Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/11**

Paper 1 Multiple Choice **October/November 2024**

1 hour 15 minutes

You must answer on the multiple choice answer sheet.

3587767020

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.

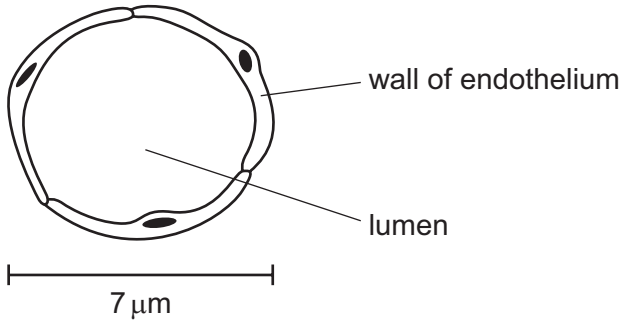
INFORMATION

- 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 The diagram shows a transverse section through a blood capillary.



What is the magnification of the drawing?

A ×200 **B** ×245 **C** ×500 **D** ×5000

2 Which statement explains why lymphocytes with **no** nucleoli die?

A The cells do **not** have centrioles and cannot divide.

B The cells do **not** have mitochondria and cannot release energy.

C The cells do **not** have mRNA and cannot transcribe DNA.

D The cells do **not** have ribosomes and cannot synthesise protein.

3 Density gradient centrifugation is used to separate cell structures by their relative density. Larger cell structures have greater density and sink further down the centrifuge tube.

What is the correct order of the cell structures, starting from the top of the centrifuge tube?

A chloroplasts → nuclei → mitochondria → ribosomes

B nuclei → chloroplasts → mitochondria → ribosomes

C ribosomes → chloroplasts → nuclei → mitochondria

D ribosomes → mitochondria → chloroplasts → nuclei

4 Which cell structures contain nucleic acids?

1 chloroplasts

2 Golgi bodies

3 lysosomes

4 ribosomes

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

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5 The statements describe processes that take place in a secretory cell.

1 Modification of the protein occurs in the Golgi body.

2 mRNA leaves the nucleus.

3 Ribosomes bind to mRNA during translation.

4 Transcription of a specific DNA sequence occurs.

5 Vesicles fuse with the cell surface membrane.

6 Vesicles transport the protein to the Golgi body.

Statement 4 is the first process, and statement 5 is the last process.

What is the correct sequence of the middle four processes?

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

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

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

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

6 How many types of structures with a double membrane that are found in animal cells are also found in plant cells?

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

7 A naturally occurring polysaccharide synthesised in a plant is a branched chain of α-glucose.

The straight parts of the molecule are linked by α-1,6 glycosidic bonds with only a small number of branches which are linked by either an α-1,3 glycosidic bond or an α-1,4 glycosidic bond.

Which polysaccharide has a structure **most** similar to that described?

A amylopectin

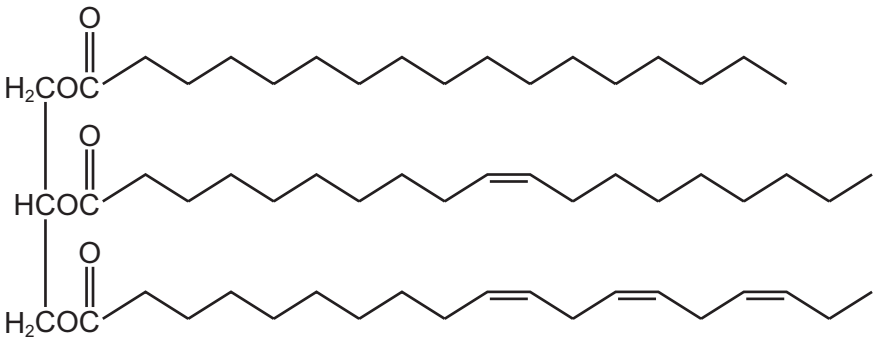
B amylose

C cellulose

D glycogen

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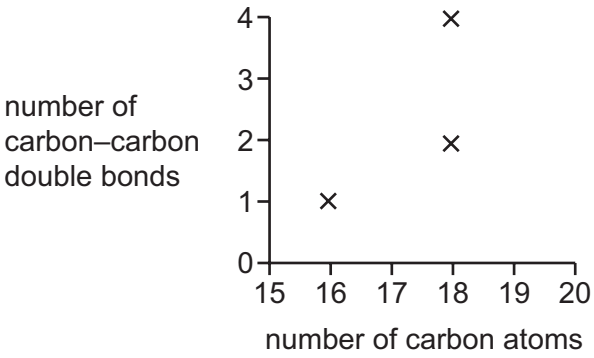
8 The diagram shows a triglyceride.



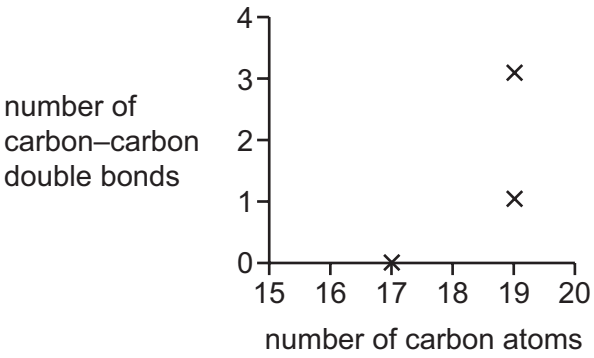
An enzyme was used to digest this triglyceride into glycerol and fatty acids.

Which scatter plot correctly represents each fatty acid component of the triglyceride?

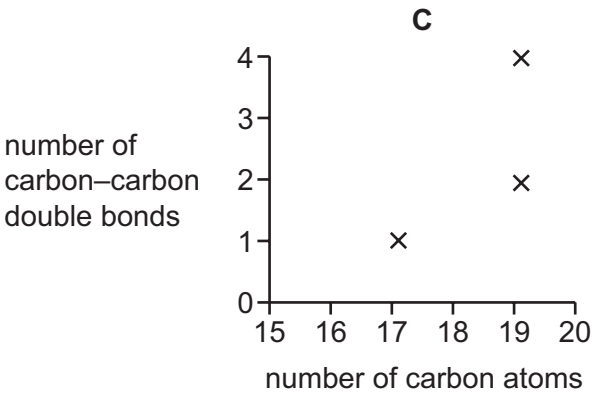
A



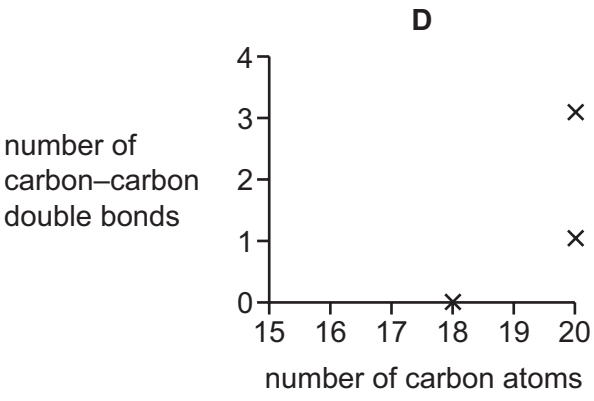
B



C

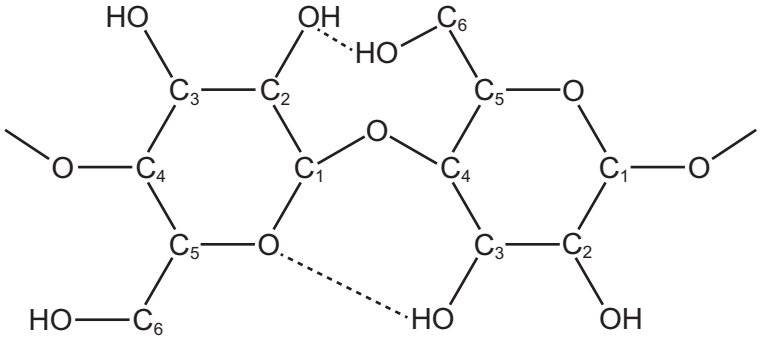


D



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9 The diagram shows how the alternating nature of β-glucose monomers along a chain allows hydrogen bonds to form between consecutive monomers.



Hydrogen bonds in cellulose affect the tensile strength (the ability to withstand pulling forces without breaking).

How do the hydrogen bonds shown in the diagram help cellulose function as a suitable material for a cell wall?

A The hydrogen bonds add additional tensile strength along individual cellulose molecules within the cell wall.

B The hydrogen bonds create stronger crosslinks between adjacent cellulose molecules, adding to the tensile strength of the cell wall.

C Stronger hydrogen bonds form between adjacent cellulose molecules, adding to the tensile strength of the cell wall.

D Cellulose molecules within a cellulose microfibril have a stronger link between them, increasing the tensile strength of the cellulose microfibrils.

10 Two solutions, 1 and 2, each contained a mix of two different biological molecules. One solution contained starch and sucrose, and the other contained glucose and protein.

The two solutions were tested with a variety of reagents to identify the presence of the biological molecules in the solution.

The table shows the results recorded for the various tests.

Which row identifies the two solutions?

	add iodine solution		boil with Benedict's solution		boil with Benedict's solution after acid hydrolysis		add biuret solution	
	1	2	1	2	1	2	1	2
A	✓	✗	✓	✗	✗	✓	✗	✓
B	✗	✓	✓	✗	✓	✗	✗	✓
C	✓	✗	✗	✓	✓	✓	✗	✓
D	✗	✓	✗	✓	✓	✓	✓	✗

key

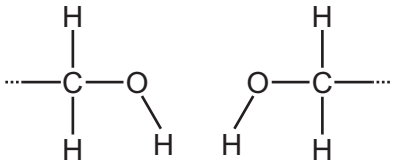
✓ = positive result

✗ = negative result

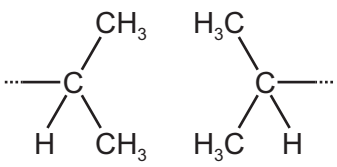
11 The diagrams show parts of three pairs of amino acids within a protein.

The pairs are labelled X, Y and Z.

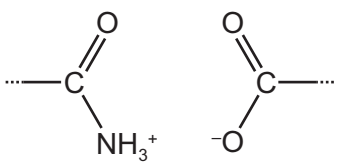
X



Y



Z



Which row shows the correct type of interaction that would occur between the two amino acids in each pair?

	X	Y	Z
A	hydrophobic interaction	hydrophobic interaction	hydrogen bond
B	hydrogen bond	hydrophobic interaction	ionic bond
C	hydrogen bond	hydrogen bond	hydrogen bond
D	hydrophobic interaction	hydrogen bond	ionic bond

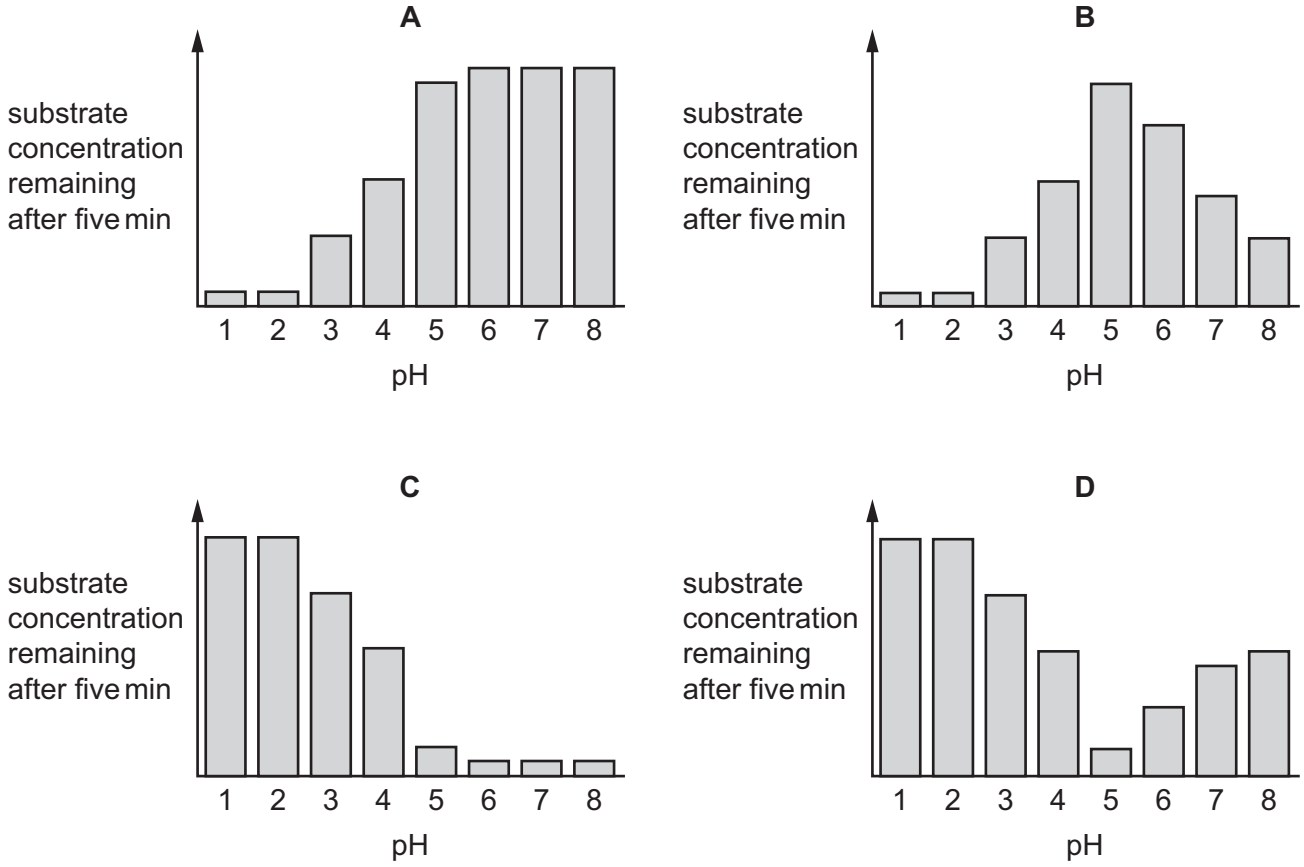
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12 A student carried out investigations at pH 1–8 to look at the effect of pH on an enzyme-catalysed reaction.

