Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/12**

Paper 1 Multiple Choice **October/November 2023**

1 hour 15 minutes

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.

IB23 11_9700_12/3RP
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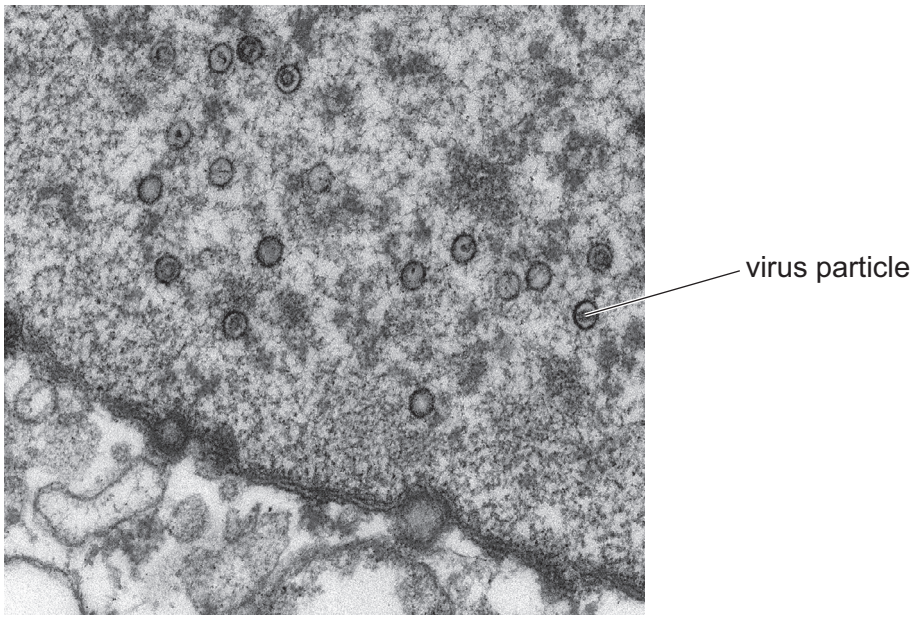
1 Which combination of lenses for a light microscope will give the greatest magnification?

	eyepiece lens	objective lens
A	×5	×100
B	×10	×40
C	×15	×40
D	×15	×100

2 The diagram shows an electron micrograph of virus particles in a human nucleus.



×24 000

What is the diameter of the labelled virus particle?

A 1.5×10^{0} μm

B 1.5×10^{-2} μm

C 1.5×10^{0} nm

D 1.5×10^{2} nm

3 What is correct about the synthesis and release of the glycoprotein mucin in goblet cells?

1 The protein is produced on ribosomes and a carbohydrate chain is added in the Golgi body.

2 The glycoproteins are packed into vesicles in the Golgi body forming lysosomes.

3 Secretory vesicles containing the glycoprotein move from the Golgi body and fuse with the cell surface membrane.

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

4 What are functions of microtubules?

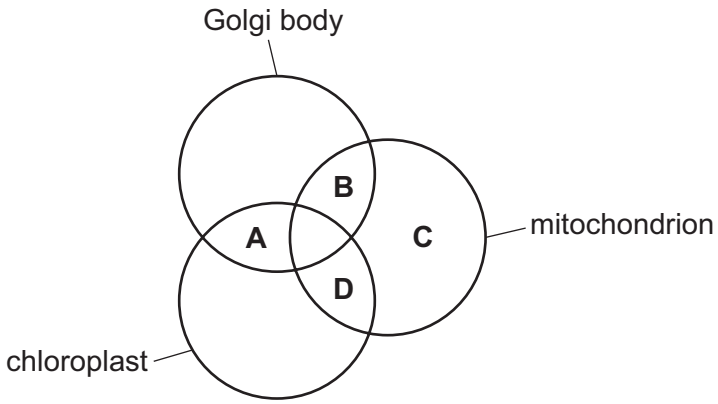
1 allowing movement of cilia in a bronchus

2 attachment to centromeres during metaphase

3 moving secretory vesicles around a cell

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

5 Which organelles contain nucleic acids?



6 Some features of cells are listed.

1 cell wall

2 cell surface membrane

3 ribosomes

Which features can be found in plant cells **and** in prokaryotic cells?

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

7 Which bonds are present in **all** viruses?

1 phosphodiester

2 peptide

3 covalent

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

8 A student carried out the Benedict's test on four different concentrations of glucose solution and then recorded the time taken for the first appearance of a colour change (the end-point).

The student found it difficult to identify the first appearance of a colour change and consistently timed each solution for two seconds after the colour change first appeared. This introduced a source of error into the experiment.

Which statements about this error are correct?

1 The effect of the error will be reduced if the student performs three repeats at each concentration of glucose.

2 The error will prevent the student from identifying which solution has the highest concentration of glucose.

3 The error is systematic as the student consistently timed each solution for two seconds after the end-point.

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

9 Which statements about amylopectin and glycogen are correct?

1 Amylopectin and glycogen contain 1-4 glycosidic bonds.

2 Amylopectin contains β-glucose.

3 Glycogen contains more 1-6 branches than amylopectin.

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

10 How many statements about fatty acids are correct?

- Fatty acids are either saturated or unsaturated.
- Fatty acids always have at least two double bonds.
- Long chains of fatty acids are very good energy stores.
- Fatty acids are insoluble in water and do not affect the water potential of the cell.

