Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/11**

Paper 1 Multiple Choice **October/November 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 Which row shows the correct order of size of these cell structures?

1 width of a mitochondrion

2 width of a ribosome

3 width of a cell surface membrane

4 width of a chloroplast

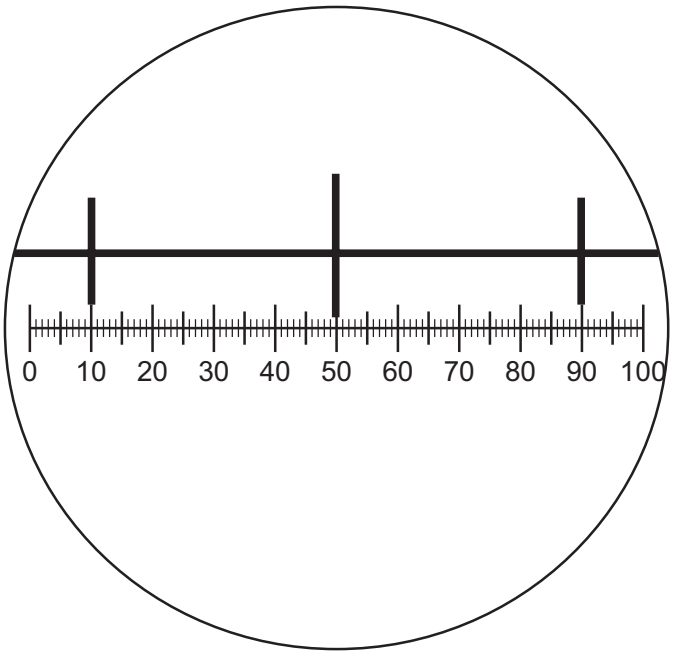
	largest →			smallest
A	1	4	2	3
B	1	4	3	2
C	4	1	2	3
D	4	2	1	3

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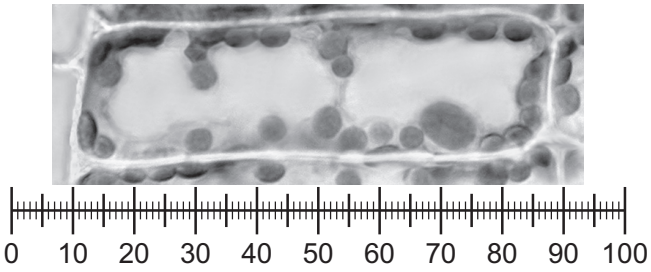
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2 The diagram shows a stage micrometer scale viewed through an eyepiece containing a graticule.

The small divisions of the stage micrometer scale are 0.1 mm.



The stage micrometer scale is replaced by a slide of a plant cell.



What is the actual length of the nucleus in the plant cell?

A 8 μm **B** 25 μm **C** 200 μm **D** 0.8 mm

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3 Insulin is a hormone synthesised from two polypeptide chains inside cells of the pancreas.

Which row shows the cell structures that are used in producing insulin and releasing it from the cells?

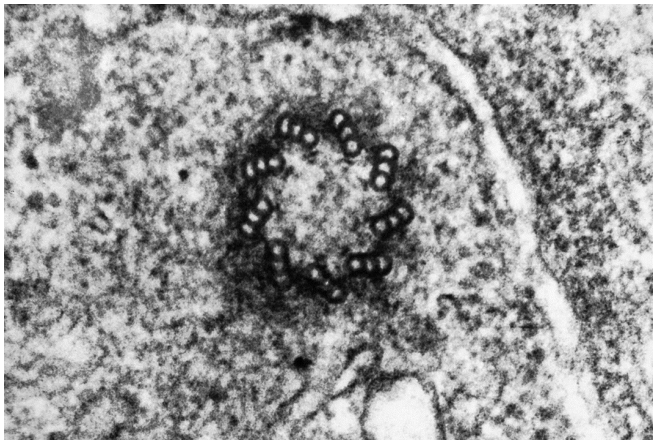
	Golgi body	lysosome	rough endoplasmic reticulum
A	✓	✓	✗
B	✓	✓	✓
C	✓	✗	✓
D	✗	✓	✓

key

✓ = used

✗ = not used

4 The electron micrograph shows a cell structure in a eukaryotic cell.



Which statements about this cell structure are correct?

1 ATP is synthesised in this cell structure.

2 The cell structure is made of protein molecules.

3 The cell structure replicates during interphase of the cell cycle.

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

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

The functions were listed by number.

1 synthesis of polypeptides

2 synthesis of lipids

3 packaging of hydrolytic enzymes that will remain in the cell

The appearances were listed by letter.

V membranes which surround an enclosed inner cavity

W non-membrane-bound, spherical structures

X a double membrane interspersed with 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	V	Z
B	W	Z	Y
C	Z	W	Z
D	Z	V	W

6 The DNA of typical prokaryotes is naked and circular.

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

A Only DNA of eukaryotes has a nuclear envelope around it and is a double helix.

B Only DNA of eukaryotes has a nuclear envelope around it and is circular.

C Only DNA of eukaryotes has proteins attached to it and is a double helix.

D Only DNA of eukaryotes has proteins attached to it and is linear.

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[Turn over

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7 A student carried out the Benedict's test on two different types of milk, X and Y.

A sample of each type of milk was heated to 100 °C in a water-bath with Benedict's solution and the time taken for the first appearance of a colour change was recorded.

The results are shown in the table.

type of milk	time for first appearance of a colour change with Benedict's solution / s
X	13
Y	26

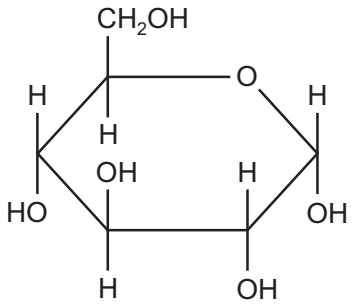
Which row shows the biological molecule the student detected in each sample of milk and the sample of milk with the highest concentration of this biological molecule?

	biological molecule present in each sample of milk	sample of milk with the highest concentration of this biological molecule
A	glucose	X
B	glucose	Y
C	reducing sugar	X
D	reducing sugar	Y

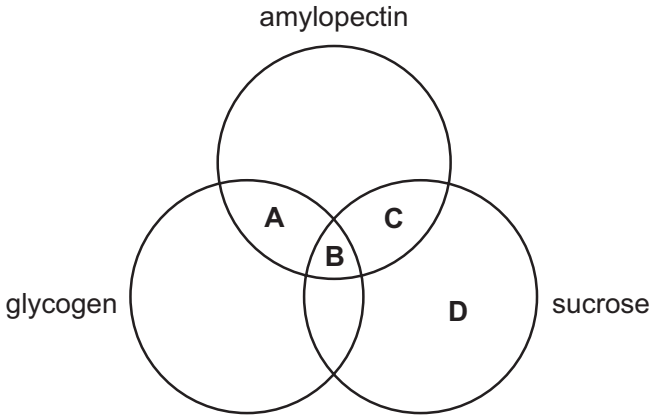
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8 The diagram shows the structure of a monomer.



