Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/13**

Paper 1 Multiple Choice **May/June 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.

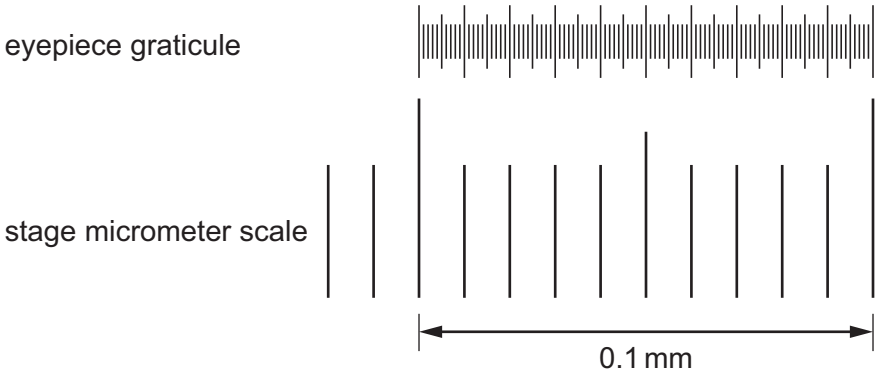
This document has **20** pages. Any blank pages are indicated.

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1 Which set of measurements is correct?

	diameter of capillary	diameter of red blood cell	thickness of cell surface membrane of red blood cell
A	7 μm	7 μm	7 nm
B	7 μm	7 nm	7 nm
C	0.7 mm	7 μm	7 nm
D	0.7 mm	0.7 mm	7 μm

2 The diagram shows an eyepiece graticule and part of a stage micrometer scale as seen using ×100 magnification.



Which is the correct method for calculating the value of one eyepiece graticule unit in micrometres (μm)?

A divide 100 by 0.1 then multiply by 1000

B divide 100 by 0.1 then multiply by 1000 divided by 100

C multiply 0.1 by 1000 then divide by 100

D multiply 0.1 by 1000 then divide by 100 then divide again by 100

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

What is the diameter as shown in the electron micrograph?

A 0.5 mm **B** 5 mm **C** 50 mm **D** 500 mm

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4 Which cell structures contain DNA?

1 mitochondria

2 chloroplasts

3 centrioles

4 nucleolus

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

5 Four students were asked to match the function with the appearance of some cell structures in an animal cell.

The functions were listed by number.

1 mRNA passes through to the ribosome

2 synthesis of polypeptides

3 synthesis of lipids

The appearances were listed by letter.

V membranes which surround an enclosed inner cavity

W non-membrane bound, spherical structures

X a double membrane interspersed with pores

Y non-membrane bound, cylindrical structures

Z membrane-bound sacs, arranged as a flattened stack

Which student correctly matched the numbered function with the appearance of the cell structure?

	1	2	3
A	V	X	Z
B	V	Z	W
C	X	W	V
D	X	Z	V

6 Which row is correct for structures found in eukaryotic cells?

	circular DNA	70S ribosomes	80S ribosomes
A	present	present	present
B	present	present	absent
C	present	absent	present
D	absent	present	absent

7 Four solutions were tested for the presence of four different biological molecules. The appearance of the solutions after each test are shown in the table.

solution	Benedict's following acid hydrolysis	Benedict's	biuret	emulsion
1	blue	blue	purple	cloudy
2	green	blue	purple	clear
3	red	green	purple	cloudy
4	yellow	yellow	blue	clear

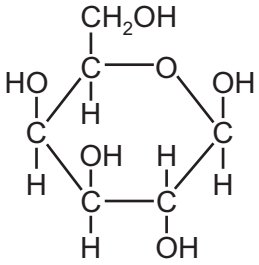
Which solutions contained molecules with ester bonds?

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

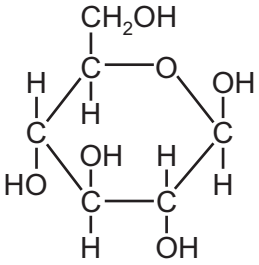
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8 The diagrams represent two monosaccharides with the same molecular formula ($C_6H_{12}O_6$).