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

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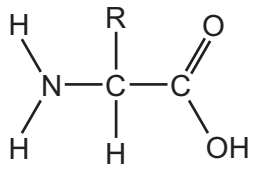
11 The diagram represents an amino acid.



R represents a variable side chain.

What is **not** a possible side chain?

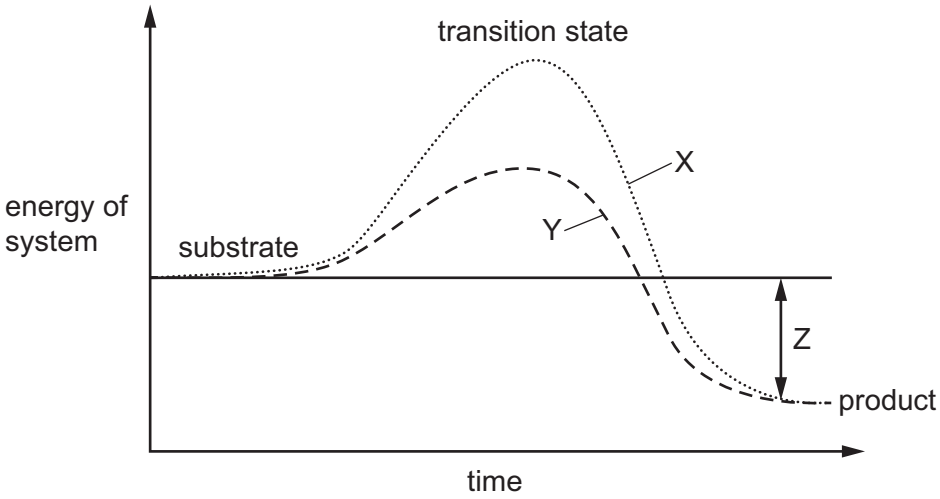
A CH_3

B $CH_2CH_2SCH_3$

C CH_2CONH_2

D $HOCH_2CH(OH)CH_2OH$

12 The graph shows the effect of an enzyme on a reaction.



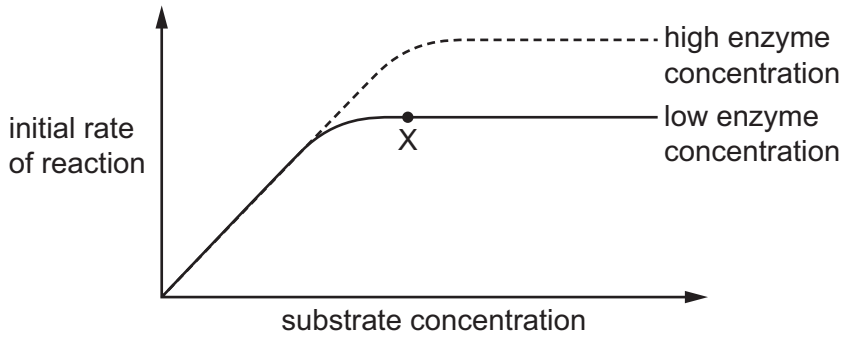
Which row identifies X, Y and Z?

	X	Y	Z
A	catalysed reaction	uncatalysed reaction	energy lost by product
B	catalysed reaction	uncatalysed reaction	overall energy lost during reaction
C	uncatalysed reaction	catalysed reaction	energy gained by product
D	uncatalysed reaction	catalysed reaction	overall energy released during reaction

13 The graph shows the results of two experiments on the effect of increasing substrate concentration on the rate of an enzyme-catalysed reaction.

One experiment was at a high concentration of enzyme and the second was at a low concentration of enzyme.

All other variables were standardised.



What would limit the initial rate of reaction at point X?

A enzyme concentration

B pH

C substrate concentration

D temperature

14 Which statements about the Michaelis–Menten constant (K_m) of an enzyme are correct?

1 At the K_m value, half the active sites of the enzyme should be occupied by the substrate.

2 K_m represents the substrate concentration at which the enzyme is working at half its maximum rate.

3 The lower the K_m value, the lower the affinity of the enzyme to its substrate.

4 When an enzyme has a high K_m value, the enzyme-catalysed reaction will proceed very slowly to its maximum rate.

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

15 Which component of cell surface membranes helps to reduce fluidity of the phospholipids at high temperatures?

A phosphate groups

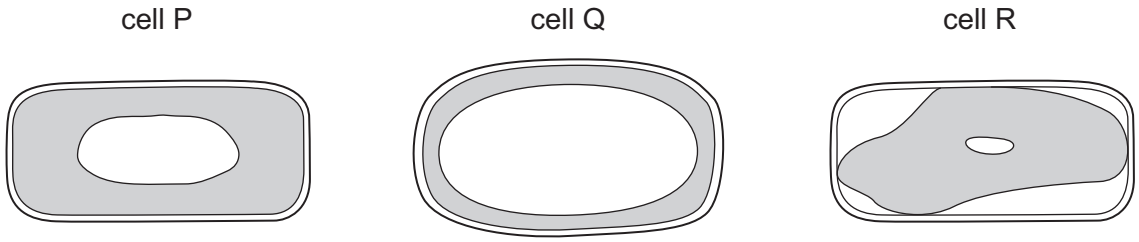
B unsaturated fatty acids

C cholesterol

D proteins

16 Plant cells were left for 50 minutes in three different sugar solutions, 10%, 5% and 1%. The water potential in the cytoplasm of the three cells was the same at the start of the experiment.

