Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/11**

Paper 1 Multiple Choice **May/June 2020**

1 hour

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

INSTRUCTIONS

- There are **forty** questions on this paper. Answer **all** questions.
- For each question there are four possible answers **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in soft pencil on the multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.

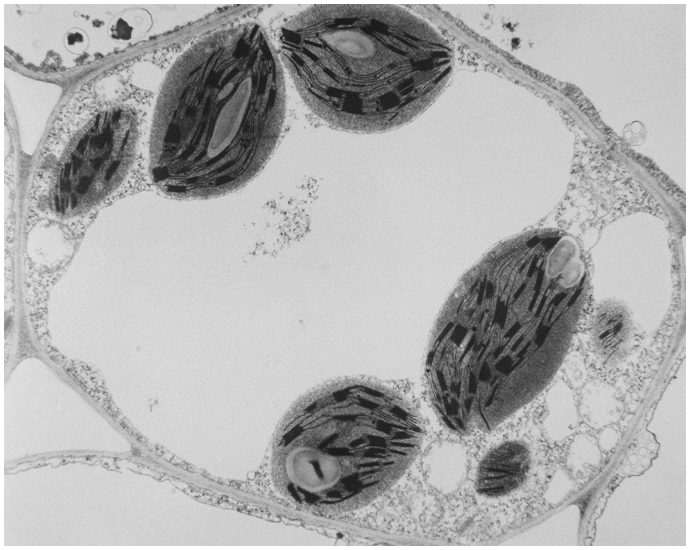
INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
- Any rough working should be done on this question paper.

This document has **20** pages. Blank pages are indicated.

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1 The photomicrograph shows the ultrastructure of part of a cell.



Which statement about the type of cell shown in the photomicrograph is correct?

A It is a plant cell because it has both chloroplasts and a nucleus.

B It is a plant cell because it has chloroplasts.

C It is an animal cell because it has a cell membrane.

D It is an animal cell because it has mitochondria.

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2 Which structures are found in typical eukaryotic cells?

1 70S ribosomes

2 80S ribosomes

3 linear DNA (chromosomes)

4 circular DNA

A 1, 2, 3 and 4

B 1, 2 and 3 only

C 1 and 4 only

D 2 and 3 only

3 A student examined a slide of human blood with a light microscope and made a careful drawing of the different cell types. The student used an eyepiece graticule so that the relative sizes of the different cell types were drawn accurately.

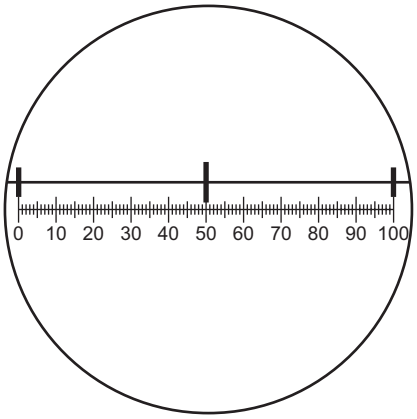
In the drawing:

- red blood cells were 7 mm in diameter
- lymphocytes were 6 mm in diameter
- neutrophils were 14 mm in diameter.

What is the linear magnification of the drawing?

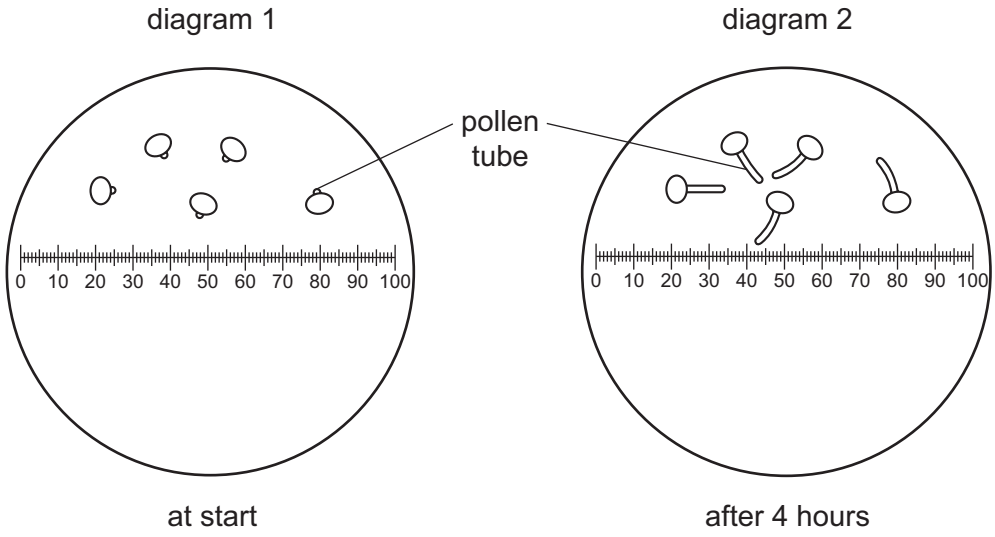
A ×10 **B** ×40 **C** ×100 **D** ×1000

4 The diagram shows a graduated slide, with divisions of 0.1 mm viewed using an eyepiece graticule.



Pollen grains were grown in a sugar solution and viewed using the eyepiece graticule.

Diagram 1 shows the pollen grains at the start. Diagram 2 shows the pollen grains after four hours.



What is the growth rate of the pollen tubes?

A $5\,\mu mh^{-1}$ **B** $10\,\mu mh^{-1}$ **C** $5\,mmh^{-1}$ **D** $10\,mmh^{-1}$

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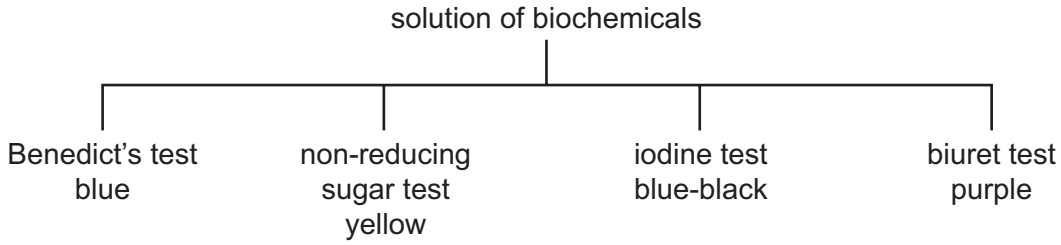
5 The table shows a comparison between two features of a typical eukaryotic cell and a typical prokaryotic cell.

Which row shows the correct comparison between these cells?

	presence of centromeres		presence of telomeres	
	eukaryotic cell	prokaryotic cell	eukaryotic cell	prokaryotic cell
A	✓	✓	✗	✗
B	✓	✗	✓	✗
C	✗	✓	✗	✓
D	✗	✗	✓	✓

key
✓ = present
✗ = not present

6 The flow diagram shows the results of a number of tests on a solution of biochemicals.



Which substances are present in the solution?

A amylose, amylopectin and lipid

B glucose, starch and catalase

C sucrose, amylase and triglyceride

D sucrose, starch and catalase

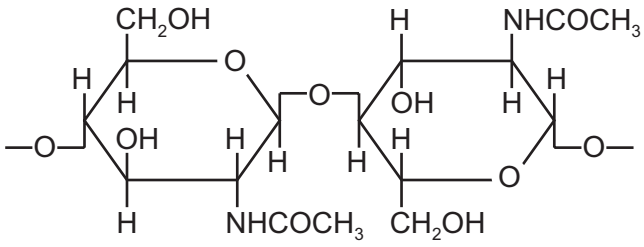
7 Maltose and sucrose are disaccharides. Maltose is formed from two molecules of glucose, whilst sucrose is formed from fructose and glucose.

Which row shows the molecular formulae of the two disaccharides?

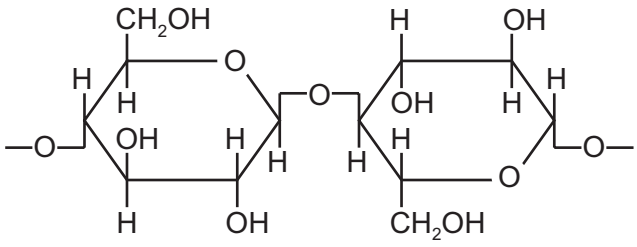
	maltose	sucrose
A	$C_{12}H_{22}O_{11}$	$C_{12}H_{22}O_{11}$
B	$C_{12}H_{22}O_{11}$	$C_{12}H_{24}O_{12}$
C	$C_{12}H_{24}O_{12}$	$C_{12}H_{22}O_{11}$
D	$C_{12}H_{24}O_{12}$	$C_{12}H_{24}O_{12}$

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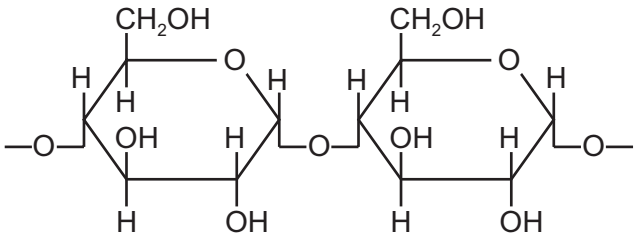
8 The diagrams show short sections of some common polysaccharides and modified polysaccharides.



1



2



3

The polysaccharides can be described as:

- F is composed of β-glucose monomers with 1,4 glycosidic bonds
- G is composed of α-glucose monomers with 1,4 glycosidic bonds
- H is composed of N-acetylglucosamine monomers with β-1,4 glycosidic bonds.

Which row correctly matches the numbered diagrams to the descriptions of the polysaccharides?

	polysaccharide F	polysaccharide G	polysaccharide H
A	2	1	3
B	2	3	1
C	3	1	2
D	3	2	1

9 Which molecules contain at least two double bonds?

1 unsaturated fatty acid

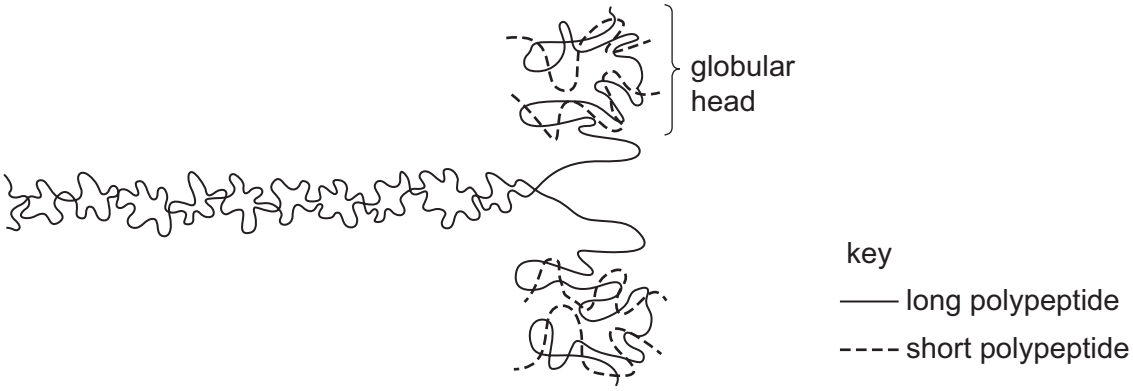
2 collagen

3 haemoglobin

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

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10 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 globular 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

11 Which types of bond will keep a folded protein in its precise shape for the longest time as the temperature rises?

A disulfide

B hydrogen

C hydrophobic interactions

D ionic

12 Protease enzymes are found in many locations inside and outside the cells. Four of these locations are listed.

1 lysosomes

2 lumen of the stomach

3 at a telophase spindle

4 mucus in the trachea

Which of these locations are sites of intracellular hydrolysis?