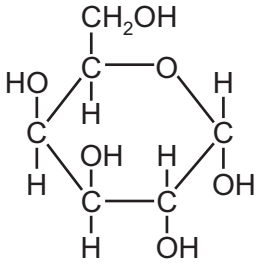
Both can exist in an alpha (α) or beta (β) form as shown.



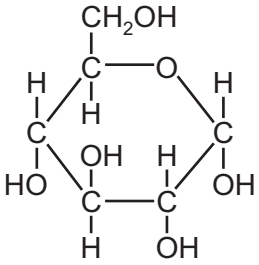
β-galactose



β-glucose

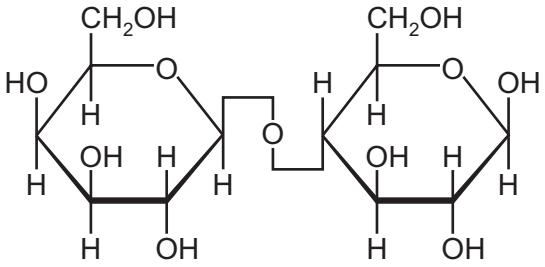


α-galactose



α-glucose

The diagram shows a lactose molecule formed by condensation between glucose and galactose.



Which molecules have condensed to form lactose?

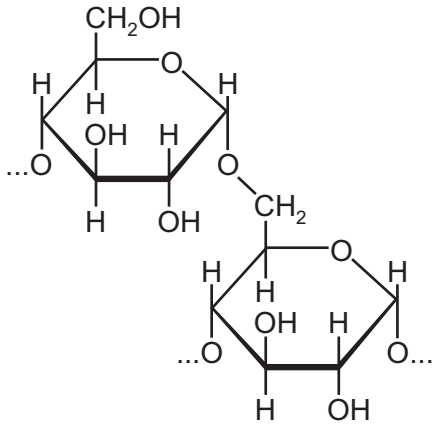
A α-glucose and α-galactose

B α-glucose and β-galactose

C β-glucose and α-galactose

D β-glucose and β-galactose

9 One type of covalent bond between two monomers is shown.



Which molecules contain this type of covalent bond?

A amylopectin, amylase, glycogen and starch

B amylopectin, amylase and glycogen only

C amylopectin, glycogen and starch only

D amylase, glycogen and starch only

10 Which statements about carbohydrates **and** triglycerides are correct?

1 They form polymers.

2 They contain carbon, hydrogen and oxygen.

3 They are used as energy stores.

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

11 Which molecules contain at least three double bonds?

A saturated fatty acid, collagen and haemoglobin

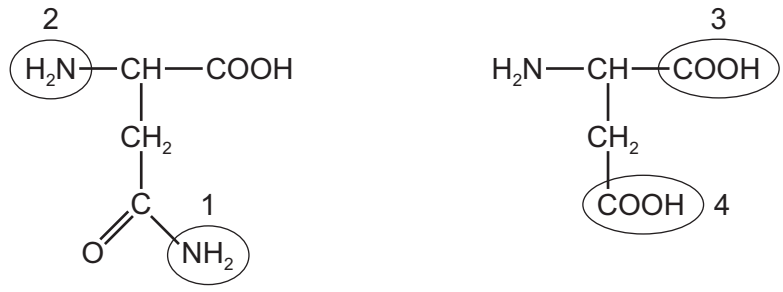
B collagen and saturated fatty acid

C haemoglobin and collagen

D saturated fatty acid and haemoglobin

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12 The diagrams show the structures of two amino acids. One contains two amino ($-NH_2$) groups, labelled 1 and 2. The other contains two carboxylic (–COOH) groups, labelled 3 and 4.



A peptide bond is formed between the two amino acids.

Which groups form the peptide bond?

