Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/11**

Paper 1 Multiple Choice **May/June 2017**

1 hour

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

6591632733

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 definition of the magnification of a drawing of a leaf is correct?

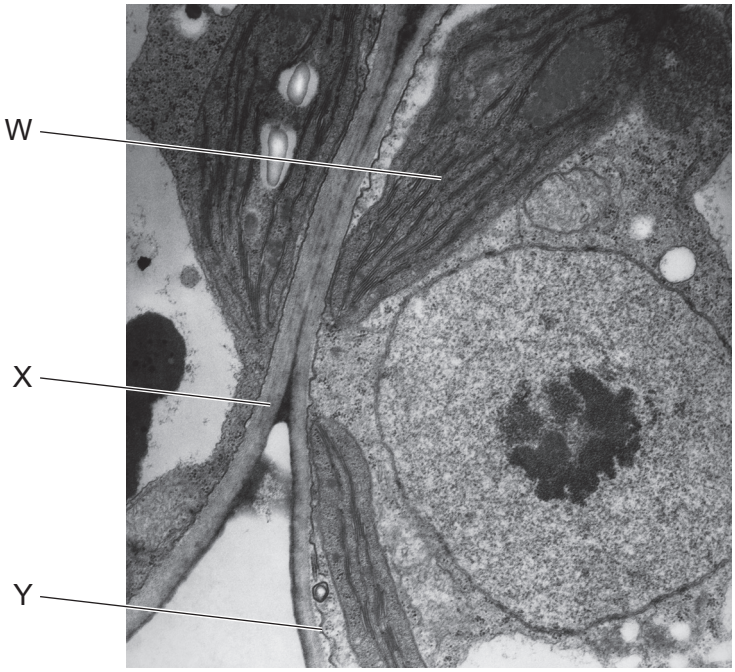
A the actual size of an object multiplied by the magnification of the microscope

B the difference in size between an actual object and a drawing of the object

C the increase in size of an object when observed using a microscope

D the size of the drawing of a specimen in comparison to the actual size

2 The electron micrograph shows part of two cells.



Which labelled features identify these cells as eukaryotic?

A W, X and Y **B** W and X only **C** W only **D** X only

3 Plant cells are fixed, stained and viewed using a student microscope. The light source was natural light.

What would be clearly visible at ×400 magnification?

A cristae of mitochondria

B grana of chloroplasts

C nucleoli

D ribosomes

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4 Which lengths are equivalent to 1 μm?

1 1000 mm

2 0.001 nm

3 0.001 mm

4 1 000 000 nm

5 0.01 mm

6 1000 nm

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

5 Some secretory cells synthesise and release glycoproteins.

What is the correct order of the sequence of events as they occur in the secretory cell?

1 exocytosis

2 product accumulates in secretory vesicle

3 mRNA binds to ribosomes

4 synthesis of glycoprotein

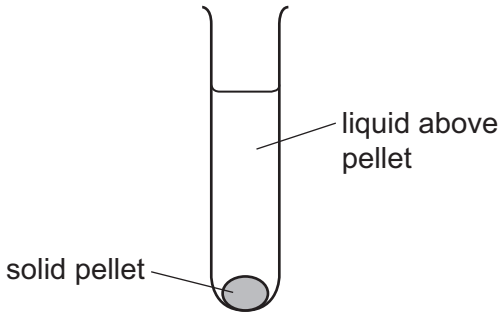
A 3, 4, 1, 2 **B** 3, 4, 2, 1 **C** 4, 3, 1, 2 **D** 4, 3, 2, 1

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6 A scientist carried out an experiment to separate the organelles in an animal cell by mass.

The scientist mixed the cells with a buffer solution which had the same water potential as the cells. He then broke the cells open with a blender to release the organelles.

The extracted mixture was filtered and then spun in a centrifuge at a speed to separate the heaviest organelle. This sank to the bottom, forming a solid pellet, 1.



The liquid above pellet 1 was poured into a clean centrifuge tube and spun in the centrifuge at a higher speed to separate the next heaviest organelle. This organelle sank to the bottom, to form a solid pellet, 2.

He repeated this procedure twice more to obtain pellet 3 and pellet 4, each containing a single organelle.

What is the function of the organelle extracted in pellet 3?

A digestion of old organelles

B production of ATP

C synthesis of mRNA

D synthesis of protein

7 What is the general formula for amylopectin?

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

8 Which statement describes how the molecular structure of starch is suited to its function?

A Amylose has a branched structure and amylopectin is coiled to give a compact molecule for transport.

B In the breakdown of amylose and amylopectin, many condensation reactions release stored energy.

C In the formation of amylose and amylopectin, many hydrolysis reactions allow the release of stored energy.

D The amylose-amylopectin complex is insoluble and does not affect the water potential of the cell.

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9 Cows and whales are mammals that produce milk to feed their babies. Newborn whales grow faster than newborn cows. The milk of both cows and whales contains saturated fatty acids with different chain lengths.

The table shows the percentage of saturated fatty acids of different lengths in cow and whale milk.

chain length of saturated fatty acid / number of carbon atoms	percentage of saturated fatty acids in milk	
	cow	whale
4–12	22.2	0
14	10.6	13.8
16	25.5	27.9
18	40.1	29.4
> 18	1.6	28.9

Which statement about the ratio of short fatty acids (4–16 carbons) to long fatty acids (18 or more carbons) in the milk of cows and whales is correct?

A The ratio in cow milk is higher because young cows need more energy than young whales.

B The ratio in cow milk is lower because young cows need less energy than young whales.

C The ratio in whale milk is higher because young whales need less energy than young cows.

D The ratio in whale milk is lower because young whales need more energy than young cows.

10 The structure of phospholipids and triglycerides include the following.

1 glycerol linked to fatty acids

2 hydrophobic fatty acid chains

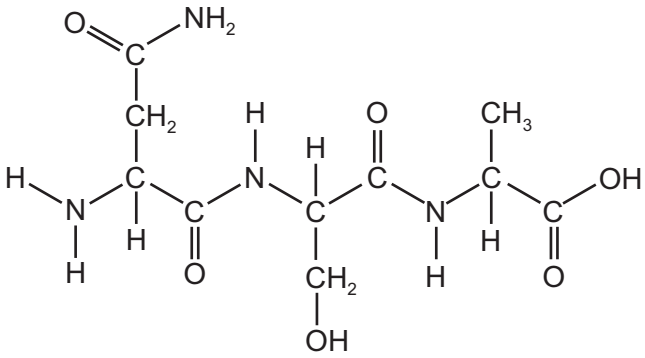
3 saturated fatty acid chains

Which structures enable the formation of a lipid bilayer in cell surface membranes?

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

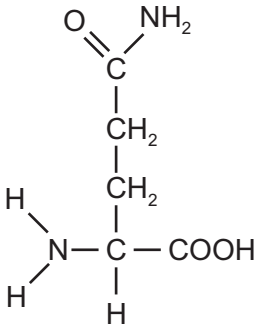
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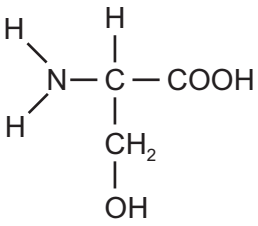
11 The diagram shows the molecular structure of a peptide.

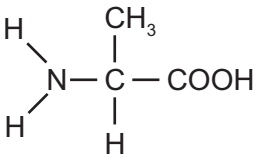


Which molecules would result from the complete hydrolysis of the peptide?

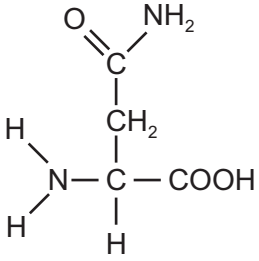
A

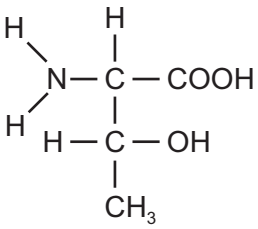


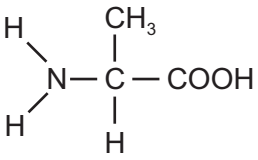




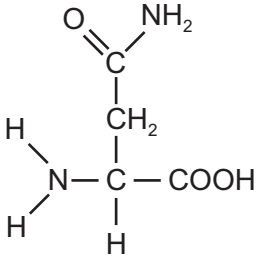
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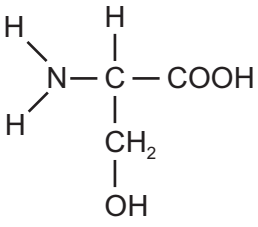


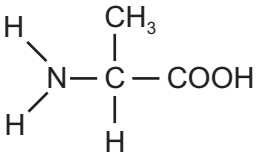




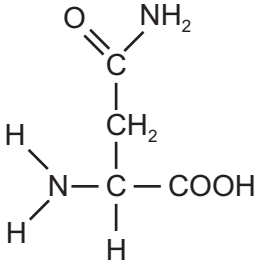
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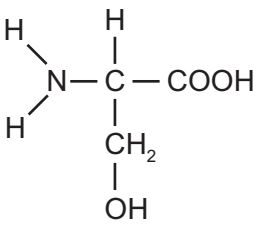


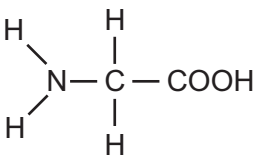




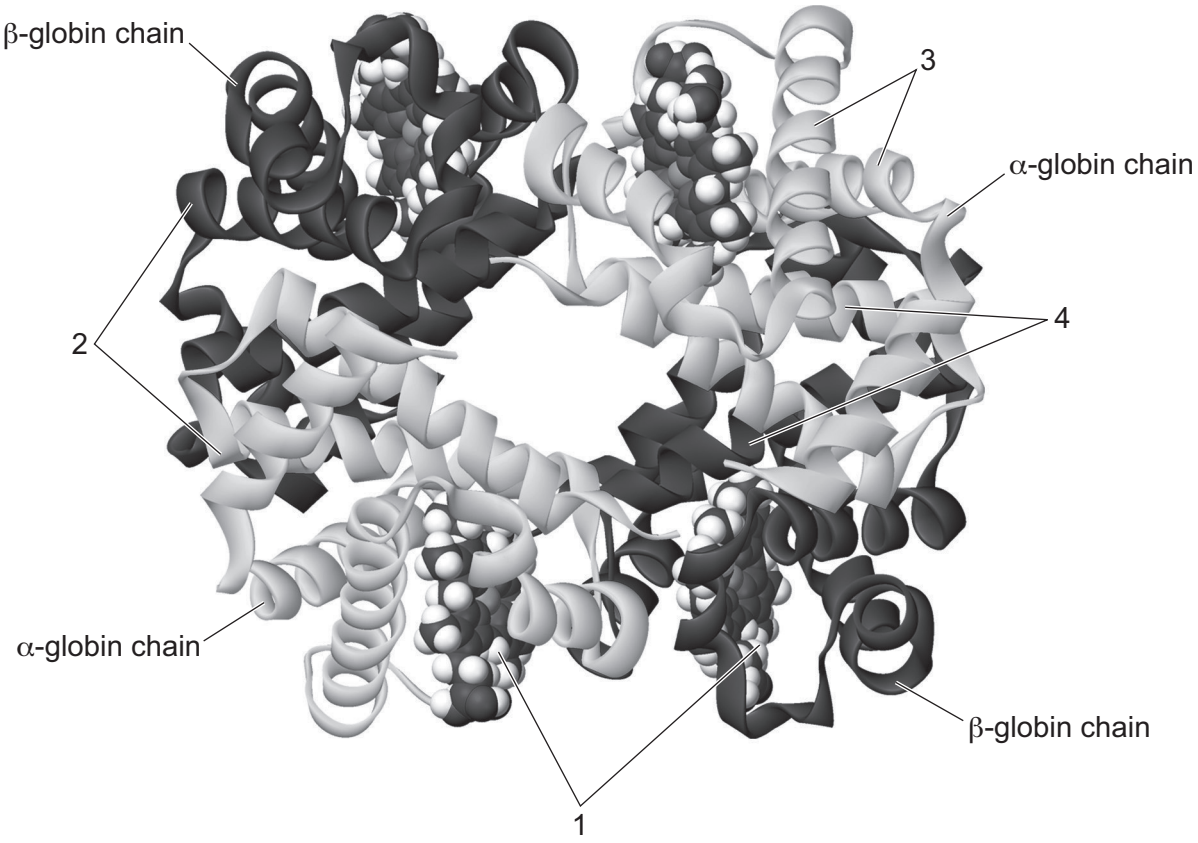
D







12 The diagram shows a haemoglobin molecule.



Which row identifies the different parts of the molecule?

