Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/11**

Paper 1 Multiple Choice **October/November 2025**

1 hour 15 minutes

You must answer on the multiple choice answer sheet.

9032476168

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 In a photomicrograph of magnification ×5000, a chloroplast measures 25 mm in diameter.

What is the actual diameter of the chloroplast?

A 0.2 μm **B** 0.5 μm **C** 2 μm **D** 5 μm

2 What is a function of Golgi bodies?

A formation of vesicles for endocytosis

B modification of proteins for secretion

C synthesis of ATP

D synthesis of polypeptides

3 A cell in the human body is specialised for synthesis and secretion of lipids.

Which row shows the organelles required by the cell for synthesis **and** secretion of lipids?

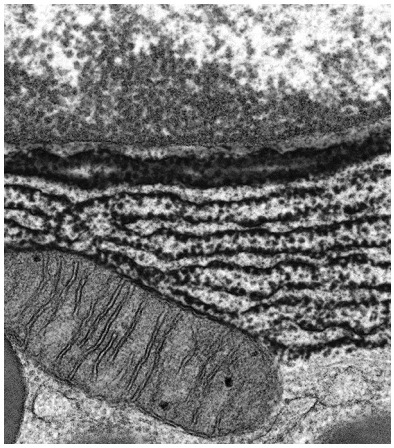
	mitochondria	smooth endoplasmic reticulum	vesicles
A	✓	✓	✓
B	✓	✗	✗
C	✗	✓	✓
D	✗	✓	✗

key

✓ = required

✗ = **not** required

4 The photomicrograph shows part of a cell.



Which row is correct?

	this cell will contain 70S ribosomes	this could be part of a plant cell	the organelles shown could be used to make antibodies
A	✓	✓	✓
B	✓	✗	✗
C	✗	✓	✗
D	✗	✗	✓

key

✓ = correct

✗ = **not** correct

5 Which statement about viruses is correct?

A They are cells with a capsid made of phospholipids.

B They are cells with a capsid made of protein.

C They are particles with a capsid made of phospholipids.

D They are particles with a capsid made of protein.

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[Turn over

6 Solution X was tested for the presence of non-reducing sugars. It did **not** contain reducing sugars.

Some steps that can be used to test for the presence of biological molecules are listed.

1 Add Benedict's solution to the test-tube.

2 Add dilute hydrochloric acid to the test-tube.

3 Add sodium hydrogencarbonate to the test-tube.

4 Heat the test-tube in a water-bath.

Which order of steps to identify the presence of non-reducing sugars in solution X is correct?

A $1 \rightarrow 4$

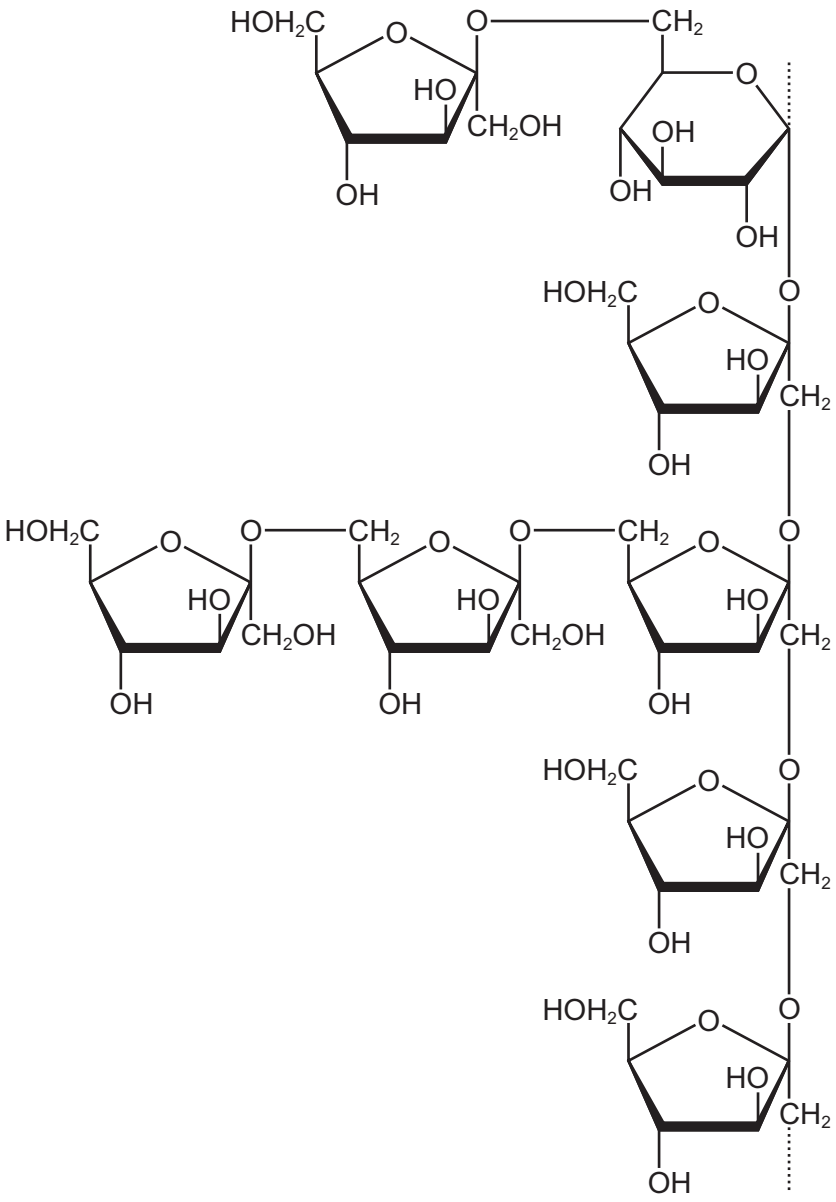
B $2 \rightarrow 3 \rightarrow 1 \rightarrow 4$

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

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

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7 The diagram shows the structure of part of a biological molecule.



Which statements about this biological molecule are correct?

1 It has monomers joined by ester bonds.

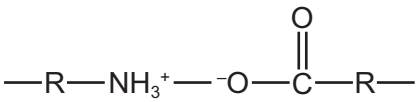
2 It is a macromolecule.

3 It is a polysaccharide.

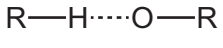
A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

8 Which diagram has a covalent bond that joins monomers together to form a biological polymer in eukaryotes?

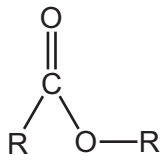
A



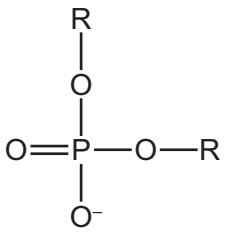
B



C



D



9 Which feature of storage polysaccharides means they do **not** change the water potential of cells?

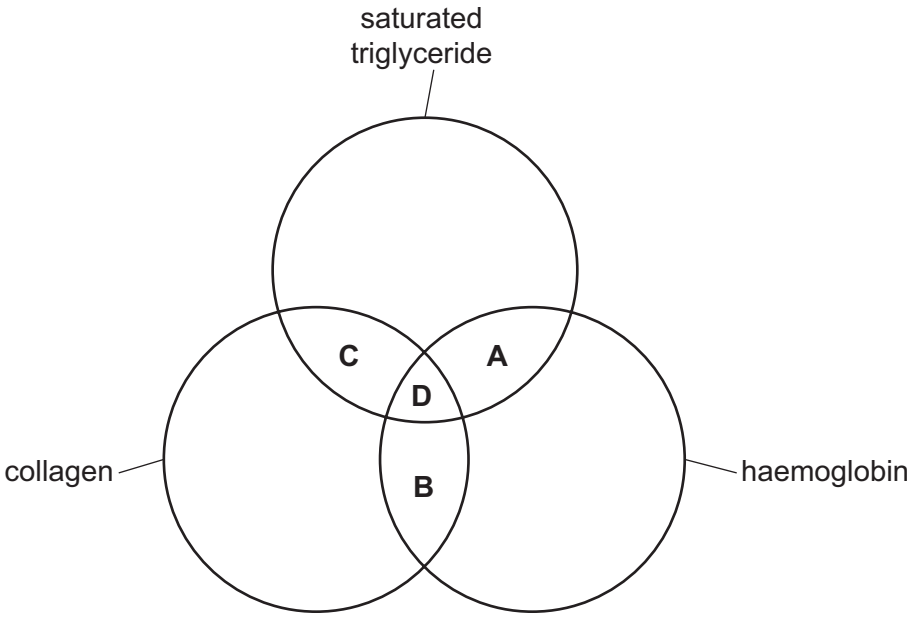
A They are easily hydrolysed.

B They are compact.

C They are insoluble.

D They are branched molecules.

10 Which molecules contain at least four double bonds?



11 In some people a mutation can affect the beta chains in their haemoglobin molecules. As a result polar amino acids on the outer surfaces of the chains are replaced by non-polar amino acids.

What will be the effect on haemoglobin?

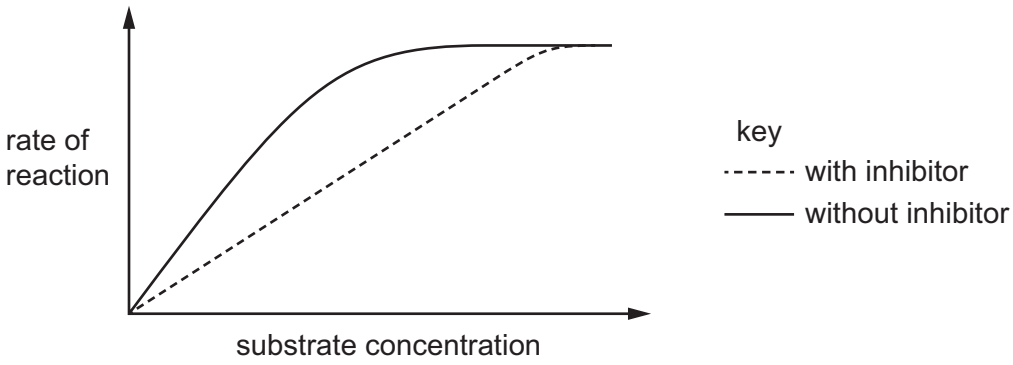
A Haemoglobin will become less soluble.

B Haemoglobin will become more soluble.

C Hydrophobic interactions between amino acids will decrease.

D More hydrogen bonds will form in the molecule.

12 The graph shows the effect of substrate concentration on an enzyme-catalysed reaction with and without a competitive inhibitor.



What is the effect of the competitive inhibitor on V_{max} and K_m?

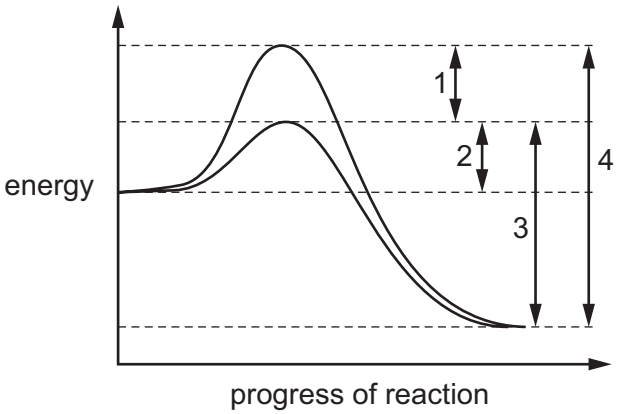
A V_{max} decreases and K_m decreases.

B V_{max} stays the same and K_m decreases.

C V_{max} stays the same and K_m increases.

D V_{max} decreases and K_m stays the same.

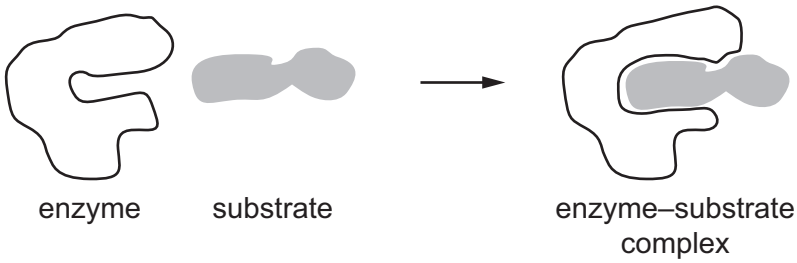
13 The graph shows energy changes in a chemical reaction.



What is the activation energy when an enzyme is added?

A 1 + 2 **B** 2 only **C** 3 – 2 **D** 4

14 The diagram shows an enzyme, its substrate and an enzyme–substrate complex.



Which statement explains how this substrate is able to enter the active site of this enzyme?

A Contact between the substrate and the enzyme causes a change in the enzyme shape.

B The shape of the active site and the shape of the substrate are complementary.

C The substrate within the active site forms hydrogen bonds with amino acids.

D When the enzyme–substrate complex forms, the tertiary structure of the enzyme changes.

15 What are the main roles of glycolipids in cell surface membranes?

1 to help cells to attach to each other to form tissues

2 to act as antigens for cell-to-cell recognition

3 to increase fluidity for the cell surface membrane

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

16 A sample of healthy plant cells taken from the same tissue is placed in a beaker containing distilled water.

The cells change in size.

What would explain this change in size?

A Water will leave the cells by active transport.

B Water will enter the cells by osmosis.

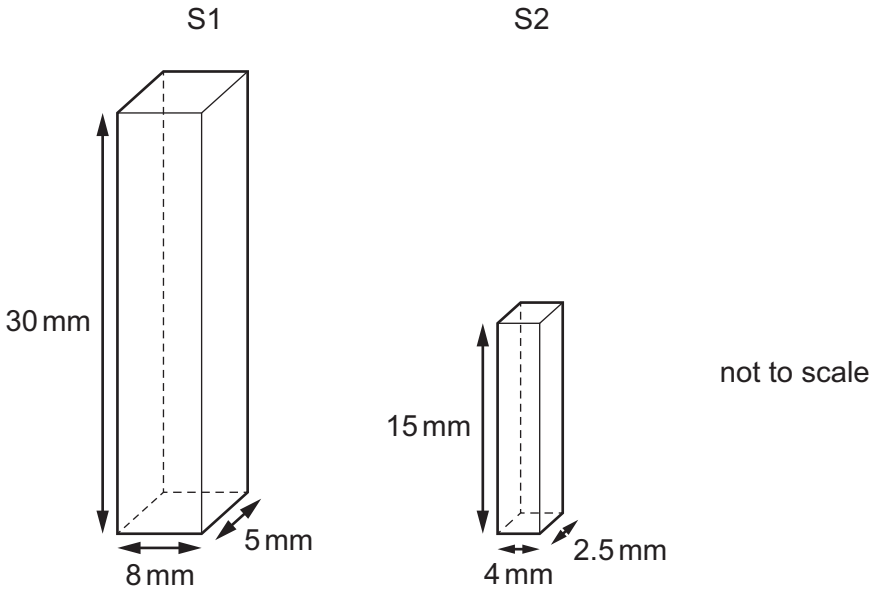
C Solutes will enter the cells by active transport.

D Solutes will leave the cells by osmosis.

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17 A student studying surface area to volume ratio and diffusion made a cuboid, S1, using agar stained blue with a pH indicator. The dimensions of S1 are shown in the diagram.

The student made a second agar cuboid, S2. Each dimension of S2, (the length, the width and the height), was half that of S1.



The student placed each cuboid in a test-tube and covered it in acid. The time taken for each cuboid to completely change colour was recorded. All variables other than the size of the cuboids were standardised.

Which row shows the surface area to volume ratio of S1 and the time taken for S1 to change colour completely in acid compared to the time taken for S2 to change colour completely?

	surface area to volume ratio of S1	time taken for S1 to change colour completely in acid compared to S2
A	0.72 : 1	S1 takes less time than S2
B	0.72 : 1	S1 takes more time than S2
C	1.4 : 1	S1 takes less time than S2
D	1.4 : 1	S1 takes more time than S2

18 Two test-tubes, labelled X and Y, were set up containing equal volumes of solution X or solution Y respectively.

A large number of type P cells and a large number of type Q cells were added into test-tube X and also into test-tube Y.

After a few minutes, samples of the solutions were taken and the cells were observed with a microscope.

- In solution X, all of cell type P had burst and cell type Q had **not** burst.
- In solution Y, **no** cells had burst.

Which row correctly identifies cell type Q and solutions X and Y?

	cell type Q	solution X	solution Y
A	red blood cells	5% NaC*l* solution	distilled water
B	goblet cells	5% glucose solution	distilled water
C	liver cells	distilled water	5% glucose solution
D	root hair cells	distilled water	5% NaC*l* solution

19 A human muscle cell contains 46 chromosomes.

How many centromeres will be present in a cell during the stages of the mitotic cell cycle?

	early prophase	metaphase	anaphase
A	46	46	92
B	46	92	92
C	46	46	46
D	92	46	46

20 Telomeres become shorter during each cell cycle of a specialised cell.

In which phase of the cell cycle do telomeres shorten?

A cytokinesis

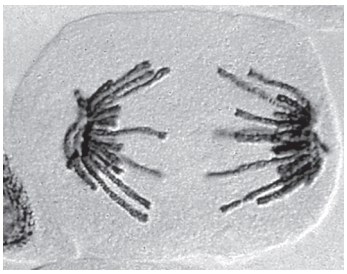
B G_1

C S

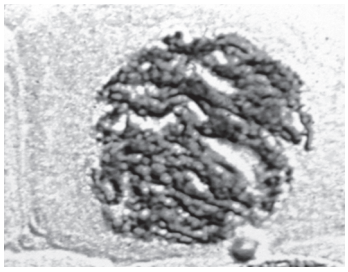
D G_2

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21 The photomicrographs show stages of mitosis.



