Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/13**

Paper 1 Multiple Choice **October/November 2018**

1 hour

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

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READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.
DO **NOT** WRITE IN ANY BARCODES.

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 separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
Electronic calculators may be used.

This document consists of **18** printed pages and **2** blank pages.

1 Which statement explains why it is necessary to use an electron microscope to see the cristae of a mitochondrion?

A The magnification of the electron microscope is greater than that of the light microscope.

B The membranes of the cristae are separated by a distance greater than 200 nm.

C The resolution of a student microscope using daylight is too low.

D The wavelength of an electron beam is longer than the wavelength of light.

2 A prokaryotic cell which is 0.25 μm in diameter, is magnified 50 000 times on an electron micrograph.

How big will its diameter be in the electron micrograph?

A 1.25×10^{-1} mm

B 1.25×10^{0} mm

C 1.25×10^{1} mm

D 1.25×10^{2} mm

3 When making measurements in experiments, which methods could have parallax errors?

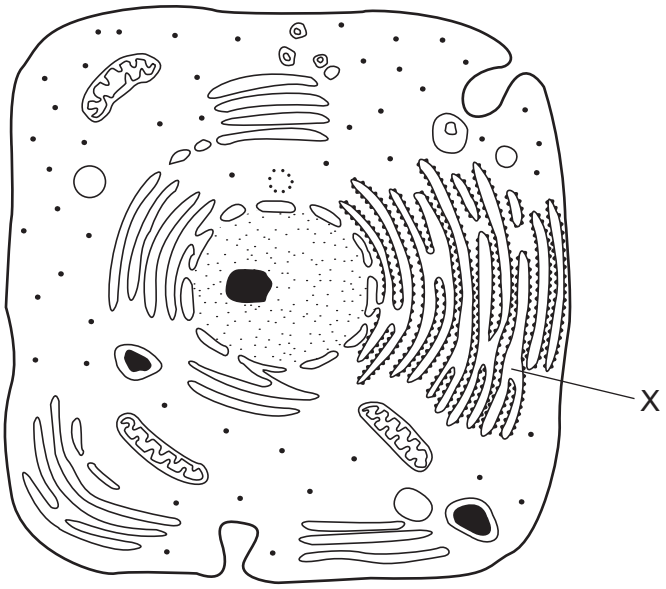
1 using a calibrated eyepiece graticule to measure length

2 using a measuring cylinder to measure volume

3 using a ruler to measure length of a shoot

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

4 The diagram is a drawing from an electron micrograph of a typical animal cell.



What is the function of the membrane system labelled X?

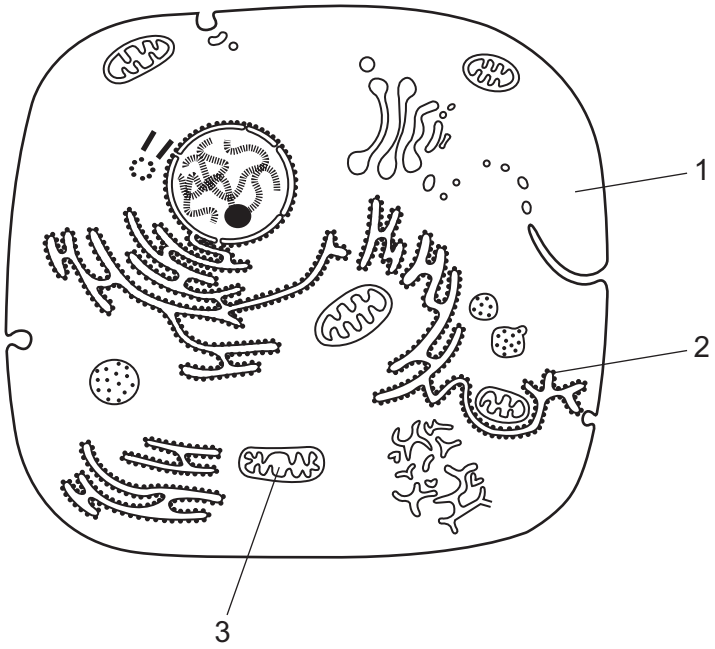
A lipid synthesis only

B protein synthesis and transport

C protein synthesis only

D protein transport only

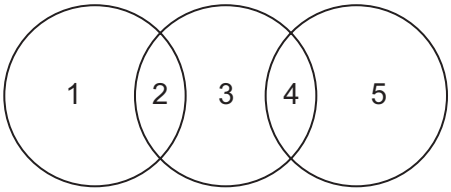
5 The diagram is a drawing from an electron micrograph of a typical animal cell.



