Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/11**

Paper 1 Multiple Choice **October/November 2018**

1 hour

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

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READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.
DO **NOT** WRITE IN ANY BARCODES.

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 separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
Electronic calculators may be used.

This document consists of **16** printed pages.

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1 A student made notes describing photomicrographs of four cells.

cell 1 Grey cytoplasm at edge of cell contains many black lines and spots. Large white area in centre of cell.

cell 2 Grey cytoplasm contains many black lines and spots which fill the entire cell.

cell 3 Pale blue cytoplasm surrounds a single dark blue spot.

cell 4 Many green structures are enclosed within a rectangular shape with visible boundaries.

Which table identifies the type of cell and the type of microscope used to take each photograph?

A

	animal cell	plant cell
electron microscope	1	2
light microscope	3	4

B

	animal cell	plant cell
electron microscope	1	2
light microscope	4	3

C

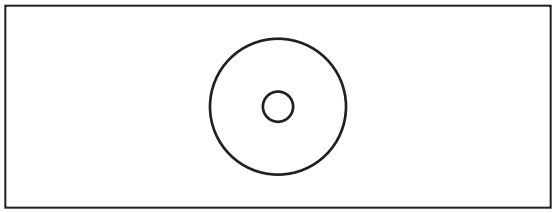
	animal cell	plant cell
electron microscope	2	1
light microscope	3	4

D

	animal cell	plant cell
electron microscope	2	1
light microscope	4	3

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2 The diagram shows a slide of a transverse section of a stem. This diagram is the same size as the actual slide.



A student observed this slide using a light microscope at a magnification of ×40. The student made a plan drawing of the stem, which was 20 cm in diameter.

The student labelled the plan 'Transverse section of a stem ×40'.

Which statement explains why this label is **not** correct?

A The actual size of the stem should have been checked using an eyepiece graticule.

B The actual size of the stem was smaller under low power.

C The image size in the drawing was larger than ×40.

D The image size in the drawing was smaller than ×40.

3 Which cell structures may contain cisternae?

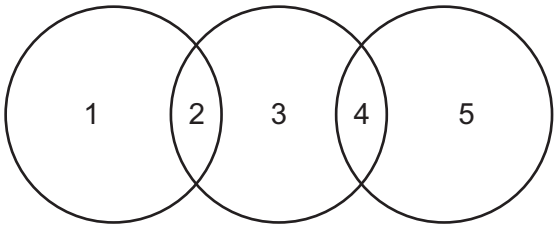
	chloroplast	endoplasmic reticulum	Golgi body	mitochondrion
A	✓	✓	✓	✗
B	✓	✗	✗	✓
C	✗	✓	✓	✗
D	✗	✓	✗	✓

key
✓ = may contain cisternae
✗ = does not contain cisternae

4 Which row correctly describes the function of the cell structures?

	lysosomes	mitochondria	smooth endoplasmic reticulum	Golgi body
A	digestion of unwanted structures	abundant in sites of active transport	processing of proteins	a stack of flattened sacs
B	digestion of unwanted structures	ATP synthesis	lipid production	glycoprotein production
C	spherical sacs containing hydrolytic enzymes	abundant in sites of active transport	lipid production	glycoprotein production
D	spherical sacs containing hydrolytic enzymes	ATP synthesis	glycoprotein production	lipid production

5 The diagram shows the relationship between various cells and their components.



Which row is correct?

	1	2	3	4	5
A	80S ribosome	eukaryotic cell	mitochondrion	70S ribosome	prokaryotic cell
B	chloroplast	plant cell	cell wall	prokaryotic cell	80S ribosome
C	circular DNA	nucleus	eukaryotic cell	mitochondrion	70S ribosome
D	prokaryotic cell	circular DNA	chloroplast	membrane bound	70S ribosome

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6 Which comparison of bacteria cell walls and plant cell walls is correct?

	bacteria cell wall	plant cell wall
A	made of a polymer of α-glucose	made of cellulose
B	made of a polymer of β-glucose	made of a polymer of amino sugars
C	made of a polymer of amino sugars	made of a polymer of α-glucose
D	made of peptidoglycan	made of a polymer of β-glucose

7 A glycosidic bond is broken and two monosaccharides are formed during a positive test for a non-reducing sugar.

Which row identifies the catalyst and reactants in this process?

	catalyst	reactants
A	hydrochloric acid	fructose and glucose
B	hydrochloric acid	sucrose and water
C	sucrase enzyme	fructose and glucose
D	sucrase enzyme	sucrose and water

8 Which pair of statements are correct?

A Carbon and oxygen occur in a ratio of 2 : 1 in carbohydrates.
Triglycerides are soluble in water.

B Glycolipids are found in all cell surface membranes.
Carbohydrates are stored as starch in plants.

C Phospholipids all have two saturated hydrocarbon chains.
Polysaccharides are polymers.

D Water is released during the formation of a glycosidic bond.
Phospholipids all have three ester bonds.

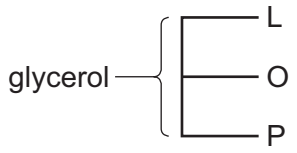
9 What is the general formula for cellulose?

A $(C_5H_{10}O_5)_n$ **B** $(C_5H_{10}O_6)_n$ **C** $(C_6H_{10}O_5)_n$ **D** $(C_6H_{12}O_6)_n$

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10 A triglyceride consists of glycerol and three different fatty acids, linoleic acid (L), oleic acid (O) and palmitic acid (P).

The diagram shows one possible arrangement of the fatty acids L, O and P in the molecule.



What is the total number of different arrangements of the fatty acids in this triglyceride?

A 3 **B** 4 **C** 5 **D** 9

11 Which statements about a peptide bond are correct?

1 It joins two monomers which are always identical to each other.

2 It contains four different atoms.

3 It can be broken by the addition of water at room temperature.

4 It is important in the primary structure of proteins.

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

12 Which statements about the primary structure of a protein are correct?

1 It may be branched.

2 It is determined by the sequence of DNA bases.

3 It is unique to that protein.

4 It determines the tertiary structure of the protein.

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

13 A mutation occurred within the DNA sequence coding for an enzyme, causing a decrease in the rate of a reaction catalysed by this enzyme.

Which statements could explain the decrease in the rate of reaction?

1 An inhibitor for this enzyme has an increased affinity for the enzyme and forms an enzyme–inhibitor complex more easily.

2 The active site of the enzyme might have changed shape and so is no longer complementary.

3 The activation energy for the reaction with the mutated enzyme is greater than with the non-mutated enzyme.

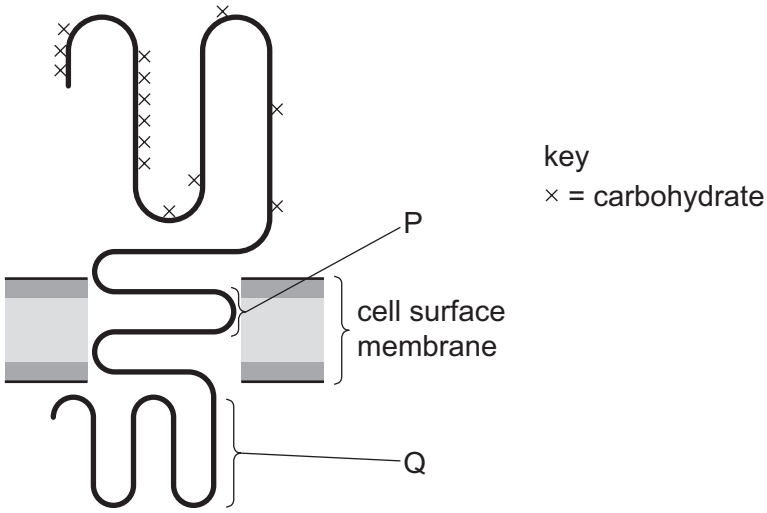
A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

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14 Which row is correct for an enzyme with a low Michaelis-Menten constant?

	affinity of enzyme for substrate	substrate concentration at maximum reaction rate
A	high	high
B	high	low
C	low	high
D	low	low

15 The diagram shows a glycoprotein embedded in the cell surface membrane of a human red blood cell. This glycoprotein is part of a system of cell surface blood group recognition sites.



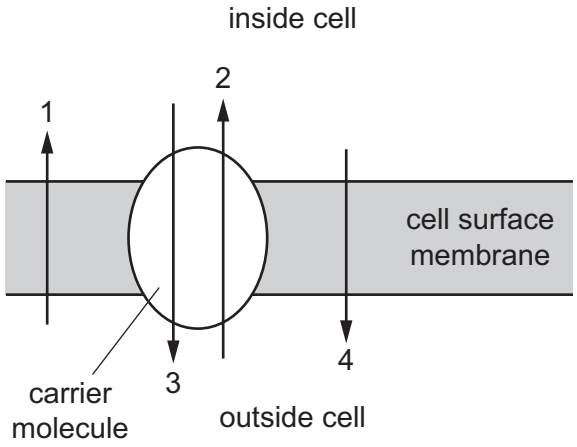
Which row identifies the role of this glycoprotein and regions P and Q of the molecule?

	role of glycoprotein	region P	region Q
A	antigen	amino acids with hydrophobic R groups	amino acids with hydrophilic R groups in the cell's cytoplasm
B	carrier	amino acids with hydrophilic R groups	amino acids with hydrophilic R groups in the cell's cytoplasm
C	channel	amino acids with hydrophilic R groups	amino acids with hydrophobic R groups outside the cell
D	receptor	amino acids with hydrophobic R groups	amino acids with hydrophobic R groups outside the cell

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16 The diagram shows the transport of ions across the cell surface membrane. Inside the cell there is a low concentration of sodium ions (Na^+) and a high concentration of potassium ions (K^+). Outside the cell there is a low concentration of K^+ and a high concentration of Na^+.