1



2



3



4



5

What is the correct order for the stages of mitosis?

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

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

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

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

22 The gene that codes for protein R is 130 kb long.

Protein R is 220 kDa in mass.

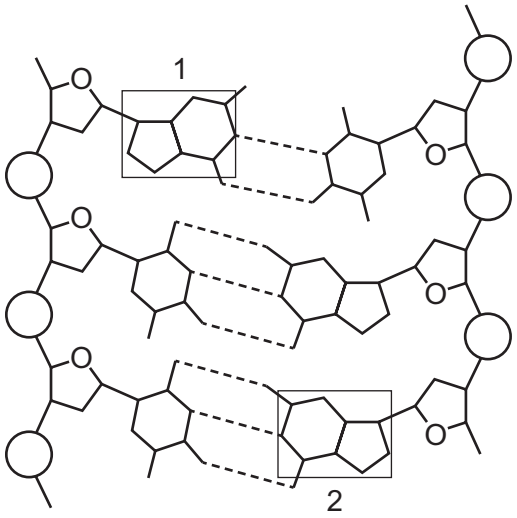
The typical mass of an amino acid is 110 Da.

(1000 base pairs = 1 kb, 1000 Da = 1 kDa)

Which row is correct?

	approximate length of introns in this gene / base pairs	approximate length of mRNA for this gene / base pairs
A	6000	6000
B	6000	130 000
C	124 000	6000
D	124 000	130 000

23 The diagram shows a section of DNA. Two of the bases in this section are labelled 1 and 2.



Which row correctly identifies the bases 1 and 2?

	base 1	base 2
A	purine	adenine
B	purine	guanine
C	pyrimidine	adenine
D	pyrimidine	guanine

24 Which row describes the role of the enzymes DNA polymerase and DNA ligase?

	DNA polymerase	DNA ligase
A	adds nucleotides in a 5′ to 3′ direction	joins sections of DNA together on the lagging strand
B	adds nucleotides in a 3′ to 5′ direction	joins sections of DNA together on the leading strand
C	adds nucleotides in a 3′ to 5′ direction	joins sections of DNA together on the lagging strand
D	adds nucleotides in a 5′ to 3′ direction	joins sections of DNA together on the leading strand

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

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

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

CCA TTC ACG GCG TTA GCA

Two mutations occur in this sequence during DNA replication.

Which mutated DNA would result in two different amino acids?

A CCA ATC ACG GCG TTG GCA

B CCA TTC ACA GCA TTA GCA

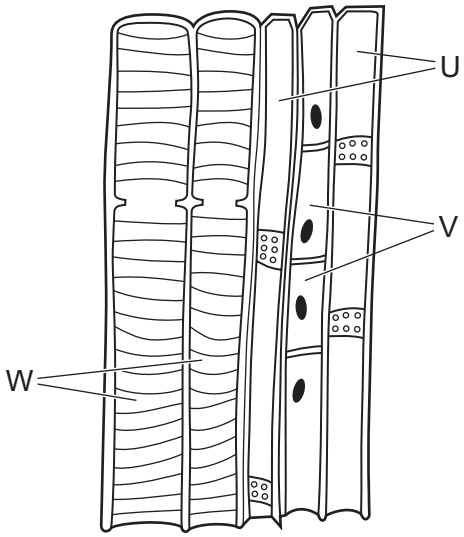
C CCA TTC ACG CCG TTA GCC

D CCA TTC ACG GCG TTC GGA

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[Turn over

26 The diagram shows a vertical section through part of the stem of a dicotyledonous plant. Three types of structures are labelled.



What are the structures U, V and W?

	companion cells	phloem sieve tube elements	xylem vessel elements
A	U	W	V
B	V	U	W
C	U	V	W
D	W	V	U

27 Which features of xylem vessels help to reduce the resistance to water flow?

1 Lignin forms an incomplete secondary wall.

2 There are **no** cross walls between the vessel elements.

3 The xylem vessels form narrow tubes.

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

28 What causes water to move from the root hair cells to the endodermis?

A diffusion through cell walls and osmosis down a water potential gradient in the cytoplasm

B diffusion through the symplast and osmosis and root pressure through the apoplast

C osmosis from cell vacuole to cell vacuole and active transport into the endodermis

D osmosis through the intercellular spaces and diffusion in cell walls and cytoplasm

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29 Which changes occur as carbohydrate is moved into a sink?

	water potential of the sieve tube element becomes	volume of liquid of the sieve tube element
A	lower	decreases
B	lower	increases
C	higher	decreases
D	higher	increases

30 Which statement correctly compares blood plasma and tissue fluid in a healthy person?

A Blood plasma contains more protein than tissue fluid.

B Both blood plasma and tissue fluid contain red blood cells.

C Tissue fluid contains white blood cells whereas blood plasma does **not** contain lymphocytes.

D Tissue fluid is formed from blood plasma and is **not** returned to blood plasma.

31 The body maintains an average normal blood pH of 7.4.

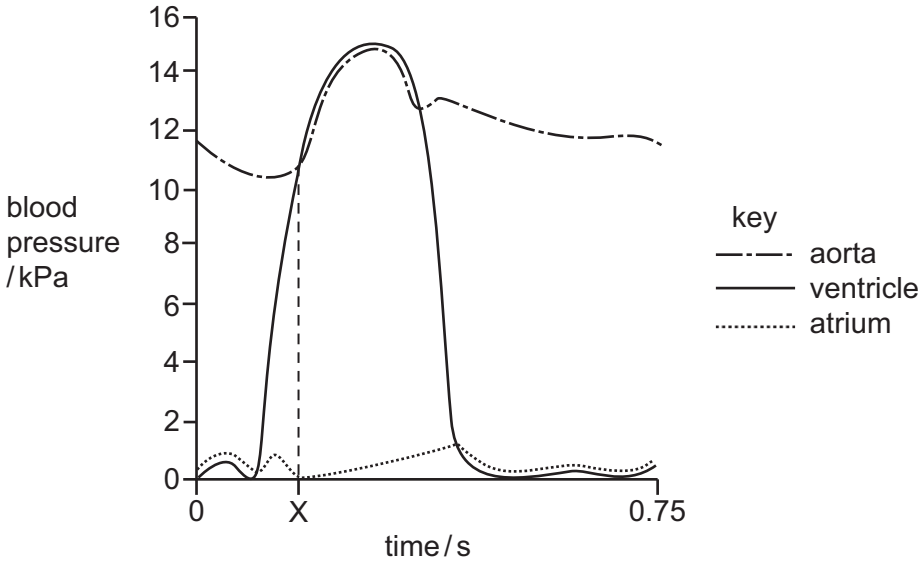
Which row describes the conditions that would increase the dissociation rate of haemoglobin the most during periods of intense exercise?

	blood pH	blood CO_2 partial pressure / kPa
A	7.2	5.6
B	7.2	9.5
C	7.6	5.6
D	7.6	9.5

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[Turn over

32 The graph shows changes in blood pressure during one cardiac cycle.



What is happening at time X?

	aortic semilunar valve	atrium
A	closing	emptying
B	closing	filling
C	opening	emptying
D	opening	filling

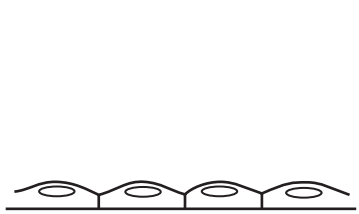
33 How many times must a carbon dioxide molecule pass through a cell surface membrane to travel from the tissue fluid into the blood plasma?

(Assume there are no pores between the cells the carbon dioxide molecule must pass through.)

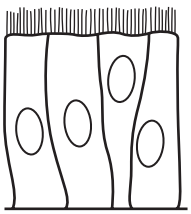
A 1 **B** 2 **C** 3 **D** 4

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34 Two types of epithelial cells, 1 and 2, occur in the mammalian gas exchange system in a healthy human.



1



2

Which row shows the function and distribution of these types of epithelial cells?

	cell type 1	cell type 2
A	absorption in bronchi	secrete mucus in alveoli
B	exchange surface in alveoli	secrete mucus in bronchi
C	absorption in bronchi	move mucus in alveoli
D	exchange surface in alveoli	move mucus in bronchi

35 Which tissues would be seen in a photomicrograph of the wall of the trachea?

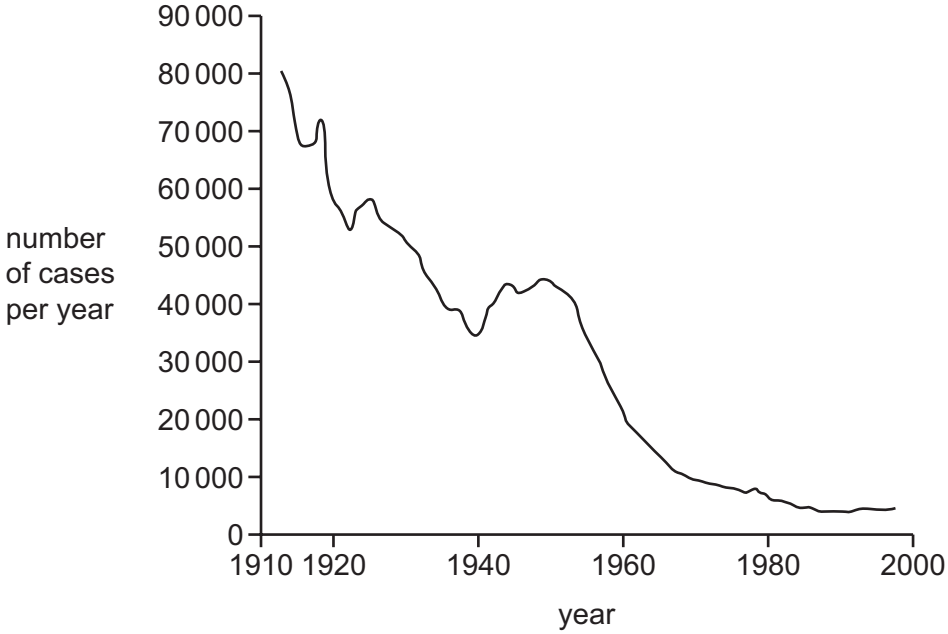
	elastic fibres	smooth muscle
A	✗	✓
B	✓	✗
C	✓	✓
D	✗	✗

key

✓ = present

✗ = **not** present

36 The graph shows the decrease in cases of tuberculosis (TB) in a country between 1910 and 2000.



Which factors could have contributed to the fall over this period?

1 pasteurisation of milk

2 the provision of new housing to reduce overcrowding

3 removing large pools of stagnant water

4 identification of contacts of people infected with TB

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

37 The pathogens for some diseases are transmitted by vectors.

Which disease is transmitted with the help of a vector that could be controlled by the removal of pools of water?

A cholera

B HIV/AIDS

C malaria

D tuberculosis

38 How does penicillin affect bacteria?

A It inhibits DNA replication by binding to nucleotides.

B It inhibits translation by preventing tRNA binding to ribosomes.

C It is a competitive inhibitor of an enzyme in cell wall synthesis.

D It is a competitive inhibitor of an enzyme in protein synthesis.

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39 The hybridoma method is used for the production of monoclonal antibodies.

Which two types of cell are used in this method?

A stem cell and B-lymphocyte

B stem cell and T-lymphocyte

C tumour cell and B-lymphocyte

D tumour cell and T-lymphocyte

40 What describes a non-specific immune response?

A activation of killer T-lymphocytes by infected cells

B cloning of B-lymphocytes to form plasma cells

C ingestion of a bacterial cell by a neutrophil

D recognition of antigens on the cell surface of macrophages

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BIOLOGY **9700/12**

Paper 1 Multiple Choice **October/November 2025**

1 hour 15 minutes

You must answer on the multiple choice answer sheet.

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You will need: Multiple choice answer sheet
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INSTRUCTIONS

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INFORMATION

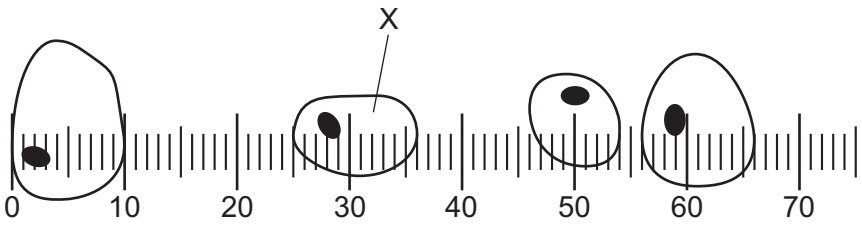
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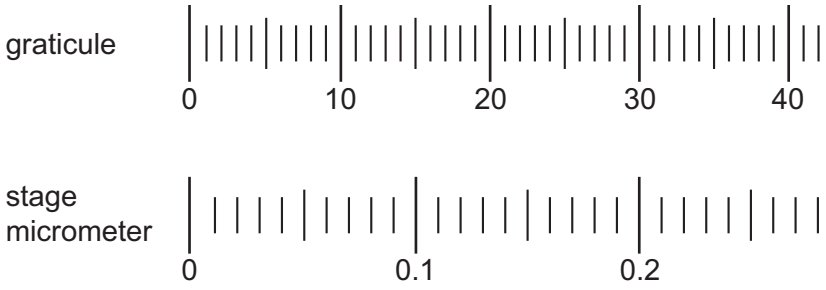
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1 A student observed some cells using a microscope with an eyepiece graticule.



They then replaced the slide containing the cells with a stage micrometer with a millimetre scale, and lined up the eyepiece graticule as shown.



What is the maximum diameter of the cell labelled X?

A 0.0066 μm **B** 66 μm **C** 73 μm **D** 733 μm

2 Which structures will be present in a cell that causes cholera?

1 circular DNA

2 cytoplasmic DNA

3 70S ribosomes

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

3 Which organelles have a partially permeable membrane?

1 Golgi apparatus

2 lysosome

3 mitochondrion

4 ribosome

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 Mouse cells were grown in a dish containing a growth medium. Radioactively labelled amino acids were added to the growth medium. The table shows the time taken for the radioactively labelled amino acids to appear in three different organelles, R, S and T.

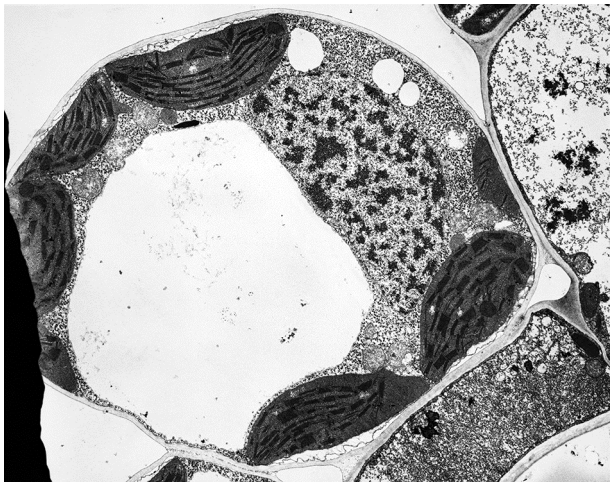
organelle	time taken for radioactivity to appear / min
R	2
S	9
T	35

Which row correctly identifies the organelles?

	R	S	T
A	Golgi body	lysosome	rough endoplasmic reticulum
B	Golgi body	rough endoplasmic reticulum	lysosome
C	rough endoplasmic reticulum	Golgi body	lysosome
D	rough endoplasmic reticulum	lysosome	Golgi body

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5 The electron micrograph shows a section through a cell.



What would be present in this type of cell?

	mitochondria	peptidoglycan cell wall	histone proteins
A	✓	✓	✗
B	✓	✗	✓
C	✗	✓	✗
D	✗	✗	✓

key

✓ = present

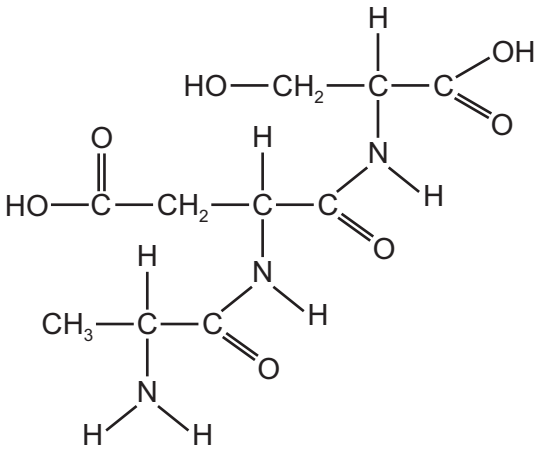
✗ = **not** present

6 A student carried out four tests for biological molecules. The observations are shown in the table.

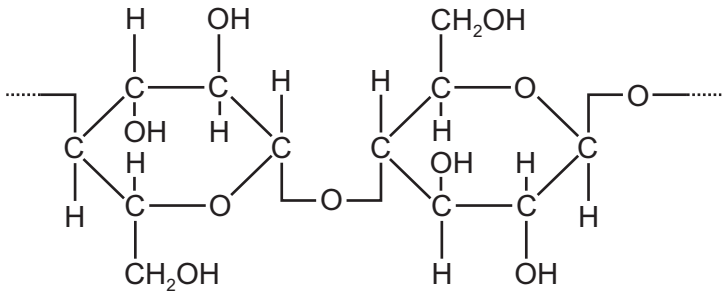
test	observations
iodine	orange
biuret	purple
Benedict's	orange
emulsion	clear

The diagrams show molecules or parts of molecules.

