Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/13**

Paper 1 Multiple Choice **October/November 2021**

1 hour

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.

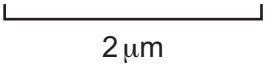
INFORMATION

- 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.

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1 A student was asked to use the scale bar shown to calculate the magnification of a cell on a photomicrograph.



Which method could the student use to calculate the magnification of the cell?

A divide the diameter of the cell by the length of the scale bar, with both measured in the same units of length

B measure the diameter of the cell in millimetres, multiply by 2000 and divide by the length of the scale bar measured in millimetres

C measure the length of the scale bar in millimetres, convert to micrometres and divide by 2

D measure the length of the scale bar in millimetres, convert to micrometres and multiply by 2

2 Which statements about light microscopy are always correct?

1 The greater the resolution of a light microscope, the greater the detail that can be seen.

2 The greater the magnification of a light microscope, the greater the detail that can be seen.

3 Increasing the magnification of a light microscope up to its limit of resolution allows more detail to be seen.

4 The shorter the wavelength of light used in a light microscope, the greater the detail that can be seen.

A 1, 2, 3 and 4

B 1, 3 and 4 only

C 1 and 2 only

D 4 only

3 What is the length of a typical prokaryote, such as the bacterium *Escherichia coli*?

A 1.5×10^{1} nm

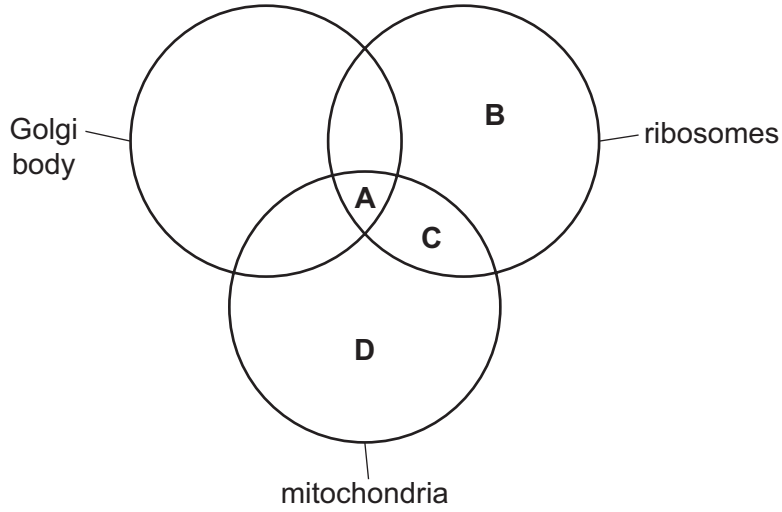
B 1.5×10^{2} nm

C 1.5×10^{0} μm

D 1.5×10^{1} μm

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4 Which cell structures are present in *Plasmodium*?



5 Which cell structures may contain nucleic acid?

1 cytoplasm

2 chloroplast

3 ribosome

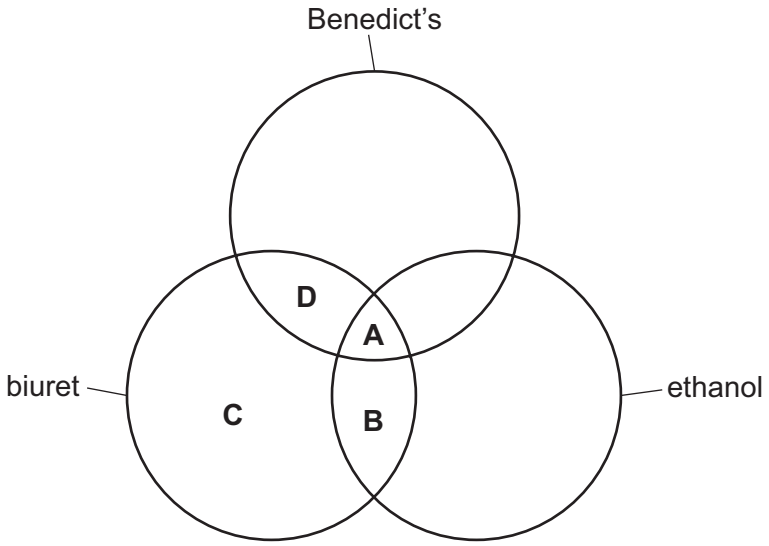
4 Golgi body

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

6 Which row shows correct features of ATP?

	carbohydrate in ATP	site of production of ATP
A	deoxyribose	mitochondria and chloroplasts
B	pentose	mitochondria and chloroplasts
C	hexose	chloroplasts only
D	ribose	mitochondria only