The optimum condition for this enzyme is the acidic environment of the stomach at pH 1–2.

The remaining substrate concentration was measured after five minutes at each different pH.

Which graph shows the effect of increasing pH on substrate concentration remaining after five minutes?



13 Which statement is correct for a non-competitive inhibitor?

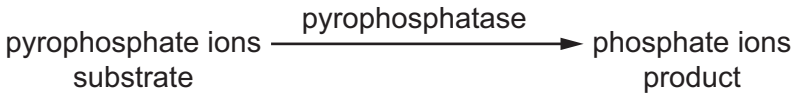
A The inhibitor binds to the active site of the enzyme and decreases V_{max}.

B The inhibitor binds away from the active site and increases the Michaelis–Menten constant.

C The inhibitor decreases V_{max}, but the Michaelis–Menten constant does **not** change.

D The inhibitor does **not** change V_{max} but increases the Michaelis–Menten constant.

14 Pyrophosphatase enzymes catalyse a hydrolysis reaction.

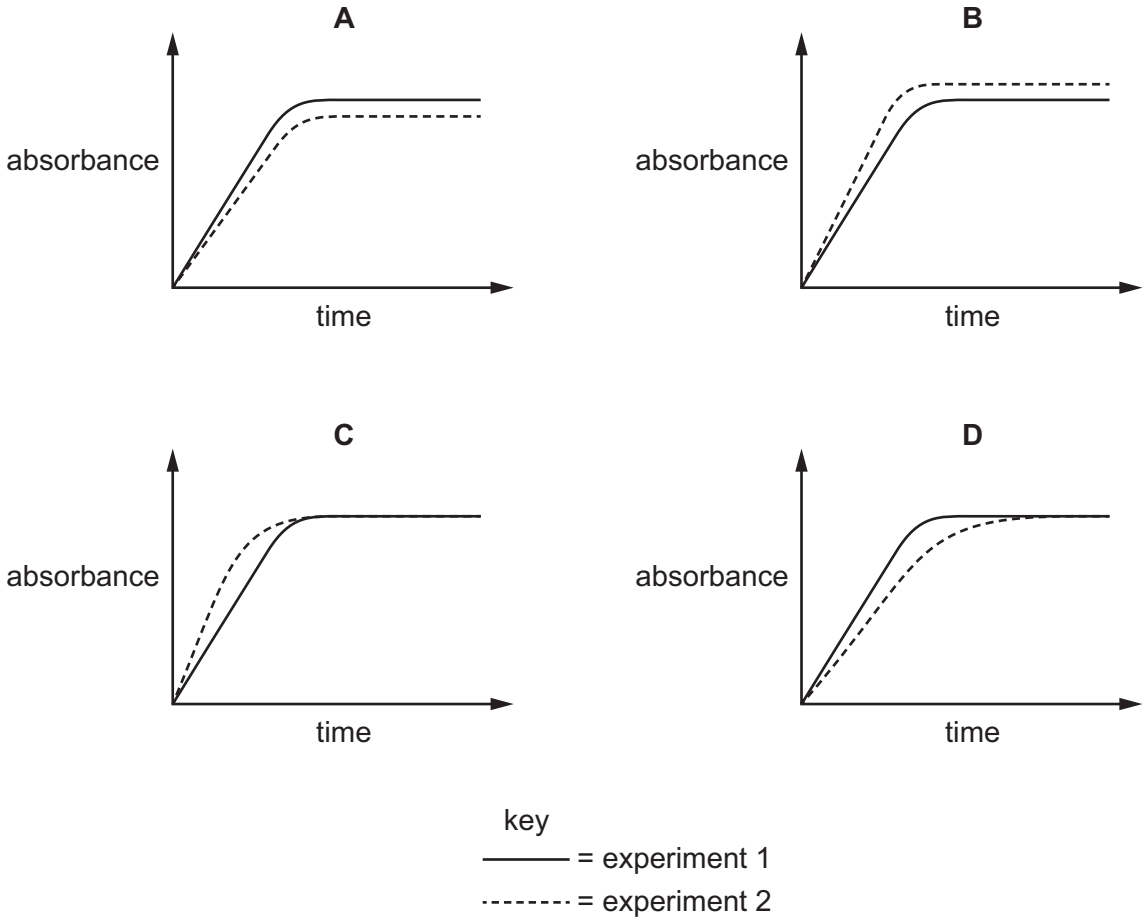


In experiment 1, a scientist studied the rate of this reaction, using a colorimeter.

The absorbance of the solution was measured at regular intervals until all of the pyrophosphate ions had been converted into phosphate ions.

In experiment 2, the scientist repeated the procedure with a higher concentration of pyrophosphatase. All other variables were standardised.

Which graph shows the effect of increasing the concentration of pyrophosphatase?



15 Proteases are a group of enzymes that digest proteins.

Which statements about proteases are correct?

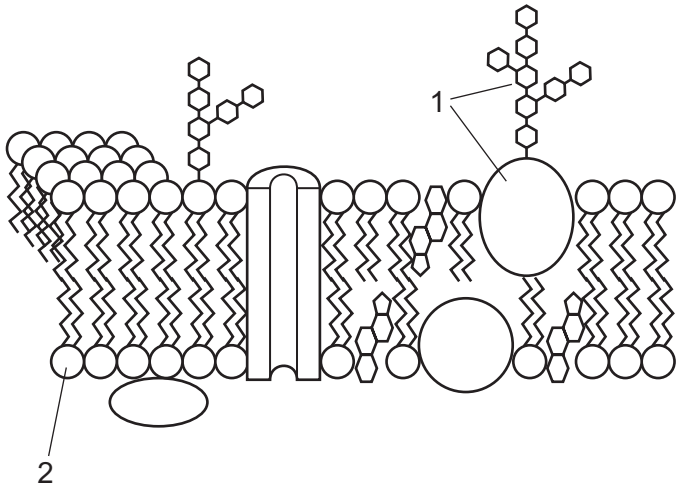
1 A bacterial protease that is secreted from a disease-causing bacterium could act as an antibody and cause the production of antigens against it.

2 Non-competitive inhibition of a protease that has an optimum condition of pH 2 can be overcome by increasing the substrate concentration and increasing the pH.

3 Water molecules are required when peptide bonds that link the monomers together are broken by the action of proteases in hydrolysis reactions.

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

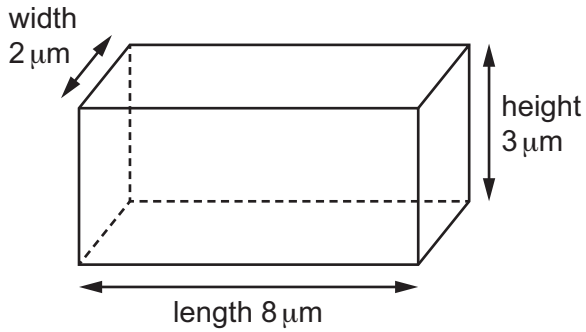
16 The diagram shows part of a cell surface membrane.



Which row correctly identifies the molecules labelled 1 and 2?

	1	2
A	glycoprotein	protein
B	glycolipid	lipoprotein
C	glycoprotein	phosphate head
D	glycolipid	phosphate head

17 The diagram shows the mean dimensions of an epithelial cell in micrometres (μm).



Which row shows the surface area to volume ratio of the epithelial cell and how the surface area to volume ratio of the cell would change if the cell width doubled?

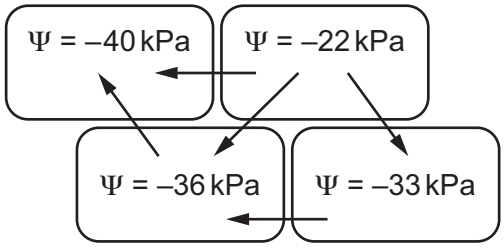
	surface area : volume	how surface area : volume changes if the cell width doubled
A	12 : 23	decreases
B	12 : 23	increases
C	23 : 12	decreases
D	23 : 12	increases

18 Which diagram shows the correct direction of net water movement between the four cells due to osmosis?

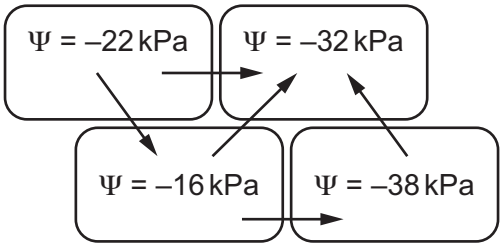
key

Ψ = water potential

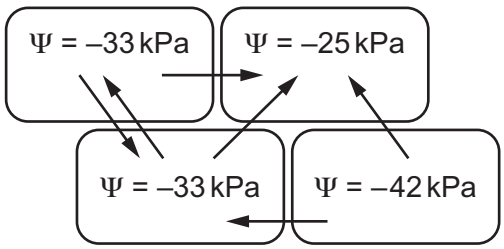
A



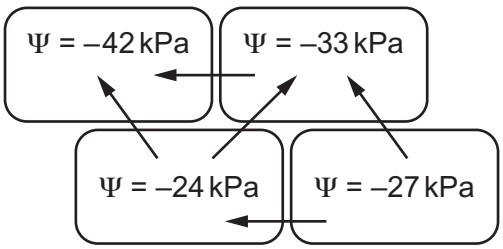
B



C



D



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19 An investigation was carried out into the effect of four different treatments on the permeability of the cell surface membranes and tonoplasts of beetroot cells. Beetroot cell vacuoles contain a red pigment. This pigment **cannot** diffuse through the tonoplasts or cell surface membranes.

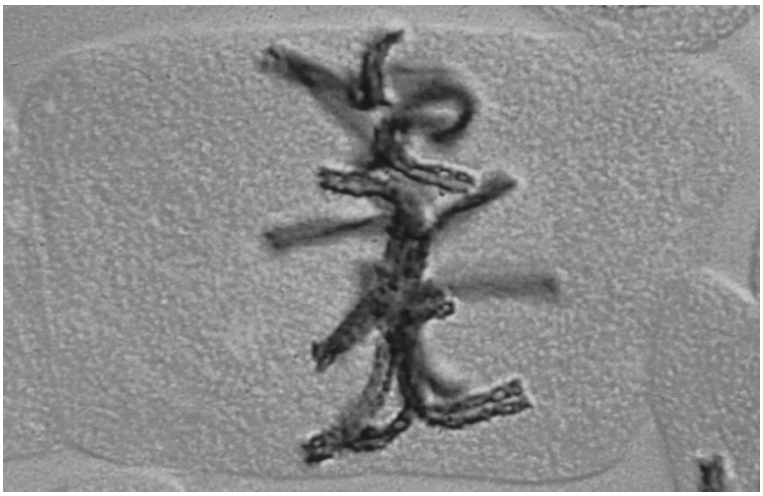
1 cm^3 cubes were cut from beetroot tissue and washed in running water for 20 minutes to remove any pigment released from damaged cells.

Two cubes were then placed in each of the four test-tubes containing different contents and observed for five minutes.

Which row shows a correct explanation for the observation recorded for one of the treatments?

	treatment	observation	explanation
A	dilute hydrochloric acid	contents of test-tube stay clear	membrane proteins have been denatured
B	ethanol	contents of test-tube turn red	lipids, including membrane phospholipids, have dissolved
C	water at 20 °C	contents of test-tube stay clear	membrane proteins have been denatured
D	water at 80 °C	contents of test-tube turn red	lipids, including membrane phospholipids, have dissolved

20 The photomicrograph shows a stage of mitosis.



What would be correct for the next stage in mitosis?

	two sister chromatids remain attached	nuclear membrane
A	no	**not** present
B	no	re-forming
C	yes	**not** present
D	yes	breaking down

21 What are the correct roles of mitosis?

	stem cell growth	replacing lost skin cells
A	✓	✗
B	✓	✓
C	✗	✗
D	✗	✓

key

✓ = correct

✗ = **not** correct

22 Which row about the stages of the mitotic cell cycle is correct?

	DNA ligase used in the nucleus	RNA polymerase used in the nucleus
A	G_1 phase	S phase
B	G_2 phase	mitosis
C	mitosis	G_2 phase
D	S phase	G_1 phase

23 Which statements describe how a gene mutation can lead to the production of a non-functional protein?

1 During transcription, an incorrect nucleotide is added to a DNA molecule.

2 The mutated gene results in a new codon being transcribed.

3 The order of the bases in an anticodon on tRNA is altered during translation.

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

24 There are 64 chromosomes in the muscle cells of a particular mammal.

How many DNA molecules are present in a cell during early prophase and telophase of mitosis?

	early prophase	telophase
A	64	32
B	64	64
C	128	128
D	128	64

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25 The diagram shows the nucleotide sequence of a small section of the transcribed strand of a gene.

