Cambridge Assessment International Education

Cambridge International A Level

BIOLOGY **9700/12**

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 **16** pages.

1 A scale bar on an electron micrograph is 2 cm long and represents an actual length of 1 μm.

What is the magnification of the electron micrograph?

A ×200 **B** ×2000 **C** ×20 000 **D** ×200 000

2 The eyepiece of a microscope is fitted with an eyepiece graticule and a stage micrometer scale is placed on the microscope.

Which statements about the stage micrometer scale are correct?

1 The scale can be used to measure the actual length of cells directly.

2 The scale allows you to calibrate the eyepiece graticule.

3 Less of the scale is visible as the objective lens changes from ×10 to ×40.

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

3 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 organises microtubules to produce the spindle during cell division

3 synthesis of polypeptides

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

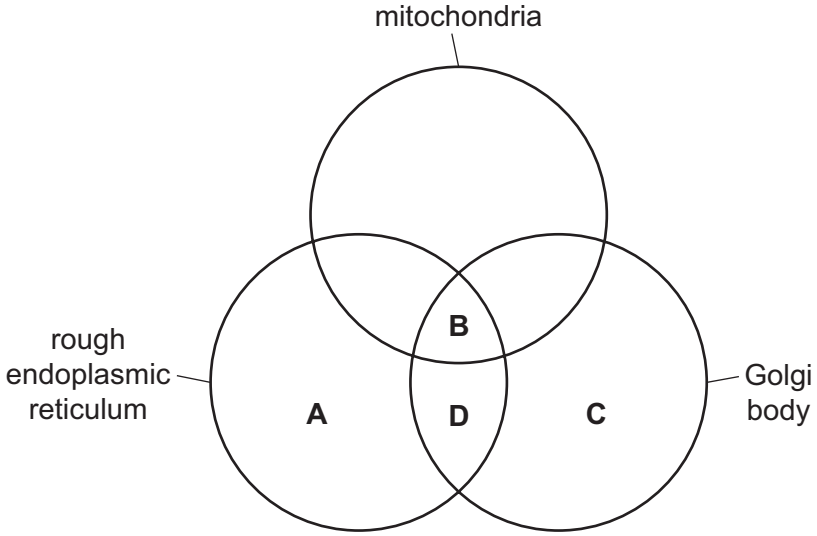
Y non-membrane bound, cylindrical structures

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	W	X
B	V	Y	Z
C	X	W	Z
D	X	Y	W

4 Which cell structures are required for the formation of lysosomes and the hydrolytic enzymes that they contain?



5 Which cell structures contain rRNA?

1 chloroplast

2 mitochondrion

3 nucleus

4 smooth endoplasmic reticulum

A 1, 2, 3 and 4

B 1, 2 and 3 only

C 1, 2 and 4 only

D 3 and 4 only

6 The single-celled organism *Thiomargarita namibiensis* measures 700 μm in diameter and is enclosed in a cell wall. The genetic material of *T. namibiensis* is located free in the cytoplasm where it occurs as thousands of copies of circular DNA. Most of the cell is taken up by a large vacuole, which stores essential chemicals for metabolism.

Which statement is correct?

A It must be a eukaryote because a diameter of 700 μm is too large for a prokaryote.

B It must be a plant because it contains a vacuole.

C It must be a plant because it is enclosed in a cell wall.

D It must be a prokaryote because its DNA is circular and located in the cytoplasm.

7 A student carried out four tests on a sample of biological molecules.

test	observation
emulsion	cloudy
Benedict's	yellow
biuret	purple
iodine	yellow

Which conclusions made by the student are correct?

1 Fat was present.

2 Glucose was present.

3 Protein was present.

4 Starch was not present.

A 1, 2, 3 and 4

B 1, 2 and 4 only

C 1, 3 and 4 only

D 2 and 3 only

8 Which general formula is correct for monosaccharides such as fructose?

A $(CHO)_n$ **B** $(CH_2O)_n$ **C** $(CHO_2)_n$ **D** $(C_2HO)_n$

9 Which statements can be used to describe the structure of cellulose?

1 a polymer of glucose monomers linked by β-1,4 glycosidic bonds

2 a polysaccharide of hexose monomers

3 an unbranched macromolecule made of β-glucose monomers

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

10 Complete hydrolysis of polysaccharides requires all the glycosidic bonds between the monomers to be broken.

Enzyme X only breaks α-1,4 glycosidic bonds.