The diagrams show the appearance of the cells after 50 minutes, using a light microscope.



Which conclusion is correct?

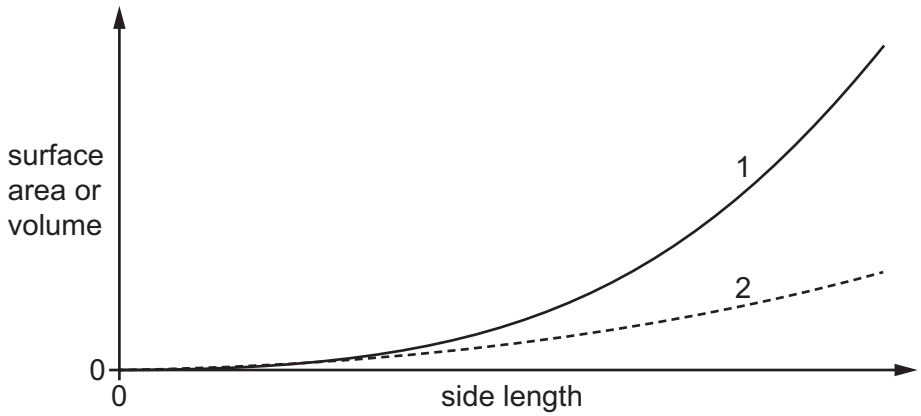
A Cell P has the same concentration of sugar inside and outside the cell.

B Cell Q is flaccid and cell P is plasmolysed.

C Cell Q was placed in the 1% solution.

D The sugar solution outside cell R has a less negative water potential than inside cell R.

17 The graph shows the effect of increasing the side length of agar cubes on the surface area and the volume of the cubes.



Which row correctly identifies line 1, line 2 and the effect of increasing side length on the surface area : volume ratio of the cubes?

	line 1	line 2	surface area : volume ratio
A	surface area	volume	decreases
B	surface area	volume	increases
C	volume	surface area	decreases
D	volume	surface area	increases

18 A human embryo consists of 12 cells at the start of day 1. The cells divide by mitosis for 4 complete days at a rate of 1 division every 32 hours.

What is the maximum number of cells in the embryo at the end of day 4?

A 48 cells

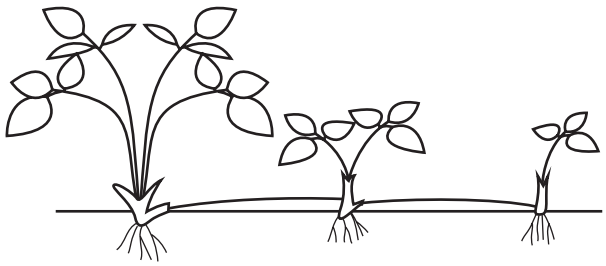
B 96 cells

C 192 cells

D 384 cells

19 Which diagrams show roles of mitosis?

1



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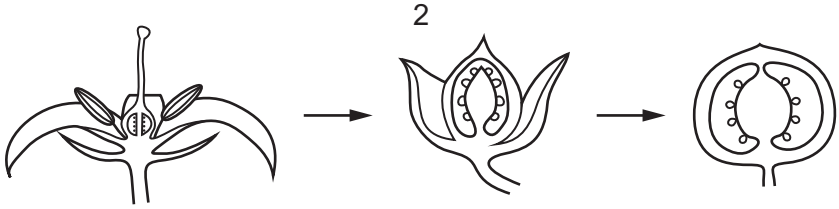

3

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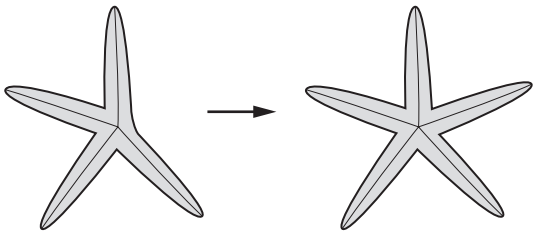