GCG CGC GGC GCG

The table shows the amino acids coded for by 10 mRNA codons.

mRNA codon	amino acid
AAG	Lys
ACG	Thr
CGG CGC CGU	Arg
CCG	Pro
GCC GCG	Ala
GGC	Gly
UGC	Cys

What is the sequence of the four amino acids in the polypeptide translated from this small section of a gene?

A Ala-Ala-Cys-Ala

B Ala-Arg-Gly-Ala

C Arg-Ala-Pro-Arg

D Arg-Arg-Thr-Arg

26 How many hydrogen bonds form when adenine and cytosine each bind to their complementary bases?

	adenine	cytosine
A	2	2
B	2	3
C	3	2
D	3	3

27 Which statement correctly identifies the movement of sucrose and amino acids in plant vascular tissue?

A They are carried from source to sink by mass flow in upward and downward directions.

B They are carried from sink to source by cohesion-tension in upward and downward directions.

C They are carried from sink to source by mass flow in one direction.

D They are carried from source to sink by cohesion-tension in one direction.

28 Xylem vessel elements are specialised cells that are adapted for the transport of water.

Which statement correctly matches an adaptation of a xylem vessel element to its function?

A Cytoplasm is only found in a thin layer next to the cell walls and does **not** contain any organelles. This reduces resistance to the flow of water in the xylem vessels.

B The end walls between xylem vessel elements have partially broken down, forming end plates. This reduces resistance to the flow of water in the xylem vessel.

C The walls of the xylem vessel elements contain cellulose that is hydrophilic and can form hydrogen bonds to water, allowing adhesion of water molecules to the vessel walls.

D Xylem vessel elements have plasmodesmata that connect them with companion cells. The companion cells provide ATP, which is needed for the transport of water.

29 A student makes an accurate labelled plan diagram of a section of a leaf containing a vascular bundle.

Which statement correctly describes part of their plan diagram?

A The vascular bundle has labels for the xylem vessel elements, phloem sieve tube elements and companion cells.

B The vascular bundle is divided into two sections, with the section closer to the upper epidermis labelled as xylem and the other section labelled as phloem.

C In the section of the vascular bundle positioned closer to the lower epidermis, each sieve tube element has an associated companion cell.

D The phloem sieve tube elements are drawn with thick cell walls to represent the lignin in the walls.

30 Some babies are born with a hole between the right and left atria. These babies are found to have an increased number of red blood cells.

What is the reason for this increase in red blood cells in these babies?

A Blood is pumped faster, which causes more blood to circulate in the heart.

B More blood is needed in the heart because the pressure is lower.

C Their haemoglobin has a higher affinity for oxygen.

D There is a lower oxygen concentration in the body of the newborn baby.

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31 An increase in carbon dioxide in human blood shifts the oxyhaemoglobin dissociation curve to the right.

What is the explanation for this effect?

A An increase in carbon dioxide concentration increases the breathing rate.

B Carbon dioxide is more soluble than oxygen and displaces it.

C Diffusion of carbon dioxide between the alveoli and the blood is more rapid.

D Increasing the H^+ concentration decreases haemoglobin affinity for oxygen.

32 'Heart block' is a disease which can result in a lower than normal heart rate. A doctor treating a person with heart block found that electrical impulses were initiated as normal but were not correctly conducted to the ventricles, so the rate of ventricular contraction was slowed.

Which parts may **not** be functioning correctly in the person with heart block?

1 atrioventricular node (AVN)

2 Purkyne tissue

3 sinoatrial node (SAN)

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

33 The pumping action of the heart creates hydrostatic pressure in the blood. The table shows the hydrostatic pressure in a blood capillary.

	arteriole end of capillary / KPa	venule end of capillary / KPa
hydrostatic pressure in blood	4.2	1.7

About 90% of the tissue fluid which surrounds a capillary is returned to the blood at the venule end.

How is this achieved?

A The capillary wall is more permeable at the arteriole end than the venule end.

B The hydrostatic pressure in tissue fluid is higher than in blood.

C There is a higher concentration of dissolved solutes in tissue fluid than in blood.

D There is osmotic movement of water from the tissue fluid into the blood.

34 What is the function of cilia in the gas exchange system?

A to increase the surface area

B to move mucus

C to produce mucus

D to trap dust and pathogens

35 Which tissues are present in the walls of a trachea and an alveolus?

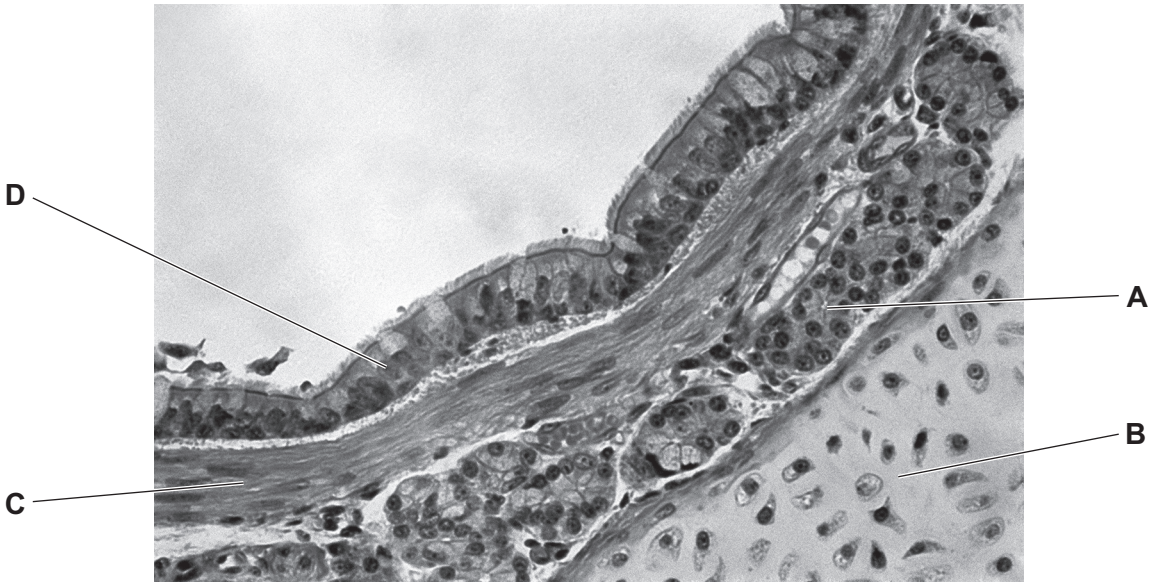
		tissue	
		epithelium with goblet cells	smooth muscle
A	trachea	✓	✓
	alveolus	✗	✗
B	trachea	✓	✓
	alveolus	✗	✓
C	trachea	✓	✗
	alveolus	✓	✓
D	trachea	✗	✓
	alveolus	✗	✗

key

✓ = present
✗ = **not** present

36 The photomicrograph shows part of a bronchus.

Which label identifies cartilage?



37 Which structures or compounds are present in a typical cell that can be killed by penicillin?

1 circular DNA

2 cytoplasmic DNA

3 70S ribosomes

4 peptidoglycan

A 1, 2, 3 and 4

B 1, 2 and 4 only

C 1 and 2 only

D 4 only

38 Three statements about cholera and its transmission are listed.

1 The pathogen causes watery faeces.

2 Frequent air flight has led to mobile populations.

3 The pathogen is transmitted through water.

Which statements are reasons why outbreaks of cholera are likely to occur?

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

39 What will be produced by the division of memory cells during a secondary immune response?

A macrophages

B plasma cells

C neutrophils

D monocytes

40 A vaccine is used to give immunity to the virus that causes the disease influenza.

A new influenza vaccine is needed every year because the virus mutates regularly.

What is the reason for needing a new influenza vaccine every year?

A Memory cells become less effective as they age.

B The primary immune response does **not** produce enough antibodies.

C The secondary immune response does **not** produce enough antibodies.

D The virus antigens change and are **not** recognised by the immune system.

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Cambridge International AS & A Level

BIOLOGY **9700/12**

Paper 1 Multiple Choice **October/November 2024**

1 hour 15 minutes

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You will need: Multiple choice answer sheet
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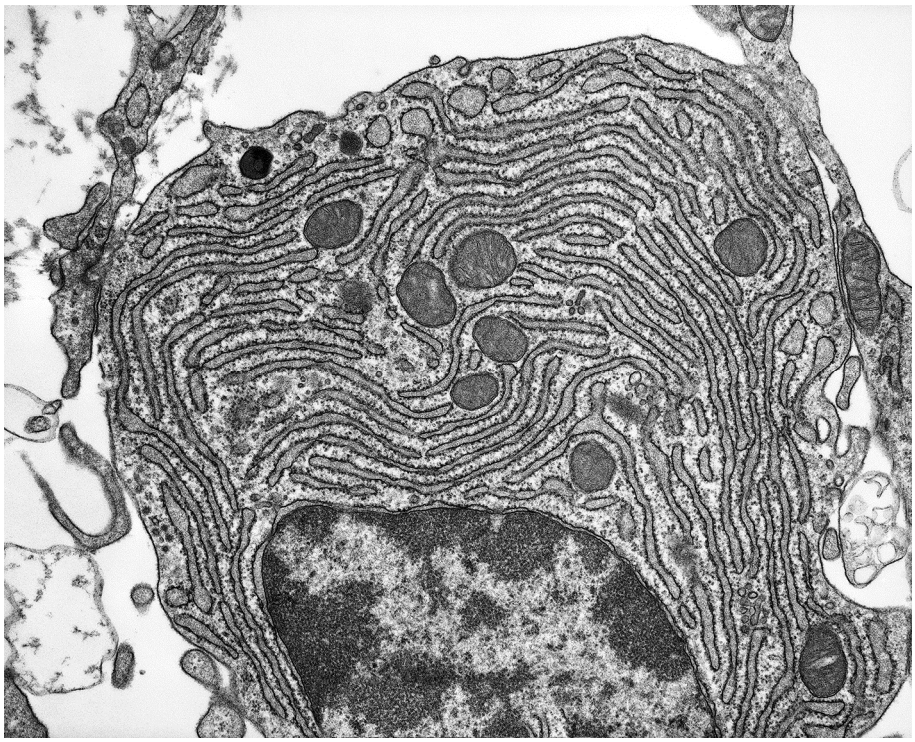
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1 A light microscope is used to observe two structures that are 200 nm apart on the slide.

What is the actual distance between the two structures when the magnification is changed from ×40 to ×400?

A 2 μm **B** 20 μm **C** 200 nm **D** 2000 nm

2 A cell is shown in the micrograph.



Which statement explains how it is possible to identify the type of microscope used to produce the micrograph?

A The nucleus is visible, so an electron microscope was used.

B The endoplasmic reticulum is **not** visible, so a light microscope was used.

C Chloroplasts are visible, so a light microscope was used.

D Ribosomes are visible, so an electron microscope was used.

3 Which statement supports the fact that mature plant cells contain organelles that carry out the same role as lysosomes?

A A range of hydrolytic enzymes can be found within mature plant vacuoles.

B Glycogen, found within vesicles, can be hydrolysed to glucose molecules.

C Double membrane-bound vesicles are formed from plant Golgi bodies.

D Vesicles, formed from the cell surface membrane, contain enzymes.

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4 Which cell structures may contain cisternae?

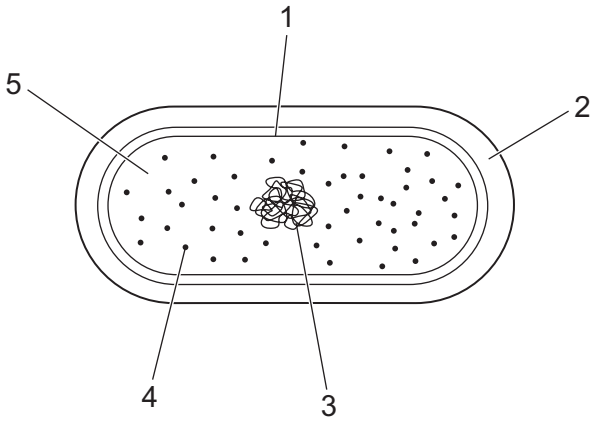
	chloroplast	endoplasmic reticulum	Golgi body	mitochondrion
A	✓	✓	✓	✗
B	✓	✗	✗	✓
C	✗	✓	✓	✗
D	✗	✓	✗	✓

key

✓ = may contain cisternae

✗ = does **not** contain cisternae

5 The diagram shows some cell structures of one type of cell.



Which labelled cell structures are present in typical eukaryotic cells **and** typical bacterial cells?