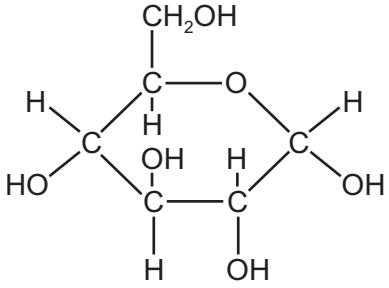
Which pair is present in the solution?



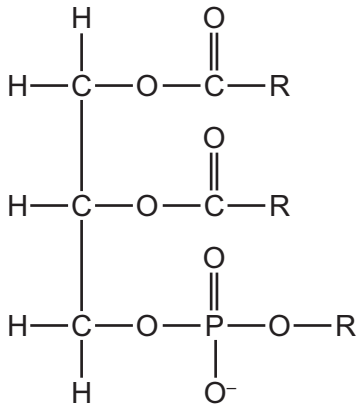
1



2



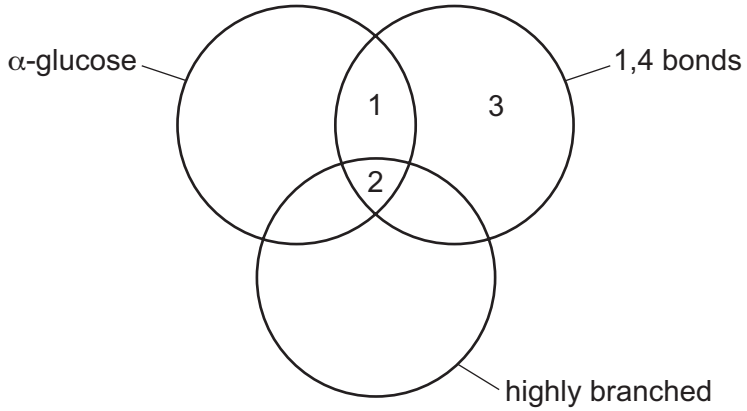
3



4

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

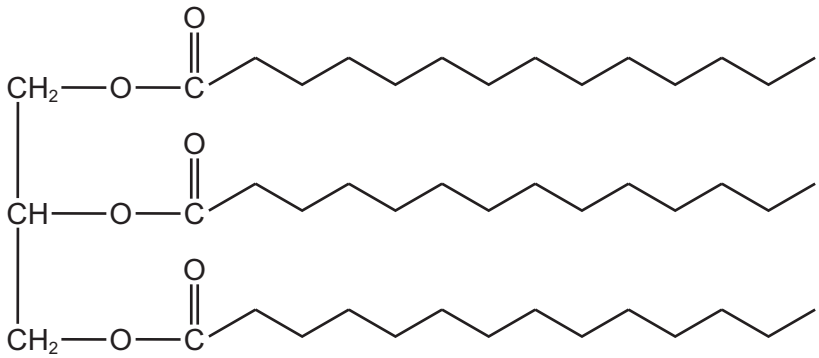
7 The diagram shows some relationships between features of carbohydrates.



Which row correctly matches the carbohydrate with some of its features?

	1	2	3
A	amylopectin	glycogen	amylose
B	amylose	amylopectin	cellulose
C	cellulose	glycogen	sucrose
D	glycogen	amylose	amylopectin

8 The diagram shows a triglyceride molecule.



Which statement is correct for the structure and function of this triglyceride?

A The glycerol head forms hydrogen bonds with water in cytoplasm to produce oil droplets.

B The hydrophobic fatty acids allow only small molecules to pass through the cell surface membrane.

C It packs closely with identical triglyceride molecules to form energy reserves in lysosomes.

D It has long hydrocarbon chains that release high energy output per unit mass when oxidised.

9 Enzyme P has been found in a tropical grass.

- The enzyme catalyses the hydrolysis of the fungal polysaccharide, chitin, into amino sugars.
- It also inhibits the activity of an enzyme in locust guts which catalyses the digestion of amylose.

Which row describes the actions of enzyme P?

	reaction catalysed	reaction inhibited
A	hydrolysis of glycosidic bonds	condensation of glycosidic bonds
B	hydrolysis of glycosidic bonds	hydrolysis of glycosidic bonds
C	hydrolysis of peptide bonds	condensation of glycosidic bonds
D	hydrolysis of peptide bonds	hydrolysis of glycosidic bonds

10 Which bonds between amino acids hold the shape of the secondary structure and also the tertiary structure of proteins?

A peptide bonds

B disulfide bonds

C hydrogen bonds

D ionic bonds

11 Resilin is a protein found in the wings of insects. It is an elastic, fibrous protein and scientists have suggested that it may have an important role in allowing the wings of an insect to fold and unfold without damage.

Peptidyl transferase is an enzyme which catalyses the condensation of amino acids during translation to form resilin.

Which statements are correct?

1 Peptidyl transferase and resilin have structural roles in the insect.

2 Peptidyl transferase is a globular protein.

3 Peptidyl transferase is soluble in water.

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

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12 Collagen is a protein that helps to strengthen and increase the elasticity and hydration of the skin. Aging can lead to dry skin and the formation of wrinkles, due to the body producing less collagen.

Which row is correct for the structure of collagen in the skin?

	every fourth amino acid is glycine	fibrous protein
A	✗	✗
B	✓	✓
C	✗	✓
D	✓	✗

key

✓ = correct

✗ = **not** correct

13 What is the effect of an enzyme in an enzyme-catalysed reaction?

A decreases the activation energy and decreases the energy yield

B decreases the activation energy and has **no** effect on the energy yield

C increases the activation energy and increases the energy yield

D decreases the activation energy and increases the energy yield

14 How is the Michaelis–Menten constant (K_m) used?

A to determine the number of collisions between the enzyme and substrate

B to compare the affinity of enzymes for their substrates

C to find the maximum velocity of an enzyme (V_{max})

D to find the optimum rate of reaction

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15 Some students investigated the effect of pH on the rate of starch digestion by amylase at 20 °C.

- They added 2 cm^3 of a 1% amylase solution and 1 cm^3 of pH 4 buffer to a test-tube.
- They added 2 cm^3 of a starch solution, containing 0.02 g of starch, to the test-tube.
- They measured the time taken for the starch to be digested (to disappear).

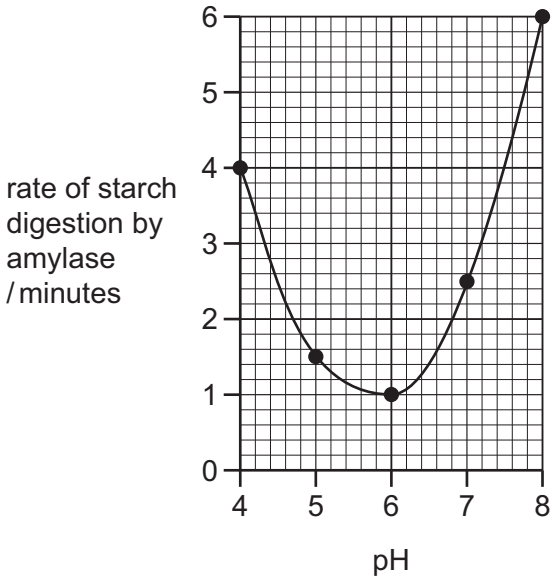
The students then repeated these steps with pH 5, pH 6, pH 7 and pH 8 buffers.

The table shows the results.

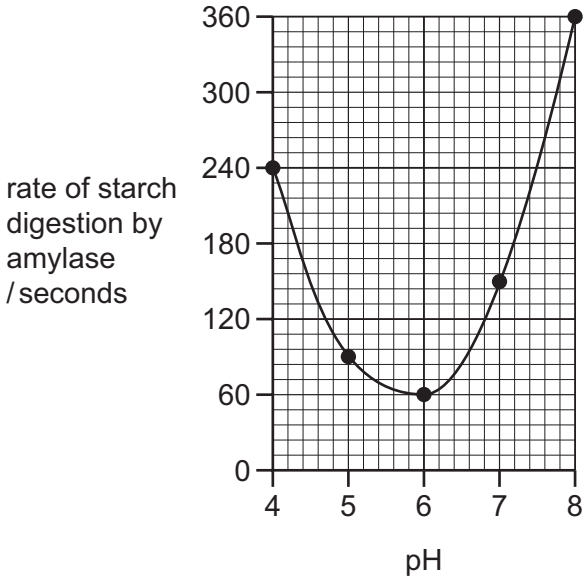
pH	time taken for starch to be digested / minutes
4	4.0
5	1.5
6	1.0
7	2.5
8	6.0

Which graph is correct for these data?

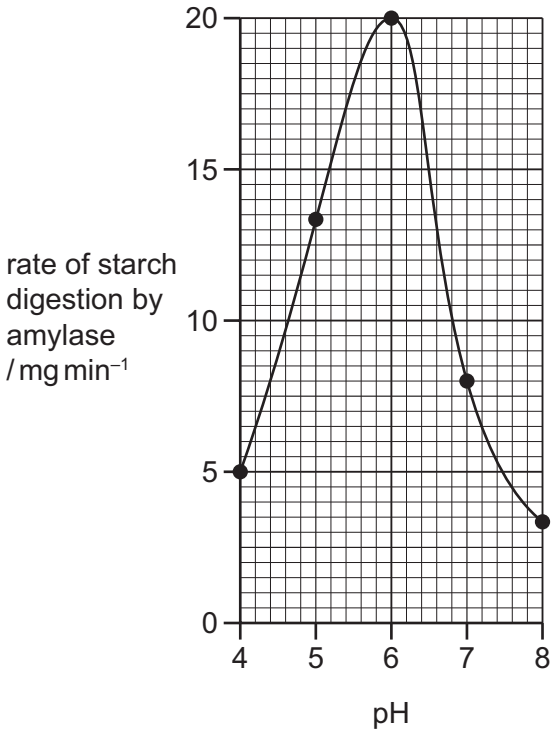
A



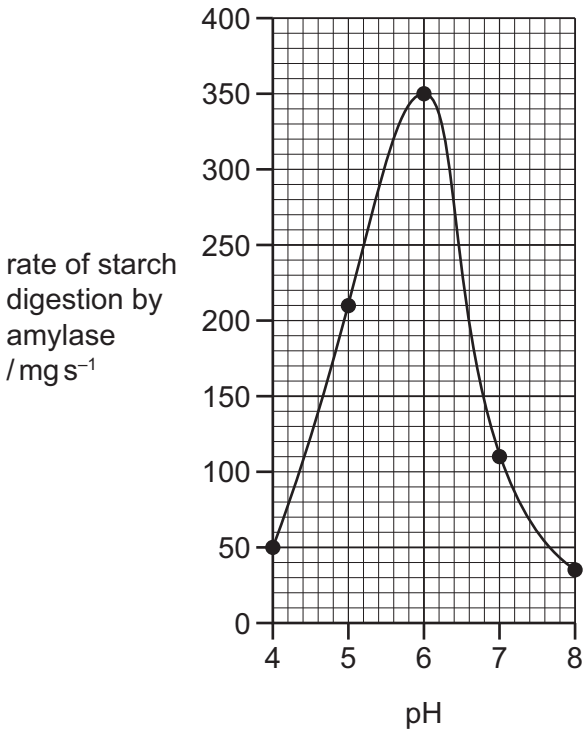
B



C



D



16 Which statements are correct for a non-competitive inhibitor of enzyme action?

1 Increasing the concentration of the enzyme's substrate will reduce its effect.

2 It reduces the activation energy required for a reaction to take place.

3 It reduces the maximum rate of reaction.

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

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17 What can increase the fluidity of the cell surface membrane at low temperatures?

1 double bonds between carbon atoms in the fatty acid chains

2 cholesterol

3 fatty acids having shorter chains

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

18 Which statements about the proteins and glycoproteins in cell surface membranes are correct?

1 They can allow cells to bond together to form tissues.

2 They can recognise messenger molecules like hormones.

3 They can be antigens and allow cell-to-cell recognition.

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

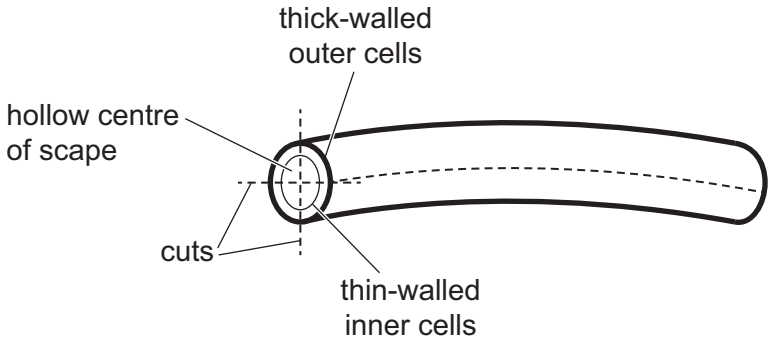
19 In an experiment, four different-sized cubes of colourless agar were placed into a blue dye. The time taken for each cube to turn blue was recorded.

Which row shows the surface area and volume of the cube that took the longest time to turn completely blue?

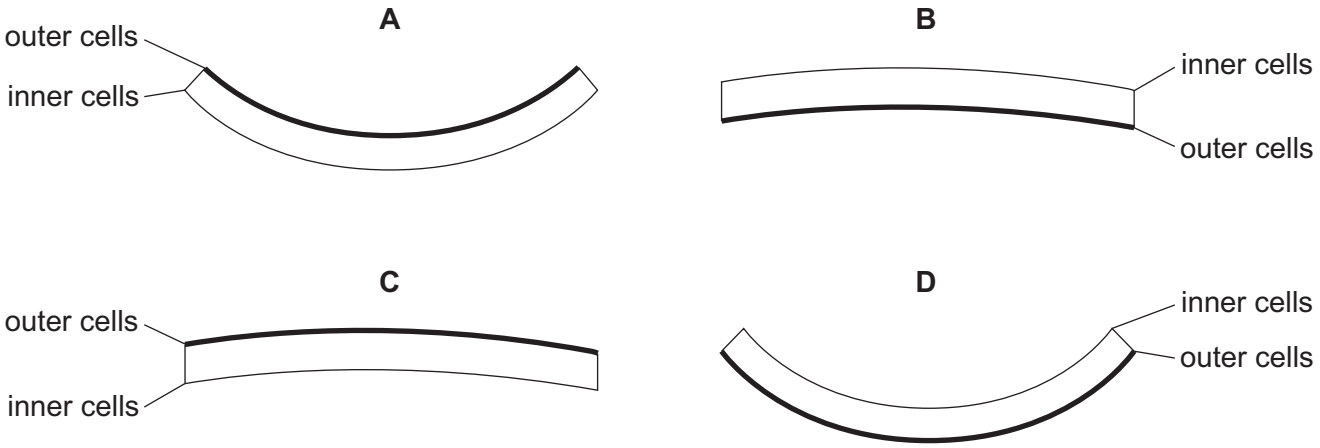
	surface area / cm^2	volume / cm^3
A	6.0	1
B	9.5	2
C	12.5	3
D	38.0	16

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20 The stalk of a dandelion flower is a hollow tube called a scape. Pieces of the scape are cut as shown by the dotted lines and placed in sucrose solutions of different water potentials.



Which diagram shows the piece that is placed in the sucrose solution with the highest water potential?



21 Telomeres prevent the loss of genes during DNA replication.

Which row correctly shows cell types that contain telomeres?

	typical animal cell	typical plant cell	typical bacterial cell
A	✓	✓	✓
B	✓	✓	✗
C	✗	✗	✓
D	✓	✗	✗

key
✓ = present
✗ = **not** present

22 Which events listed are part of mitosis?

1 interphase

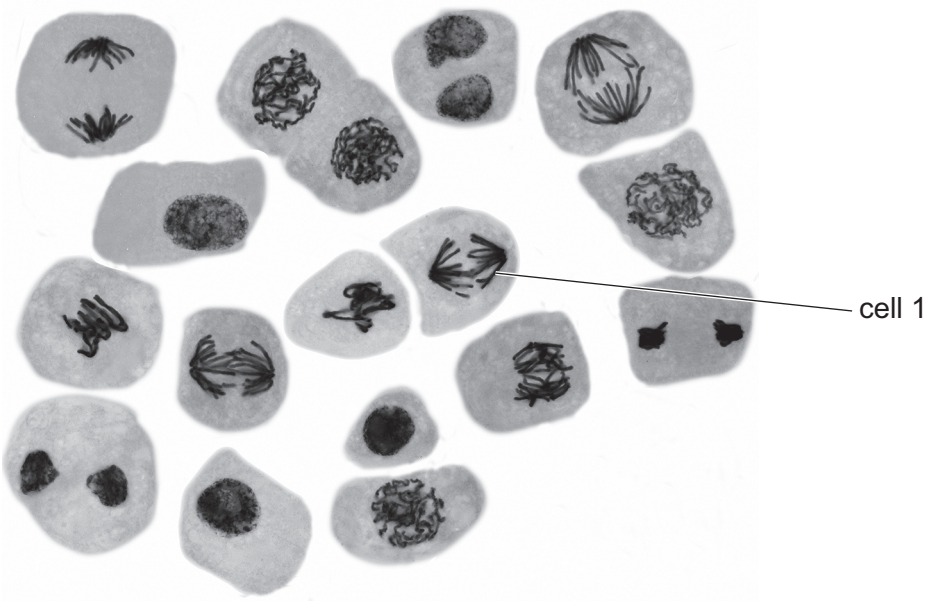
2 prophase

3 cytokinesis

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

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23 The photomicrograph shows 17 cells in different stages of the mitotic cell cycle.

