Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/11**

Paper 1 Multiple Choice **May/June 2019**

1 hour

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

7713874507

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.

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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 was told that the actual length of a cell structure is 5 μm.

The student was asked to state an equation that can be used to calculate the magnification of an electron micrograph of this cell structure. The student used some of the letters *q* to *u* in the equation.

q = the length of the cell structure image on the micrograph in centimetres

r = the length of the cell structure image on the micrograph in millimetres

s = 1000

$t = \frac{1}{5}$

u = 5

Which is the correct equation to calculate the magnification?

A $\frac{q}{s} \times u$ **B** $q \times s \times t$ **C** $\frac{r}{s} \times u$ **D** $r \times s \times t$

2 Which features of cilia and root hairs are correct?

	increase cell surface area	cannot be resolved with the light microscope	contain vacuoles	more than one present on a cell
A	cilia	cilia	root hairs	root hairs
B	cilia	root hairs	cilia	cilia
C	root hairs	cilia	root hairs	cilia
D	root hairs	root hairs	cilia	root hairs

3 Which are functions of microtubules?

1 allowing movement of cilia in a bronchus

2 attachment of centromeres during metaphase

3 moving secretory vesicles around a cell

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

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4 Some cell structures are listed.

1 mitochondria

2 nucleus

3 chloroplasts

4 ribosomes

What is the correct order of these cell structures when listed from largest to smallest?

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

5 Which cell structures have ribosomal RNA (rRNA)?

1 chloroplast

2 mitochondrion

3 nucleus

4 rough endoplasmic reticulum

A 1, 2, 3 and 4

B 1, 2 and 3 only

C 1, 2 and 4 only

D 2, 3 and 4 only

6 A cell structure in the macrophage destroys bacteria. Some bacteria stop this cell structure from functioning.

Which cell structure in the macrophage is stopped from functioning by the bacteria?

A Golgi body

B lysosome

C ribosome

D vesicle

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7 A solution of amylase was added to a suspension of starch. After 30 seconds, three samples of the mixture were tested with iodine solution, Benedict's solution or with biuret reagent.

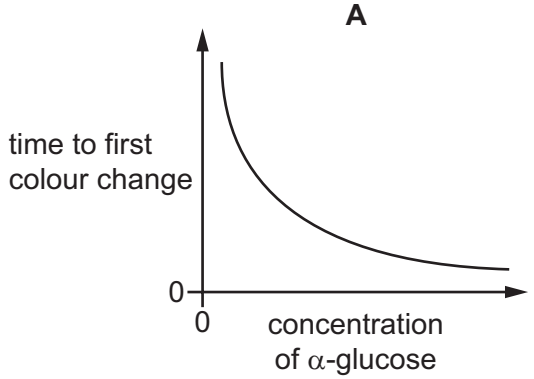
Which are the expected results?

	colour with test reagent		
	iodine solution	Benedict's solution	biuret reagent
A	black	green	purple
B	black	red	blue
C	brown	blue	purple
D	brown	yellow	blue

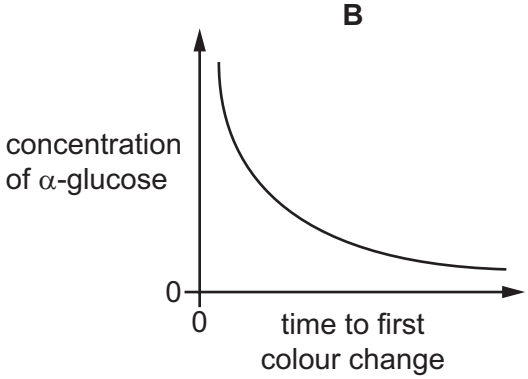
8 A student carried out a Benedict's test on several different known concentrations of α-glucose.

Which graph represents the results correctly?

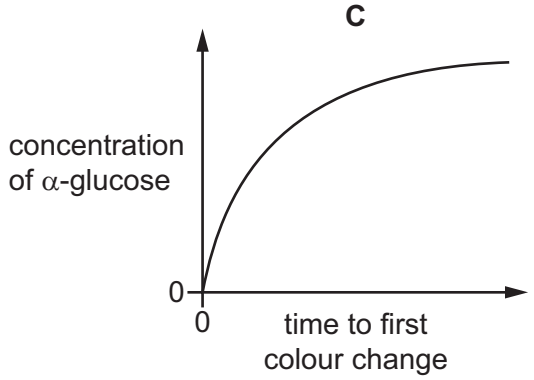
A



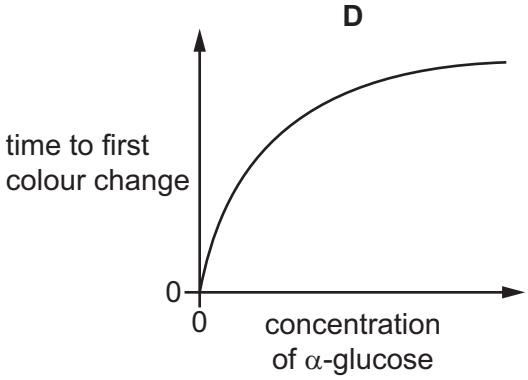
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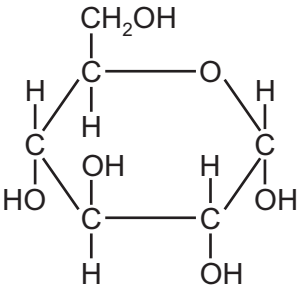
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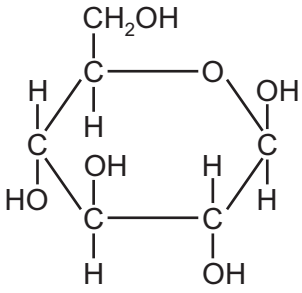
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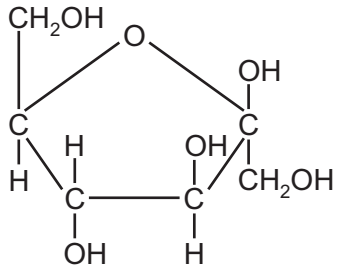
9 The diagram shows three hexose sugars.



1



2



3

Which row correctly shows examples of carbohydrates in which these three hexose sugars occur?

	sucrose	cellulose	starch
A	1	2	3
B	1	3	2
C	2	3	1
D	3	2	1

10 What can occur during condensation of carbohydrates?

A a disaccharide is produced from monosaccharides

B glycosidic bonds are broken

C molecules of water are used up

D monosaccharides are produced

11 What is true about triglycerides?

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

key

✓ = correct

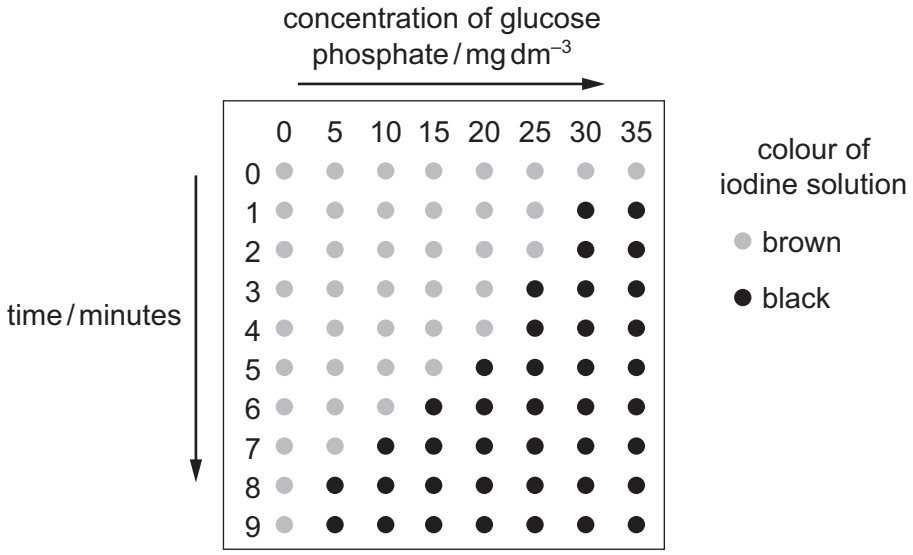
✗ = not correct

12 What is the minimum number of carbon atoms in an amino acid?

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

13 In an investigation, the same concentration of the enzyme phosphorylase was added to different concentrations of glucose phosphate and incubated at 30 °C. At 1 minute intervals, one drop of the reaction mixture was removed and added to a drop of iodine solution on a white tile.

The diagram shows the results of this investigation.



What explains the trend in the results of this investigation?

A Phosphorylase catalyses a reaction converting glucose phosphate to starch.

B The maximum rate of reaction is reached at 20 mg dm^{-3} of glucose phosphate.

C Substrate concentration is limiting at concentrations of glucose phosphate 25 mg dm^{-3} or less.

D Enzyme concentration is limiting at concentrations of glucose phosphate 25 mg dm^{-3} or less.

14 What is the definition of the Michaelis-Menten constant, K_m, for an enzyme?

A V_{max}

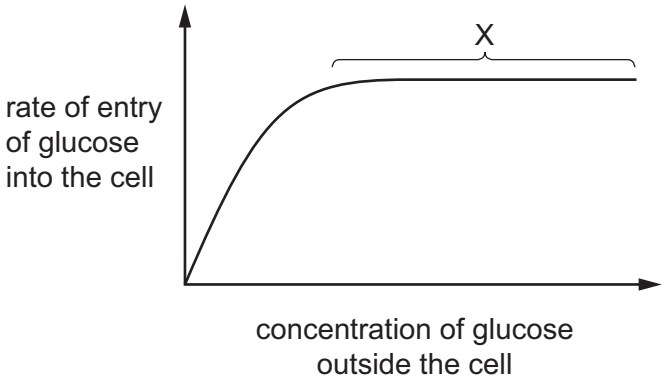
B half V_{max}

C the substrate concentration that gives V_{max}

D the substrate concentration that gives half V_{max}

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15 The graph shows how the rate of entry of glucose into a cell changes as the concentration of glucose outside the cell changes.



What is the cause of the plateau at X?

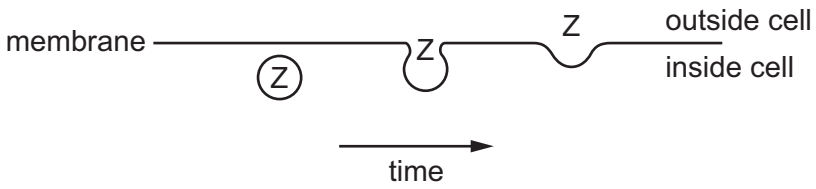
A All the carrier proteins are saturated with glucose.

B The carrier proteins are denatured and no longer able to function.

C The cell has used up its supply of ATP.

D The concentrations of glucose inside and outside the cell are equal.

16 The diagram shows the movement of substance Z across a cell surface membrane.



Which process is involved in this movement?