The carrier molecule is a pump which exchanges Na^+ for K^+.



Which ionic movements are represented by the arrows?

	active transport of K^+	active transport of Na^+	diffusion of Na^+	diffusion of K^+
A	2	3	1	4
B	2	3	4	1
C	3	2	1	4
D	3	2	4	1

17 The indicator cresol red changes from red to yellow when put into an acid.

Some blocks of agar containing cresol red were cut to different sizes and put in an acid. All other variables were kept constant. The blocks were measured in mm.

Which block became completely yellow most quickly?

A $3 \times 30 \times 30$ **B** $6 \times 6 \times 6$ **C** $6 \times 12 \times 12$ **D** $12 \times 12 \times 12$

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18 When red blood cells are put into pure 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

19 How many copies of each DNA molecule will be found in a cell at each stage of the mitotic cell cycle?

	G_1 of interphase	cytokinesis
A	1	1
B	1	2
C	2	1
D	2	2

20 Which metabolic processes will be very active in a cell that has just completed cytokinesis?

1 ATP formation

2 DNA replication

3 protein synthesis

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

21 A mutation occurs in a gene which prevents the production of telomerase.

What is the effect of this mutation if it occurs in bone marrow stem cells?

A a rapid increase in the production of lymphocytes

B a tumour grows in the bone marrow

C bone marrow stem cells eventually no longer divide

D the total blood cell count will be unchanged

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22 What are the products when a DNA molecule replicates?

A two molecules of DNA each made of a paired sequence of bases

B two molecules of DNA each made of a paired sequence of nucleotides

C two strands of DNA each made of a paired sequence of bases

D two strands of DNA each made of a paired sequence of nucleotides

23 Following translation, the alpha polypeptide chain of haemoglobin, α-globin, undergoes modification. During this modification, the first amino acid is removed, leaving 141 amino acid residues.

How many nucleotides does the gene coding for α-globin contain?

A 141 **B** 142 **C** 423 **D** 426

24 Which statements correctly describe transport pathways in dicotyledonous plants?

1 In the apoplast pathway, water does not move through plasmodesmata.

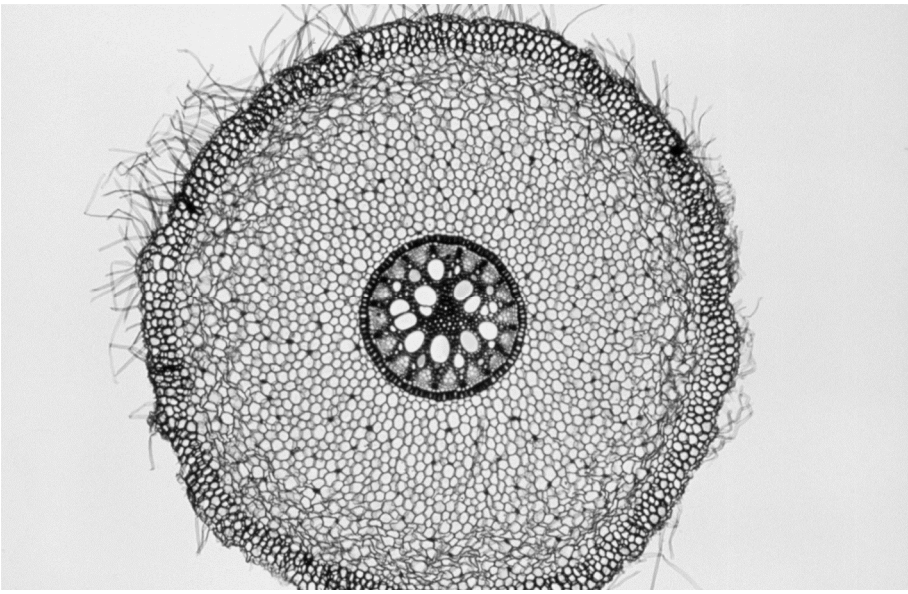
2 In the symplast pathway, water does not move through intercellular spaces.

3 The apoplast pathway may be blocked by the Casparian strip.

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

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25 The photomicrograph shows a transverse section through a root.



What is the simplest ratio of the diameter of the root (excluding root hairs) to the diameter of the vascular tissue and endodermis?

A 40 mm : 11 mm

B 40 : 11

C 8 cm : 2.2 cm

D 80 : 22

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

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

2 Water molecules are attracted to cellulose by adhesion.

3 Water molecules have high cohesion in water columns.

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

27 What is correct for a phloem sieve tube element that is unloading to a sink?

	water potential of the phloem sieve tube element becomes	lignification of the cell wall
A	less negative than sink	absent
B	less negative than sink	present
C	more negative than sink	absent
D	more negative than sink	present

28 Which statement concerning transpiration is correct?

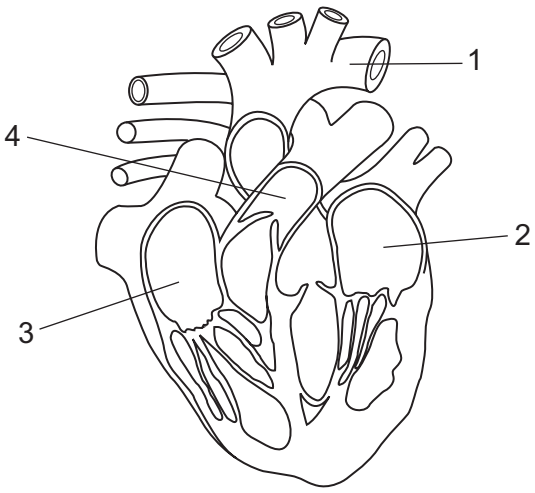
A On a humid day, the water potential gradient between the intercellular air space and the external atmosphere increases to stimulate water loss by evaporation.

B Water arriving at the spongy mesophyll cells via the symplast pathway must move by osmosis through the cell surface membrane before evaporation from the surface of the cells.

C Water diffuses down the water potential gradient from the saturated air space through the guard cells before evaporating from the surface of the cells into the atmosphere.

D Water moves up the xylem in the apoplast pathway and can continue on this pathway by osmosis to reach the spongy mesophyll cells before evaporating into the intercellular air space.

29 The diagram shows a section through the heart and the associated blood vessels.



What is correct for the flow of blood through the heart?

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

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

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

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

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30 Blood, tissue fluid and lymph each have a different composition.

Which row shows the composition of lymph?

	water	antibodies	lipid
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✓	✓

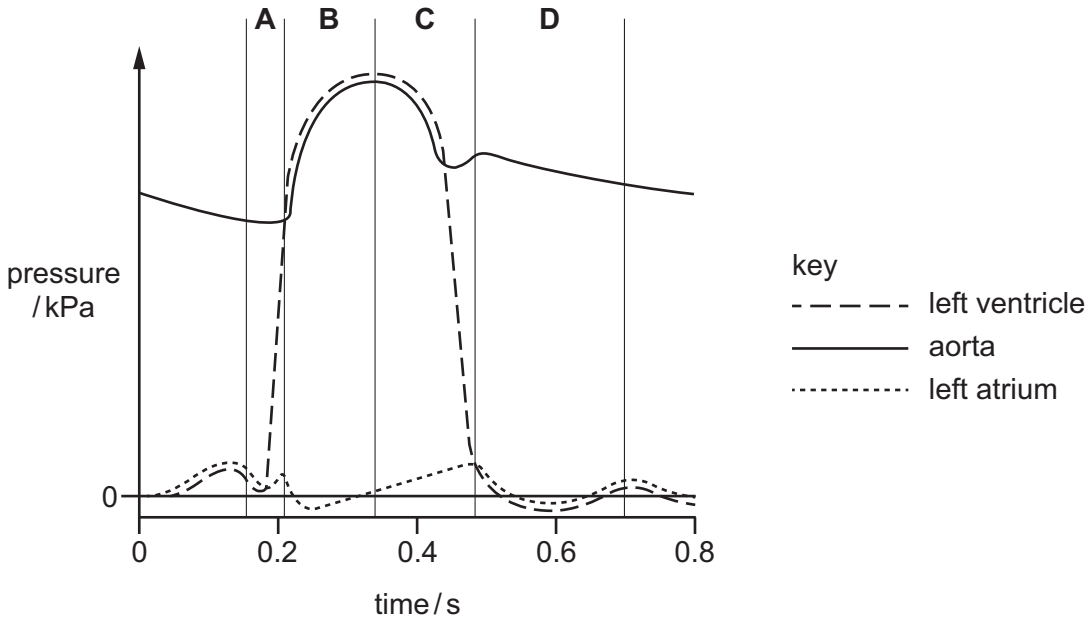
key
✓ = present
✗ = absent

31 Which row shows the change in concentration of some substances in red blood cells when carbon dioxide diffuses from active cells?

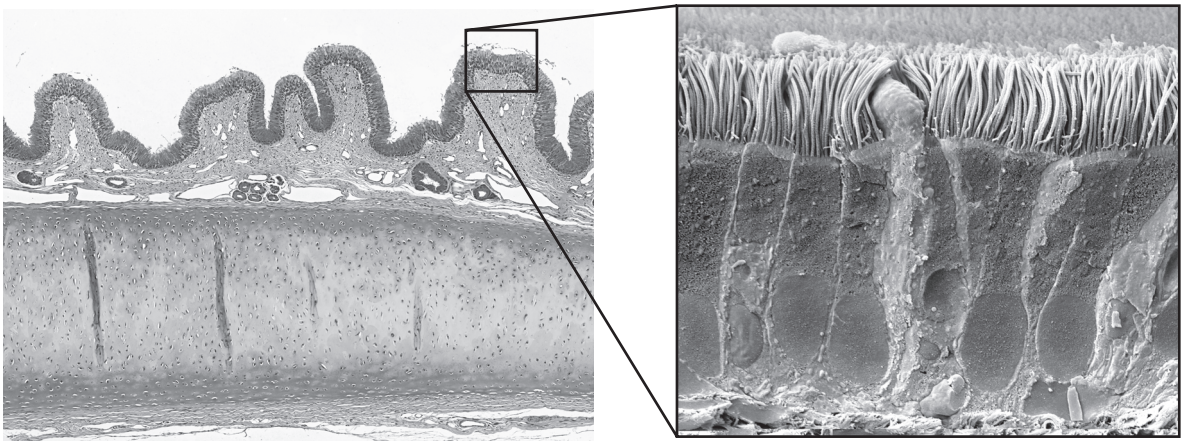
	carbonic anhydrase	hydrogencarbonate ions	hydrogen ions
A	decreases	no change	no change
B	increases	increases	increases
C	no change	decreases	increases
D	no change	increases	increases

32 The diagram shows the pressure changes in various structures of the left side of the heart during the cardiac cycle.

At the end of which period is the ventricle full of blood?