Which row shows how completely enzyme X can hydrolyse molecules of glycogen and amylose?

	glycogen	amylose
A	+	++
B	++	+
C	++	–
D	–	+

key

– no hydrolysis

\+ some hydrolysis

++ most hydrolysis

11 Which molecules contain at least two double bonds?

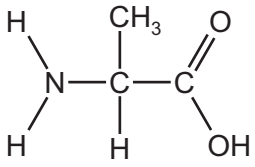
A saturated fatty acid, collagen and haemoglobin

B collagen and saturated fatty acid only

C haemoglobin and collagen only

D saturated fatty acid and haemoglobin only

12 The diagram shows an amino acid.



Which group is changed to produce different amino acids?

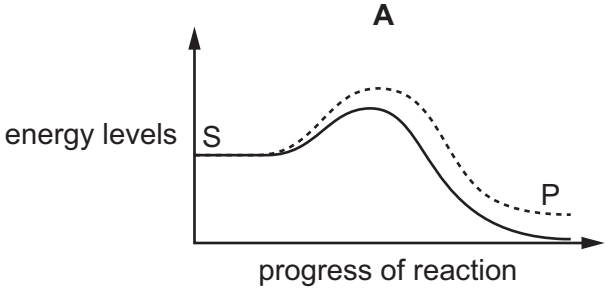
A OH **B** C=O **C** CH_3 **D** NH_2

13 Which row is correct about the structure of proteins?

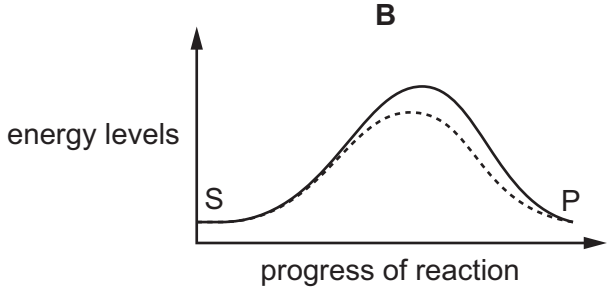
	primary	secondary	tertiary	quaternary
A	determined by the sequence of DNA nucleotides	occurs by hydrogen bonding between NH and C=O groups of amino acids	disulfide, ionic, hydrogen bonds and hydrophobic interactions are all involved	always formed by association of two or more polypeptides
B	the number of amino acids in each polypeptide chain	in a single polypeptide it is either an α-helix or a β-pleated sheet	the bonds are formed at specific points determined by the primary structure	always formed by two or more polypeptides held together by bonds formed between the polypeptides
C	formed by twenty different amino acids linked in a specific order	an α-helix is formed by hydrogen bonds between side chains of amino acids	only globular proteins have this level of structure	always formed by two or more different polypeptides to give the final shape
D	the sequence of amino acids in each polypeptide chain	a β-pleated sheet is the result of a folded polypeptide forming hydrogen bonds between adjacent strands	reactions between side chains of specific amino acids give a specific 3-D shape	always formed by two or more polypeptides and a metal ion

14 Which graph correctly shows possible changes in energy levels as a chemical reaction progresses with or without an enzyme?