A endocytosis

B exocytosis

C phagocytosis

D pinocytosis

17 Visking tubing is often used as a model during experiments to investigate osmosis in plants.

What could Visking tubing be used to represent?

	cell surface membrane	cell wall	tonoplast
A	✓	✓	✓
B	✓	✗	✓
C	✓	✗	✗
D	✗	✓	✓

key

✓ = represents

✗ = does not represent

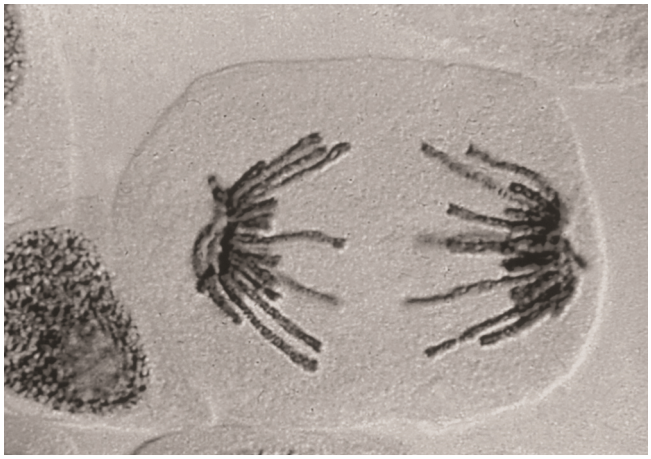
18 A scientist stains the chromosomes of a diploid plant cell with a fluorescent dye to observe the telomeres.

This cell has 38 chromosomes.

How many telomeres will the scientist observe in one of the nuclei during telophase of mitosis?

A 38 **B** 76 **C** 114 **D** 152

19 The photomicrograph shows a cell during mitosis.



What is happening in this cell?

1 Centrioles are replicating.

2 Spindle microtubules are shortening.

3 Chromatin is condensing.

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

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20 Which events listed are part of mitosis?

1 interphase

2 prophase

3 cytokinesis

A 1, 2 and 3

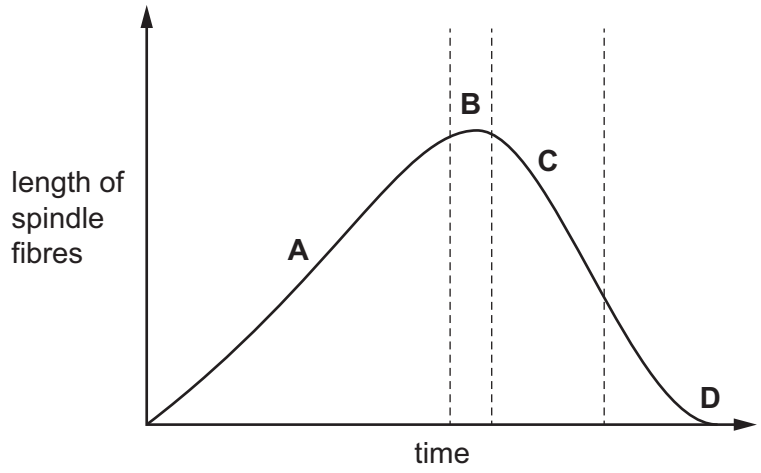
B 1 and 2 only

C 1 only

D 2 only

21 The graph shows the length of the spindle fibres during mitosis.

Which region of the graph shows when all the centromeres have detached from the spindle fibres?



22 A short piece of DNA, 19 base pairs long, was analysed to find the number of nucleotide bases in each of the polynucleotide strands. Some of the results are shown below.

	number of nucleotide bases			
	A	C	G	T
strand 1				4
strand 2		7		5

How many nucleotide bases containing C were present in strand 1?

A 2 **B** 3 **C** 5 **D** 7

23 Which nucleic acid bases are purines?

A adenine and cytosine

B cytosine and thymine

C guanine and adenine

D uracil and cytosine

24 In a genetic engineering experiment a piece of double-stranded DNA containing 6000 nucleotides coding for a specific polypeptide is transcribed and translated.

What is the total number of amino acids in this polypeptide?

A 500 **B** 1000 **C** 2000 **D** 3000

25 Which statements about tRNA are correct?

1 Hydrogen bonds between bases temporarily hold tRNA against mRNA.

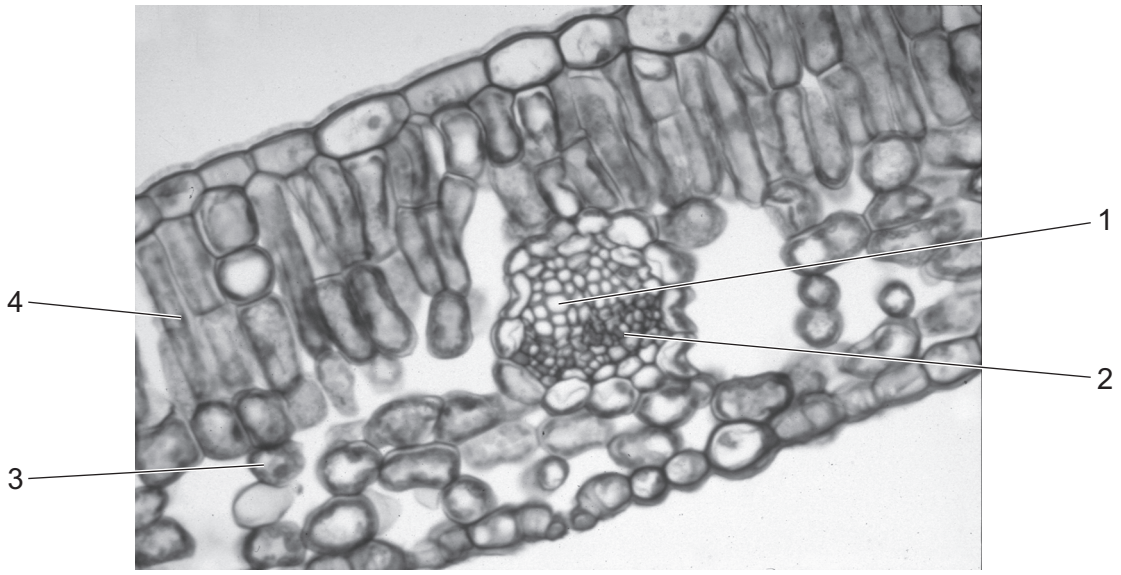
2 The base sequences in the tRNA molecules are the same as the base sequences in the mRNA that is being translated.

3 tRNA translates the base sequence in mRNA into the amino acid sequence in a protein.

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

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26 The photomicrograph shows a transverse section of part of a dicotyledonous leaf.



What are the correct labels for 1, 2, 3 and 4?

	1	2	3	4
A	phloem	xylem	palisade mesophyll	spongy mesophyll
B	phloem	xylem	spongy mesophyll	palisade mesophyll
C	xylem	phloem	palisade mesophyll	spongy mesophyll
D	xylem	phloem	spongy mesophyll	palisade mesophyll

27 Some of the features present in transport tissues in plants are listed.

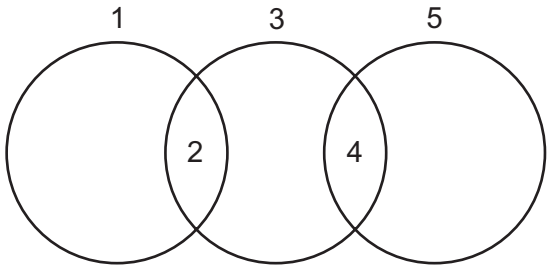
1 lignified walls
2 cytoplasm
3 mitochondria
4 pits
5 plasmodesmata

Which of these features are present in phloem sieve tube elements?

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

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28 The diagram shows the relationship between phloem sieve tube elements, xylem vessel elements and companion cells.



Which row is correct?

	1	2	3	4	5
A	companion cells	endoplasmic reticulum	phloem sieve tube elements	no nucleus	xylem vessel elements
B	companion cells	nucleus	phloem sieve tube elements	cytoplasm	xylem vessel elements
C	phloem sieve tube elements	mitochondria	companion cells	nucleus	xylem vessel elements
D	xylem vessel elements	no cytoplasm	phloem sieve tube elements	vacuole	companion cells

29 Which statement correctly describes a transport pathway in plants?

A In the apoplast pathway, water may move through plasmodesmata.

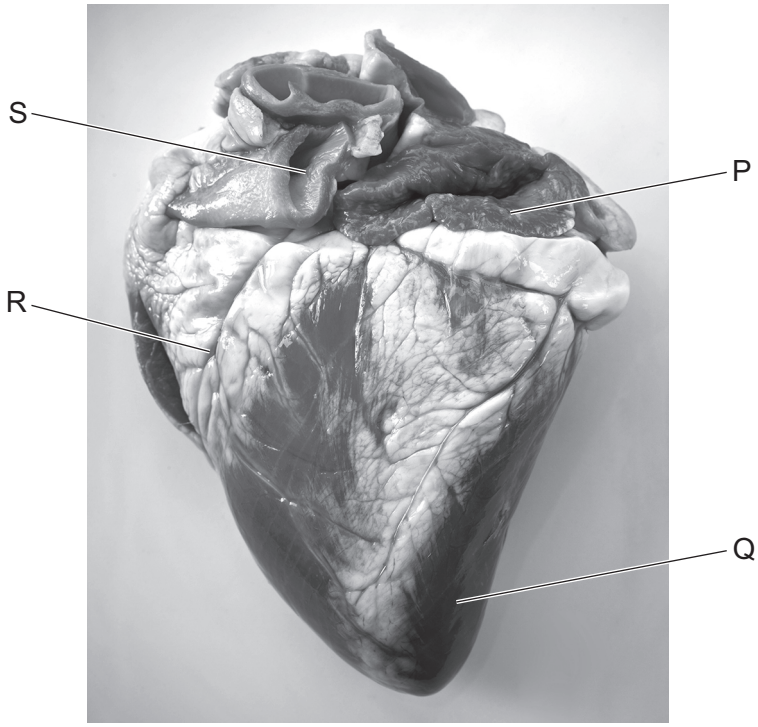
B In the symplast pathway, water may move through intercellular spaces.

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

D The symplast pathway may be blocked by the tonoplast.

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30 The photograph shows an external view of the front of a mammalian heart.



Which row identifies the position of the structures labelled P, Q, R and S?

	P	Q	R	S
A	left atrium	cardiac muscle	Purkyne tissue	pulmonary vein
B	left atrium	left ventricle	coronary artery	vena cava
C	right atrium	cardiac muscle	Purkyne tissue	aorta
D	right atrium	right ventricle	coronary artery	pulmonary artery

31 What happens during ventricular systole?

1 The atrioventricular node transmits an electrical signal to the apex of the heart.

2 The pressure in the ventricles drops below the pressure in the atria.

3 The atrioventricular valves close and the semilunar valves open.

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

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32 Athletes often move from low altitude to high altitude to train for a race.

Which statements about the effect of training at high altitude are correct?