A 1, 2, 3 and 4

B 1, 2 and 4 only

C 1 and 3 only

D 2 and 4 only

13 An enzyme is modified for industrial use. It has a lower Michaelis-Menten constant (K_m) than the unmodified enzyme.

What is true of the modified enzyme?

A It is more specific.

B It has a higher affinity for its substrate.

C It has a lower maximum rate of reaction (V_{max}).

D It needs more substrate to become saturated.

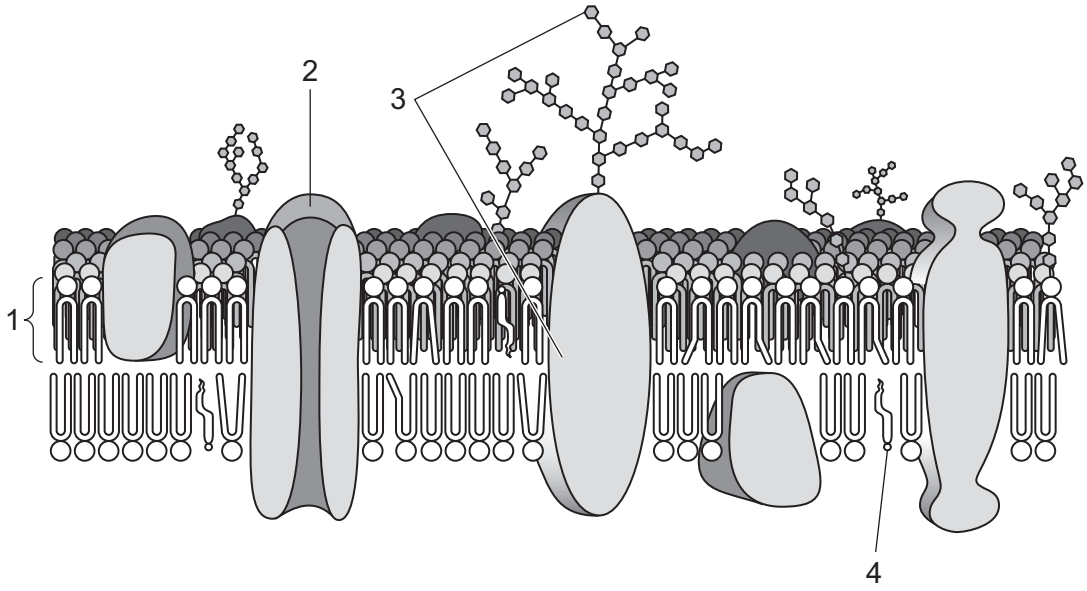
14 A decrease in some factors will increase the fluidity of the cell surface membrane.

Which pair of factors, when decreased, will increase the fluidity of the cell surface membrane?

	a decrease in
A	• distance between phospholipid molecules • proportion of short fatty acid chains
B	• distance between phospholipid molecules • temperature
C	• proportion of phospholipids with saturated fatty acid chains • proportion of long fatty acid chains
D	• proportion of phospholipids with unsaturated fatty acid chains • temperature

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15 The diagram shows a cell surface membrane.



Which statements about the labelled molecules in the membrane are correct?

- 1 is involved in the diffusion of ions.
- 2 is involved in facilitated diffusion.
- 3 is involved in the recognition of antigens.
- 4 is involved in membrane fluidity.

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

16 Equal sized potato pieces were placed into test-tubes containing equal volumes of different concentrations of sucrose solution and left for 30 minutes. All other variables were controlled.

After 30 minutes, the potato piece in one of the concentrations of sucrose solution had not changed in size.

What can be concluded from this result?

1 There is no net movement of water into or out of the potato.

2 The water potential of the potato is the same as the water potential of the sucrose solution.

3 The concentration of sucrose in the potato is the same as the concentration of the sucrose solution.

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

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17 Which feature of stem cells enables them to replace cells in tissues such as the skin?

A They are undifferentiated cells that are present at birth.

B They differentiate to form skin cells.

C They divide by mitosis to supply some cells that can differentiate.

D They have the full number of chromosomes.

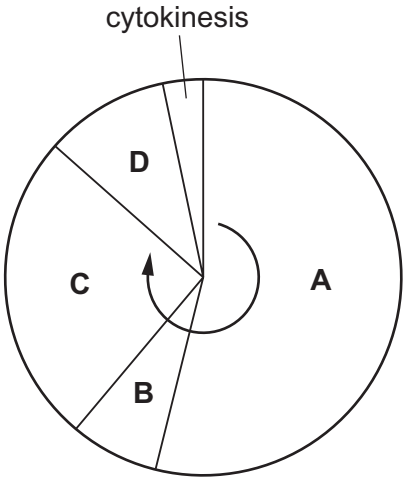
18 During prophase, a scientist stains the chromosomes of a diploid animal cell with a fluorescent dye to stain telomeres. This cell has 32 chromosomes.

How many telomeres will the scientist observe?

A 32 **B** 64 **C** 96 **D** 128

19 The diagram shows the cell cycle.

During which phase do chromosomes condense and become visible?



20 What is correct for thymine?

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

key

✓ = correct

✗ = incorrect

21 A short piece of DNA 15 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		6		3
strand 2				4

How many nucleotides containing guanine were present in strand 1?

A 2 **B** 3 **C** 4 **D** 6

22 Scientists grew bacteria in a medium containing heavy nitrogen, ^{15}N, as the only source of nitrogen.

After many generations, all of the bacterial DNA contained heavy nitrogen.

These bacteria were then moved from the heavy nitrogen medium into a medium with only light nitrogen, ^{14}N.

Some bacteria were collected from each of the **next** three generations and their DNA was analysed.

Hybrid DNA contains both heavy and light nitrogen.

Which row shows the correct DNA of the first and third generations?

	DNA of first generation	DNA of third generation
A	all hybrid	half hybrid, half light
B	all hybrid	one quarter hybrid, three quarters light
C	half hybrid, half heavy	half hybrid, one quarter heavy, one quarter light
D	half hybrid, half light	one quarter hybrid, three quarters light

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23 A population of bacteria is exposed to the antibiotic penicillin. Most of the bacteria die.

However, some bacteria in the population have an allele coding for an enzyme that breaks down penicillin. These bacteria are able to survive.

Which could explain how these bacterial cells acquired this allele?

1 An error during DNA replication.

2 An error during transcription.

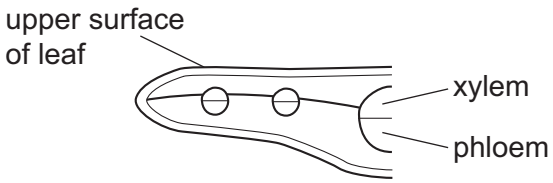
3 An error during translation.

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

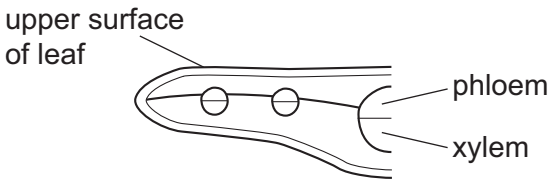
24 A dicotyledonous leaf has a palisade mesophyll layer that is approximately twice as thick as the spongy mesophyll layer.

Which plan diagram is correct?

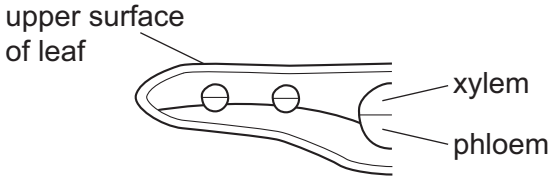
A



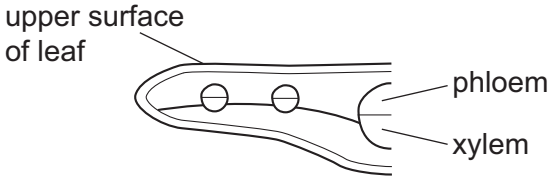
B



C



D



25 A number of processes contribute to maintaining a water potential gradient in plants allowing water to reach the highest parts of a plant.

Which processes are responsible for maintaining this water potential gradient?

1 capillarity

2 osmosis

3 transpiration

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 What is a correct statement about the movement of substances absorbed by roots?

A Ions have to pass through cell walls to cross the endodermis.

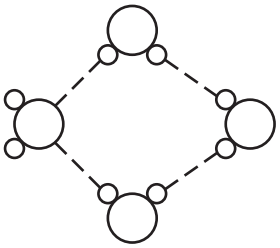
B Ions move through the symplastic pathway only until they reach the Casparian strip.

C Soil water has a more negative water potential than the xylem sap.

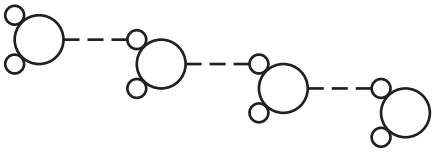
D Water passes through the symplastic pathway along a water potential gradient.

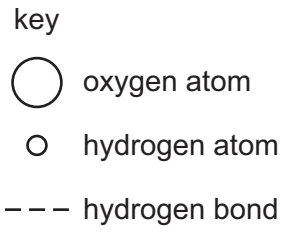
27 Which arrangement of four molecules of water shows how water may cohere when moving up a xylem vessel?

A

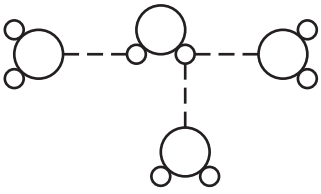


B

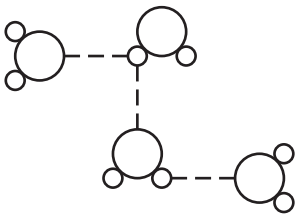




C



D



28 Which statement about sucrose loading into companion cells and then into the phloem sieve tube element is **not** correct?

A Hydrogen ions and sucrose molecules move into the companion cells using a carrier protein.

B Hydrogen ions are pumped out of the companion cells by active transport.

C Sucrose molecules are carried into the companion cells down the concentration gradient for sucrose.

D Sucrose molecules move from a companion cell into the sieve tubes of the phloem through plasmodesmata.

29 What explains why the left and right sides of the heart contract simultaneously?

A Both atria have a sinoatrial node.

B Both sides of the heart are supplied by the same coronary artery.

C Purkyne tissue links the two sides of the heart.

D There is no barrier to electrical excitation between two sides of the heart.

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30 The statements list some of the events in the cardiac cycle. They are not in the correct order.