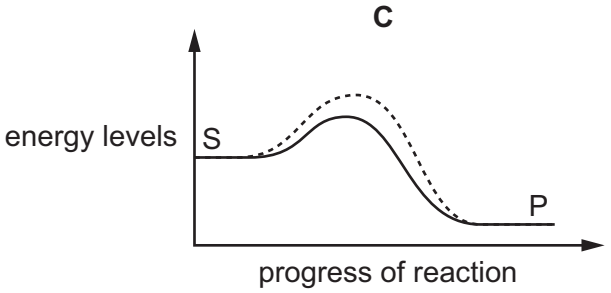
A



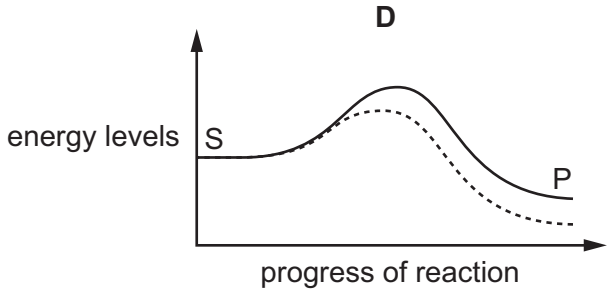
B



C



D



key

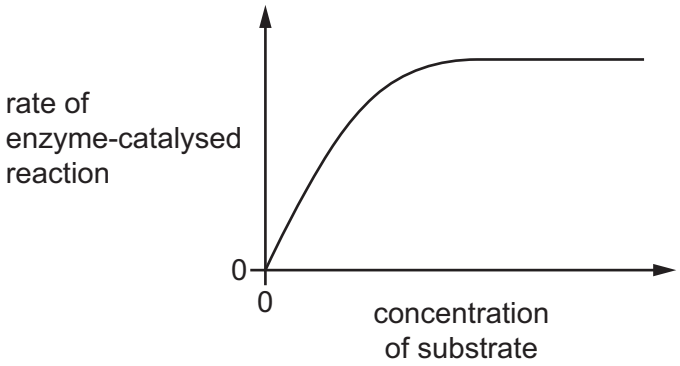
—— with enzyme

- - - - - - without enzyme

S substrate

P product

15 The graph shows the relationship between the concentration of substrate and the rate of an enzyme-catalysed reaction.



Which row shows how K_m and V_{max} for this enzyme would be affected if the same reaction was carried out in the presence of a competitive inhibitor?

	K_m	V_{max}
A	increases	decreases
B	increases	remains the same
C	remains the same	decreases
D	remains the same	remains the same

16 Liver cells contain vesicles that have proteins in their membranes which are specific for the transport of glucose.

When these cells need to take up glucose, the vesicles fuse with the cell surface membrane.

How does the uptake of glucose occur?

A exocytosis

B diffusion

C endocytosis

D facilitated diffusion

17 A student set up an experiment to investigate diffusion.

A block of agar, 1.0 cm × 1.0 cm × 1.0 cm, was stained uniformly with a water-soluble blue dye. The block of agar was put into a test-tube containing 10 cm^3 of distilled water at 20 °C.

The intensity of the blue colour of the water after five minutes was measured.

Four other experiments, **A**, **B**, **C** and **D**, were then carried out using different numbers of agar blocks, different sizes of agar blocks and different temperatures. All other variables were standardised.

Which experiment would give a lighter blue colour in the water after five minutes compared to the first experiment?

	size of each agar block / cm	number of agar blocks	temperature of distilled water / °C
A	0.5 × 0.5 × 0.5	8	30
B	0.5 × 0.5 × 0.5	2	20
C	0.5 × 1.0 × 1.0	2	30
D	2.0 × 1.0 × 1.0	1	20

18 Which description is correct?

A A centromere holds two chromatids together until the end of prophase and attaches to the microtubules of the spindle.

B A chromatid is one of two identical parts of a chromosome and is made of proteins and two molecules of DNA.

C A chromosome is a structure with two identical parts, made of DNA and proteins, found in the nucleus of a prokaryotic cell.

D A telomere is a sequence of DNA nucleotides, such as GGGTAA, repeated many times and found at the ends of each chromatid.

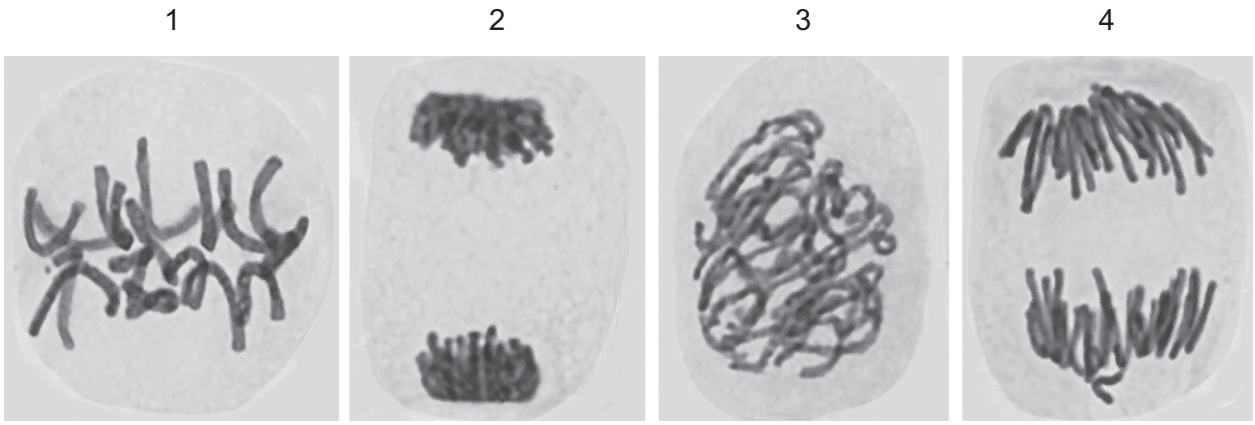
19 During metaphase, a scientist stains the chromosomes of a diploid animal cell with fluorescent dye to allow the telomeres to be observed.