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

13 Which row about the structure of proteins is correct?

	primary structure	secondary structure	tertiary structure	quaternary structure
A	is the number of amino acids present in a protein	is the right-handed spiral formed by the primary structure	is the result of cross-bonding between specific amino acids in the primary structure	is the sub-unit polypeptides that link together to form a protein
B	is the order of amino acids present in a protein encoded by DNA	is the coiling of a chain of amino acids to form a β-pleated sheet or an α-helix	is the shape formed by the folding of a polypeptide and is held together by hydrogen bonds	contains two types of polypeptide that interact forming the shape of a protein
C	is the result of translation of an mRNA molecule by a ribosome into a chain of amino acids	occurs because of an attraction between hydrogen and oxygen atoms in the peptide bonds	is the result of ionic and hydrogen bonds, disulfide bridges and hydrophobic interactions between amino acids	is formed by four polypeptides and an additional reactive group attached to the protein
D	is the sequence of amino acids in a protein coded by an mRNA molecule	is formed by hydrogen bonding between amino acids forming the primary structure	is formed as a result of interaction of the side chains of amino acids in the primary structure	is formed by the linking together of more than one polypeptide to form a protein

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14 The enzyme β-galactosidase can catalyse the hydrolysis of four substrates with similar structures.

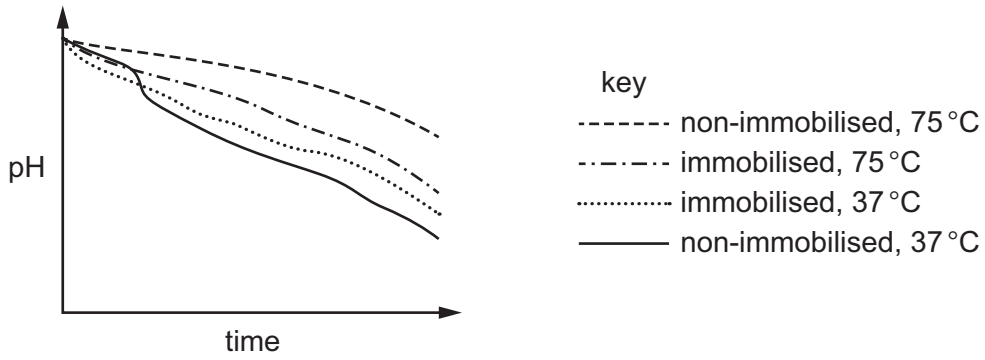
Each substrate gives a different K_m value.

For which substrate does β-galactosidase have the **highest** affinity?

	substrate	K_m / mol dm^{-3}
A	1	4×10^{-3}
B	2	1×10^{-3}
C	3	2×10^{-4}
D	4	1×10^{-4}

15 An investigation was carried out on the effect of temperature on the activity of an enzyme when it is immobilised and when it is non-immobilised (free in solution). The product of the enzyme-catalysed reaction causes a decrease in pH.

The graph shows the results of the investigation.



Which would give the highest yield of product?

A immobilised, 37 °C

B immobilised, 75 °C

C non-immobilised, 37 °C

D non-immobilised, 75 °C

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16 An indicator mixed with agar forms a pink colour. The pink-coloured agar becomes colourless when put in acid.

Blocks of pink-coloured agar are cut to different sizes and put in acid. All other variables are kept constant.

Which block becomes colourless most quickly?

A 3 mm × 30 mm × 30 mm

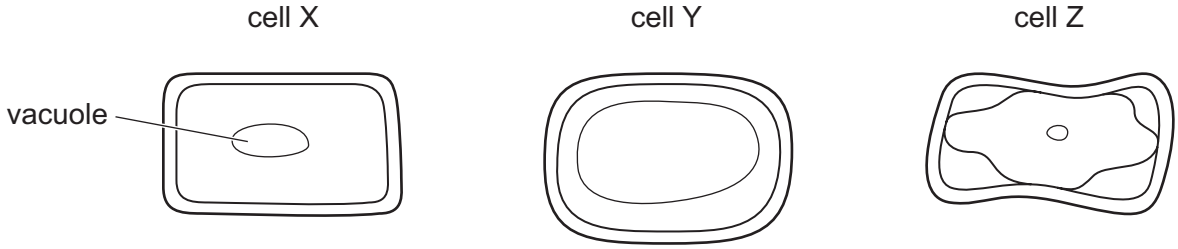
B 6 mm × 6 mm × 6 mm

C 6 mm × 12 mm × 12 mm

D 12 mm × 12 mm × 12 mm

17 Three identical plant cells were put into one of three different concentrations of sugar solution, 10%, 5% and 2.5%.

The cells were left for 50 minutes and then observed using a light microscope.



Which statement is **not** correct?