	1	2	3	4
A	α-helix	β-pleated sheet	binding site	hydrophobic amino acids
B	binding site	hydrophilic amino acids	α-helix	hydrophobic amino acids
C	haem group	hydrophobic amino acids	α-helix	hydrophilic amino acids
D	hydrophobic amino acids	β-pleated sheet	haem atom	binding site

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[Turn over

13 Bacterial cells divide by a process called binary fission.

Which macromolecules must be synthesised for binary fission?

1 cell membrane proteins and RNA

2 DNA and peptidoglycan

3 enzymes and cellulose

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

14 A student carried out experiments to investigate the effect of enzyme concentration on the rate of hydrolysis (break down) of protein in milk.

When the enzyme and milk were mixed, the protein was hydrolysed and the mixture changed from cloudy to clear.

The student investigated five different enzyme concentrations and recorded the time taken to reach the end-point for each.

What is an appropriate control for this investigation?

A Carrying out a further experiment where the enzyme solution is replaced with water.

B Carrying out each experiment in a thermostatically regulated water-bath at 35 °C.

C Performing three repeat experiments for each of the five enzyme concentrations.

D Using the same volume of enzyme solution for each of the five experiments.

15 What determines the specificity of an enzyme?

1 the bonding between R groups of the polypeptide

2 the optimum pH of the enzyme

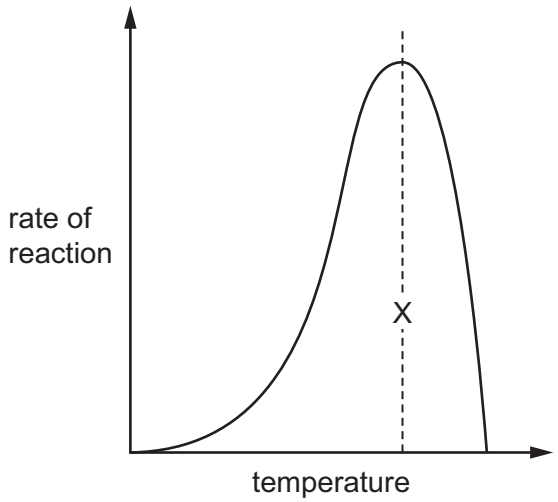
3 the peptide bonds between amino acids of the polypeptide

4 the shape of the substrate molecule

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

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16 The graph shows the effect of temperature on the rate at which the enzyme in a biological washing powder digests and removes fruit juice stains.



Which statements explain the shape of the graph at temperatures higher than X?

1 Bonds are broken between the R groups of the amino acids in the polypeptide chains of the enzyme.

2 There are more collisions between the enzyme and its substrate.

3 The tertiary structure of the enzyme is altered.

4 The shapes of the active site and the substrate are no longer complementary.

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

17 What describes a carrier protein in cell surface membranes?

A a glycoprotein that is found on the outer surface of the membranes allowing cell recognition

B a glycoprotein that is involved in moving substances through the membranes by both active and passive transport

C a protein that allows the attachment of signalling molecules which brings about changes within the cell

D a protein that is involved in moving substances through the membranes by passive transport through water-filled pores

18 What could happen to a typical bacterium when it is placed in surroundings which have a less negative water potential than that inside the cell?

A The bacterium will burst because the cell wall has no structural function.

B The bacterium will die since water leaves the cell by osmosis.

C There is no change because the cell wall is impermeable to water.

D There will be a net movement of water into the bacterium.

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19 By which process do hydrogencarbonate ions leave red blood cells?

A active transport

B endocytosis

C facilitated diffusion

D phagocytosis

20 In an experiment, fluorescent dyes were used to label proteins on the outer surface of cell surface membranes. Living human cells were labelled with one colour of fluorescent dye and mouse cells with a different colour of fluorescent dye.

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

At first, the different fluorescent labels remain separate, but after 40 minutes they are distributed randomly across the hybrid cell surface membrane.

What does this experiment show?

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

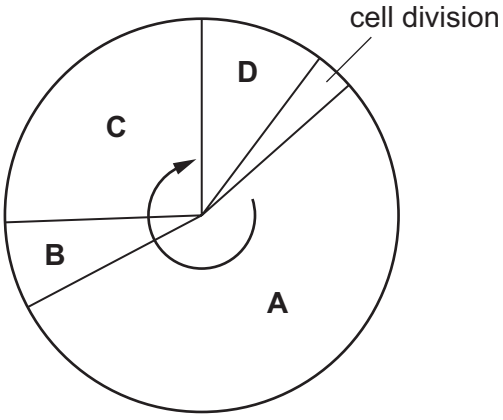
B Proteins in the outer layer of a bilayer do not penetrate into the inner layer.

C Proteins move freely in the phospholipids of a bilayer.

D The cell surface membranes of the two cells are bilayers.

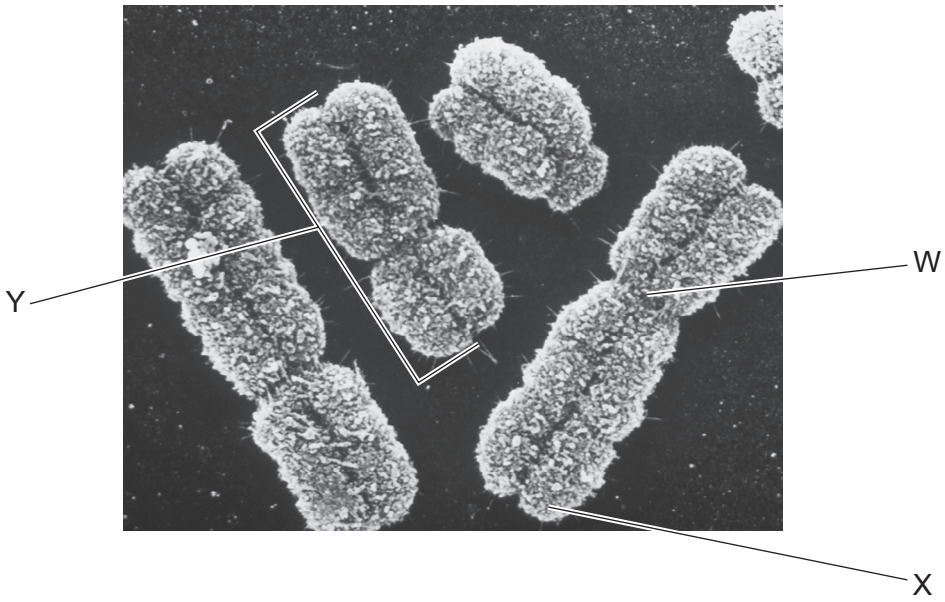
21 The diagram shows the mitotic cell cycle.

During which phase is DNA replicated?



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22 The electron micrograph shows a group of human chromosomes.



Which label is correct for each of the structures labelled W, X and Y?

	W	X	Y
A	centriole	centromere	chromatid
B	centriole	centromere	microtubule
C	centromere	telomere	chromatid
D	centromere	telomere	microtubule

23 Which statement about the behaviour of chromosomes during mitosis is correct?

A They attach to the spindle fibres to contain them within the nucleus.

B They condense to prevent further translation of genes.

C They reach the poles of the cell and become longer and thinner.

D They replicate to produce sufficient DNA to form two new nuclei.

24 What is the smallest unit of a DNA molecule that can be altered by a mutation **and** cause a change to the coding of a polypeptide?

A base

B codon

C gene

D nucleotide

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[Turn over

25 Which statements about tRNA are correct?

1 contains base pairing

2 contains hydrogen bonds

3 is single stranded

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

26 The table shows the role of four different proteins involved in DNA replication.

protein	helicase	topoisomerase	single-strand binding protein	DNA polymerase
role	unwinds the parental DNA double helix	breaks and rejoins the DNA strands	binds to separated DNA strands to stabilise them	synthesises strand of DNA

Which shows the function of these proteins?

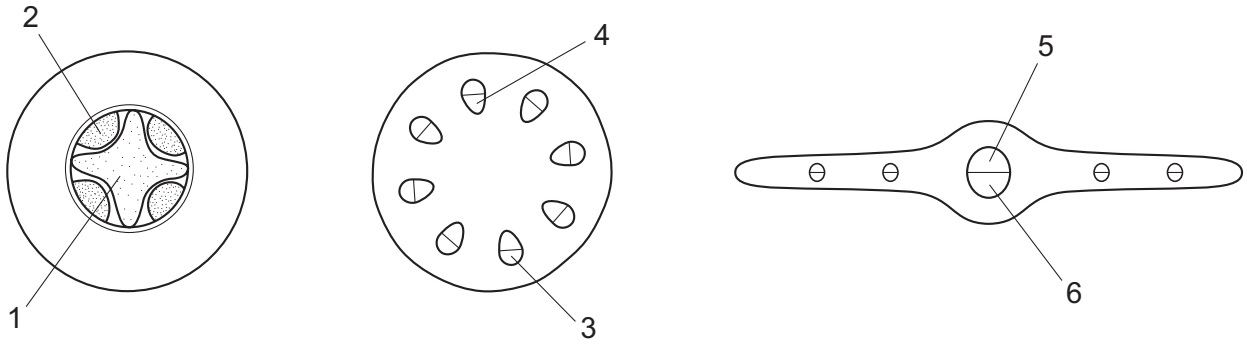
	helicase	topoisomerase	single-strand binding protein	DNA polymerase
A	adds DNA nucleotides to the 3' end of a growing polynucleotide strand	prevents original strands reforming complementary base pairs	enables tension caused by unwinding to be released	makes strands available as templates
B	enables tension caused by unwinding to be released	prevents original strands reforming complementary base pairs	makes strands available as templates	adds DNA nucleotides to the 3' end of a growing polynucleotide strand
C	enables tension caused by unwinding to be released	makes strands available as templates	adds DNA nucleotides to the 3' end of a growing polynucleotide strand	prevents original strands reforming complementary base pairs
D	makes strands available as templates	enables tension caused by unwinding to be released	prevents original strands reforming complementary base pairs	adds DNA nucleotides to the 3' end of a growing polynucleotide strand