A 1, 2, 3 and 4

B 1, 2 and 3 only

C 1 and 2 only

D 3 and 4 only

20 Which events are part of the mitotic cell cycle?

1 interphase

2 anaphase

3 cytokinesis

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

21 Which statement correctly describes a feature of a DNA molecule?

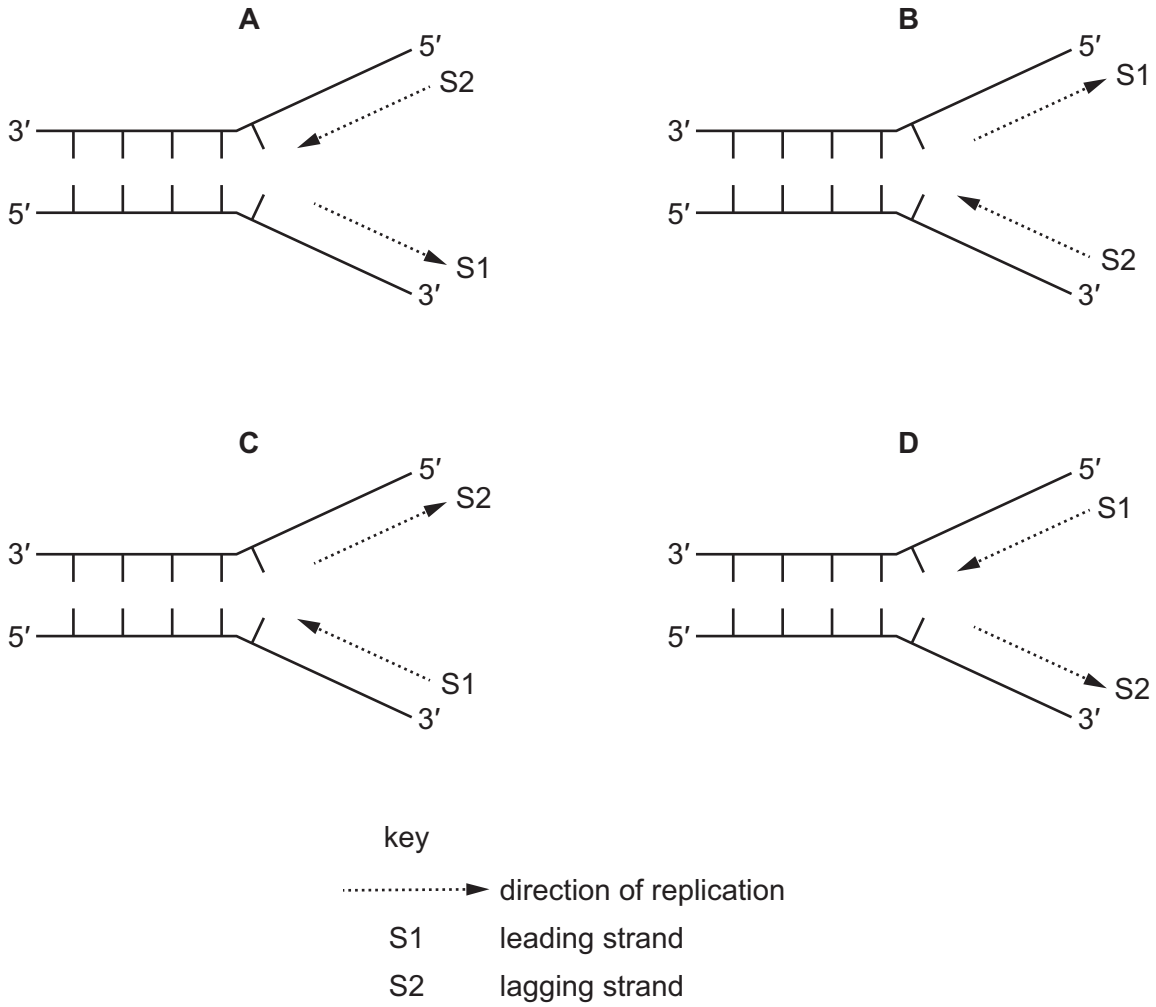
A It has two parallel strands twisted into a double helix.

B It has complementary bases all held together by three hydrogen bonds.

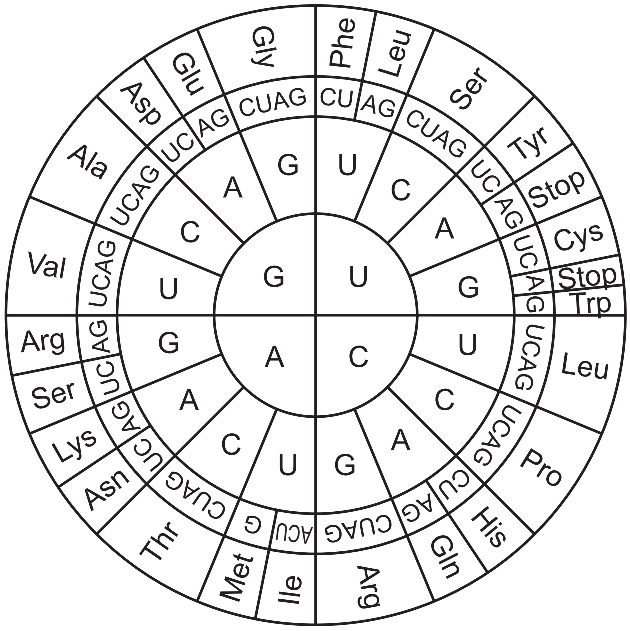
C It has phosphodiester bonds that are formed using DNA ligase.

D It has a backbone of phosphate molecules and nucleotides.

22 Which diagram correctly shows the replication of DNA?

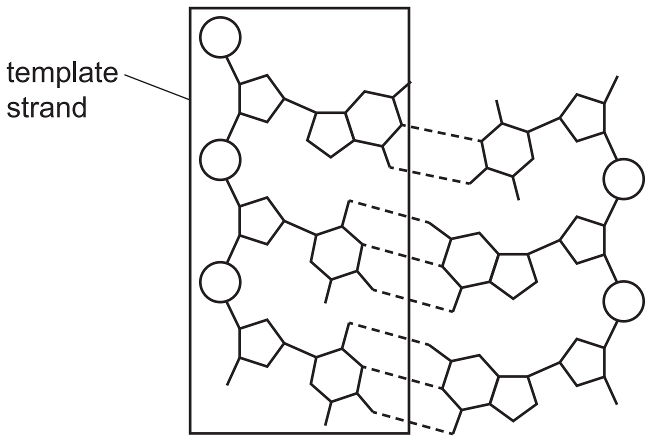


23 The RNA codon wheel is a tool used to find which amino acid would be translated from an mRNA sequence.



Codon position 1 is in the centre of the wheel, codon position 2 is in the middle of the wheel and codon position 3 is near the edge of the wheel. The three letters on the outside edge of the wheel identify the amino acid.