7 Which tests will identify biological molecules that contain monomers with a carboxyl group?



8 Which polysaccharide is correctly described?

	polysaccharide	monomer	biological role
A	amylopectin	β-glucose	storage molecule in animals
B	amylose	α-glucose	storage molecule in plants
C	cellulose	α-glucose	structural molecule in plants
D	glycogen	β-glucose	structural molecule in animals

9 Which formula represents a saturated fatty acid?

A $C_{18}H_{36}O_2$ **B** $C_{18}H_{34}O_2$ **C** $C_{18}H_{32}O_2$ **D** $C_{18}H_{30}O_2$

10 Which molecules always contain at least four double bonds?

A triglyceride, collagen and haemoglobin

B collagen and triglyceride only

C haemoglobin and collagen only

D triglyceride and haemoglobin only

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11 Which row about the structure of proteins is correct?

	primary structure	secondary structure	tertiary structure
A	the number of amino acids present in a protein	the left-handed spiral formed by the primary structure	the result of cross-bonding between specific amino acids in the primary structure
B	the order of amino acids present in a protein encoded by DNA	the coiling of a chain of amino acids to form a β-pleated sheet	the shape formed by folding of a polypeptide and held together by hydrogen bonds
C	the result of translation of an mRNA molecule by a ribosome into a chain of amino acids	occurs because of attraction between hydrogen and oxygen atoms in the side chains	the result of ionic and hydrogen bonds, disulfide bridges and hydrophobic interactions between amino acids
D	the sequence of amino acids in a protein coded by an mRNA molecule	formed by hydrogen bonding between amino acids forming the primary structure	formed as a result of interaction of the side chains of amino acids in the primary structure

12 Which statement about collagen is correct?

A A collagen fibre is made of three parallel helices with hydrogen bonds holding them in place.

B It is an insoluble fibrous protein with a quaternary structure.

C One-third of the amino acids making up collagen are valine.

D Collagen fibres are formed from several collagen molecules held together by ionic bonds.

13 Which properties of water are the result of hydrogen bonding between water molecules?

1 solvent action

2 specific heat capacity

3 latent heat of vapourisation

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

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14 Which descriptions about all enzymes are correct?

1 catalyse the breakdown of large molecules into smaller molecules

2 only function inside cells

3 form temporary bonds with the substrate

4 have a tertiary structure

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

15 The cells in the roots of beetroot plants contain a red pigment.

When pieces of root tissue are soaked in cold water, some of the red pigment leaks out of the cells into the water.

An experiment was carried out to investigate the effect of temperature on the loss of red pigment from the root cells. It was found that the higher the temperature of the water, the higher the rate of loss of red pigment from the root cells.

Which statements could explain this trend?

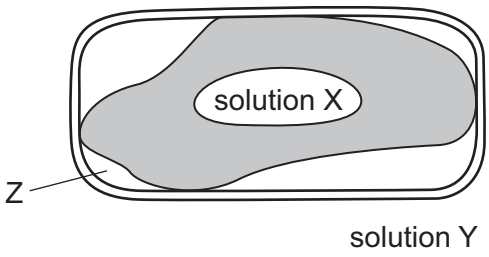
1 Enzymes in the cells denature as the temperature increases, so the pigment can no longer be used for reactions inside the cells and diffuses out.

2 As the temperature increases, the tertiary structure of protein molecules in the cell surface membrane changes, increasing the permeability of the membrane.

3 Phospholipid molecules gain kinetic energy as the temperature rises, increasing the fluidity of the phospholipid bilayer and allowing pigment molecules to diffuse out more easily.

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

16 The diagram shows a partially plasmolysed plant cell.



What is found at Z?

A air

B solution X

C solution Y

D water

17 A single-celled organism lives in freshwater. Water that enters the cytoplasm of the cell by osmosis is collected into a structure called the contractile vacuole. To remove the water the contractile vacuole fuses with the cell surface membrane.