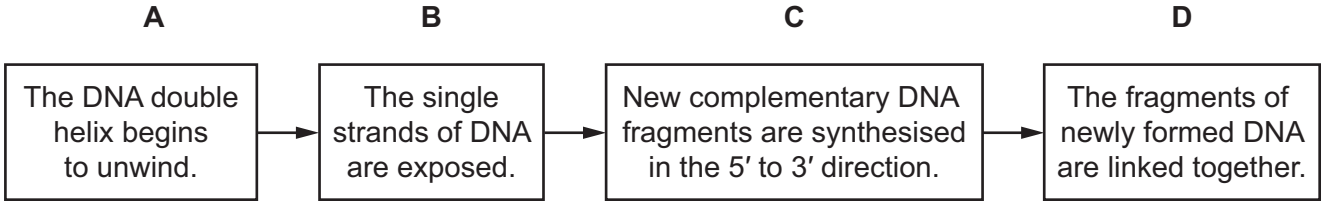


Which row is correct for this photomicrograph?

	the role of a centromere in cell 1	the proportion of the cells in the photomicrograph in telophase
A	attaches daughter chromosomes to spindle fibres	> 0.2
B	holds sister chromatids together	> 0.2
C	attaches daughter chromosomes to spindle fibres	< 0.2
D	holds sister chromatids together	< 0.2

24 The flow diagram shows some of the stages in the replication of a lagging strand of DNA.

Which stage of DNA replication uses the enzyme DNA ligase?



25 In a gene, the 20 common amino acids are each coded for by three bases in adjacent nucleotides.

Why is there a difference between the number of amino acids and the number of possible triplet codes?

A 44 triplets have **no** functions.

B Some amino acids are coded for by more than one triplet.

C Some triplets have unknown functions.

D There are 44 'start' and 'stop' triplets.

26 How is a primary transcript modified to form mRNA?

A It becomes longer as exons are joined together.

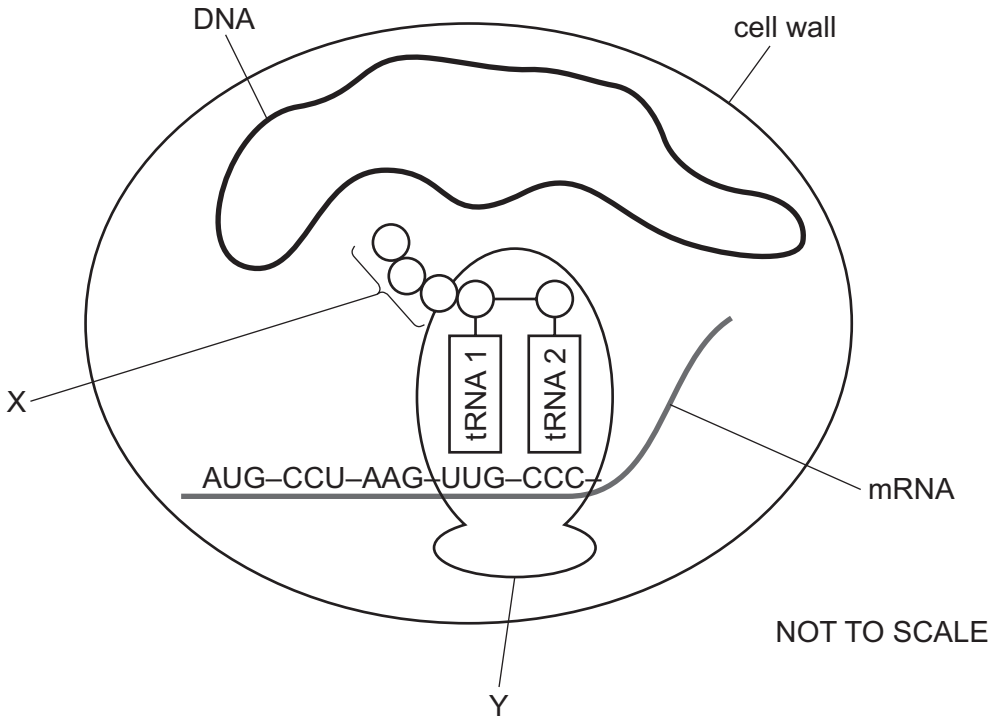
B It becomes shorter as exons are removed.

C It becomes longer as introns are joined together.

D It becomes shorter as introns are removed.

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27 The diagram shows protein synthesis in a prokaryote.



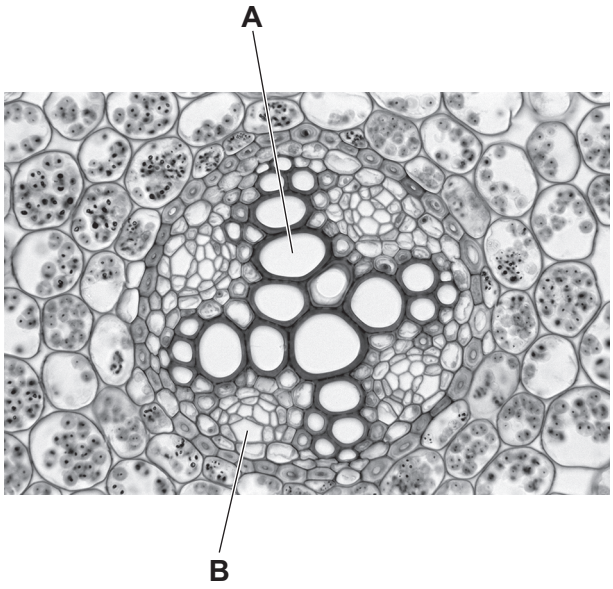
Which row is correct for molecule X, structure Y and the anticodon of tRNA 1?

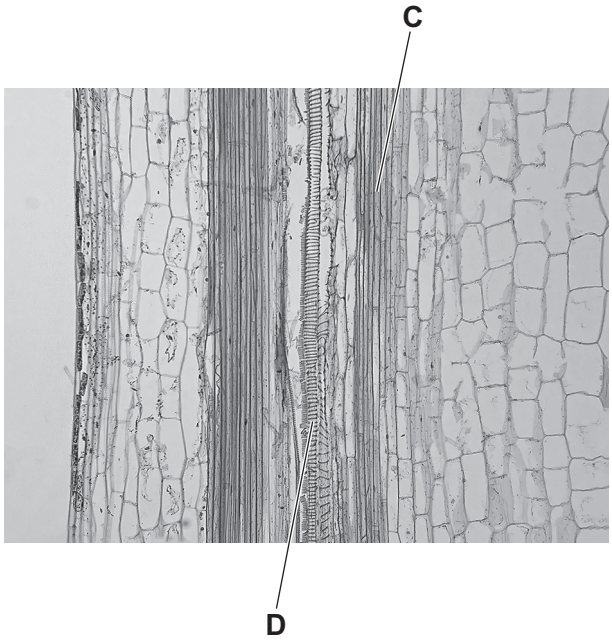
	molecule X	structure Y	anticodon of tRNA 1
A	amino acid	80S ribosome	AAC
B	polypeptide	80S ribosome	UUG
C	polypeptide	70S ribosome	AAC
D	protein	70S ribosome	UUG

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28 The photomicrographs show sections of two organs of a plant.

Which letter identifies a cell found with companion cells in a tissue in a root?





29 Which row correctly describes the pressure in the xylem and the water potential in the root hair cells used in the transport of water in a transpiring plant?

	pressure in the xylem	water potential in root hair cells
A	positive	negative
B	positive	positive
C	negative	negative
D	negative	positive

30 Which row correctly identifies the definitions for each of the key terms used in transpiration?

	attraction between water molecules and walls of the xylem vessel	effect created by evaporation of water from the surface of the leaf
A	cohesion	adhesion
B	adhesion	tension
C	cohesion	tension
D	tension	cohesion

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[Turn over

31 Which combination of features is characteristic of a phloem sieve tube element immediately after it is loaded from a source?

	water potential of the phloem sieve tube element	lignification of the cell wall
A	higher than source	**not** present
B	higher than source	present
C	lower than source	**not** present
D	lower than source	present

32 Which blood vessel carries blood with the lowest pressure?

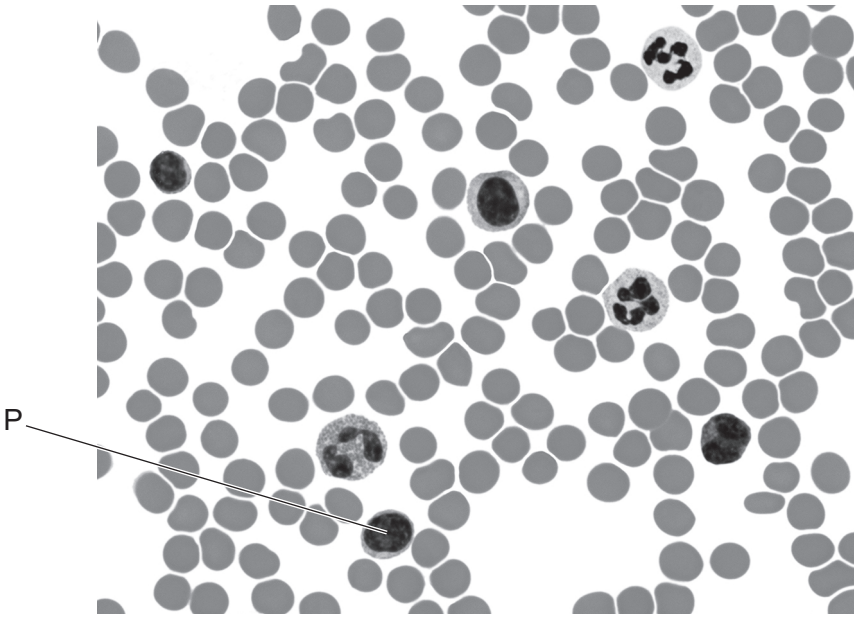
A aorta

B pulmonary artery

C pulmonary vein

D vena cava

33 The photomicrograph shows cells found in mammalian blood.



What is cell P?

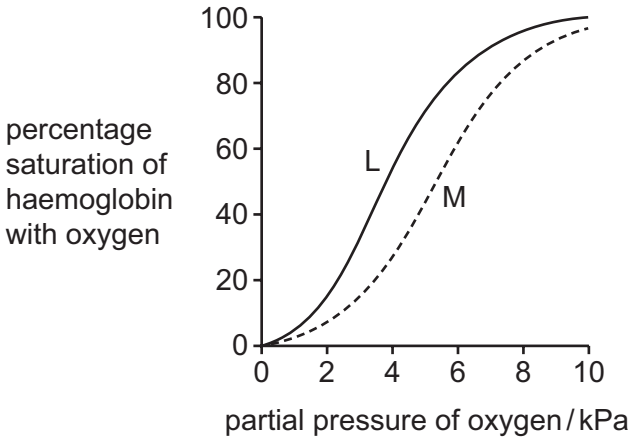
A lymphocyte

B monocyte

C neutrophil

D red blood cell

34 The diagram shows the Bohr shift in actively respiring cells.



What causes the shift from L to M?

A Carbonic acid dissociates to release protons that bind to oxyhaemoglobin, affecting the conformation of haemoglobin to reduce its affinity for oxygen.

B Hydrogencarbonate ions produced by carbonic anhydrase alter the charge of oxyhaemoglobin, reducing its ability to bind oxygen.

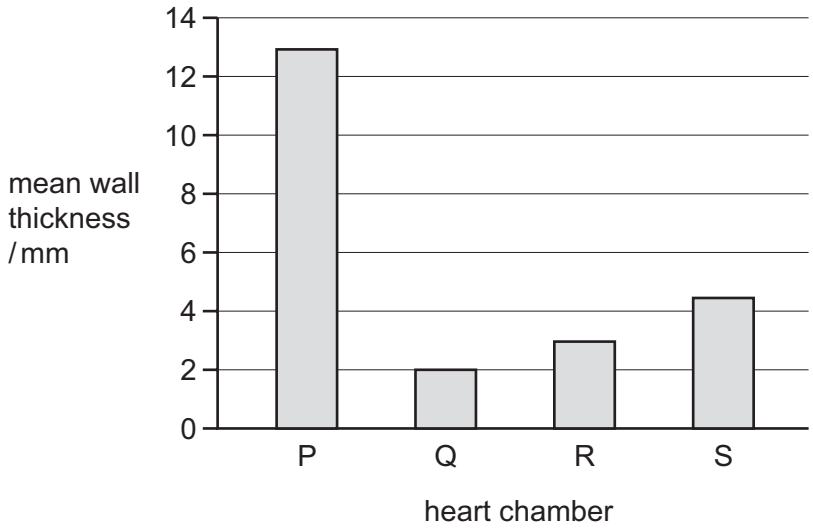
C Hydrogen ions combine with chloride ions in tissue fluid to produce hydrochloric acid, distorting oxyhaemoglobin and causing it to lose bound oxygen.

D A low concentration of oxygen in actively respiring cells causes oxyhaemoglobin to release oxygen more quickly down the concentration gradient.

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[Turn over

35 The bar chart shows the mean thickness of the walls of the main chambers in a mammalian heart.



Which row correctly identifies the heart chambers?

	right atrium	left atrium	right ventricle	left ventricle
A	R	Q	S	P
B	Q	S	R	P
C	R	Q	P	S
D	Q	R	S	P

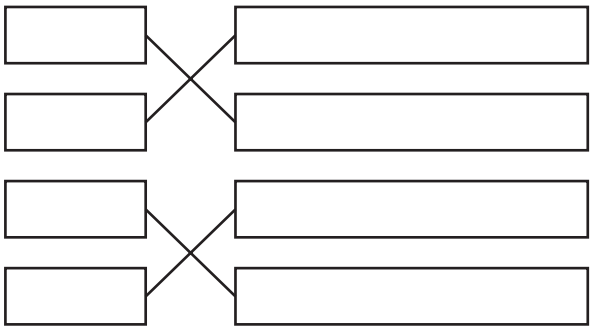
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36 The diagram shows parts of the gas exchange system in humans and the associated cells or structures.

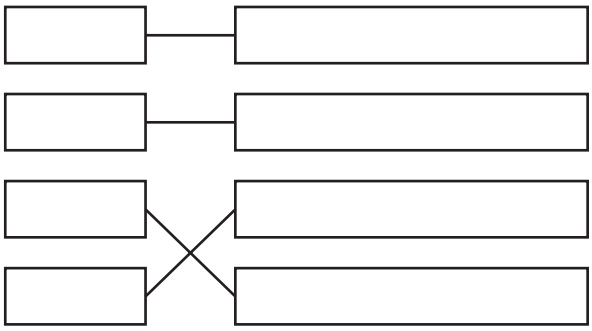
alveolus	ciliated cells
bronchiole	squamous epithelial cells
bronchus	C-shaped rings of cartilage
trachea	ciliated cells and goblet cells

Which diagram shows the lines that correctly match the parts to their cells or structures?

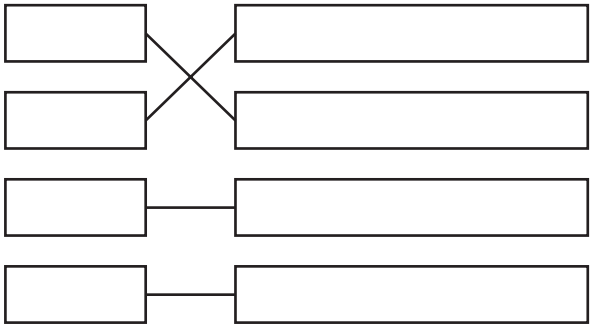
A



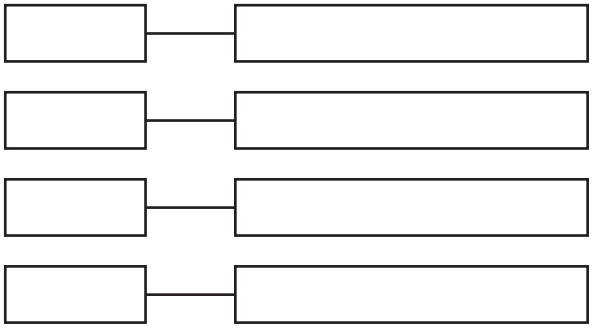
B



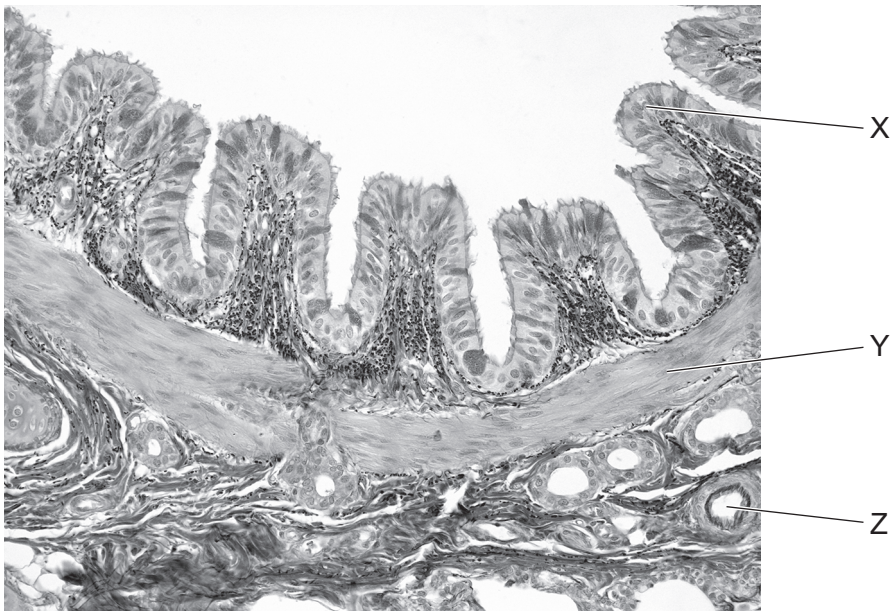
C



D



37 The photomicrograph shows the wall of a bronchus as seen with a light microscope.



Which row correctly identifies the structures labelled?