The diagram shows a section of DNA coding for one amino acid. The template strand is outlined in a box and the DNA base sequence is read in the 5′ to 3′ direction.



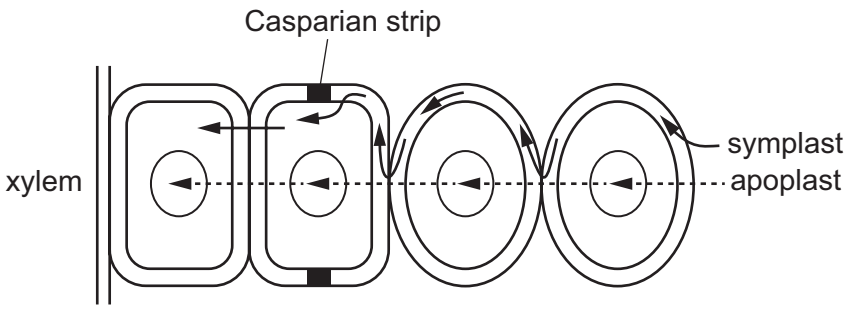
Which amino acid is coded for by this section of DNA?

A Gly **B** Pro **C** Trp **D** Thr

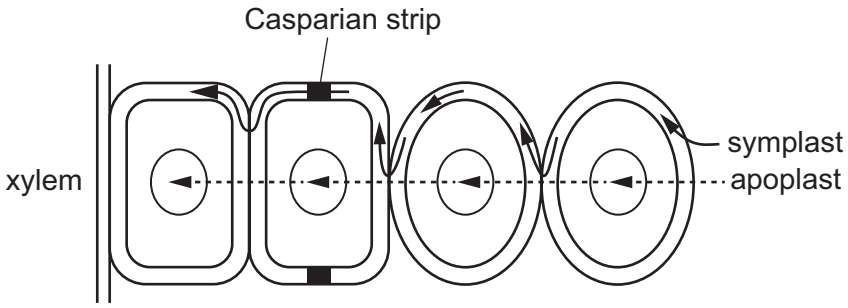
24 Four students sketched diagrams of the apoplast pathway and the symplast pathway.

Which sketch is the most accurate diagram of the two pathways?