33 The photomicrographs show a cross-section through the lining of part of the respiratory system.



Which statements are correct?

1 Goblet cells are visible between squamous epithelium cells.

2 Smooth muscle is visible.

3 The section cannot be from a bronchiole as cartilage is visible.

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

34 In the lungs, oxygen and carbon dioxide pass through cell surface membranes by diffusion.

Which row is correct?

	number of cell surface membranes diffused through by	
	oxygen from air	carbon dioxide to air
A	3	2
B	3	2 or 3
C	5	4
D	5	4 or 5

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

A	carcinogens come into contact with DNA	→	mutation occurs	→	uncontrolled cell division
B	goblet cells secrete more mucus	→	mucus accumulates causing infection	→	phagocytes attracted by inflammation
C	mucus accumulates causing infection	→	phagocytes attracted by inflammation	→	elastase destroys the alveolar walls
D	mutation occurs	→	phagocytes attracted by inflammation	→	causes irritation and coughing

36 Which list contains only infectious diseases?

A cholera, HIV / AIDS, lung cancer and malaria

B cholera, malaria, tuberculosis (TB) and sickle cell anaemia

C HIV / AIDS, malaria, measles and tuberculosis (TB)

D lung cancer, measles, sickle cell anaemia and tuberculosis (TB)

37 Which disease is caused by a eukaryote?

A cholera

B malaria

C measles

D smallpox

38 A vaccine is available against most common strains of the influenza virus.

The virus that causes influenza often undergoes mutation in the gene coding for its antigenic protein.

Which statements explain why vaccinated people are not immune to a mutated influenza virus?

1 They will not have primary immune response to the mutated antigen.

2 They will not have a secondary immune response to the mutated antigen.

3 Their memory cells do not recognise the mutated antigen.

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

39 Which statements correctly describe lymphocytes?

1 Each B-lymphocyte has the ability to make several types of antibody molecules.

2 Some B-lymphocytes and T-lymphocytes become memory cells.

3 Plasma cells secrete antibodies into the blood plasma.

4 Some T-lymphocytes stimulate macrophages to kill infected cells.

A 1, 2, 3 and 4

B 1, 2 and 3 only

C 1 and 4 only

D 2, 3 and 4 only

40 Addison's disease can occur when antibodies are produced in response to an enzyme found in some organs of the body.

Which statements correctly describe Addison's disease?

1 It is a non-infectious disease.

2 It is a type of auto-immune disease.

3 Antibodies are produced against a self-antigen.

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

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BIOLOGY **9700/12**

Paper 1 Multiple Choice **October/November 2018**

1 hour

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1 What is the diameter of a typical prokaryote, such as *Streptococcus*?

A 7.5×10^{1} nm

B 7.5×10^{2} nm

C 7.5×10^{0} μm

D 7.5×10^{1} μm

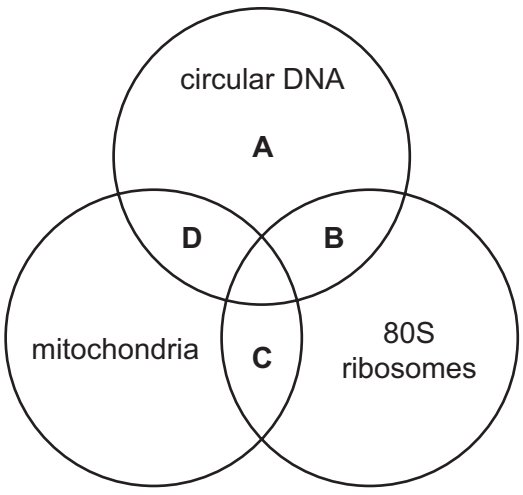
2 A specimen of plant tissue is first observed under a microscope using red light with a wavelength of 650 nm.

The same specimen is then observed under the same conditions, but using green light with a wavelength of 510 nm.

What happens to the magnification and resolution when using green light compared to red light?

	magnification	resolution
A	decreases	decreases
B	increases	increases
C	remains the same	decreases
D	remains the same	increases

3 Which structures are present in a *Vibrio cholerae* cell?



4 The removal of a plant cell wall by enzyme digestion leaves an intact membrane-bound structure called a protoplast.

Which statement explains why protoplasts are easily damaged?

A Mitochondria stop producing ATP to maintain membrane integrity.

B Net movement of water is no longer limited by turgor.

C Secretory vesicles are unable to fuse with the cell surface membrane.

D The shape of the cell structures is changed by the loss of cell shape.

5 Which statements are correct for a green plant?

1 ATP is produced by mitochondria.

2 ATP is produced by chloroplasts.

3 ATP forms part of the DNA.

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

6 Which processes occur in eukaryotes and prokaryotes?

1 hydrolysis

2 mitosis

3 transcription

4 translation

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

7 A sample of a solution was tested for reducing sugar and the result was negative.

Another sample of the same solution was then tested for non-reducing sugar and the result was positive.

Which step in the test for non-reducing sugar breaks the glycosidic bonds?

A addition of Benedict's reagent

B addition of sodium hydroxide

C boiling with hydrochloric acid

D heating to 80 °C

8 Which row correctly identifies three polysaccharides

	α-glucose straight chain	α-glucose branching chain	β-glucose straight chain
A	amylose	amylopectin	cellulose
B	amylose	glycogen	amylopectin
C	glycogen	amylose	amylopectin
D	glycogen	amylose	cellulose

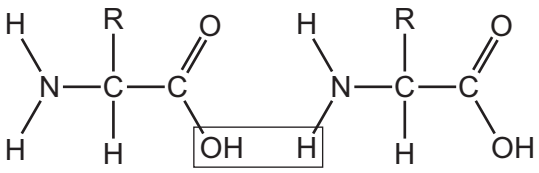
9 Which row describes a triglyceride?

	hydrophobic	insoluble in alcohol
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

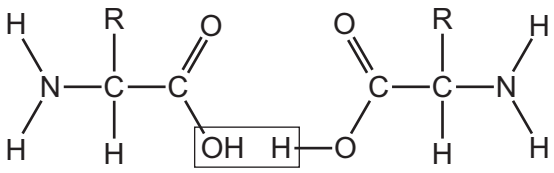
key
✓ = correct
✗ = not correct

10 Which diagram shows where a peptide bond would be formed?

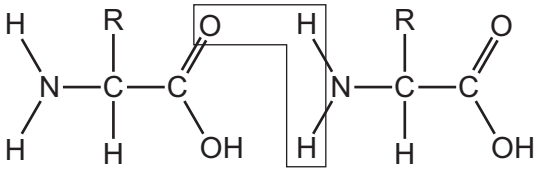
A



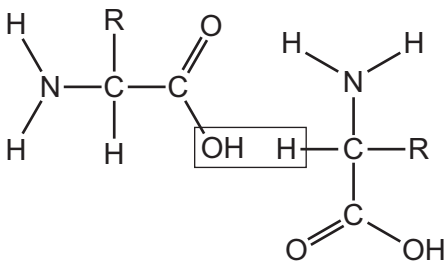
B



C



D



11 Which statements about collagen molecules are correct?

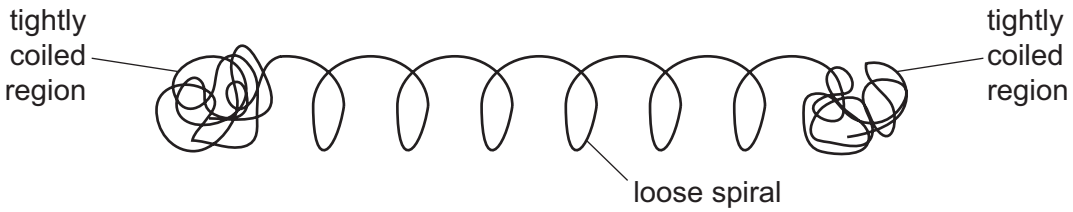
1 Both types of secondary structure occur within the molecules.

2 Large numbers of hydrogen bonds stabilise the molecules.

3 Repeated amino acid sequences determine the tertiary structure.

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

12 The protein glutenin gives bread dough its elasticity. The diagram represents a polypeptide of glutenin.



What describes the structure of glutenin?

A quaternary structure because there are both globular and fibrous regions

B quaternary structure because there are both spiral and tightly coiled regions

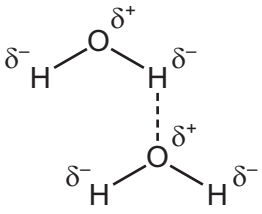
C secondary structure because the loose spiral is an α-helix

D tertiary structure because the different regions form a 3D shape

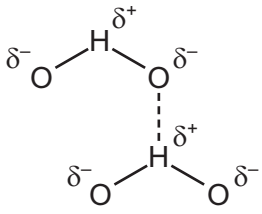
13 Which diagram correctly shows hydrogen bonding between water molecules?