Which molecules contain this monomer?



9 Which molecules are formed by condensation which involves a carboxyl group?

A amylopectin, collagen, triglyceride, sucrose

B amylopectin, collagen, triglyceride

C amylopectin, β-globin, sucrose

D collagen, β-globin, triglyceride

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10 Which row correctly matches the function with the structural features of cellulose, collagen, glycogen or triglyceride?

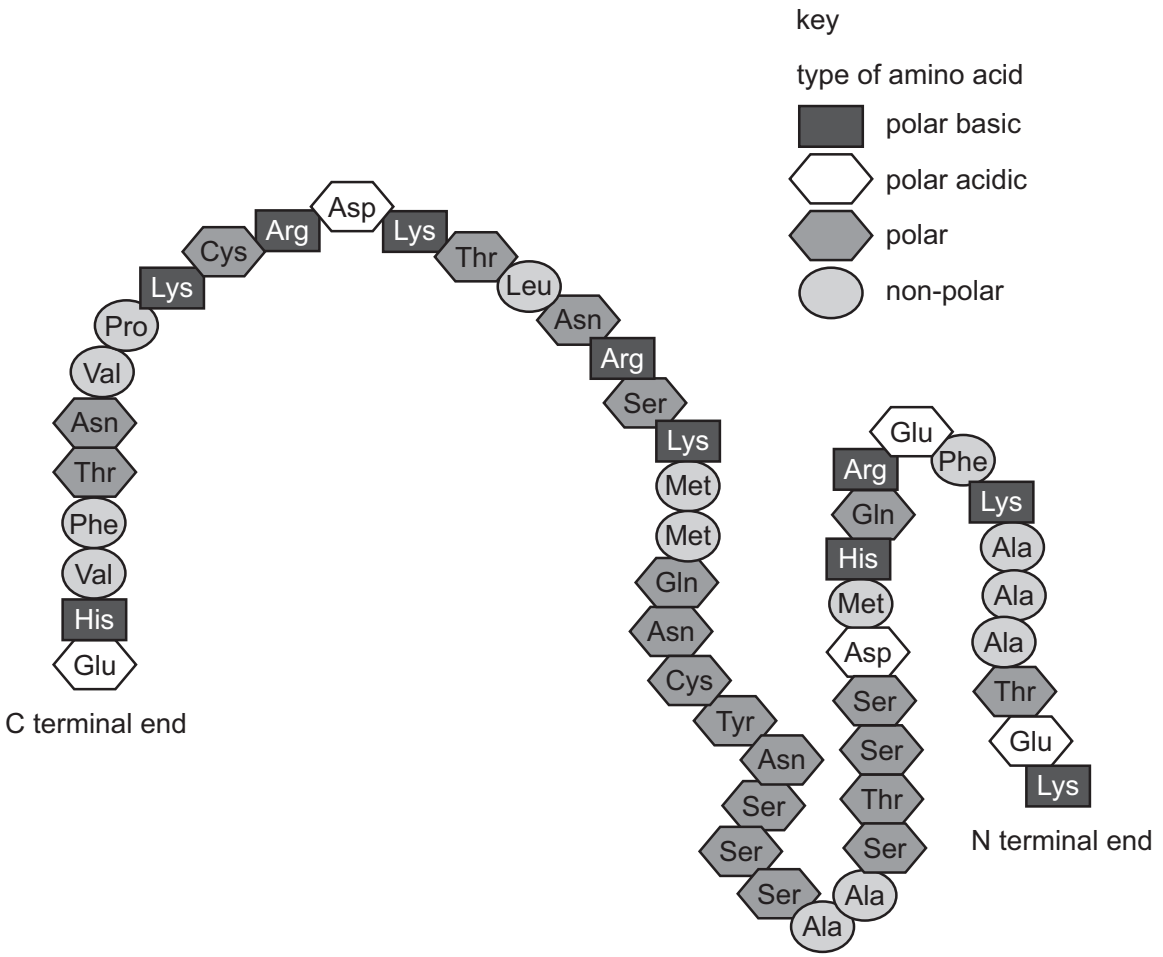
	molecule	function	structure		
			fibrous	molecules held together by hydrogen bonds	branched chains
A	cellulose triglyceride	support energy source	✓ ✗	✓ ✗	✗ ✗
B	collagen cellulose	strengthening support	✓ ✓	✓ ✗	✗ ✓
C	collagen glycogen	strengthening storage	✓ ✗	✓ ✗	✓ ✓
D	glycogen triglyceride	storage energy source	✗ ✗	✓ ✓	✓ ✗

key ✓ = correct ✗ = not correct

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11 The diagram shows the amino acids in a polypeptide.



An enzyme catalyses the hydrolysis of **any** peptide bond between a non-polar amino acid **and** any polar amino acid.

How many small peptides and single amino acids will be formed by the action of this enzyme?

	small peptides	single amino acids
A	6	1
B	8	1
C	12	3
D	13	4

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12 Which properties of water reduce temperature changes inside cells?

1 cohesion

2 latent heat of vaporisation

3 specific heat capacity

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

13 Which enzyme is extracellular?

A Amylase in saliva is an enzyme that catalyses the breakdown of starch in the mouth.

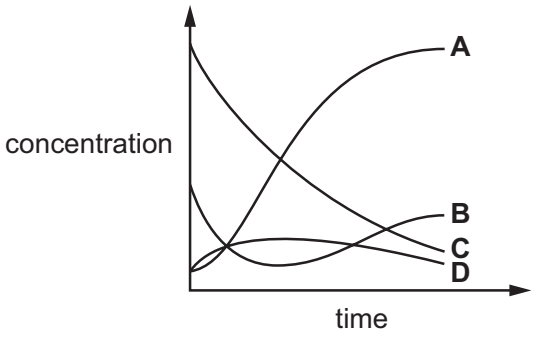
B ATP synthetase is an enzyme found in mitochondria that synthesises ATP.

C DNA polymerase is an enzyme that helps build DNA molecules by assembling nucleotides.

D RNA polymerase is an enzyme involved in the process of gene transcription.

14 The graph shows how the concentration of components of an enzyme-catalysed reaction changes with time.

Which line represents enzymes with empty active sites?