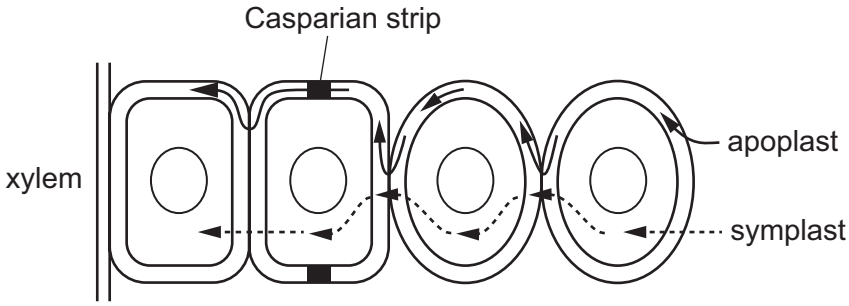
A



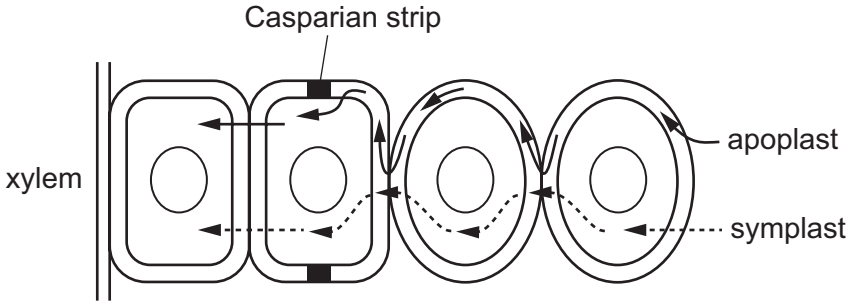
B



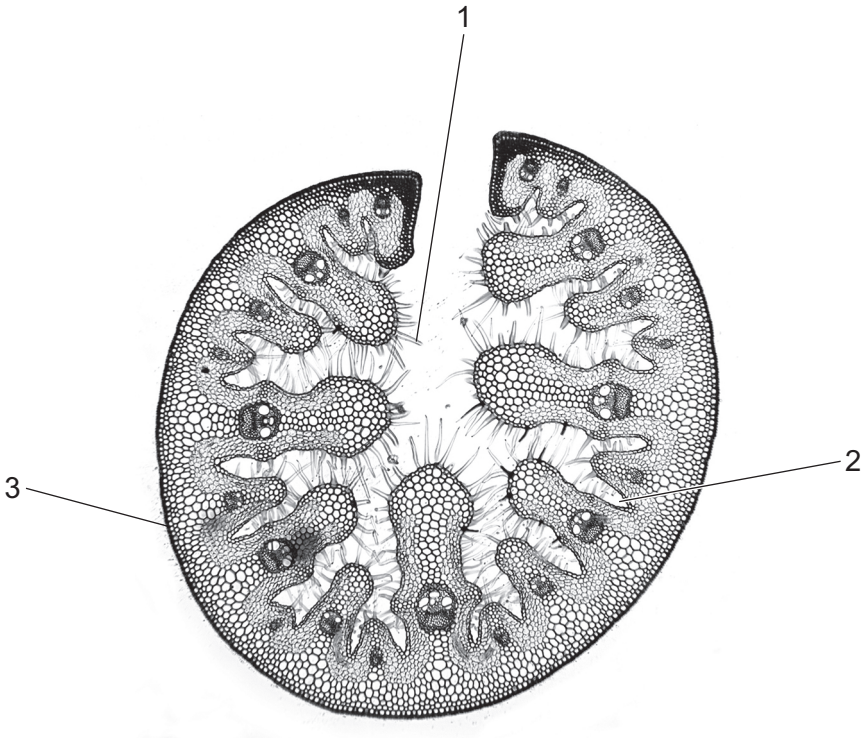
C



D



25 The photomicrograph shows some xerophytic adaptations in leaf tissue.



Which row shows the correct functions for structures 1, 2 and 3?

	reduces the water vapour concentration gradient between the inside and outside of the leaf	reduces evaporation from the epidermis of the leaf	traps a layer of moist air
A	1, 2 and 3	3 only	2 only
B	1 and 2 only	1, 2 and 3	1 and 2
C	1 only	2 and 3 only	1 and 2
D	2 and 3 only	1 and 2 only	1 only

26 Which processes are required for the transfer of assimilates from a source cell into a phloem sieve tube?

A active transport, facilitated diffusion and simple diffusion

B active transport and exocytosis

C active transport and simple diffusion only

D active transport only

27 When sucrose is loaded into the phloem it has to travel from mesophyll cells to a companion cell and then into the phloem.

Which row shows the relative concentrations of sucrose in each type of cell in order for this process to take place?

	relative concentration of sucrose / arbitrary units		
	mesophyll cell	companion cell	phloem sieve tube element
A	5	10	15
B	5	15	10
C	15	10	5
D	15	5	10

28 Which feature of transport in plants is correct for xylem **and** phloem?

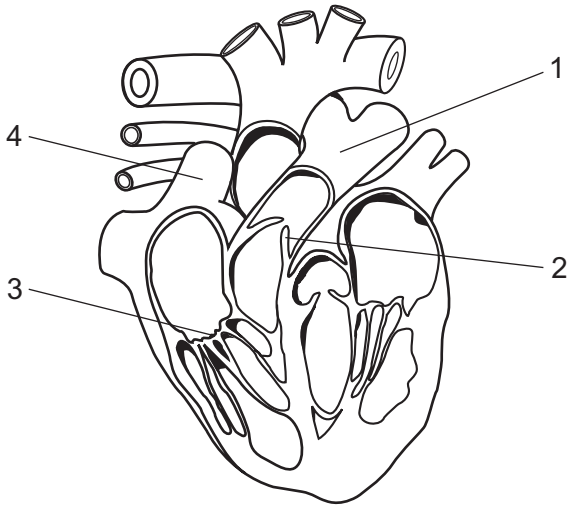
A It is passive.

B It occurs by mass flow.

C It occurs from source to sink.

D It occurs only in one direction.

29 The diagram shows an anterior view of a vertical section through the human heart.



Which row shows the correct labels for the diagram?

	1	2	3	4
A	aorta	atrioventricular valve	semilunar valve	pulmonary artery
B	pulmonary vein	semilunar valve	atrioventricular valve	pulmonary vein
C	pulmonary artery	semilunar valve	atrioventricular valve	vena cava
D	pulmonary vein	atrioventricular valve	semilunar valve	vena cava

30 What does the inner layer of veins **and** capillaries contain?

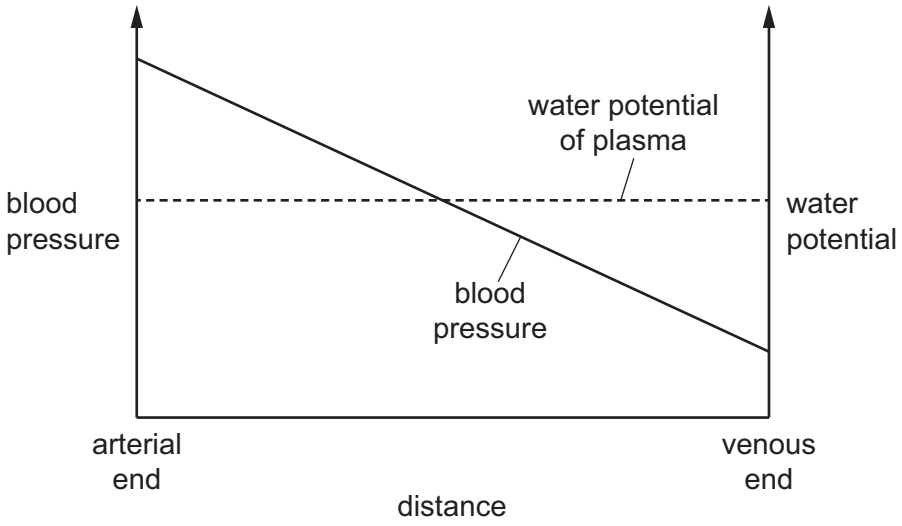
A collagen fibres

B elastic fibres

C endothelium

D smooth muscle

31 The graph shows the changes in blood pressure and water potential across a blood capillary from the arterial end of the capillary to the venous end of the capillary.