The symbol δ indicates the partial charge on an atom in the water molecule.

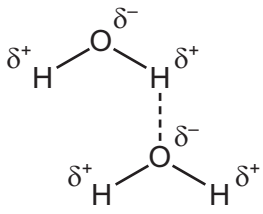
A



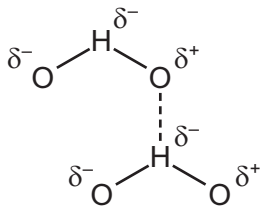
B



C



D



14 Aspirin inhibits an enzyme by reacting with an amino acid that forms an essential part of the 3D structure of the enzyme. Part of the aspirin molecule binds firmly with the amino acid.

What describes this inhibition?

1 competitive inhibition

2 non-competitive inhibition

3 reversible inhibition

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

15 The table shows the Michaelis-Menten constant, K_m, for three enzymes.

enzyme	K_m / mmoldm^{-3}
C	1.5×10^{-2}
P	3.0×10^{-4}
F	5.0×10^{-6}

Which interpretation of the information is correct?

A Enzyme C has a V_{max} which is half that of enzyme P.

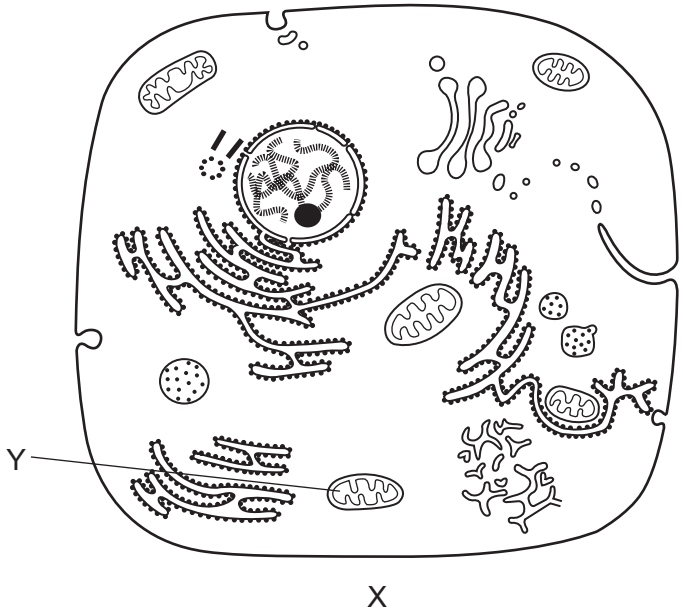
B Enzyme C will reach V_{max} in the shortest time interval.

C Enzyme F has the greatest affinity for its substrate.

D Enzyme P has a V_{max} of 6.0×10^{-3} mmoldm^{-3}.

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16 The diagram is a drawing from an electron micrograph of a typical animal cell.



How many layers of phospholipids will a molecule of oxygen cross to travel directly from X, outside the cell, to Y, the matrix of the mitochondrion?

A 3 **B** 4 **C** 5 **D** 6

17 How could water molecules cross the cell surface membrane of animal cells?

1 carrier proteins

2 channel proteins

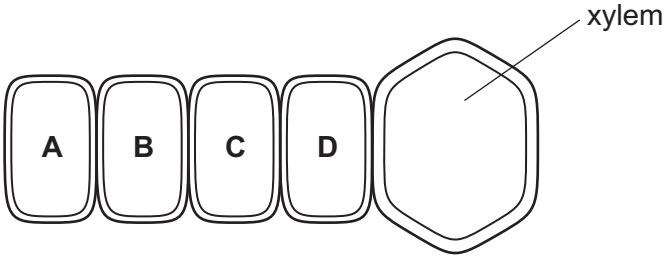
3 cholesterol molecules

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

18 The diagram shows a xylem vessel in a root and four adjacent parenchyma cells.

As water moves up the xylem vessel, it is replaced by water from cell **D**. Water in cell **D** is replaced by water in cell **C**, resulting in a flow of water from cell **A** to the xylem.

Which cell has the least negative water potential?



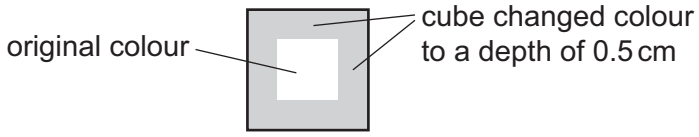
19 Agar cubes can be used to demonstrate the effect of changing surface area to volume ratio on diffusion.

Three different agar cubes made using a dilute acid were placed into an indicator solution that diffused into the cubes. When the indicator came into contact with the acid it changed colour.

The cubes were 1 cm^3, 2 cm^3 and 3 cm^3 and were left in the indicator solution for 10 minutes. All other variables were kept the same. The results were recorded as diagrams.

The results for the 2 cm^3 cube are shown.

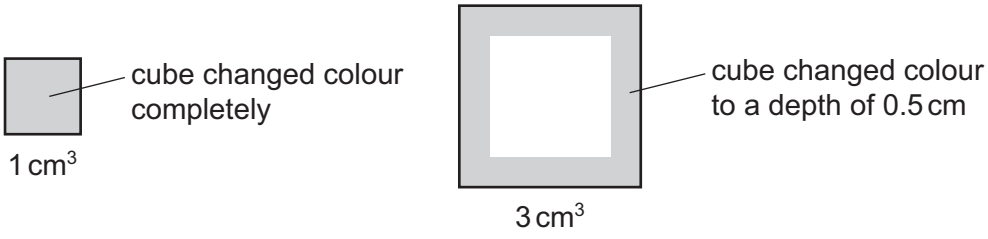
not to scale



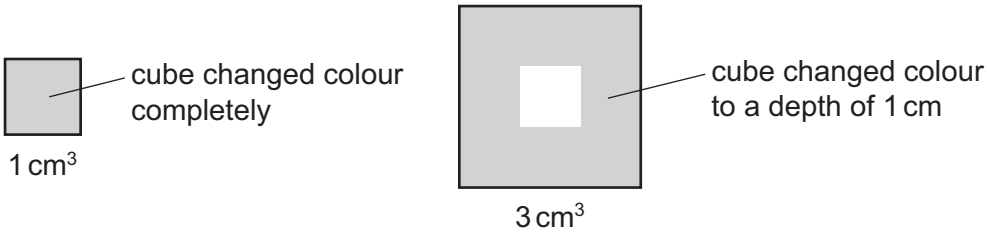
Which diagrams represent the results for the 1 cm^3 and the 3 cm^3 cubes?

not to scale

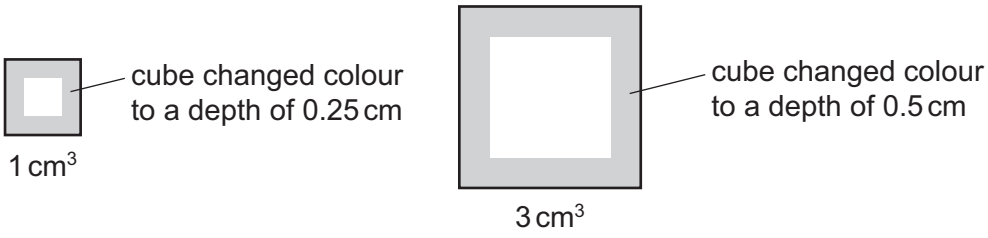
A



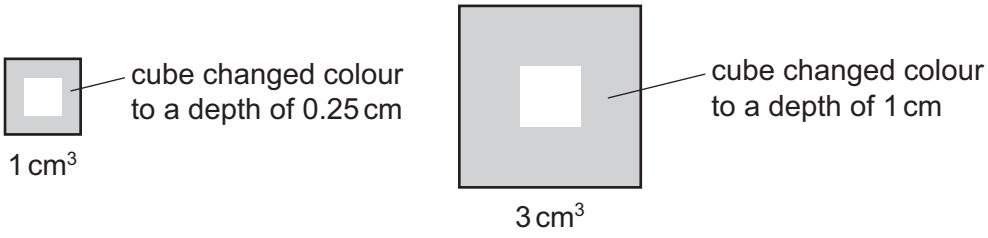
B



C

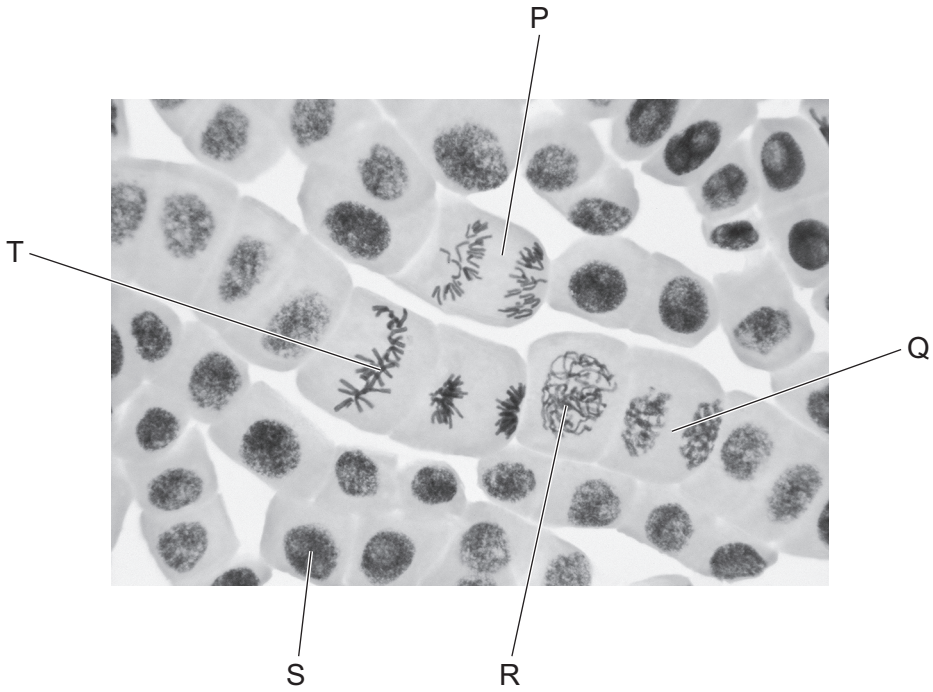


D



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20 The photomicrograph shows cells in different stages of mitosis.