1 Higher concentrations of carbon dioxide stimulate greater oxygen dissociation.

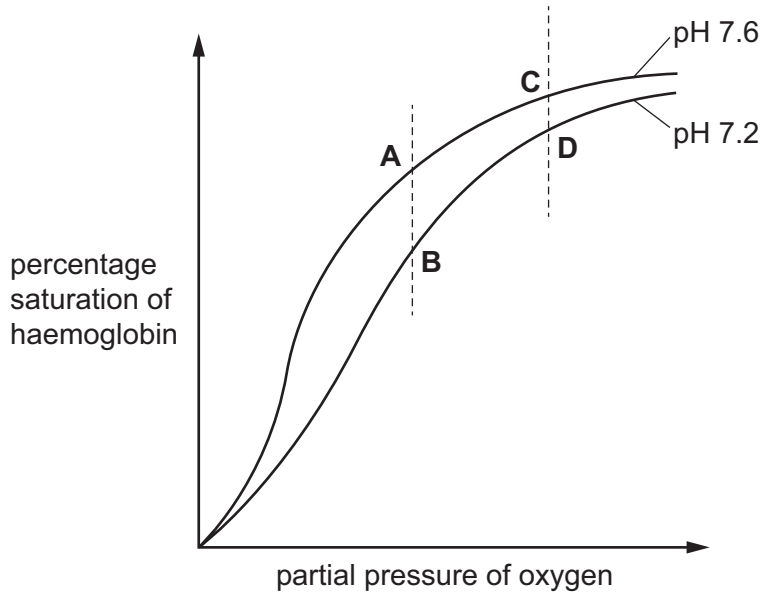
2 Lower concentrations of oxygen stimulate the uptake of more oxygen by red blood cells.

3 Lower partial pressures of oxygen stimulate higher production of red blood cells.

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

33 The graph shows the oxygen haemoglobin dissociation curves at pH 7.6 and at pH 7.2.

Which point on the graph shows the percentage saturation of haemoglobin in the blood leaving an active muscle?



34 Which row correctly describes the short-term effects of carbon monoxide and nicotine on the body of a smoker?

	demand for oxygen	concentration of oxygen in blood
A	decreased by carbon monoxide	increased by nicotine
B	decreased by nicotine	increased by carbon monoxide
C	increased by carbon monoxide	decreased by nicotine
D	increased by nicotine	decreased by carbon monoxide

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35 Which statements about bronchioles are correct?

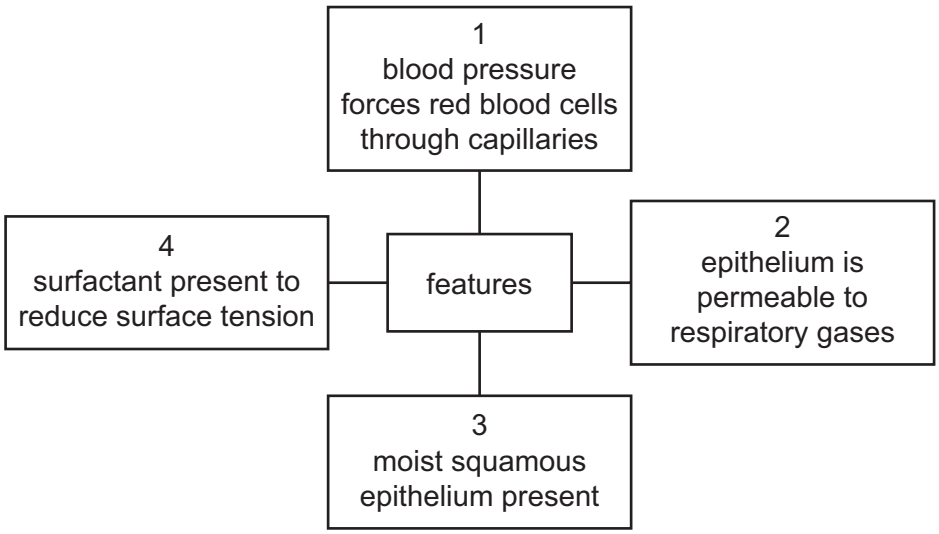
1 They have ciliated cells.

2 They have goblet cells.

3 They have muscle tissue.

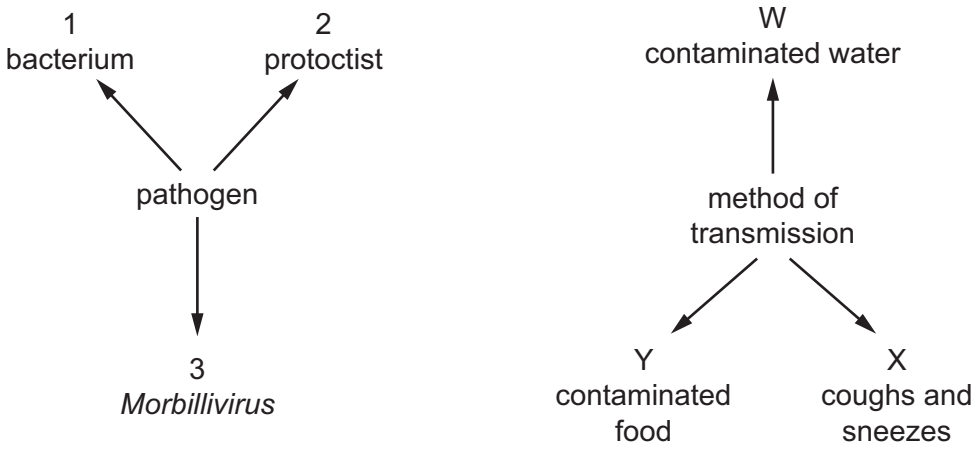
A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

36 Which features are important for the diffusion of oxygen out of an alveolus?



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

37 The diagram shows some of the pathogens that cause disease in humans and some of the ways they are transmitted.



What is the correct pathogen and method of transmission for measles?

A 1 and X **B** 2 and W **C** 3 and W **D** 3 and X

38 Which row is correct for each disease?

	cholera	HIV / AIDS	malaria	measles
A	caused by a bacterium	can be transmitted in breast milk and across placenta	eradication programme unsuccessful	caused by a virus
B	eating raw shellfish can be a source of infection	may be carried by a vector	carried by male *Anopheles* mosquitoes	can cause blindness
C	air borne infection	caused by a retrovirus	causative agent is a eukaryote	symptoms usually include a rash
D	can be caught by swimming in contaminated water	causes reduction in number of T-lymphocytes	mainly kills children under five years	no effective vaccination available

39 Which statements describe myasthenia gravis?

1 Antibodies attack proteins within the body.

2 T-lymphocytes are involved in an inflammatory response.

3 The immune system blocks receptors at the neuromuscular junction.

4 The immune system attacks the central nervous system.

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

40 Which row shows the cells that are able to divide continuously and are involved in monoclonal antibody production?

	cancer cells	mouse B-lymphocyte plasma cells	hybridoma cells
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✓	✓

key

✓ = correct

✗ = not correct

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BIOLOGY **9700/12**

Paper 1 Multiple Choice **May/June 2019**

1 hour

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

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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 The actual length of a cell structure is 8 μm.

Which steps are used to calculate the magnification of an electron micrograph of this cell structure?

step 1 measure the length of the cell structure image on the micrograph in centimetres

step 2 measure the length of the cell structure image on the micrograph in millimetres

step 3 divide the image length by 1000

step 4 multiply the image length by 1000

step 5 divide by 8

step 6 multiply by 8

A steps 1, 3 and 6

B steps 1, 4 and 6

C steps 2, 3 and 5

D steps 2, 4 and 5

2 What is the typical resolution of a microscope using daylight as a light source with a ×10 eyepiece lens and a ×40 objective lens?

A 0.20 nm **B** 200 nm **C** 100 μm **D** 400 μm

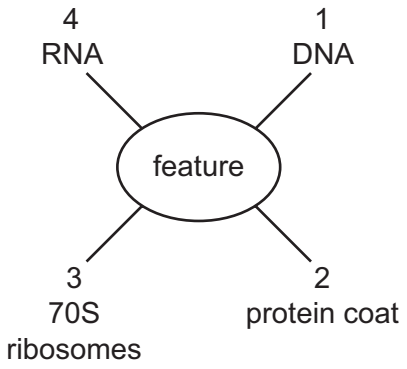
3 Two different types of cell, P and Q, were broken up using ultrasound and their contents analysed. Both types of cell contained small circular DNA. The circular DNA from P all carried the same base sequence, but those from Q were of two types, with different base sequences.

What may be concluded about the identity of cell types P and Q?

	P	Q
A	heart muscle fibres	root cortical cells
B	lymphocytes	mature red blood cells contaminated by bacteria
C	mature red blood cells	phloem sieve tube element
D	root cortical cells	leaf mesophyll cells

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4 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

5 After boiling a sample of milk with Benedict's solution, a yellow colour is observed.

Which conclusion about the sample of milk is correct?

A Reducing sugars are not present.

B Reducing sugars are present.

C There is a high concentration of fructose.

D There is a low concentration of sucrose.

6 Which of the statements about polysaccharides can be used to describe amylose and cellulose?

1 contains 1,4 glycosidic bonds

2 contains 1,6 glycosidic bonds

3 polymer of glucose

A 1 and 2

B 1 and 3

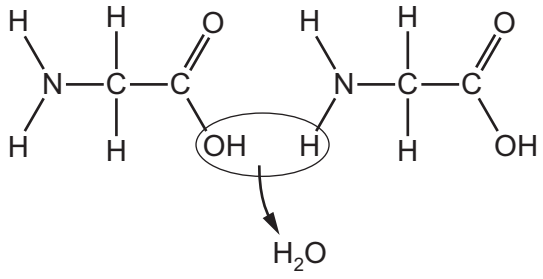
C 1 only

D 2 and 3

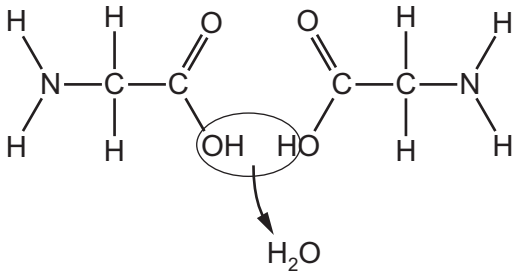
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7 Which diagram shows the formation of a peptide bond?

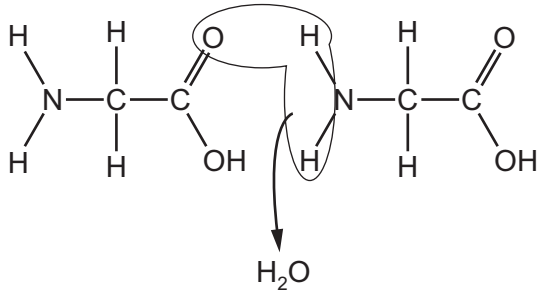
A



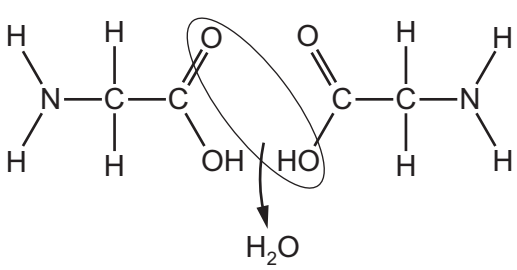
B



C



D



8 In enzyme-catalysed reactions, the position of the amino acids found at the active site is important.

During the synthesis of enzymes, amino acids are brought together in the correct position to form the active site.