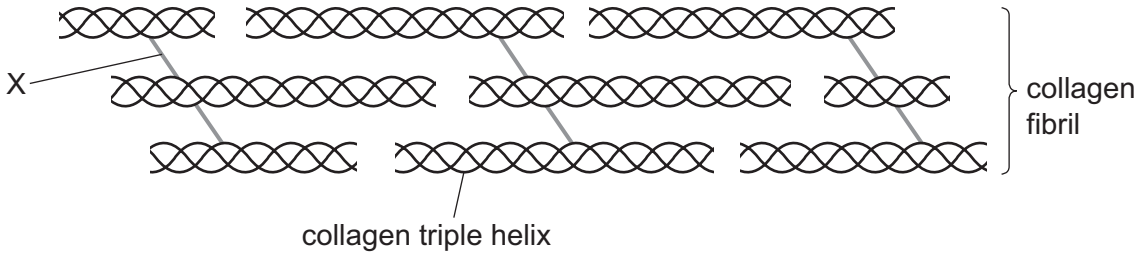
A 1, 2, 3 and 4

B 1, 3, 4 and 5

C 1, 2 and 3 only

D 3, 4 and 5 only

6 The diagram shows part of a collagen fibril made of collagen triple helices. The collagen triple helices are linked to each other by one type of bond. This bond is labelled as X in the diagram.



What is bond X?

A covalent bond

B disulfide bond

C hydrogen bond

D peptide bond

7 The table shows some information about the polypeptides that make up haemoglobin.

	α-globin	β-globin
total number of amino acid residues in polypeptide chain	141	146
position of amino acid cysteine in polypeptide chain	104	93 and 112

Scientists studied the region of the β-globin polypeptide chain containing the amino acid cysteine at position 93. They found that:

- this region faces outwards when **no** oxygen is attached to the haem group
- this region faces inwards when oxygen is attached to the haem group
- replacing cysteine with a different amino acid reduces the Bohr shift.

What can be concluded from the information about cysteine in haemoglobin?

A More than 1% of the amino acids in one haemoglobin protein are cysteine.

B In α-globin, there is a cysteine closer to the end of the polypeptide chain with an unreacted carboxyl group than in β-globin.

C The replacement of the cysteine at position 93 in β-globin decreases the affinity of haemoglobin for oxygen at low pH.

D The binding of oxygen to the haem group causes the region of β-globin containing cysteine at position 93 to become more hydrophilic.

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8 Which feature of glycogen distinguishes it from starch?

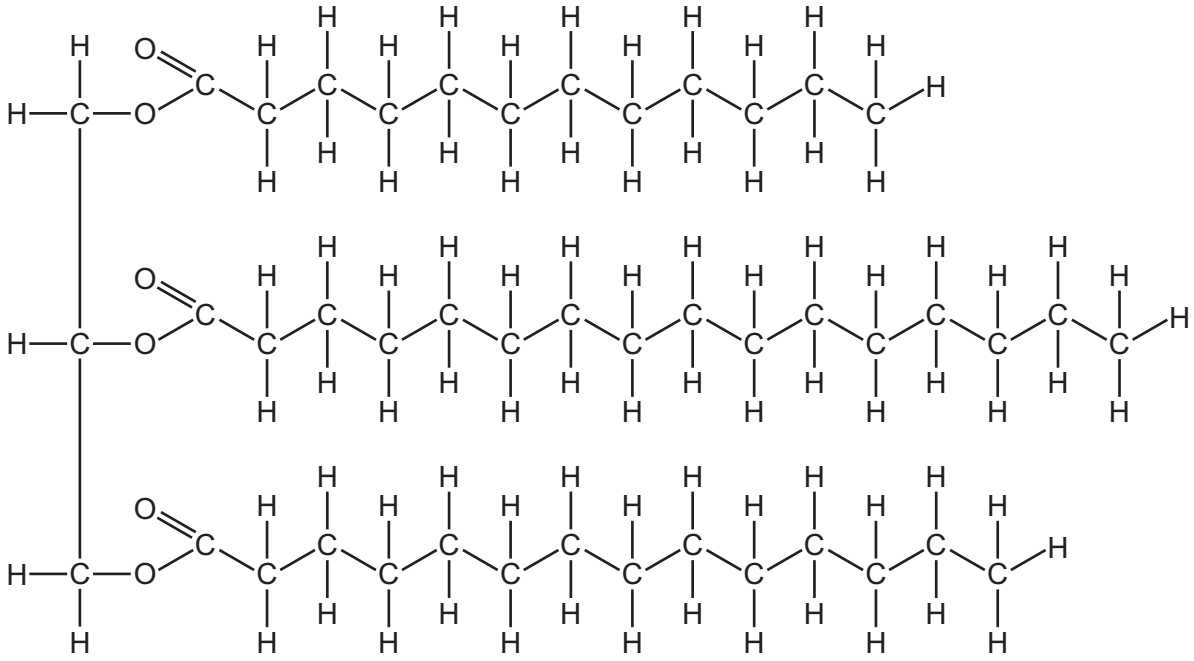
A All glycogen molecules are highly branched.

B All glycogen molecules are polysaccharides.

C All glycogen molecules contain α-glucose.

D All glycogen molecules contain 1,4-glycosidic bonds.

9 The diagram shows a biological molecule.



Which molecules would be produced if this biological molecule was hydrolysed?

A amino acids and glycerol only

B amino acids, glycerol and water

C fatty acids and glycerol only

D fatty acids, glycerol and water

10 A mixture of glucose and starch solutions was placed in a length of dialysis (Visking) tubing and the tubing sealed. The tubing was then placed in a boiling tube containing distilled water. Two samples were immediately removed from this water (time 0 minutes) and tested with either iodine solution or Benedict's solution. This was repeated at 10 minute intervals for 30 minutes.

The iodine solution gave an orange-brown colour each time.

The table shows the results of the Benedict's test.

	time / minutes			
	0	10	20	30
colour produced by Benedict's test	blue	green	yellow	red

What may be concluded from these results?

1 The pores in the Visking tubing are too small for a starch molecule to pass through.

2 Glucose diffuses through the Visking tubing down a diffusion gradient.

3 Water diffuses into the Visking tubing.

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

11 Which molecules are globular proteins?

1 amylase

2 haemoglobin

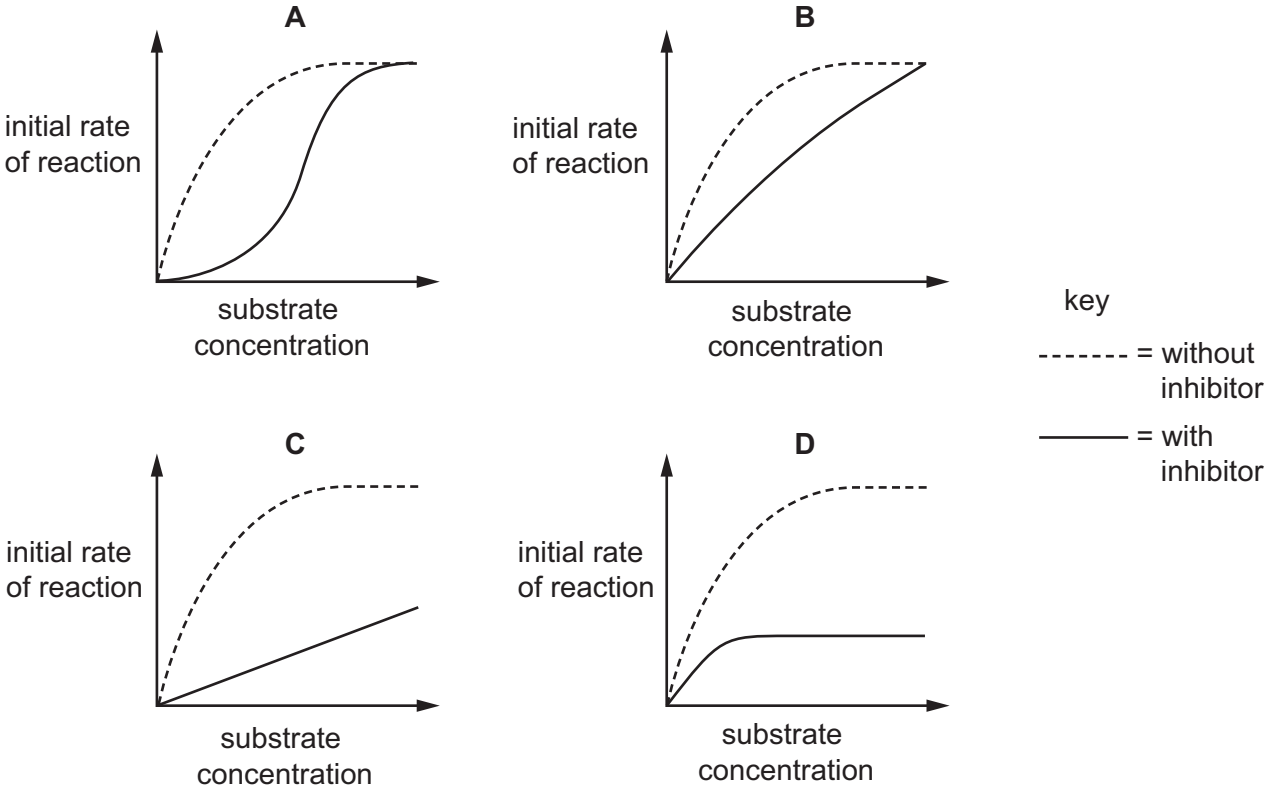
3 DNA polymerase

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

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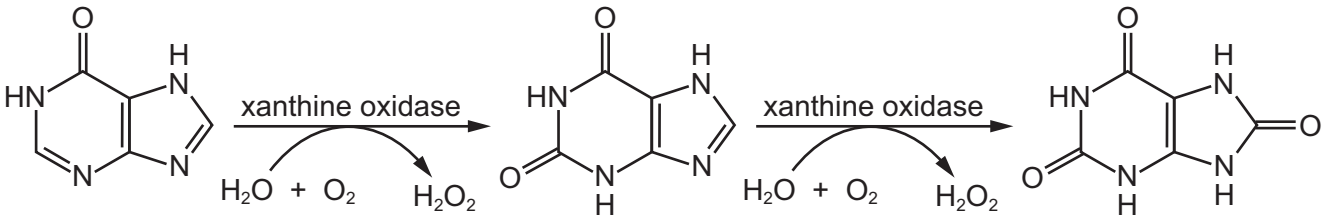
12 The initial rate of a reaction catalysed by an enzyme was measured at various substrate concentrations.

Which graph shows the effect of a low concentration of non-competitive inhibitor on the reaction?



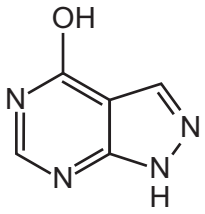
13 Gout is a type of arthritis in which small uric acid crystals form inside and around the joints. It causes sudden attacks of severe pain and swelling.

The diagram shows how uric acid is formed from hypoxanthine catalysed by the enzyme xanthine oxidase.



hypoxanthine xanthine uric acid

Gout can be treated using a drug called allopurinol which has a similar shape to hypoxanthine.



allopurinol

What can be concluded from this information about how allopurinol prevents the formation of uric acid?

A It binds to the active site of xanthine oxidase instead of hypoxanthine, resulting in reduced production of uric acid.

B It binds to another part of xanthine oxidase and this changes the shape of the active site.

C It disrupts the hydrogen bonds within xanthine oxidase so it denatures and the active site is no longer complementary to hypoxanthine and xanthine.

D It hydrolyses the peptide bonds within xanthine oxidase to change the shape of the active site.

14 Phospholipids are formed in a similar way to triglycerides.

A sample contained six phospholipid molecules.

- The molecular weight of a phosphate ion is 95 g mol^{-1}.
- The molecular weight of each individual fatty acid in this sample was found to be 282 g mol^{-1}.
- The molecular weight of glycerol is 92 g mol^{-1}.
- The molecular weight of water is 18 g mol^{-1}.

What is the molecular weight of the sample in g mol^{-1}?

A 2598 **B** 4182 **C** 4506 **D** 4830

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15 Which statements about phospholipids in cell surface membranes are correct?

1 Fatty acid tails allow most ions to pass through the membrane.

2 Hydrophobic tails point inwards facing each other.

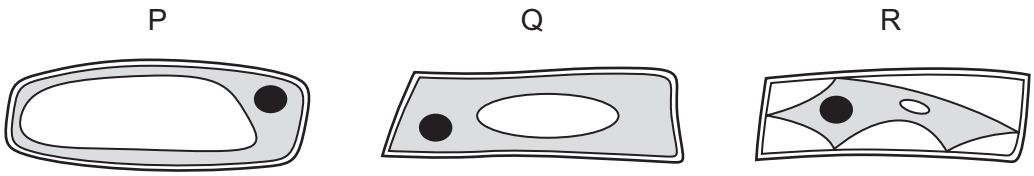
3 All polar heads face the cytoplasm.