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27 Which type of sugar and which type of bond are found in a DNA molecule?

	type of sugar	type of bond
A	non-reducing	glycosidic
B	non-reducing	hydrogen
C	reducing	peptide
D	reducing	hydrogen

28 The diagrams represent transverse sections of three plant organs.



Which row is correct for phloem?

	root	stem	leaf
A	1	3	5
B	1	4	6
C	2	3	6
D	2	4	5

29 Sucrose moves from a phloem sieve tube element into a root cell.

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

	water potential	volume of liquid
A	becomes higher	decreases
B	becomes higher	increases
C	becomes lower	decreases
D	becomes lower	increases

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[Turn over

30 Which statements about water movement in plants are correct?

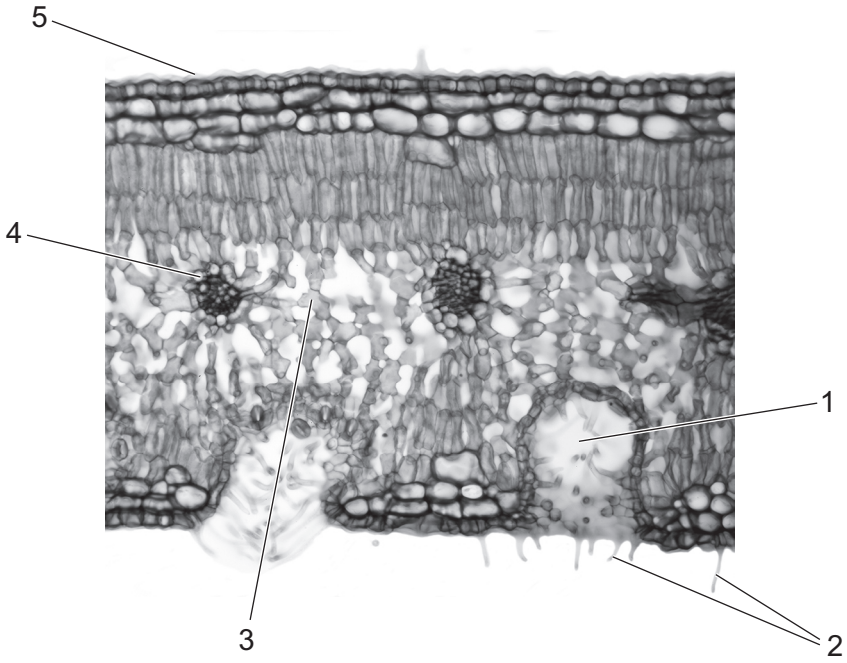
1 Water can pass through cellulose cell walls.

2 Water can pass through lignified cell walls.

3 Water cannot pass through suberin in cell walls.

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

31 The photomicrograph is a transverse section of a leaf.



Which features are characteristic of xerophytes?

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

32 A maize crop is successfully growing in a field in which the water potential of the soil is –40 KPa.

What is the most likely water potential of the cell sap in the root hair cell?

A –60 KPa **B** –40 KPa **C** –20 KPa **D** 0 KPa

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33 The contraction of the heart is coordinated through electrical impulses passing through the cardiac muscle.

Which is the correct order of part of the sequence of these impulses?

A right and left atria → sinoatrial node → atrioventricular node → ventricular walls

B sinoatrial node → right and left atria → atrioventricular node → Purkyne tissue

C sinoatrial node → right and left atria → Purkyne tissue → atrioventricular node

D sinoatrial node → right and left atria → Purkyne tissue → ventricular walls

34 Which features enable the aorta to withstand ventricular systole?

A collagen fibres and elastin fibres

B collagen fibres and smooth muscle

C elastin fibres and endothelium

D endothelium and smooth muscle

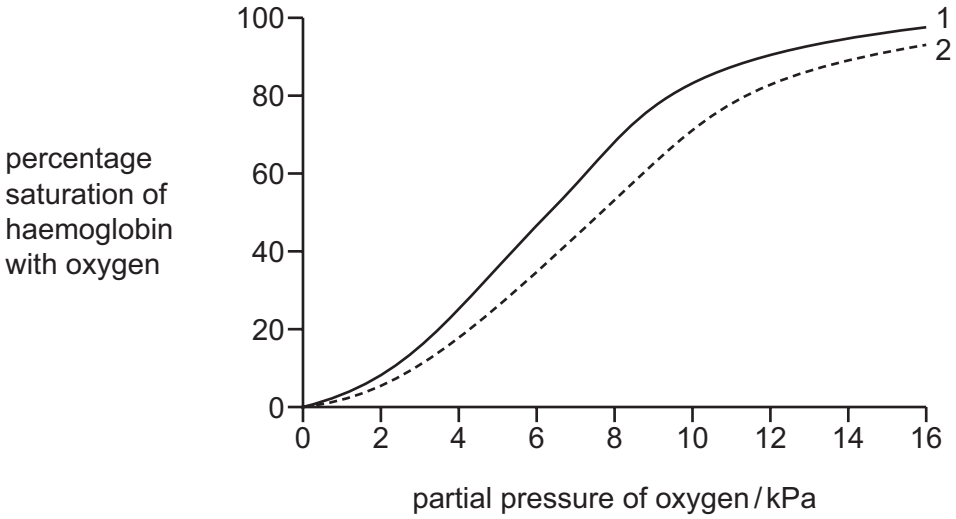
35 Which row is correct for the pulmonary artery?

	blood carried	muscle in walls	lumen size
A	deoxygenated	thick	small
B	deoxygenated	thin	large
C	oxygenated	thick	small
D	oxygenated	thin	large

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[Turn over

36 The graph shows oxygen dissociation curves of adult oxyhaemoglobin in different carbon dioxide concentrations, 1 and 2.



Which conditions could change the shape of curve 1 to the shape of curve 2?

A high carbon dioxide concentration causing a decrease in pH

B high carbon dioxide concentration causing an increase in pH

C low carbon dioxide concentration causing a decrease in pH

D low carbon dioxide concentration causing an increase in pH

37 Which characteristic of the human gaseous exchange surface and the lungs, maintains the necessary concentration gradients for carbon dioxide and oxygen?

A good ventilation of the lungs

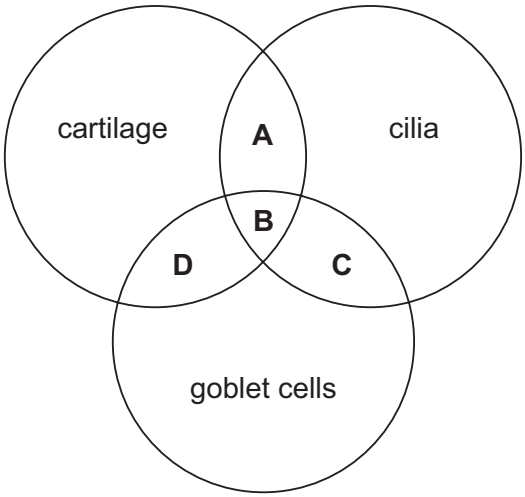
B large surface area of the alveoli

C low resistance to air flow

D the walls of the alveoli are thin

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38 Which identifies the tissues present in the trachea?



39 The global mortality figures for some diseases in 2002 are shown in the table.

cause of death	millions of deaths	percentage of all deaths
HIV / AIDS	2.8	4.4
TB	1.6	2.7
malaria	1.3	2.2
measles	0.6	1.1

How many millions of people died in 2002 from the bacterial diseases listed in the table?

A 0.6 **B** 1.6 **C** 2.2 **D** 2.7

40 B-lymphocytes and T-lymphocytes are often unable to respond to the antigens on pathogens that are intracellular parasites.

What is the reason for this?

A The antigens are constantly mutating.

B The antigens can destroy the lymphocytes.

C The lymphocytes do **not** encounter the antigens.

D The lymphocytes do **not** recognise the antigens.

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BIOLOGY **9700/12**

Paper 1 Multiple Choice **May/June 2017**

1 hour

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

MODIFIED LANGUAGE

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1 Which organelles are enclosed in a single phospholipid bilayer and contain hydrolytic enzymes?

A endocytotic vesicles

B Golgi body

C lysosomes

D mitochondria

2 The DNA of prokaryotes is naked and circular.

Which statement describes how the DNA of eukaryotes differs from that of prokaryotes?

A It has a nuclear envelope around it and is a double helix.

B It has a nuclear envelope around it and is circular.

C It has proteins attached to it and is a double helix.

D It has proteins attached to it and is linear.

3 The recently discovered *Pandoravirus* measures 1000 nm in diameter.

The *Mimivirus* has a diameter of 400 nm.

What can be detected using a light microscope with a maximum resolution of 0.25 μm?

A both the *Mimivirus* and the *Pandoravirus*

B neither the *Mimivirus* nor the *Pandoravirus*

C the *Mimivirus,* but not the *Pandoravirus*

D the *Pandoravirus*, but not the *Mimivirus*

4 What are found in chloroplasts **and** mitochondria?

1 DNA

2 70S ribosomes

3 mRNA

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

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5 Boiling the bones and teeth from dead animals can be used to produce a type of glue.

The glue is formed from the collagen fibres present in bones and teeth.

Which statement describes the changes to collagen that occur when the glue is produced?

A The fibres of collagen become more coiled.

B The fibres of collagen become more flexible.

C The helices of collagen molecules unwind.

D The molecules of collagen dissolve in water.

6 What describes the primary structure of a protein?

A α-helix

B a dipeptide

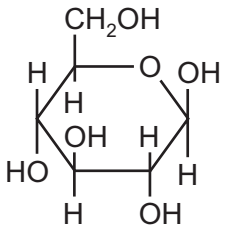
C a globular structure

D the specific order of amino acids

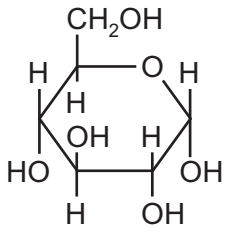
7 The diagrams show four monosaccharides with the formula $C_6H_{12}O_6$.

Which diagram shows α-glucose?

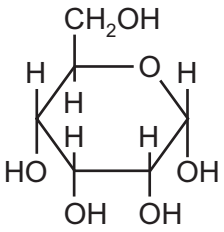
A



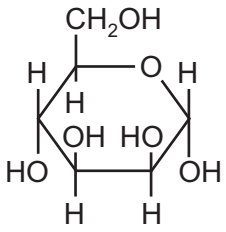
B



C



D



8 Complete digestion of polysaccharides requires all the glycosidic bonds between the monomers to be broken.

Amylase only breaks α-1,4 glycosidic bonds.