A Cell X has the same water potential as the sugar solution it was put into.

B Cell Y is turgid and cell Z is plasmolysed.

C Cell Y was put into the 2.5% sugar solution.

D Cell Z had a more negative water potential than the sugar solution it was put into.

18 How many copies of each different DNA molecule are found in a cell at the start of each of these stages of the mitotic cell cycle?

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

19 Hydra are simple animals which can reproduce asexually.

The photomicrograph shows an adult hydra with a new hydra developing while attached to the side of the adult animal.



Which processes have occurred in the two hydra?

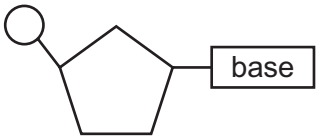
1 DNA replication

2 growth

3 mitosis

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

20 The diagram represents a nucleotide containing thymine.



Which statements about this nucleotide are correct?

1 Thymine is a pyrimidine.

2 Base pairing occurs with two hydrogen bonds.

3 The carbohydrate can be ribose or deoxyribose.

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

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21 Some of the events that occur during transcription are listed.

1 Bonds break between complementary bases.

2 Bonds form between complementary bases.

3 Sugar-phosphate bonds form.

4 Free nucleotides pair with complementary nucleotides.

Before the mRNA molecule leaves the nucleus, which events occur twice during transcription?

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

22 The table shows the DNA triplet codes for some amino acids.

amino acid	DNA triplet code	amino acid	DNA triplet code
arginine	GCA	glycine	CCA
arginine	GCC	glycine	CCG
arginine	GCG	glycine	CCT
asparagine	TTA	lysine	TTC
asparagine	TTG	lysine	TTT
cysteine	ACA	proline	GGA
cysteine	ACG	proline	GGC
STOP	ATC	valine	CAC

The base sequence on the DNA template strand coding for part of a polypeptide is shown.

CCA TTC ACG GCG TTA GCA

Two mutations occur in this sequence during DNA replication.

Which mutated DNA would result in a polypeptide with one different amino acid?

A CCA ATC ACG GCG TTG GCA

B CCA TTC ACA GCA TTA GCA

C CCA TTC ACG CCG TTA GCC

D CCT TTC ACG GCG TTA GCC

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23 A gene codes for the sequence of amino acids in a single polypeptide. Haemoglobin consists of two α-globins and two β-globins.

How many genes are needed to code for a single haemoglobin molecule?

A 1 **B** 2 **C** 4 **D** 8

24 Which properties of water molecules are important in the upward flow of water through the xylem?

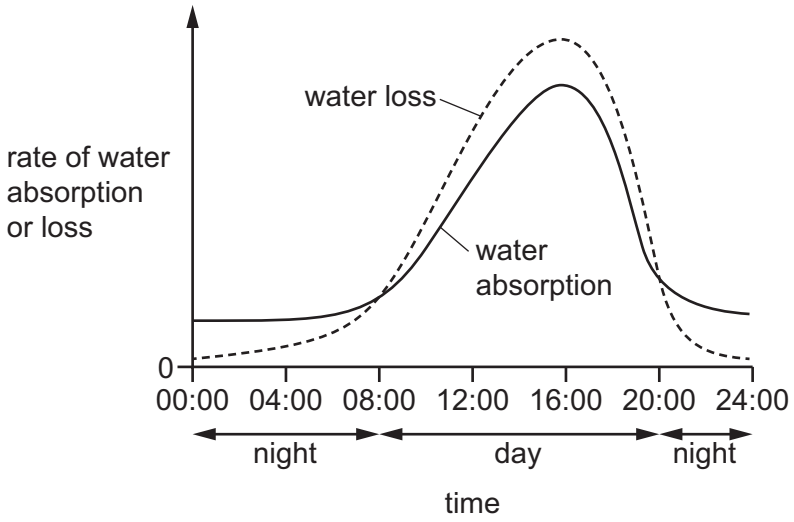
1 Water molecules are attracted to each other by hydrogen bonding.

2 Water molecules are attracted to cellulose by adhesion.

3 Water molecules have high cohesion in water columns.

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

25 The graph shows the rate of water absorption and the rate of water loss by a plant during one 24-hour period. The plant was growing in natural conditions.



What may be concluded from the graph?