4 The phospholipids help with the flexibility of the membrane.

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

16 In an experiment, pieces of onion epidermis are put into three different concentrations of sucrose solutions, P, Q and R. The pieces of onion are left for an hour and then examined using the low power of a light microscope.

Each diagram shows one cell from the epidermis that was placed in each of the sucrose concentrations.



What explains the appearance of cells in solution Q?

A The concentration of solution Q is equal to the concentration of the solutes in the cell sap.

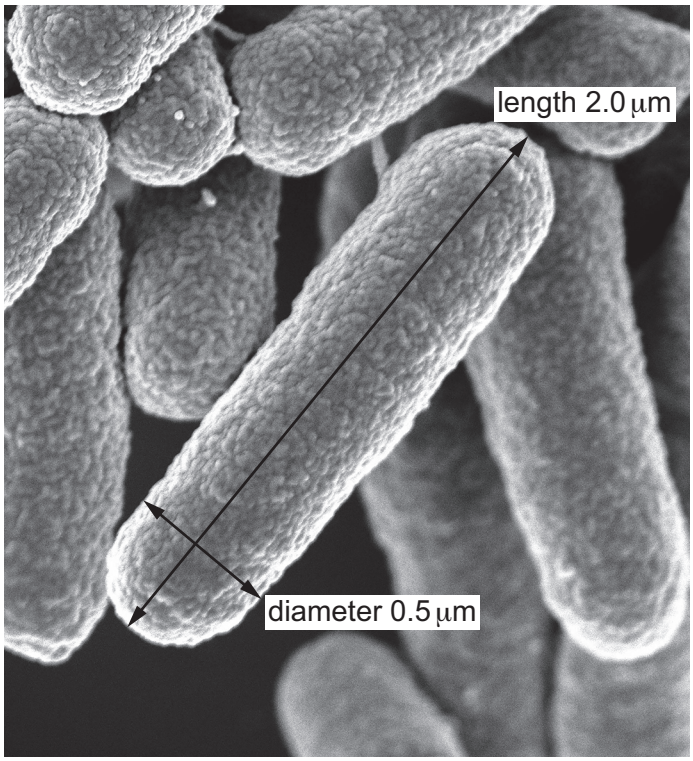
B The cytoplasm has the same concentration of sucrose as solution Q.

C The water potential of the cytoplasm is equal to the water potential of the vacuole.

D The water potential of the cell sap is equal to the water potential of solution Q.

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17 The electron micrograph shows rod-shaped bacteria.



The actual length of the bacterium is 2.0 μm and the diameter is 0.5 μm. Assume that the bacterium is cylinder-shaped.

What is the surface area to volume ratio of the bacterium?

A 3.0 : 1.0 **B** 5.0 : 1.0 **C** 8.0 : 1.0 **D** 9.0 : 1.0

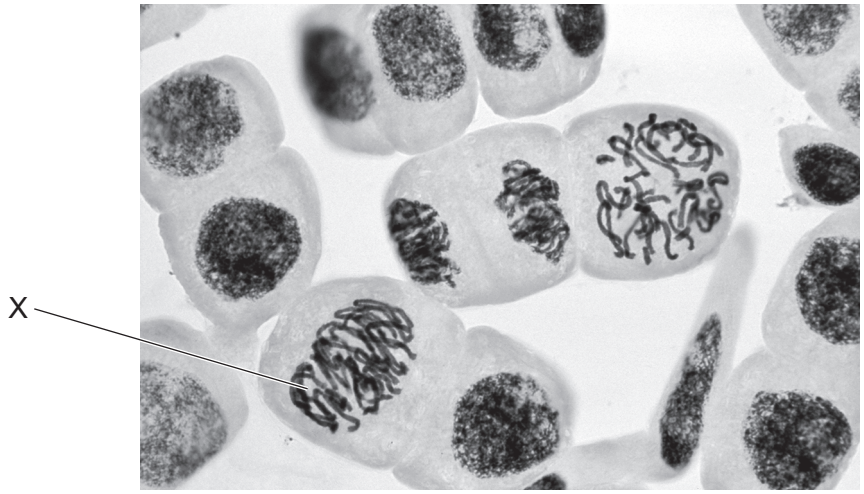
18 Chickens have 78 chromosomes in the nucleus of a body cell.

How many DNA molecules are there in a chicken body cell at the start of prophase of mitosis?

A 46 **B** 78 **C** 92 **D** 156

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19 The photomicrograph shows cells undergoing mitosis.



Which statement describes what will happen next in cell X?

A Chromatin coils up tightly and the nuclear envelope breaks down.

B Chromosomes line up along the equator of the cell and attach to the spindle.

C Sister chromatids move towards opposite poles, pulled by the spindle fibres.

D Spindle fibres break down and the cell prepares for cytokinesis.

20 Which processes occur in bone marrow cells that are in a mitotic cell cycle?

1 Phosphate groups bind to ADP molecules to form ATP.

2 Bonds form between nucleotides in a DNA strand.

3 Hydrogen bonds form between tRNA anticodons and mRNA codons.

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

21 The enzyme telomerase prevents loss of telomeres after many mitotic cell cycles.

Which cells need to transcribe telomerase enzyme?

1 stem cells

2 activated memory B-lymphocytes

3 helper T-lymphocytes secreting cytokines

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

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22 A polypeptide molecule contains the amino acid sequence:

glycine – leucine – lysine – valine.

The table shows DNA triplets for these amino acids.

glycine	leucine	lysine	valine
CCC	GAA	TTT	CAA

Which tRNA anticodons are needed for the synthesis of this polypeptide?

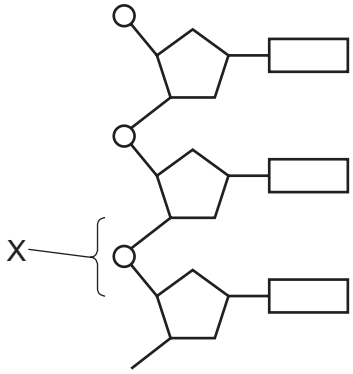
A CCC GAA TTT CAA

B CCC GAA UUU CAA

C GGG CUU AAA GUU

D GGG CUU UUU GUU

23 The diagram shows a section of a strand of DNA.



Which type of bond is labelled X?

A glycosidic

B hydrogen

C peptide

D phosphodiester

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24 Which row correctly describes cytosine?

	ring structure	number of hydrogen bonds it forms with its complementary base	type of base
A	double	three	purine
B	double	two	pyrimidine
C	single	three	pyrimidine
D	single	two	purine

25 During the production of protein molecules, only one strand from the DNA double helix is used.

Which name is given to the DNA strand that is used to produce a new protein?

A non-transcribed strand

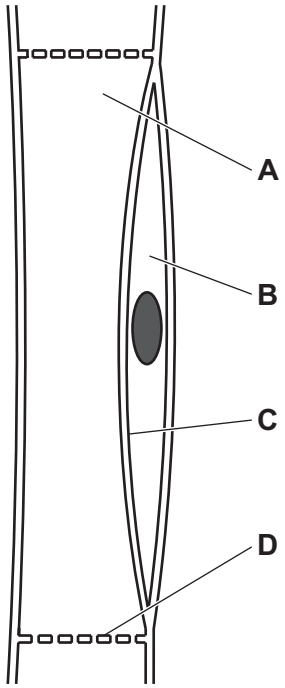
B leading strand

C template strand

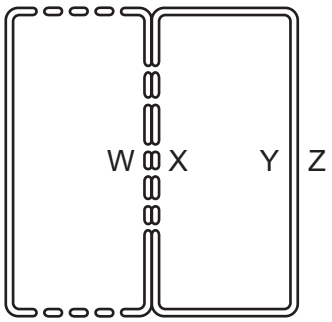
D lagging strand

26 The diagram shows a longitudinal section of a phloem sieve tube with a companion cell.

Where are the mitochondria located for the release of energy for cotransport?



27 The diagram shows a phloem sieve tube element and a companion cell that are involved in translocation of sucrose.



Which process correctly describes the translocation of sucrose through these cells?

A Sucrose moves from Y to Z by active transport.

B Protons move from Y to Z by active transport.

C Protons move from Z to Y by diffusion.

D Protons move from X to W by diffusion.

28 Which types of molecules are cotransported into companion cells?

A monomers and disaccharides

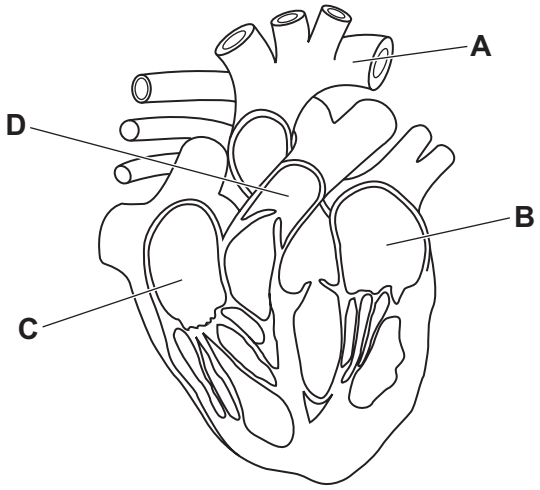
B monomers and polysaccharides

C polymers and disaccharides

D polymers and monosaccharides

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29 The diagram shows a section through the human heart.



Which label is correct?

A pulmonary artery

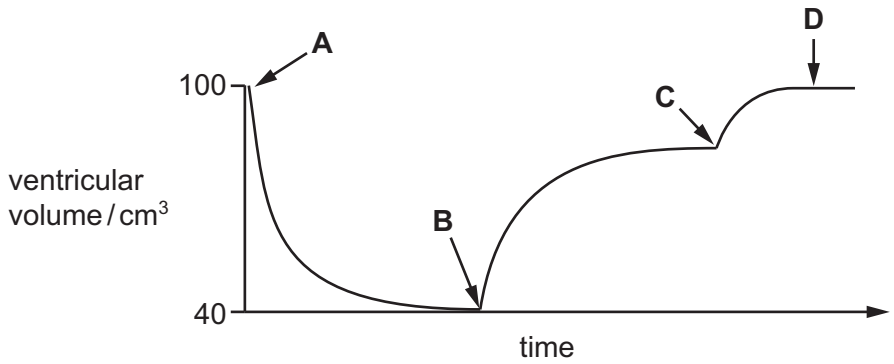
B left ventricle

C right atrium

D aorta

30 The graph shows how the volume of the left ventricle changes during one cardiac cycle.

Which point on the graph represents the start of atrial systole?



31 Which statement is correct?

A In a red blood cell, CO_2 can combine with haemoglobin to form haemoglobinic acid.

B Carbonic anhydrase is an enzyme that catalyses the reaction between CO_2 and H_2O.

C At the lungs, carbon dioxide is released when carbonic acid and water react together.

D The greater the concentration of CO_2 in the blood, the higher the affinity of haemoglobin for oxygen.

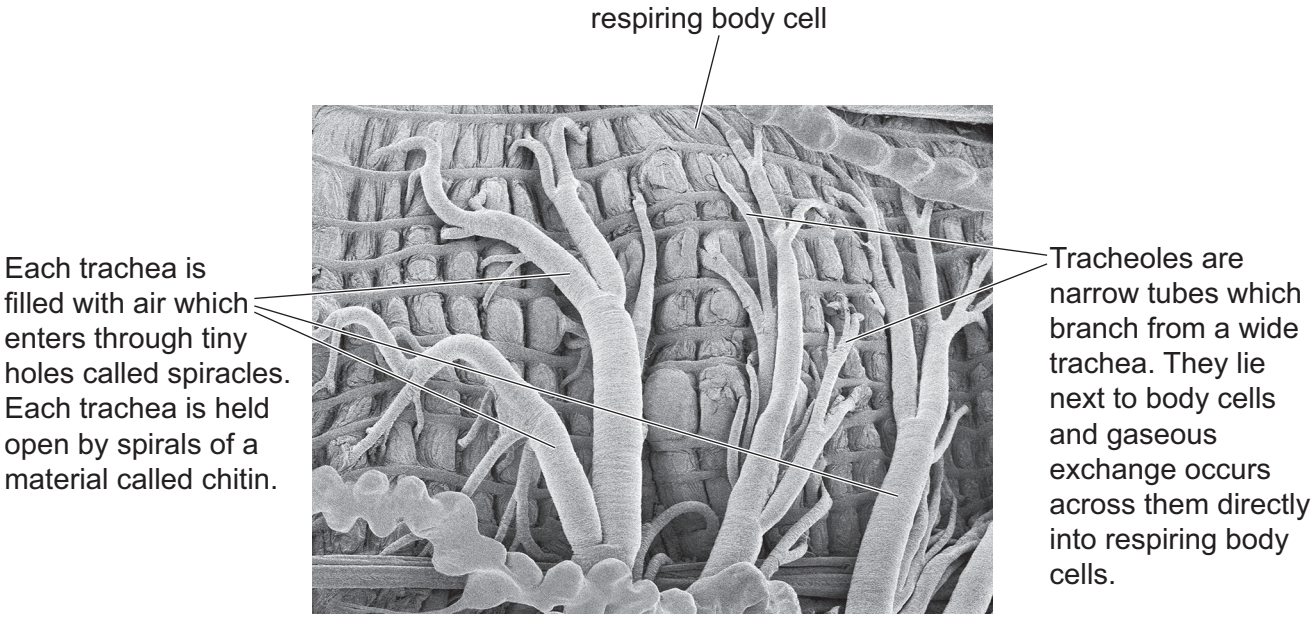
32 Which row is correct for an artery?

	inner layer	middle layer	outer layer
A	smooth layer of endodermis cells	collagen, elastic fibres and smooth muscle	collagen only
B	smooth layer of endodermis cells	elastic fibres and smooth muscle only	collagen and elastic fibres
C	smooth layer of squamous cells	collagen, elastic fibres and smooth muscle	collagen and elastic fibres
D	smooth layer of squamous cells	elastic fibres and smooth muscle only	collagen only

33 Which row shows the features of the gas exchange surface that increase diffusion of carbon dioxide and oxygen?

	concentration gradient	diffusion distance
A	steep	long
B	steep	short
C	shallow	long
D	shallow	short

34 The electron micrograph shows some of the airways in the gaseous exchange system of an insect and the respiring body cells that surround them.