15 Which effects can non-competitive inhibitors have on enzyme-controlled reactions?

1 lower the K_m value

2 reduce the concentration of the product

3 reduce the rate of a metabolic pathway

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

16 Which processes can allow transport into or out of a cell?

1 active transport

2 facilitated diffusion

3 osmosis

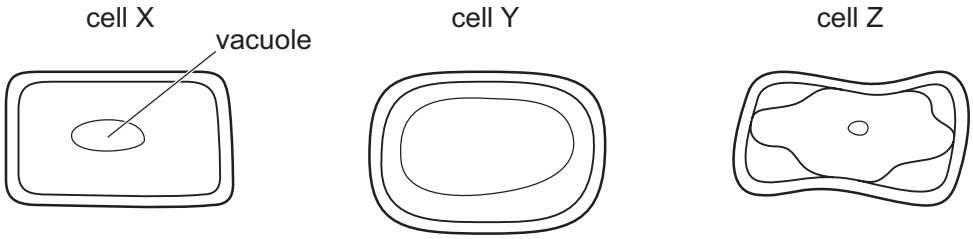
A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

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17 Plant cells were put into one of three different concentrations of sugar solution, 10%, 5% and 2.5%.

The cells were left for 50 minutes and then observed using a light microscope.



Which statements are correct?

1 Cell Y had a lower water potential than the sugar solution it was put into.

2 Cell Z was put into the 10% sugar solution.

3 Cell Z had a less negative water potential than the sugar solution it was put into.

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

18 During telophase of mitosis, a scientist stains the chromosomes of a diploid animal cell with a fluorescent dye to observe the telomeres.

This cell has 22 chromosomes.

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

A 22 **B** 44 **C** 66 **D** 88

19 Methotrexate is a drug used to treat cancer. It can act as an enzyme inhibitor preventing the synthesis of nucleotides containing thymine.

Cells treated with methotrexate are not able to complete the cell cycle.

A cell entering telophase is treated with methotrexate.

Which stage of the cell cycle will be affected by the action of methotrexate?

A anaphase

B interphase

C metaphase

D prophase

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20 Which stage of mitosis is correctly described?

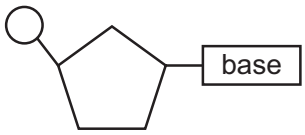
A In anaphase chromosomes line up across the equator.

B In metaphase the centrosomes replicate.

C In prophase chromatids move to opposite poles.

D In telophase chromosomes uncoil to form chromatin.

21 The diagram represents a nucleotide containing cytosine.



Which statements about this nucleotide are correct?

1 The carbohydrate could be ribose.

2 The organic base contains nitrogen.

3 Base pairing occurs with guanine.

4 Cytosine is a purine.

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

22 A section of DNA contains 73 base pairs.

	number of bases on each strand			
	adenine	cytosine	guanine	thymine
strand 1	29	V	14	W
strand 2	21	X	Y	Z

Which row represents the correct number of bases?

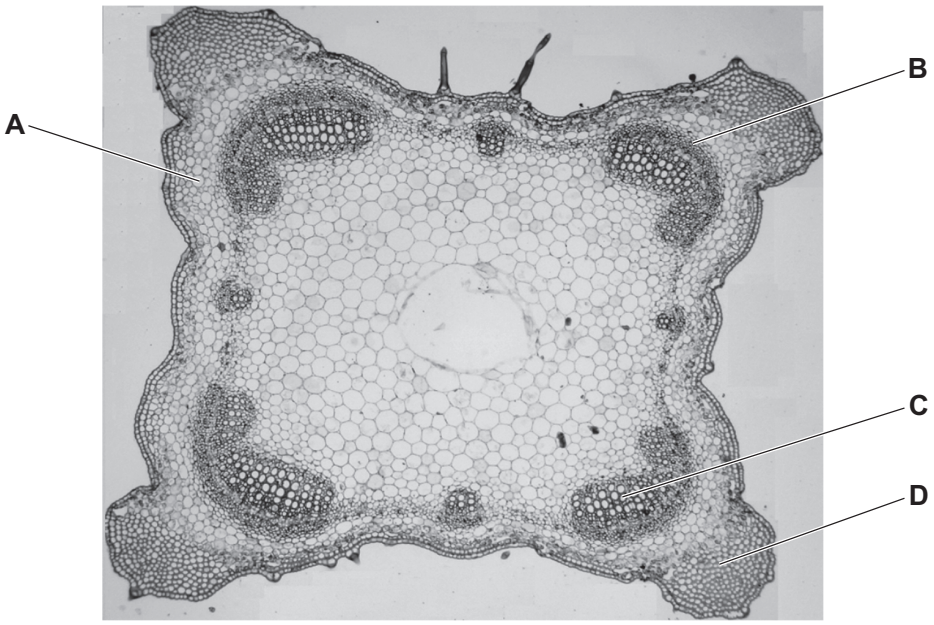
	V	W	X	Y	Z
A	9	21	14	9	29
B	14	29	9	9	21
C	21	9	29	9	14
D	29	9	29	14	9

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23 The photograph shows a section of a stem.

Which labelled part is the xylem?



24 Some fungi cause wilting in crop plants by growing within the xylem vessel elements.

Which process will be directly affected by these fungi?

A cohesion between water molecules

B development of root pressure

C mass flow during movement of assimilates

D uptake of water by root hair cells

25 Which features have a role in the transport of water in xylem vessel elements?

1 capillary action

2 adhesion

3 hydrogen bonding

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

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26 The loading of sucrose into companion cells involves a number of processes.

Which process is active?

A the movement of hydrogen ions into the cytoplasm of companion cells

B the movement of hydrogen ions out of the cytoplasm of companion cells

C the movement of sucrose into companion cells

D the movement of sucrose out of companion cells

27 The statements describe events that occur during the movement of sucrose.

1 Hydrostatic pressure is decreased.

2 Hydrostatic pressure is increased.

3 Sucrose is loaded into the phloem vessel.

4 Sucrose is unloaded from the phloem vessel.

5 Water moves by osmosis into the phloem.

6 Water moves by osmosis out of the phloem.

7 Water potential decreases in the phloem.

8 Water potential increases in the phloem.

Which sequence correctly describes what happens in a plant at a source during the movement of sucrose?