1 The rate of water absorption and the rate of water loss peak at 16:00.

2 The rate of water loss is greater than the rate of water absorption for 12 hours.

3 The rate of water absorption is greater than the rate of water loss at night.

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

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26 Which statements explain why a stem is cut under water and connected to a potometer under water?

1 to prevent plasmolysis of xylem vessel elements

2 to prevent the collapse of xylem vessel elements

3 to prevent air entering xylem vessel elements

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

27 Sucrose moves into an actively dividing shoot tip from a phloem sieve tube element.

Which changes to the water potential and the volume of liquid in the phloem sieve tube element are correct?

	water potential becomes	volume of liquid
A	less negative	decreases
B	less negative	increases
C	more negative	decreases
D	more negative	increases

28 Sucrose is loaded into phloem sieve tubes from companion cells.

What is the correct order of statements that explains this mechanism?

1 Hydrogen ions diffuse into companion cells through co-transporter proteins.

2 Hydrogen ions are pumped out of companion cells by active transport.

3 Sucrose diffuses into phloem sieve tubes via plasmodesmata.

4 Sucrose is co-transported along with hydrogen ions.

A $1 \rightarrow 2 \rightarrow 4 \rightarrow 3$

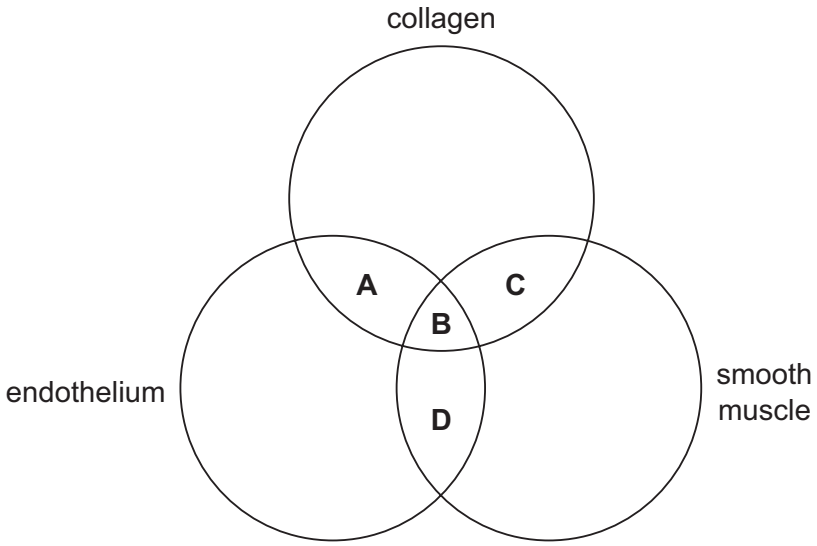
B $1 \rightarrow 4 \rightarrow 2 \rightarrow 3$

C $2 \rightarrow 1 \rightarrow 4 \rightarrow 3$

D $4 \rightarrow 1 \rightarrow 2 \rightarrow 3$

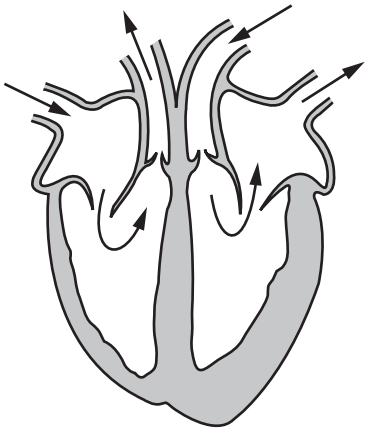
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29 Which components are found in arteries?