	X	Y	Z
A	epithelium	elastic fibres	bronchiole
B	endothelium	smooth muscle	bronchiole
C	epithelium	smooth muscle	blood vessel
D	endothelium	elastic fibres	blood vessel

38 Which factors affect the global pattern of distribution of malaria?

1 the disease is mainly restricted to tropical and subtropical environments

2 the effective vaccine has eradicated the disease in many countries

3 the vector required for transmission of malaria parasites

	1	2	3
A	✓	✓	✗
B	✓	✓	✓
C	✓	✗	✓
D	✗	✓	✓

key

✓ = effect

✗ = **not** an effect

39 Which molecule could be a self antigen?

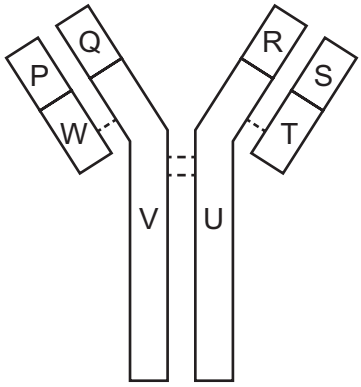
A a viral capsid protein

B a phospholipid in a viral envelope

C a toxin released by a pathogen

D a glycoprotein on the surface of a macrophage

40 The diagram shows an antibody molecule with some parts labelled.



Which row is correct about the parts that form an antigen-binding site and have identical amino acid sequences?

	form an antigen-binding site	have identical amino acid sequences
A	P and Q	R and S
B	Q and V	P and S
C	R and S	U and V
D	U and V	Q and R

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BIOLOGY **9700/13**

Paper 1 Multiple Choice **October/November 2025**

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.

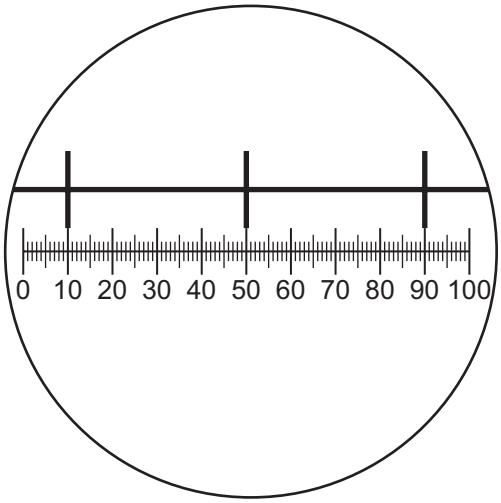
INFORMATION

- 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 The diagram shows a stage micrometer, with divisions 0.1 mm apart, viewed through an eyepiece containing a graticule.



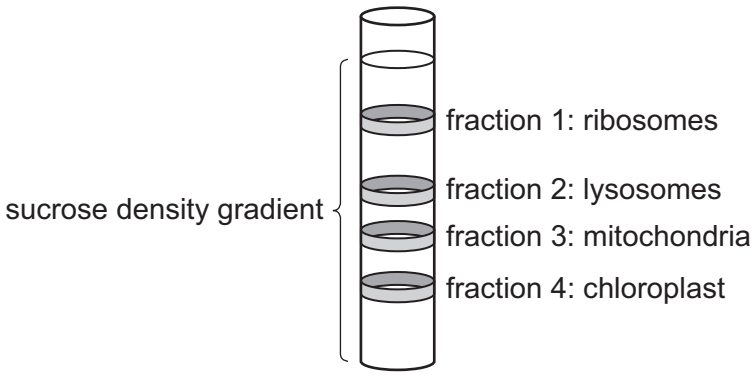
The same eyepiece is now used to examine a blood smear.

How many graticule divisions will cover the diameter of a lymphocyte of 10 μm?

A 1 **B** 4 **C** 10 **D** 20

2 Cell structures can be isolated by centrifuging the cells in a sucrose density gradient. This breaks up the cells and separates the cell structures into fractions.

The diagram shows the positions of some of these fractions in a sucrose density gradient.

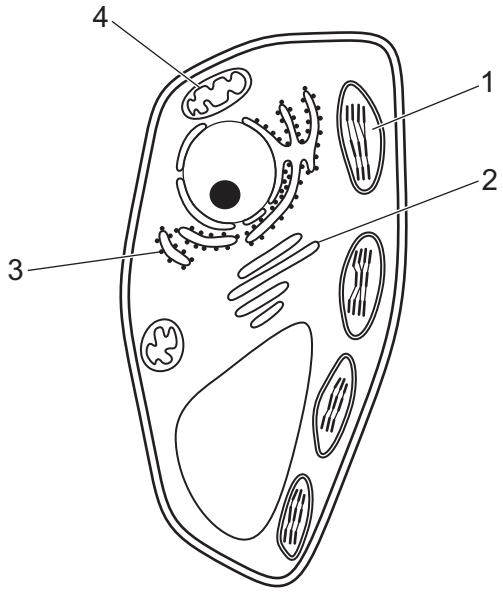


Which fractions contain cell structures that carry out protein synthesis?

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

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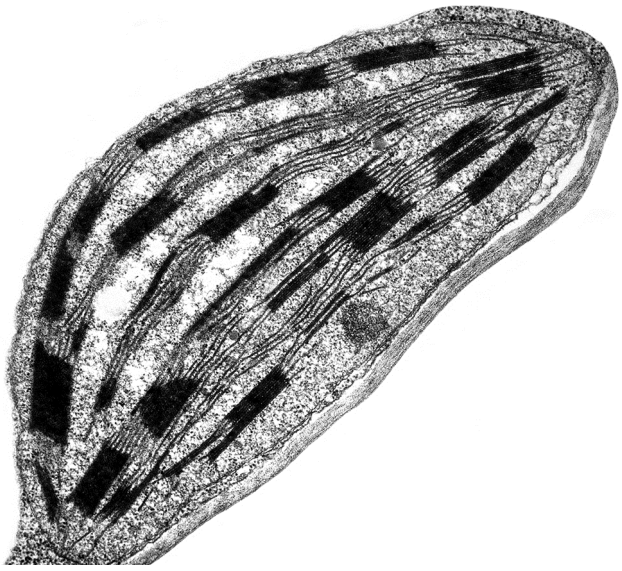
3 The diagram shows a plant cell.



Which labelled organelles would contain nucleotides?

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

4 The image shown is produced using a microscope.



How many statements about this image are correct?

- It is an electron micrograph.
- It shows part of a eukaryotic cell.
- It shows at least one mitochondrion.
- It shows a specimen viewed at more than ×400 magnification.

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

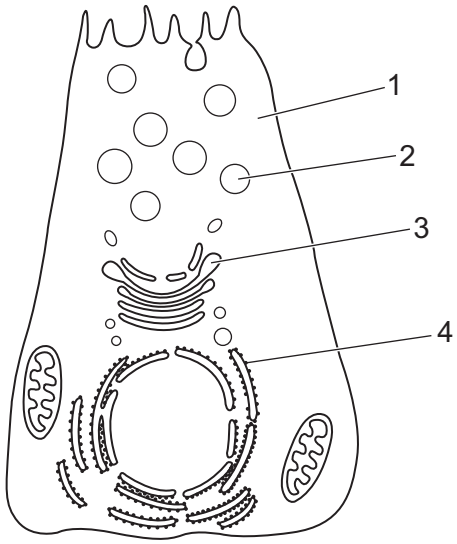
5 Bacterial ribosomes consist of two subunits and a total of three rRNA molecules per ribosome. An analysis of **all** the 70S ribosomes from a single cell of the bacterium *Escherichia coli* showed that there were:

- 57 000 rRNA molecules
- three types of rRNA molecule
- 19 000 copies of each type of rRNA molecule.

How many 70S ribosomes were there in the *E. coli* cell?

A 9500 **B** 19 000 **C** 38 000 **D** 57 000

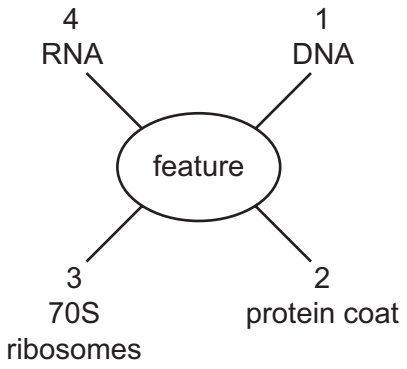
6 Radioactively labelled amino acids are introduced into a tracheal cell that uses them to make mucus (a glycoprotein).



Which route will the amino acids take?

	first →			last
A	1	2	3	4
B	1	4	3	2
C	4	1	2	3
D	4	3	2	1

7 Which features shown in the diagram can be present in viruses?



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

8 The diagram shows some steps in a laboratory method used to identify the presence of non-reducing sugars in a food sample.

Some terms are missing.



Which terms are correct for the expected result for a very low concentration of non-reducing sugar?

	X	Y	Z
A	acid hydrolysis	Benedict's test	orange
B	Benedict's test	acid hydrolysis	orange
C	acid hydrolysis	Benedict's test	green
D	Benedict's test	acid hydrolysis	green

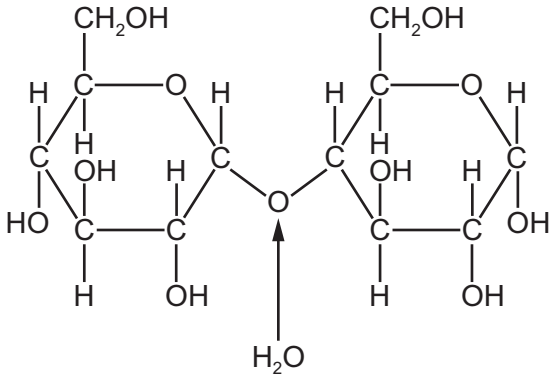
9 Many biological molecules exist as polymers made up of monomer subunits.

Which row correctly identifies the monomer in each of the biological molecules?

	collagen	glycogen	cellulose
A	amino acid	α-glucose	β-glucose
B	α-glucose	β-glucose	amino acid
C	β-glucose	amino acid	α-glucose
D	amino acid	β-glucose	α-glucose

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10 Which statement correctly explains the result when the two molecules shown in the diagram react together?



A A hydrolysis reaction is forming the disaccharide maltose.

B A reducing sugar is split into two monosaccharides by hydrolysis.

C Condensation of two α-glucose molecules is taking place.

D A condensation reaction is forming two reducing sugars.

11 Which row describes amylopectin?

	α-1,4 glycosidic bonds	α-1,6 glycosidic bonds	shape of molecule	function of molecule
A	✓	✓	branched	storage
B	✓	✗	helical	storage
C	✓	✓	branched	structural
D	✗	✓	helical	structural

key
✓ = present
✗ = **not** present

12 What is a feature of triglyceride molecules?

A They are hydrophobic molecules.

B They are molecules with a single ester bond.

C They are polar molecules.

D They are water-soluble molecules.

13 An unsaturated fatty acid molecule has 17 carbon atoms in the tail which is attached to its carboxyl group. The tail contains three double bonds.

How many hydrogen atoms does the tail contain?

A 29 **B** 31 **C** 33 **D** 35

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14 Which statement about phospholipids in the bilayer of a cell surface membrane is correct?

A The non-polar phosphate heads face outwards and the polar fatty acid tails face inwards.

B The polar phosphate heads face outwards and the non-polar fatty acid tails face inwards.

C The non-polar fatty acid tails face outwards and the polar phosphate heads face inwards.

D The polar fatty acid tails face outwards and the non-polar phosphate heads face inwards.

15 Which descriptions of enzymes that use the lock-and-key hypothesis are correct?

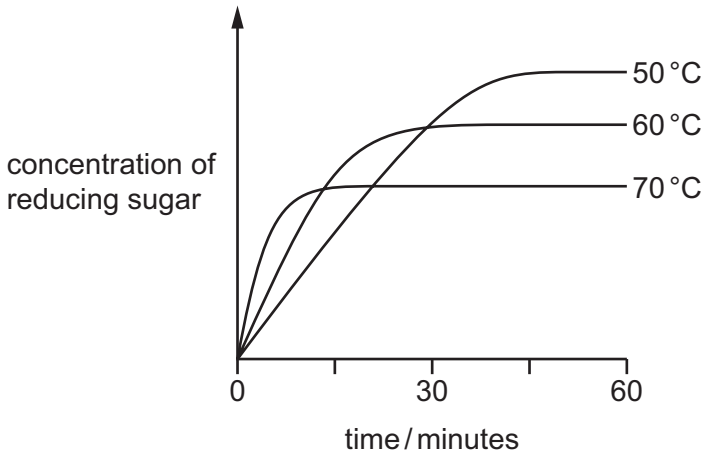
1 The active site is complementary to the substrate the enzyme acts on.

2 Bonds that form in the enzyme–substrate complex change the shape of the active site.

3 Most of the amino acids in an enzyme help to maintain the specific shape of the enzyme.

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

16 The graph shows the results of an investigation into the effect of amylase on starch at three different temperatures.



Which statements are correct conclusions using these results?

1 The optimum temperature is 50 °C.

2 The initial rate of reaction is highest at 70 °C.

3 The higher the temperature the more quickly the enzyme denatures.

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

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17 The rate of enzyme-catalysed reactions in human cells is regulated.

What may be involved in this regulation?

1 a change in enzyme concentration

2 a change in substrate concentration

3 inhibition by the final product of the reaction

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

18 Proteins in the cell surface membranes of human cells and mouse cells were labelled with fluorescent dyes. The human cells were labelled with a red dye and the mouse cells were labelled with a green dye.

A human cell and a mouse cell were then fused to form a hybrid cell.

At first, the different dyes remained separate. After 40 minutes, the two dyes were evenly distributed in the hybrid cell surface membrane.

What explains this observation?

A All protein molecules in the cell surface membrane are fixed to structures within the cell, but phospholipid molecules move freely between them.

B Groups of protein and phospholipid molecules in the cell surface membrane are attached to each other and move together.

C Only protein molecules in the outer layer of the cell surface membrane can move freely between phospholipid molecules.

D Protein molecules in the outer layer of the cell surface membrane and those which span the bilayer can move freely between phospholipid molecules.

19 Which statements about the cell surface membrane are correct?

1 Channel proteins allow water soluble ions and molecules across the membrane.

2 Glucose can pass into the cell via carrier proteins.

3 Oxygen passes freely through the membrane as it is soluble in lipids.

4 Some glycoproteins act as antigens.

A 1, 2, 3 and 4

B 1, 3 and 4 only

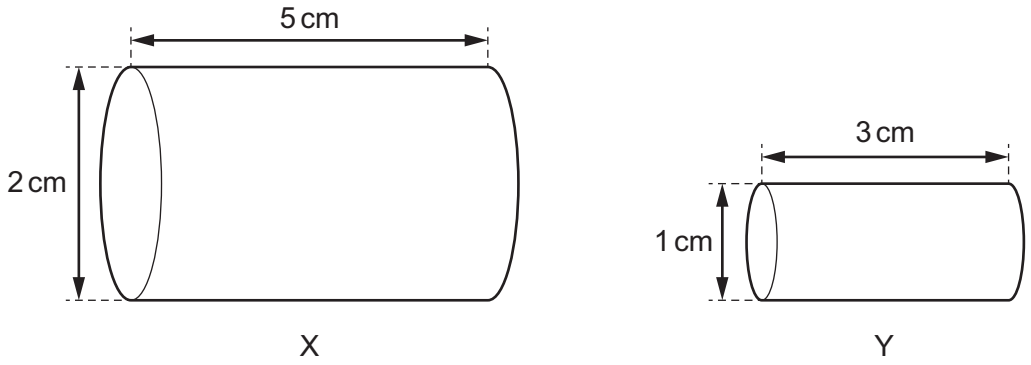
C 1 and 2 only

D 2, 3 and 4 only

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20 The diagram shows two cylinders of agar.

The agar cylinders are placed into a solution of dye at the same time. The time taken for the dye to diffuse into the centre of each cylinder is recorded.



Which statement explains why the dye reaches the centre of one agar cylinder faster than the other agar cylinder?

A The dye reaches the centre of X in a shorter time than the dye reaches the centre of Y because X has a larger surface area to volume ratio.

B The dye reaches the centre of X in a shorter time than the dye reaches the centre of Y because X has a larger surface area.

C The dye reaches the centre of Y in a shorter time than the dye reaches the centre of X because the dye has a shorter distance to diffuse to the centre.

D The dye reaches the centre of Y in a shorter time than the dye reaches the centre of X because Y has a smaller volume.

21 What are roles of adult stem cells in humans?

1 repair other cells by mitosis

2 divide to replace cells in tissues

3 differentiate into a new organism

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

22 Which statements are correct for the mitotic cell cycle?

1 DNA is replicated semi-conservatively during mitosis.

2 DNA is never changed from one generation of cells to the next generation.

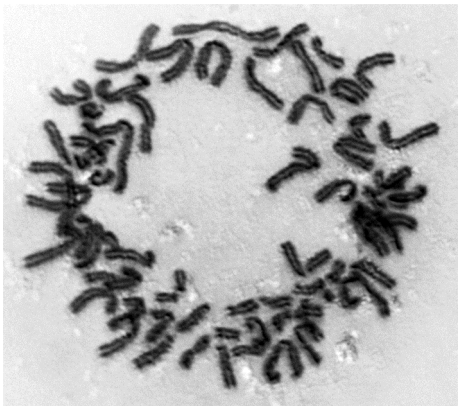
3 The daughter cells at the end of a mitotic cell division have the potential to produce the same enzymes as the parent cell.

