Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/12**

Paper 1 Multiple Choice **February/March 2025**

1 hour 15 minutes

You must answer on the multiple choice answer sheet.

0360361920

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 **16** pages.

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1 In an electron micrograph, the length of a mitochondrion is measured as 17.1 cm. The magnification of the electron micrograph is ×38 000.

What is the actual length of the mitochondrion?

A 0.22 μm **B** 0.45 μm **C** 2.22 μm **D** 4.50 μm

2 There is a theory that mitochondria and chloroplasts were originally free-living prokaryotes. It is thought that millions of years ago these free-living prokaryotes were taken into larger cells by endocytosis where, instead of being digested, they became functional organelles.

Which features of mitochondria and chloroplasts support this theory?

1 Mitochondria and chloroplasts are surrounded by double membranes.

2 Mitochondria and chloroplasts have small, circular DNA.

3 Mitochondria and chloroplasts synthesise proteins.

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

3 Which row correctly describes a function of each cell structure?

	lysosome	mitochondrion	smooth endoplasmic reticulum
A	digestion of unwanted structures	abundant in sites of active transport	processing of proteins
B	digestion of unwanted structures	ATP synthesis	lipid production
C	spherical sacs containing hydrolytic enzymes	abundant in sites of active transport	lipid production
D	spherical sacs containing hydrolytic enzymes	ATP synthesis	processing of proteins

4 Which cell components are present in typical prokaryotic cells?

	cell wall	80S ribosomes
A	✓	✓
B	✓	✗
C	✗	✗
D	✗	✓

key

✓ = present

✗ = **not** present

5 X-ray analysis of fossilised cells found in rocks in central India dating back 1.6 billion years has revealed several features.

1 The cells are up to 145 μm long.

2 The cells are joined end to end to form filaments.

3 The cells contain some internal cell structures.

4 The cells are surrounded by a cell wall.

Which two features, when taken together, provide most support for the conclusion that the cells are plant cells?

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

6 The electron micrograph shows an organelle found in some cells of many multicellular organisms.



Which row shows structures that are expected to be present in cells that contain this organelle?

	cell wall	centrioles	plasmodesmata
A	✗	✓	✗
B	✓	✗	✗
C	✗	✓	✓
D	✓	✗	✓

key

✓ = expected to be present

✗ = **not** expected to be present

7 What could take place during a hydrolysis reaction?

1 A glycosidic bond is broken.

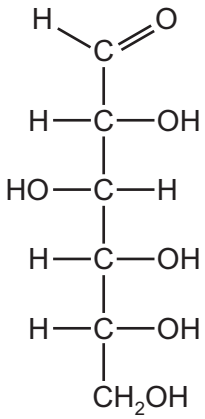
2 A molecule of water is produced.

3 A sucrose molecule is split into fructose and glucose.

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

8 Sugars with a ring structure can also have a linear structure.

Which sugar molecules could be represented by the linear structure shown in the diagram?



A glucose, deoxyribose and ribose

B glucose only

C deoxyribose and ribose only

D deoxyribose only

9 Which statement about triglycerides is correct?

A Each triglyceride molecule is formed by combining three fatty acid molecules with a glycogen molecule.

B A triglyceride molecule contains four ester bonds, each formed in a condensation reaction.

C Triglyceride molecules form a bilayer in the cell surface membranes of cells due to hydrophobic and hydrophilic interactions.

D The ratio of oxygen atoms to carbon atoms is lower for triglyceride molecules than for carbohydrate molecules.

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10 Hydroxyproline is synthesised by addition of an –OH group to the R-group of the amino acid proline.

Hydroxyproline is a major component of collagen and has an important role in increasing the stability of its structure.

Which statement explains why the addition of an –OH group to proline could increase the stability of collagen?

A It strengthens hydrogen bonding between the R-groups of adjacent polypeptide chains, resulting in a tertiary structure that is more resistant to heat denaturation.

B It increases the number of sites available for the formation of hydrogen bonds within the secondary structure of collagen, resulting in more stable alpha helices.