A 3 → 7 → 5 → 2

B 3 → 8 → 6 → 1

C 4 → 7 → 5 → 2

D 4 → 8 → 6 → 1

28 Which are present in the walls of capillaries?

	endothelium	smooth muscle	elastic tissue	collagen fibres
A	✓	✗	✗	✗
B	✓	✗	✗	✓
C	✗	✓	✗	✓
D	✗	✓	✓	✗

key

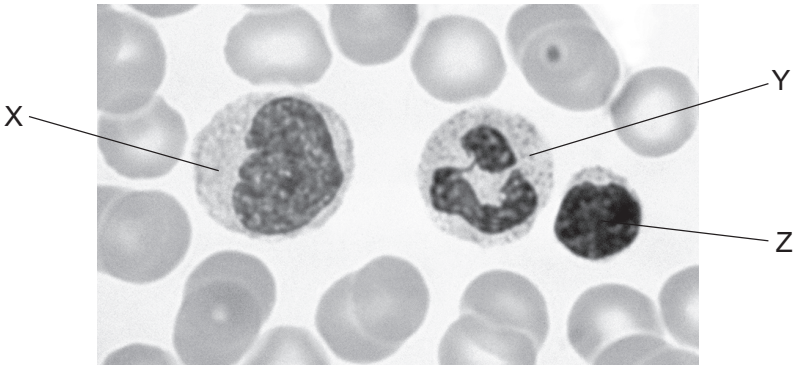
✓ = present

✗ = not present

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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	monocyte	neutrophil
B	lymphocyte	neutrophil	monocyte
C	monocyte	neutrophil	lymphocyte
D	neutrophil	monocyte	lymphocyte

30 Which sequence of letters correctly identifies the order of events during the cardiac cycle?

T atrial walls contract

U impulse is delayed a fraction of a second

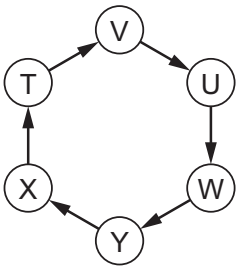
V wave of excitation enters the atrioventricular node

W wave of excitation passes down the Purkyne tissue

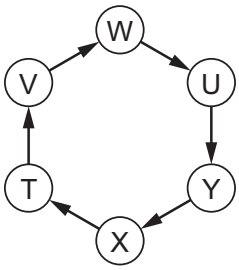
X wave of excitation spreads from the sinoatrial node

Y ventricles contract

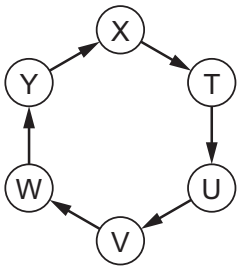
A



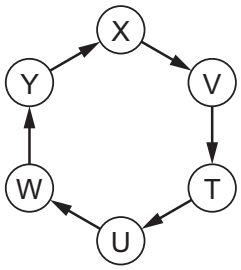
B



C

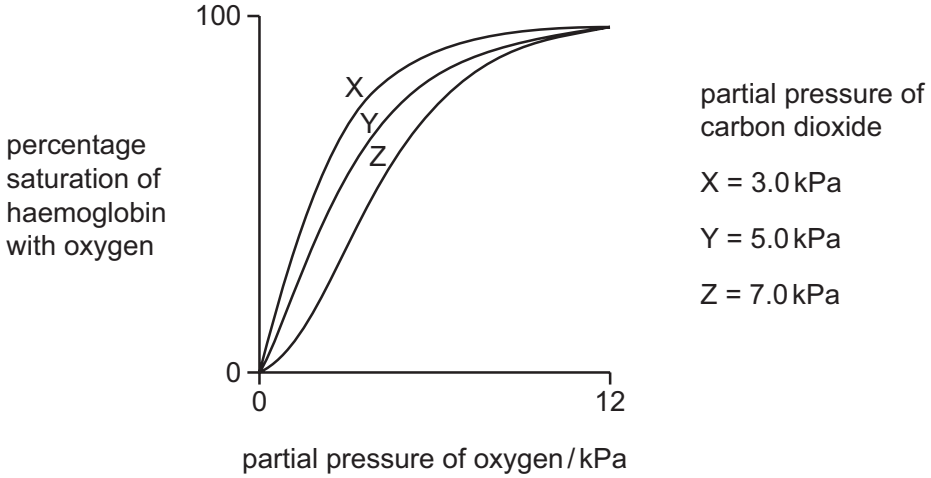


D



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31 The graph shows the effect of three different partial pressures of carbon dioxide on the oxygen dissociation curve for human haemoglobin.



What effect does decreasing the partial pressure of carbon dioxide have on haemoglobin?

A It is less efficient at taking up oxygen and less efficient at releasing oxygen.

B It is less efficient at taking up oxygen and more efficient at releasing oxygen.

C It is more efficient at taking up oxygen and less efficient at releasing oxygen.

D It is more efficient at taking up oxygen and more efficient at releasing oxygen.

32 What is correct about the transport of carbon dioxide by blood?

1 The enzyme carbonic anhydrase catalyses the formation of carbonic acid in red blood cells.

2 Carbon dioxide diffuses from active cells to red blood cells and reacts with water.

3 Carbonic acid dissociates forming hydrogen ions that combine with haemoglobin to form carbaminohaemoglobin.

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

33 Which statements about all bronchioles are correct?

1 they have goblet cells

2 they have ciliated cells

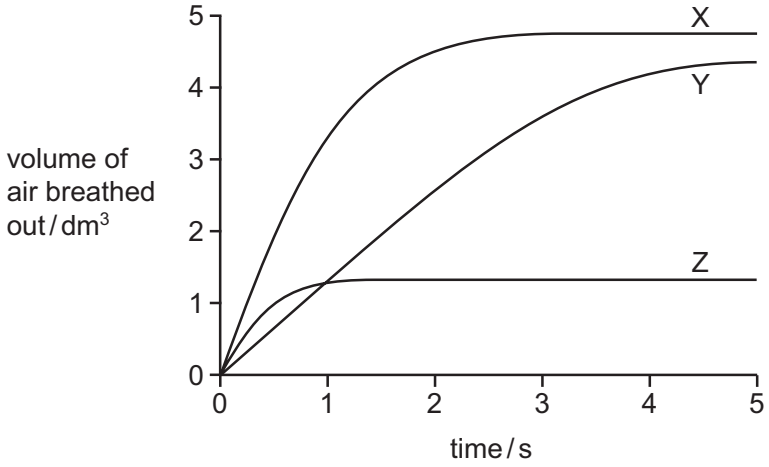
3 they have muscle tissue

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

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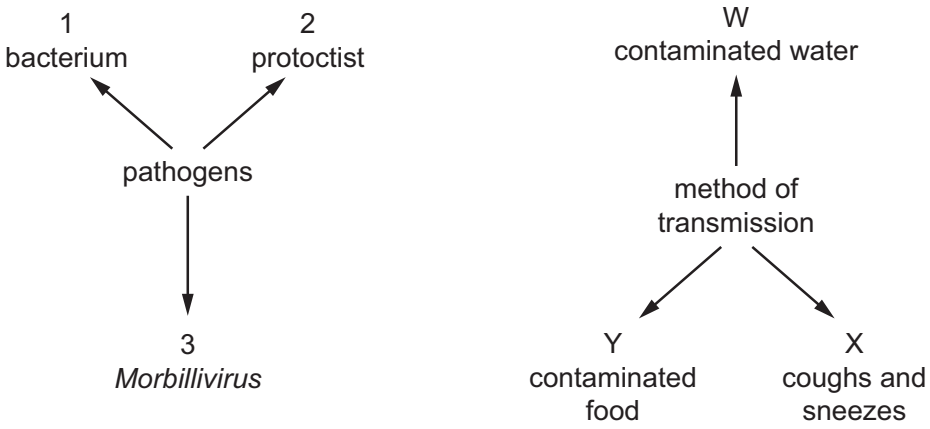
34 The graph shows the volume of air breathed out quickly and with force, following a deep breath in, for three different people, X, Y and Z.