Which levels of protein structure **must** be involved in forming the active site?

	level of protein structure			
	primary	secondary	tertiary	quaternary
A	✓	✓	✓	✓
B	✓	✓	✓	✗
C	✗	✓	✓	✓
D	✗	✓	✗	✓

key

✓ = involved

✗ = not involved

9 Which features affect the tensile strength of collagen?

1 the helical structure of collagen chains

2 the small R group of the amino acids in collagen

3 the insoluble nature of collagen

4 the bonds between collagen molecules

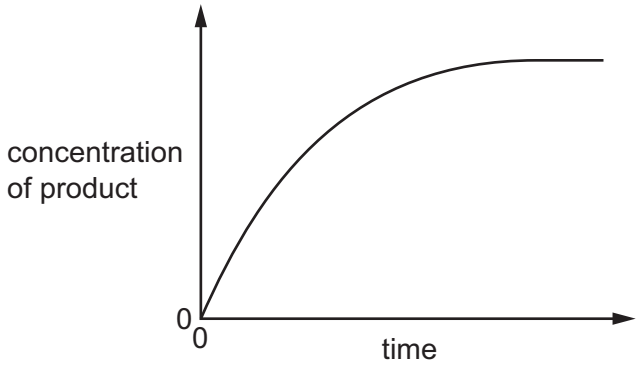
A 1, 2, 3 and 4

B 1, 2 and 4 only

C 1 and 3 only

D 2, 3 and 4 only

10 A fixed volume of the enzyme catalase was added to a fixed volume of hydrogen peroxide solution. The diagram shows how the concentration of product changed over the course of the reaction.



What explains the shape of this graph?

A The active sites become saturated.

B The enzyme was denatured.

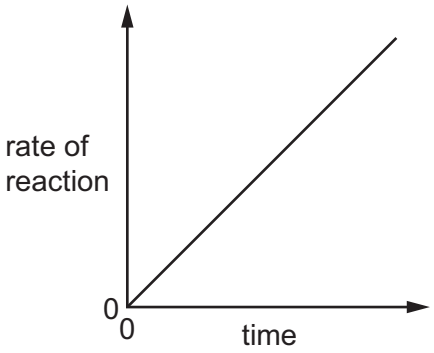
C The hydrogen peroxide inhibited the reaction.

D The substrate molecules were used up.

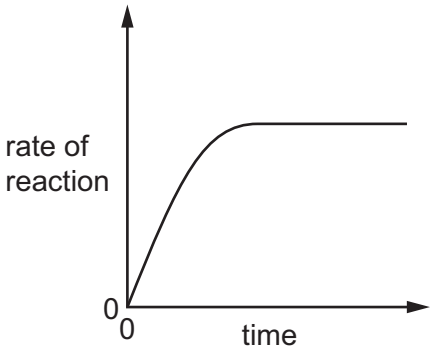
11 A fixed volume and concentration of substrate and enzyme were mixed. All other variables were kept constant. The enzyme-catalysed reaction was left until it was complete.

Which graph shows how the rate of reaction changes with time?

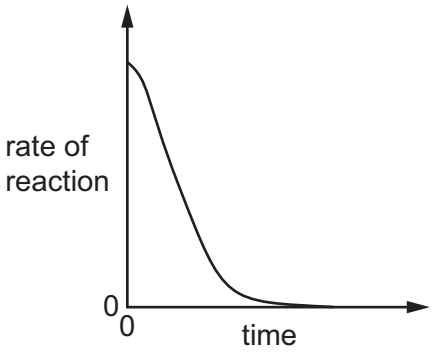
A



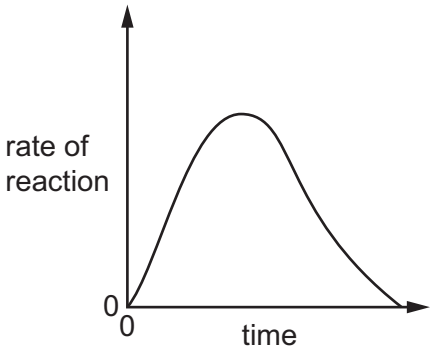
B



C

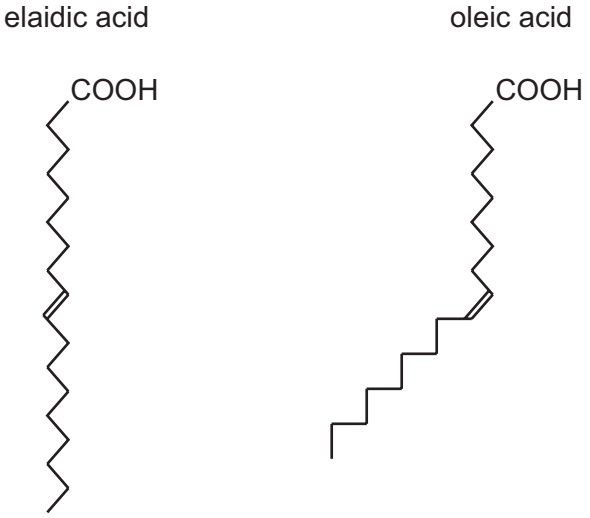


D



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12 The fatty acids elaidic acid and oleic acid have exactly the same structural formulae, with one double bond in the chain. However, the shapes of the chains are different, as shown in the diagram.

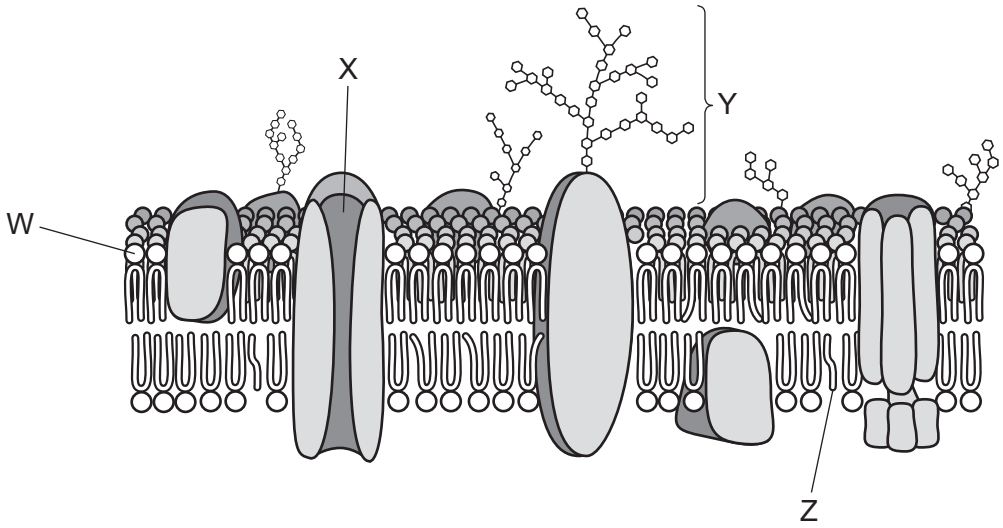


Which row shows the effect of the presence of these fatty acids on the structure and behaviour of a cell surface membrane?

	elaidic acid	oleic acid
A	does not fit closely with other fatty acids so that the membrane is less fluid at high temperatures	fits closely with other fatty acids so that the membrane is less fluid at low temperatures
B	does not fit closely with other fatty acids so that the membrane is more fluid at low temperatures	fits closely with other fatty acids so that the membrane is less fluid at low temperatures
C	fits closely with other fatty acids so that the membrane is less fluid at high temperatures	does not fit closely with other fatty acids so that the membrane is more fluid at low temperatures
D	fits closely with other fatty acids so that the membrane is more fluid at low temperatures	does not fit closely with other fatty acids so that the membrane is more fluid at high temperatures

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13 The diagram shows a cell surface membrane.



Which is a correct role for a labelled molecule?

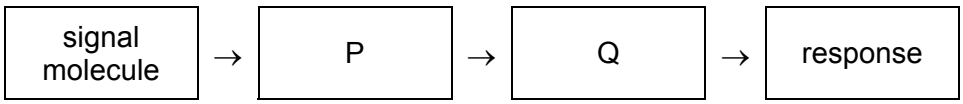
A W is involved in controlling membrane stability.

B X is involved in active transport.

C Y is involved in cell signalling.

D Z is involved in diffusion of ions.

14 The diagram shows a simple cell signalling pathway in which a signal molecule leads to a response, such as a secretion.



Which row identifies P and Q?

	P	Q
A	activated enzyme in cytoplasm	target in cell surface membrane
B	lipid in cell surface membrane	extracellular enzyme
C	protein in cell surface membrane	activated enzyme in cytoplasm
D	target in cytoplasm	protein in cell surface membrane

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15 Three parts of a chromosome and their functions are listed.

part	function
P1 centromere	F1 holds the coils of DNA together
P2 histone proteins	F2 holds two chromatids together
P3 telomere	F3 prevents loss of genes

Which part is matched with its correct function?

A P1 and F1 **B** P2 and F1 **C** P2 and F3 **D** P3 and F2

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

Which cells need to transcribe telomerase enzyme?

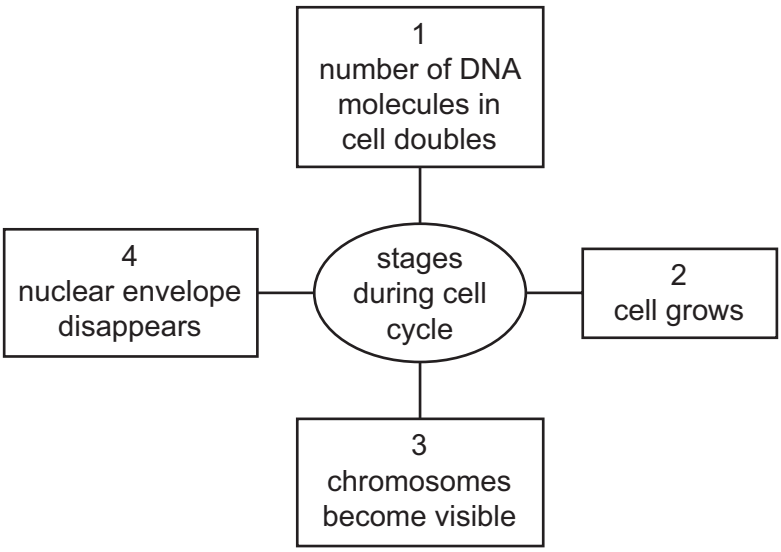
1 cancer cells

2 stem cells

3 activated memory B-lymphocytes

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

17 The diagram shows some of the stages which take place during the cell cycle.



Which two stages take place during interphase?