C It increases the formation of hydrogen bonds between R-groups and water molecules, which help to hold the chains of the collagen triple helix together by strengthening hydrophilic interactions.

D It strengthens the quaternary structure of collagen by providing more sites for hydrogen bonding between the R-groups of distantly separated amino acids within the same polypeptide chain.

11 Plant cell walls are strengthened by cellulose molecules that are arranged in several layers. Within each layer, the cellulose molecules are arranged in the same direction (parallel).

Which row shows the bonds that hold adjacent cellulose molecules together within each layer and the arrangement of cellulose molecules in different layers?

	bonds that hold adjacent cellulose molecules together	arrangement of cellulose molecules in different layers
A	glycosidic	in different directions
B	glycosidic	parallel
C	hydrogen	in different directions
D	hydrogen	parallel

12 Galactogen is a storage polysaccharide in some animal species. It is a branched polymer that is formed from β-galactose monomers.

Which comparison of galactogen with another polysaccharide correctly summarises one similarity and one difference?

A Glycogen and galactogen are both branched, but glycogen is **not** a storage polysaccharide in animals.

B Glycogen and galactogen are both storage polysaccharides in animals, but glycogen is unbranched.

C Cellulose and galactogen are both branched, but cellulose is a structural polysaccharide found in plants.

D Amylopectin and galactogen are both storage polysaccharides, but amylopectin is formed from α-glucose monomers.

13 Which levels of protein structure are **always** involved in forming the active site of an enzyme?

	level of protein structure		
	primary	tertiary	quaternary
A	✓	✓	✓
B	✓	✓	✗
C	✗	✓	✓
D	✗	✗	✓

key

✓ = always involved

✗ = **not** always involved

14 Catalase is an enzyme that breaks down hydrogen peroxide into water and oxygen.

Catalase was added to a solution of hydrogen peroxide and the oxygen produced was collected in a gas syringe.

The total volume of oxygen produced from the start of the reaction was recorded every 10 seconds for 1 minute.

The results are shown in the table.

time / s	total volume of oxygen produced / cm^3
0	0
10	22
20	40
30	50
40	55
50	57
60	58

What can be concluded from these results?

A The reaction stopped after 60 seconds and no more oxygen was produced.

B The highest rate of oxygen production occurred 10 seconds after the start of the reaction.

C It took more than 20 seconds from the start of the reaction for half of the substrate to be converted to water and oxygen.

D The mean rate of reaction between 20 and 30 seconds was twice the mean rate of reaction between 30 and 40 seconds.

15 Succinic dehydrogenase is an enzyme that catalyses the conversion of succinate to fumarate in aerobic respiration.

Malonate is a reversible inhibitor of succinic dehydrogenase. Malonate reduces the enzyme's activity by binding to its active site. Malonate and succinate **cannot** bind to the active site at the same time.

Which statement describes the effect of malonate on the activity of succinic dehydrogenase?

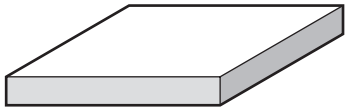
A In the presence of malonate, V_{max} can still be reached if the concentration of succinate is increased.

B Malonate has no effect on the K_m.

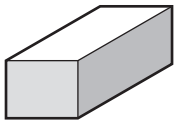
C In the presence of malonate, V_{max} can still be reached if the concentration of fumarate is increased.

D Malonate decreases the K_m.