What is a possible explanation for the differences in the volume of air breathed out by these people shown?

	chronic bronchitis	emphysema	normal lung function
A	X	Z	Y
B	Y	X	Z
C	Y	Z	X
D	Z	Y	X

35 The diagrams show some of the pathogens that cause disease in humans and some of the ways they are transmitted.



What is the correct pathogen and method of transmission for the disease TB?

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

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36 The proportion of the local population who have malaria in area R is higher than the proportion in area S.

Which factor causes this difference?

A Area R has a more humid climate than area S.

B Area R is nearer the equator than area S.

C There is a higher population in area R than area S.

D There is less sewage treatment in area R than area S.

37 Species X is a single-celled eukaryote.

Species X has been genetically modified to produce penicillin, which does not harm the cell walls of species X.

What may be concluded from this information?

1 The cell walls of species X are chemically different from those of bacteria.

2 The cell walls of species X are made of peptidoglycan.

3 The cell walls of species X are made of cellulose.

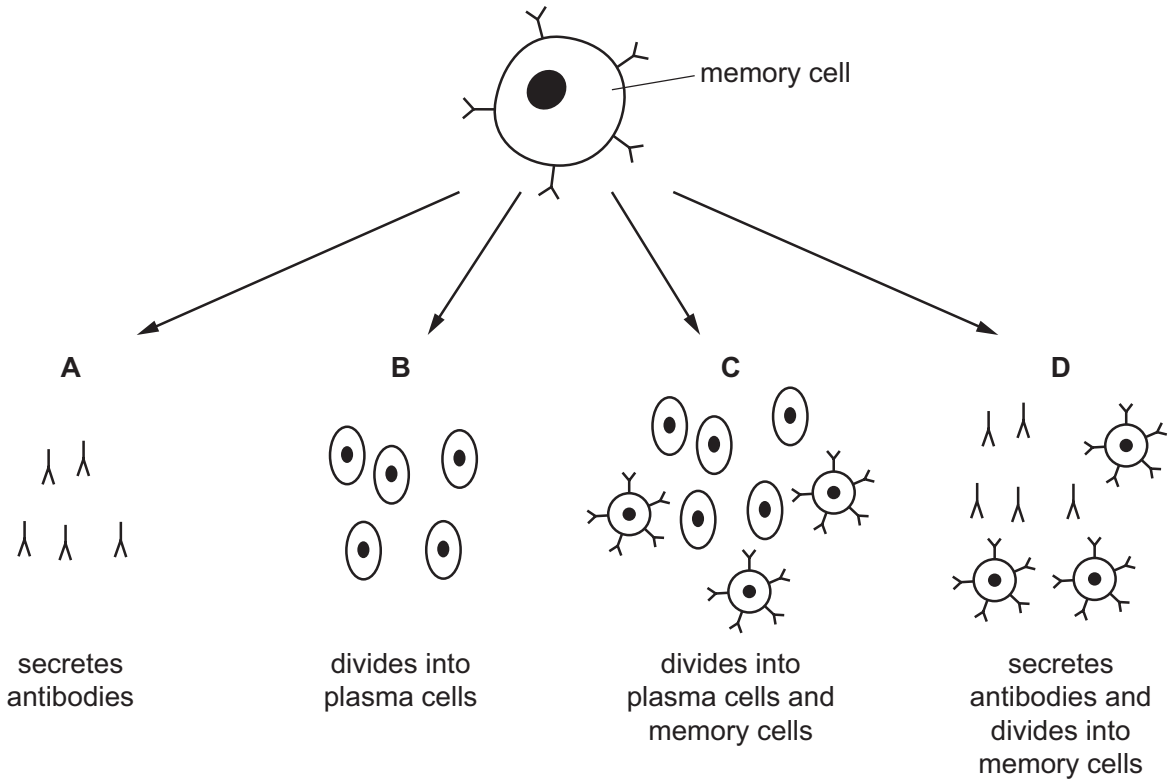
A 1 and 2 **B** 1 only **C** 2 only **D** 3 only

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38 When exposed to an antigen for a second time, memory cells stimulate a secondary immune response.

Which correctly shows the secondary immune response?



39 Monoclonal antibodies are produced for use in diagnosis or treatment of disease. To obtain the antibodies for an antigen, a mouse is injected with the antigen.

Some of the events in the production of the monoclonal antibody are listed.

1 Plasma cells are fused with cancer cells to form a hybridoma.

2 Hybridomas that secrete the required antibody are identified and cloned.

3 B-lymphocytes that recognise the antigen multiply and become plasma cells.

4 Hybridomas divide by mitosis and secrete antibodies.

5 Plasma cells are removed from the mouse spleen.

What is the sequence of the first four events in the production of the monoclonal antibody?

A 3 → 5 → 1 → 2

B 3 → 5 → 1 → 4

C 5 → 1 → 2 → 4

D 5 → 1 → 4 → 2

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40 Which row describes passive immunity?

	triggered by an antigen	involves an immune response	memory cells produced	permanent protection
A	✓	✓	✓	✓
B	✓	✓	✗	✗
C	✗	✗	✓	✓
D	✗	✗	✗	✗

key

✓ = correct

✗ = not correct

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Cambridge International AS & A Level

BIOLOGY **9700/12**

Paper 1 Multiple Choice **October/November 2020**

1 hour

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- Do **not** write on any bar codes.
- You may use a calculator.

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

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1 The size of the measles virus, *Morbillivirus*, is approximately 150 nm.

The *Mimivirus* is approximately 4.5 times larger than *Morbillivirus*, whilst the *Pandoravirus* is approximately 1.5 times larger than the *Mimivirus*.

Which viruses can be seen using a light microscope with a maximum resolution of 0.25 μm **and** using an electron microscope?

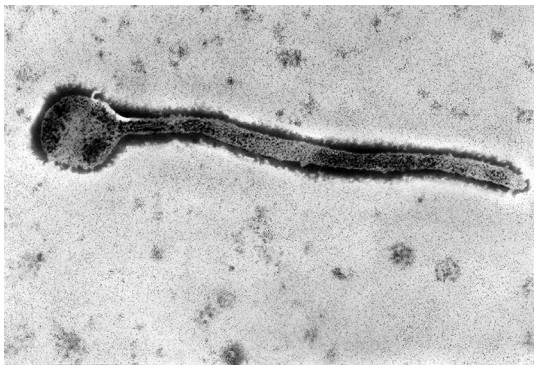
	Morbillivirus	*Mimivirus*	*Pandoravirus*
A	✓	✓	✓
B	✗	✓	✓
C	✗	✗	✓
D	✗	✗	✗

key

✓ = can be seen

✗ = cannot be seen

2 The electron micrograph shows a type of virus at a magnification of ×60 000.

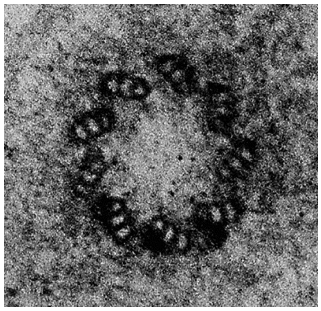


What is the actual length of the virus?