A student counted the number of times that the contractile vacuole filled and emptied when the cell was placed in solutions with different water potentials. The results are shown in the table.

water potential of external solution / kPa	rate of contractile vacuole emptying / min^{-1}
0	31
–100	20
–200	13
–300	8
–400	6
–500	0

Which statement explains the pattern observed as the water potential of the external solution decreased?

A The water potential gradient between the cell and the solution increased, causing water to move into the cell more rapidly and the contractile vacuole to empty more frequently.

B The water potential gradient between the cell and the solution increased, causing water to move into the cell less rapidly and the contractile vacuole to empty less frequently.

C The water potential gradient between the cell and the solution decreased, causing water to move into the cell more rapidly and the contractile vacuole to empty more frequently.

D The water potential gradient between the cell and the solution decreased, causing water to move into the cell less rapidly and the contractile vacuole to empty less frequently.

18 Which row shows the correct number of each component of a single chromatid during anaphase of mitosis?

	centromeres	polynucleotide strands	telomeres
A	1	2	2
B	1	4	4
C	2	2	4
D	2	4	2

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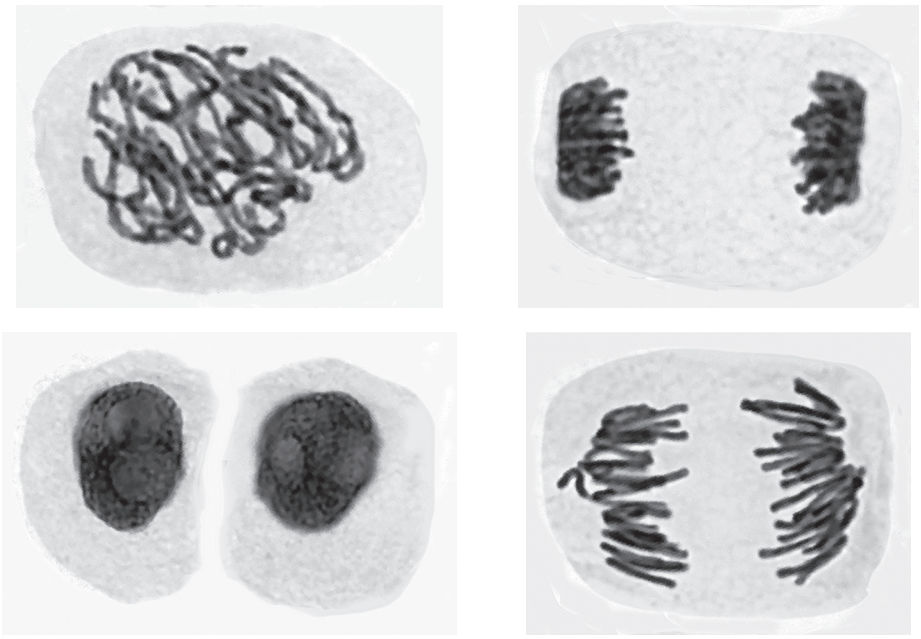
19 Some processes are listed.

- cytokinesis
- differentiation
- DNA replication
- mitosis

How many of the listed processes occur during tissue repair by stem cells?

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

20 The photomicrographs show cells in various stages of the cell cycle.



Which stage of mitosis is **not** shown?