Where would nucleic acid be found?

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

6 The diagram shows some similarities between chloroplasts, mitochondria and typical prokaryotes.



Which row is correct?

	1	2	3	4	5
A	chloroplasts	circular DNA	mitochondria	linear DNA	prokaryotes
B	mitochondria	70S ribosomes	chloroplasts	linear DNA	prokaryotes
C	mitochondria	linear DNA	chloroplasts	70S ribosomes	prokaryotes
D	prokaryotes	70S ribosomes	mitochondria	70S ribosomes	chloroplasts

7 A student carried out tests on the same volume of four different solutions to investigate the presence of protein, starch and reducing sugar in each.

The results are shown in the table.

solution	Benedict's solution	biuret reagent	iodine solution
1	blue	purple	yellow
2	orange	pale purple	blue-black
3	orange	purple	yellow
4	red	pale blue	yellow

Which conclusion can be drawn from these results?

A Solution 1 has a lower protein and lower reducing sugar content than solution 2.

B Solution 2 has less starch compared to solutions 1, 3 and 4.

C Solution 3 has the most protein and the least starch.

D Solution 4 has a high reducing sugar content and no starch.

8 Which words correctly complete the description of amylose?

The ……1…… amylose is a ……2…… made up of ……3…… of the ……4…… glucose.

	1	2	3	4
A	macromolecule	monomer	polymers	disaccharide
B	macromolecule	monomer	polymers	monosaccharide
C	polysaccharide	polymer	monomers	disaccharide
D	polysaccharide	polymer	monomers	monosaccharide

9 Which statements about glycosidic bonds are correct?

1 They occur by condensation reactions between the OH groups of two molecules.

2 They occur only between glucose molecules.

3 The bonds can only be formed between carbon 1 and carbon 4 or carbon 1 and carbon 6 of adjacent molecules.

4 Hydrolysis of the bonds releases energy.

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

10 What is the general formula for glycogen?

A $(C_5H_{10}O_5)_n$ **B** $(C_5H_{10}O_6)_n$ **C** $(C_6H_{10}O_5)_n$ **D** $(C_6H_{12}O_6)_n$

11 Which statements are correct?

1 In a triglyceride molecule the bonds between the fatty acids and the glycerol molecule are called ester bonds.

2 Triglycerides are formed by a condensation reaction between the hydroxyl group of a fatty acid molecule and one of the carboxyl groups of the glycerol molecule.

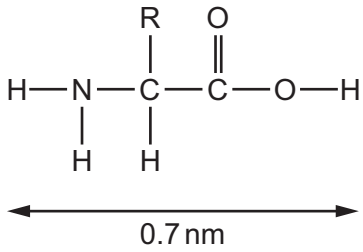
3 Triglycerides are insoluble in water because the fatty acid carbon chain is non-polar.

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

12 The table shows the diameter of some atoms when they form bonds.

atom	single bond / nm	double bond / nm
H	0.060	–
O	0.132	0.110
N	0.140	0.120
C	0.154	0.134

The approximate length of the amino acid shown was estimated using the figures in the table.



What would be the approximate length of a dipeptide formed using this amino acid?

A 0.9 nm **B** 1.2 nm **C** 1.4 nm **D** 1.7 nm

13 Which statement about the typical modes of action of a competitive inhibitor and a non-competitive inhibitor is correct?

A Competitive inhibitors can bind to alternative (allosteric) sites of an enzyme, non-competitive inhibitors have an irreversible effect on the enzyme.

B Competitive inhibitors have exactly the same shape as the substrate, non-competitive inhibitors can have any shape.

C Competitive inhibitors may be used to regulate enzyme activity, non-competitive inhibitors have no functions in enzyme regulation.

D Competitive inhibitors will not alter V_{max}, non-competitive inhibitors will reduce V_{max}.

14 Some animals produce antimicrobial proteins which protect them from pathogens. These proteins could be used to kill human pathogens, however when used as a medicine they are broken down by protein-digesting enzymes.