A 1.1 nm **B** 11 nm **C** 110 nm **D** 1100 nm

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3 The electron micrograph shows a structure found in the cytoplasm of an animal cell.



Which biological molecules are found in this structure?

1 nucleic acid

2 protein

3 phospholipid

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

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 number.

1 mRNA passes through to the ribosome

2 synthesis of lipids

3 packaging of hydrolytic enzymes that will remain in the cell

The appearances were listed by letter.

V membranes which surround an enclosed inner cavity

W non-membrane-bound, spherical structures

X a double membrane interspersed with 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	V	W	Z
B	V	Z	Y
C	X	V	W
D	X	V	Z

5 Which are found in typical prokaryotic cells **and** in typical plant cells?

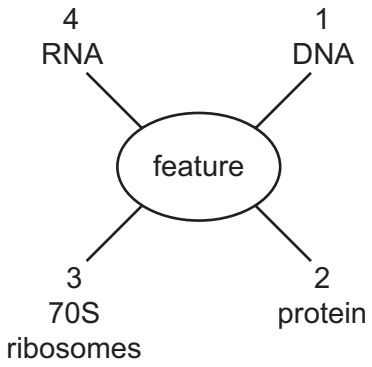
1 cell wall

2 circular DNA

3 cytoplasm

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

6 The diagram shows some features that occur in organisms.



Which features can be present in viruses?

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

7 Diastase is an enzyme that breaks down starch into maltose. Maltose is a reducing sugar.

A sample of starch is treated with boiled diastase and left for 15 minutes.

Samples of the mixture are then tested with iodine solution and with Benedict's reagent.

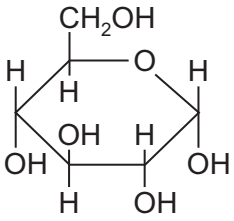
What are the results?

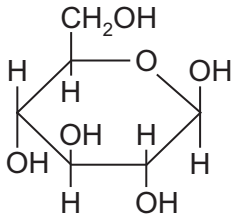
	iodine solution	Benedict's reagent
A	blue-black	blue
B	blue-black	red
C	brown	blue
D	brown	red

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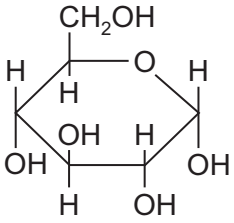
8 Which pair of monosaccharides forms sucrose?

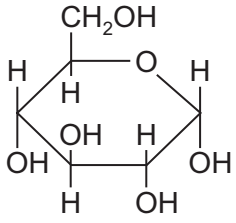
A



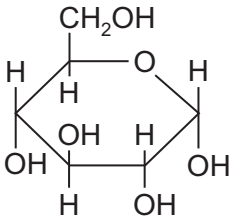


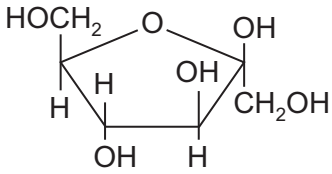
B



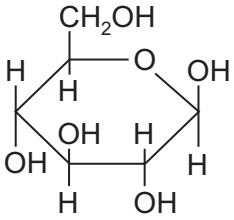


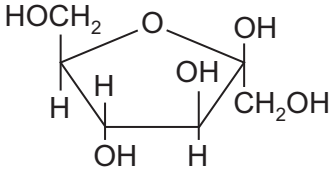
C



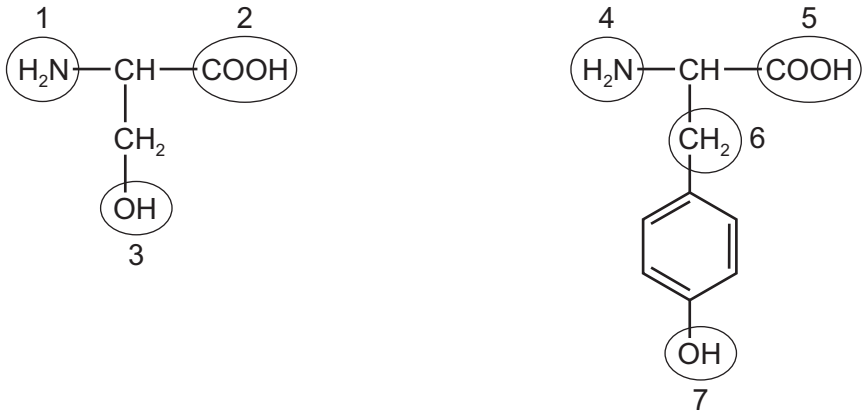


D





9 The diagram shows the structures of two amino acids.



These amino acids will form part of a protein that has a tertiary structure.

Which numbered groups could form hydrogen bonds to maintain the tertiary structure of the protein?

A 1 and 6 **B** 2 and 4 **C** 3 and 5 **D** 3 and 7

10 Which row about the structure of proteins is correct?

	primary structure	tertiary structure	quaternary structure
A	is the number of amino acids present in a protein	is the result of cross bonding between all the amino acids in the primary structure	is the polypeptides that link together to form a protein
B	is the order of amino acids present in a protein encoded by DNA	is the shape formed by folding of a polypeptide and held together by hydrogen bonds	contains two types of polypeptide that interact forming the shape of a protein
C	is the result of translation of an mRNA molecule by a ribosome into a chain of amino acids	is the result of ionic and hydrogen bonds, disulfide bridges and hydrophobic interactions between amino acids	is formed by four polypeptides and an additional reactive group attached to the protein
D	is the sequence of amino acids in a protein coded by an mRNA molecule	is formed as a result of interaction of the side chains of amino acids in the primary structure	is formed by the linking together of more than one polypeptide to form a protein

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11 Which row correctly identifies structural features of a collagen molecule and a haemoglobin molecule?

	molecule consists of more than one polypeptide	globular protein
A	collagen and haemoglobin	collagen and haemoglobin
B	collagen and haemoglobin	haemoglobin only
C	haemoglobin only	collagen and haemoglobin
D	haemoglobin only	haemoglobin only