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

18 Which statement correctly describes the base pairing in a molecule of DNA?

A The purine adenine forms bonds with the pyrimidine thymine.

B The purine adenine forms bonds with the pyrimidine uracil.

C The purine cytosine forms bonds with the pyrimidine guanine.

D The purine guanine forms bonds with the pyrimidine thymine.

19 Which statements about complementary base pairing are correct?

1 It allows translation to occur.

2 Purines and pyrimidines are the same size.

3 The base pairs are of equal length.

4 Uracil forms two hydrogen bonds with adenine.

A 1, 2, 3 and 4

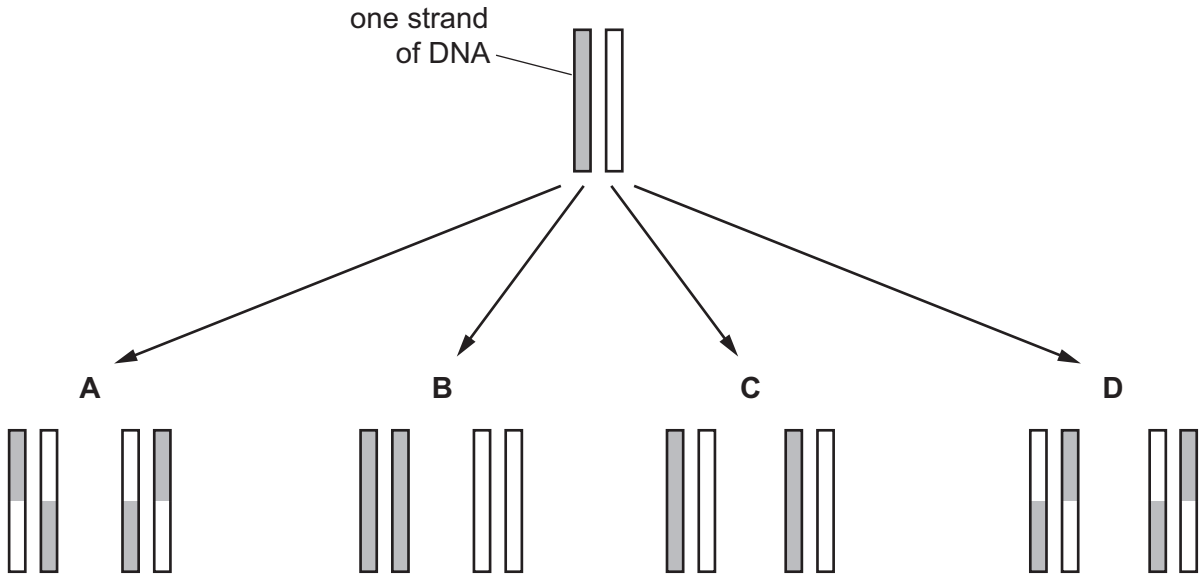
B 1, 3 and 4 only

C 1 and 4 only

D 2 and 3 only

20 The diagram shows the possible organisation of DNA molecules after one replication.

Which organisation is correct?



21 The diagram shows part of the DNA sequence of a gene and a mutated sequence of the same gene.

normal DNA sequence ...CCG GAT TAT TGC GAG AAA TGG CAT TCT AGG...

mutated DNA sequence ...CCG GAT GTA TTG CGA GAA ATG CAT TCT AGG...

What are possible effects of the mutated sequence?

1 the presence of mRNA stop codons, UAG, UAA or UGA

2 a change in the sequence of amino acids

3 a non-functional protein

4 ribosomes cannot translate the mRNA

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

22 What is correct for phloem sieve tube elements?

A Companion cells provide structural support to the phloem sieve tube elements.

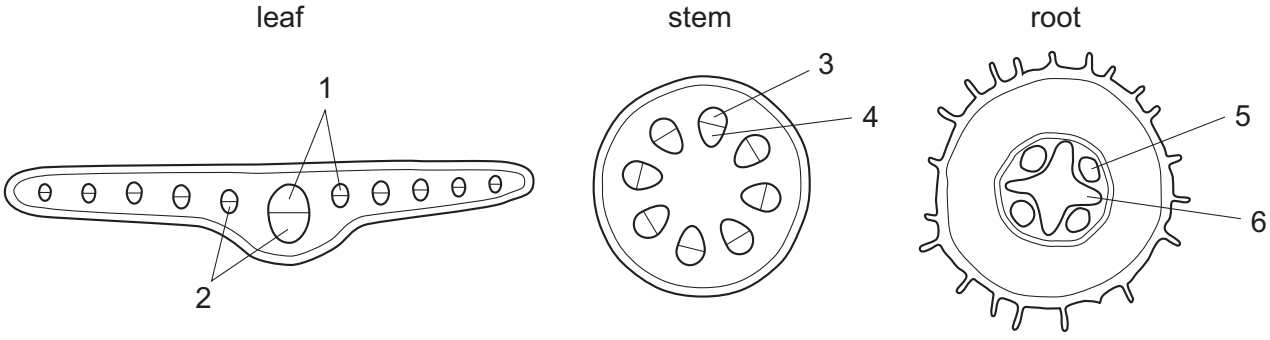
B Lignified walls of phloem sieve tube elements prevent transport of mineral salts by mass flow.

C Phloem sieve tube elements become narrower as movement of sucrose occurs.

D Plasmodesmata allow movement of water and solutes across cell walls of phloem sieve tube elements.

23 The diagrams show transverse sections of parts of a plant.

Transport tissues are labelled 1 to 6.



Which combination shows the tissues that have a main function of transporting water?

	1	2	3	4	5	6
A	✓	✓	✗	✗	✓	✓
B	✓	✗	✗	✓	✗	✓
C	✗	✓	✓	✗	✓	✗
D	✗	✓	✗	✓	✓	✗

key

✓ = transporting water is a main function

✗ = transporting water is **not** a main function

24 The statements are descriptions of how water moves across the root to the xylem vessel elements.

1 Water enters cell walls.

2 Water enters cytoplasm by osmosis.

3 Water moves from cell to cell through plasmodesmata.

4 Water moves through cell walls.

Which statements describe the apoplast pathway?

A 1, 2, 3 and 4

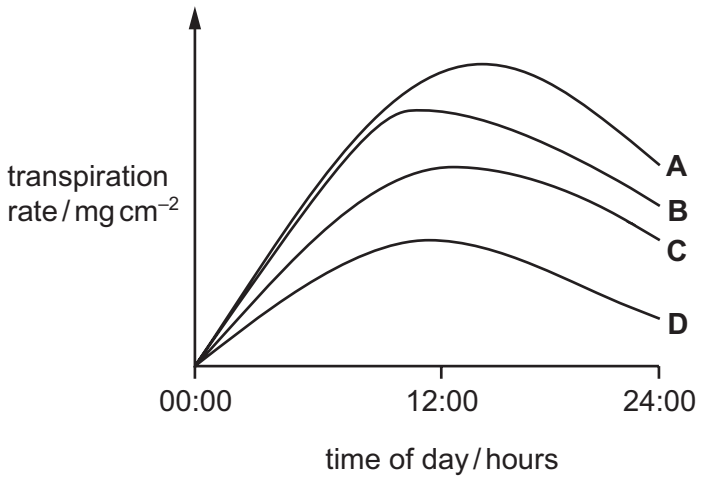
B 1, 2 and 3 only

C 1 and 4 only

D 4 only

25 Four plants, **A**, **B**, **C** and **D**, were grown in the same conditions and their transpiration rates measured.

Which plant is most likely to be a xerophyte?



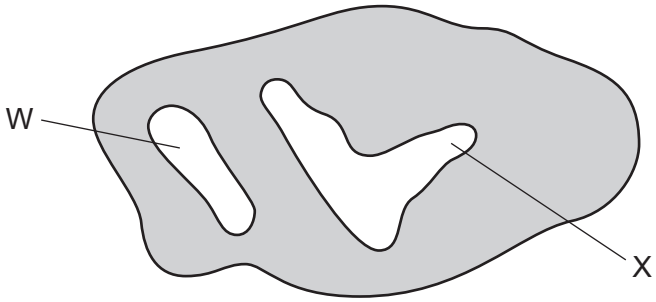
26 Sucrose moves from a mesophyll cell in a leaf into a phloem sieve tube element.

Which changes to the water potential and the volume of liquid in the phloem sieve tube element are correct?

	water potential becomes	volume of liquid
A	less negative	decreases
B	less negative	increases
C	more negative	decreases
D	more negative	increases

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27 The diagram shows a cross-section through a mammalian heart.



Which chambers of the heart are represented by W and X?

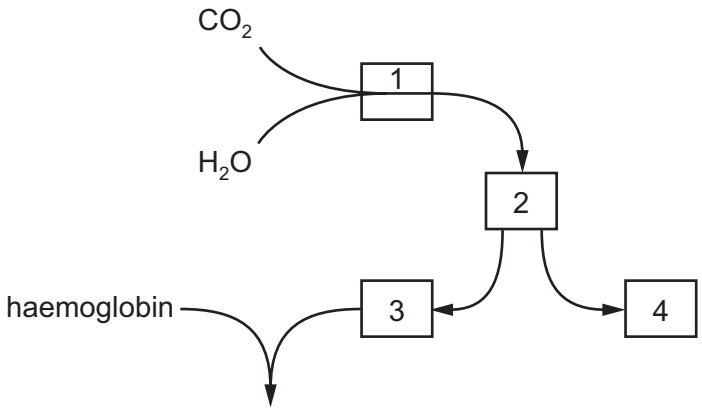
	W	X
A	left ventricle	right ventricle
B	right atrium	left atrium
C	right atrium	right ventricle
D	right ventricle	left ventricle

28 At a certain point in a cardiac cycle, the pressure in the right ventricle is lower than that in the right atrium and lower than that in the pulmonary artery.

Which row is correct?

	atrioventricular valve	semilunar valve
A	closed	closed
B	closed	open
C	open	closed
D	open	open

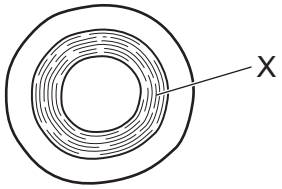
29 The diagram shows the pathway for the transport of carbon dioxide that occurs in red blood cells.



Which row is correct?

	1	2	3	4
A	carbaminohaemoglobin	haemoglobinic acid	hydrogen ions	hydrogencarbonate ions
B	carbonic anhydrase	carbonic acid	hydrogen ions	hydrogencarbonate ions
C	carboxyhaemoglobin	carbonic anhydrase	carbonic acid	carbon dioxide
D	haemoglobinic acid	carbonic acid	hydrogencarbonate ions	hydrogen ions

30 The diagram shows a transverse section through an artery.



Which statement describes the tissues present in layer X?