1 The impulse travels through Purkyne tissue.

2 A wave of excitation sweeps across the atria.

3 The atrioventricular node delays the impulse for a fraction of a second.

4 The sinoatrial node contracts.

5 The wave of excitation sweeps upwards from the base of the ventricles.

6 The ventricles contract.

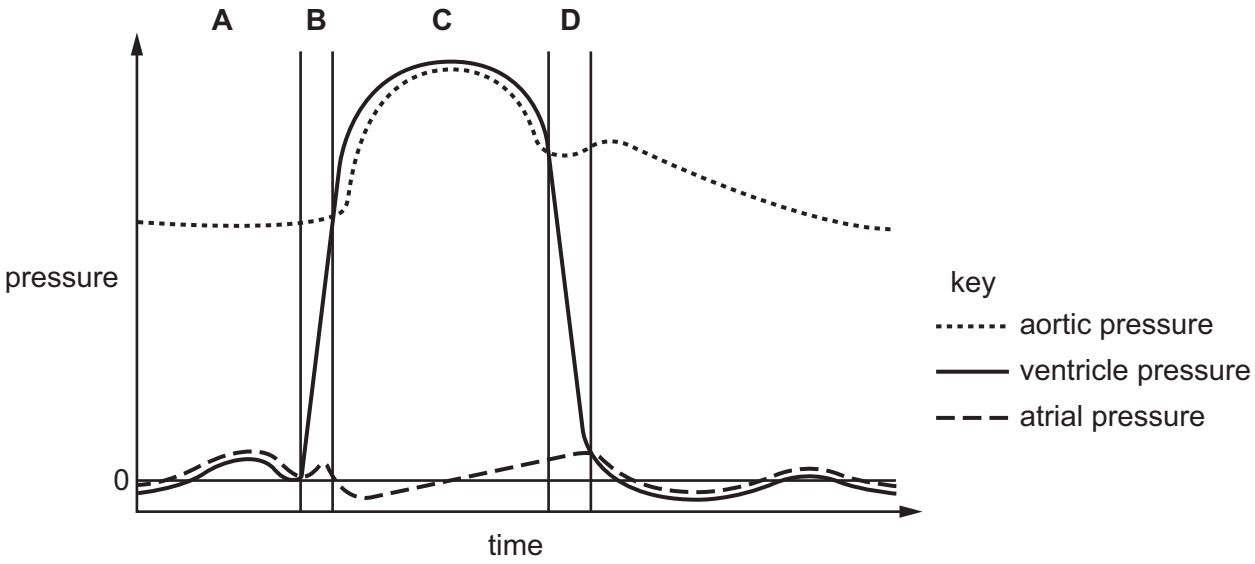
7 The atria contract.

Which statement describes the third of these events to occur in the cardiac cycle?

A 1 **B** 3 **C** 4 **D** 7

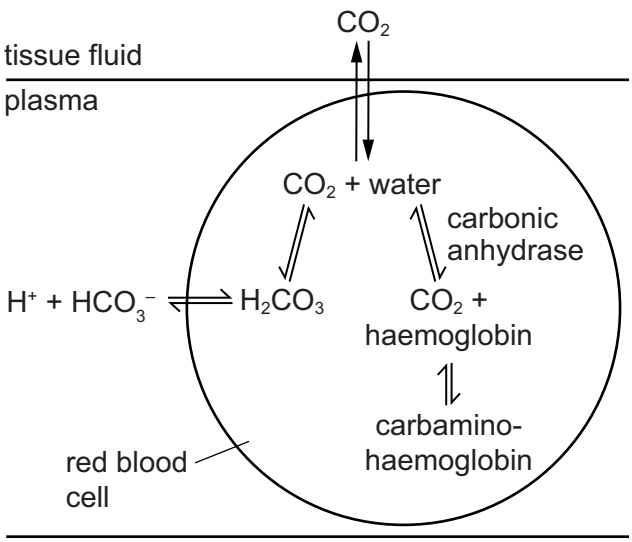
31 The diagram shows pressure changes in different parts of the heart during one cardiac cycle.

During which period are the semilunar valves open and the atrioventricular valves closed?

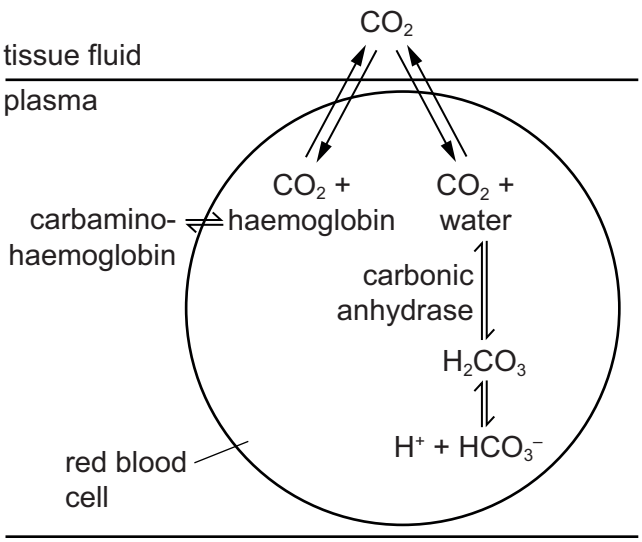


32 Which diagram shows the events that occur during transport of carbon dioxide by the blood?

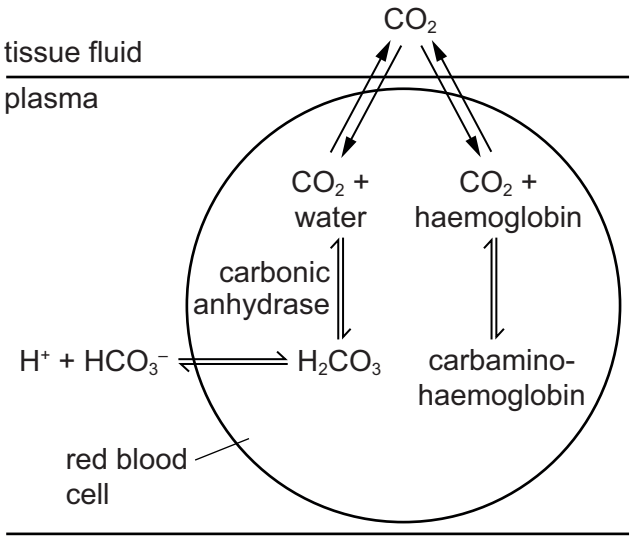
A



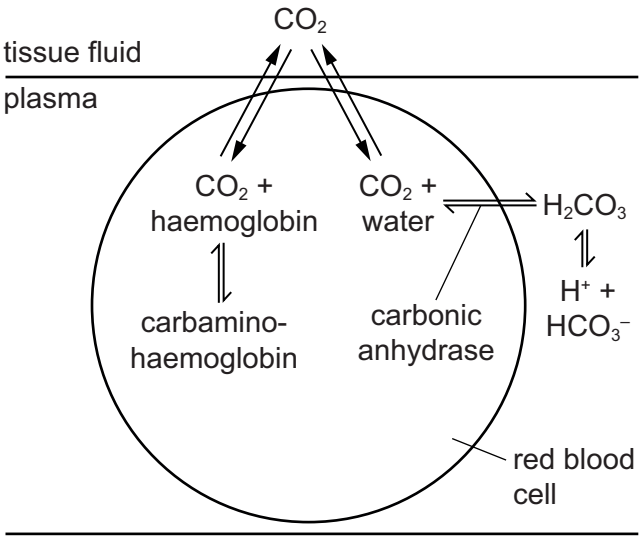
B



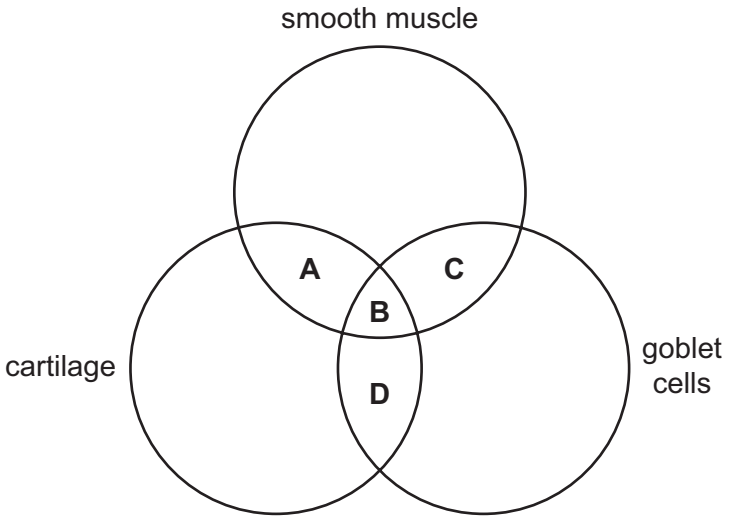
C



D



33 Which structures are found in bronchi?



34 Which tissue in the respiratory system is correctly linked to its function?

	tissue	function
A	cartilage	stretch and recoil to force air out
B	ciliated epithelium	gives protection from suspended particles in the air
C	elastic fibres	contract and relax to adjust diameter of bronchioles
D	smooth muscle	keeps trachea and bronchi open

35 Chronic obstructive pulmonary disease (COPD) includes emphysema.

Which effects does emphysema have on gaseous exchange?

1 surface area to volume ratio of lungs decreases

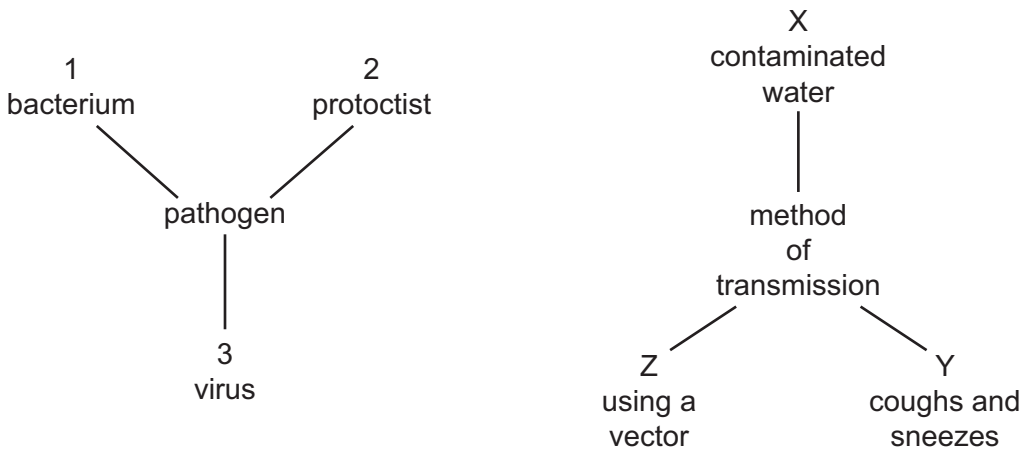
2 distance of the diffusion pathway decreases

3 volume of oxygen diffused per unit time decreases

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

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



Which row matches the correct number for the pathogen with the correct letter for their mode of transmission for cholera and measles?

	cholera	measles
A	1 and X	3 and Y
B	1 and Y	3 and Y
C	2 and X	2 and Z
D	3 and Z	1 and X

37 Which factors would increase the global distribution of malaria?

1 a fall in annual rainfall

2 an increase in the use of antibiotics

3 a rise in global air temperatures

4 increasing irrigation of land for farming

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

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38 The antibiotic teixobactin was discovered in January 2015. Teixobactin kills some bacteria such as *Staphylococcus* and *Mycobacterium*.

Most antibiotics work by binding to proteins. Teixobactin binds to lipids that are used in the synthesis of bacterial cell walls. This means that it is unlikely that bacteria will quickly develop resistance to teixobactin.