16 The diagram shows the dimensions of two blocks of agar. The diagram has been drawn to scale.



width	30 mm
length	20 mm
height	4 mm



width	10 mm
length	15 mm
height	8 mm

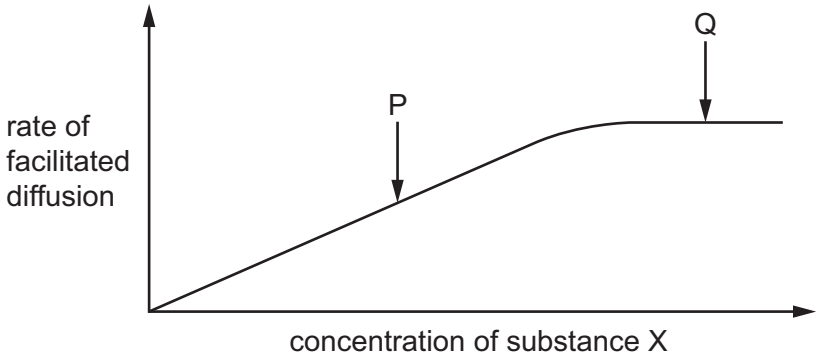
The blocks of agar were stained pink with a pH indicator. In acidic conditions, the pink pH indicator becomes colourless.

The two blocks of agar were placed in a beaker of acid at the same time. As the acid diffused into the blocks, the blocks became colourless.

What is the surface area to volume ratio of the block that became completely colourless first?

A 0.58 : 1 **B** 0.67 : 1 **C** 1.50 : 1 **D** 1.71 : 1

17 The graph shows how the rate of facilitated diffusion of substance X across a cell surface membrane changed as the concentration of substance X increased. All conditions, except for the concentration of substance X, were kept constant. Temperature was maintained at 15 °C.



Which statement about the rate of facilitated diffusion is correct?

A The rate of facilitated diffusion of substance X at Q will increase if the temperature is increased to 20 °C.

B The rate of facilitated diffusion of substance X at P will increase if the concentration of ATP is increased.

C The rate of facilitated diffusion of substance X at Q will increase if the concentration of substance X is increased.

D The rate of facilitated diffusion of substance X at P will increase if the length of time over which the rate is measured is increased.

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18 Which molecule forms a bilayer in the cell surface membrane of a bacterial cell?

A fatty acid

B peptidoglycan

C phospholipid

D cholesterol

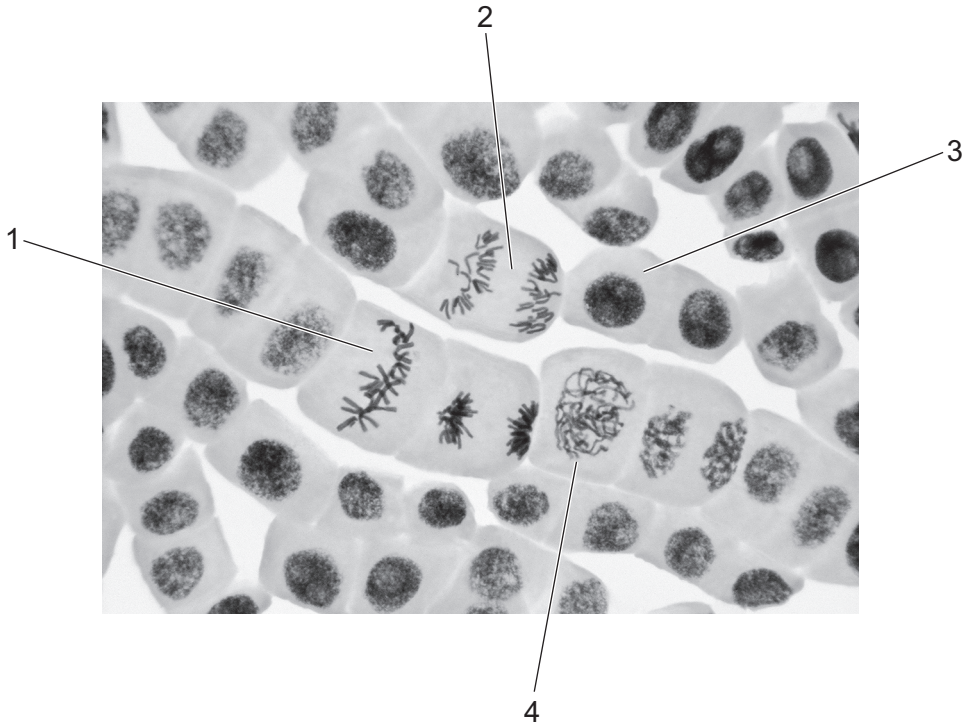
19 A nucleus in a body cell of a species of fruit fly has 8 chromosomes.