A collagen and smooth muscle only

B elastic fibres and collagen only

C elastic fibres and smooth muscle only

D elastic fibres, collagen and smooth muscle

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31 The large arteries close to the heart have a thick elastic layer in their walls.

Which statements about this layer are correct?

1 helps to maintain the blood pressure in arteries

2 reduces friction within the arteries

3 prevents too much pressure bursting the artery wall

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

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

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

key

✓ = present
✗ = absent

33 The surface tension of the layer of liquid lining the alveoli tends to pull the walls inwards so alveoli could collapse.

Which statements could explain how this is prevented?

1 Alveolar fluid is moved around by cilia.

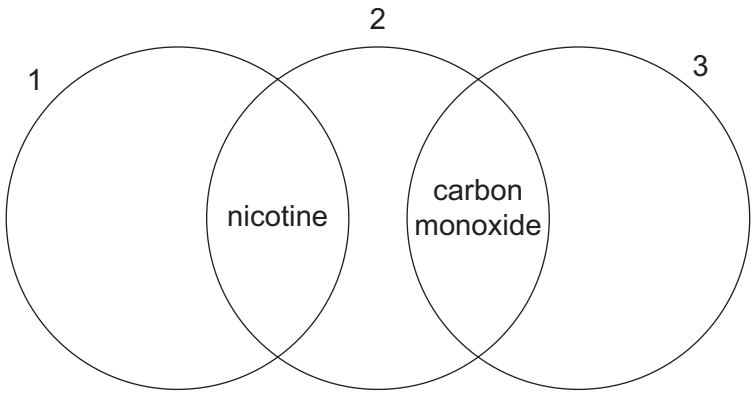
2 Elastic fibres keep the alveoli open.

3 Epithelial cells secrete a chemical that reduces the cohesion in water.

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

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34 The diagram shows some of the effects of nicotine and carbon monoxide in cigarette smoke.



Which row is correct?

	1	2	3
A	increase in heart rate	short-term effect on cardiovascular system	combines more readily with haemoglobin than oxygen
B	increases diameter of small arteries	can cause chronic bronchitis	combines irreversibly with haemoglobin
C	reduces the oxygen carrying capacity of blood	short-term effect on gas exchange system	reduces the blood supply to hands and feet
D	stimulates goblet cells to secrete more mucus	highly addictive	increases risk of blood clotting

35 Which row correctly identifies the causative organism of each disease?

	cholera	measles	smallpox	tuberculosis
A	*Variola*	*Morbillivirus*	*Vibrio*	*Mycobacterium*
B	*Variola*	*Mycobacterium*	*Vibrio*	*Morbillivirus*
C	*Vibrio*	*Morbillivirus*	*Variola*	*Mycobacterium*
D	*Vibrio*	*Mycobacterium*	*Variola*	*Morbillivirus*

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36 The following advice was given to a person travelling to a country where there had been an outbreak of an infectious disease.

- cook food well and eat it hot
- peel fruit and vegetables
- drink only cool, boiled water
- wash hands often with soap and cool, boiled water

Which infectious disease would this advice help to protect against?

A cholera

B malaria

C measles

D tuberculosis

37 What is a **social** factor that affects the spread of malaria?

A an increase in drug resistant forms of malaria

B climate change

C difficulty in producing a vaccine

D migration of people because of wars

38 Which are specific immune responses?

1 phagocytosis

2 production of antibodies

3 production of memory cells

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

39 Newborn babies have natural passive immunity.

What is correct for this type of immunity?

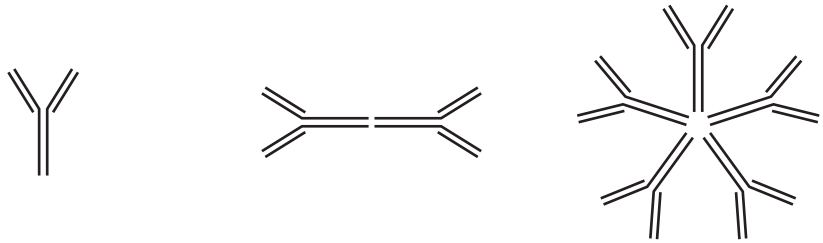
	immunity is temporary	antibodies are broken down
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

key

✓ = correct

✗ = not correct

40 The diagrams show three different types of antibody structure.



IgG IgA IgM

Which row is correct?

	IgG	IgA	IgM
A	one binding site for an antigen molecule	two light chains	two heavy chains
B	two heavy chains	four binding sites for antigen molecules	five hinge regions
C	two hinge regions	four heavy chains	five light chains
D	two light chains	four hinge regions	ten binding sites for antigen molecules

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BIOLOGY **9700/13**

Paper 1 Multiple Choice **May/June 2019**

1 hour

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

8538879965

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.

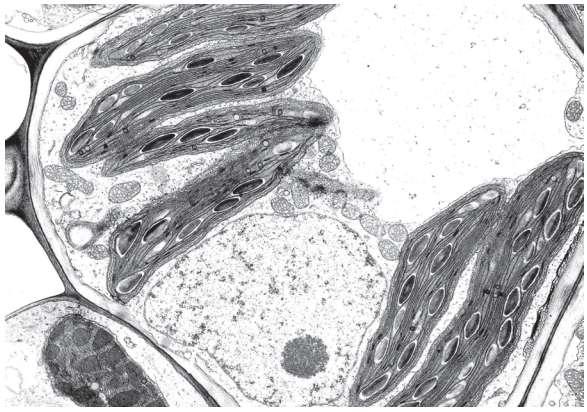
This document consists of **17** printed pages and **3** blank pages.

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1 Which combination of lenses for a light microscope will give the greatest magnification?

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

2 The photomicrograph shows some mesophyll tissue from a dicotyledonous leaf.

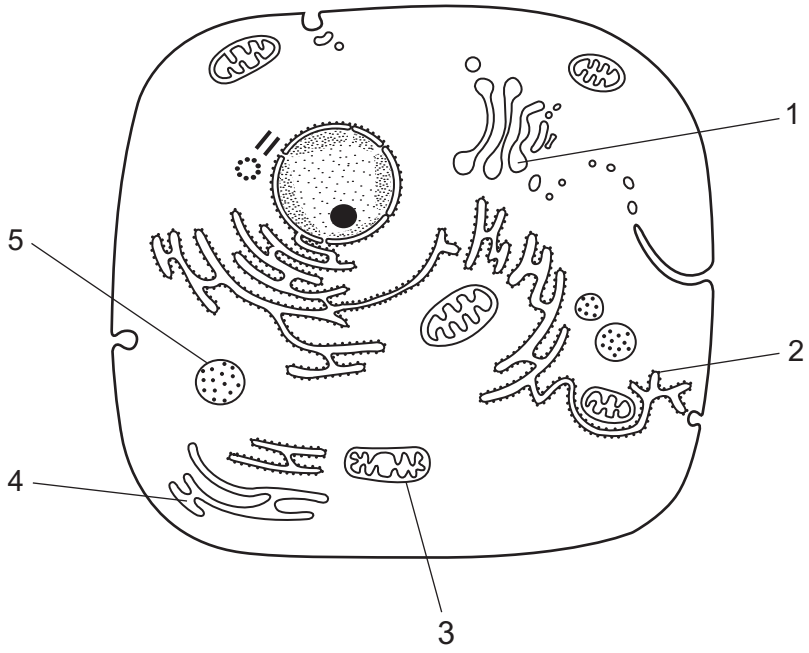


What is the magnification of the photomicrograph?

A ×280 **B** ×2800 **C** ×3570 **D** ×7000

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3 The diagram shows a typical animal cell as seen using an electron microscope.



Which of the numbered structures are needed for proteins to be secreted at the cell surface membrane?

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

4 Lysosomes vary in shape and size, making them difficult to identify.

What describes a lysosome?

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

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

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

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

5 Which statements about ATP are correct?

1 It is produced in mitochondria only.

2 It can be hydrolysed to form ADP.

3 It contains deoxyribose.

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

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6 A single-celled organism lives inside the body of a fish. This single-celled organism is rod-shaped, 700 μm long, enclosed in a cell wall and has cytoplasm containing thousands of copies of small, circular DNA.

Which statement about this single-celled organism is correct?

A It is a eukaryote, because it can be seen without using a microscope.

B It is a eukaryote, because it is too large to be a prokaryote.

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

D It is a prokaryote, because it has small, circular DNA in its cytoplasm.

7 A solution of amylase was added to a suspension of starch. The mixture was stirred and kept at 40 °C for 45 minutes.

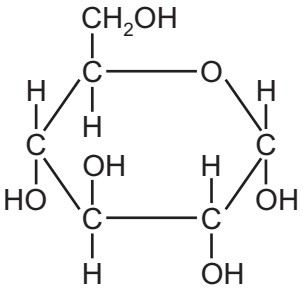
Samples were then tested with various reagents.

What is the expected set of results?

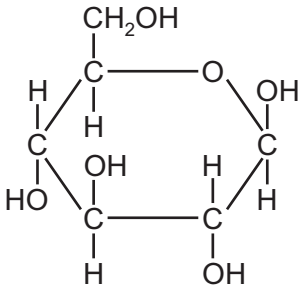
	test and resulting colour		
	iodine test	Benedict's test	biuret test
A	black	blue	blue
B	black	orange	purple
C	brown	blue	blue
D	brown	orange	purple

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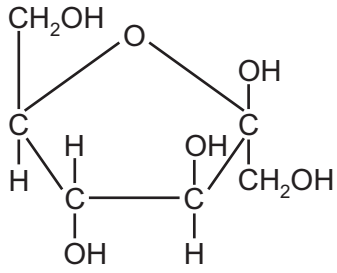
8 The diagram shows three hexose sugars.



1



2



3

Which row correctly shows examples of carbohydrates in which these three hexose sugars occur?

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

9 What can occur as a result of a condensation reaction?

1 A disaccharide is formed.

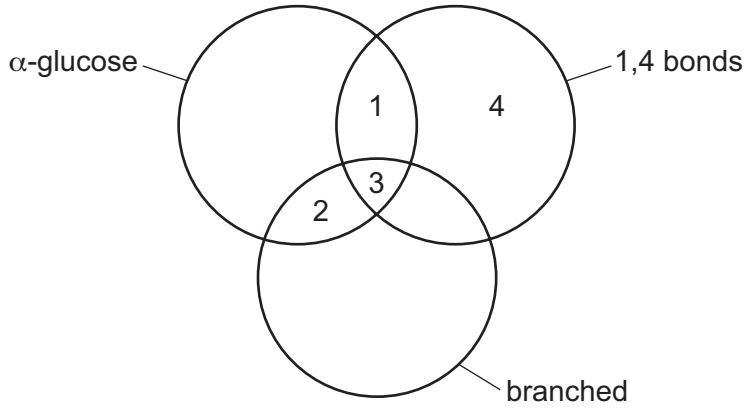
2 A glycosidic bond is broken.