Which statements explain why bacteria are unlikely to quickly develop resistance to teixobactin?

1 A mutation in the gene coding for a protein allows selection for resistance.

2 Teixobactin binds to a lipid rather than to a protein.

3 The structure of a lipid is not encoded by DNA.

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

39 Which row correctly describes the type of immunity gained from being injected with an antitoxin?

	active	artificial	passive	natural
A	✓	✓	✗	✗
B	✓	✗	✗	✓
C	✗	✓	✓	✗
D	✗	✗	✓	✓

key

✓ = correct

✗ = not correct

40 Where are antibodies found during an immune response?

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

key

✓ = antibodies found

✗ = antibodies not found

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BIOLOGY **9700/12**

Paper 1 Multiple Choice **May/June 2020**

1 hour

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet
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Soft pencil (type B or HB is recommended)

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- You may use a calculator.

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This document has **16** pages. Blank pages are indicated.

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1 What is the definition of the resolution of a light microscope?

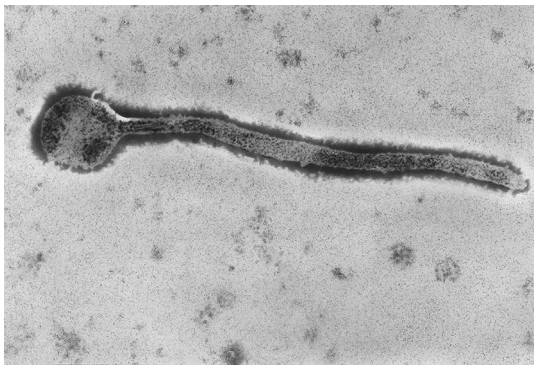
A the degree of sharpness produced by the microscope

B the greatest distance between two objects visible in the same field of view

C the minimum distance that allows two objects to be viewed as separate

D the size of the smallest object visible using the microscope

2 The electron micrograph shows a type of virus at a magnification of ×30 000.



What is the length of the virus?

A 2.2×10^3 nm

B 2.2×10^2 nm

C 2.2×10^1 nm

D 2.2×10^0 nm

3 Which row correctly shows a feature of a cell structure?

	site of protein synthesis	makes lysosomes
A	smooth endoplasmic reticulum	rough endoplasmic reticulum
B	ribosomes	Golgi body
C	rough endoplasmic reticulum	ribosomes
D	Golgi body	smooth endoplasmic reticulum

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4 Four students were asked to match the function with the appearance of some cell structures in an animal cell.

The functions were listed by a number.

1 organises microtubules to produce the spindle during cell division

2 synthesis of polypeptides

3 packaging of hydrolytic enzymes that will remain in the cell

The appearances were listed by a letter.

V membranes which surround an enclosed inner cavity

W non-membrane bound, spherical structures

X a double membrane with many pores

Y non-membrane bound, cylindrical structures

Z membrane-bound sacs, arranged as a flattened stack

Which student correctly matched the numbered function with the appearance of the cell structure?

	1	2	3
A	W	X	Y
B	W	Z	W
C	Y	W	Z
D	Y	Z	Z

5 The features of some cells and cell structures that make ATP are listed.

1 has outer boundary membrane and folded inner membrane

2 has peptidoglycan cell wall outside an outer boundary membrane

3 has a double boundary membrane and stacks of inner membranes

Which row identifies these components?

	1	2	3
A	bacterium	chloroplast	mitochondrion
B	chloroplast	bacterium	mitochondrion
C	chloroplast	mitochondrion	bacterium
D	mitochondrion	bacterium	chloroplast

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6 Mitochondria are thought to have evolved from prokaryotic cells that were ingested by an ancestral cell.

Which feature have these prokaryotes lost during their evolution into mitochondria?

A cell wall

B circular chromosome

C internal membranes

D ribosomes

7 A student carried out the Benedict's test on a sample and got a negative result.

What should the student do to confirm there are no sugars present in the sample?

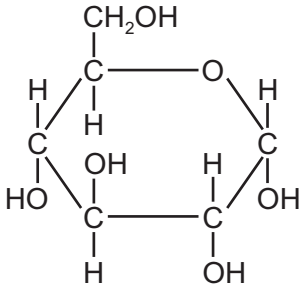
A boil the sample for 5 minutes then repeat the Benedict's test

B boil with alkali, neutralise with hydrochloric acid and repeat the Benedict's test

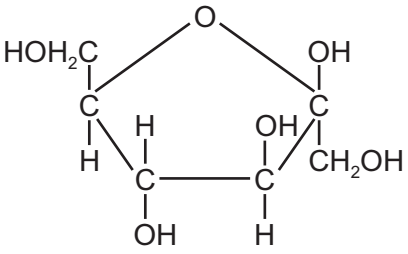
C boil with hydrochloric acid, neutralise with alkali and repeat the Benedict's test

D repeat the Benedict's test but add more Benedict's reagent

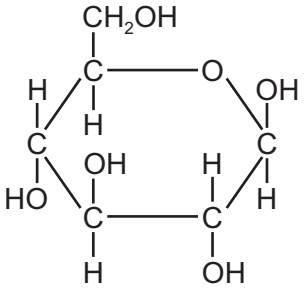
8 The diagrams show three hexoses.



1



2



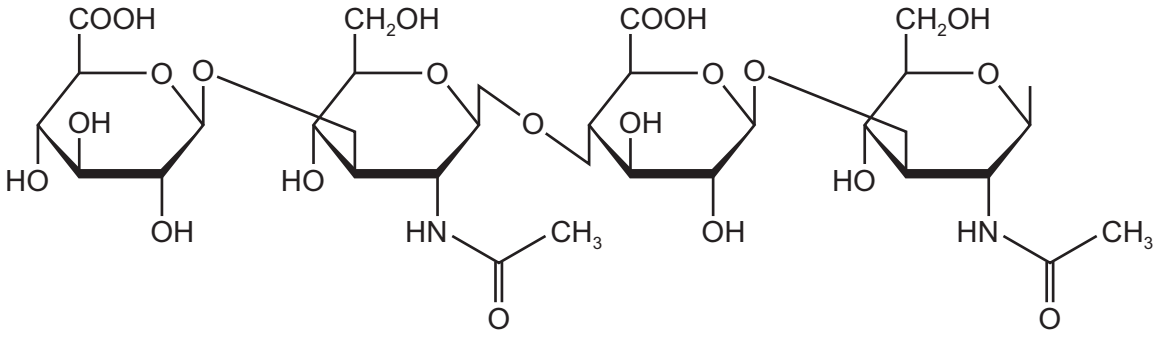
3

In which carbohydrates do these three hexoses occur?

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

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9 The diagram shows part of the chemical structure of a naturally occurring polysaccharide.



What types of glycosidic bonds are present?

A α-1,3 and α-1,4

B α-1,4 and α-1,6

C β-1,3 and β-1,4

D β-1,4 and β-1,6

10 What is the maximum number of water molecules produced when a triglyceride is synthesised?

A 3 **B** 2 **C** 1 **D** 0

11 What occurs during the formation of a peptide bond between two amino acids?

A OH is removed from COOH and H is removed from an R group.

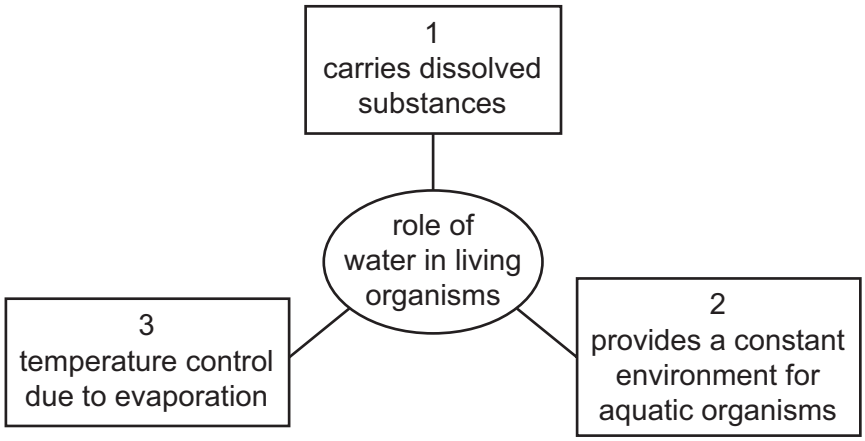
B OH is removed from COOH and H is removed from NH_2.

C H is removed from COOH and OH is removed from an R group.

D O is removed from COOH and 2H is removed from NH_2.

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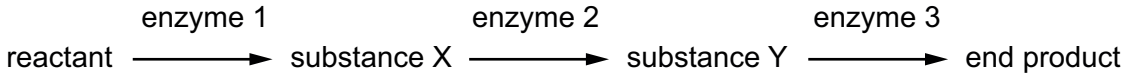
12 The diagram represents roles of water in living organisms.



Which roles are dependent upon hydrogen bonds between water molecules?

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

13 The diagram shows a metabolic pathway.



What would be the effect of adding a small amount of a non-competitive inhibitor of enzyme 2?

A Enzyme 2 would be partially denatured.

B Substance X would increase in concentration.

C Substance Y would no longer be formed.

D The initial reactant would no longer be metabolised.

14 Two enzymes are added to a solution containing a low concentration of a substrate that they can both use.

Which statement is correct?

A Both enzymes will use equal amounts of the substrate.

B Neither enzyme will be able to use the substrate.

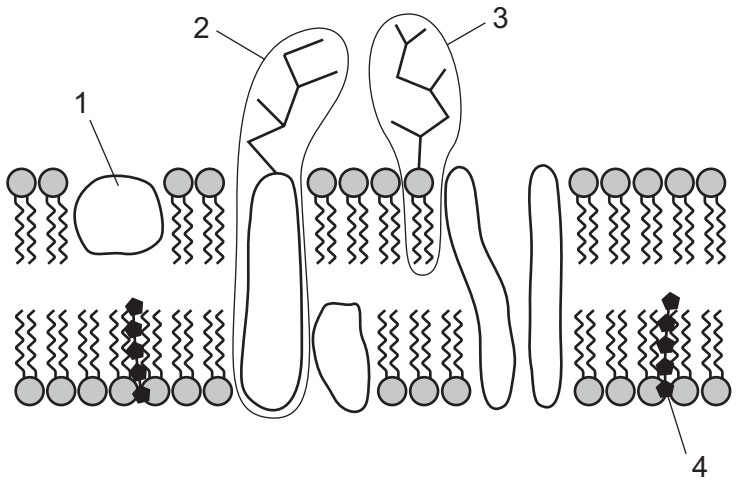
C The enzyme with the lower V_{max} will use less of the substrate than the other enzyme.

D The enzyme with the lower V_{max} will use more of the substrate than the other enzyme.

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

Structures 1, 2, 3 and 4 are types of molecule.



Which types of molecules are always identical?

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

16 What is the role of G protein in cell signalling?

A to act as a membrane-bound enzyme

B to act as a switch releasing a second messenger

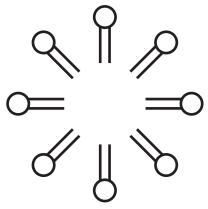
C to amplify the original signal

D to change the shape of the protein receptor

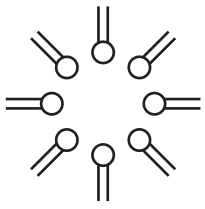
17 When a small quantity of phospholipid is added to a test-tube of water and then shaken vigorously, an emulsion is formed by small droplets called liposomes.