Replacing one of the amino acids found in the protein with one that had been synthesised in the laboratory resulted in a modified protein that was not broken down.

What could explain why this modified protein was not broken down by the protein digesting enzymes?

1 The modified protein has a different tertiary structure to the original protein.

2 The modified protein is not complementary in shape to the enzyme's active site.

3 The modified protein is unable to induce a fit with the protein digesting enzyme.

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

15 An investigation was carried out on the effect of temperature on an enzyme-catalysed reaction.

The enzyme and its substrate were initially placed into separate test-tubes and raised to the temperature required. They were then mixed and placed into four tubes **A**, **B**, **C** and **D**.

These tubes were incubated for the time and at the temperature stated. The mass of the product formed was then measured.

In which tube was the rate of reaction highest?

	incubation time / s	incubation temperature / °C	mass of product / μg
A	30	25	2.5
B	30	45	5.0
C	600	25	32.0
D	600	45	10.0

16 In an experiment the proteins in the cell surface membrane of a living cell were labelled with a fluorescent dye.

A small area of the membrane was observed using a microscope. A laser was then used to permanently destroy the fluorescence of the dye molecules in this field of view.

The fluorescence in this field of view was later seen to return.

What does this experiment show?

A Proteins are found only on the outer surface of cell surface membranes.

B Proteins in the outer layer of a bilayer do not penetrate into the inner layer.

C Proteins move freely in the phospholipids of a bilayer.

D The cell surface membrane of the cell is a bilayer.

17 In plants adapted to cold conditions, their cell surface membranes change as the weather gets colder, allowing the plants to carry out exocytosis.

Which change occurs in their cell surface membranes?

A a decrease in the ratio of proteins to saturated phospholipids

B a decrease in the ratio of unsaturated phospholipids to saturated phospholipids

C an increase in the ratio of proteins to unsaturated phospholipids

D an increase in the ratio of unsaturated phospholipids to saturated phospholipids

18 Which statement describes endocytosis?

A movement across a membrane against the concentration gradient and requiring energy

B movement across a membrane down the concentration gradient using a carrier molecule

C movement across a membrane into a cell using a vesicle and requiring energy

D movement across a membrane using a vesicle and requiring no energy

19 An indicator is colourless in acid and pink in alkali.

In an experiment a petri dish of agar was prepared using an acidic solution of this indicator.

A disc of agar 1 cm in diameter was removed from the centre to create a well.

A white card showing circular marker lines 1 cm apart was placed underneath the petri dish.

1 cm^3 alkali solution was put into the well in the agar and a stop-watch was started.

A circular disc of pink colour appeared and spread through the agar. It reached the first marker line in a short time but took longer to reach the second marker line and a very long time to reach the third marker line.

What explains these observations?

A facilitated diffusion of alkali solution

B facilitated diffusion of the indicator

C simple diffusion of alkali solution

D simple diffusion of the indicator

20 How many copies of each DNA molecule will be found in a cell at each stage of the mitotic cell cycle?

	G_2 of interphase	metaphase	cytokinesis
A	1	1	1
B	1	2	2
C	2	1	1
D	2	2	2

21 Centromere, chromatids and telomeres are parts of a chromosome in a eukaryotic cell.

Which row correctly describes these structures?

	centromere	chromatid	telomere
A	binds the two sister chromatids of a chromosome together	contains histone proteins and a molecule of double-stranded DNA	protects the tips of each chromatid from shortening at each mitotic division
B	site of attachment of spindle microtubules	contains histone proteins and a molecule of single-stranded DNA	prevents the genes nearest the ends of each chromatid from being lost
C	site of production of spindle microtubules	contains a molecule of double-stranded DNA with no associated histone proteins	contains DNA with many repeats of short base sequences
D	splits at metaphase of mitosis	contains a molecule of single-stranded DNA with no associated histone proteins	ensures that when DNA is replicated, the ends of the molecule are included

22 Which bases found in nucleic acids are purines?

A adenine and cytosine

B guanine and adenine

C thymine and cytosine

D uracil and guanine

23 A length of double-stranded DNA contains 120 nucleotides and codes for a section of a polypeptide.

What is the maximum length of this section of a polypeptide?

A 20 amino acids

B 40 amino acids

C 60 amino acids

D 120 amino acids

24 Four students were asked to suggest a set of four labels to add to a plan diagram of a transverse section of a dicotyledonous leaf.