Which statements are correct?

1 Cell T shows metaphase.

2 DNA replication occurs in cell R.

3 The amount of DNA in cell P is the same as in cell T.

4 The correct order for the stages is S → R → T → P → Q.

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

21 Which changes in a group of mammalian cells, dividing by mitosis, would be necessary for the formation of a tumour?

1 Mitosis is no longer inhibited by cell to cell contact.

2 Cells acquire the ability to migrate and set up new colonies.

3 Cells become able to divide indefinitely.

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

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22 Which row shows some of the events during a mitotic cycle in the correct time sequence?

	time →			
A	centromere of each chromosome splits	nucleoli become visible	nuclear envelope breaks into small vesicles	spindle microtubules produced
B	nuclear envelope breaks into small vesicles	spindle microtubules produced	centromere of each chromosome splits	nucleoli become visible
C	nucleoli become visible	nuclear envelope breaks into small vesicles	spindle microtubules produced	centromere of each chromosome splits
D	spindle microtubules produced	centromere of each chromosome splits	nucleoli become visible	nuclear envelope breaks into small vesicles

23 What is the maximum number of hydrogen bonds in a length of DNA containing 700 base pairs?

A 350 **B** 700 **C** 1400 **D** 2100

24 What is the common component of the three molecules RNA, DNA, and ATP?

A adenosine

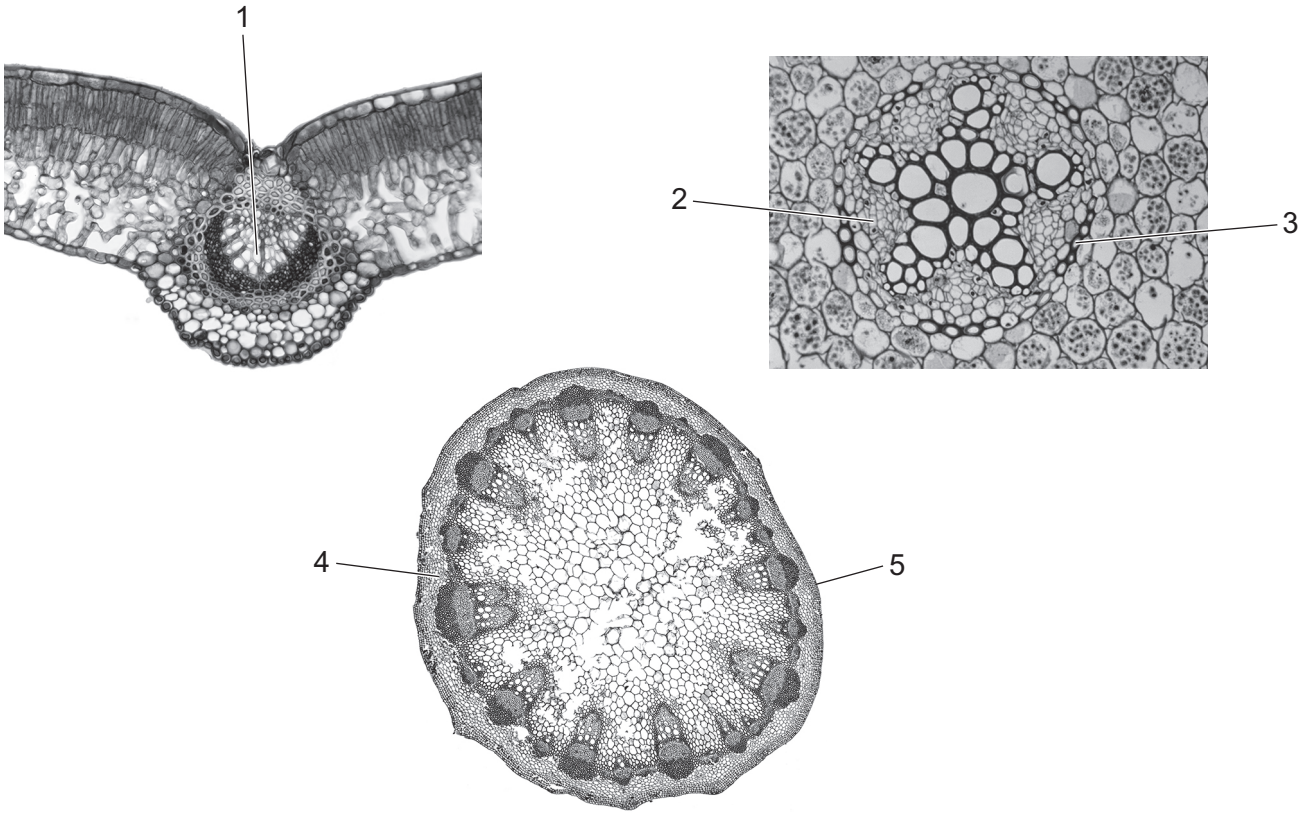
B hydrogen bonds

C phosphate

D ribose

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25 Photomicrographs of a dicotyledonous plant root, stem and leaf are shown.



Which row is correct for the labels 1 to 5 on the photomicrographs?

	1	2	3	4	5
A	cortex	phloem	epidermis	parenchyma	endodermis
B	phloem	parenchyma	xylem	epidermis	cortex
C	phloem	xylem	endodermis	cortex	epidermis
D	xylem	phloem	endodermis	cortex	epidermis

26 Which features apply to phloem sieve tube elements and to xylem vessel elements?

1 no cytoplasm

2 no end walls

3 no nucleus

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

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27 Which statement correctly describes an event in the process of mass flow in phloem sieve tube elements?

A Any part of a plant where sucrose is loaded into a sieve tube element is called a sink.

B Loading sucrose into a sieve tube element increases the water potential inside it.

C Mass flow in the phloem is a passive process occurring at the same rate as diffusion.

D Sucrose moves down a hydrostatic pressure gradient in the phloem from source to sink.

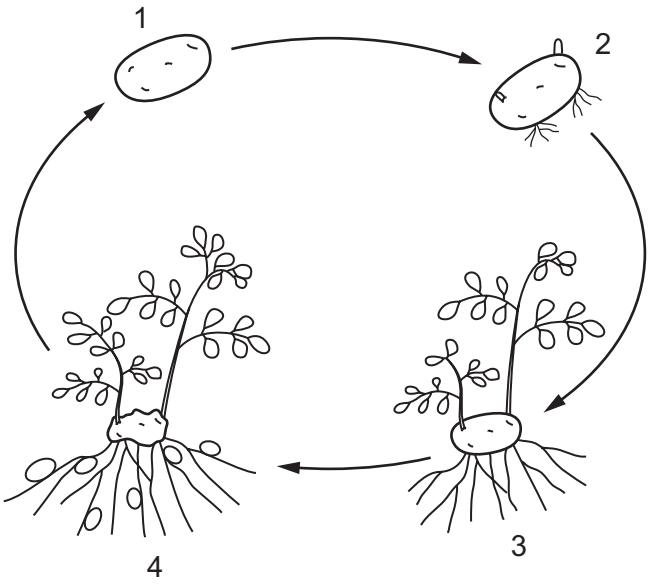
28 The diagram shows a potato tuber at different stages.

1 dormant tuber (not growing)

2 sprouting roots and shoots

3 growing roots and shoots

4 making new potato tubers



Which row identifies a stage where a potato tuber acts as a source and a stage where it acts as a sink?

	source	sink
A	1	3
B	2	4
C	3	2
D	4	1

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29 What describes the role of the atrio-ventricular node of the heart?

A It causes the muscles of the ventricles to contract from the apex upwards.

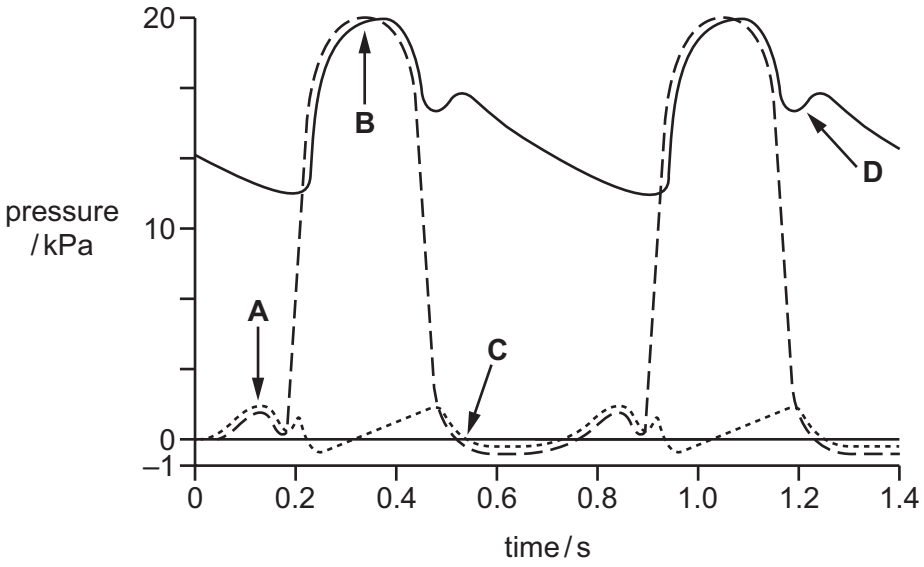
B It delays the transmission of a wave of electrical activity from the sinoatrial node.