Which diagram shows the arrangement of phospholipid molecules in a cross-section of a liposome?

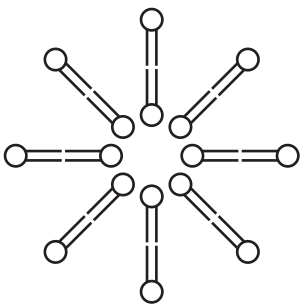
A



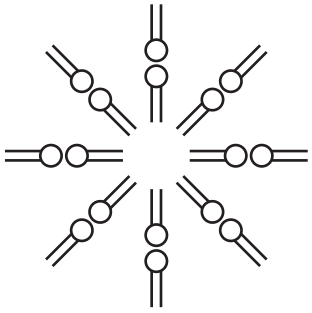
B



C



D



18 What are the features of facilitated diffusion?

1 It uses protein channels in the membrane and is driven by the energy from ATP.

2 It moves molecules from regions of higher concentration to lower concentration and is driven by the kinetic energy of the molecules which are diffusing.

3 It uses protein channels in the membrane, and the maximum rate of diffusion depends on the number of these channels.

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

19 Which description of chromosome structure is correct?

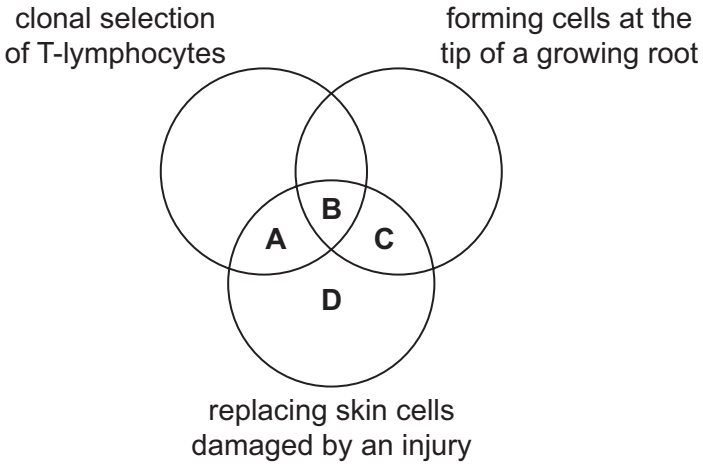
A A chromosome at the beginning of interphase consists of two identical chromatids, each containing one linear molecule of DNA.

B Telomeres are lengths of non-coding DNA found at one end of each chromatid to prevent loss of genes during cell division.

C The two identical chromatids of a chromosome are held together by a centromere in which there is no DNA.

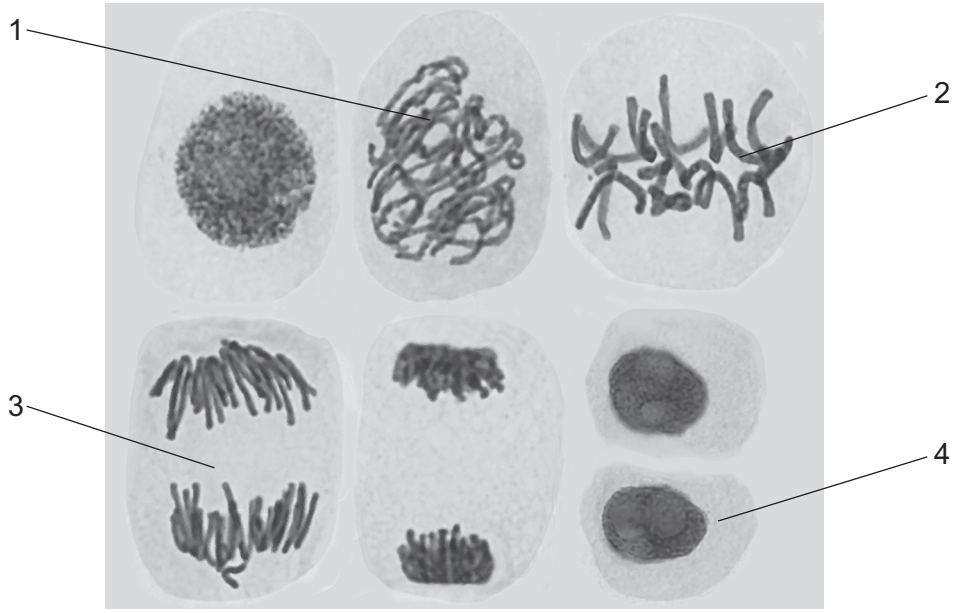
D The very long DNA molecule of each chromatid is coiled and held together by proteins called histones.

20 Which processes involve mitosis?



21 A drug has been developed to treat certain types of cancer. It prevents mitosis by binding to the spindle and preventing sister chromatids being separated and moving to opposite poles of the cell.

The photomicrograph shows cells in different phases of mitosis.



What represents the stages of mitosis that will be able to occur in a cell which is entering prophase when treated with this drug?

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

22 Some viruses have single-stranded DNA as their genetic material. This DNA molecule has to be folded to fit in the protein coat.

Which statements about single-stranded DNA are correct?

1 Single-stranded DNA cannot replicate semi-conservatively.

2 If only the percentage of cytosine is known, then the percentage of guanine can be calculated, but the percentage of adenine and thymine cannot be calculated.

3 Hydrogen bonds may be present within the DNA molecule.

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

23 How many statements are true for semi-conservative replication of DNA in a eukaryotic cell?

1 The process takes place in the nucleus.

2 Adenine will line up against uracil on the complementary strand.

3 Each new molecule will contain one strand of the original molecule.

4 If the original molecule contained 40% guanine each new molecule will contain 20% guanine.

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

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24 Part of the nucleotide sequence of an mRNA molecule is shown, with spaces between the codons.

CAG UAC AGC AAU CUA UAA

The translation of the codons is provided.

codon	amino acid or STOP
AAU	asn
AGC	ser
CAG	gln
CUA	leu
UAA	STOP
UAC	tyr
UAU	tyr

Which events will cause the termination of polypeptide synthesis during translation?

1 Deletion of C from the leu codon.

2 Deletion of C from the tyr codon.

3 The ribosome reaching the UAA codon.

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

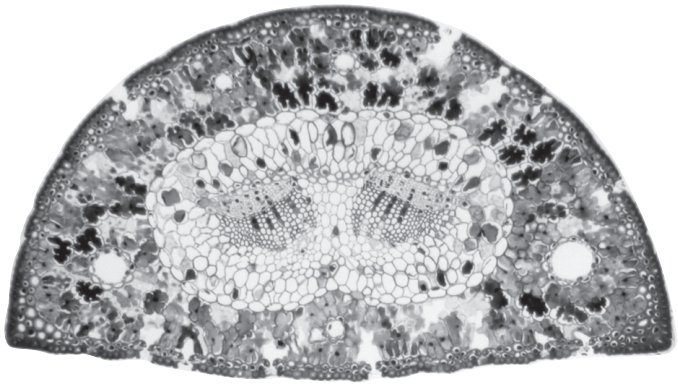
25 External factors change the rate of transpiration, which also affects the water potential gradient of cells in the leaf.

Which combination is correct?

	external factor changing the rate of transpiration	water potential gradient in the leaf
A	decreasing temperature	increases
B	decreasing wind speed	increases
C	increasing relative humidity	decreases
D	increasing sunlight	decreases

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26 The photomicrograph shows a transverse section through a leaf.



×50

Which features of a xerophytic leaf are visible in this section?

1 sunken stomata

2 two layers of epithelium

3 thick cuticle

4 small surface area to volume

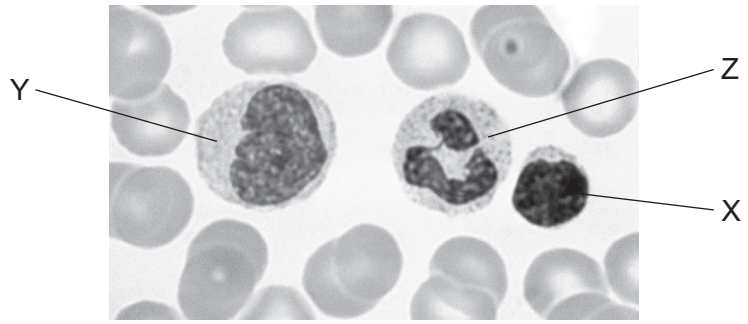
A 1, 2, 3 and 4 **B** 1 and 2 only **C** 1 and 3 only **D** 3 and 4 only

27 Which changes occur as carbohydrates move out of a root cell into a phloem sieve tube?

	water potential in a phloem sieve tube becomes	volume of liquid in phloem sieve tube
A	less negative	decreases
B	less negative	increases
C	more negative	decreases
D	more negative	increases

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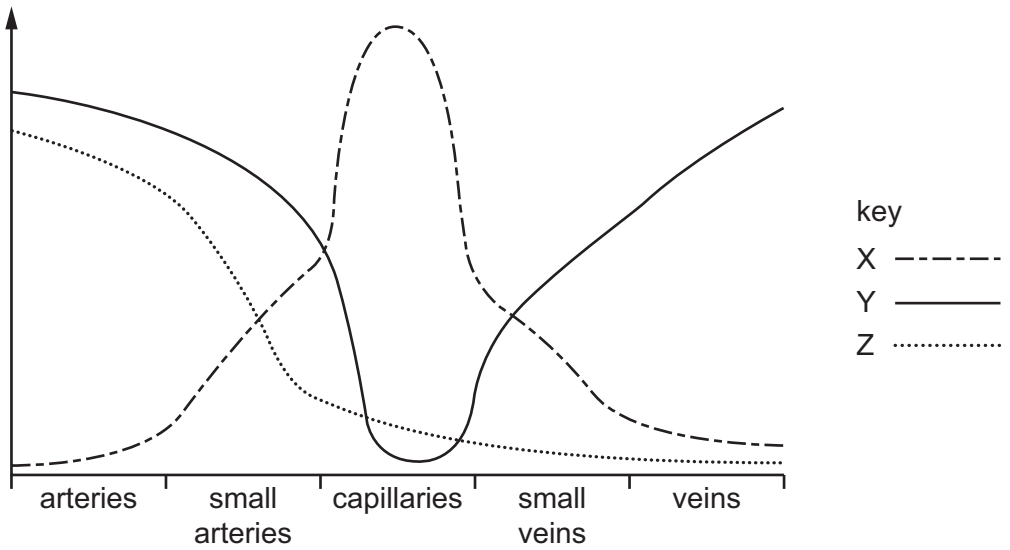
28 The photomicrograph shows three white blood cells labelled X, Y and Z.



Which row correctly identifies these cells?

	cell X	cell Y	cell Z
A	lymphocyte	monocyte	neutrophil
B	lymphocyte	neutrophil	monocyte
C	monocyte	neutrophil	lymphocyte
D	neutrophil	monocyte	lymphocyte

29 The graph represents data on blood vessels and blood flow.



Which row correctly identifies the curves?

	speed of blood flow	pressure of blood	total cross-sectional area
A	X	Y	Z
B	X	Z	Y
C	Y	Z	X
D	Z	X	Y

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30 Which components of blood are present in lymph?

	white blood cells	proteins	sodium ions
A	✓	✓	✓
B	✓	✗	✓
C	✗	✓	✓
D	✗	✓	✗

key

✓ = present

✗ = not present

31 What correctly describes the significance of the increase of the red blood cell count of humans who move from living at low altitude to high altitude?