Which row shows how completely amylase can digest molecules of cellulose, amylopectin or amylose?

	polysaccharide		
	cellulose	amylopectin	amylose
A	–	++	+
B	–	+	++
C	+	++	–
D	++	–	+

key

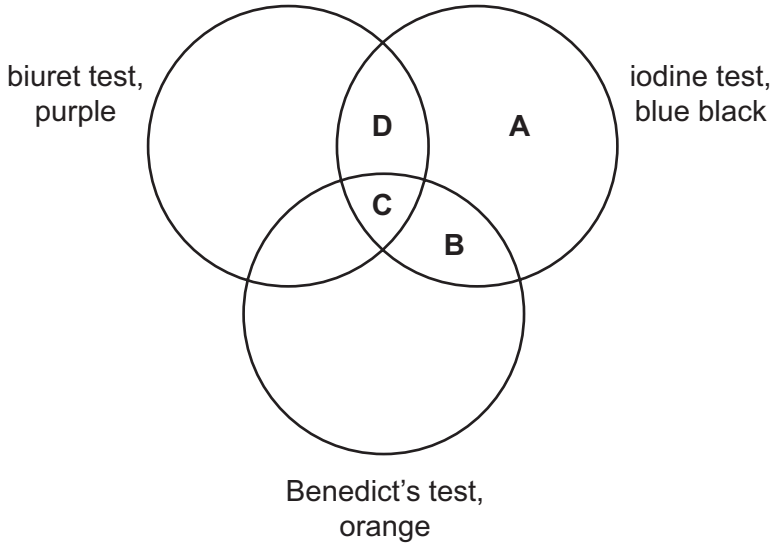
– no digestion

\+ some digestion

++ most digestion

9 The diagram shows the results of tests on four solutions containing biological molecules.

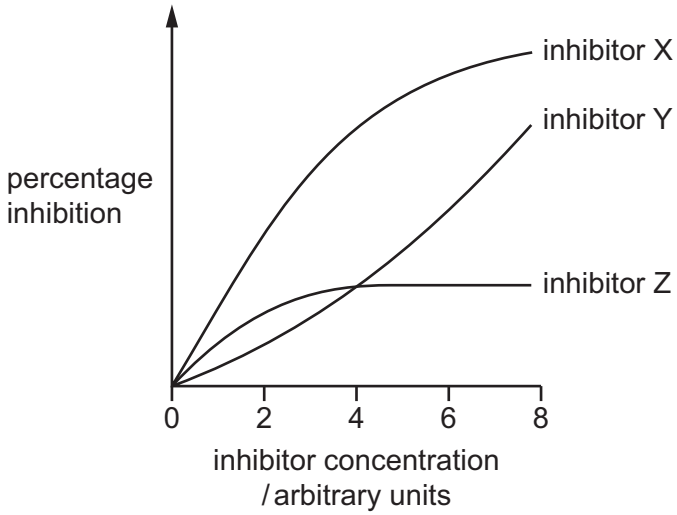
Which shows the solution that contains only starch and protein?



10 The enzyme invertase catalyses the breakdown of sucrose to glucose and fructose.

Three different enzyme inhibitors of invertase X, Y and Z were investigated. The percentage inhibition of invertase was measured at different concentrations of inhibitor.

The graph shows the result of the investigation.



Which are valid conclusions from these results?

1 The higher the concentration of inhibitor X, the less sucrose is broken down.

2 The production of glucose and fructose using inhibitor Y is higher than when inhibitor Z is used.

3 The production of glucose and fructose at an inhibitor concentration of 2 arbitrary units is lower than at an inhibitor concentration of 4 arbitrary units, for all inhibitors.

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

11 The following statements are about enzymes.

1 Folding of an enzyme molecule causes the formation of the active site.

2 The shape of the active site changes to enable the substrate to bind.

3 Temporary bonds hold the substrate in the active site.

4 More enzyme-substrate complexes are formed at the optimum temperature.

Which statements are correct for the induced fit hypothesis?

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

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12 How is the Michaelis-Menten constant (K_m) used?

A to assess the efficiency of an enzyme in catalysing a reaction

B to compare the affinity of enzymes for their substrate

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

D to find the rate at which substrate is loaded by an enzyme

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

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

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

What explains this observation?

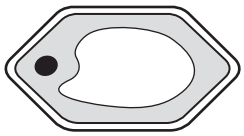
A All protein molecules in the cell surface membrane are fixed to structures within the cell, but phospholipid molecules move freely between them.

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

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

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

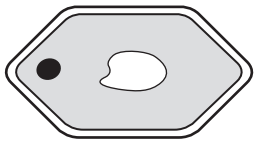
14 The diagram shows a plant cell.



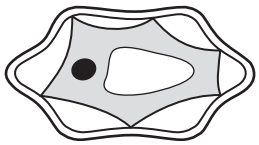
The plant cell is put into a solution with a water potential less negative than the cell contents.

What will happen to the appearance of the cell?

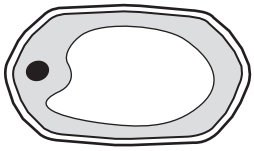
A



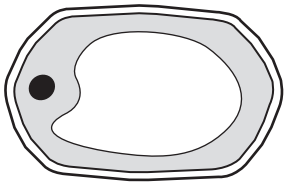
B



C

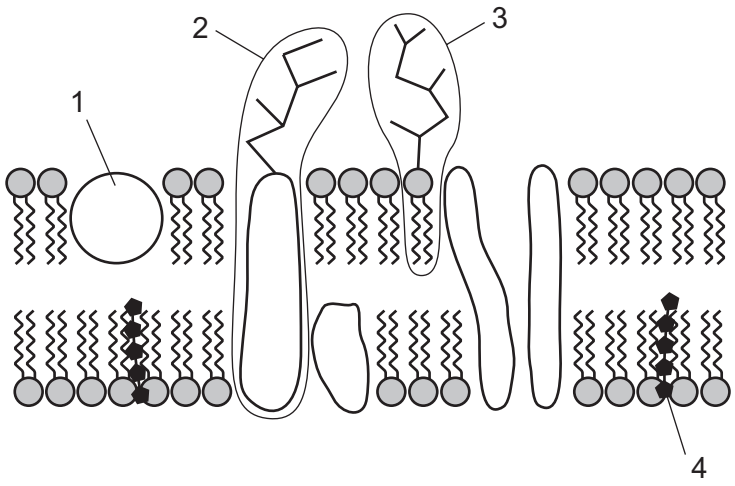


D



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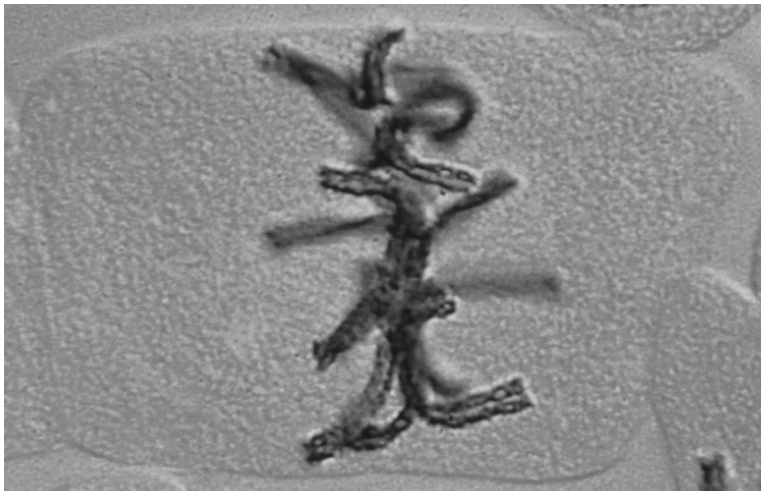
15 The diagram shows the fluid mosaic model of membrane structure.



Which molecules in the membrane are identical?

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

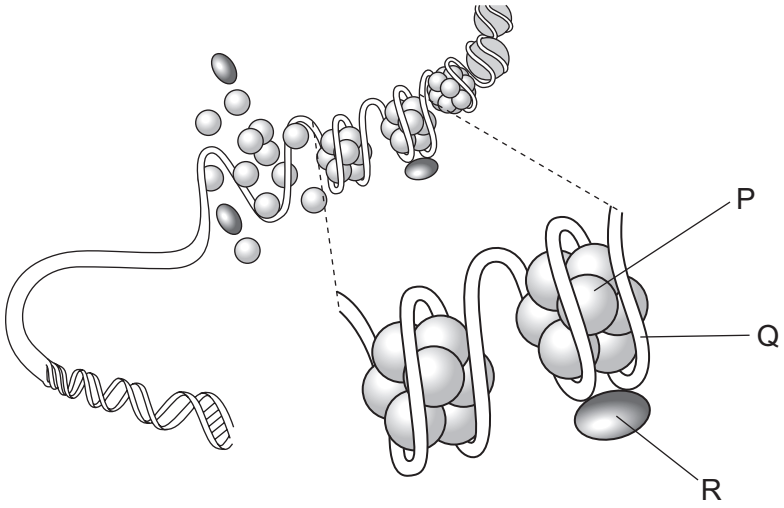
16 The photomicrograph shows a stage of mitosis.



What would be correct for the next stage in mitosis?

	paired chromatids	nuclear membrane
A	absent	absent
B	absent	re-forming
C	present	absent
D	present	breaking down

17 The diagram shows part of the organisation of a DNA molecule and the associated histones.



Which statement about the features labelled P, Q and R during prophase of mitosis is correct?

A The coiled DNA molecule forms Q and wraps around the histones of R to form small clusters held in place by histone P.

B The groups of histones, P, and its associated DNA, Q, move closer together as the chromosome condenses around R.

C The histones P and R are made of protein around which the DNA molecule, Q, is wrapped so that the DNA molecule can fit inside the nucleus.

D The linked groups of histones P and R and the associated DNA, Q, form strands that fold and twist together to form a chromatid.

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18 The bacterium *Escherichia coli* divides once every 50 minutes at 36 °C.

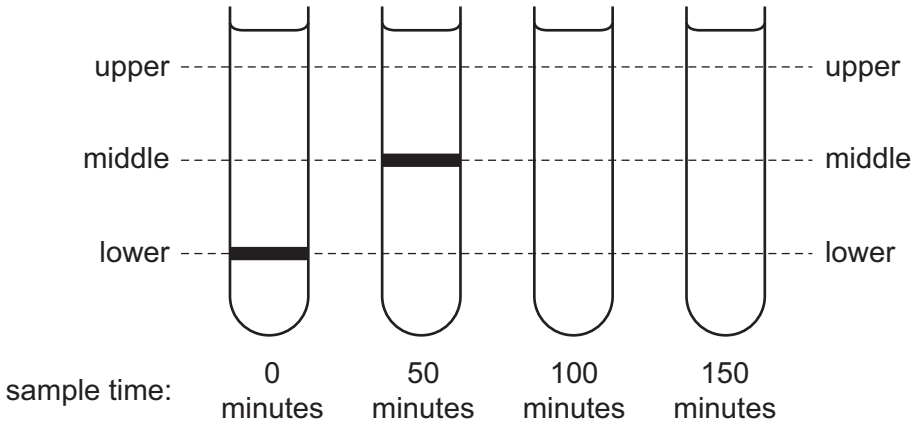
E. coli were grown on a medium containing only heavy nitrogen, ^{15}N, until all of the bacterial DNA contained heavy nitrogen (0 minutes).

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

Some bacteria were collected after each of three generations. Their DNA was extracted and centrifuged.

Hybrid DNA contains heavy and light nitrogen.

The diagram shows the possible positions (upper, middle and lower) of the bands of DNA. The actual positions of bands in the first two samples are shown.



Which proportion of the DNA of the sample taken at 150 minutes will be at the upper position?

