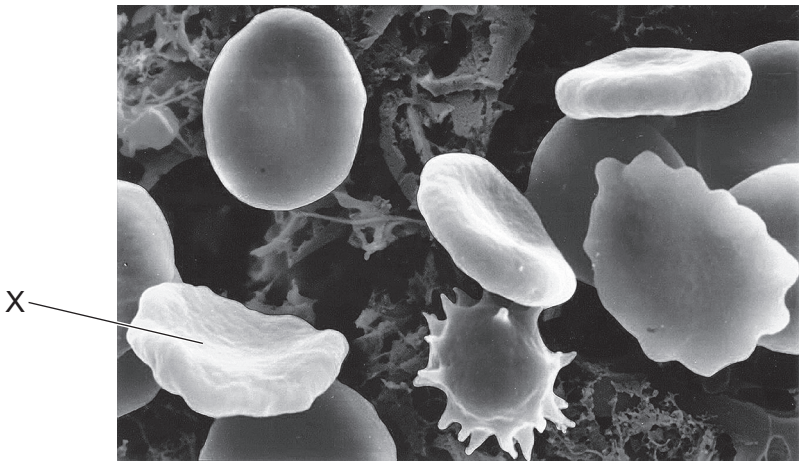
15 The diagram shows the entry of molecule X into a cell.



Which row shows a property of molecule X and the effect of the concentration of ATP in the cytoplasm on the rate of entry of molecule X?

	property of molecule X	concentration of ATP in the cytoplasm
A	non-polar	affects rate of entry of molecule X
B	non-polar	has no effect on rate of entry of molecule X
C	polar	affects rate of entry of molecule X
D	polar	has no effect on rate of entry of molecule X

16 The electron micrograph shows some human blood cells.



Which row correctly shows the net movement of water by osmosis and the water potential of the cytoplasm of cell X compared with the solution surrounding the cells?

	net movement of water by osmosis	water potential of cytoplasm of cell X compared with the solution
A	into the cell	higher
B	into the cell	lower
C	out of the cell	higher
D	out of the cell	lower

17 A red indicator solution was mixed with agar and the resulting solid was cut into small cylindrical blocks. The blocks were placed in an acid which turns the indicator yellow and all other variables were kept constant. The dimensions of the blocks are shown.

block 1	height 3 mm	diameter 6 mm
block 2	height 6 mm	diameter 12 mm
block 3	height 8 mm	diameter 16 mm

The formula for calculating the surface area of a cylinder is $2\pi rh + 2\pi r^2$. The formula for calculating the volume of a cylinder is $\pi r^2 h$.

Which row shows the correct surface area (SA) to volume (V) ratio for each block and the time taken for the block to turn yellow?

	block 1		block 2		block 3	
	SA to V ratio	time to turn yellow / mins	SA to V ratio	time to turn yellow / mins	SA to V ratio	time to turn yellow / mins
A	0.75 : 1.0	4	1.5 : 1.0	5	2.0 : 1.0	11
B	0.75 : 1.0	11	1.5 : 1.0	5	2.0 : 1.0	4
C	1.33 : 1.0	4	0.67 : 1.0	5	0.5 : 1.0	11
D	1.33 : 1.0	11	0.67 : 1.0	5	0.5 : 1.0	4

18 Which metabolic processes will be very active in a cell that has just completed cytokinesis?

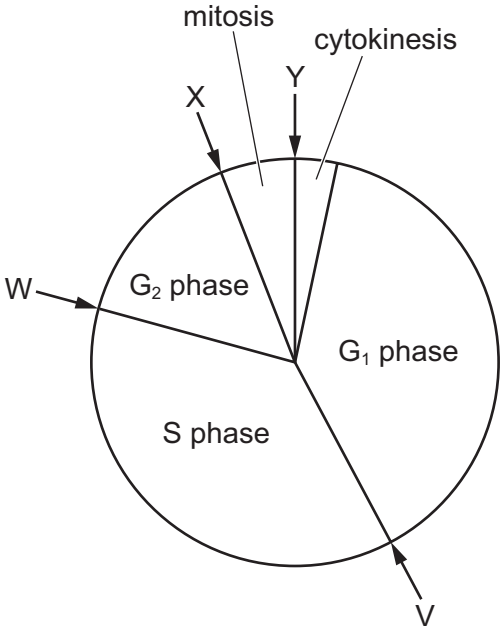
1 ATP formation

2 DNA replication

3 protein synthesis

A 1, 2 and 3 **B** 1 and 3 only **C** 2 only **D** 3 only

19 The diagram shows a typical mitotic cell cycle and the point in the cell cycle that has been reached by each of four cells, V, W, X and Y.