A After a few weeks at high altitude, the number of red blood cells increases to compensate for the lower availability of oxygen in the air.

B At high altitude, the bone marrow produces more red blood cells to provide binding sites for the increased number of oxygen molecules available.

C At high concentrations of oxygen in the blood, a cytokine stimulates the production of red blood cells to increase the oxygen-carrying capacity of the blood.

D After only a few days at high altitude the number of red blood cells increases considerably to compensate for the lower availability of oxygen in the air.

32 Which structures of the human gas exchange system are supported by cartilage?

	bronchus	bronchiole	trachea
A	✗	✓	✓
B	✗	✓	✗
C	✓	✓	✓
D	✓	✗	✓

key

✓ = cartilage present

✗ = cartilage not present

33 Carbon monoxide, nicotine and tar are components of tobacco smoke.

Which row correctly describes their effect on a smoker's body?

	carbon monoxide	nicotine	tar
A	causes loss of consciousness at very low concentrations	increases the diameter of blood vessels	destroys cilia on cells lining the airways
B	forms a stable compound with haemoglobin	increases blood pressure	stimulates goblet cells to secrete mucus
C	forms carbaminohaemoglobin	increases the diameter of the coronary artery	settles on cells lining the airways
D	forms carboxyhaemoglobin	decreases the heart rate	contains carcinogens

34 Which statements about chronic obstructive pulmonary disease (COPD) are correct?

1 The disease can often be reversed by treatment.

2 The patient's symptoms normally do not change.

3 The patient is normally over 30 years old.

4 The patient coughs frequently, producing a lot of mucus.

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

35 Which of these causative agents of disease can be transmitted by droplet infection?

1 *Vibrio*

2 *Mycobacterium*

3 *Morbillivirus*

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

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36 The table compares total antibiotic use (X) and the percentage of antibiotic-resistant pneumonia cases (Y) in five countries.

country	(X) total antibiotic use / defined dose per 1000 people per day	(Y) percentage of penicillin-resistant pneumonia cases
Austria	13	10
Denmark	11	4
Iceland	17	15
Spain	30	50
USA	24	33

What is supported by the data?

A When X decreases there is an increase in Y.

B When X increases there is an increase in Y.

C When X increases it causes an increase in Y.

D There is no relationship between X and Y.

37 Which statement about the development of resistance to antibiotics in bacteria is correct?

A All mutations in bacteria result in resistance to antibiotics.

B Antibiotics increase the rate of mutation in bacteria.

C Mutations leading to antibiotic resistance only occur when antibiotics are used to treat pathogenic bacteria.

D The proportion of antibiotic-resistant bacteria in a population only increases if the antibiotic is used.

38 A blood cell count can indicate how many white blood cells there are in the blood.

Where else in the body are white blood cells found?

1 bone marrow

2 lymph

3 lungs

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

39 Myasthenia gravis is a disease that results from the immune system failing to distinguish between self and non-self. Antibodies bind to a component of the junctions between a muscle and its nerve.

What correctly describes Myasthenia gravis?

A Impulses in the nerve to the affected muscle cannot be blocked.

B The affected muscle cannot be repeatedly stimulated.

C The affected muscle is permanently stimulated.

D The nerve to the affected muscle does not carry any nerve impulses.

40 A monoclonal antibody, specific for a virus, 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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BIOLOGY **9700/13**

Paper 1 Multiple Choice **May/June 2020**

1 hour

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

INSTRUCTIONS

- There are **forty** questions on this paper. Answer **all** questions.
- For each question there are four possible answers **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in soft pencil on the multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.

INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
- Any rough working should be done on this question paper.

This document has **20** pages. Blank pages are indicated.

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1 A student was given a photomicrograph of a cell and told the magnification of the image.

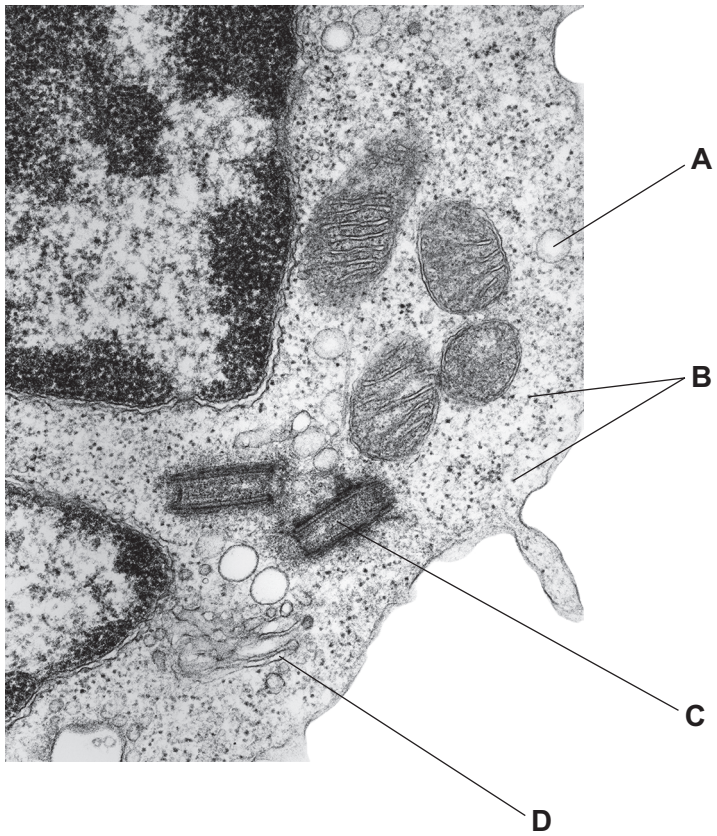
The student was asked to calculate the actual size of the cell.

Which row in the table explains how to do this?

	measure the image in	convert to μm by multiplying by	rearrange the formula to
A	cm	1.0×10^4	$\frac{M}{I}$
B	cm	1.0×10^6	$I \times M$
C	mm	1.0×10^3	$\frac{I}{M}$
D	mm	1.0×10^4	$I \times M$

2 The electron micrograph shows part of a eukaryotic cell.

Which cell structure is a site of protein synthesis?



3 Some stains can be used to identify cell structures in living cells.

A dilute solution of one stain causes the whole cell to appear blue.

The blue colour rapidly disappears in most cell structures. Those cell structures that release energy stay blue.

Which type of cell structure is likely to stay blue?

A endoplasmic reticulum

B Golgi body

C lysosome

D mitochondrion

4 A molecule of carbon dioxide is in the centre of a mitochondrion.

Assuming there are no other cell structures in its path, how many phospholipid layers will the carbon dioxide molecule have to pass through in order to leave the cell?

A 2 **B** 3 **C** 6 **D** 8

5 Which row identifies the type of ribosome found in each of the different structures?

	chloroplast	cytoplasm of eukaryotic cell	prokaryotic cell	mitochondrion
A	70S	70S	80S	70S
B	70S	80S	70S	70S
C	80S	70S	80S	80S
D	80S	80S	70S	80S

6 The colour of a positive Benedict's test is due to the formation of copper oxide. The mass of copper oxide is proportional to the mass of reducing sugar present.

Samples of fruit juice were tested for the presence of reducing sugars and non-reducing sugars using the Benedict's test.

The table shows the mass of copper oxide after boiling with Benedict's solution and after acid hydrolysis and boiling with Benedict's solution.

Which sample contained the most **non-reducing** sugar?

	mass of copper oxide / mg	
	after boiling with Benedict's solution	after acid hydrolysis and boiling with Benedict's solution
A	20	20
B	30	45
C	50	55
D	65	75

7 Which polysaccharides contain 1, 4 **and** 1, 6 glycosidic bonds?

1 amylopectin

2 amylose

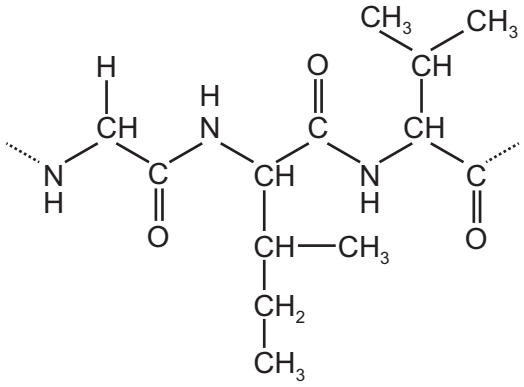
3 cellulose

4 glycogen

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

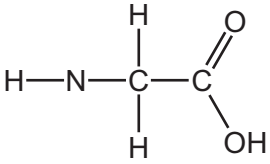
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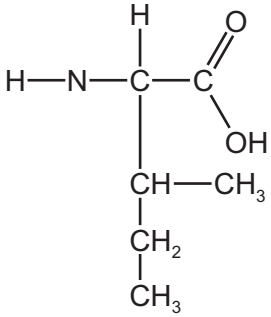
8 The diagram shows a small part of a polypeptide.

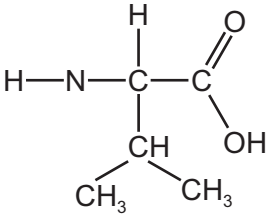


What would the products be if the part shown was completely hydrolysed?

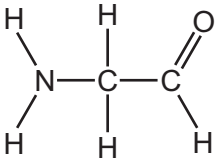
A

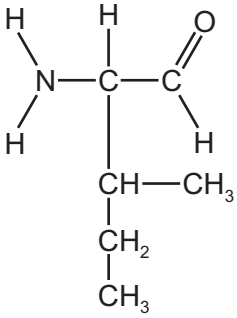


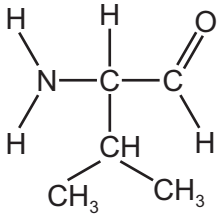




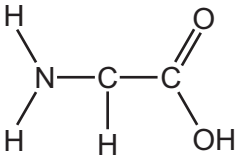
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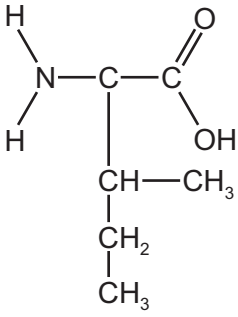


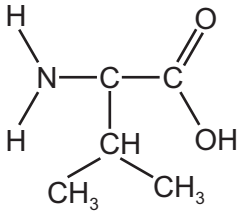




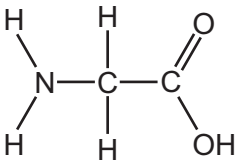
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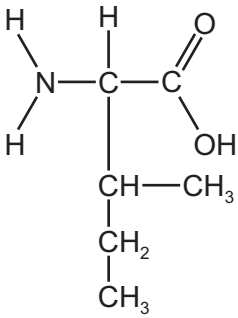


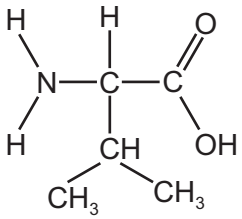




D







9 The enzyme trypsin hydrolyses proteins to amino acids. Trypsin does not function when the pH is very low as its 3D shape would be changed.