Which statements describe correct differences between the insect gas exchange system shown in the electron micrograph and the human gas exchange system?

1 Gas exchange occurs through the walls of the airways directly into respiring body cells in insects but this does **not** occur in humans.

2 There are spirals of chitin in the walls of a trachea in insects to hold it open but **not** in humans.

3 There is more than one trachea in the gas exchange system of the insect but only one in humans.

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

35 Which row is correct for the wall of the trachea **and** the wall of the bronchus?

	cartilage	smooth muscle	goblet cells
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✓	✗

key

✓ = present

✗ = **not** present

36 A bacterial pathogen produces a protein that acts as a toxin. This toxin is harmful to humans.

Scientists are developing monoclonal antibodies that can be used to detect the presence of the toxin in the body so that early treatment can be given.

Which statements describe steps in the development of these monoclonal antibodies?

1 The toxin protein is injected into a mouse and triggers mitosis of specific B-lymphocytes.

2 Antibodies are collected from the spleen of the mouse and fused with myeloma cells.

3 A hybridoma cell produces many antibodies with a variety of different variable regions.

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

37 Which statements are correct for penicillin?

1 It is harmful to prokaryotic cells.

2 It disrupts cell wall synthesis.

3 It becomes less effective with regular use.

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

38 Why is passive immunity effective for only a short time?

A Antibodies are rapidly broken down.

B Antigens are rapidly broken down.

C Memory cells soon die.

D Phagocytes soon die.

39 Which row is correct for the control or prevention methods for each disease?

	TB	malaria	cholera
A	vaccination	chlorination of water	vaccination
B	chlorination of water	contact tracing	destruction of the vector
C	contact tracing	destruction of the vector	chlorination of water
D	destruction of the vector	vaccination	contact tracing

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40 Peptidoglycan is stained purple by the chemical crystal violet.

Which cells would stain purple in the presence of crystal violet?

A palisade mesophyll cells

B *Vibrio cholerae* cells

C *Plasmodium falciparum* cells

D endothelial cells

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BIOLOGY **9700/13**

Paper 1 Multiple Choice **October/November 2024**

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. Any blank pages are indicated.

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1 Which steps are needed to find the actual width of a xylem vessel viewed in transverse section using a ×10 objective lens?

1 Convert from mm to μm by multiplying by 10^{-3}.

2 Calibrate the eyepiece graticule using a stage micrometer on a ×4 objective lens.

3 Measure the width of the xylem vessel using an eyepiece graticule.

4 Multiply the number of eyepiece graticule units by the calibration of the eyepiece graticule.

A 1, 2, 3 and 4

B 1 and 2 only

C 2, 3 and 4 only

D 3 and 4 only

2 Which cell structure is found in human cells **and** typical plant cells?

A 70S ribosomes

B cilia

C plasmodesmata

D tonoplast

3 Which statements are correct for a typical prokaryotic cell?

1 It contains 70S ribosomes.

2 It contains a cellulose cell wall.

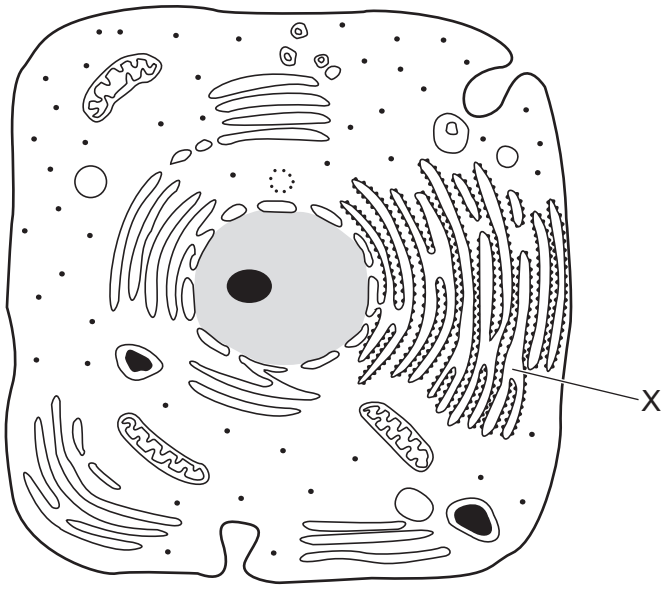
3 It contains circular DNA.

4 It is up to 5 μm in diameter.

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

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4 The diagram shows 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 What describes a lysosome?

A a vesicle containing enzymes, enclosed by a double membrane, that is budded off the endoplasmic reticulum

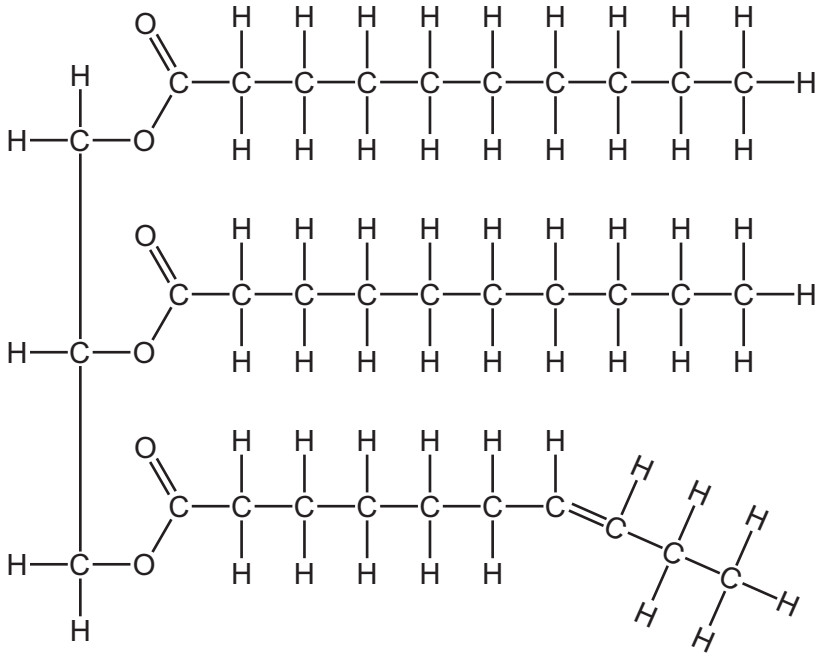
B a vesicle containing hydrolytic enzymes and surrounded by a single membrane, found only in phagocytes

C a vesicle enclosed by a single membrane, containing several different hydrolytic enzymes that may act inside or outside the cell

D a vesicle surrounded by a double membrane, containing enzymes which can hydrolyse damaged organelles in a cell

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6 The diagram shows a triglyceride.



What will be the products after hydrolysis of this triglyceride?

A 1 molecule of glycogen, 3 unsaturated fatty acids and 3 molecules of water

B 1 molecule of glycerol, 2 saturated fatty acids and 1 unsaturated fatty acid

C 1 molecule of glycogen, 2 saturated fatty acids and 1 unsaturated fatty acid

D 1 molecule of glycerol, 1 saturated fatty acid, 2 unsaturated fatty acids and 3 molecules of water

7 Which description lists all the components of a human haemoglobin molecule?

A four polypeptides that are all the same and one haem group

B four polypeptides that are **not** all the same and one haem group

C four polypeptides that are all the same and four haem groups

D four polypeptides that are **not** all the same and four haem groups

8 HIV-1 protease is an enzyme produced by the HIV virus.

Two identical chains of 99 amino acids form the enzyme. In each chain, amino acids 25, 26 and 27 in the sequence form part of the active site.

Which orders of protein structure control the shape of the active site?

A primary, secondary, tertiary and quaternary

B primary, secondary and tertiary only

C primary and quaternary only

D quaternary only

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9 Which statements are correct reasons for how animals cool down in hot environments using latent heat of vaporisation of water?

1 Some animals lie down and roll in wet soil.

2 Fish move into deeper water.

3 Some animals lick their fur to make it wet.

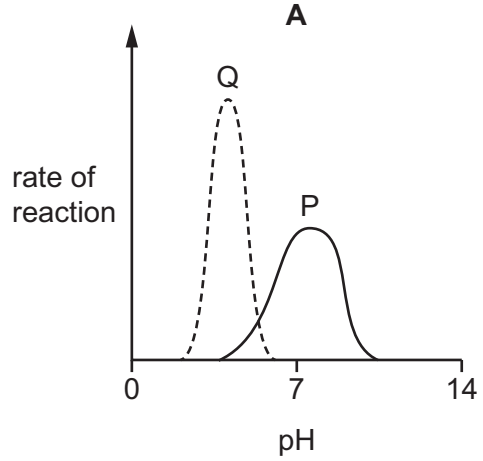
4 Some animals breathe quickly with a wet tongue hanging out of their mouth.

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

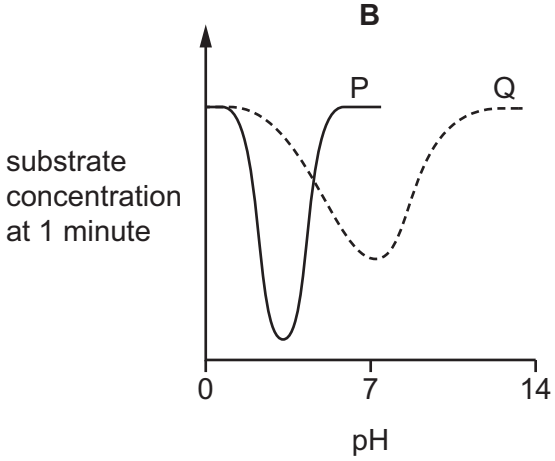
10 Two different enzymes, P and Q, are investigated to find the optimum pH for each enzyme. The results show that P works only in acidic conditions. Q has an optimum pH which is slightly alkaline.

Which graph shows the correct results for P and Q?

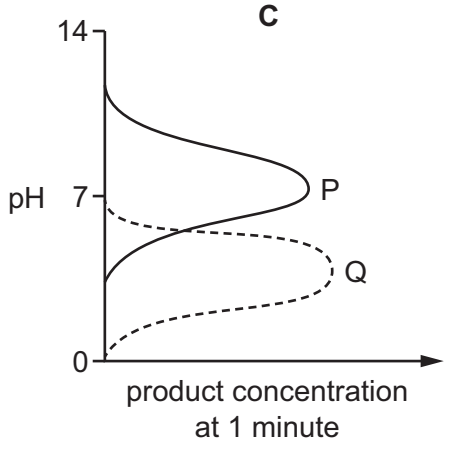
A



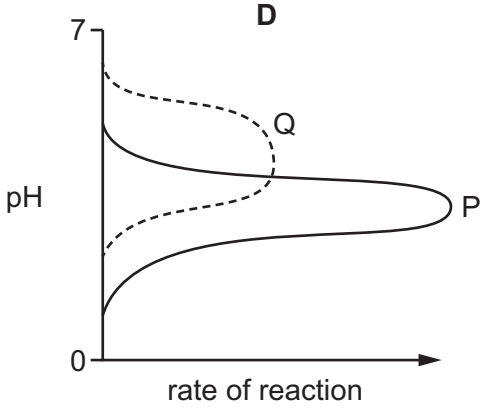
B



C

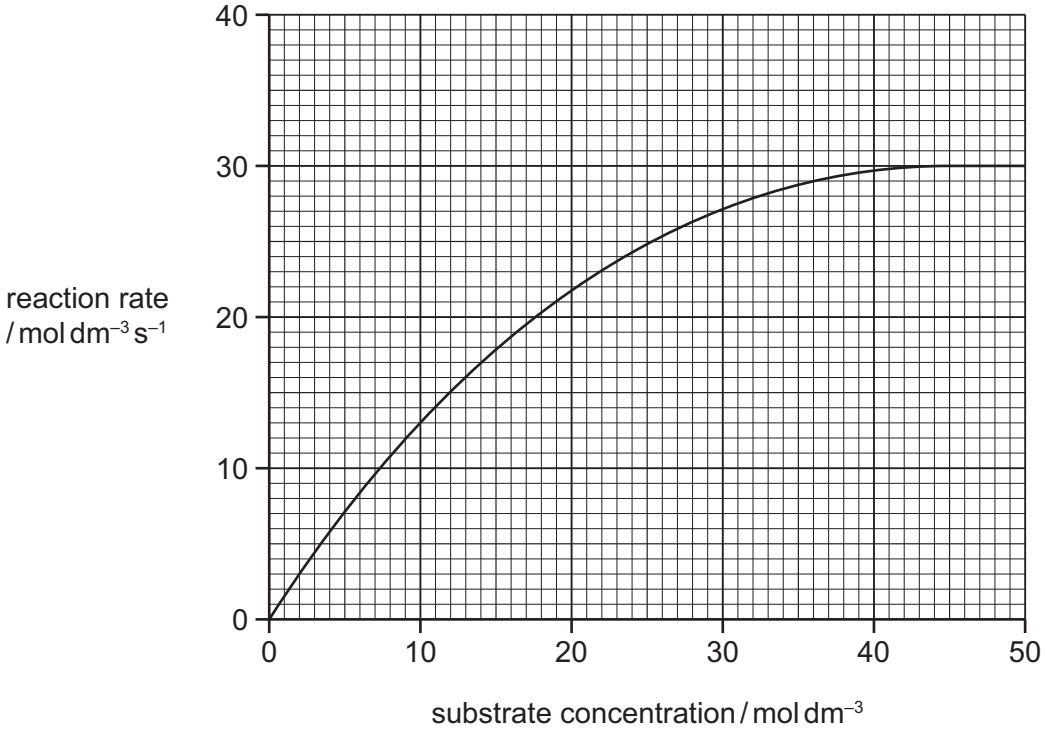


D



11 A student investigated the effect of substrate concentration on the rate of an enzyme-catalysed reaction.

The student plotted the results in a graph.