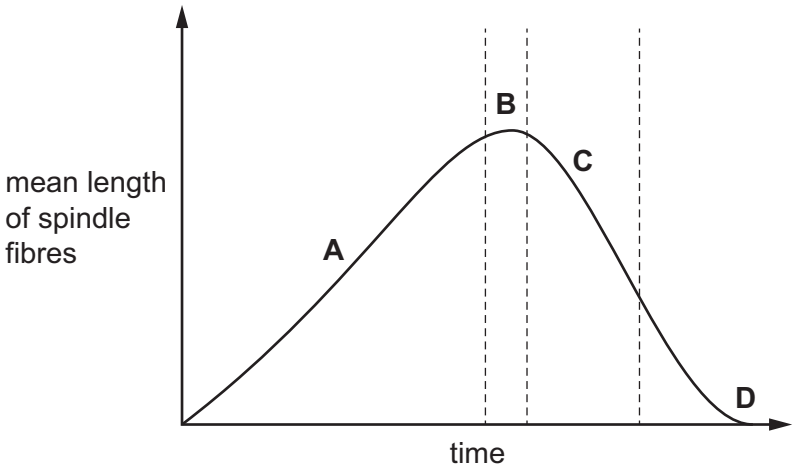


Which row correctly identifies the cells that match the two descriptions?

	DNA replication is complete but the cell has **not** yet reached its maximum size	preparation for microtubule formation is nearly complete but chromosomes have **not** yet condensed
A	V	X
B	W	Y
C	V	Y
D	W	X

20 The graph shows the mean length of the spindle fibres during mitosis.

Which region of the graph shows when all the centromeres have detached from the spindle fibres?



21 The mRNA codons ACU, ACC, ACA and ACG all code for the same amino acid, threonine.

Which anticodons could specify an amino acid other than threonine?

1 UCA

2 ACC

3 UGU

4 UGC

A 1, 3 and 4 **B** 1 and 2 **C** 2 and 3 **D** 3 and 4 only

22 Which bond formation does DNA polymerase catalyse?

A hydrogen bonds between bases

B hydrogen bonds between nucleotides

C phosphodiester bonds between bases

D phosphodiester bonds between nucleotides

23 In eukaryotes, the RNA molecules formed during transcription are modified by the removal of non-coding sequences. This is followed by the joining together of coding sequences to form mRNA.

What are the coding sequences also called?

A codons

B exons

C introns

D primary transcripts

24 Which row correctly identifies sinks for sucrose transported by mass flow in plants?

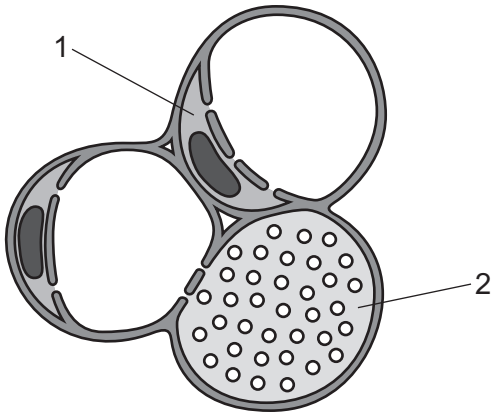
	root storage organ	growing leaf bud	growing shoot tip
A	✓	✓	✓
B	✓	✗	✓
C	✗	✓	✗
D	✗	✗	✓

key

✓ = sink

✗ = not a sink

25 The diagram shows a transverse section through a transport tissue in a plant.



Which row correctly identifies cell 1 and cell 2?

	cell 1	cell 2
A	companion cell	phloem sieve tube element
B	companion cell	xylem vessel element
C	phloem sieve tube element	phloem sieve tube element
D	phloem sieve tube element	xylem vessel element

26 Which statement correctly describes the movement of solutes in the symplast pathway?

A Cell surface membranes regulate the selective absorption of solutes into the symplast pathway.