3 A molecule of water is produced.

4 Two monosaccharides join together.

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

10 The diagram shows some relationships between features of carbohydrates.



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

	1	2	3	4
A	amylopectin	sucrose	glycogen	cellulose
B	amylose	glycogen	amylopectin	cellulose
C	cellulose	amylopectin	glycogen	sucrose
D	glycogen	cellulose	amylose	amylopectin

11 Which row describes a triglyceride?

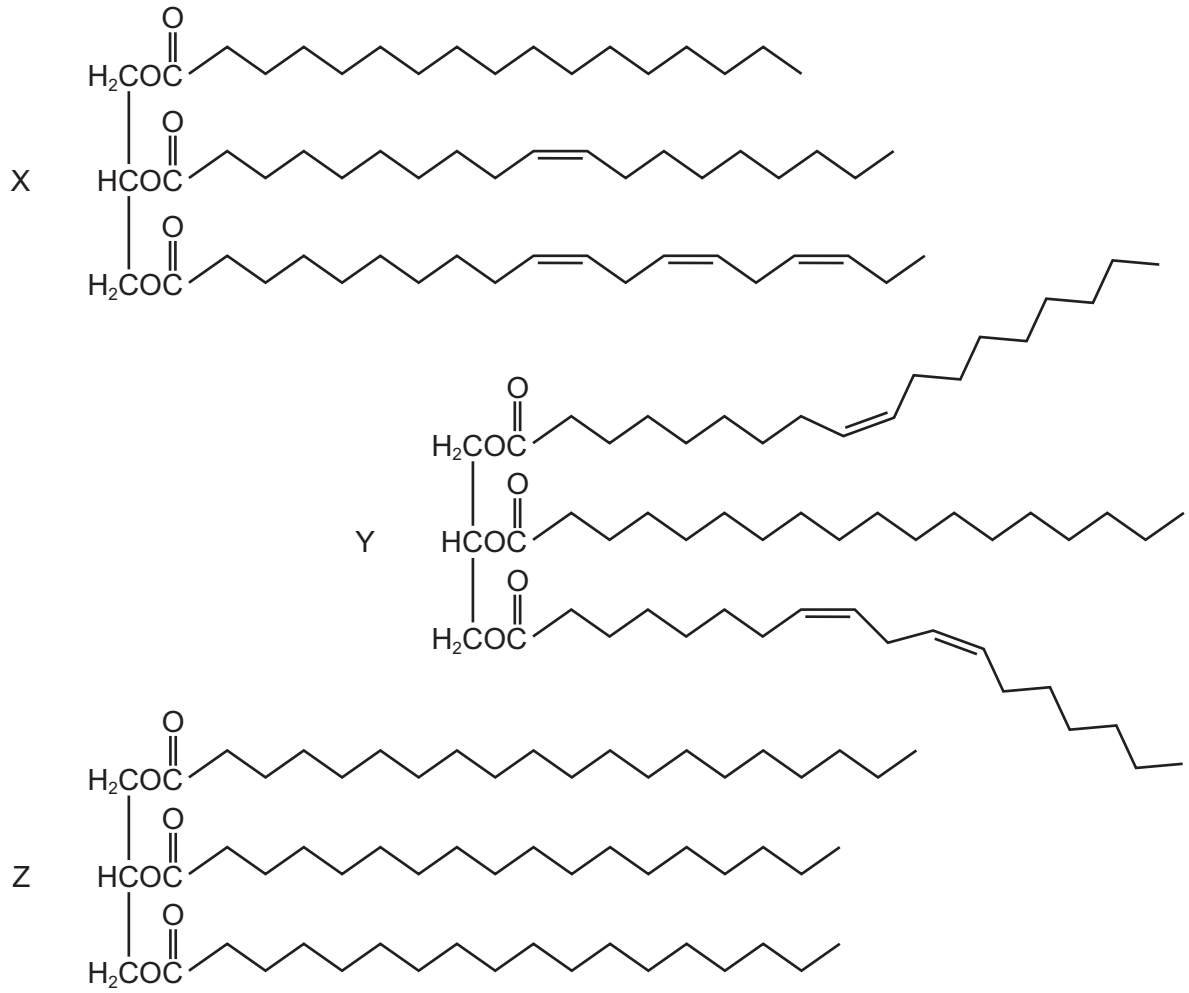
	hydrophilic	insoluble in alcohol
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

key

✓ = correct

✗ = not correct

12 The diagram shows three triglycerides, X, Y and Z.



What is correct for these triglycerides?

	contains saturated fatty acids	contains unsaturated fatty acids	contains more than two different fatty acids
A	X, Y and Z	X and Y	X and Y
B	X, Y and Z	Z	X and Y
C	X and Y	X, Y and Z	X, Y and Z
D	Z	X and Y	X, Y and Z

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[Turn over

13 Which features of collagen result in it having high tensile strength?

1 Bonds form between adjacent molecules.

2 Each three-stranded molecule is held together by hydrogen bonds.

3 Every third amino acid in the polypeptide is small.

4 The primary structure is held together by peptide bonds.

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

14 Which levels of protein structure would always be changed if an enzyme works by the induced fit hypothesis?

	primary	secondary	tertiary	quaternary
A	✓	✓	✓	✓
B	✓	✓	✗	✗
C	✗	✓	✗	✗
D	✗	✗	✓	✗

key

✓ = always changed

✗ = not changed

15 The enzyme β-galactosidase can catalyse the hydrolysis of four substrates, **A**, **B**, **C** and **D**, with similar structures.

Each substrate has a different K_m value.

For which substrate does β-galactosidase have the **lowest** affinity?

A $K_m = 4 \times 10^{-3}\,\text{mol}\,\text{dm}^{-3}$

B $K_m = 1 \times 10^{-3}\,\text{mol}\,\text{dm}^{-3}$

C $K_m = 2 \times 10^{-4}\,\text{mol}\,\text{dm}^{-3}$

D $K_m = 1 \times 10^{-4}\,\text{mol}\,\text{dm}^{-3}$

16 Which is correct for competitive inhibitors of enzymes?

1 They occupy the active site of an enzyme.

2 They have exactly the same shape as the substrate.

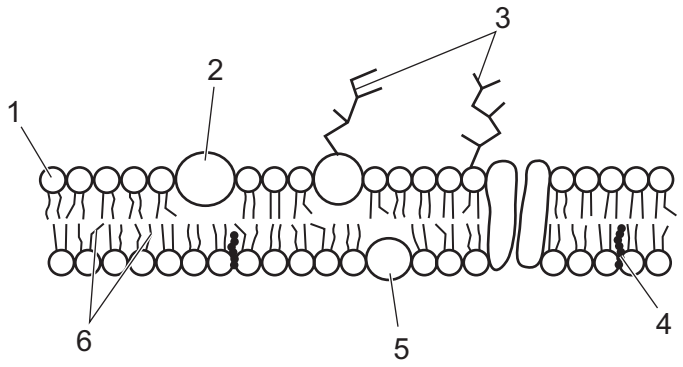
3 They can be used to control the rate of enzyme activity.

4 They can bind to a site on an enzyme other than the active site.

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

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17 The diagram represents the fluid mosaic model of membrane structure.



Which two of the numbered components contribute to the fluidity of the membrane?

A 1 and 3 **B** 2 and 4 **C** 3 and 5 **D** 4 and 6

18 The cell surface membranes of some cells are largely made up of phospholipids and cholesterol, with few proteins.

Which transport mechanisms will be reduced across these membranes?

1 facilitated diffusion

2 active transport

3 diffusion

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

19 One of the glycoproteins present in the cell surface membrane of human cells is called ICAM-1.

ICAM-1 is a cell adhesion molecule and it is also used by the common cold virus to attach to human cells.

Which statements are true about ICAM-1?

1 A drug binding to ICAM-1 to block the common cold virus could stop cells attaching to each other.

2 Part of the ICAM-1 structure must be complementary to proteins in the coat of the common cold virus.

3 The ICAM-1 structure must have hydrophobic parts to stabilise it within the cell membrane.

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

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20 A student weighed a cylinder of potato and then put it into a test-tube containing a salt solution.

The potato cylinder was removed from the salt solution after one hour. It was blotted dry and then reweighed. The student recorded that the potato had lost mass.

Which row shows the correct explanation for the results the student collected?

	water potential of the potato cells before soaking	condition of the potato cells after soaking
A	higher	plasmolysed
B	higher	turgid
C	lower	plasmolysed
D	lower	turgid

21 Some parts of a typical human chromosome are more numerous than others.

Which of the parts are listed in order from the most numerous to the least numerous?

A centromere, nucleotide, histone

B DNA molecule, telomere, centromere

C histone, telomere, DNA molecule

D telomere, centromere, nucleotide

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

Which cells need to transcribe telomerase enzyme?

1 stem cells

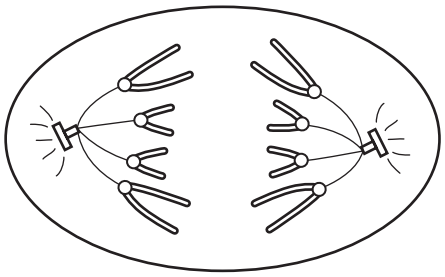
2 activated memory B-lymphocytes

3 helper T-lymphocytes secreting cytokines

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

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23 The diagram shows a cell during mitosis.



Which description correctly identifies the cell?

A a plant cell during anaphase

B a plant cell during metaphase

C an animal cell during anaphase

D an animal cell during metaphase

24 A gene codes for the production of a protein, p53, that binds to damaged DNA during interphase and prevents its replication. A carcinogen in cigarette smoke mutates this gene.

Which statement explains why this mutation may cause cancer?

A Cells with no p53 are allowed to undergo mitosis.

B Cells with no p53 allow their damaged DNA to replicate.

C The carcinogen in cigarette smoke increases the rate of cell division.

D The p53 causes uncontrolled cell division.

25 What is the role of DNA polymerase?

A condensation reactions to produce DNA nucleotides for replication

B correct alignment of RNA nucleotides along a template strand of DNA

C formation of bonds to complete the sugar-phosphate backbone

D formation of glycosidic bonds between complementary base pairs

26 Which row represents the correct features of the nitrogenous base thymine?

	has a single ring structure	is a purine	forms two hydrogen bonds with its complementary base	pairs with cytosine
A	✓	✓	✗	✗
B	✓	✗	✓	✗
C	✗	✓	✗	✓
D	✗	✗	✓	✓

key

✓ = correct

✗ = not correct

27 Meselson and Stahl investigated DNA in bacteria. They grew bacteria in a medium with only heavy nitrogen, ^{15}N, until all of the bacterial DNA was heavy.

These bacteria were moved from a heavy nitrogen medium and cultured in a medium with only light nitrogen, ^{14}N.

A sample of bacteria was collected from the second generation and their DNA analysed.

Hybrid DNA contains both heavy and light DNA.