How many strands of DNA are present in the nucleus at the end of interphase?

A 8 **B** 16 **C** 32 **D** 64

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20 The photomicrograph shows plant cells in different stages of the mitotic cell cycle. Four of the cells are labelled with a number to identify them.



One of the numbered cells is within the main stage of mitosis in which the spindle begins to form.

A second numbered cell is within the main stage of mitosis in which the spindle fibres shorten.

Which row correctly identifies the two cells that are in these stages of mitosis?

	stage in which spindle begins to form	stage in which spindle fibres shorten
A	1	2
B	2	1
C	3	1
D	4	2

21 Which percentage of the chromosomal DNA present in a cell during G_1 is present in the same cell later in the same mitotic cell cycle during prophase and during telophase?

	prophase	telophase
A	50%	25%
B	50%	50%
C	100%	50%
D	100%	100%

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22 The statements are about two genes and their protein products that can have a role in tumour formation.

- The protein coded for by the *PTEN* gene prevents cells from growing and dividing too rapidly.
- The protein coded for by the *p53* gene prevents cells progressing through the mitotic cell cycle if the cells have damaged DNA.

Which combination of mutations of these two genes in an individual is most likely to result in the formation of a tumour?

	gene	
	PTEN	*p53*
A	mutation present	mutation present
B	no mutation	mutation present
C	mutation present	no mutation
D	no mutation	no mutation

23 Telomerase is an enzyme that prevents the shortening of telomeres. It is **not** present in most normal cells, but is active in an estimated 85% to 95% of human tumour cells.

Which statement explains the effect of telomerase on human tumour cells?

A Telomerase triggers a self-destruct process, known as apoptosis, ending the life of the cell.

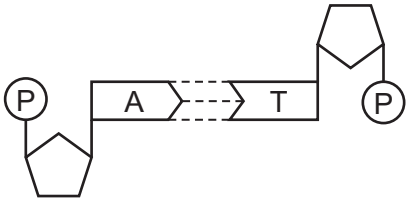
B Telomerase damages the chromosomes so they become genetically unstable and are unable to replicate and divide.

C Telomerase helps human tumour cells avoid senescence, or cell death, which is usually the expected consequence of repeated cell division.

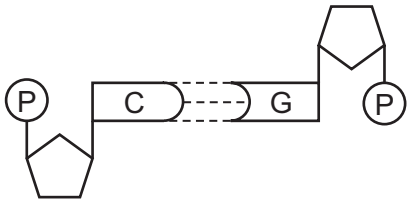
D Telomerase enables the human tumour cells to divide more rapidly by reducing the time taken for a complete mitotic cell cycle.

24 Which diagram correctly represents one of the base pairs of DNA?

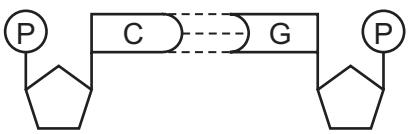
A



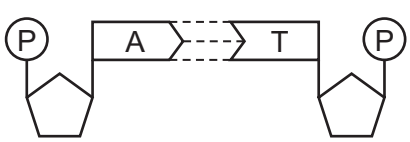
B



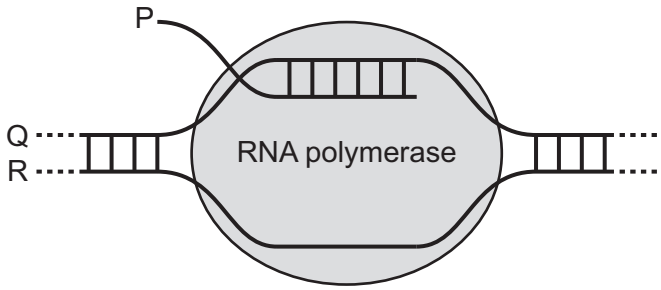
C



D



25 The diagram represents the process of transcription of a gene in the nucleus of an animal cell.



Which row correctly identifies P, Q and R?