12 Which statements describe some enzyme actions?

1 Enzymes hold reacting molecules so that their reactive groups are close together.

2 In an enzyme-catalysed reaction, more molecules have sufficient energy to react than in the absence of the enzyme.

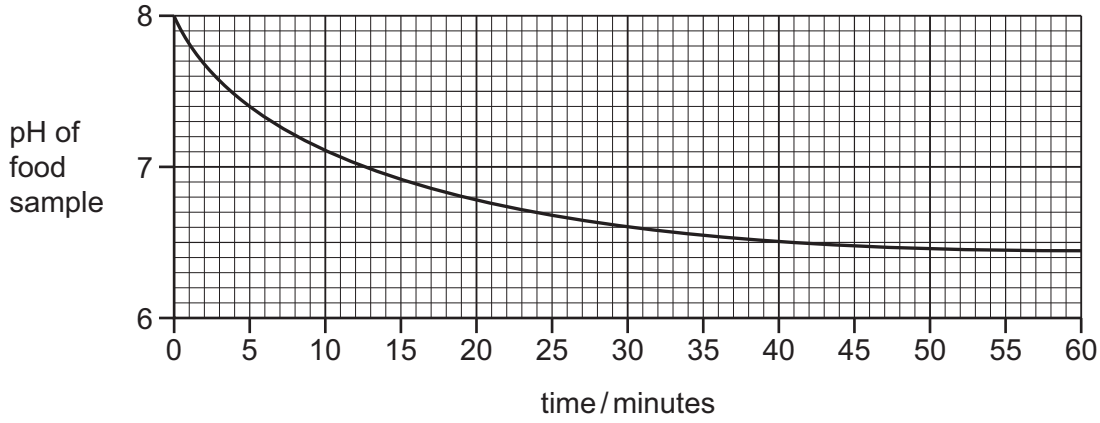
3 Reactions catalysed by enzymes take place at a lower temperature than they would without the enzyme.

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

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13 Lipase is an enzyme that catalyses the hydrolysis of lipids. An experiment was carried out to investigate changes in pH when lipase is added to a food sample containing a high proportion of lipids.

The results are shown in the graph.



Which statements are possible explanations of the results of the experiment between 50 minutes and 60 minutes?

1 Enzyme concentration becomes the limiting factor.

2 Substrate concentration becomes the limiting factor.

3 All the enzyme active sites are occupied.

4 Denaturation of the enzyme by the products takes place.

5 Products are acting as competitive inhibitors.

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

14 The painkiller ibuprofen reduces the activity of an enzyme involved in the production of prostaglandin.

Ibuprofen binds reversibly to the active site of the enzyme.

Which type of enzyme inhibition describes this example and why?

A competitive inhibition because ibuprofen alters the shape of the enzyme

B competitive inhibition because ibuprofen and the substrate cannot bind at the same time

C non-competitive inhibition because ibuprofen blocks the active site

D non-competitive inhibition because ibuprofen has the same shape as the substrate

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15 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 the result for this potato piece?

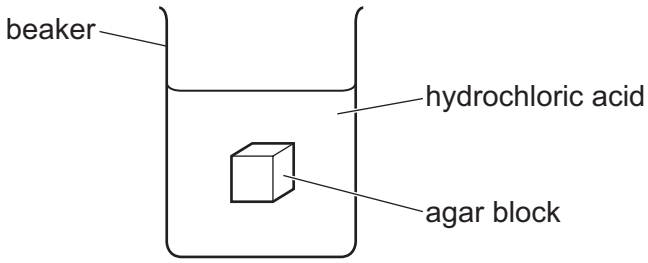
1 The concentration of sucrose in the potato is the same as the concentration of the sucrose solution.

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

3 There is no more movement of water into or out of the potato.

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

16 Four agar blocks are stained green using universal indicator and suspended in $1\,mol\,dm^{-3}$ hydrochloric acid.



The time taken for the agar blocks to change from green to red was recorded.

Which agar block would be the first to become completely red?

A $2\,cm \times 2\,cm \times 2\,cm$

B $2\,cm \times 1\,cm \times 4\,cm$

C $2\,cm \times 3\,cm \times 2\,cm$

D $5\,cm \times 2\,cm \times 3\,cm$

17 During the cell cycle, the mass of DNA in a cell is doubled.

At which stage in the cell cycle is the mass of DNA in a cell reduced?

A anaphase

B cytokinesis

C interphase

D prophase

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18 How many of the listed structures typically contain genetic material that has telomeres?

- bacterial cell
- chloroplast
- mitochondrion
- nucleus

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

19 In eukaryotes, the chromosomes become shorter and thicker during mitosis. The thickening may be increased by molecules called protamines. The protamines replace part of the structure of the chromosome.

Which part of the chromosome is replaced by protamines?

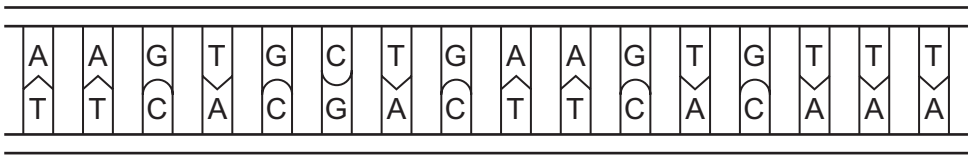
A centromeres

B chromatids

C histones

D telomeres

20 How many hydrogen bonds are holding the two strands of this section of a DNA molecule together?



A 16 **B** 32 **C** 38 **D** 48

21 Which description of a eukaryotic gene is correct?

A a sequence of bases that forms part of a DNA molecule and codes for a protein

B a sequence of nucleotides that forms part of a DNA molecule and codes for a polypeptide

C a sequence of bases that forms part of an RNA molecule and codes for a protein

D a sequence of nucleotides that forms part of an RNA molecule and codes for a polypeptide

22 The DNA sequence CCAAGAAGTCGACAAACA is translated to synthesise the amino acid chain gly-ser-ser-ala-val-cys.

As a result of a mutation, the sequence length of the amino acid chain is shortened from six to two amino acids. A stop codon in mRNA is UGA.

Which base in the DNA sequence was changed by the mutation?

A A **B** C **C** G **D** T

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23 Which combination of features is correct for a phloem sieve tube element as it unloads into a sink?

	water potential	lignified cell wall
A	higher than sink	absent
B	higher than sink	present
C	lower than sink	absent
D	lower than sink	present

24 Mass flow is the bulk movement of materials from one place to another.

Which vessels carry fluids by mass flow?

1 artery

2 phloem sieve tube

3 vein

4 xylem vessel

A 1, 2, 3 and 4

B 1, 2 and 3 only

C 1 and 3 only

D 2 and 4 only

25 Which two rows are correct for the movement of water from the soil into a root?

	soil	root
1	lower solute concentration	higher solute concentration
2	higher water potential	lower water potential
3	higher solute concentration	lower solute concentration
4	lower water potential	higher water potential

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

26 ATP is used in companion cells to provide the energy for loading a sieve tube element with sucrose.

How does the co-transporter mechanism use this energy?