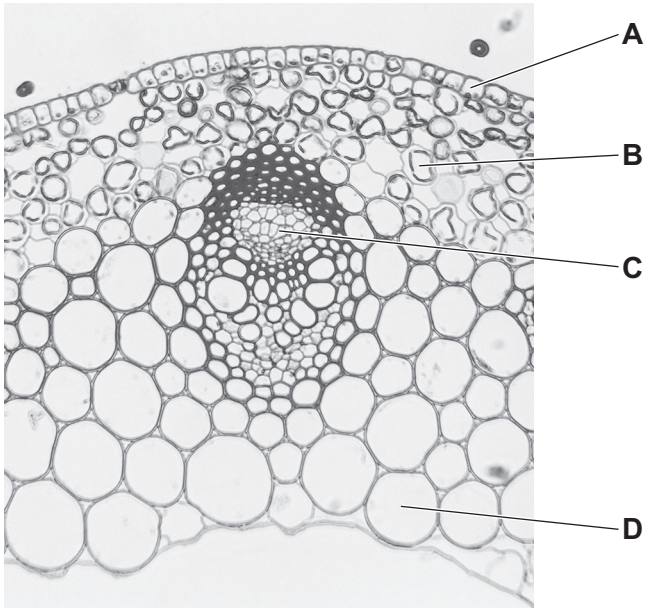
Which student suggested a correct set of labels?

	label 1	label 2	label 3	label 4
A	lower epidermis	phloem	spongy mesophyll	palisade mesophyll
B	phloem sieve tubes	upper epidermis	spongy mesophyll	xylem vessel elements
C	spongy mesophyll	endodermis	xylem vessel elements	palisade mesophyll
D	waxy cuticle	xylem	companion cells	spongy mesophyll

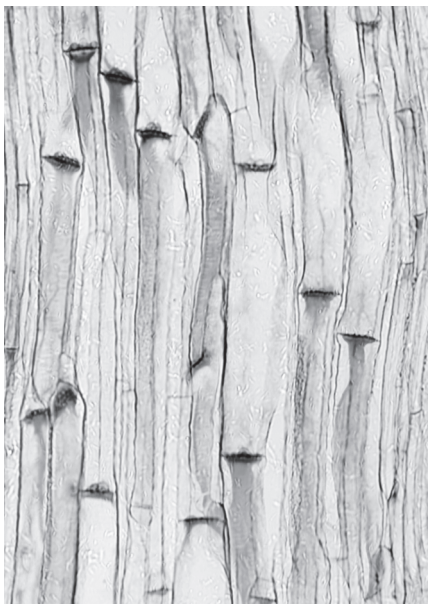
25 Photomicrograph X shows a transverse section through a typical stem. Photomicrograph Y shows a longitudinal section through one type of cell shown in photomicrograph X.

Which letter represents the cells from photomicrograph Y?

photomicrograph X



photomicrograph Y



26 By which process would water rise up through xylem vessels in a plant root when the shoot has been removed?

A capillarity, root pressure and transpiration pull

B capillarity and root pressure only

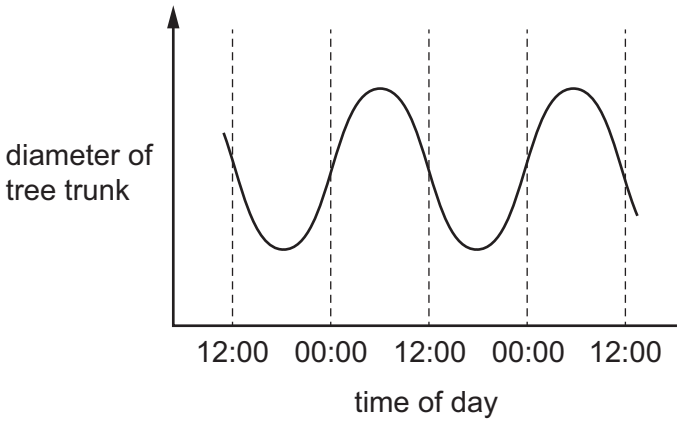
C capillarity and transpiration pull only

D root pressure only

27 Which changes occur to the water potential and the volume of liquid in the phloem sieve tube element when carbohydrate is moved into a sink?

	water potential of the sieve tube element	volume of liquid of the sieve tube element
A	lowers	decreases
B	lowers	increases
C	raises	decreases
D	raises	increases

28 The graph shows the diameter of a tree trunk over time.



Which statement explains these changes?