	P	Q	R
A	mRNA	transcribed strand	template strand
B	primary transcript	transcribed strand	template strand
C	mRNA	template strand	non-transcribed strand
D	primary transcript	template strand	non-transcribed strand

26 Which row correctly describes the role of growing leaves as sources or sinks for amino acids and sucrose?

	amino acids	sucrose
A	leaves act as sinks only	leaves can act as sources or sinks
B	leaves act as sinks only	leaves act as sources only
C	leaves can act as sources or sinks	leaves act as sources only
D	leaves can act as sources or sinks	leaves can act as sources or sinks

27 Which row correctly matches each description to cilia or root hairs?

	contain vacuoles	more than one present per cell
A	root hairs	root hairs
B	cilia	cilia
C	root hairs	cilia
D	cilia	root hairs

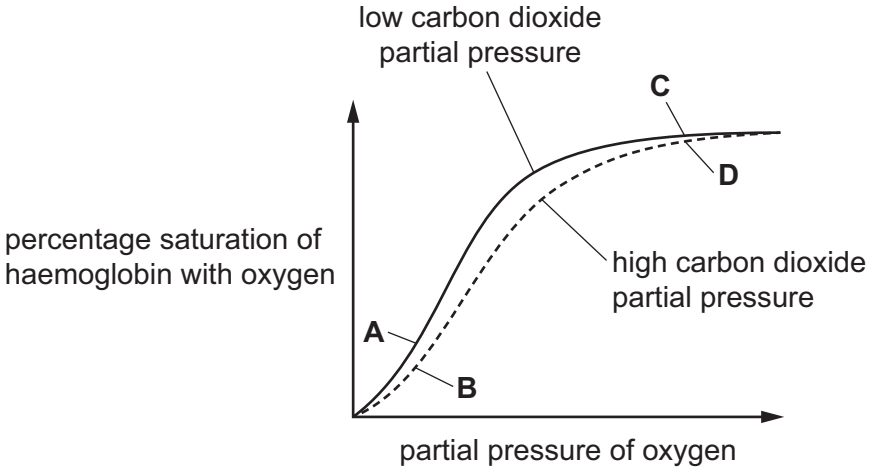
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28 Which changes occur as amino acids are moved into phloem sieve tubes at a source?

	change in water potential in phloem sieve tubes	change in volume of sap in phloem sieve tubes
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

29 The graph shows the dissociation curves for haemoglobin at two different partial pressures of carbon dioxide.

Which labelled point on the oxygen dissociation curves will result in the highest concentration of haemoglobinic acid?



30 Which statements about the transport of carbon dioxide in the blood are correct?

1 Carbonic anhydrase catalyses the reaction of carbon dioxide and water to form carbonic acid.

2 Carbonic acid dissociates into hydrogen ions and hydrogencarbonate ions.

3 Some carbon dioxide combines with haemoglobin to form carbaminohaemoglobin.

4 Haemoglobin readily combines with hydrogencarbonate ions to form haemoglobinic acid.

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

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31 What happens as a result of the blood pressure in the left ventricle becoming higher than the blood pressure in the left atrium?

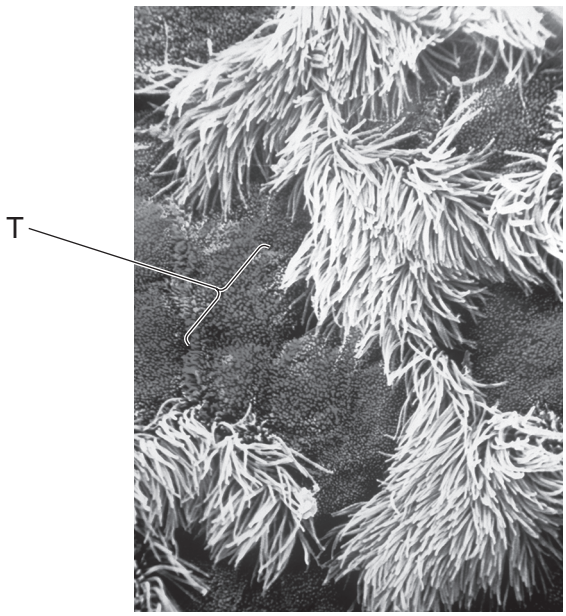
A The left atrioventricular valve closes.