4 The same quantity of DNA is distributed to the nuclei of two new cells at the end of a mitotic cell division.

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

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23 The photomicrograph shows a stage of the cell cycle.



Which stage is shown in the photomicrograph?

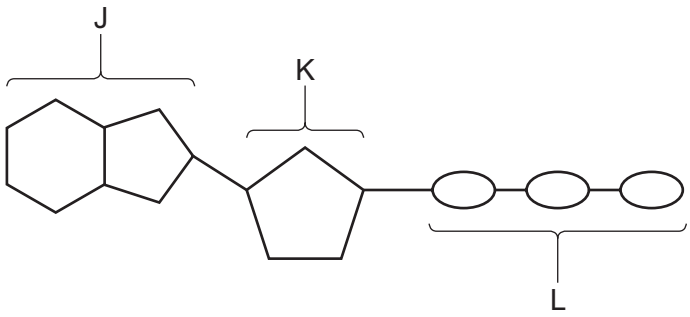
A anaphase

B interphase

C metaphase

D telophase

24 The diagram represents a molecule of ATP.



What are the components of ATP labelled J, K and L?

	J	K	L
A	adenine	deoxyribose	phosphates
B	adenosine	pentose	a phosphate group
C	adenosine	ribose	phosphorus
D	purine	pentose	phosphates

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25 Which statements about complementary base pairing are correct?

1 It occurs during translation.

2 Purines and pyrimidines are the same size.

3 The base pairs are of equal length.

4 Uracil forms three hydrogen bonds with adenine.

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

26 Which statement is correct for protein synthesis?

A During translation, the strand of DNA used is the template strand.

B mRNA is formed when introns are removed from the primary transcript.

C The DNA primary transcript is modified by removing exons.

D tRNA has codons which attach to anticodons on the mRNA.

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27 A mutation occurred in this original DNA nucleotide sequence.

C T A G A A T C C T C T C C C

After the mutation occurred, the new DNA nucleotide sequence coded for the amino acids Asp, Leu, Gly and Glu.

The table shows the amino acids that are coded for by each DNA triplet.

1st base	2nd base: A	2nd base: G	2nd base: T	2nd base: C
A	AAA Phe AAG Phe AAT Leu AAC Leu	AGA Ser AGG Ser AGT Ser AGC Ser	ATA Tyr ATG Tyr ATT *Stop* ATC *Stop*	ACA Cys ACG Cys ACT *Stop* ACC Trp
G	GAA Leu GAG Leu GAT Leu GAC Leu	GGA Pro GGG Pro GGT Pro GGC Pro	GTA His GTG His GTT Gln GTC Gln	GCA Arg GCG Arg GCT Arg GCC Arg
T	TAA Ile TAG Ile TAT Ile TAC Met	TGA Thr TGG Thr TGT Thr TGC Thr	TTA Asn TTG Asn TTT Lys TTC Lys	TCA Ser TCG Ser TCT Arg TCC Arg
C	CAA Val CAG Val CAT Val CAC Val	CGA Ala CGG Ala CGT Ala CGC Ala	CTA Asp CTG Asp CTT Glu CTC Glu	CCA Gly CCG Gly CCT Gly CCC Gly

Which type of gene mutation occurred in the DNA nucleotide sequence?

A deletion of one nucleotide

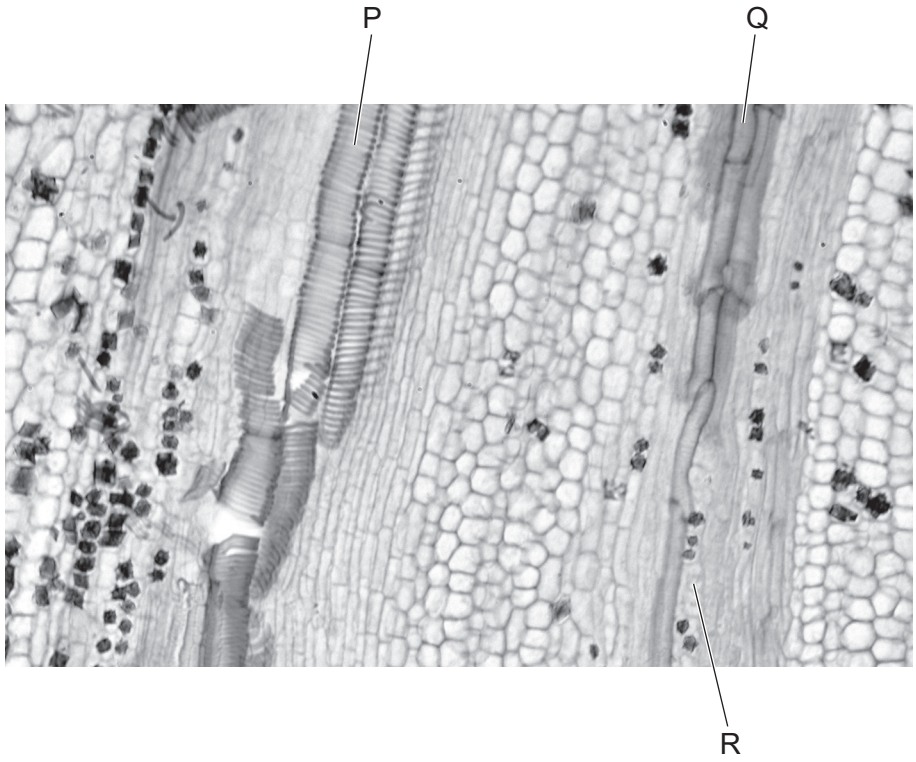
B insertion of one nucleotide

C insertion of two nucleotides

D substitution of one nucleotide

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28 The photomicrograph shows a longitudinal section of part of a plant stem.



Which row correctly identifies structures P, Q and R?

	P	Q	R
A	phloem sieve tube element	companion cell	xylem vessel element
B	phloem sieve tube element	xylem vessel element	companion cell
C	xylem vessel element	phloem sieve tube element	companion cell
D	xylem vessel element	companion cell	phloem sieve tube element

29 Which statement about the pathway taken by a water molecule travelling from the soil to the xylem is correct?

A A water molecule in a cortex cell that takes the symplast pathway must enter the next cortex cell by passing between two adjacent phospholipid molecules in a cell surface membrane.

B A water molecule can pass into xylem vessels either through pits or through the cell wall of the xylem vessel elements by osmosis.

C A water molecule would pass into the cytoplasm of the endodermal cell if it always takes the apoplast pathway all the way to the xylem.

D A water molecule that has left the endodermal cells can travel by either the apoplast pathway or symplast pathway.

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30 Amino acids move from a phloem sieve tube element into a root cell.

What are the changes to the water potential and the volume of liquid in the phloem sieve tube element at the sink, when this event is happening?

	water potential in the phloem sieve tube element	volume of liquid in the phloem sieve tube element
A	becomes higher	decreases
B	becomes higher	increases
C	becomes lower	decreases
D	becomes lower	increases

31 The table shows the comparison of blood pressure in three main blood vessels during diastole.

	vessel 1	vessel 2	vessel 3
blood pressure in the vessel during diastole	low	very high	high

Which row identifies the three blood vessels?

	vessel 1	vessel 2	vessel 3
A	pulmonary vein	pulmonary artery	aorta
B	vena cava	aorta	pulmonary vein
C	pulmonary vein	aorta	pulmonary artery
D	pulmonary artery	pulmonary vein	vena cava

32 Red blood cells may contain a molecule known as 2,3-bisphosphoglycerate (2,3-BPG).

When 2,3-BPG binds to haemoglobin, a higher partial pressure of oxygen is needed to bring about 50% saturation of haemoglobin with oxygen.

Which statements about the effect of 2,3-BPG are correct?

1 2,3-BPG in red blood cells causes the oxygen dissociation curve to shift to the right.

2 The binding of 2,3-BPG to haemoglobin reduces the Bohr effect.

3 The binding of 2,3-BPG to haemoglobin lowers the affinity of the haemoglobin for oxygen.

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

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33 A person has a small hole in the septum between the ventricles. This is called a ventricular septal defect (VSD). The person has no other heart defects.

What is the direction of the net flow of blood during ventricular systole in the heart of this person?

A left ventricle to left atrium

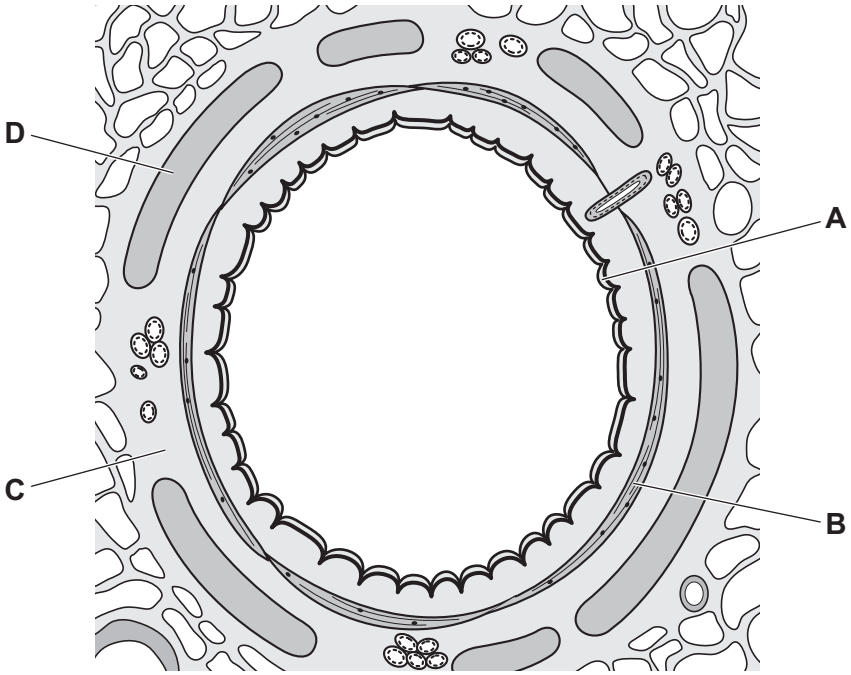
B right ventricle to right atrium

C left ventricle to right ventricle

D right ventricle to left ventricle

34 The diagram shows a transverse section through a human bronchus.

Which labelled tissue is the cartilage?



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

A the flow of blood through the lungs

B the presence of haemoglobin in blood cells

C the single-celled alveolar walls

D the squamous epithelium of capillaries

36 Which row correctly identifies the pathogens causing malaria and TB?

	malaria	TB
A	protoctist	virus
B	protoctist	bacterium
C	prokaryote	bacterium
D	prokaryote	virus

37 What could be used to help prevent an outbreak of cholera in a town?

A treatment of sewage waste

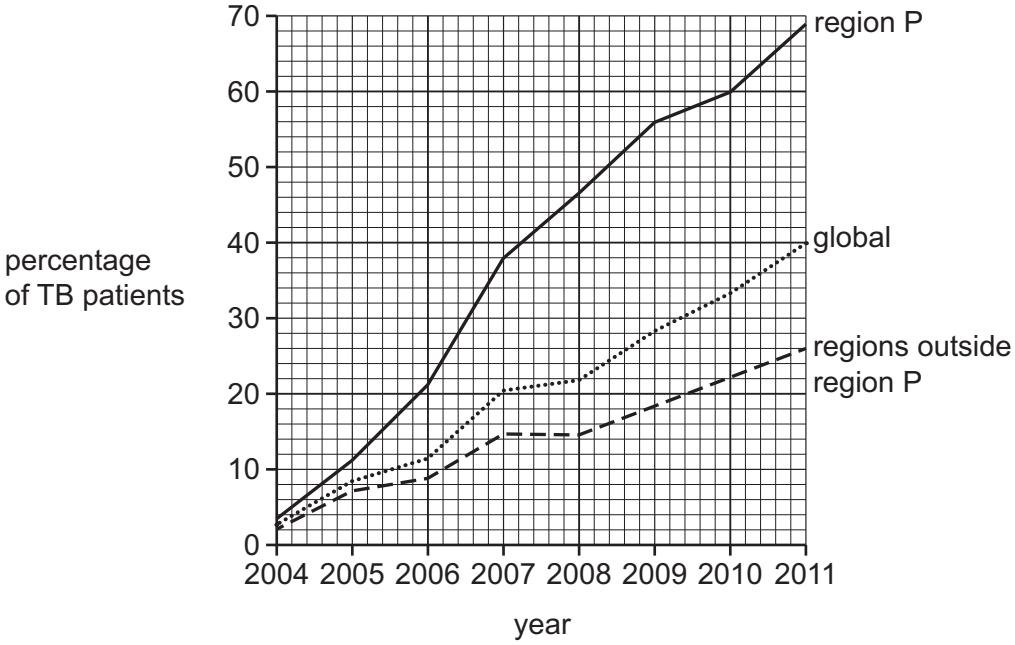
B spraying still water with insecticides to kill mosquito larvae

C increased use of antiviral medicine

D preventing the reuse of hypodermic needles

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38 The graph shows the percentage of tuberculosis (TB) patients who were also known to be infected with HIV, from 2004 to 2011.



Which statement about the graph is correct?

A From 2004 to 2010, the percentage of TB patients with HIV infection in region P increased from 3% to 69%.

B From 2005 to 2011, the percentage of TB patients with HIV infection increased more rapidly in region P than in regions outside region P.

C From 2006 to 2011, the percentage of TB patients with HIV infection in regions outside region P doubled.

D From 2007 to 2011, the percentage of TB patients with HIV infection globally increased from 20% to 30%.

39 Four different treatments were tested in a human volunteer during a year. One of these treatments was a vaccine.

The treatments were injected into the volunteer and blood samples were taken after two weeks. The samples were analysed to obtain a cell count for four types of cell.

The results are shown in the table.

Which treatment was the vaccine?

(Assume the volunteer's baseline blood cell count was the same before each treatment.)

	cell count / cells per cm^3			
	monocytes	neutrophils	plasma cells	macrophages
A	250	180	450	230
B	500	190	220	240
C	260	450	240	250
D	250	190	230	550

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

People can be vaccinated to protect them from the effects of this pathogen.

Which statement describes the sequences of events that occur in a vaccinated person to protect them from the effects of this pathogen?

A Memory cells divide by mitosis and then differentiate into macrophages that engulf and digest the toxin.

B Memory cells divide by mitosis and then differentiate into plasma cells that produce antibodies to bind to the toxin.

C Macrophages divide by mitosis and then differentiate into memory cells that engulf and digest the toxin.

D Plasma cells divide by mitosis and then differentiate into memory cells that produce antibodies to bind to the toxin.

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BIOLOGY **9700/14**

Paper 1 Multiple Choice **October/November 2025**

1 hour 15 minutes

You must answer on the multiple choice answer sheet.

4564272684

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 structures are visible in an appropriately stained plant cell using a high power (×400) light microscope?

	centrioles	mitochondria	starch grains
A	✓	✗	✓
B	✓	✗	✗
C	✗	✓	✗
D	✗	✓	✓

key

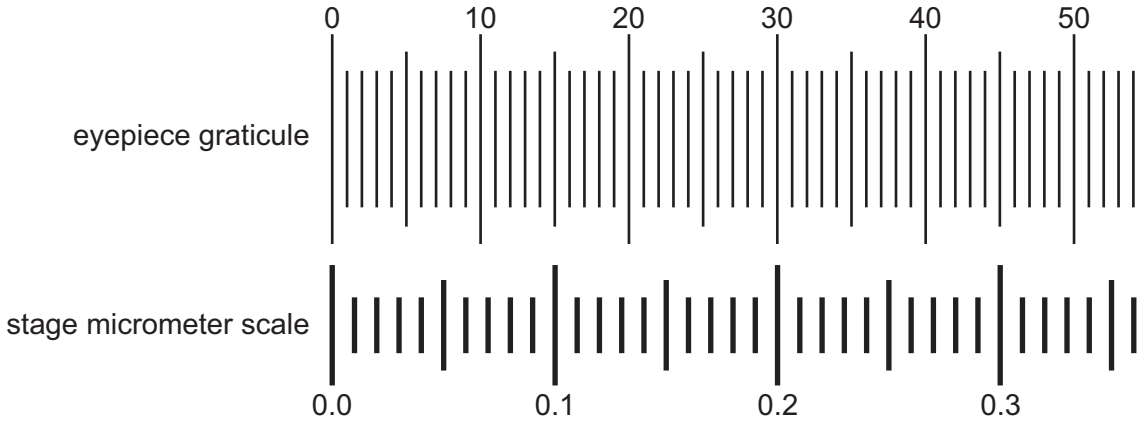
✓ = visible

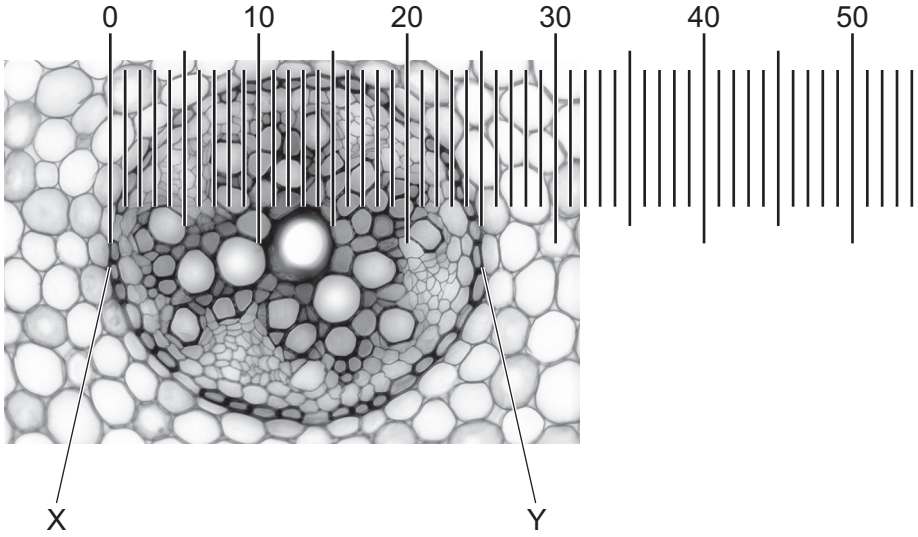
✗ = **not** visible

2 The images show an eyepiece graticule and a stage micrometer scale viewed through a microscope.

The smallest divisions of the stage micrometer scale are 0.01 mm.