A Cohesive tension forces increased during the day.

B Columns of water break up during the day.

C Mass flow of sucrose decreased during the day.

D Root pressure increased during the day.

29 What is found in **all** blood vessels, lymph and tissue fluid?

1 carbon dioxide

2 glucose

3 white blood cells

4 antibodies

A 1, 2, 3 and 4

B 1, 2 and 3 only

C 1, 3 and 4 only

D 2 and 4 only

30 Which reactions will be taking place in blood that is passing through active tissues?

1 $HbO_8 \rightarrow Hb + 4O_2$

2 $HbO_8 + H^+ \rightarrow HHb + 4O_2$

3 $HCO_3^- + H^+ \rightarrow H_2CO_3$

4 $H_2O + CO_2 \rightarrow H_2CO_3$

A 1, 2, 3 and 4

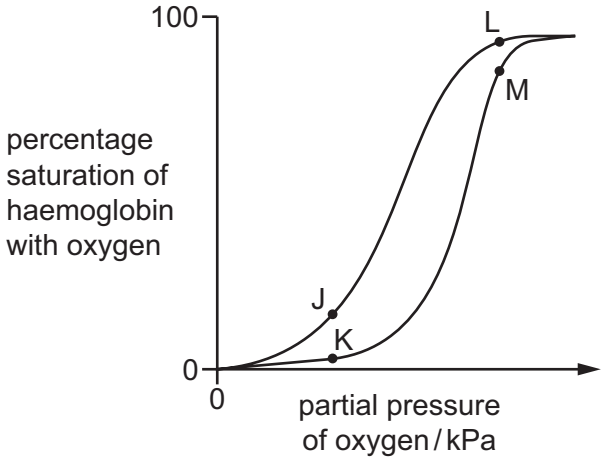
B 1, 2 and 4 only

C 1, 3 and 4 only

D 2 and 3 only

31 The graph shows the percentage saturation of haemoglobin with oxygen at a range of partial pressures of oxygen and at two partial pressures of carbon dioxide.

One curve is at the partial pressure of carbon dioxide in the lungs and the other curve at the partial pressure of carbon dioxide in the liver.



Which points on the curves correspond to the percentage saturation of haemoglobin at the lungs and at the liver?

A L and J **B** L and K **C** M and J **D** M and K

32 A person moves from sea level to live at a high altitude.

After three months living at high altitude, which change would be found in this person when at rest?

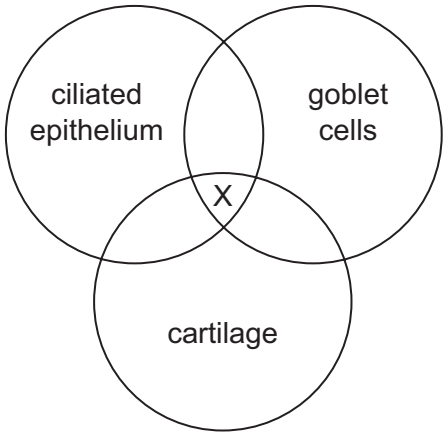
A increased volume of blood per heartbeat

B increased breathing rate

C increased heart rate

D increased mass of red blood cells

33 The diagram shows three of the features found in tissues of the gas exchange system.



Which structures of the gas exchange system could be represented at position X in the diagram?

1 bronchiole

2 trachea

3 bronchus

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

34 Chronic obstructive pulmonary disease (COPD) includes bronchitis and emphysema.

Which row shows the effects of bronchitis?

	T-helper cells	bronchioles	infection
A	destroyed	inflamed	absent
B	destroyed	narrowed	present
C	increased	scarred	present
D	increased	stiffened	absent

35 Which factors affect the distribution of the disease malaria?

1 draining swamps

2 vaccination

3 antibiotics

4 migration of people due to conflict

5 climate

A 1, 2 and 4 **B** 1, 4 and 5 **C** 2, 3 and 5 **D** 3, 4 and 5

36 Which diseases **cannot** be treated with antibiotics?

1 cholera

2 HIV/AIDS

3 measles

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

37 A West African country introduced a measles vaccination during a measles epidemic.

Later, it was realised that vaccinated children were more likely to survive childhood than unvaccinated children, even when there were no measles epidemics.