What is the K_m for this enzyme-catalysed reaction?

A 12 mol dm^{-3}

B 15 mol dm^{-3} s^{-1}

C 30 mol dm^{-3} s^{-1}

D 50 mol dm^{-3}

12 Which statements could be used to describe enzyme molecules **and** antibody molecules?

1 Hydrogen bonds stabilise the structure of the protein and are important for it to function efficiently.

2 Hydrophilic R-groups point in to the centre of the molecule and cause it to curl into a spherical shape.

3 The tertiary structure of the protein molecule plays an important role in the functioning of the protein.

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

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13 Which description identifies a reversible, non-competitive enzyme inhibitor?

A It can attach to the active site.

B It can attach to a site other than the active site.

C It can attach to the active site and another site simultaneously.

D It can attach to either the active site or another site.

14 Before mitochondria are extracted from cells for microscopy, they are usually kept in a $0.25\,mol\,dm^{-3}$ sucrose solution.

Why is the sucrose solution used?

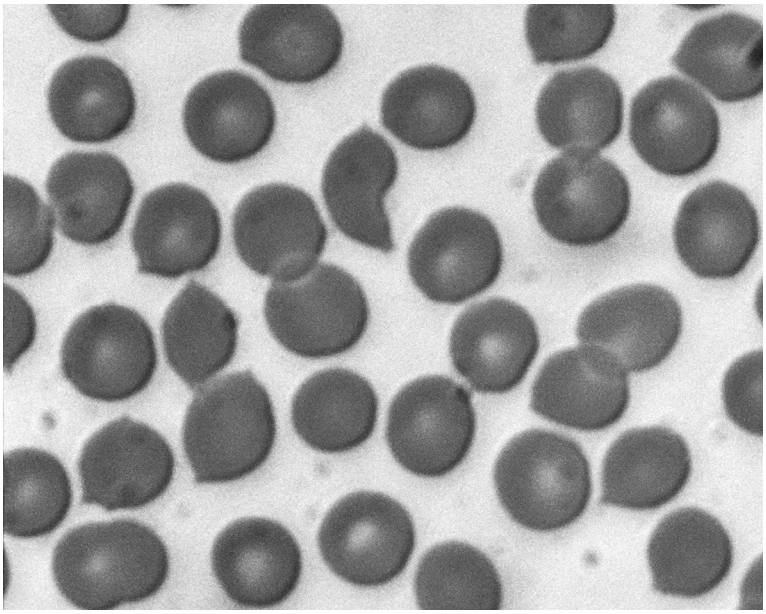
A to act as a solvent

B to enable the rate of reaction of the mitochondria to be determined

C to prevent the mitochondria from changing in dimension

D to provide a source of energy

15 The photomicrograph shows a type of blood cell.



Which statements about these cells are correct?

1 Oxygen diffuses through the phospholipid bilayer.

2 Sodium ions diffuse through the phospholipid bilayer.

3 Water passes in and out of these cells by osmosis.

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

16 Which row is correct for parts of a phospholipid molecule?

	can be saturated or unsaturated	can also be found in a triglyceride
A	head	tail
B	tail	head
C	head	head
D	tail	tail

17 A student filled dialysis tubing with a sucrose solution and knotted both ends. This formed a cylinder with a length of 5.0 cm and a radius of 2.0 cm.

What is the surface area to volume ratio for this cylinder of dialysis tubing?

A 0.7 : 1.0 **B** 1.0 : 1.0 **C** 1.4 : 1.0 **D** 2.5 : 1.0

18 Which process does **not** involve mitosis?

A asexual reproduction

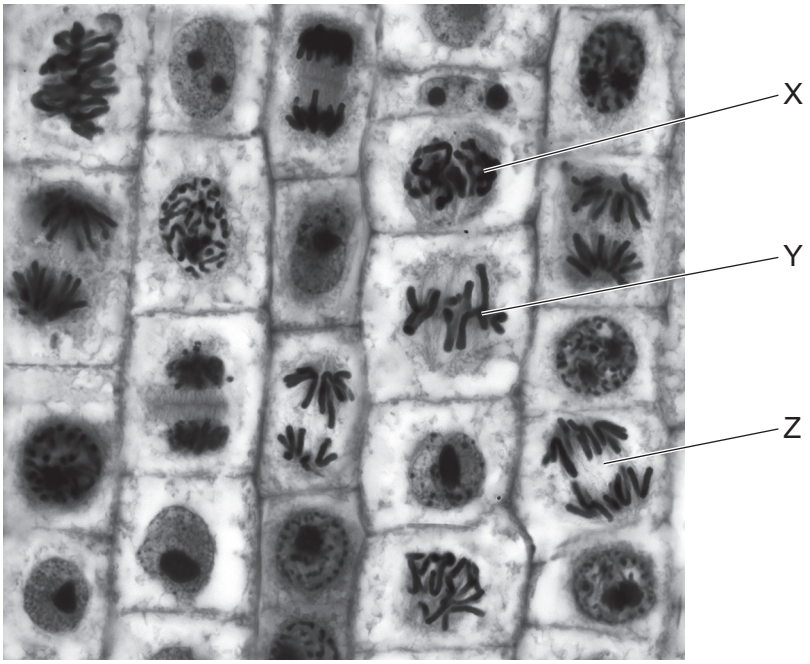
B growth of unicellular organisms

C repair of tissues by cell replacement

D replacement of damaged or dead cells

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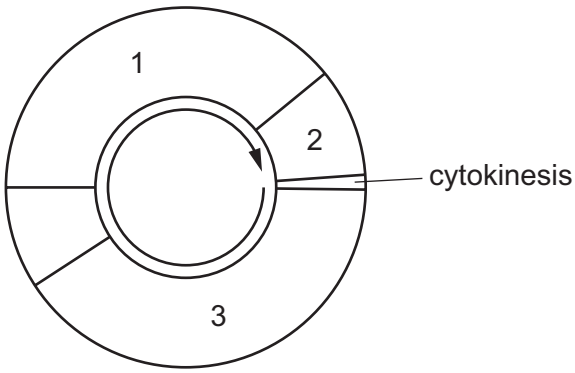
19 The photomicrograph shows cells in an onion root tip.



Which labelled cells are in anaphase, metaphase and prophase?

	anaphase	metaphase	prophase
A	X	Y	Z
B	Y	Z	X
C	Z	X	Y
D	Z	Y	X

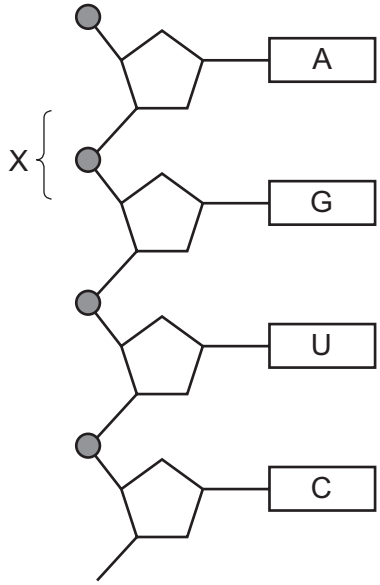
20 The diagram shows an outline of the mitotic cell cycle.



Which numbered stages of the cell cycle include a period of time when each chromosome consists of sister chromatids joined by a centromere?

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

21 The diagram shows part of a nucleic acid molecule.



What is the name of bond X?

A glycosidic bond

B hydrogen bond

C peptide bond

D phosphodiester bond

22 XNA is a laboratory-made nucleic acid. XNA is made of nucleotides in which one component has been replaced by chemical X. The chemical X is organic but is **not** found in nature. The part of the molecule responsible for coding is **not** changed.

Which component of a DNA or RNA nucleotide has been replaced by the organic chemical X?

A five-carbon sugar

B phosphate group

C purine base

D pyrimidine base

23 Which strand of DNA does RNA polymerase bind to?

A lagging strand

B leading strand

C non-transcribed strand

D template strand

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24 Which processes occur during the formation of messenger RNA?

1 condensation

2 polymerisation

3 replication

4 transcription

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

25 The anticodon for the amino acid tryptophan is ACC.

What shows a template DNA sequence that includes the DNA triplet for tryptophan?

A UGG CGU CCG

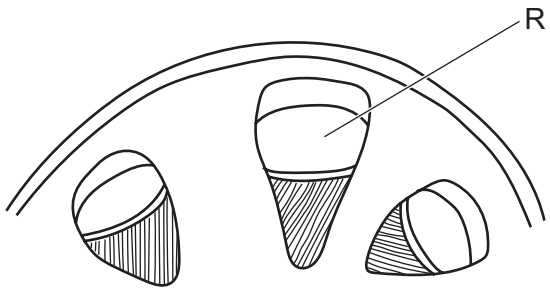
B GCU GAC ACG

C CTT TGG ATG

D CCT ACC CAT

26 A student drew a plan diagram of some plant tissue.

The diagram is shown. It contains a mistake in the way that it is drawn.



The maximum width of R is 15 mm on the diagram and its actual width is 250 μm.

The student was asked to draw a scale bar on their diagram.

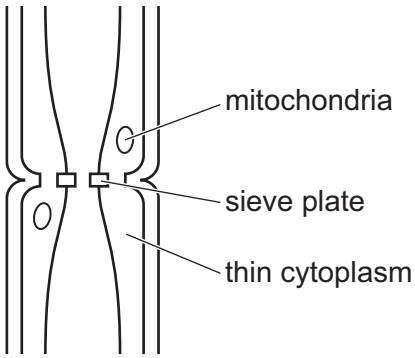
Which row is correct?

	part of the plant drawn	location of drawing mistake	length of scale bar in mm to correctly represent 100 μm
A	root	phloem	6
B	root	xylem	170
C	stem	phloem	170
D	stem	xylem	6

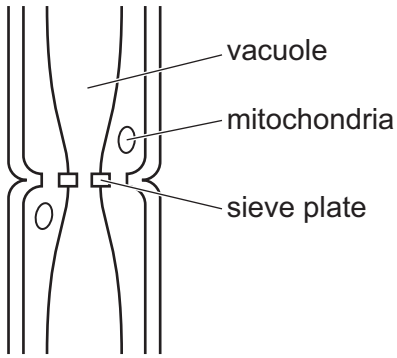
27 Four students have drawn and labelled part of a structure seen on an electron micrograph.

Which student has labelled their drawing correctly?

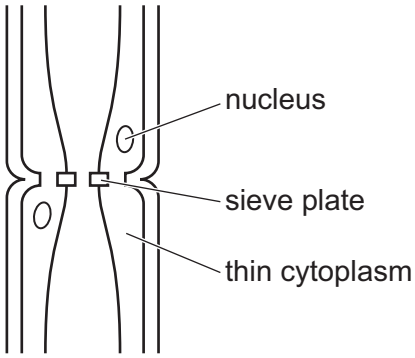
A



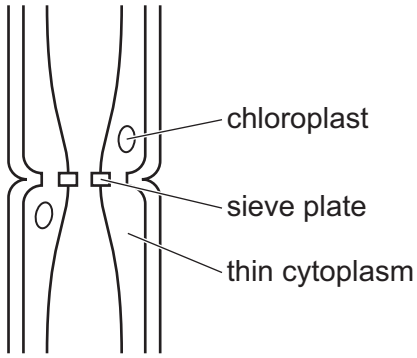
B



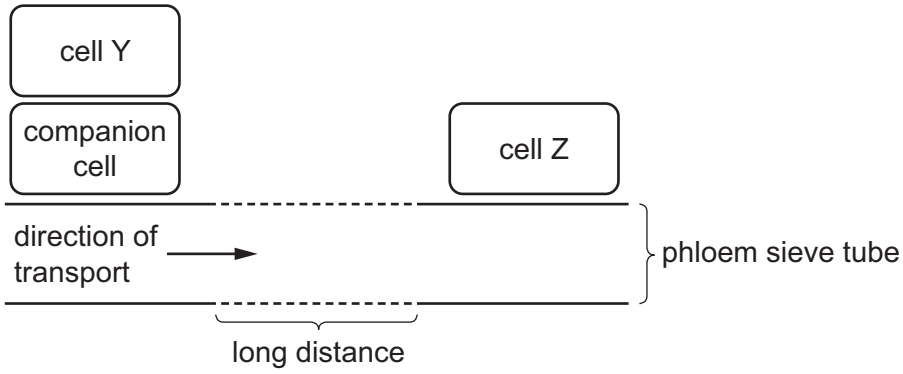
C



D



28 The diagram shows some structures used for transport in the phloem.



Which statement is correct?