The images also show a photomicrograph of a transverse section through a plant root using the same eyepiece graticule and the same magnification.





What is the actual width of the vascular tissue in the plant root between X and Y?

A 17 μm **B** 25 μm **C** 170 μm **D** 250 μm

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3 It is thought that some organelles in eukaryotic cells evolved from free-living prokaryotes.

Which organelles have features that suggest they evolved from free-living prokaryotic ancestors?

A chloroplasts and mitochondria

B chloroplasts and Golgi bodies

C mitochondria and smooth endoplasmic reticulum

D Golgi bodies and smooth endoplasmic reticulum

4 A student completed a table showing the structures that are found in four different types of cells.

cell structure	cell Q	cell R	cell S	cell T
cell surface membrane	✓	✓	✓	✓
cellulose cell wall	✓	✓	✗	✓
chloroplast	✓	✗	✗	✗
mitochondrion	✓	✓	✗	✓
nucleus	✓	✓	✗	✗

key

✓ = present

✗ = **not** present

How many of these types of cells can be found in plants?

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

5 Some features of cells are listed.

1 cytoplasm

2 cell surface membrane

3 ribosomes

Which features are found in animal cells and also in prokaryotic cells?

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

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6 Trehalose is a non-reducing disaccharide.

Separate samples of a mixture of fructose and trehalose were tested with Benedict's solution before and after acid hydrolysis.

What will be the results of these Benedict's tests?

	before acid hydrolysis	after acid hydrolysis
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

key

✓ = positive result with Benedict's test

✗ = negative result with Benedict's test

7 Which molecules have a structural formula that contains C=O bonds?

1 glucose

2 glycerol

3 protein

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

8 Which statement about monosaccharides and disaccharides is correct?

A Sucrose is a non-reducing disaccharide produced from two identical monosaccharides joined together by a condensation reaction.

B The hydrolysis of the reducing disaccharide maltose produces a reducing monosaccharide, and a non-reducing monosaccharide.

C Maltose is a non-reducing disaccharide that contains two identical reducing monosaccharides connected by a glycosidic bond.

D The addition of a water molecule to the glycosidic bond in a sucrose disaccharide produces two different reducing monosaccharides.

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9 Which row is correct for glycogen?

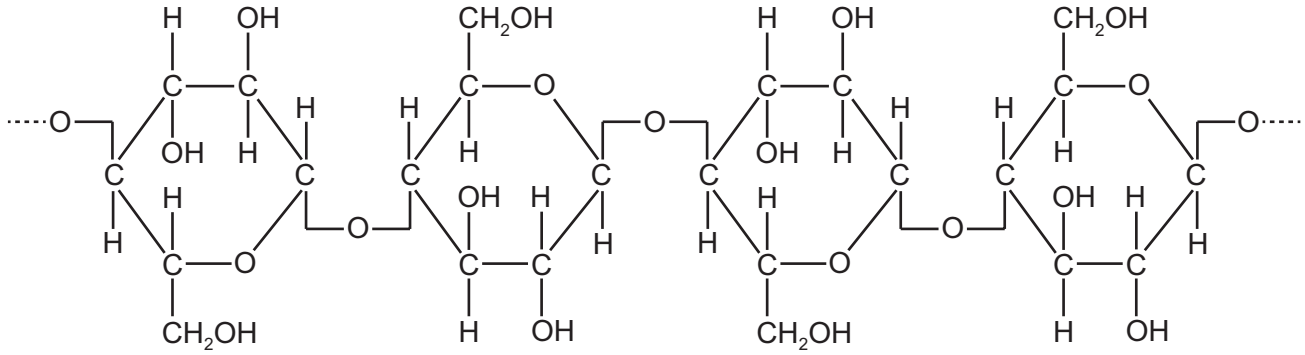
	glycogen is hydrolysed rapidly due to its branched structure	glycogen is insoluble so the water potential of cells is unaffected	glycogen is a compact molecule because it contains many β-glucose molecules
A	✓	✓	✓
B	✓	✓	✗
C	✗	✗	✓
D	✗	✓	✗

key

✓ = correct for glycogen

✗ = incorrect for glycogen

10 The diagram shows a section of a polysaccharide.



Which statement about this polysaccharide is correct?

A It coils into a tight helix that provides a compact shape for energy storage in cells.

B It has high tensile strength when arranged into fibrils in plant cell walls.

C It folds into a globular shape that is soluble in water and easily transported.

D It combines with protein molecules to act as cell markers on the cell surface membrane.

11 Thermostable enzymes can maintain their tertiary structure at high temperatures.

Scientists studying the primary structure of a thermostable enzyme found that the enzyme contained:

- more charged amino acids
- fewer polar amino acids that are **not** charged
- more hydrophobic amino acids

than enzymes that are **not** thermostable.

Which row shows a correct comparison between this thermostable enzyme and an enzyme that is **not** thermostable?

	number of amino acids forming interactions at the centre of a thermostable enzyme compared to an enzyme that is **not** thermostable	number of ionic bonds in a thermostable enzyme compared to the number in an enzyme that is **not** thermostable
A	less than	more than
B	less than	less than
C	more than	less than
D	more than	more than

12 Collagen is a strong, elastic molecule that is often found in the connective tissues of animals. Glycine is an amino acid found at regular positions in the primary structure of a collagen polypeptide.

Which row shows features of collagen that contribute to its strength and elasticity?

	glycine is found on the outside of the helical polypeptides to allow them to lie closer together	disulfide bonds form between glycine amino acids to join the polypeptides together
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

key

✓ = contributes to the strength and elasticity of collagen

✗ = does **not** contribute to the strength and elasticity of collagen

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13 Which statements describe the action of an extracellular enzyme?

1 synthesis of a polynucleotide in the nucleus during DNA replication

2 digestion of macromolecules in the lumen of the small intestine

3 synthesis of ATP molecules in the mitochondria

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

14 Which statement about the induced-fit hypothesis of enzyme action is correct?

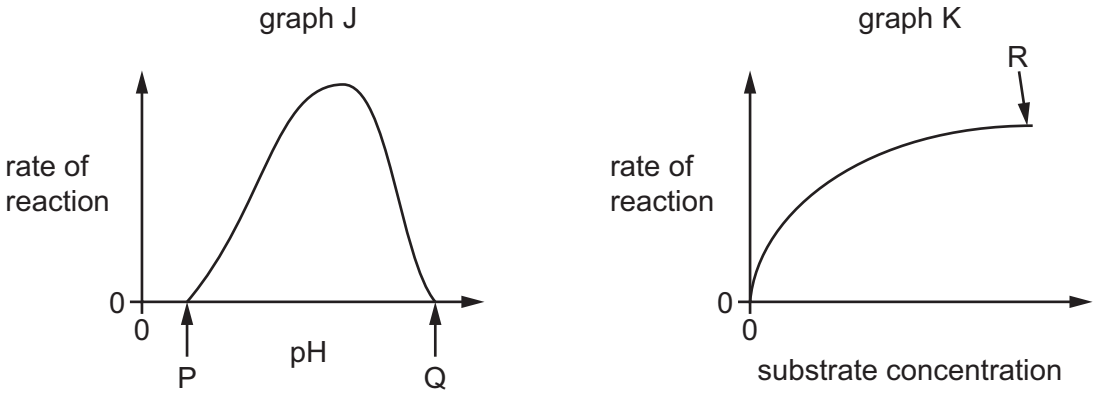
A An enzyme that uses the induced-fit mechanism will increase the activation energy of a reaction.

B The binding of a substrate causes conformational changes in an enzyme.

C The active site of an enzyme changes to become the same shape as the substrate.

D An enzyme that uses an induced-fit mechanism has decreased specificity to the substrate.

15 Graph J shows the effect of pH on the rate of an enzyme reaction. Graph K shows the effect of substrate concentration on the rate of an enzyme reaction.



A student wrote four statements about the graphs.

1 In graph J, the enzyme is denatured at point Q.

2 In graph J, the enzyme is inactive at point P.

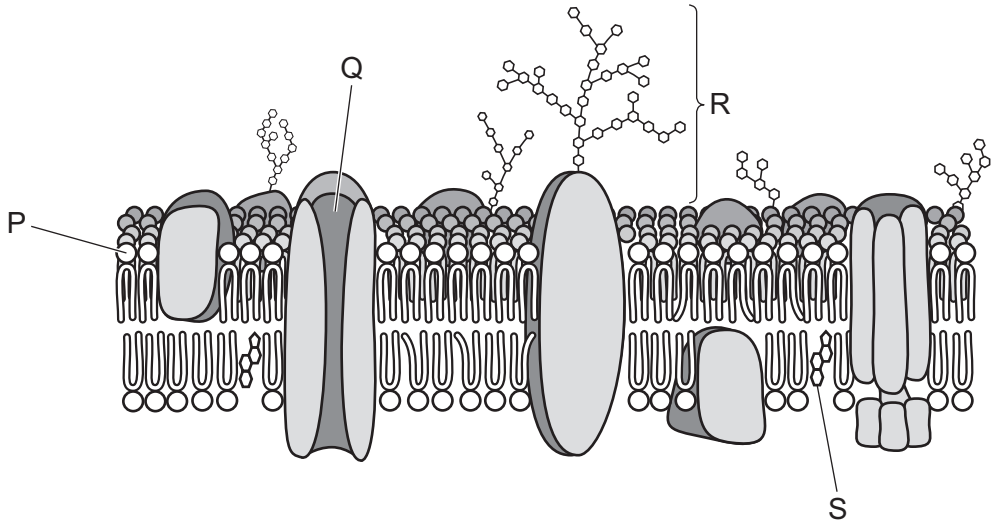
3 In graph K, the rate of reaction is directly proportional to the substrate concentration.

4 In graph K, V_{max} is reached at point R.

Which statements are correct?

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

16 The diagram shows a section through a cell surface membrane.



What is a correct role for a labelled molecule?

A P is involved in controlling membrane stability.

B Q is involved in active transport.

C R is involved in cell signalling.

D S is involved in diffusion of ions.

17 When red blood cells are put into distilled water they burst (haemolysis).

Which statements explain this haemolysis?

1 The water potential of the surrounding liquid is lower than the water potential of the contents of the red blood cell.

2 The cell surface membranes of red blood cells are **not** supported by cell walls.

3 More water moves into the red blood cells by osmosis than leaves the cells.

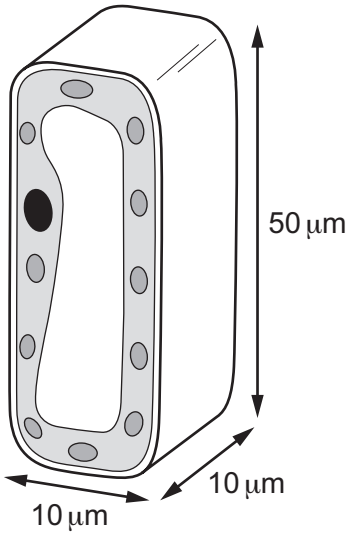
4 Water enters the red blood cells by osmosis but does **not** leave the cells.

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

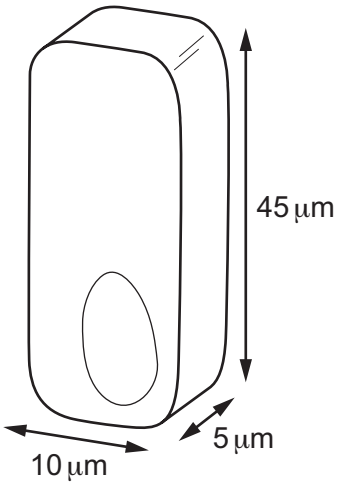
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18 The diagrams show the shape and size of two types of cell.

palisade mesophyll cell
surface area = 2200 μm^2



columnar epithelial cell
volume = 2250 μm^3



not to scale

Which statement about the palisade cell and epithelial cell shown in the diagrams is correct?

A An increase in surface area reduces the distance for gases to reach the centre of the cell.

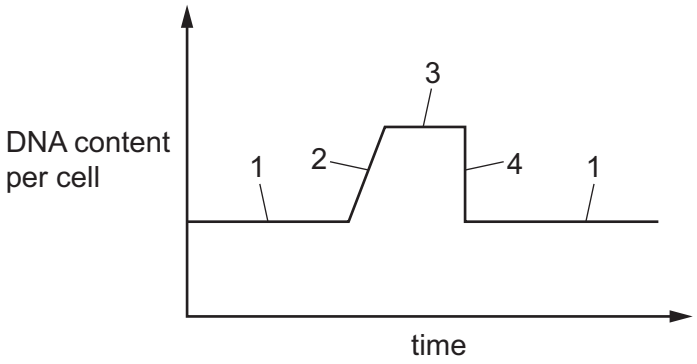
B The surface area of the palisade mesophyll cell is 500 μm^2 greater than the columnar epithelial cell.

C The surface area to volume ratio is greater in the columnar epithelial cell than the palisade mesophyll cell.

D The volume of the palisade mesophyll cell is 2500 μm^3 greater than that of the columnar epithelial cell.

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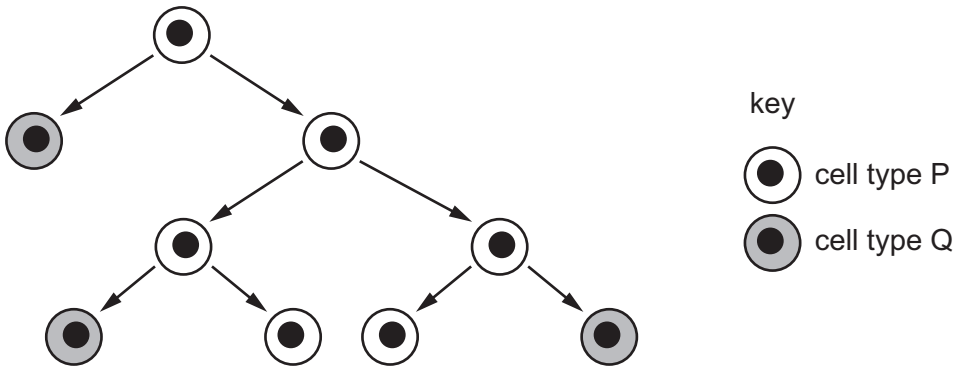
19 The DNA content of a cell changes as the mitotic cell cycle proceeds through a series of stages.



Which row correctly identifies when DNA replicates and when the nuclear envelope breaks down?

	DNA replicates	nuclear envelope breaks down
A	1	3
B	1	4
C	2	3
D	2	4

20 The diagram shows three cycles of cell division from an original cell of cell type P in bone marrow. Some of the cells that form are cell type Q.



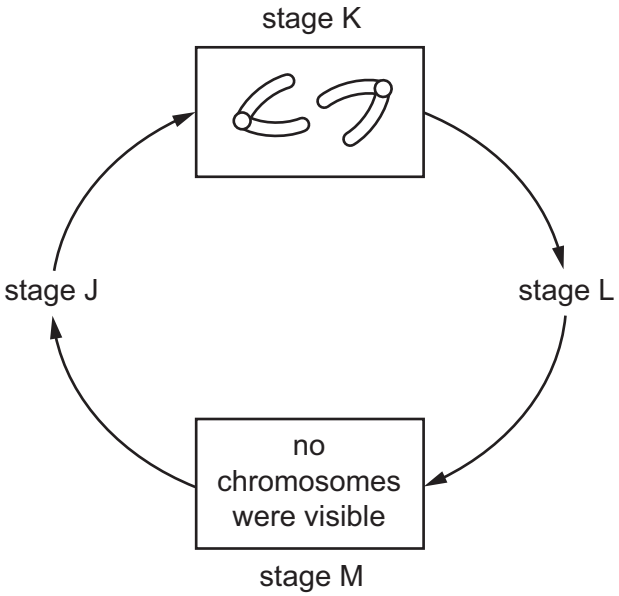
not to scale

Which row correctly identifies cell type P and cell type Q?

	cell type P	cell type Q
A	cancer cell	differentiated cell
B	cancer cell	stem cell
C	differentiated cell	stem cell
D	stem cell	differentiated cell

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21 A student made a drawing of two chromosomes at stage K of a mitotic cell cycle.