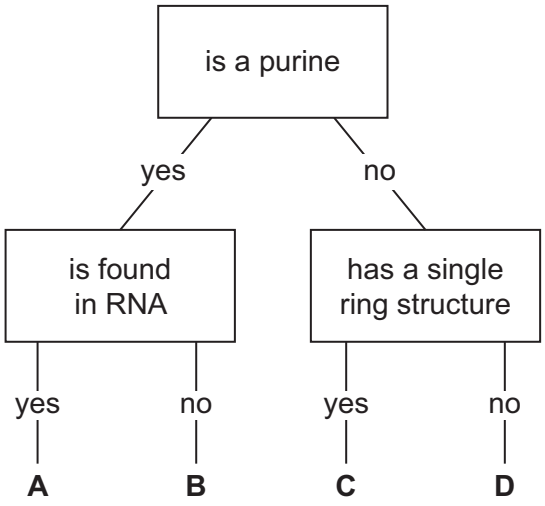
A anaphase

B prophase

C metaphase

D telophase

21 Which letter in the key describes uracil?



22 When a gene for protease is activated, which nucleic acid will be formed?

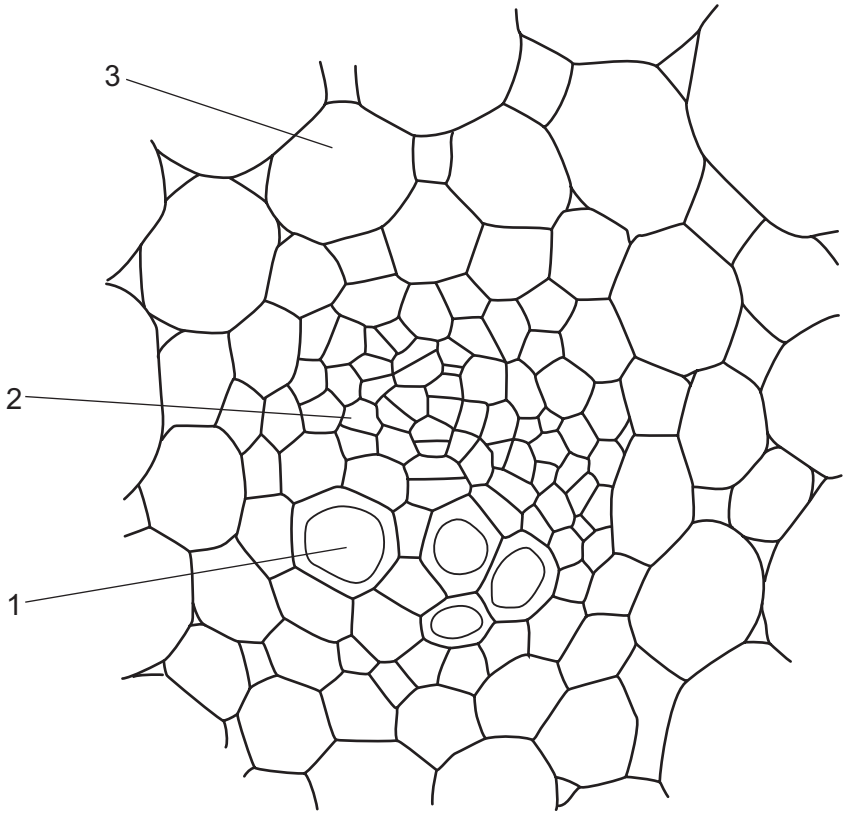
A DNA

B mRNA

C rRNA

D tRNA

23 The diagram shows a vascular bundle from the stem of a plant.



Which row describes the functions of the labelled cells?

	transports sucrose	transports mineral ions	stores starch
A	1	2	3
B	2	1	3
C	2	3	1
D	3	1	2

24 Some of the features present in the transport tissues of plants are listed.

1 lignified walls

2 cytoplasm

3 mitochondria

4 chloroplasts

5 plasmodesmata

Which features are present in sieve tube elements?

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

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25 Which statements explain why transpiration is an inevitable consequence of gas exchange in plants?

1 Hydrolysis reactions are taking place in cells.

2 ATP production is occurring.

3 Stomata must be open.

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

26 In an investigation, a leafy shoot was attached to a potometer and exposed to a variety of conditions. The time taken for the meniscus to move 50 mm along the capillary tubing was recorded for each set of conditions.

temperature / °C	humidity	air movement	time taken to move 50 mm / s
20	dry	not moving	125
20	dry	moving	71
30	dry	not moving	40
20	humid	not moving	166
20	humid	moving	83
30	humid	not moving	55

Which row shows the slowest and fastest rates of water uptake for this investigation?

	slowest rate / $mm\,s^{-1}$	fastest rate / $mm\,s^{-1}$
A	0.3	1.3
B	0.3	3.3
C	3.3	0.3
D	1.3	0.8

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27 Proton pumps (H^+ pumps) and co-transporters are used by plants when loading sucrose into a phloem sieve tube element at a source.