A 25% **B** 50% **C** 75% **D** 100%

19 Different tissues in a plant were supplied with a radioactively labelled substance to identify which tissues were actively synthesising mRNA.

Which radioactively labelled substances would be most suitable for this experiment?

1 adenine

2 ribose

3 inorganic phosphate

4 uracil

A 1, 2, 3 and 4

B 1, 2 and 3 only

C 2 and 4 only

D 4 only

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20 Electron micrographs may show large numbers of ribosomes forming chains along mRNA molecules.

What is the advantage of this arrangement, compared to when ribosomes appear singly on the mRNA?

A Different polypeptides can be produced simultaneously.

B Fewer tRNA molecules are required to translate the polypeptide.

C Large polypeptide chains can be produced.

D Polypeptides can be produced more rapidly.

21 Which row is correct for adenine?

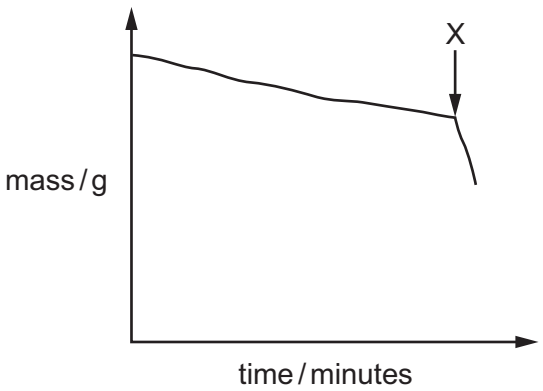
	has a single ring structure	is a purine	joins to its complementary base with 3 hydrogen bonds
A	✓	✓	✓
B	✓	✗	✗
C	✗	✓	✗
D	✗	✗	✓

key

✓ = correct

✗ = incorrect

22 The graph shows the loss of mass in a potted plant due to transpiration.



What could have occurred at point X on the graph?

A A plastic bag was placed around the plant.

B The lower epidermis was sealed with petroleum jelly.

C The plant was placed into a dark cupboard.

D Warm moving air was blown over the plant.

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23 Which row is correct for a phloem sieve tube element?

	cell surface membrane	cytoplasm	nucleus	80S ribosomes
A	✓	✓	✓	✓
B	✓	✓	✓	✗
C	✓	✓	✗	✗
D	✗	✗	✗	✗

key

✓ = present

✗ = absent

24 An aphid, such as a greenfly, uses a tubular mouthpart called a stylet to feed on nutrients in the plant.

It inserts the stylet through the surface of a stem or leaf.

When a stylet is cut near the aphid's head, leaving the stylet in the plant, a liquid with a low water potential continues to flow out of the plant.

Which statement explains this?

A The stylet is in a phloem sieve tube element in which there is a high concentration of solutes.

B The stylet is in a phloem sieve tube element in which there is a low concentration of solutes.

C The stylet is in a xylem vessel element in which there is a high concentration of solutes.

D The stylet is in a xylem vessel element in which there is a low concentration of solutes.

25 Which statement correctly describes transport pathways in dicotyledonous plants?

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

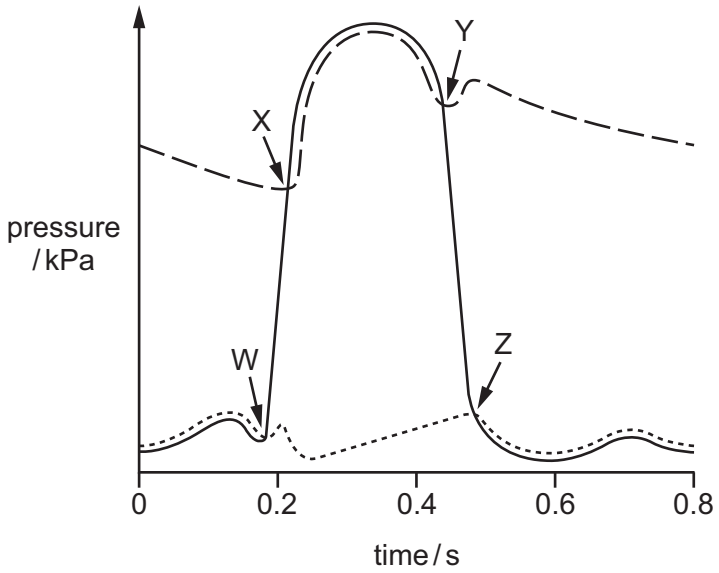
B In the symplast pathway, water may move through intercellular spaces.

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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26 The graph shows pressure changes during a cardiac cycle.



Which row correctly identifies W, X, Y, and Z?

	W	X	Y	Z
A	atrioventricular valves close	semi-lunar valves close	semi-lunar valves open	atrioventricular valves open
B	atrioventricular valves close	semi-lunar valves open	semi-lunar valves close	atrioventricular valves open
C	semi-lunar valves close	atrioventricular valves open	atrioventricular valves close	semi-lunar valves open
D	semi-lunar valves open	atrioventricular valves close	atrioventricular valves open	semi-lunar valves close

27 What is systolic blood pressure?

A the blood pressure in the arteries when the heart is relaxing

B the blood pressure in the left ventricle at the end of a contraction

C the maximum blood pressure in the arteries

D the maximum blood pressure in the right ventricle

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28 When they remain at high altitudes the red blood cell count of humans increases.

Why does this occur?

1 to increase the Bohr effect

2 to increase the diffusion gradient for oxygen in the lungs

3 to maintain transport of oxygen

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

29 Which comparisons of blood, tissue fluid and lymph are correct?

1 Blood has a higher concentration of proteins than tissue fluid because the larger proteins are too big to pass through the endothelial pores into tissue fluid.

2 Lymph has a higher concentration of lymphocytes than tissue fluid as a high number of lymphocytes are located in lymph nodes.

3 Macrophages are too large to leave the blood to enter tissue fluid whereas neutrophils, which are much smaller, can enter tissue fluid and pass into lymph.

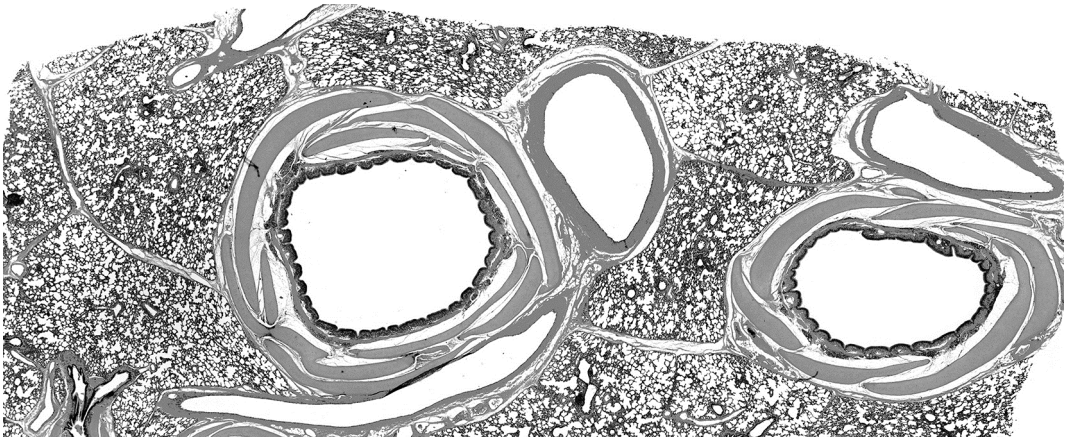
A 1, 2 and 3 **B** 1 and 2 only **C** 2 and 3 only **D** 3 only

30 A number of different tissues occur in the walls of major blood vessels.

Which row correctly identifies the main tissues found in the three layers of the wall of an artery?

	outer layer (tunica externa)	middle layer (tunica media)	inner layer (tunica intima)
A	collagen	elastic	endothelium
B	collagen	muscle	elastic
C	elastic	collagen	endothelium
D	muscle	collagen	elastic

31 The photomicrograph shows a section through lung tissue.



Which structures are present in this photomicrograph?

	artery	vein	bronchioles	bronchus	trachea
A	✓	✓	✗	✓	✗
B	✓	✗	✓	✗	✓
C	✗	✓	✓	✓	✗
D	✗	✗	✗	✓	✓

key

✓ = present

✗ = absent

32 An athlete who smokes just before a race may not be able to run at their maximum speed because less oxygen is carried by the blood.

Which explanation is correct?

A Carbon dioxide binds to haemoglobin forming carbaminohaemoglobin.

B Carbon dioxide binds to haemoglobin forming carboxyhaemoglobin.

C Carbon monoxide binds to haemoglobin forming carbaminohaemoglobin.

D Carbon monoxide binds to haemoglobin forming carboxyhaemoglobin.

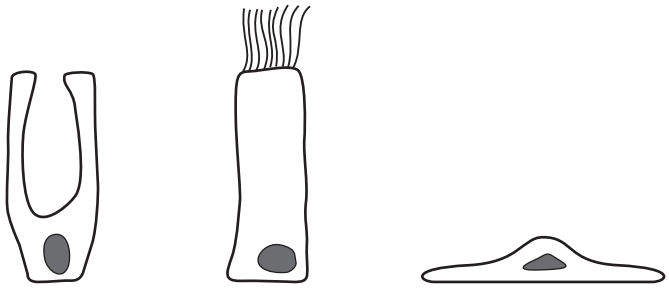
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33 Some of the requirements of an efficient gas exchange system are a large surface area and a short diffusion distance.

What is correct about how alveoli are adapted to meet these requirements?

	large surface area	short diffusion distance
A	collagen and elastin fibres that allow the alveoli to stretch	an extracellular layer round the alveolus wall contains blood capillaries
B	gases dissolve in a layer of liquid to speed up diffusion	walls of alveoli are squamous epithelium
C	many folded interconnected alveoli	capillaries are next to alveolus wall
D	sac shape of alveoli formed by squamous cells	red blood cells are very close to capillary walls

34 The diagram shows three types of cell found in the human gas exchange system.



Apart from causing cancer, which cell types will be directly affected when a person is exposed to tar in cigarette smoke?

A X, Y and Z **B** X and Y only **C** X and Z only **D** Y and Z only

35 Some common antibiotics are listed. The action of each antibiotic is described.

1 rifampicin – inhibits RNA polymerase

2 streptomycin – inhibits 70S ribosomes

3 neomycin – inhibits DNA synthesis

4 ampicillin – inhibits peptidoglycan synthesis

Which of these antibiotics will affect the activities of bacterial cells **only**?

A 1, 2, 3 and 4

B 1, 2 and 3 only

C 2 and 4 only

D 4 only

36 What could cause an outbreak of malaria in a country after it had been eliminated?

1 mosquitoes become resistant to insecticides

2 migration of population due to war

3 malarial parasites become resistant to quinine

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

37 Which disease is caused by a bacterium and can be spread by airborne droplets?

A cholera

B measles

C smallpox

D tuberculosis (TB)

38 Smallpox has been eradicated, but malaria and cholera have not.

Which statements correctly explain this?

1 Cholera pathogens in the intestines are not destroyed by antibiotics.

2 Plasmodium antigens change during the life cycle.

3 Smallpox antigens remain stable.

4 Vaccines only work against viruses.

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

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39 When a person is given a vaccination immunity to certain pathogens develops.