What could result in an accumulation of excess tissue fluid?

A an increase in concentration of large proteins in the blood plasma

B an increase in blood pressure

C a decrease in the concentration of small proteins in tissue fluid

D a decrease in blood pressure

32 Which statement is correct about a red blood cell that has just entered a capillary in a respiring muscle?

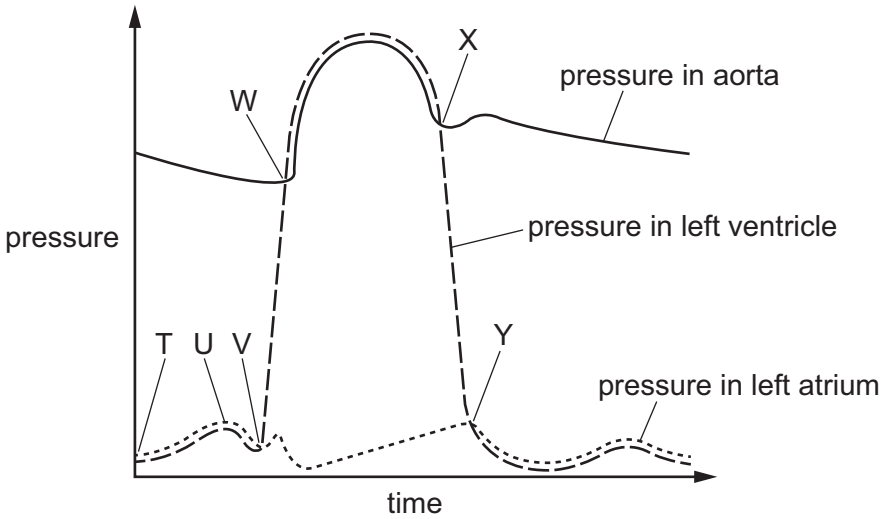
A There is a net decrease in chloride ions.

B There is a net decrease in haemoglobinic acid.

C There is a net increase in carbonic anhydrase.

D There is a net increase in carbaminohaemoglobin.

33 The graph shows some blood pressure changes that occur in a human during one cardiac cycle.



When does systole start and end in the right atrium and in the right ventricle?

	in right atrium		in right ventricle	
	systole starts	systole ends	systole starts	systole ends
A	T	V	V	X
B	T	U	V	Y
C	U	V	W	X
D	V	W	W	Y

34 Which statements about **all** bronchioles are correct?

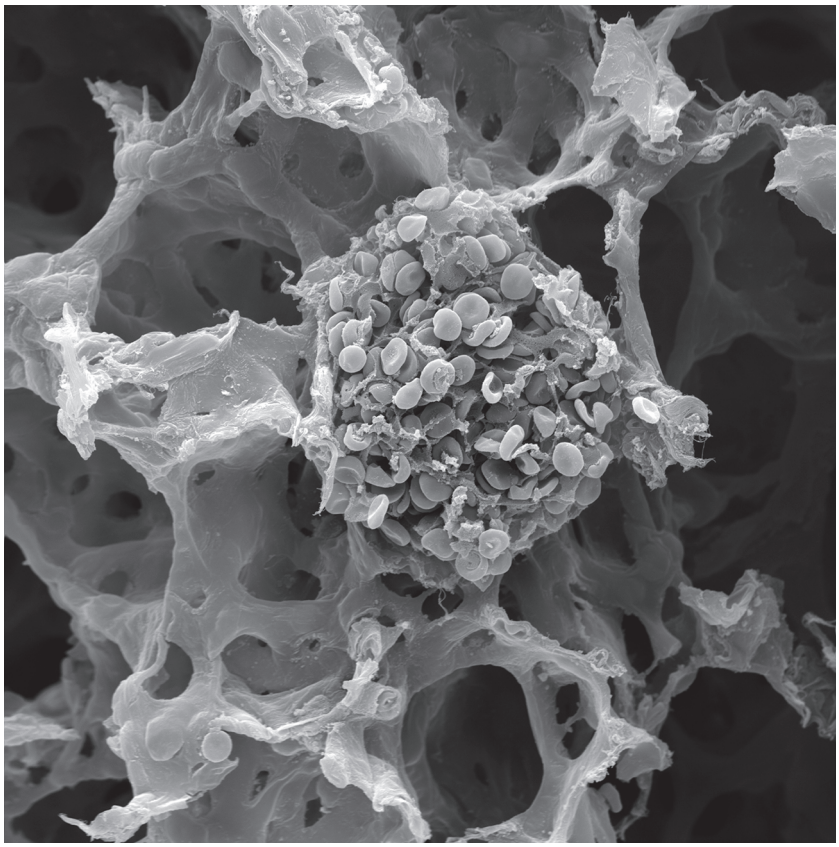
1 They have goblet cells.

2 They have epithelial cells.

3 They have muscle tissue.

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

35 What is shown in the electron micrograph?



×850

A scanning electron micrograph of bronchial epithelium and lymphocytes

B scanning electron micrograph of lung squamous epithelium and red blood cells

C transmission electron micrograph of bronchial epithelium and lymphocytes

D transmission electron micrograph of lung squamous epithelium and red blood cells

36 Which statement correctly describes infectious diseases?

A They are diseases caused by environmental factors that are not passed from one person to another.