A Cell Y is the sink cell.

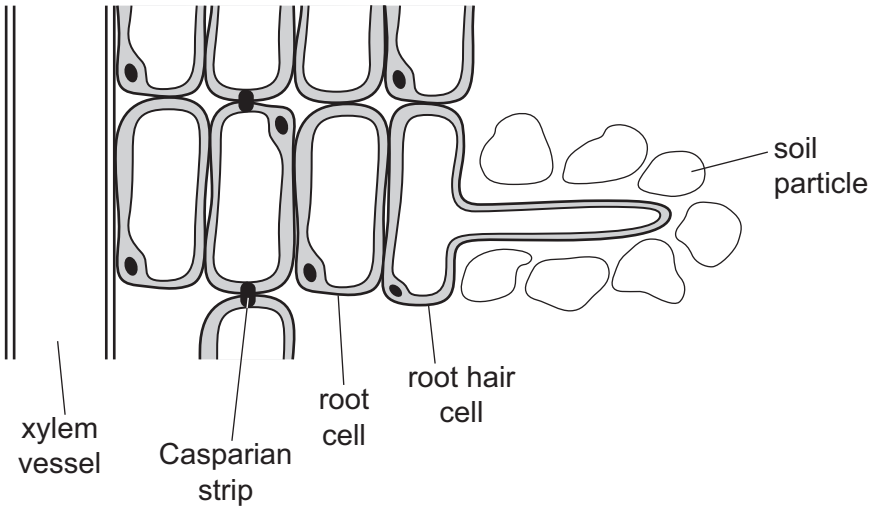
B Cell Z can be above or below cell Y in the plant.

C Cell Z must be in a photosynthetic tissue.

D Cell Y allows glucose to move to the sieve tube via the companion cell.

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29 The diagram shows a section through a root of a dicotyledonous plant.



Which statement correctly describes the movement of water and solutes through this root?

A A layer of suberin causes water and solutes to move from the apoplast pathway into the symplast pathway.

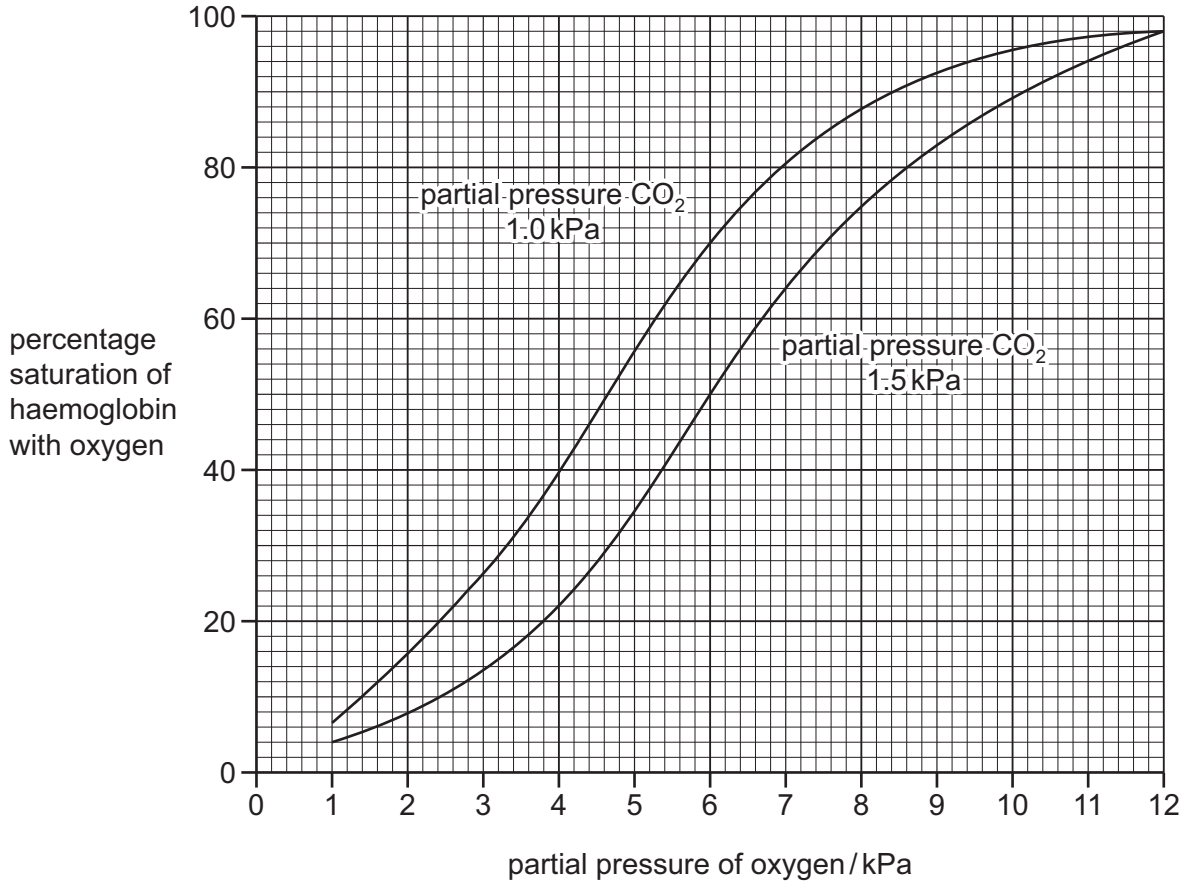
B A layer of suberin causes water and solutes to move from the symplast pathway into the apoplast pathway.

C The tonoplast causes water and solutes to move from the symplast pathway into the apoplast pathway.

D The tonoplast causes water and solutes to move from the apoplast pathway into the symplast pathway.

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30 The graph shows the effect of different partial pressures of carbon dioxide (CO_2) on the oxygen dissociation curve for haemoglobin.



What is the change in percentage oxygen saturation of haemoglobin at a partial pressure of oxygen of 6 kPa as the partial pressure of carbon dioxide changes from 1.0 kPa to 1.5 kPa?

A –26% **B** –20% **C** 20% **D** 46%

31 What happens in the heart at the start of ventricular diastole?

A The semilunar valves open.

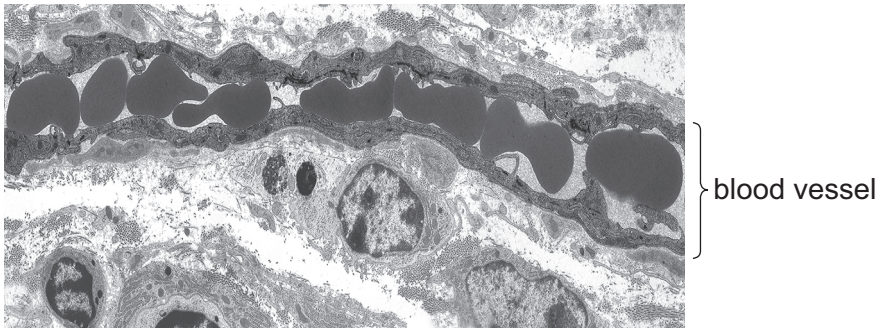
B The atrioventricular valves open.

C The pressure in the atria rises above the pressure in the ventricles.

D The pressure in the left atrium rises more than the pressure in the right atrium.

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32 The electron micrograph shows a longitudinal section through a blood vessel.



Which type of blood vessel is shown?

A arteriole

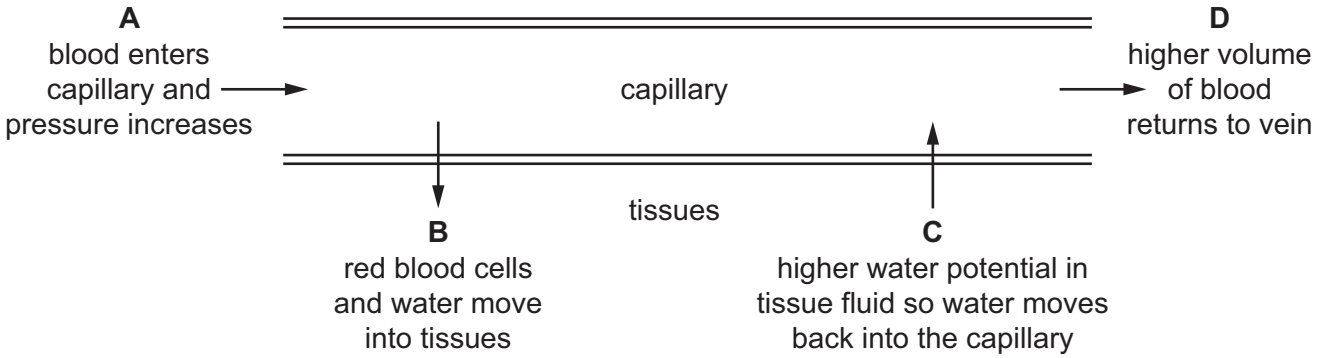
B capillary

C vein

D venule

33 A student drew a sketch to show the formation of tissue fluid.

Which label is correct?



34 Which structures are present in the trachea **and** also in all bronchioles?

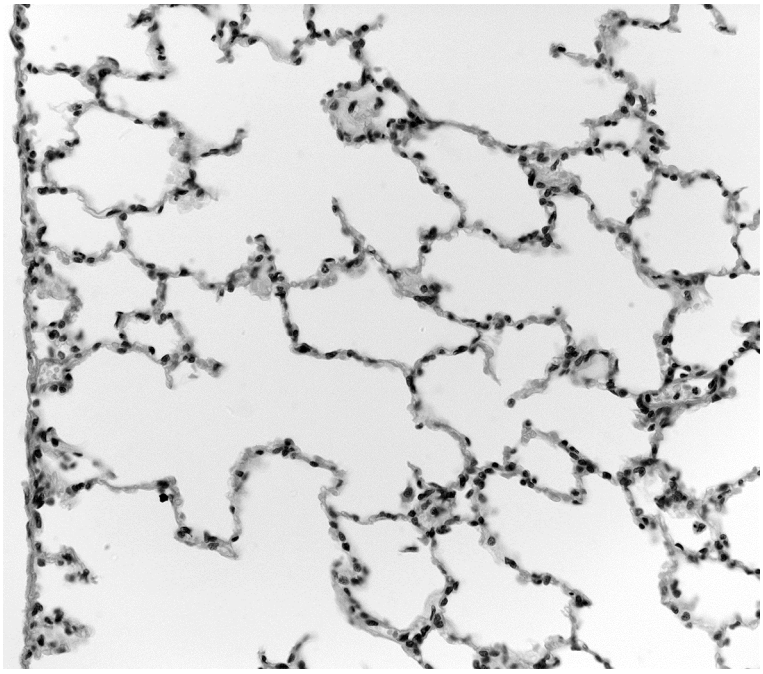
1 cartilage

2 smooth muscle

3 epithelial cells

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

35 The photomicrograph shows a section through part of the gas exchange system.



Which tissue can be seen?

A cartilage

B ciliated epithelium

C smooth muscle

D squamous epithelium

36 What is the function of the goblet cells in the gas exchange system?

A to increase the surface area

B to move mucus

C to release mucus

D to trap dust and pathogens

37 Which organisms have cell walls that can be affected by penicillin?

1 bacteria

2 protoctists

3 viruses

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

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38 Each year, there are 462 000 deaths from malaria in children under 5 years old globally.

Insecticide-treated nets could prevent 50% of malaria cases and reduce deaths of children under 5 years old by 18%.

How many children could be saved by using insecticide-treated nets?

A 41 580 **B** 83 160 **C** 231 000 **D** 332 640

39 Which row is correct?

	involved in phagocytosis	secrete antibodies
A	T-lymphocytes	B-lymphocytes
B	T-lymphocytes	T-lymphocytes
C	B-lymphocytes	B-lymphocytes
D	B-lymphocytes	T-lymphocytes

40 Four steps that occur during the primary immune response to a pathogen are listed.

P B-lymphocytes divide by mitosis.

Q T-helper cells interact with macrophages that have digested pathogens.

R Plasma cells secrete antibodies.

S T-helper cells activate other lymphocytes.

These steps can be arranged in the sequence in which they occur.

Which step occurs third in the sequence?

A P **B** Q **C** R **D** S

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