Which of the effects of vaccination are correct?

1 production of antibodies to protect against future infections

2 results in artificial active immunity

3 stimulation of appropriate lymphocytes

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

40 What is the first response by the immune system to a pathogen?

A ingestion of the pathogen by phagocytes

B production of antibodies

C production of antigens

D stimulation of B memory cells

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BIOLOGY **9700/13**

Paper 1 Multiple Choice **May/June 2017**

1 hour

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

9519836939

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 Where are cisternae found in a cell?

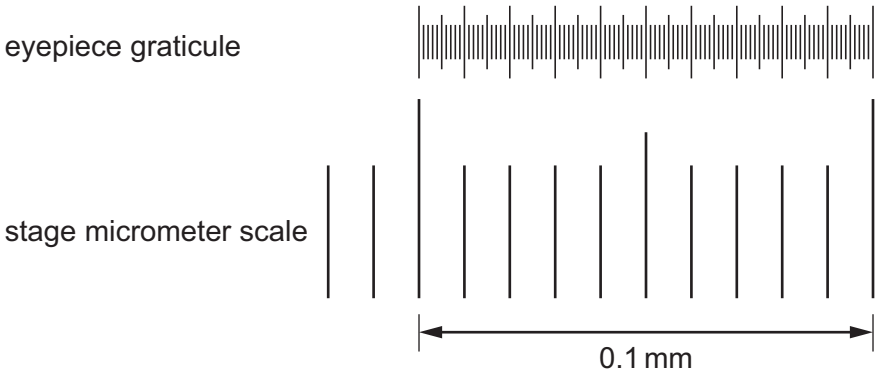
1 endoplasmic reticulum

2 Golgi body

3 mitochondrion

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

2 The diagram shows an eyepiece graticule and part of a stage micrometer scale as seen using ×100 magnification.



How is the value, in μm, of one eyepiece graticule unit calculated?

A divide 100 by 0.1 and multiply by 1000

B divide 100 by 0.1 and multiply by 1000 divided by 100

C multiply 0.1 by 1000 and divide by 100

D multiply 0.1 by 1000 and divide by 100 then divide again by 100

3 It is possible for a bacterium to synthesise a eukaryotic protein.

This involves introducing a eukaryotic gene into the bacterial DNA, which can be translated.

What explains why a bacterial cell can produce a eukaryotic protein but cannot produce a eukaryotic glycoprotein?

A Bacteria do not have 70S ribosomes.

B Bacteria do not have a nuclear envelope.

C Bacteria do not have Golgi bodies.

D Bacteria do not have mitochondria.

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4 Which structures are found in **both** typical eukaryotic cells **and** typical prokaryotic cells?

1 70S ribosomes

2 80S ribosomes

3 circular DNA

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

5 Steps 1–4 are used to test for a non-reducing sugar.

1 Put 5 cm^3 of solution into a test-tube.

2 Add a few drops of acid.

3 Neutralise with alkali.

4 Add 6 cm^3 Benedict's solution.

When is the solution boiled?

A between steps 1 and 2

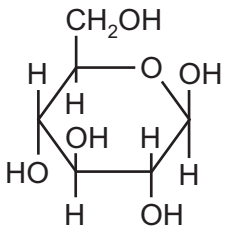
B between steps 2 and 3 and after step 4

C between steps 2 and 3 only

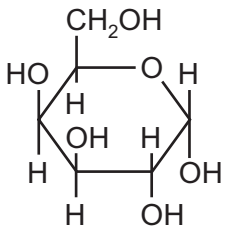
D after step 4 only

6 Which diagram shows the monomer of cellulose?

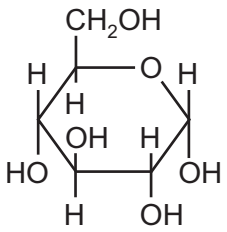
A



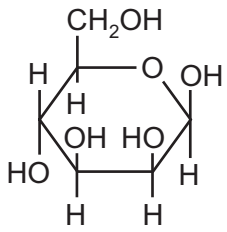
B



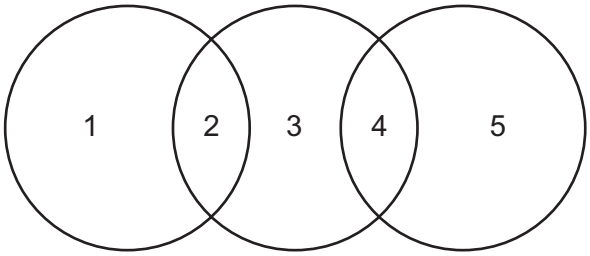
C



D



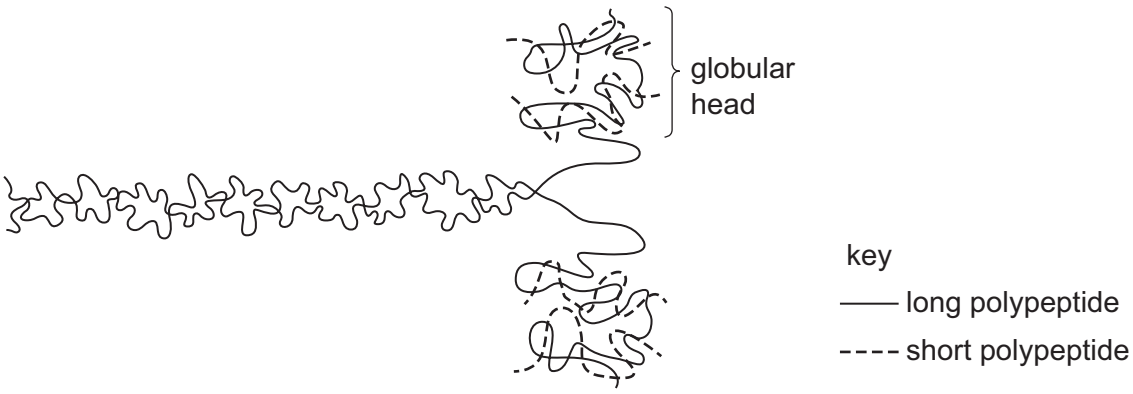
7 The diagram shows some of the relationships between cellulose, collagen and haemoglobin.



Which row is correct?

	1	2	3	4	5
A	cellulose	carbohydrate	collagen	protein	haemoglobin
B	cellulose	fibrous	haemoglobin	structural	collagen
C	haemoglobin	globular	cellulose	carbohydrate	collagen
D	haemoglobin	protein	collagen	structural	cellulose

8 The diagram shows a protein molecule.



Two long polypeptides each form α-helices for much of their length and these twist together into a fibre.

At one end, each of these polypeptides coils into a globular head.

Two short polypeptides bind to each head.

What describes the protein structure of this molecule?

A quaternary structure because each molecule consists of six polypeptides

B secondary structure because the long polypeptides form α-helices

C tertiary structure because the α-helices form a fibre

D tertiary structure because the heads form globular proteins

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9 Which statements about **both** amylose and amylopectin are correct?

1 They are polymers.

2 They are formed by hydrolysis reactions.

3 They are linear molecules.

4 They contain α-1,4 glycosidic bonds.

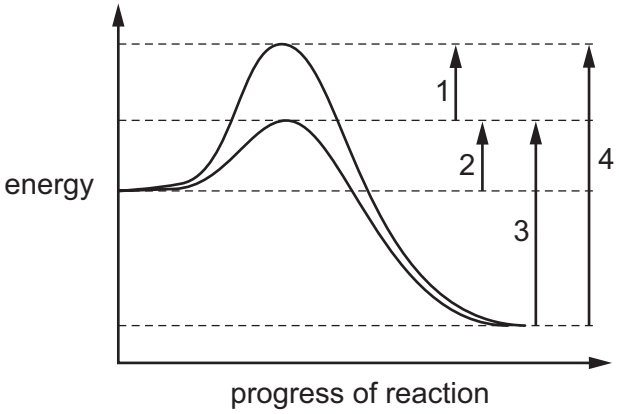
A 1, 2, 3 and 4

B 1, 2 and 4 only

C 1 and 4 only

D 2 and 3 only

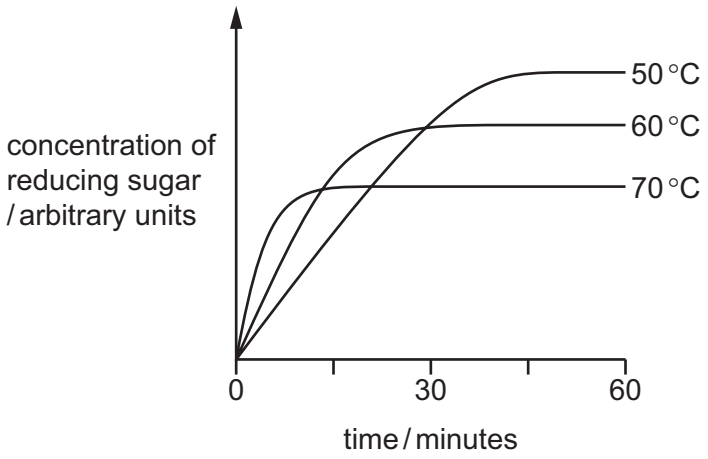
10 The graph shows energy changes in a chemical reaction.



What is the activation energy when an enzyme is added?

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

11 The graph shows the results of investigations into the effect of amylase on the hydrolysis of starch at three different temperatures.



In each investigation the concentration and volume of the solutions was kept constant.

Which conclusion may be drawn?

A 50 °C is the optimum temperature of amylase.

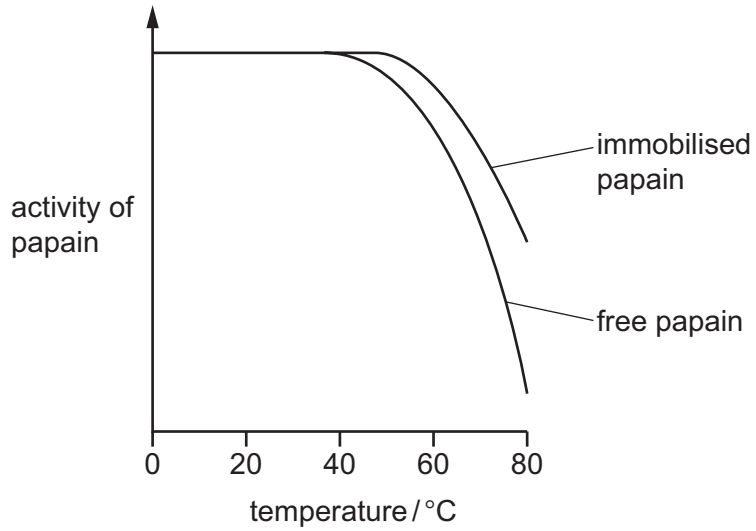
B At 60 °C all the starch is hydrolysed after 30 minutes.

C At 70 °C the amylase is denatured before hydrolysis is complete.

D The rate of hydrolysis of starch is faster at 50 °C than at 70 °C.

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12 The graph compares the effect of temperature on the activity of the protease enzyme, papain, when in solution (free) and when immobilised in alginate beads.



Which statement about the effect of immobilisation of papain is correct?

A It alters the shape of papain's active site at higher temperatures.

B It decreases the activity of papain at higher temperatures.