B They are diseases caused by a fault in the DNA that can be passed from a parent to their offspring.

C They are diseases caused by a lack of a nutrient in the diet, such as a vitamin or mineral.

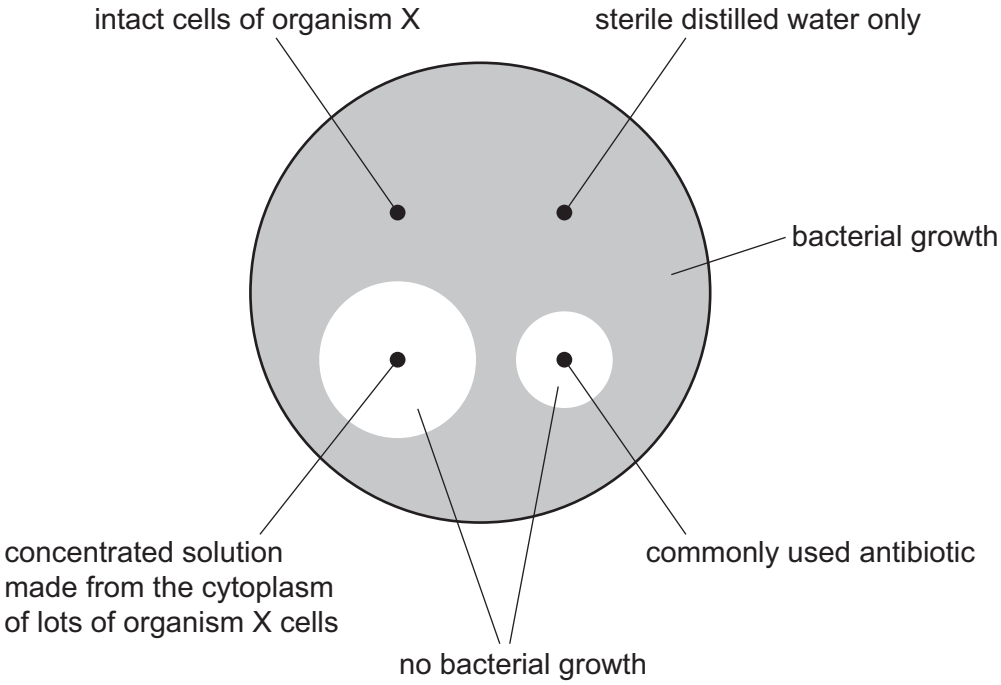
D They are diseases caused by a pathogen such as a bacterium, fungus, protoctist or virus.

37 Organism X produces molecule Y, which blocks the activity of 70S ribosomes.

An experiment was carried out to investigate the effect of Y on bacterial cells.

An agar plate with bacteria growing all over its surface had four wells cut into the agar. Different substances were added to each well and the agar plate with bacteria was incubated for a week.

The diagram shows the results after a week.



Which conclusions can be made from these results?

	molecule Y functions as an antibiotic	molecule Y cannot be released from cells of organism X	molecule Y would also affect the synthesis of proteins from nuclear DNA in a human cell
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✓	✓

key
✓ = can be concluded
✗ = cannot be concluded

38 A patient has had repeated infections from the same pathogen over a few months. The patient has been treated with the same antibiotic on each occasion.

Which treatment could prevent an increase in the antibiotic resistance of the pathogen?

A a narrow spectrum antibiotic to treat a non-cellular pathogen

B a repeat prescription for the same antibiotic at a higher dose

C a specific antibiotic after testing for the pathogen

D a wide spectrum antibiotic to treat different strains of the pathogen

39 A patient with kidney failure can be given a kidney transplant. In a kidney transplant, a healthy kidney is taken from another person and put into the patient's body.

Sometimes the donated kidney cells are killed by the patient's body. In this primary immune response, T-lymphocytes bind to antigens on the donated kidney cells and are activated.

The statements describe the next stages of the primary immune response.

1 Activated T-lymphocyte secretes cytokines.

2 B-lymphocytes differentiate into plasma cells and make antibodies.

3 T-killer cells bind to antigens on donor kidney cells.

4 T-killer cells release toxins that destroy the donor kidney cells.

5 T-lymphocytes multiply by mitosis and differentiate into T-killer cells.

Which order correctly explains how donor kidney cells are killed?

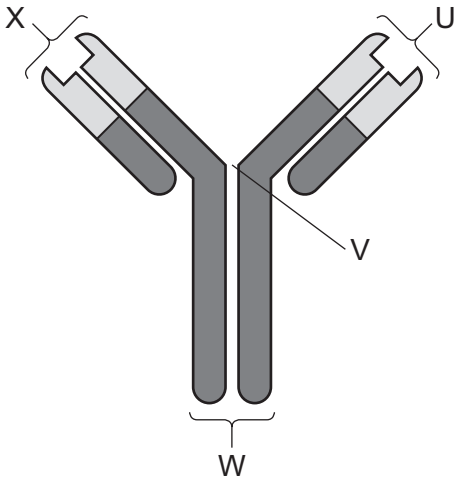
A $1 \rightarrow 5 \rightarrow 2 \rightarrow 3$

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

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

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

40 The diagram shows the simplified structure of an antibody.



Which statement is correct?

A U and X allow the antibody to bind to two different antigens.

B V allows the antibody to be flexible to bind to two antigens.

C W can bind to one specific antigen.

D X can bind with a specific phagocyte receptor.

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