C It initiates a new wave of electrical activity in the ventricles.

D It provides a non-conducting barrier between the atria and the ventricles.

30 The diagram shows pressure changes during the cardiac cycle.

Which arrow indicates ventricular systole?



31 Which process can be carried out by a mature red blood cell?

A active transport

B cell division

C phagocytosis

D protein synthesis

32 Haemoglobin can bind to carbon dioxide, carbon monoxide and oxygen.

Which statement about the binding sites of haemoglobin is correct?

A Carbon dioxide and carbon monoxide bind to one site, oxygen binds to a different site.

B Carbon dioxide and oxygen bind to one site, carbon monoxide binds to a different site.

C Carbon monoxide and oxygen bind to one site, carbon dioxide binds to a different site.

D Carbon monoxide, oxygen and carbon dioxide all bind to different sites.

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33 Which tissues are present in a bronchus?

	cartilage	ciliated epithelium	smooth muscle
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✓	✓

key
✓ = present
✗ = absent

34 Cigarette smoke contains tar.

Which statements describe the effect of tar on the respiratory system?

1 Tar causes goblet cells to increase the secretion of mucus.

2 Tar increases the risk of blood clots forming inside blood vessels.

3 Tar may cause changes to the DNA in epithelial cells.

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

35 Symptoms of chronic obstructive pulmonary disease (COPD) include a cough, breathlessness and chest infections.

Some of the changes in the lungs that result from smoking are listed.

1 Alveoli lose elastin and collapse.

2 Bacteria accumulate in the mucus.

3 Cilia are inactivated.

4 Goblet cells secrete more mucus.

Which changes cause the cough in COPD?

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

36 Which statements about infectious diseases are correct?

1 Cholera has a vaccine available and is caused by a bacterial pathogen of the *Vibrio* group.

2 Measles has a vaccine available and is caused by a pathogen called *Morbillivirus*.

3 Smallpox was eradicated by vaccination and was caused by a bacterial pathogen called *Variola*.

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

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37 The antibiotic tetracycline binds to the small subunit of bacterial ribosomes, stopping protein synthesis.

Bacteria have become resistant to tetracycline due to the effect of mutations.

Which effect could produce resistance to tetracycline?

A preventing tetracycline from binding to the bacterial cell wall

B preventing tetracycline from entering the bacterial cell

C preventing tetracycline from inhibiting transcription

D preventing the production of tetracycline by ribosomes

38 Where are antigens found?

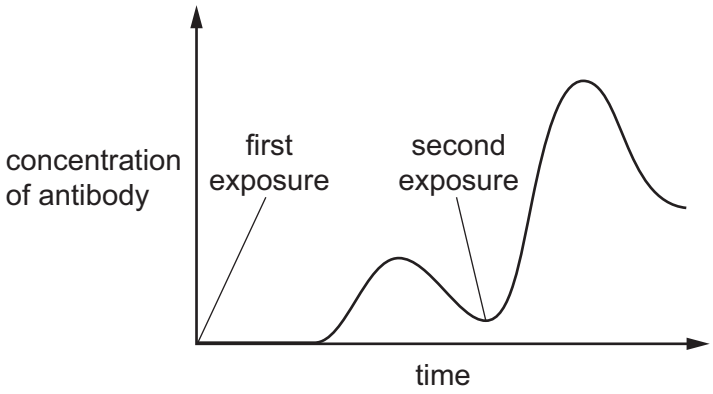
	on the surface of macrophages	in blood plasma
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

key

✓ = antigens found

✗ = antigens not found

39 The graph shows how the body reacts following exposure to an antigen for the first and second time.



What is the direct cause of the increase in antibody production after the second exposure to antigens?

A B-memory cells

B macrophages

C plasma cells

D T-memory cells

40 Why has it proved difficult to develop an effective vaccine against malaria?

A Mosquitoes have many stages in their life cycles.

B The human immune system does not recognise the antigens of the parasite.

C The parasites can only be attacked when outside the liver cells and red blood cells.

D Vaccines are rapidly broken down by proteases in the stomach.

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BIOLOGY **9700/13**

Paper 1 Multiple Choice **October/November 2018**

1 hour

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

9654955273

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.
DO **NOT** WRITE IN ANY BARCODES.

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 separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
Electronic calculators may be used.

This document consists of **18** printed pages and **2** blank pages.

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1 Which statement explains why it is necessary to use an electron microscope to see the cristae of a mitochondrion?

A The magnification of the electron microscope is greater than that of the light microscope.

B The membranes of the cristae are separated by a distance greater than 200 nm.

C The resolution of a student microscope using daylight is too low.

D The wavelength of an electron beam is longer than the wavelength of light.

2 A prokaryotic cell which is 0.25 μm in diameter, is magnified 50 000 times on an electron micrograph.

How big will its diameter be in the electron micrograph?

A 1.25×10^{-1} mm

B 1.25×10^{0} mm

C 1.25×10^{1} mm

D 1.25×10^{2} mm

3 When making measurements in experiments, which methods could have parallax errors?

1 using a calibrated eyepiece graticule to measure length

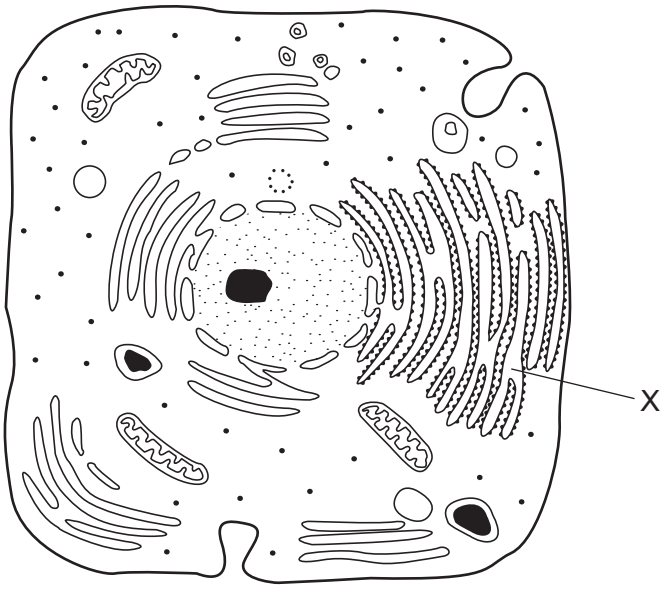
2 using a measuring cylinder to measure volume

3 using a ruler to measure length of a shoot

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

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4 The diagram is a drawing from an electron micrograph of a typical animal cell.



What is the function of the membrane system labelled X?

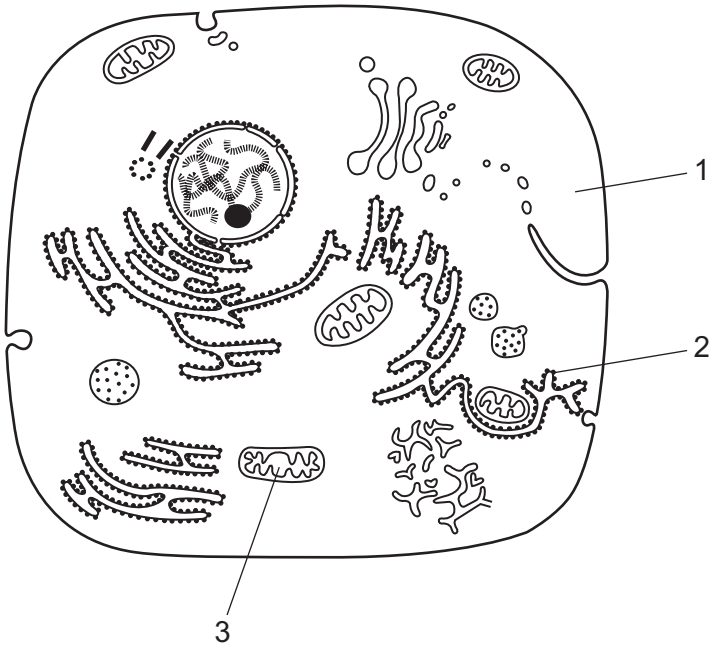
A lipid synthesis only

B protein synthesis and transport

C protein synthesis only

D protein transport only

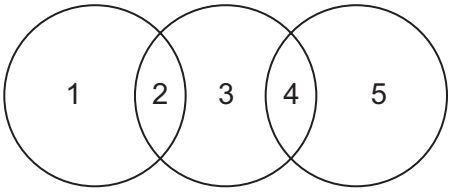
5 The diagram is a drawing from an electron micrograph of a typical animal cell.



Where would nucleic acid be found?

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

6 The diagram shows some similarities between chloroplasts, mitochondria and typical prokaryotes.



Which row is correct?

	1	2	3	4	5
A	chloroplasts	circular DNA	mitochondria	linear DNA	prokaryotes
B	mitochondria	70S ribosomes	chloroplasts	linear DNA	prokaryotes
C	mitochondria	linear DNA	chloroplasts	70S ribosomes	prokaryotes
D	prokaryotes	70S ribosomes	mitochondria	70S ribosomes	chloroplasts

7 A student carried out tests on the same volume of four different solutions to investigate the presence of protein, starch and reducing sugar in each.

The results are shown in the table.

solution	Benedict's solution	biuret reagent	iodine solution
1	blue	purple	yellow
2	orange	pale purple	blue-black
3	orange	purple	yellow
4	red	pale blue	yellow

Which conclusion can be drawn from these results?

A Solution 1 has a lower protein and lower reducing sugar content than solution 2.

B Solution 2 has less starch compared to solutions 1, 3 and 4.

C Solution 3 has the most protein and the least starch.

D Solution 4 has a high reducing sugar content and no starch.

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8 Which words correctly complete the description of amylose?