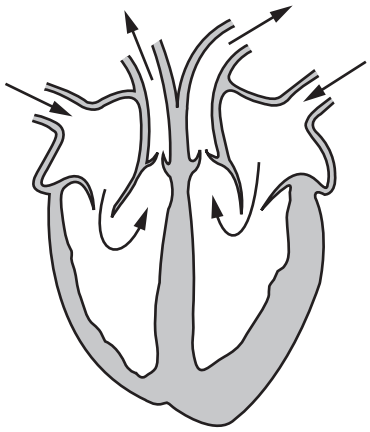


30 Which diagram correctly shows the direction of the flow of blood through the heart?

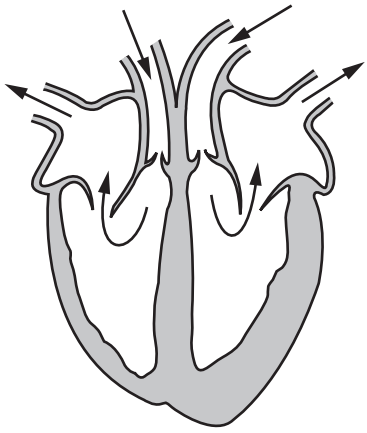
A



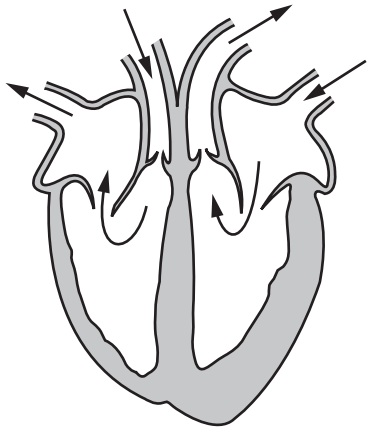
B



C



D



31 Which row correctly identifies the pulmonary artery?

	thickness of blood vessel wall / mm	oxygen content of blood inside vessel	blood pressure / mmHg
A	1.30	deoxygenated	15–30
B	2.10	oxygenated	80–120
C	0.15	oxygenated	5–15
D	0.20	deoxygenated	3–8

32 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

33 At high altitudes, the oxygen content of the air may be a third of that at sea level.

As a person slowly climbs a mountain, their body gradually adjusts to the high altitude.

What is increased during this period of adjustment?

A the concentration of haemoglobin in the red blood cells

B the oxygen-carrying capacity of the haemoglobin

C the number of red blood cells per mm^3 of blood

D the rate at which haemoglobin releases oxygen into the tissues

34 Which row correctly shows features present in terminal bronchioles?

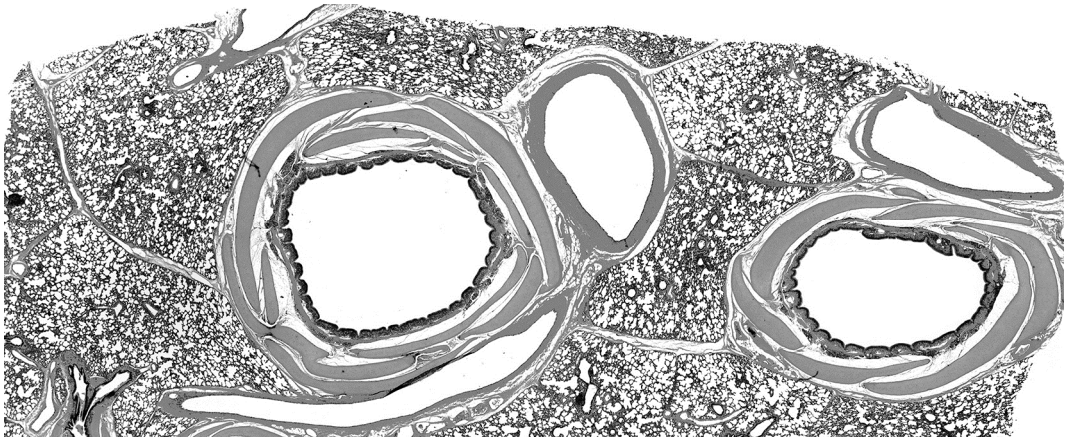
	cartilage	cilia	smooth muscle
A	✓	✓	✗
B	✓	✗	✓
C	✗	✓	✓
D	✗	✓	✗

key

✓ = present

✗ = not present

35 The photomicrograph shows a section through lung tissue.



Which structures are present in this photomicrograph?

	artery	vein	bronchus	trachea
A	✓	✓	✓	✗
B	✓	✗	✗	✓
C	✗	✓	✗	✓
D	✗	✗	✓	✓

key

✓ = present

✗ = not present

36 The symptoms of two diseases are listed.

disease 1	disease 2
coughing up blood	shortness of breath
pain when breathing	difficulty breathing out
loss of weight	fatigue

Which row identifies diseases 1 and 2?

	disease 1	disease 2
A	chronic bronchitis	emphysema
B	emphysema	lung cancer
C	lung cancer	chronic bronchitis
D	lung cancer	emphysema

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37 Disease transmission can be reduced in different ways.