C It increases the stability of papain at higher temperatures.

D It reduces the number of collisions of papain with the substrate.

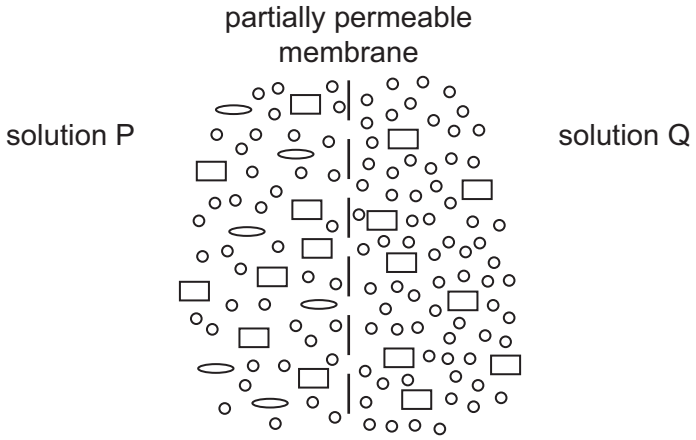
13 Which row is correct for facilitated diffusion of molecules or ions into a cell?

A	ATP required	movement against the concentration gradient	membrane protein required
B	ATP required	movement down the concentration gradient	membrane protein not required
C	ATP not required	movement against the concentration gradient	membrane protein not required
D	ATP not required	movement down the concentration gradient	membrane protein required

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[Turn over

14 The diagram represents an experiment where two solutions, P and Q, were separated by a partially permeable membrane.



What is correct about the initial movement of the molecules ○, □ and ⬭ between the two solutions, P and Q?

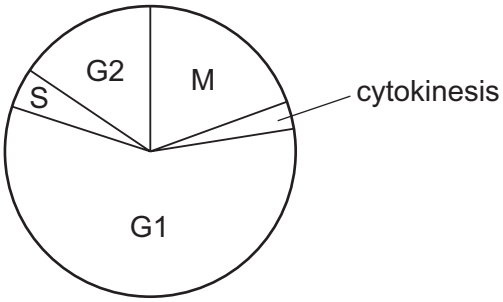
	net movement from Q to P	net movement from P to Q	no net movement
A	○	□	⬭
B	○	⬭	□
C	□	⬭	○
D	⬭	○	□

15 Which functions are correct for components of the cell surface membrane?

	stabilising the hydrophobic layer	allowing osmosis to occur	barrier to dissolved ions
A	cholesterol	phospholipids and proteins	phospholipids
B	glycolipids	phospholipids	proteins
C	phospholipids	proteins	cholesterol
D	proteins	glycoproteins and glycolipids	glycolipids

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16 The diagram shows the cell cycle of a mammalian cell.



Checkpoints in the cell cycle of mammals prevent the cycle from continuing when mistakes are made or DNA is damaged.

Four of the checkpoints are described.

1 Mitosis is blocked if DNA replication is incomplete.

2 Anaphase is blocked if the assembly of chromatids on the spindle is unsuccessful.

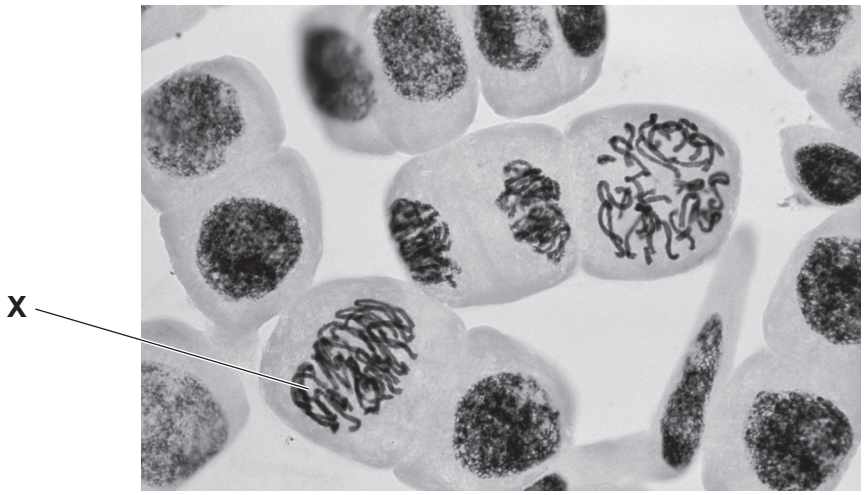
3 DNA replication is blocked if DNA is damaged.

4 DNA replication stops if damage to DNA has not been repaired.

In which phases of the cell cycle do these checkpoints occur?

	checkpoint			
	1	2	3	4
A	M	G1	S	G2
B	G2	M	G1	S
C	G2	S	G1	M
D	S	G2	M	G1

17 The photomicrograph shows cells undergoing mitosis.



Which statement describes what will happen next in cell **X**?

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

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

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

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

18 Which statement about nucleotides is correct?

A Adenine and guanine are pyrimidines.

B ATP is a phosphorylated nucleotide.

C Purines have a single ring structure.

D Uracil replaces cytosine in RNA.

19 Scientists have made a nucleic acid (HNA) that has a sugar with the same number of carbon atoms as glucose instead of deoxyribose. Although genetic information can be stored by HNA, naturally occurring DNA polymerase cannot replicate HNA.

Which statements could explain why naturally occurring DNA polymerase cannot replicate HNA?

1 DNA polymerase cannot form bonds between the sugars of two HNA nucleotides.

2 DNA polymerase cannot form hydrogen bonds between two HNA nucleotides.

3 HNA nucleotides do not fit into the active site of DNA polymerase.

4 The shape of an HNA nucleotide is slightly larger than that of a DNA nucleotide.

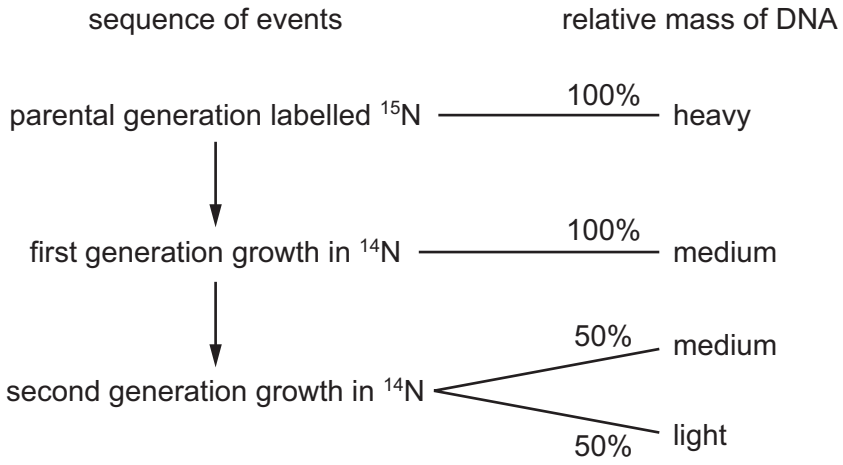
A 1, 2, 3 and 4 **B** 1 and 4 only **C** 2 and 3 only **D** 3 and 4 only

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20 Meselson and Stahl investigated DNA replication by growing bacteria in a culture containing heavy nitrogen, ^{15}N, until all the DNA was labelled.

These bacteria, the parental generation, were then transferred to a culture containing only light nitrogen, ^{14}N, and allowed to replicate for two generations.

DNA was extracted from each generation of bacteria and its relative mass estimated. The flow diagram shows the results.



Which row explains the relative mass of the DNA in the second generation grown in ^{14}N?

	50% medium DNA molecules		50% light DNA molecules	
	strand 1	strand 2	strand 1	strand 2
A	only ^{15}N	only ^{14}N	only ^{14}N	only ^{14}N
B	only ^{15}N	only ^{15}N	only ^{14}N	only ^{14}N
C	only ^{15}N	only ^{15}N	only ^{14}N	only ^{15}N
D	only ^{15}N	half ^{14}N, half ^{15}N	only ^{14}N	half ^{14}N, half ^{15}N

21 Which statement is correct?

A During transcription, mRNA is synthesised from DNA nucleotides to have the same sequence of nucleotides as the DNA strand on which it was made.

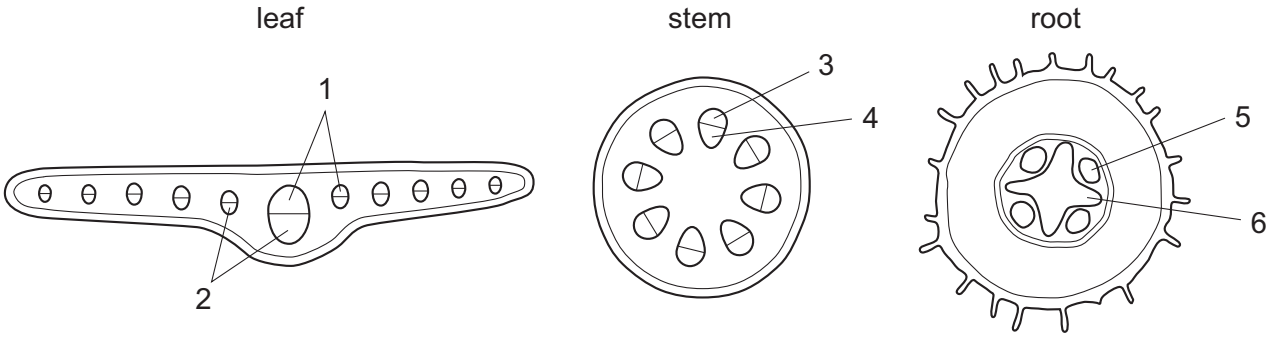
B During transcription, tRNA is synthesised from RNA nucleotides and carries codons that are complementary to the sequence of nucleotides on the DNA strand on which it was made.

C During translation, mRNA is synthesised from RNA nucleotides to have the complementary sequence of nucleotides to that of the DNA strand on which it was made.

D During translation, ribosomes join amino acids in a sequence determined by mRNA with the complementary sequence of nucleotides to that of the DNA strand on which it was made.

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



In the transverse sections, which tissues transport most amino acids?

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

key

✓ = transports most amino acids

✗ = does not transport most amino acids

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

1 Water enters the intercellular spaces.

2 Water enters the cytoplasm by osmosis.

3 Water moves from cell to cell through plasmodesmata.

4 Water moves through the cell wall.

Which statements are correct for **both** the apoplast pathway **and** the symplast pathway?