B Plasmodesmata control the movement of solutes from the symplast pathway to the apoplast pathway.

C The symplast pathway transports dissolved mineral ions from the soil that **cannot** be transported by the apoplast pathway.

D The movement of solutes through plasmodesmata in the symplast pathway is prevented in the endodermis by suberin.

27 Which statement helps to explain why water molecules are forced to move through xylem vessel elements as a consequence of transpiration?

A Water molecules form hydrogen bonds with cellulose in the walls of xylem vessel elements in a process known as adhesion.

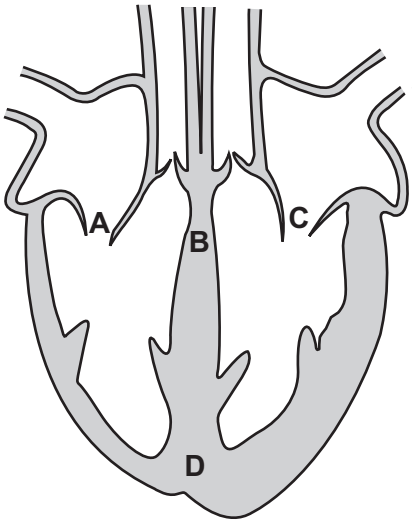
B Water molecules form hydrogen bonds with neighbouring water molecules in a process known as cohesion.

C Water molecules form ionic bonds with dissolved mineral ions, which helps to keep the water molecules together in a continuous column.

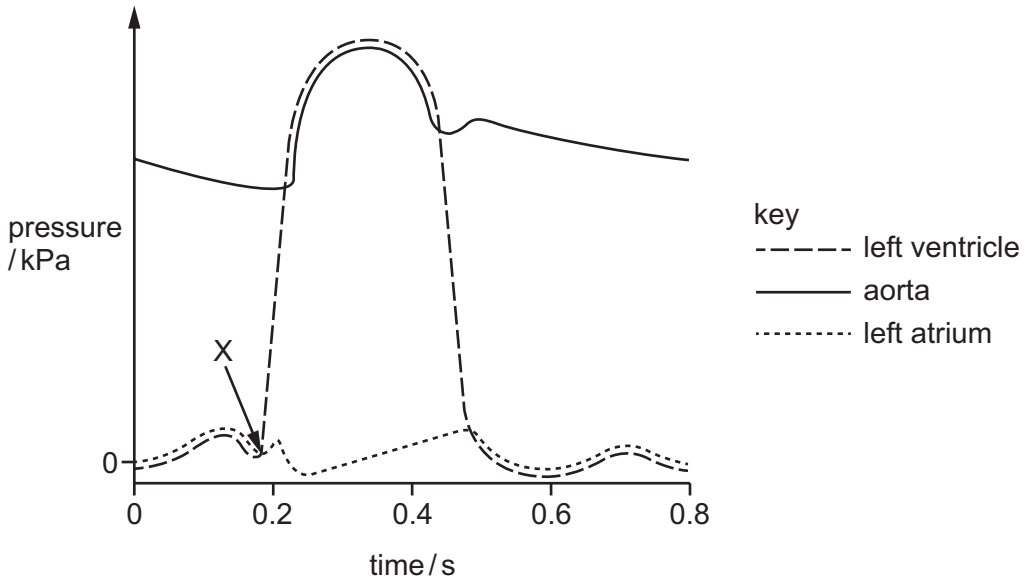
D Water has a high latent heat of vaporisation and this prevents the evaporation of water in the xylem vessel elements.

28 The diagram shows the internal structure of the mammalian heart.

Which letter identifies the location of the atrioventricular node?



29 The diagram shows pressure changes in the left side of the heart during the cardiac cycle.



What happens in the heart at X?

A The atrioventricular valves close.

B The atrioventricular valves open.

C The semilunar valves close.

D The semilunar valves open.