The ……1…… amylose is a ……2…… made up of ……3…… of the ……4…… glucose.

	1	2	3	4
A	macromolecule	monomer	polymers	disaccharide
B	macromolecule	monomer	polymers	monosaccharide
C	polysaccharide	polymer	monomers	disaccharide
D	polysaccharide	polymer	monomers	monosaccharide

9 Which statements about glycosidic bonds are correct?

1 They occur by condensation reactions between the OH groups of two molecules.

2 They occur only between glucose molecules.

3 The bonds can only be formed between carbon 1 and carbon 4 or carbon 1 and carbon 6 of adjacent molecules.

4 Hydrolysis of the bonds releases energy.

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

10 What is the general formula for glycogen?

A $(C_5H_{10}O_5)_n$ **B** $(C_5H_{10}O_6)_n$ **C** $(C_6H_{10}O_5)_n$ **D** $(C_6H_{12}O_6)_n$

11 Which statements are correct?

1 In a triglyceride molecule the bonds between the fatty acids and the glycerol molecule are called ester bonds.

2 Triglycerides are formed by a condensation reaction between the hydroxyl group of a fatty acid molecule and one of the carboxyl groups of the glycerol molecule.

3 Triglycerides are insoluble in water because the fatty acid carbon chain is non-polar.

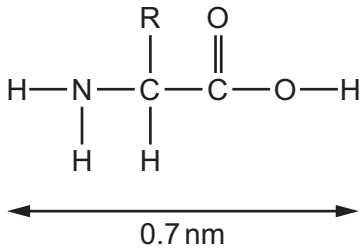
A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

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12 The table shows the diameter of some atoms when they form bonds.

atom	single bond / nm	double bond / nm
H	0.060	–
O	0.132	0.110
N	0.140	0.120
C	0.154	0.134

The approximate length of the amino acid shown was estimated using the figures in the table.



What would be the approximate length of a dipeptide formed using this amino acid?

A 0.9 nm **B** 1.2 nm **C** 1.4 nm **D** 1.7 nm

13 Which statement about the typical modes of action of a competitive inhibitor and a non-competitive inhibitor is correct?

A Competitive inhibitors can bind to alternative (allosteric) sites of an enzyme, non-competitive inhibitors have an irreversible effect on the enzyme.

B Competitive inhibitors have exactly the same shape as the substrate, non-competitive inhibitors can have any shape.

C Competitive inhibitors may be used to regulate enzyme activity, non-competitive inhibitors have no functions in enzyme regulation.

D Competitive inhibitors will not alter V_{max}, non-competitive inhibitors will reduce V_{max}.

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14 Some animals produce antimicrobial proteins which protect them from pathogens. These proteins could be used to kill human pathogens, however when used as a medicine they are broken down by protein-digesting enzymes.

Replacing one of the amino acids found in the protein with one that had been synthesised in the laboratory resulted in a modified protein that was not broken down.

What could explain why this modified protein was not broken down by the protein digesting enzymes?

1 The modified protein has a different tertiary structure to the original protein.

2 The modified protein is not complementary in shape to the enzyme's active site.

3 The modified protein is unable to induce a fit with the protein digesting enzyme.

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

15 An investigation was carried out on the effect of temperature on an enzyme-catalysed reaction.

The enzyme and its substrate were initially placed into separate test-tubes and raised to the temperature required. They were then mixed and placed into four tubes **A**, **B**, **C** and **D**.

These tubes were incubated for the time and at the temperature stated. The mass of the product formed was then measured.

In which tube was the rate of reaction highest?

	incubation time / s	incubation temperature / °C	mass of product / μg
A	30	25	2.5
B	30	45	5.0
C	600	25	32.0
D	600	45	10.0

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16 In an experiment the proteins in the cell surface membrane of a living cell were labelled with a fluorescent dye.

A small area of the membrane was observed using a microscope. A laser was then used to permanently destroy the fluorescence of the dye molecules in this field of view.

The fluorescence in this field of view was later seen to return.

What does this experiment show?

A Proteins are found only on the outer surface of cell surface membranes.

B Proteins in the outer layer of a bilayer do not penetrate into the inner layer.

C Proteins move freely in the phospholipids of a bilayer.

D The cell surface membrane of the cell is a bilayer.

17 In plants adapted to cold conditions, their cell surface membranes change as the weather gets colder, allowing the plants to carry out exocytosis.

Which change occurs in their cell surface membranes?

A a decrease in the ratio of proteins to saturated phospholipids

B a decrease in the ratio of unsaturated phospholipids to saturated phospholipids

C an increase in the ratio of proteins to unsaturated phospholipids

D an increase in the ratio of unsaturated phospholipids to saturated phospholipids

18 Which statement describes endocytosis?

A movement across a membrane against the concentration gradient and requiring energy

B movement across a membrane down the concentration gradient using a carrier molecule

C movement across a membrane into a cell using a vesicle and requiring energy

D movement across a membrane using a vesicle and requiring no energy

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19 An indicator is colourless in acid and pink in alkali.

In an experiment a petri dish of agar was prepared using an acidic solution of this indicator.

A disc of agar 1 cm in diameter was removed from the centre to create a well.

A white card showing circular marker lines 1 cm apart was placed underneath the petri dish.

1 cm^3 alkali solution was put into the well in the agar and a stop-watch was started.

A circular disc of pink colour appeared and spread through the agar. It reached the first marker line in a short time but took longer to reach the second marker line and a very long time to reach the third marker line.

What explains these observations?

A facilitated diffusion of alkali solution

B facilitated diffusion of the indicator

C simple diffusion of alkali solution

D simple diffusion of the indicator

20 How many copies of each DNA molecule will be found in a cell at each stage of the mitotic cell cycle?

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

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21 Centromere, chromatids and telomeres are parts of a chromosome in a eukaryotic cell.

Which row correctly describes these structures?

	centromere	chromatid	telomere
A	binds the two sister chromatids of a chromosome together	contains histone proteins and a molecule of double-stranded DNA	protects the tips of each chromatid from shortening at each mitotic division
B	site of attachment of spindle microtubules	contains histone proteins and a molecule of single-stranded DNA	prevents the genes nearest the ends of each chromatid from being lost
C	site of production of spindle microtubules	contains a molecule of double-stranded DNA with no associated histone proteins	contains DNA with many repeats of short base sequences
D	splits at metaphase of mitosis	contains a molecule of single-stranded DNA with no associated histone proteins	ensures that when DNA is replicated, the ends of the molecule are included

22 Which bases found in nucleic acids are purines?

A adenine and cytosine

B guanine and adenine

C thymine and cytosine

D uracil and guanine

23 A length of double-stranded DNA contains 120 nucleotides and codes for a section of a polypeptide.

What is the maximum length of this section of a polypeptide?

A 20 amino acids

B 40 amino acids

C 60 amino acids

D 120 amino acids

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24 Four students were asked to suggest a set of four labels to add to a plan diagram of a transverse section of a dicotyledonous leaf.

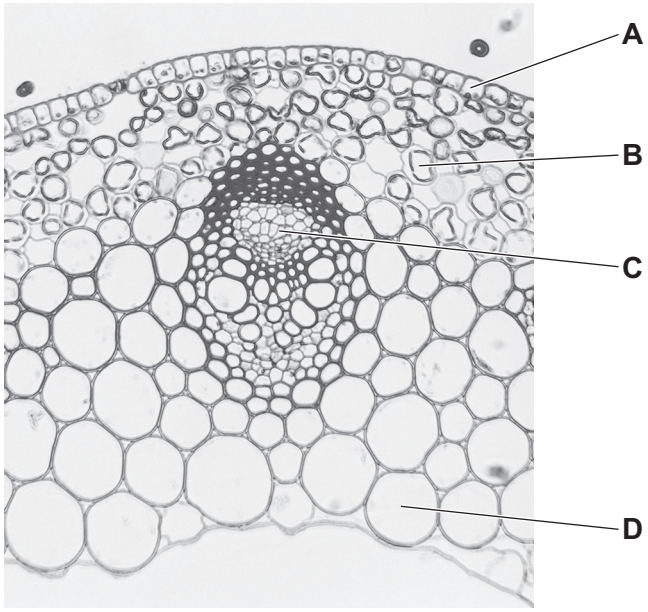
Which student suggested a correct set of labels?

	label 1	label 2	label 3	label 4
A	lower epidermis	phloem	spongy mesophyll	palisade mesophyll
B	phloem sieve tubes	upper epidermis	spongy mesophyll	xylem vessel elements
C	spongy mesophyll	endodermis	xylem vessel elements	palisade mesophyll
D	waxy cuticle	xylem	companion cells	spongy mesophyll

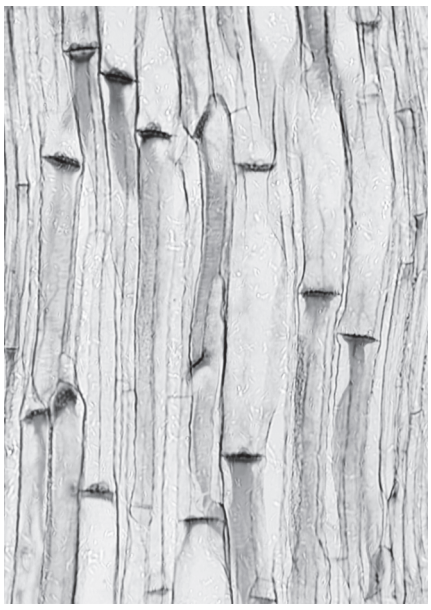
25 Photomicrograph X shows a transverse section through a typical stem. Photomicrograph Y shows a longitudinal section through one type of cell shown in photomicrograph X.