Which row is correct?

	proton pump	co-transporter
A	pumps protons into a companion cell raising its pH	the high concentration of protons in the companion cell allows the transporter to be used for moving sucrose out of the cell
B	pumps protons into a mesophyll cell raising its pH	the high concentration of protons in a mesophyll cell drives the transport of sucrose into the cell
C	pumps protons out of a companion cell into its cell wall	the high concentration of protons outside a companion cell drives the transport of sucrose into the cell
D	pumps protons out of a mesophyll cell into its cell wall	the low concentration of protons in a mesophyll cell allows the transporter to be used for moving sucrose out of the cell

28 The statements list some of the events in the cardiac cycle. They are not in the correct order.

1 The impulse travels through Purkyne tissue.

2 A wave of excitation sweeps across the atria.

3 The atrioventricular node delays the impulse for a fraction of a second.

4 The sinoatrial node contracts.

5 The wave of excitation sweeps upwards from the base of the ventricles.

6 The ventricles contract.

7 The atria contract.

Which statement describes the sixth of these events to occur in the cardiac cycle?

A 1 **B** 3 **C** 4 **D** 5

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29 Which tissue types are present in the walls of **all** blood vessels?

1 collagen

2 elastic

3 endothelial

4 smooth muscle

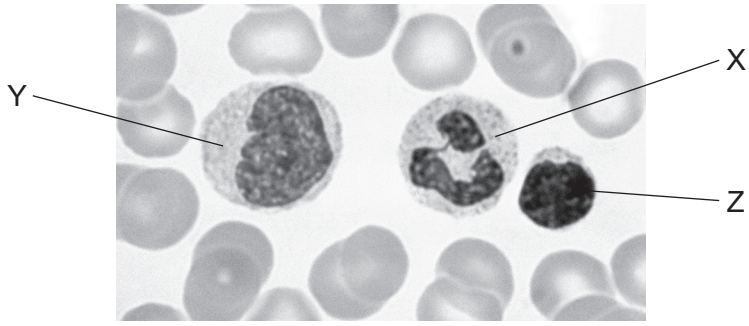
A 1, 2, 3 and 4

B 1, 2 and 4 only

C 2 and 3 only

D 3 only

30 The photomicrograph shows three white blood cells labelled X, Y and Z.



Which row correctly identifies these cells?

	cell X	cell Y	cell Z
A	lymphocyte	monocyte	neutrophil
B	lymphocyte	neutrophil	monocyte
C	monocyte	neutrophil	lymphocyte
D	neutrophil	monocyte	lymphocyte

31 When active tissues have high carbon dioxide concentrations, oxyhaemoglobin needs to release oxygen to the tissues.

How is the carbon dioxide transported away by the blood from the tissues?

1 as carboxyhaemoglobin

2 as carbaminohaemoglobin

3 as hydrogencarbonate ions

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

32 Which effect does increasing carbon dioxide concentration have on haemoglobin?

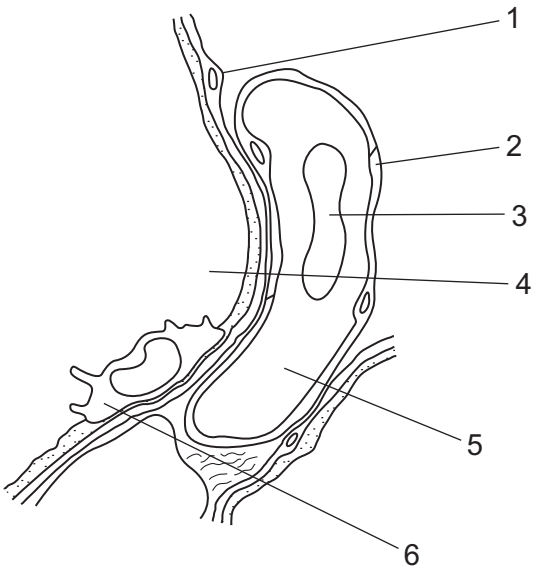
A Haemoglobin is less efficient at taking up oxygen and less efficient at releasing oxygen.

B Haemoglobin is less efficient at taking up oxygen and more efficient at releasing oxygen.

C Haemoglobin is more efficient at taking up oxygen and less efficient at releasing oxygen.

D Haemoglobin is more efficient at taking up oxygen and more efficient at releasing oxygen.