This cell has 26 chromosomes.

How many telomeres will the scientist observe?

A 26 **B** 52 **C** 78 **D** 104

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



Which cells contain twice as many DNA molecules as a cell from the same organism that has just finished a complete mitotic cell cycle ending with cytokinesis?

A 1, 2, 3 and 4

B 1, 2 and 4 only

C 1 and 3 only

D 2 and 4 only

21 Uncontrolled cell division can result in the formation of a tumour.

Which part of the cell cycle would take less time during the formation of a tumour?

A cytokinesis

B interphase

C mitosis

D telophase

22 A piece of a DNA molecule contains 84 base pairs. The table shows the number of adenine and cytosine bases in one or both of the DNA strands in this piece of DNA molecule.

base	strand 1	strand 2
adenine	28	23
cytosine	15	

How many guanine bases are present in this piece of DNA molecule?

A 18 **B** 33 **C** 36 **D** 41

23 The mRNA sequences of the three stop codons are shown.

UAA UAG UGA

Which mutation in the template (transcribed) strand of a DNA sequence that codes for a polypeptide would cause translation to stop prematurely?

A ATT changed to ATC

B ACT changed to ACA

C ACC changed to ATT

D ATC changed to TAG

24 Which features of companion cells are essential to their function?

1 They are connected to the sieve tube elements by plasmodesmata.

2 They have a thicker cell wall than a sieve tube element.

3 They contain a nucleus and mitochondria.

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

25 Which statements about water movement in plants are correct?

1 Water can pass through cellulose cell walls.

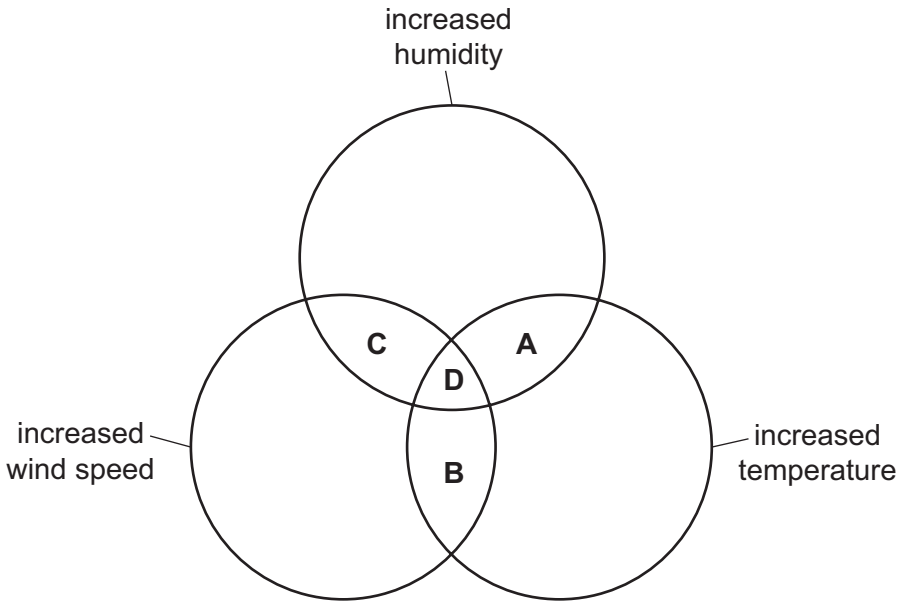
2 Water cannot pass through lignified cell walls.

3 Water can pass through cell walls that contain suberin.

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

26 The diameter of a tree trunk usually decreases slightly during the day.

Which changes in environmental factors during the day could cause the diameter to decrease even more?