The vaccine had given the children some protection against other pathogenic infections.

Which statement could account for this extra protection?

A B-lymphocytes produced memory cells which gave the children passive immunity to these infections.

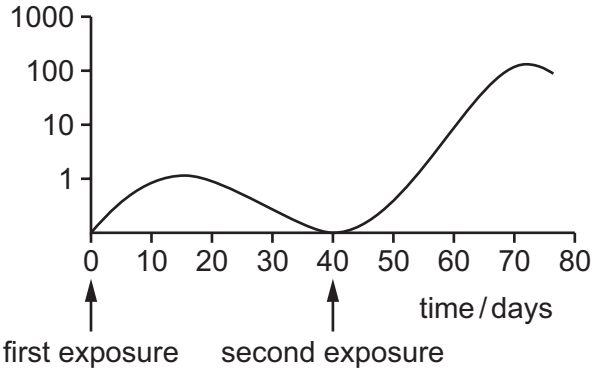
B Memory cells produced plasma cells which secreted anti-measles antibodies that bound to antigens that closely resembled measles antigens.

C Memory cells produced plasma cells which secreted anti-measles antibodies that bound to any antigen.

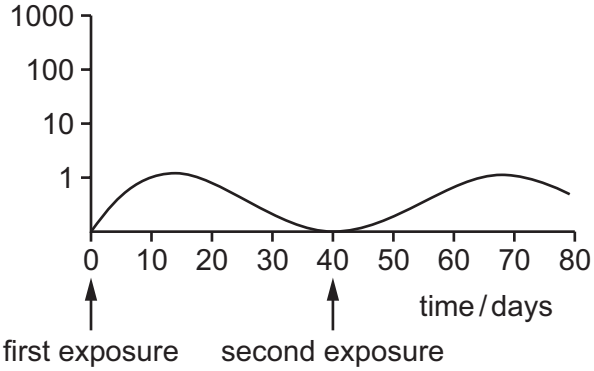
D T-lymphocytes produced memory cells which gave the children natural immunity against these other infections.

38 Which graph shows the changes in antibody concentration following a second exposure to the same infection?

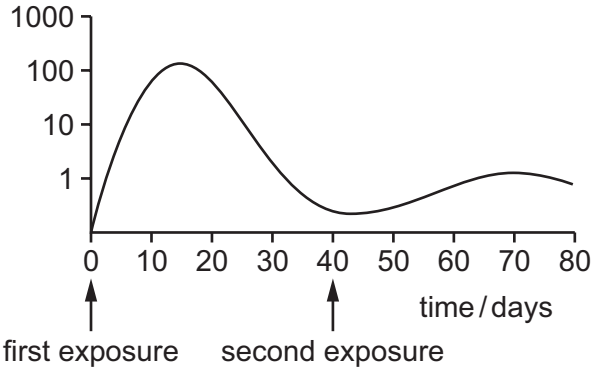
A



B



C



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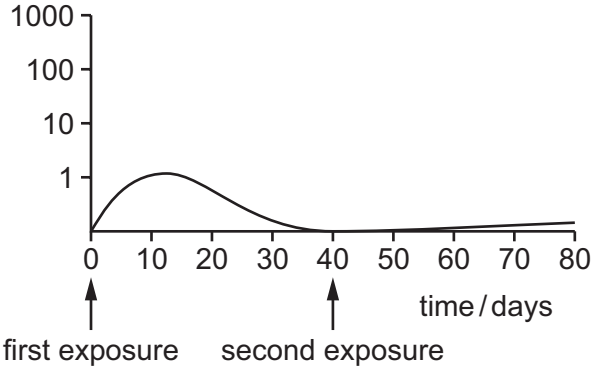

[Turn over

39 Where are antigens found?

	on surface of pathogen	in blood plasma
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

key

✓ = antigens found

✗ = antigens not found

40 Whooping cough is a highly infectious disease of the gas exchange system, caused by the bacterium *Bordetella pertussis*.

Which method provides protection to infants against whooping cough and reduces the chance of developing this disease later in life?

A a short course of more than one type of antibiotic

B a six month course of one type of antibiotic

C injections of antibody specific to *Bordetella pertussis*

D injections of dead *Bordetella pertussis* bacteria

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