What explains this change in 3D shape?

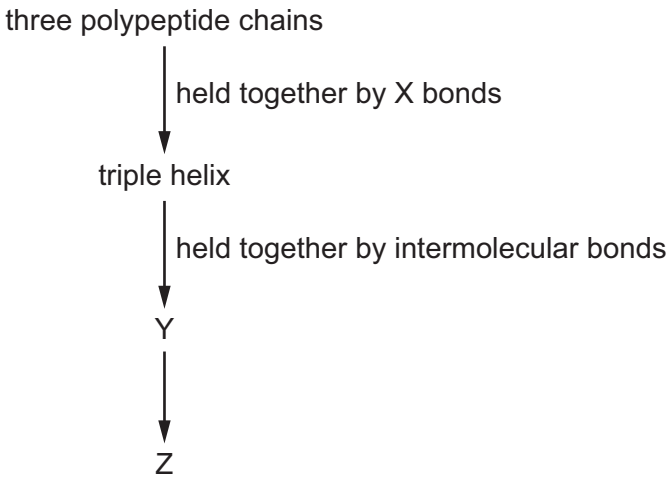
A Hydrogen ions attach themselves to negatively charged R groups.

B Hydrogen ions disrupt disulfide bonds.

C Hydrogen ions increase hydrogen bonding between amino acids.

D Hydrogen ions reduce the affinity of hydrophilic R groups for water.

10 The flow chart shows some of the steps in the formation of collagen.



Which row correctly identifies X, Y and Z?

	X	Y	Z
A	disulfide	fibres	fibrils
B	hydrogen	fibrils	fibres
C	hydrogen	microfibrils	fibres
D	peptide and hydrogen	fibres	microfibrils

11 Which molecules contain at least two double bonds?

1 saturated fatty acid

2 collagen

3 haemoglobin

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

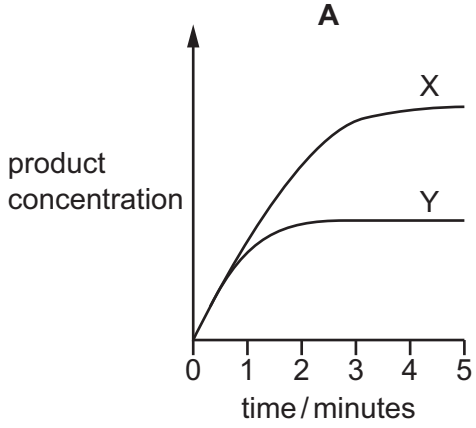
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12 Two experiments, X and Y, were carried out using an enzyme from humans.

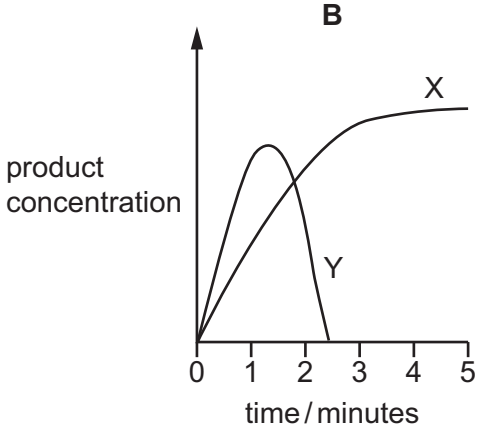
Experiment X was carried out at a constant temperature of 37 °C. During experiment Y, the temperature was increased from 37 °C to 80 °C. All other factors were kept the same.

Which graph shows the results?

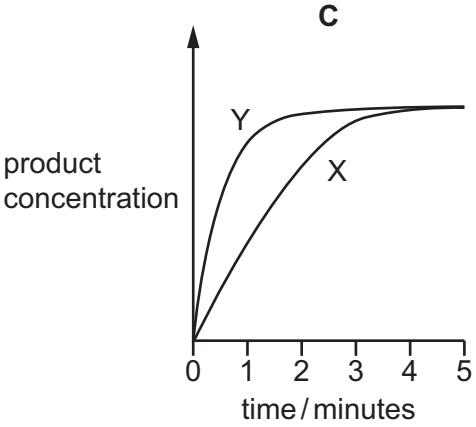
A



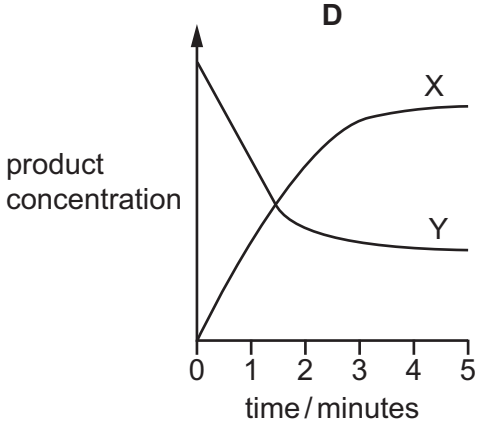
B



C



D



13 What affects the rate of an enzyme-catalysed reaction when in the presence of a non-competitive inhibitor?

1 enzyme concentration

2 inhibitor concentration

3 substrate concentration

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

14 What describes the fluid-mosaic model of membrane structure?

A Cholesterol makes the membrane more fluid.

B Fluids can cross the membrane by diffusion or osmosis.

C Proteins act as receptors for cell signalling.

D Proteins and phospholipids move and change places.

15 Blocks of agar are stained with a pH indicator and used to investigate the diffusion of an acid solution.

Which block would completely change colour the fastest?

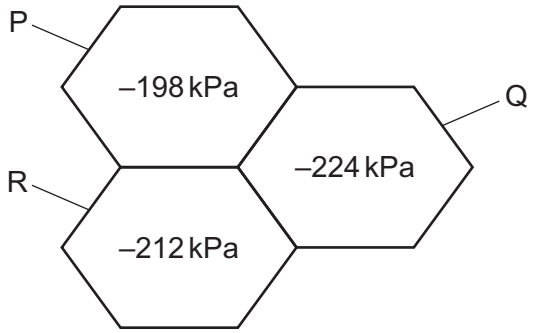
A 1mm × 1mm × 1 mm

B 1mm × 0.25mm × 0.25 mm

C 1mm × 0.5mm × 0.5 mm

D 2mm × 0.5mm × 0.5 mm

16 The diagram shows the water potential of three adjacent plant cells, P, Q and R.



Which shows the net movement of water between cells P, Q and R?

A P → Q and P → R and R → Q

B P → Q and P → R

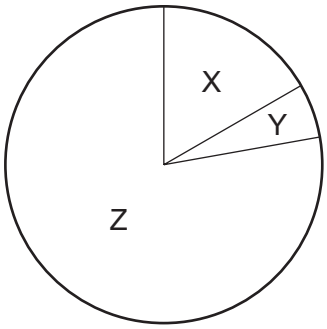
C Q → P and Q → R and R → P

D Q → P and R → P

17 Which row correctly describes parts of chromosome structure present during mitosis?

	centromere	chromatid	telomere
A	region of a chromosome with no DNA	single DNA polynucleotide with histone proteins	region of DNA with many cytosine and guanine bases
B	region of non-coding DNA holding two chromatids together	double-stranded DNA molecule with histone proteins	region of DNA with many short repeated sequences of bases
C	region of DNA with no histone proteins that allows separation of chromatids during anaphase	DNA molecule coiled round histone proteins to form a chain of nucleosomes	region of DNA with no proteins that protects the end of a chromatid
D	region that attaches to spindle microtubules and divides during prophase	one of two identical DNA molecules that was replicated during interphase	region of non-coding DNA holding the ends of the chromatids together

18 The diagram shows the relative time taken for each stage in the cell cycle.



Which row identifies the correct sequence of the stages in the cell cycle?

	cytokinesis	interphase	mitosis
A	X	Y	Z
B	X	Z	Y
C	Y	Z	X
D	Z	X	Y

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

20 Which statements about the nucleotide containing uracil are correct?

1 Uracil is a pyrimidine.

2 The carbohydrate is always ribose.

3 Base pairing occurs with 3 hydrogen bonds.

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

21 DNA replication involves several stages.

1 Each strand of DNA double helix acts as a template for the opposite strand.

2 The enzyme DNA polymerase links bases together.

3 Hydrogen bonds between bases A and T and between C and G are broken.

Which statements about DNA replication are correct?

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

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22 The sequence of bases in mRNA for the first eight amino acids in the β-polypeptide of adult haemoglobin is:

GUG–CAC–CUG–ACU–CCU–GAG–GAG–AAG.

In haemoglobin C, which is a cause of haemolytic anaemia, the sequence is:

GUG–CAC–CUG–ACU–CCU–AAG–GAG–AAG.

The coding for seven of the amino acids is listed.

amino acid	DNA triplet
glu	CTC
his	GTG
leu	GAG
lys	TTC
pro	GGA
thr	TGA
phe	AAG

Which change occurs to the amino acid sequence of adult haemoglobin to make haemoglobin C?

A Histidine is changed to leucine.

B Proline is changed to threonine.

C Glutamic acid is changed to lysine.

D Leucine is changed to phenylalanine.

23 Some antibiotics kill prokaryotes by binding to RNA polymerase.

What effect will this have on protein synthesis?

A Codons on mRNA will be unable to hydrogen bond to complementary anticodons on tRNA.

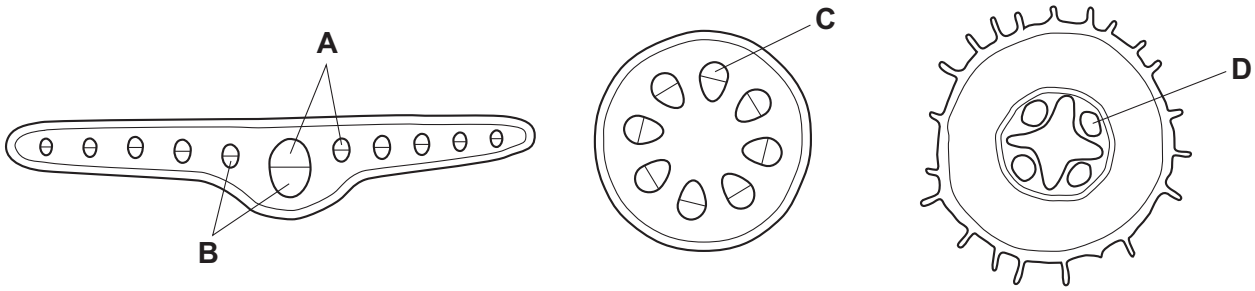
B Condensation reactions joining RNA nucleotides will not take place to form mRNA.

C DNA will not unwind and unzip to allow for base pairing with RNA nucleotides.

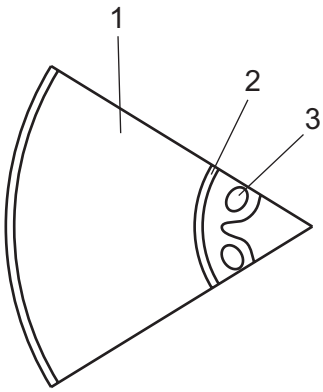
D Free RNA nucleotides will not base pair to exposed bases on the DNA template strand.

24 The diagrams show transverse sections through parts of plants.

Which of the labelled regions contains cells which are dead?