Which row shows the percentage of heavy DNA strands and the percentage of hybrid DNA molecules in the second generation produced in the medium containing light nitrogen?

	percentage of heavy DNA strands	percentage of hybrid DNA molecules
A	25	25
B	25	50
C	50	25
D	50	50

28 The table shows 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
STOP	ATC	proline	GGA
cysteine	ACA	proline	GGC
cysteine	ACG	valine	CAC

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

CCA TTC ACG GCG TTA GCA

Two mutations occur in this sequence during DNA replication.

Which mutated DNA would have **no** effect on the polypeptide synthesised?

A CCA ATC ACG GCG TTG GCA

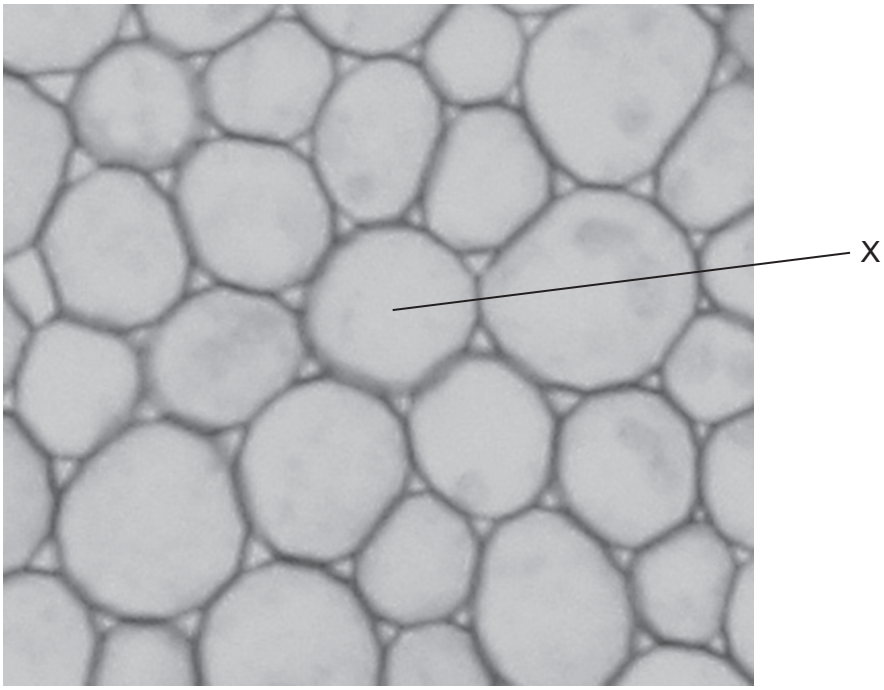
B CCA TTC ACA GCA TTA GCA

C CCA TTC ACG CCG TTA GCC

D CCT TTC ACG GCG TTA GGA

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29 A group of students were asked to look at the photomicrograph of a cross-section of unfamiliar material and make observations.



The students described X as:

1 circular

2 a hollow tube

3 a spherical structure.

Which descriptions are correct?

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

30 Irrigating crop plants with water containing low concentrations of salt causes an increase in the concentration of salt in the soil.

What explains why the increase in salt concentration eventually kills the crop?

	water potential in roots	water potential in soil	direction of water movement
A	↓		into the roots
B	↑		into the soil solution
C		↓	out of the roots
D		↑	into the roots

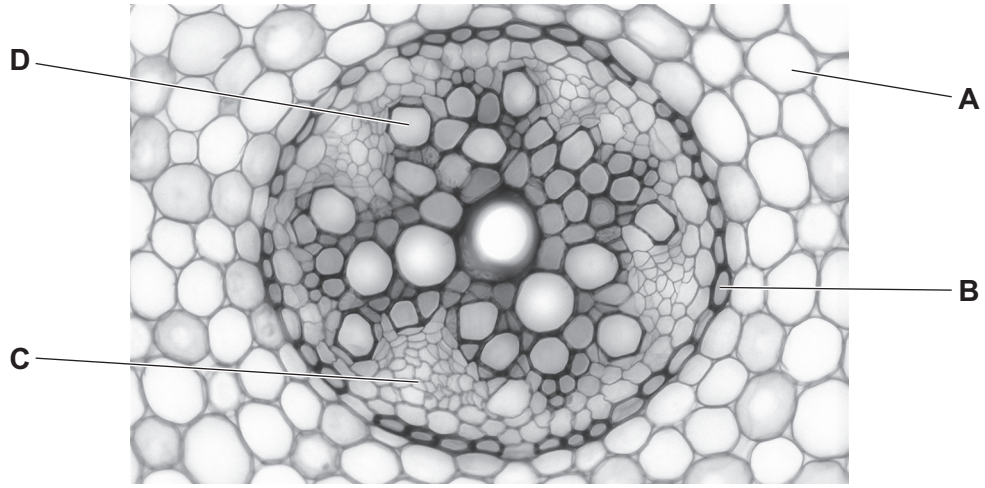
key

↑ = water potential increases

↓ = water potential decreases

31 The photomicrograph shows a transverse section through part of a plant root.

Which tissue inhibits the path of water through the apoplastic pathway?



32 The table shows some information about three blood vessels, P, Q and R, from a mammal.

	diameter / mm	wall thickness / mm	percentage composition of wall		
			muscle	collagen	elastin
P	25	2	22	33	40
Q	20	1	25	40	25
R	4	1	35	25	30

Which row identifies blood vessels P, Q and R?

	P	Q	R
A	artery	vein	artery
B	artery	vein	capillary
C	vein	artery	capillary
D	vein	artery	vein

33 Which row correctly identifies the locations in which a type of molecule or cell is present?

	type of molecule or cell	blood	lymph	tissue fluid
A	antigen	✓	✓	✓
B	glucose	✓	✗	✓
C	lymphocyte	✗	✓	✗
D	neutrophil	✗	✓	✓

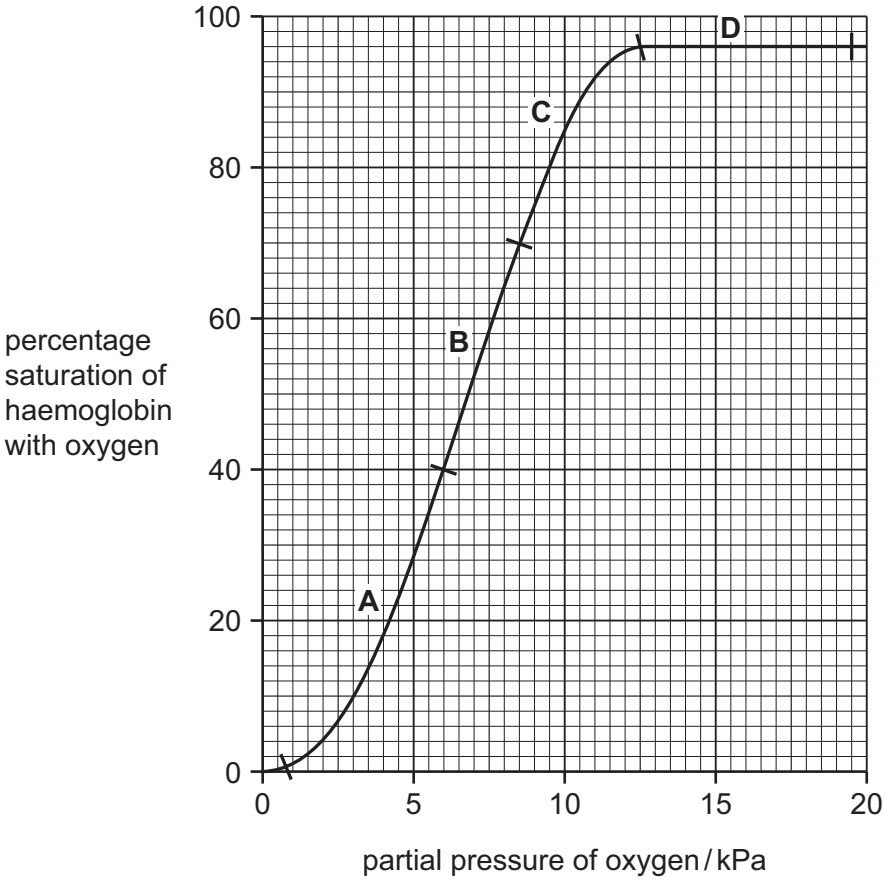
key

✓ = is present

✗ = is not present

34 The graph shows the percentage saturation of haemoglobin with oxygen at different partial pressures of oxygen.

Which range of partial pressures of oxygen results in the greatest change of percentage saturation of haemoglobin per kPa?



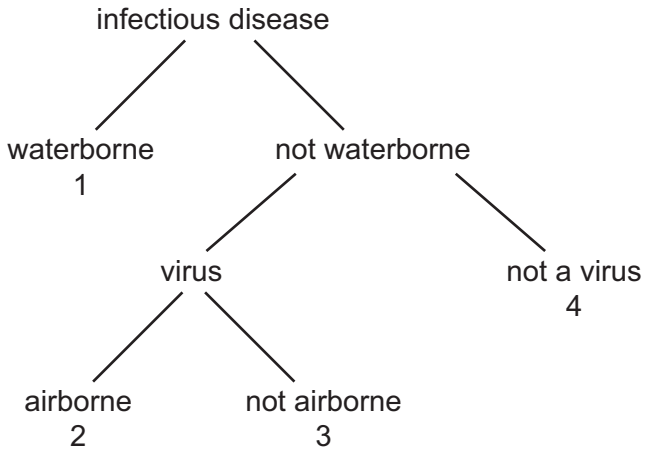
35 How many layers of cell surface membrane separate an oxygen molecule in the air space of an alveolus from the nearest haemoglobin molecule?

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

36 Which biochemical is formed and what happens to the oxygen dissociation curve of adult haemoglobin when carbon dioxide combines with haemoglobin?

	biochemical formed	oxygen dissociation curve
A	carbaminohaemoglobin	shifts to the left
B	carbaminohaemoglobin	shifts to the right
C	carboxyhaemoglobin	shifts to the left
D	carboxyhaemoglobin	shifts to the right

37 The diagram has been used to identify four infectious diseases.



Which row correctly identifies the infectious diseases?

	1	2	3	4
A	cholera	measles	HIV / AIDS	TB
B	cholera	smallpox	malaria	measles
C	malaria	HIV / AIDS	TB	cholera
D	malaria	TB	measles	cholera

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 Growth factors are chemicals that stimulate a cell to divide.

Growth factors are transported around the body in the blood, and they attach to cells that have complementary growth factor receptors on their surface.

Some cells have too many growth factor receptors on their surface and so the cells continue to divide, forming a tumour.

Trastuzumab is used as a treatment for some cancers.

Trastuzumab works by binding to a specific growth factor receptor on a tumour cell. This stops the cell dividing and the cell dies.

What is trastuzumab?

A a monoclonal antibody

B a vaccine

C an antibiotic

D an enzyme inhibitor

40 What describes artificial active immunity?

A protection against a pathogen by an injection of antibodies

B protection against a pathogen by drinking colostrum containing antibodies

C stimulation of lymphocytes by antigens contained in a vaccine

D stimulation of lymphocytes by antigens on the surface of invading pathogens

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