30 Which components of blood are present in tissue fluid?

	phagocytes	some proteins	sodium ions
A	✓	✓	✓
B	✓	✗	✗
C	✗	✓	✓
D	✗	✓	✗

key
✓ = present
✗ = not present

31 In the lungs, movement of dissolved carbon dioxide out of the capillaries occurs in one of two ways:

- by diffusion through the endothelial cells of the capillaries
- by leakage through pores in the endothelial cells of the capillaries.

What is the **minimum** number of times that a carbon dioxide molecule that has been transported to the lungs in a red blood cell must cross a cell surface membrane to reach an air space in an alveolus?

A 2 **B** 3 **C** 4 **D** 5

32 What maintains the steep concentration gradients needed for successful gas exchange in the lungs?

1 Air flow in the alveoli is in the opposite direction to blood flow in the capillaries.

2 Blood arrives in the lungs with a lower oxygen concentration and a higher carbon dioxide concentration than the air in the alveoli.

3 Blood is constantly flowing through and out of the lungs, bringing a fresh supply of red blood cells.

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

33 Where is cartilage tissue always found in the human gas exchange system?

A in the trachea only

B in the bronchi only

C in the bronchioles and trachea

D in the bronchi and trachea

34 Scientists compared the density of goblet cells in the lungs and the density of mucus in the lungs of three groups of people:

- people who do not smoke and do not have lung disease
- people who smoke tobacco but do not have lung disease
- people who smoke tobacco and have lung disease.

The results are shown in the table.

group	goblet cell density / cells per mm^2	mucus density / arbitrary units
non-smokers	19	6
smokers who do not have lung disease	54	26
smokers with lung disease	37	15

What is indicated by these data?

1 There is a positive correlation (relationship) between density of goblet cells and density of mucus.

2 Lung disease results in an increase in goblet cell density.

3 There is an association between tobacco smoking and an increase in mucus density.

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

35 Which disease does *Mycobacterium bovis* cause?

A cholera

B HIV / AIDS

C malaria

D tuberculosis

36 An antibiotic inhibits the formation of cross-links between the molecules that form cell walls in bacteria.

Which statements explain why bacteria are killed by the antibiotic?