- antibiotic therapy for sufferers
- vaccination for non-sufferers
- more living space per person

The transmission of which disease can be reduced by all of these methods?

A cholera

B TB

C malaria

D measles

38 What do pathogens of HIV / AIDS, malaria and TB have in common?

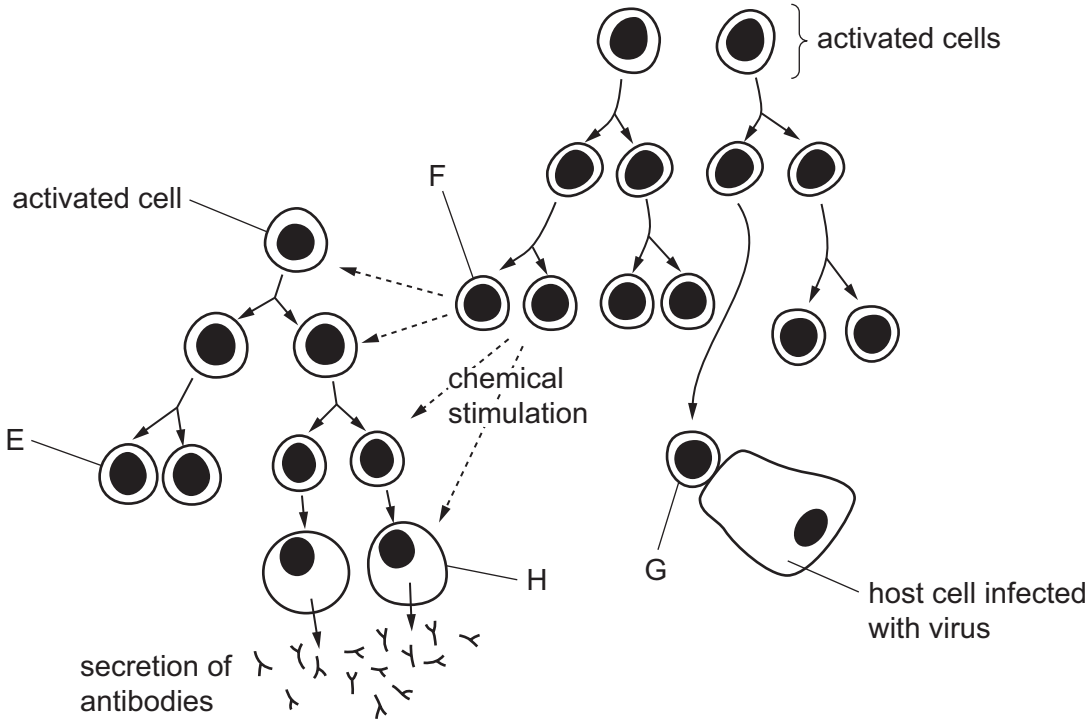
	cell surface membrane	genes	ribosomes
A	✓	✓	✓
B	✓	✗	✗
C	✗	✓	✓
D	✗	✓	✗

key

✓ = common to all three pathogens

✗ = not common to all three pathogens

39 The diagram shows the immune response following infection by a virus.



Which row identifies the cells labelled E, F, G and H?

	E	F	G	H
A	B-memory cell	T-helper cell	T-killer cell	plasma cell
B	B-memory cell	T-memory cell	macrophage	plasma cell
C	plasma cell	T-memory cell	T-helper cell	B-memory cell
D	T-killer cell	B-memory cell	macrophage	T-helper cell

40 Monoclonal antibodies are used to test for the presence of the hormone HCG in the urine of a human female during early pregnancy.

Which statements describe how the monoclonal antibodies used in this test are produced?

1 HCG is injected into a mouse, and plasma cells in the mouse produce antibodies specific to HCG.

2 Antibodies are extracted from the mouse and then fused with cancer cells to produce hybridoma cells.

3 Single hybridoma cells are cultured and they divide by mitosis to produce a clone of hybridoma cells.

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

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