A 1, 2, 3 and 4

B 1, 2 and 3 only

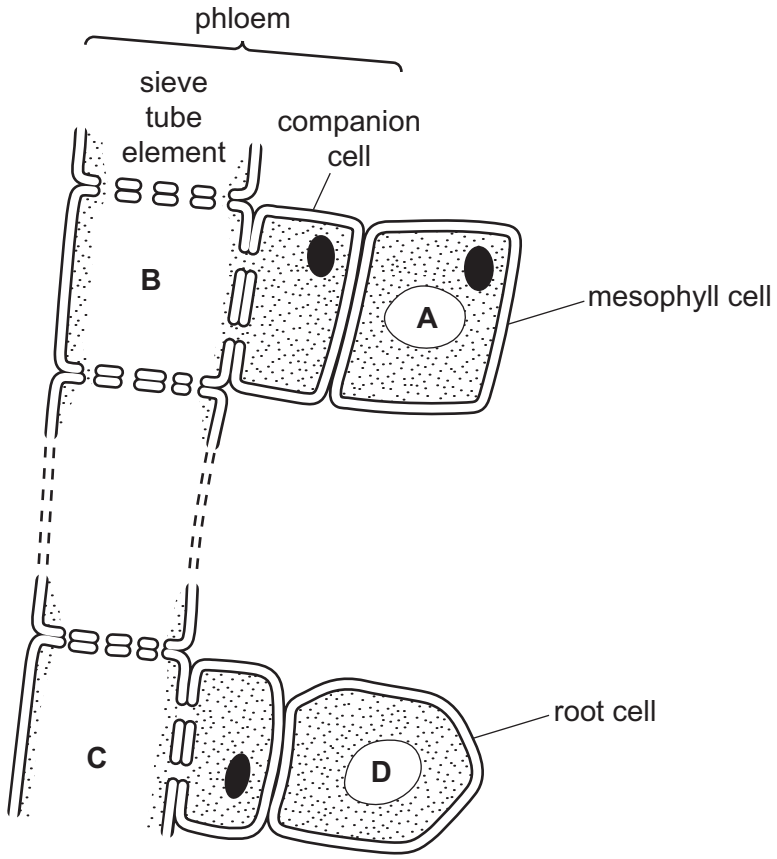
C 2 and 4 only

D 4 only

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24 The diagram shows the tissues involved in the transport of sucrose in a plant.

Where is the highest concentration of sucrose?



25 Which features adapt root hair cells for efficient absorption of water?

1 a large number of mitochondria

2 a large number of protein carriers in the cell surface membrane

3 a large surface area to volume ratio

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

26 Three areas involved in the control of heart action are listed.

1 atrioventricular node

2 Purkyne tissue

3 sinoatrial node

In which order are they involved?

A $1 \rightarrow 2 \rightarrow 3$ **B** $1 \rightarrow 3 \rightarrow 2$ **C** $3 \rightarrow 1 \rightarrow 2$ **D** $3 \rightarrow 2 \rightarrow 1$

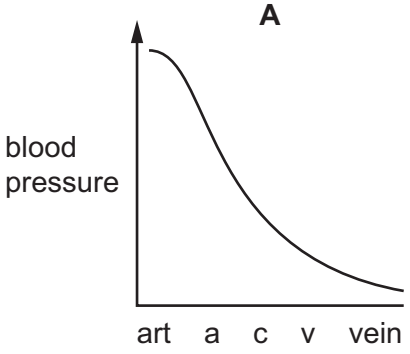
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27 As blood flows from an artery to a vein, the blood pressure in the vessels changes. The four graphs represent data for blood vessels in the sequence shown.

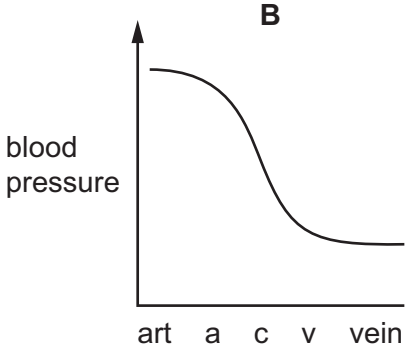
key	artery	arteriole (small artery)	capillaries	venule (small vein)	veins
	art	a	c	v	vein

Which graph shows these changes correctly?

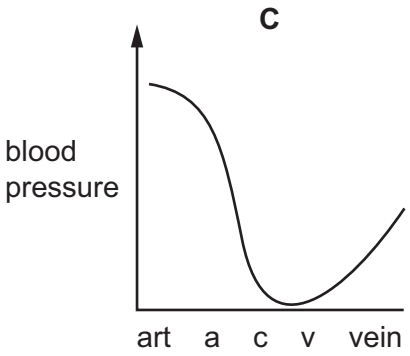
A



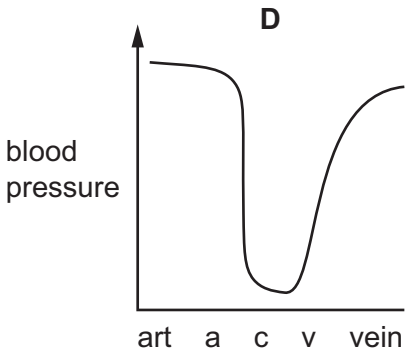
B



C



D



28 How is most carbon dioxide transported in the blood?

A as carbaminohaemoglobin

B as carbonic acid

C as hydrogencarbonate ions

D in solution in cytoplasm

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29 When a doctor or nurse takes a blood sample from a person they use a needle to penetrate a vein, not an artery.

Which reasons explain why veins are used?

1 Arteries carry blood under more pressure than veins.

2 Arteries have a thicker middle layer than veins.

3 Veins carry deoxygenated blood.

4 Veins have a larger lumen than arteries.

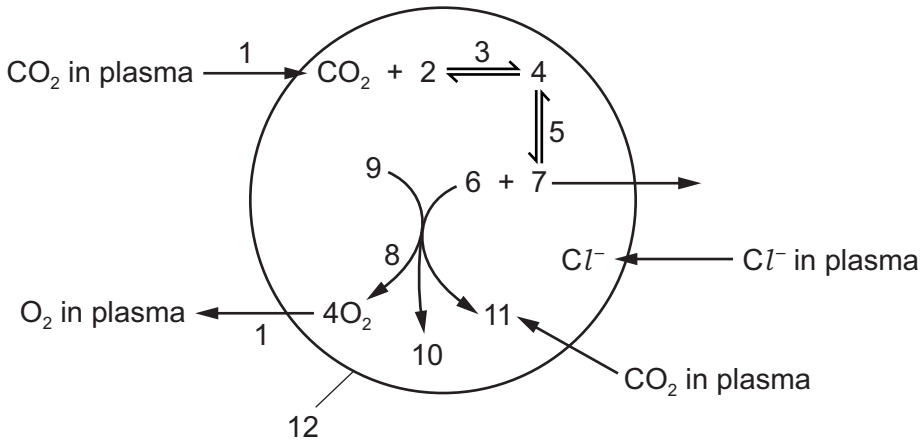
A 1, 2, 3 and 4

B 1, 2 and 3 only

C 1, 2 and 4 only

D 3 and 4 only

30 The diagram is an incomplete summary explaining the role of haemoglobin in the carriage of carbon dioxide.



Which set of labels is correct?

A 1 = facilitated diffusion, 4 = carbonic acid, 7 = hydrogencarbonate ions

B 2 = water, 8 = dissociation, 10 = carbaminohaemoglobin

C 3 = carbonic anhydrase, 9 = oxyhaemoglobin, 11 = carbaminohaemoglobin

D 5 = carbonic anhydrase, 6 = hydrogen ions, 12 = red blood cell

31 Which description of part of the gas exchange system is correct?

	part of gas exchange system	cartilage	ciliated epithelium	goblet cells	smooth muscle
A	alveolus	✗	✓	✗	✗
B	bronchus	✓	✓	✓	✓
C	bronchiole	✗	✓	✓	✗
D	trachea	✓	✓	✓	✗

key

✓ = present

✗ = absent

32 When a person suffers an asthma attack, the tubes of the gas exchange system narrow and extra mucus is produced.

Which changes occur during an asthma attack?

1 Activity of ciliated epithelium increases.

2 Endocytosis in goblet cells increases.

3 Smooth muscles are more active.

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

33 Which factors result from paralysis of cilia caused by smoking?

1 accumulation of mucus

2 increased chance of lung infection

3 emphysema

4 scarring of airway lining

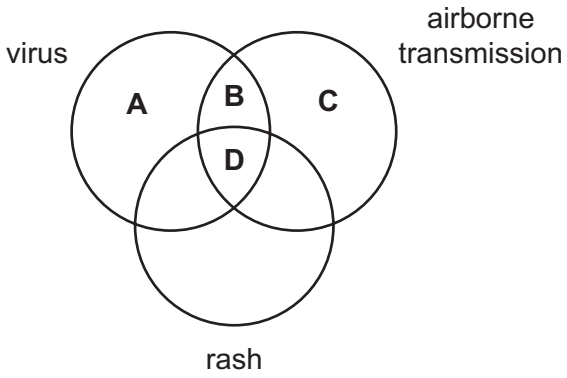
A 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

34 What is the **minimum** number of cell membranes a molecule of carbon dioxide and a molecule of oxygen pass through during gas exchange between alveoli and the plasma in the capillaries?

	carbon dioxide	oxygen
A	2	4
B	3	5
C	4	4
D	4	5

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35 Which is correct for measles?



36 Some antibiotics are used in animal feed to reduce disease.

What explains why these antibiotics should **not** be used in the treatment of human diseases?

A Human cells may stop responding to these antibiotics.

B Humans may be allergic to these antibiotics.

C Pathogenic bacteria may develop resistance to these antibiotics.

D Useful gut bacteria may be killed by these antibiotics.

37 In what order do the following processes occur to produce a population of bacteria that are resistant to a new antibiotic?

1 change in reproductive success of bacteria

2 increase in frequency of the resistance allele in the population

3 increase in genetic variation within the population

4 random mutation occurs in bacterial DNA

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

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

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

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

38 Which type of new vaccine production would be most important in the fight to eradicate measles in **developing** countries?

A a combined vaccine to combat it and other diseases

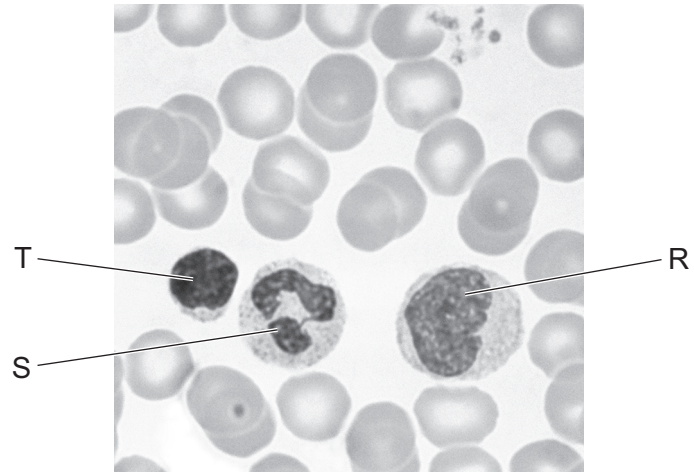
B a single vaccine, without the need for boosters

C a vaccine containing only live measles pathogens

D a vaccine containing monoclonal antibodies

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39 The photomicrograph shows human blood, with three types of white cell labelled.



Which row correctly identifies these white cells?

	cell R	cell S	cell T
A	lymphocyte	lymphocyte	lymphocyte
B	lymphocyte	phagocyte	phagocyte
C	phagocyte	lymphocyte	phagocyte
D	phagocyte	phagocyte	lymphocyte

40 A monoclonal antibody specific for a virus was produced.

This antibody was treated with an enzyme to break the bonds between the variable and constant regions.

The separated variable and constant regions were then added to cells infected with the virus.

Which statements are correct?

1 The constant regions would bind to different parts of the virus antigens.

2 The viruses could be engulfed by phagocytes if they were present.

3 The variable regions would all bind to the same part of the virus antigens.

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

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