1 The bacterial cell is destroyed by osmotic lysis.

2 Cellulose molecules **cannot** form hydrogen bonds.

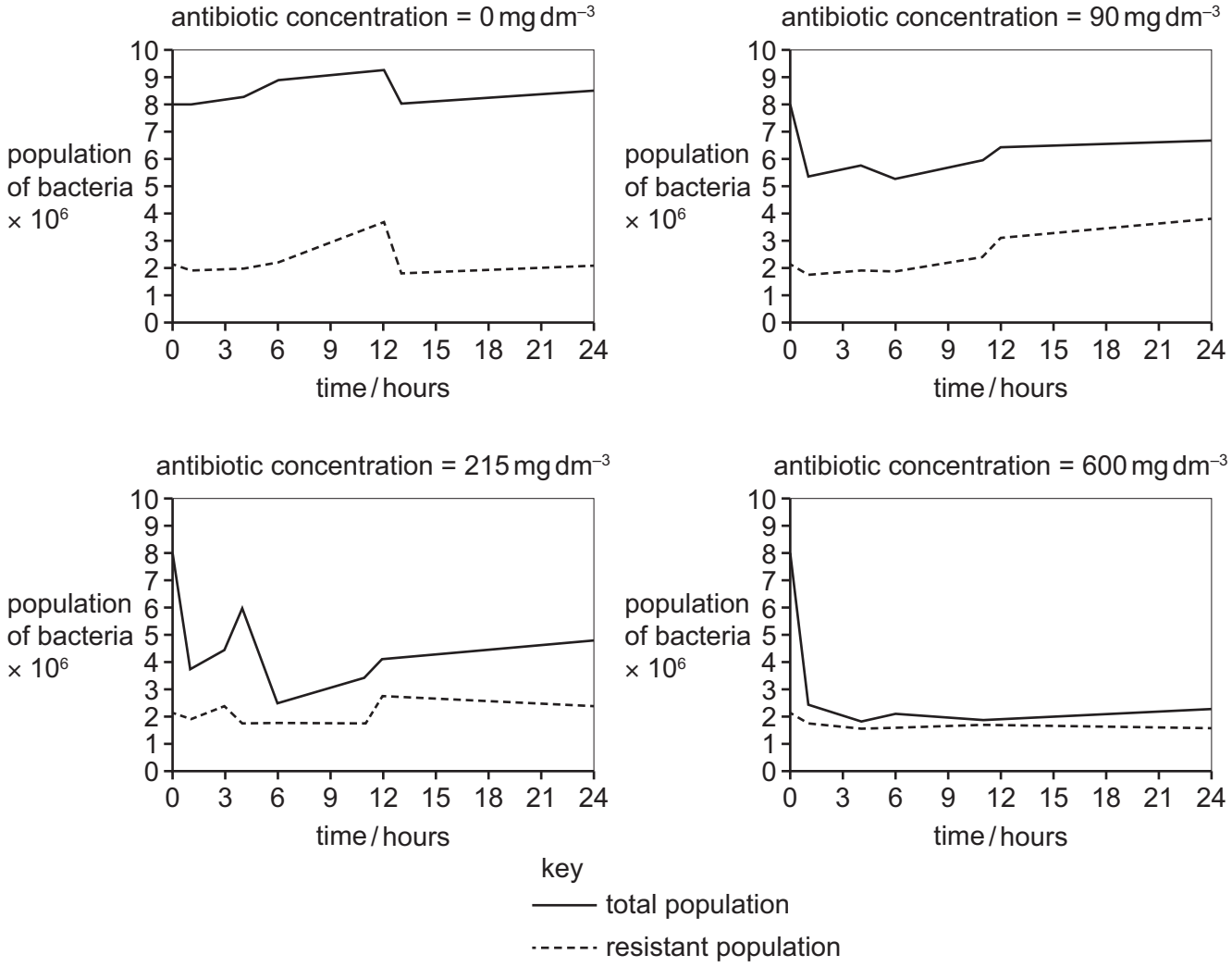
3 The cell wall is no longer partially permeable.

A 1 and 2 only **B** 2 and 3 only **C** 1 only **D** 2 only

37 Scientists investigated the effect of increasing concentrations of an antibiotic on the development of antibiotic resistance in bacteria.

The scientists grew four groups of bacteria and added a different concentration of antibiotic to each group. The number of resistant bacteria and the total population of bacteria were measured at intervals for 24 hours for each group.

The graphs show the results.



Which statements are correct conclusions that can be made from the results of this investigation?

1 Increasing the concentration of antibiotic decreases the population of non-resistant bacteria at the end of 24 hours.

2 The proportion of antibiotic-resistant bacteria increases with increasing concentrations of antibiotics.

3 Increasing the concentration of antibiotic always increases the number of resistant bacteria.

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

38 What is the correct sequence of events in a primary immune response?

A T-lymphocyte activation → B-lymphocyte selection → plasma cell release

B antigen presentation by macrophages → cytokines released by T-helper cells → B-lymphocyte differentiation

C antigen presentation by neutrophils → T-memory cell activation → B-lymphocyte selection

D T-memory cell activation → B-memory cell activation → antibody production

39 Which statement about the properties of the antigen-binding sites in different antibody molecules is correct?

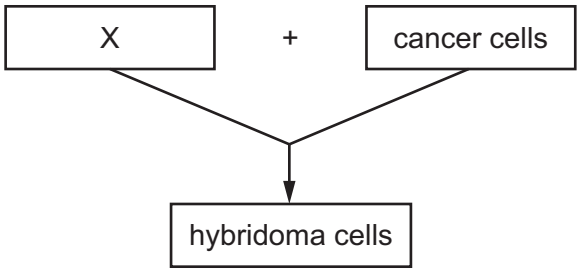
A They are located on the light chains only.

B They have a hinge region to give flexibility for different antigens.

C They have binding sites for receptors on phagocytes.

D They have variable amino acid sequences for different antigens.

40 The diagram shows a stage in monoclonal antibody production.



What is represented by X?

A T-lymphocytes

B B-lymphocytes

C antigens

D antibodies

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of Cambridge Assessment. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which is a department of the University of Cambridge.

© UCLES 2024