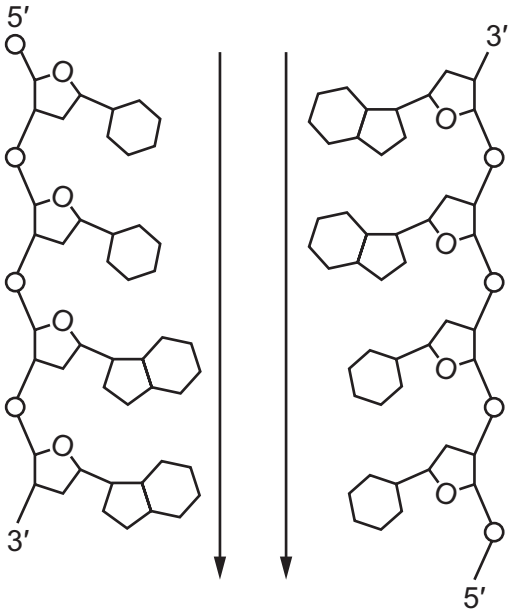
Which row shows the possible events that occur in stages J, L and M?

	J	L	M
A	spindle attachment	cytokinesis	DNA replication
B	chromosome condensation	spindle attachment	cytokinesis
C	DNA replication	chromosome condensation	spindle attachment
D	cytokinesis	DNA replication	chromosome condensation

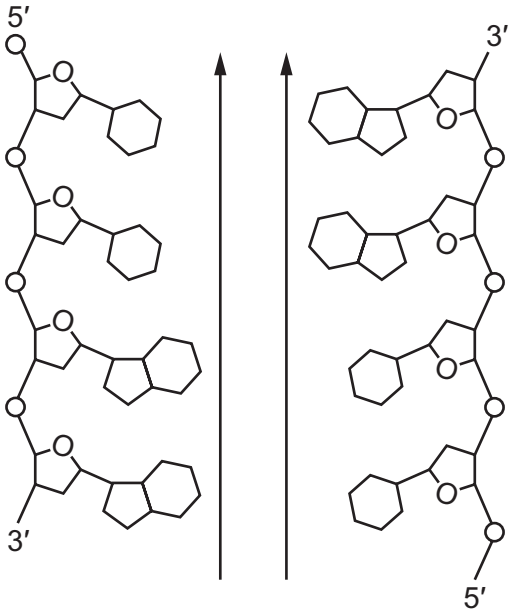
22 During DNA replication, the two original strands of a DNA molecule separate.

Which diagram shows the direction in which DNA polymerase moves along each of the original strands during DNA replication?

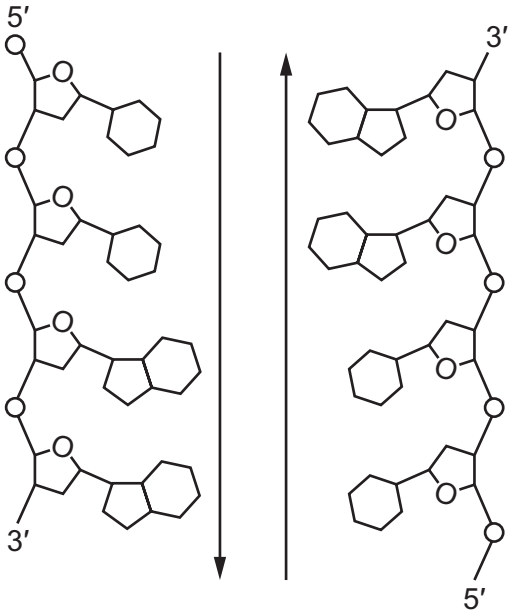
A



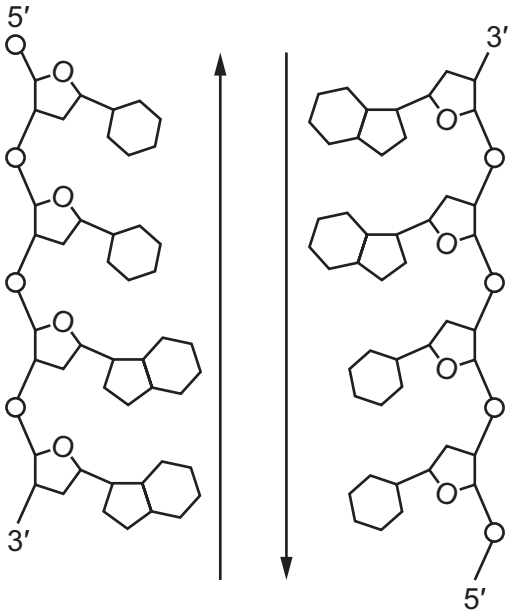
B



C



D



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23 Which statements about anticodons are correct?

1 The base sequence of an anticodon will always be the same as that of the corresponding triplet on the transcribed DNA strand.

2 There are 20 naturally occurring amino acids, so therefore there are only 20 anticodons as each anticodon is specific for only one amino acid.

3 The formation of hydrogen bonds between the bases of the anticodon with those of the complementary mRNA codon must occur before the new peptide bond can form.

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

24 Part of a DNA molecule is transcribed to form an RNA molecule that is then modified.

Which row describes the RNA molecule before and after modification?

	before modification	after modification
A	contains exons and introns	contains exons only
B	contains exons and introns	contains introns only
C	contains exons only	contains introns only
D	contains introns only	contains exons only

25 When a gene mutation occurs, which of the following may be altered, resulting in the production of a non-functional protein?

1 amino acid sequence

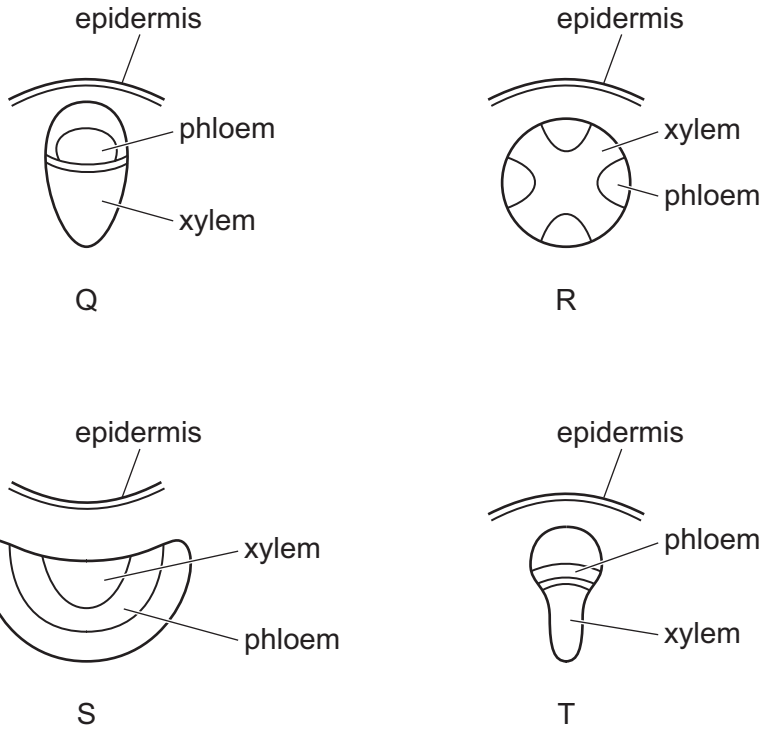
2 DNA nucleotide sequence

3 mRNA nucleotide sequence

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

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26 The diagrams show the arrangements of phloem and xylem tissues in some plant organs.



Where will arrangements Q, R, S and T be found in plants?

	Q	R	S	T
A	leaf	root	stem	root
B	root	stem	root	leaf
C	stem	stem	leaf	root
D	stem	root	leaf	stem

27 Which feature of xylem vessel elements allows them to have reduced resistance to water movement?

A Lignin forms an incomplete secondary wall.

B New vessels transport extra water as a plant grows.

C There are no cross walls between vessel elements.

D Vessel elements join to form narrow tubes.

28 Which statement describes movement through a plant in the apoplast pathway?

A Water moves through the cell walls.

B Water moves through the cytoplasm.

C Water moves through the plasmodesmata.

D Water moves through the vacuoles.

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29 What is the correct name for the attraction due to the hydrogen bonding between water molecules during mass flow in plants?

A transpiration

B cohesion

C tension

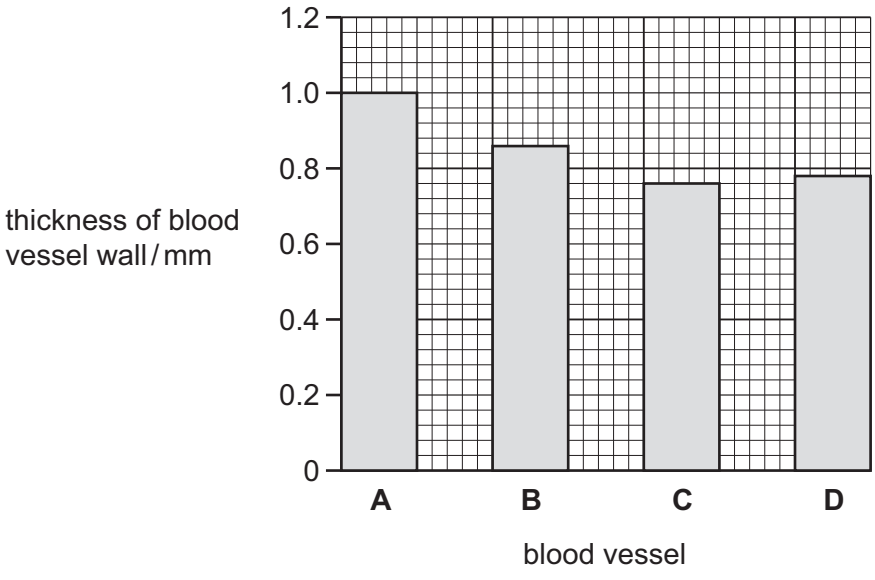
D adhesion

30 Which row shows the cause of mass flow in the phloem and the direction of movement of phloem sap by mass flow?

	cause of mass flow in the phloem	direction of movement of phloem sap by mass flow
A	hydrostatic pressure gradient	sink to source
B	hydrostatic pressure gradient	source to sink
C	water potential gradient	sink to source
D	water potential gradient	source to sink

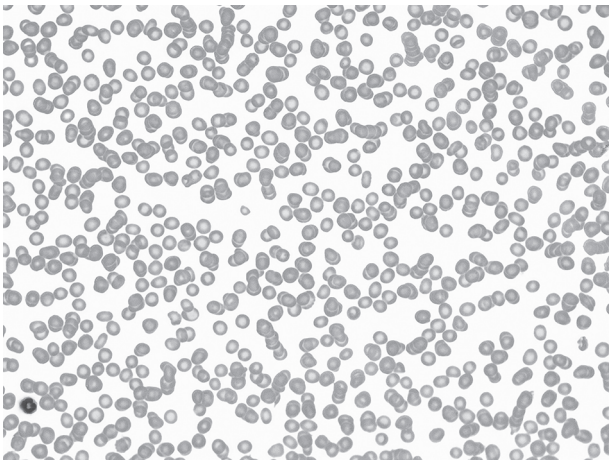
31 The graph shows the thickness of the walls of the main blood vessels to and from a mammalian heart.

Which blood vessel is the pulmonary artery?

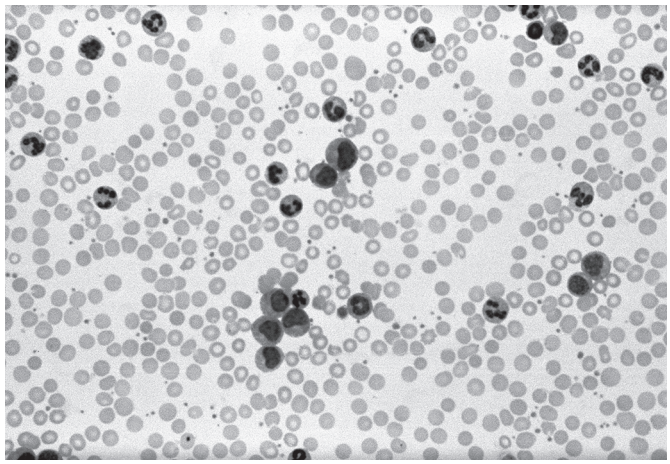


32 The photomicrographs show blood smears from two different people. Person J does **not** have a disorder that affects their blood. Person K does have a disorder that affects their blood.

person J



person K



The table shows some disorders that increase or decrease the number of neutrophils, red blood cells or lymphocytes.

	disorders related to blood count changes	
	increase	decrease
neutrophil	chronic inflammation	autoimmune neutropenia
red blood cell	heart failure	anaemia
lymphocyte	chronic leukaemia	sepsis

Which disorder does person K have?

A autoimmune neutropenia

B heart failure

C sepsis

D chronic leukaemia

33 Which statement correctly describes the Bohr shift?

A the decrease in affinity of haemoglobin for oxygen that occurs when pH is lowered

B the increase in affinity of haemoglobin for oxygen that occurs when oxygen concentration rises

C the increase in affinity of haemoglobin for oxygen that occurs when pH is at an optimum

D the release of oxygen from oxyhaemoglobin in the absence of carbonic acid

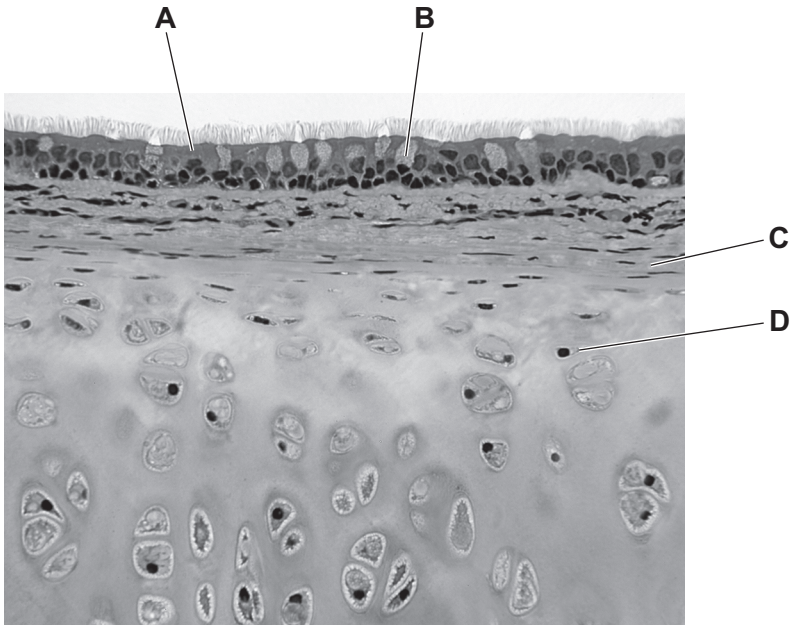
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34 Which row correctly describes the features for two of the heart chambers?

	left atrium	left ventricle
A	large force of contraction to allow blood to travel a long distance	large force of contraction to allow blood to travel a long distance
B	small force of contraction as blood only needs to travel a short distance	large force of contraction to allow blood to travel a long distance
C	small force of contraction as blood only needs to travel a short distance	small force of contraction as blood only needs to travel a short distance
D	large force of contraction to allow blood to travel a long distance	small force of contraction as blood only needs to travel a short distance

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

Which row shows the correct name and function of one of the labelled structures in the photomicrograph?



	name	function
A	ciliated epithelial cell	traps particles
B	goblet cell	secretes mucus
C	cartilage	prevents collapse of trachea
D	smooth muscle	contracts to expand airways

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[Turn over

36 Infectious diseases may be caused by bacteria, protoctists and viruses. Different pathogens may be transmitted by airborne droplets, from faeces to mouth (faecal-oral), by sexual intercourse and by vectors.

Four examples of infectious diseases are listed.

1 cholera

2 HIV/AIDS

3 malaria

4 tuberculosis

Which table classifies the four diseases correctly to show the type of pathogen that causes the disease and the mode of transmission?

A

	bacterium	protoctist	virus
droplet			2
faecal-oral	1		
sexual		3	
vector			4

B

	bacterium	protoctist	virus
droplet		2	
faecal-oral	1		
sexual			3
vector		4	

C

	bacterium	protoctist	virus
droplet	4		
faecal-oral	1		
sexual			2
vector		3	

D

	bacterium	protoctist	virus
droplet	3		
faecal-oral		2	
sexual	1		
vector			4

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37 Scientists investigated the sensitivity and resistance of a bacterium called *Clostridium difficile* to four antibiotics. Colonies of bacteria were grown on agar plates for 24 hours, after which a different antibiotic was added to each plate. The number of bacterial colonies that died, stopped growing and continued growing were then counted. A bacterial colony is a group of bacterial cells that have multiplied from one bacterium.

Which antibiotic would be the best to treat a person infected with *Clostridium difficile*?

	antibiotic	number of colonies that died	number of colonies that stopped growing	number of colonies that continued growing
A	ampicillin	2	5	13
B	clindamycin	4	8	6
C	metronidazole	13	6	1
D	cefoxitin	9	5	4

38 A vaccine is used to create artificial active immunity. After a person has been given a vaccine, it takes a period of time before they develop long-term immunity to the disease.

Which statement about this period of time explains the delay in developing long-term immunity?

A **No** memory cells have been produced from B-lymphocytes.

B **No** plasma cells have been produced from B-lymphocytes.

C The primary immune response has **not** produced enough antibodies.

D The secondary immune response has **not** produced enough antibodies.

39 An antiserum to a snake toxin can be obtained by injecting the toxin into a horse. The antiserum is made from blood plasma taken from the horse a few weeks later. The antiserum is injected into a person who has been bitten by the same species of snake.

Which type of immunity occurs as a result of using this antiserum?

A artificial active

B artificial passive

C natural active

D natural passive

40 Which statement describes the feature of monoclonal antibodies that allows them to accurately treat a specific disease?

A They bind to human hormones to produce a colour change.

B A fluorescent dye can be attached to them.

C They have active sites that are complementary to antigens.

D They can carry toxic chemicals.

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