27 Which sequence of events could lead to mass flow in a phloem sieve tube?

1 Sucrose moves into a sieve tube element.

2 Protons (H^+) and sucrose molecules move into a companion cell through a co-transporter protein.

3 A very high hydrostatic pressure is produced.

4 The water potential of the sieve tube element decreases.

5 Protons (H^+) are actively pumped out of a companion cell.

6 Water moves down a water potential gradient by osmosis.

A $1 \rightarrow 2 \rightarrow 5 \rightarrow 6 \rightarrow 4 \rightarrow 3$

B $3 \rightarrow 1 \rightarrow 2 \rightarrow 5 \rightarrow 6 \rightarrow 4$

C $3 \rightarrow 5 \rightarrow 1 \rightarrow 2 \rightarrow 4 \rightarrow 6$

D $5 \rightarrow 2 \rightarrow 1 \rightarrow 4 \rightarrow 6 \rightarrow 3$

28 What will happen as a result of the blood pressure in the right ventricle becoming higher than the blood pressure in the right atrium?

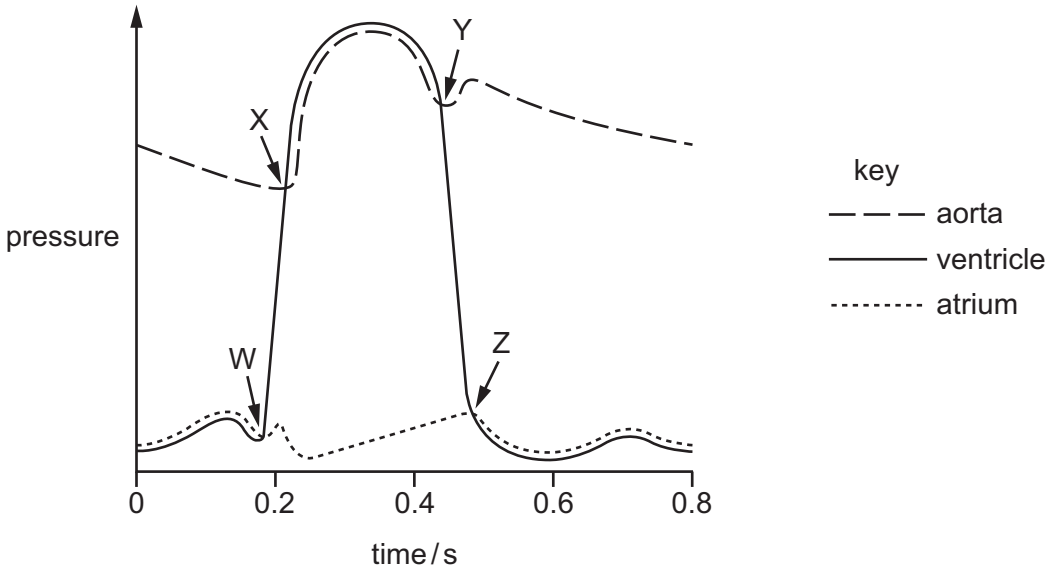
A The semilunar valve in the aorta will close.

B The semilunar valve in the pulmonary artery will close.

C The left atrioventricular valve will close.

D The right atrioventricular valve will close.

29 The graph shows pressure changes in different parts of the heart during a mammalian cardiac cycle. W, X, Y and Z indicate when a valve opens or closes.



Which row correctly identifies W, X, Y and Z?

	W	X	Y	Z
A	atrioventricular valve opens	atrioventricular valve closes	semilunar valve opens	semilunar valve closes
B	atrioventricular valve closes	semilunar valve opens	semilunar valve closes	atrioventricular valve opens
C	semilunar valve opens	semilunar valve closes	atrioventricular valve opens	atrioventricular valve closes
D	semilunar valve closes	atrioventricular valve opens	atrioventricular valve closes	semilunar valve opens