Which letter represents the cells from photomicrograph Y?

photomicrograph X



photomicrograph Y



26 By which process would water rise up through xylem vessels in a plant root when the shoot has been removed?

A capillarity, root pressure and transpiration pull

B capillarity and root pressure only

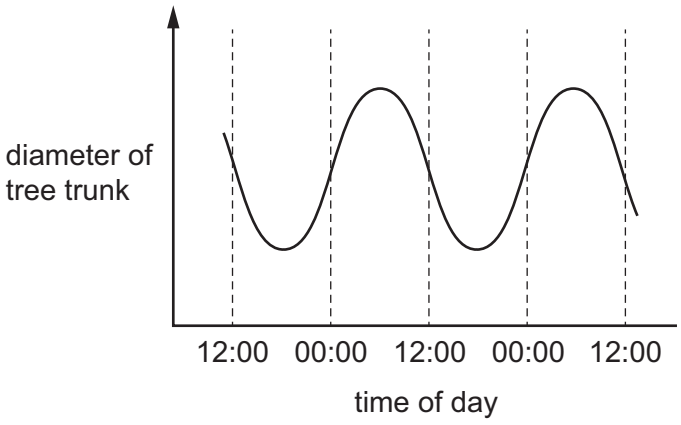
C capillarity and transpiration pull only

D root pressure only

27 Which changes occur to the water potential and the volume of liquid in the phloem sieve tube element when carbohydrate is moved into a sink?

	water potential of the sieve tube element	volume of liquid of the sieve tube element
A	lowers	decreases
B	lowers	increases
C	raises	decreases
D	raises	increases

28 The graph shows the diameter of a tree trunk over time.



Which statement explains these changes?

A Cohesive tension forces increased during the day.

B Columns of water break up during the day.

C Mass flow of sucrose decreased during the day.

D Root pressure increased during the day.

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29 What is found in **all** blood vessels, lymph and tissue fluid?

1 carbon dioxide

2 glucose

3 white blood cells

4 antibodies

A 1, 2, 3 and 4

B 1, 2 and 3 only

C 1, 3 and 4 only

D 2 and 4 only

30 Which reactions will be taking place in blood that is passing through active tissues?

1 $HbO_8 \rightarrow Hb + 4O_2$

2 $HbO_8 + H^+ \rightarrow HHb + 4O_2$

3 $HCO_3^- + H^+ \rightarrow H_2CO_3$

4 $H_2O + CO_2 \rightarrow H_2CO_3$

A 1, 2, 3 and 4

B 1, 2 and 4 only

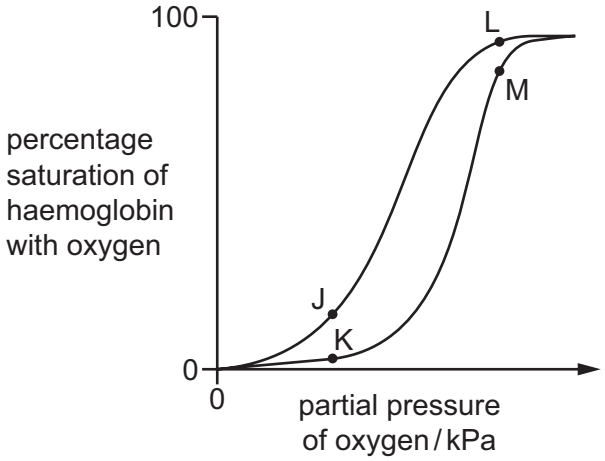
C 1, 3 and 4 only

D 2 and 3 only

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31 The graph shows the percentage saturation of haemoglobin with oxygen at a range of partial pressures of oxygen and at two partial pressures of carbon dioxide.

One curve is at the partial pressure of carbon dioxide in the lungs and the other curve at the partial pressure of carbon dioxide in the liver.



Which points on the curves correspond to the percentage saturation of haemoglobin at the lungs and at the liver?

A L and J **B** L and K **C** M and J **D** M and K

32 A person moves from sea level to live at a high altitude.

After three months living at high altitude, which change would be found in this person when at rest?

A increased volume of blood per heartbeat

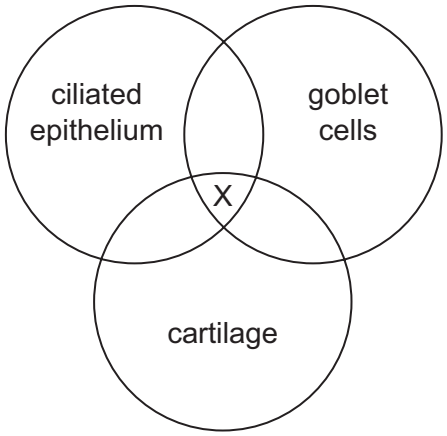
B increased breathing rate

C increased heart rate

D increased mass of red blood cells

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33 The diagram shows three of the features found in tissues of the gas exchange system.



Which structures of the gas exchange system could be represented at position X in the diagram?

1 bronchiole

2 trachea

3 bronchus

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

34 Chronic obstructive pulmonary disease (COPD) includes bronchitis and emphysema.

Which row shows the effects of bronchitis?

	T-helper cells	bronchioles	infection
A	destroyed	inflamed	absent
B	destroyed	narrowed	present
C	increased	scarred	present
D	increased	stiffened	absent

35 Which factors affect the distribution of the disease malaria?

1 draining swamps

2 vaccination

3 antibiotics

4 migration of people due to conflict

5 climate

A 1, 2 and 4 **B** 1, 4 and 5 **C** 2, 3 and 5 **D** 3, 4 and 5

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36 Which diseases **cannot** be treated with antibiotics?

1 cholera

2 HIV/AIDS

3 measles

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

37 A West African country introduced a measles vaccination during a measles epidemic.

Later, it was realised that vaccinated children were more likely to survive childhood than unvaccinated children, even when there were no measles epidemics.

The vaccine had given the children some protection against other pathogenic infections.

Which statement could account for this extra protection?

A B-lymphocytes produced memory cells which gave the children passive immunity to these infections.

B Memory cells produced plasma cells which secreted anti-measles antibodies that bound to antigens that closely resembled measles antigens.

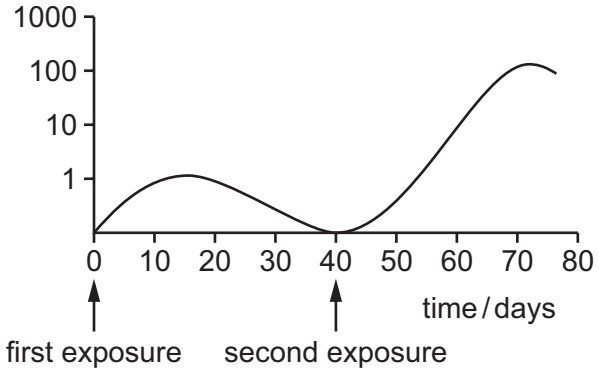
C Memory cells produced plasma cells which secreted anti-measles antibodies that bound to any antigen.

D T-lymphocytes produced memory cells which gave the children natural immunity against these other infections.

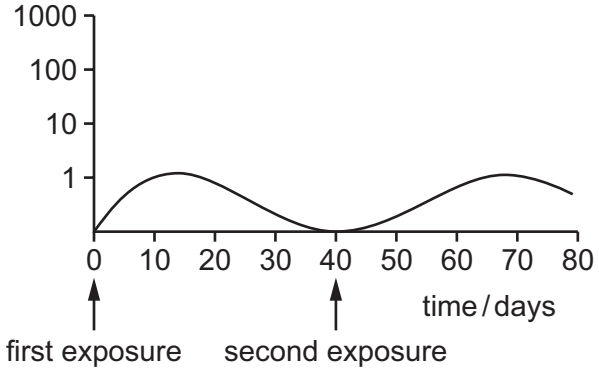
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38 Which graph shows the changes in antibody concentration following a second exposure to the same infection?

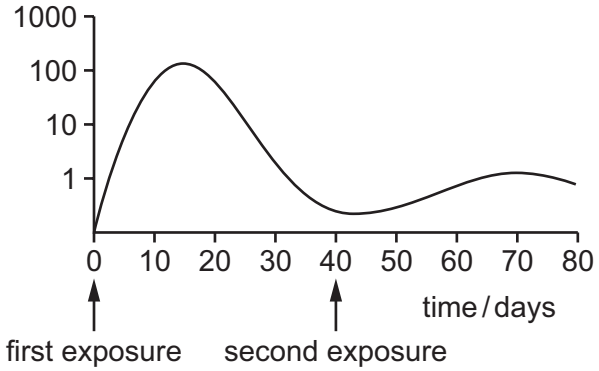
A



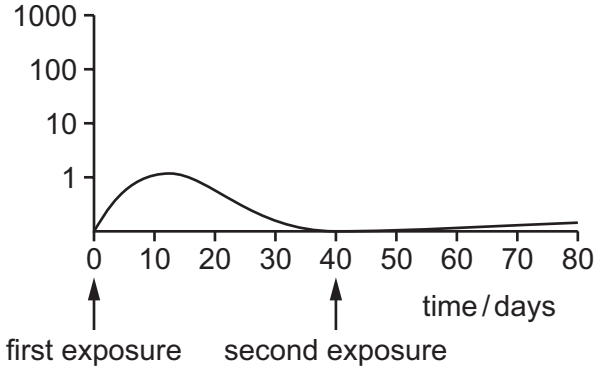
B



C



D



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[Turn over

39 Where are antigens found?

	on surface of pathogen	in blood plasma
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

key

✓ = antigens found

✗ = antigens not found

40 Whooping cough is a highly infectious disease of the gas exchange system, caused by the bacterium *Bordetella pertussis*.

Which method provides protection to infants against whooping cough and reduces the chance of developing this disease later in life?

A a short course of more than one type of antibiotic

B a six month course of one type of antibiotic

C injections of antibody specific to *Bordetella pertussis*

D injections of dead *Bordetella pertussis* bacteria

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