33 The diagram shows a magnified section of part of the lungs containing specialised tissues.



Which row is correct for the structures labelled 1 to 6?

	contains high proportion of		
	carbonic anhydrase	hydrogencarbonate ions	lysosomes
A	1	3	4
B	2	4	5
C	3	5	6
D	4	6	1

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34 The table shows some parts of an animal's lungs that contain different cell types.

part of lungs	cell type present		
	ciliated	goblet	smooth muscle
trachea	✓	✓	✓
bronchus	✓	✓	✓
bronchiole	✓	✗	✓
alveoli	✗	✗	✗

key
✓ = present
✗ = not present

Which parts of this animal's lungs clean inhaled air and which carry out gas exchange?

	clean inhaled air	gas exchange
A	bronchiole and alveoli	bronchus and trachea
B	bronchus and trachea only	bronchiole only
C	bronchus and trachea only	bronchiole and alveoli
D	bronchiole, bronchus, trachea	alveoli only

35 What helps to maintain a steep oxygen concentration gradient between the air in an alveolus and the blood?

1 Breathing in brings in a supply of air with a relatively high concentration of oxygen to the alveolus.

2 Blood flow brings blood with a relatively low concentration of oxygen to the alveolus.

3 The relatively low concentration of carbon dioxide in the alveolus results in the carbon dioxide leaving the red blood cell, allowing haemoglobin to combine with oxygen.

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

36 Goblet cells are found in the trachea.

Which cell structures would be found extensively in a goblet cell?

	Golgi body	mitochondria	ribosomes
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✓	✓

key
✓ = found extensively
✗ = not found extensively

37 In a country where malaria has successfully been eliminated, an outbreak of malaria can occur years later.

What could allow this later outbreak of malaria to occur?

1 mosquitoes become resistant to insecticides

2 migration of the population due to war

3 malarial parasites become resistant to quinine

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

38 Which row about a person with leukaemia only and about a person with measles only is correct?

	white blood cell count in a person with leukaemia only	bone marrow function in a person with leukaemia only	white blood cell count in a person with measles only
A	decreased	increased	decreased
B	decreased	decreased	increased
C	increased	normal	decreased
D	increased	increased	increased

39 What is the cause of symptoms of people with myasthenia gravis?

A antibodies block receptor molecules on the cell surface membrane of muscle cells

B it is an autoimmune disease where self-antigens attack antibodies

C the destruction of T-lymphocytes, which have receptors complementary to self-antigens

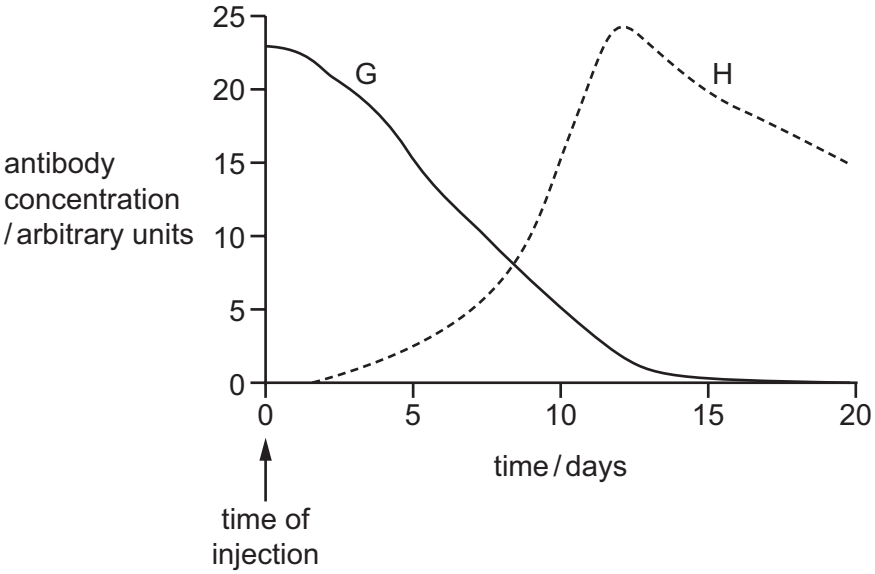
D the loss of cell surface membrane receptors in nerve cells found in the spinal cord

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40 Tetanus is a bacterial infection.

The graph shows the blood antibody concentration of two people.

On day 0, person G was injected with antibodies to the tetanus toxin and person H was injected with the vaccine for tetanus.



What could be the result if G and H were infected with the tetanus bacteria on day 20?

A Tetanus antibodies would not be produced in person G.

B Antibody production would peak after day 32 in person G.

C Antibody concentration would stay constant in person H.

D A second antibody peak would occur in person H that would be lower than the first peak.

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