25 The diagram shows the distribution of tissues in part of a transverse section through a plant organ.



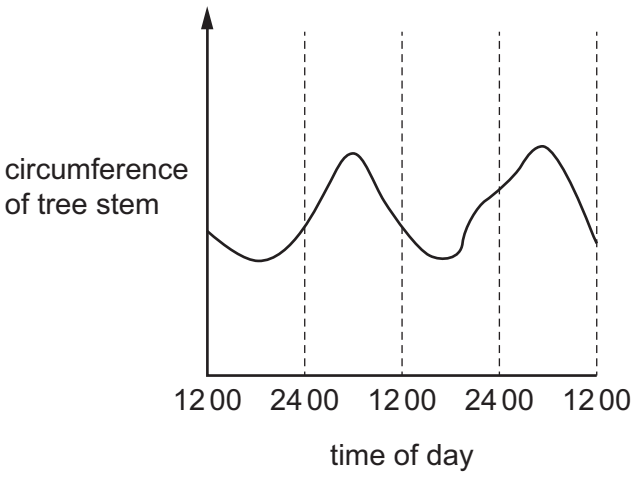
Which row correctly identifies tissues 1, 2 and 3?

	1	2	3
A	cortex	endodermis	phloem
B	cortex	epidermis	xylem
C	endodermis	epidermis	pith
D	pith	endodermis	phloem

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26 The circumference of a tree stem was measured continually for 48 hours.

The results are shown on the chart recording.



What explains the changes in circumference recorded during the 48 hours?

A Adhesion forces decrease during the night.

B Cohesive tension forces increase during the day.

C Mass flow of sucrose increases during the night.

D Root pressure decreases during the day.

27 Which description of movement in phloem is correct?

A Adding sucrose to a sieve tube element increases its water potential so that water enters and increases the hydrostatic pressure.

B At a sink, such as a storage organ, sucrose is removed from a sieve tube element and polymerised into starch.

C At a source, such as a photosynthesising leaf, sucrose enters a sieve tube element by facilitated diffusion.

D At a source, sucrose is loaded into a companion cell using a protein that carries both hydrogen ions and sucrose molecules.

28 Which statements about blood vessels are correct?

1 Collagen fibres in the walls of arteries and veins prevent overstretching.

2 Elastic fibres in large arteries allow stretching during ventricular systole.

3 Smooth muscle in arteries controls the distribution of blood to different parts of the body.

4 Veins have valves because their walls are thin.

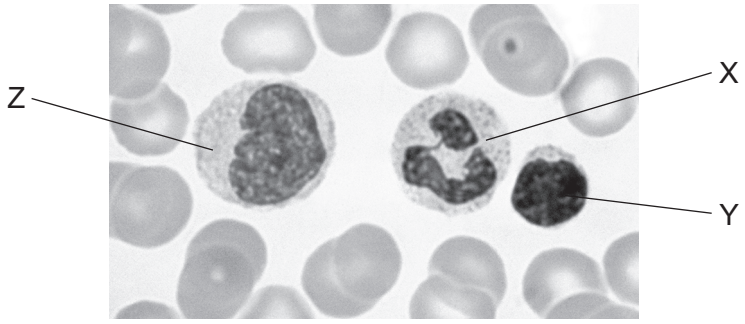
A 1, 2, 3 and 4

B 1, 2 and 3 only

C 2 and 4 only

D 3 and 4 only

29 The photomicrograph shows three white blood cells labelled X, Y and Z.



Which row correctly identifies these cells?

	cell X	cell Y	cell Z
A	lymphocyte	neutrophil	monocyte
B	lymphocyte	monocyte	neutrophil
C	monocyte	lymphocyte	neutrophil
D	neutrophil	lymphocyte	monocyte

30 The enzyme carbonic anhydrase catalyses the reaction:

$$CO_2 + H_2O \rightarrow HCO_3^- + H^+$$

Which statements describe the role of the enzyme carbonic anhydrase?

1 to speed up the decrease in pH of blood in the presence of carbon dioxide

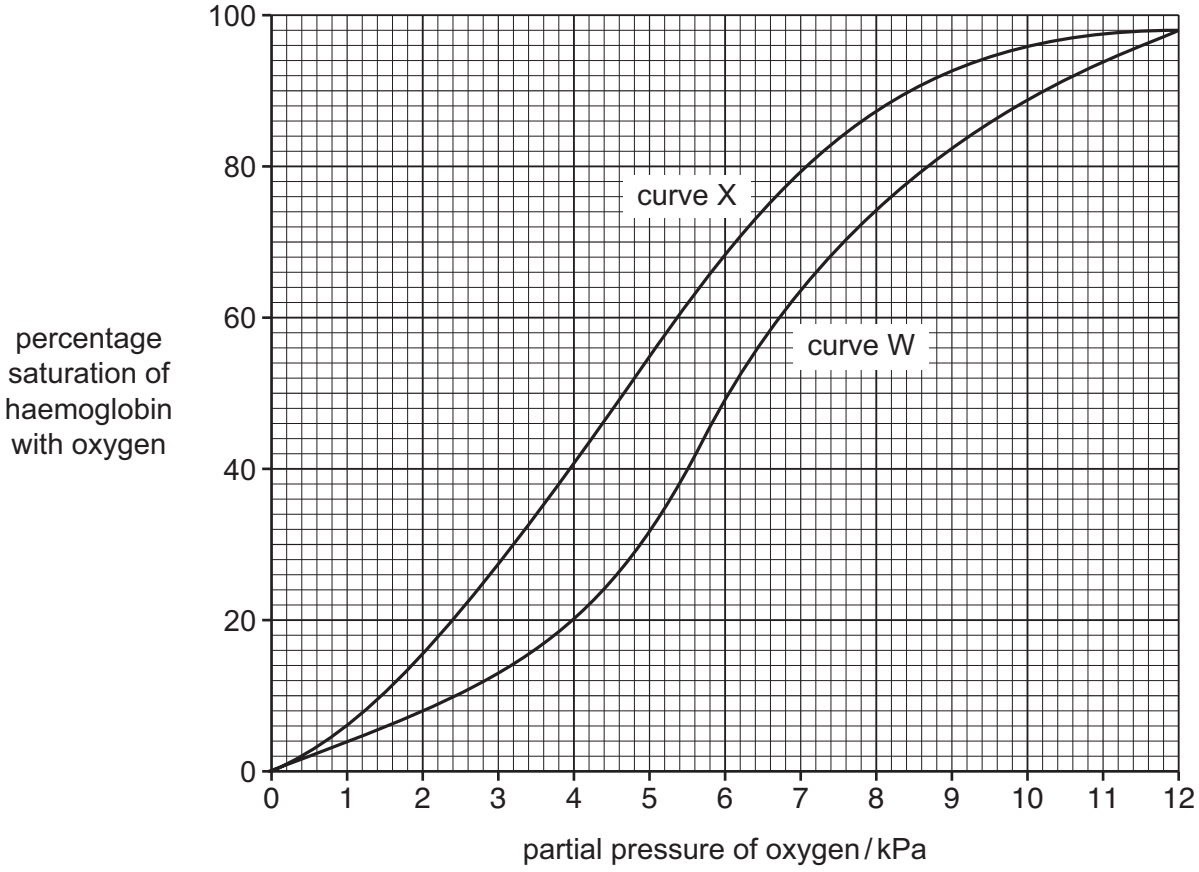
2 to facilitate the Bohr effect in haemoglobin

3 to speed up the reaction between carbon dioxide and water

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

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31 The graph shows the oxygen dissociation curves of adult haemoglobin at two partial pressures of carbon dioxide W and X.



Which pair of statements are correct?

1 Curve W shows the oxygen dissociation curve at a higher concentration of carbon dioxide than curve X.

2 Curve X shows the oxygen dissociation curve at a higher concentration of carbon dioxide than curve W.

3 At a partial pressure of oxygen of 7.0 kPa the haemoglobin from curve W has a higher affinity for oxygen than haemoglobin from curve X.

4 At a partial pressure of oxygen of 7.0 kPa the haemoglobin from curve X has a higher affinity for oxygen than haemoglobin from curve W.

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

32 A person has two blood tests one month apart. The number of each type of cell in a fixed sample size is counted.

type of cell	first test	after one month
red blood cells	normal	higher
lymphocytes	normal	higher

What could this suggest about the person based on the results after one month?

	body temperature higher	moved to higher altitude	ATP synthesis in cells is higher
A	no	no	yes
B	no	yes	no
C	yes	no	no
D	yes	yes	yes

33 A student was asked to describe the differences between four microscope slides of sections taken from different parts of the gas exchange system.

slide 1 not present: cartilage, glands
present: few goblet cells, ciliated epithelial cells, smooth muscle

slide 2 present: incomplete cartilage rings, glands, goblet cells, ciliated epithelial cells, smooth muscle

slide 3 not present: cartilage, glands, goblet cells, smooth muscle
present: squamous epithelial cells

slide 4 present: plates of cartilage, glands, goblet cells, ciliated epithelial cells, smooth muscle

Which is the correct identification of the parts of the gas exchange system?

	slide 1	slide 2	slide 3	slide 4
A	alveolus	bronchiole	bronchus	trachea
B	bronchiole	bronchus	alveolus	trachea
C	bronchiole	trachea	alveolus	bronchus
D	bronchus	trachea	bronchiole	alveolus

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34 Cigarette smoke contains carbon monoxide, nicotine and tar.

Which row correctly describes how these substances affect the body?

	carbon monoxide	nicotine	tar
A	stimulates nerve endings	stimulates the nervous system to reduce the diameter of the arteries	leads to obstructive lung disease
B	forms carbaminohaemoglobin	increases the risk of blood clots	blocks goblet cells
C	causes increased blood pressure	combines with haemoglobin	increases the risk of blood clots
D	combines with haemoglobin	stimulates nerve endings	carcinogenic

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

In what order do these events occur as emphysema develops?

1 Macrophages move into alveolar air spaces.

2 Tar paralyses cilia.

3 Macrophages secrete elastase.

4 Bacteria accumulate in alveoli.

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

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

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

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

36 If someone smokes cigarettes, what will be the immediate result of this action on the red blood cells?

A Carbon monoxide will combine with the globin in haemoglobin.

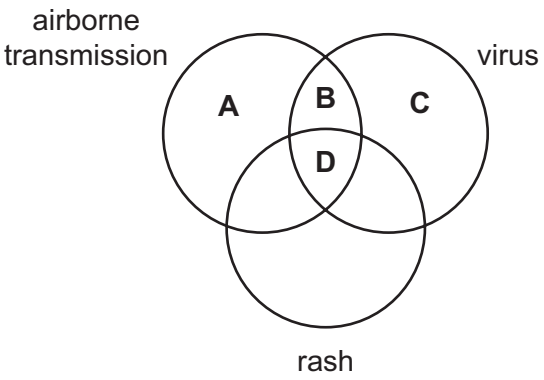
B Carbon monoxide replaces carbon dioxide in carbaminohaemoglobin.

C Less oxyhaemoglobin will form.

D More haemoglobinic acid will be formed.

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37 What is correct for tuberculosis (TB)?



38 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

39 Which method of gaining immunity can be described as natural active immunity?

A feeding on colostrum

B inhaling the chicken pox virus

C injection with antibodies

D through the placenta

40 Which statements correctly explain why smallpox has been eradicated, but not malaria or cholera?

1 Cholera vaccines provide only short-term immunity.

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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