30 Which statements are correct?

1 Compared with blood, tissue fluid has less protein and no red blood cells.

2 Lymph may contain lipids, carbon dioxide and phagocytes.

3 Tissue fluid contains glucose, amino acids, urea and carbon dioxide.

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

31 Which statements about the formation of haemoglobinic acid are correct?

1 It can only occur with the dissociation of oxygen from haemoglobin.

2 It removes excess hydrogen ions, preventing blood from becoming too acidic.

3 It is linked to the action of carbonic anhydrase.

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

32 What explains how the maximum volume of oxygen is taken up as blood passes through the capillaries of the lungs?

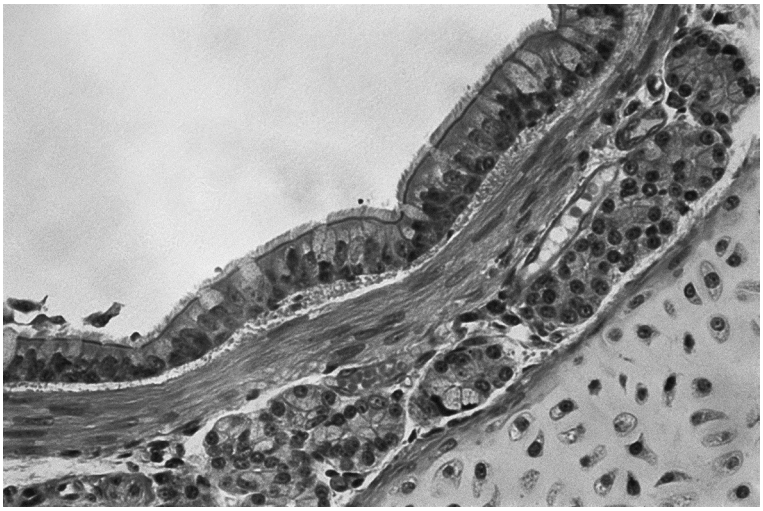
A Each haemoglobin molecule can temporarily bind to four oxygen atoms.

B The dissociation of carbon dioxide from carboxyhaemoglobin allows more haemoglobin to be available for binding oxygen.

C The binding of the first oxygen molecule to haemoglobin decreases the affinity of haemoglobin for binding other oxygen molecules.

D Oxyhaemoglobin formation increases the ability of red blood cells to transport oxygen.

33 The image shown is a photomicrograph of a transverse section of part of the gas exchange system.



What describes the image?

A a thin inner layer of ciliated epithelial cells on top of a layer containing cartilage, supported by elastic fibres

B a very thin epithelial lining with walls containing elastic fibres, surrounded by many blood vessels

C an inner layer of ciliated epithelial and goblet cells on top of elastic fibres, supported by an outer layer consisting of cartilage

D an inner layer of ciliated epithelial and goblet cells on top of loose tissue with mucous glands, supported by a continuous ring of cartilage

34 Which row shows the tissues that are present in the wall of the trachea and the wall of the bronchus?

	smooth muscle	squamous epithelium	goblet cells
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✓	✗

key

✓ = present

✗ = not present

35 When a person suffers an asthma attack, the tubes of the gas exchange system narrow and extra mucus is produced.

Which changes occur during an asthma attack?

1 Activity of ciliated epithelium increases.

2 Endocytosis in goblet cells increases.

3 Smooth muscles are more active.

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

36 Which flow diagram correctly describes the effect of tar entering the lungs?

A carcinogens come into contact with DNA → mutation occurs → uncontrolled cell division

B goblet cells secrete more mucus → mucus accumulates causing infection → phagocytes attracted by inflammation

C mucus accumulates causing infection → phagocytes attracted by inflammation → elastase destroys the alveolar walls

D mutation occurs → phagocytes attracted by inflammation → causes irritation and coughing

37 Which control measures would reduce the transmission of tuberculosis (TB)?

	boiling water before drinking it	antibiotics	vaccination
A	yes	no	no
B	yes	yes	yes
C	no	yes	no
D	no	yes	yes

38 Comorbidity is where an individual has two or more diseases or medical conditions at the same time. Some medical conditions are particularly likely to result in comorbidity. In one example, initial infection with one pathogen can increase the risk of developing a second disease by a factor of 15 or more. The second disease is then the major cause of death for these people.

Which description could fit this example?

A cholera infection followed by development of malaria

B cholera infection followed by development of AIDS

C HIV infection followed by development of TB

D malaria infection followed by development of TB

39 Which conditions are infectious **and** result in a high white blood cell count?

1 leukaemia

2 myasthenia gravis

3 TB

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

40 Which cell type causes the secondary immune response to be much faster than the primary immune response?

A helper T-lymphocyte

B memory cell

C phagocyte

D plasma cell