B The left atrioventricular valve opens.

C The semilunar valve in the aorta closes.

D The semilunar valve in the aorta opens.

32 The scanning electron micrograph shows the inner surface of a human trachea.



What is the identity of the part of the electron micrograph labelled T?

A ciliated epithelial cell

B goblet cell

C mucus

D squamous epithelial cell

33 Which rows correctly summarise the typical distribution of cartilage and smooth muscle within different parts of the gas exchange system of humans?

		cartilage	smooth muscle
1	bronchi	✓	✓
2	bronchioles	✗	✗
3	trachea	✓	✓

key

✓ = present

✗ = **not** present

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

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34 A molecule of oxygen diffuses from the air in an alveolus to haemoglobin in a red blood cell.

Assuming that the molecule crosses cellular layers by passing through cells, rather than between cells, what is the minimum number of phospholipid layers that the molecule of oxygen must pass through?

A 5 **B** 6 **C** 8 **D** 10

35 Which row shows the type of pathogen that causes cholera and its mode of transmission?

	pathogen	mode of transmission
A	protoctist	contaminated food or water
B	protoctist	airborne droplets
C	bacterium	contaminated food or water
D	bacterium	airborne droplets

36 Which statement about tuberculosis (TB) is **not** correct?

A TB can be controlled by vaccination.

B TB is caused by a virus spread by droplet infection.

C HIV/AIDS increases the risk of developing TB.

D TB may be transmitted by eating contaminated meat.

37 More cases of malaria are being reported in Europe. Other diseases, formerly confined to tropical countries and transmitted in the same way as malaria, have also spread to parts of Europe. Tropical countries have higher mean temperatures and humidity than Europe.

What could explain the increase in the number of cases of these diseases in Europe?

1 rising temperatures and humidity in Europe as a result of climate change

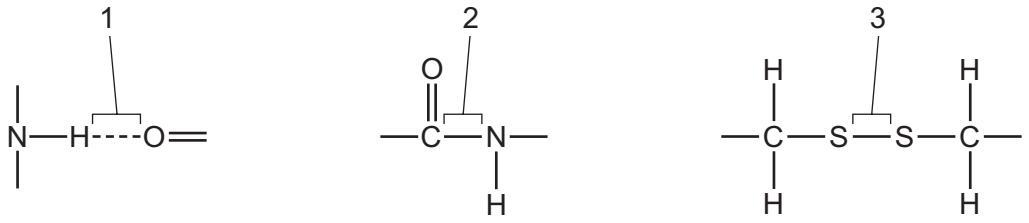
2 increased travel between Europe and tropical countries

3 creation of wetland areas such as marshes to increase biodiversity

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

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38 The diagrams show three different bonds.



Which bonds are found in an antibody molecule?

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

39 Specific monoclonal antibodies can be used to treat some forms of cancer. One example is trastuzumab, which can be used in the treatment of tumours caused by cancer.

Which statements could help to explain why monoclonal antibodies such as trastuzumab are suitable for this role?

1 The variable regions of monoclonal antibodies such as trastuzumab can change, allowing the antibodies to bind to cancer cells even if their antigens mutate.

2 Monoclonal antibodies such as trastuzumab bind to specific cell surface receptors on cancer cells, which prevents these receptors from receiving signals that are needed for cancer cells to grow and divide.

3 The antigen-binding sites of monoclonal antibodies such as trastuzumab are complementary to antigens found on some cancer cells, and have stable tertiary structures that do **not** change.

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

40 The HIV virus causes illness by infecting and destroying T-helper cells. This leads to AIDS and an inability to produce an effective immune response.

Which components of the immune system are produced less effectively when AIDS develops?

1 memory cells

2 plasma cells

3 antibodies

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

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