A to pump hydrogen ions into the sieve tube element

B to pump hydrogen ions out of the companion cell

C to pump sucrose into the sieve tube element

D to pump sucrose out of the companion cell

27 Why is the mammalian circulatory system described as a double circulation?

A Blood flows twice through the heart in one complete cardiac cycle.

B Blood flows twice through the heart in one complete circuit of the body.

C Blood remains within arteries, capillaries and veins.

D Blood transports both oxygen and carbon dioxide.

28 Which sequence of letters correctly identifies the order of events during the cardiac cycle?

T atrial walls contract

U impulse is delayed a fraction of a second

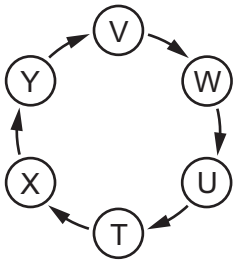
V wave of excitation enters the atrioventricular node

W wave of excitation passes down the Purkyne tissue

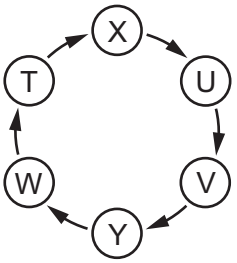
X wave of excitation spreads from the sinoatrial node

Y ventricles contract

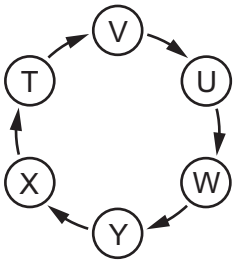
A



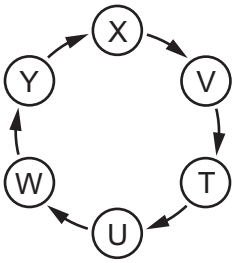
B



C



D



29 Which factors affect blood pressure?

1 the diameter of the blood vessels

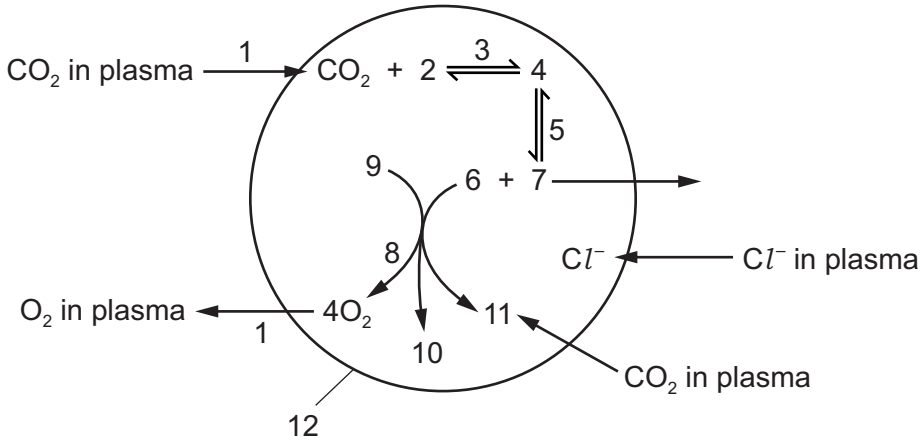
2 the systolic pressure of the heart ventricles

3 the volume of blood returning to the heart in each cardiac cycle

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

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30 The diagram is a summary of the role of haemoglobin in the transport of carbon dioxide.



Which set of labels is correct?

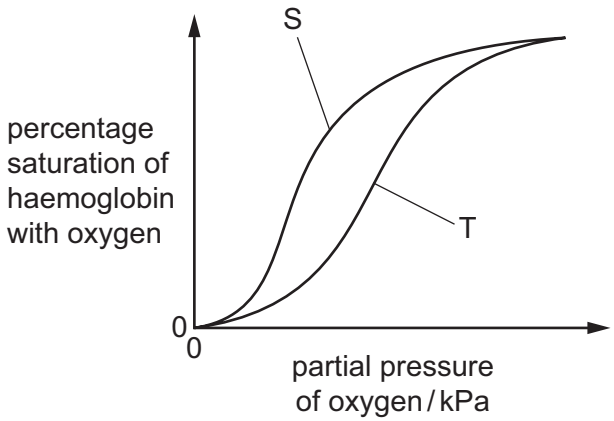
A 1 = facilitated diffusion, 4 = carbonic acid, 7 = hydrogencarbonate ions

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 The graph shows the oxygen dissociation curves of haemoglobin from two species of mammal, S and T.



Which statements could explain the difference in the oxygen dissociation curves of species S and species T?

1 Species T has a lower haemoglobin concentration in its red blood cells than species S.

2 The haemoglobin in species T has a lower affinity for oxygen than the haemoglobin in species S.

3 Species T lives at higher altitudes than species S.

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

32 Which are present in bronchioles?

1 endothelium

2 ciliated cells

3 smooth muscle tissue

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

33 The partial pressure of oxygen in air inside alveoli is 14 kPa.

The partial pressure of oxygen in pulmonary capillaries is 6 kPa.

What will be the effect of these partial pressures on diffusion?

A Carbon dioxide will not diffuse in any direction.

B Oxygen will diffuse from alveoli into capillaries.

C Oxygen will diffuse from capillaries into alveoli.

D Oxygen will diffuse equally in both directions.

34 Which can be **directly** linked to a reduction in the surface area available for gas exchange in human lungs?

1 emphysema

2 lung cancer

3 smoking tobacco

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

35 Which row is correct about the affinity between haemoglobin and the gases carbon dioxide, carbon monoxide and oxygen?

	highest affinity	⟶	lowest affinity
A	carbon monoxide	carbon dioxide	oxygen
B	carbon monoxide	oxygen	carbon dioxide
C	oxygen	carbon dioxide	carbon monoxide
D	oxygen	carbon monoxide	carbon dioxide

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36 An earthquake caused damage to sanitation systems in a large tropical village.

Drinking water became contaminated with sewage. Heavy rain then caused flooding and left large pools of water in the village. Housing was destroyed and people in the village had to live in very overcrowded conditions.

Which infectious diseases could increase in the village population as a result of the earthquake and heavy rain?

1 cholera

2 malaria

3 tuberculosis

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

37 Which statements about the use of antibiotics could cause an increase in antibiotic-resistant bacteria?

1 Patients do not always complete the course of antibiotics.

2 Patients keep unused antibiotics from previous prescriptions and take them at a later date in smaller doses than prescribed.

3 Antibiotics are used in farming to prevent infections.

4 Doctors prescribe narrow spectrum antibiotics that only kill a few types of bacteria.

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

38 Which row is correct for neutrophils and B-lymphocytes?

	neutrophil	B-lymphocyte
A	can change shape	activated by contact with antigens
B	found in organs rather than in blood	kill virus-infected cells
C	may be long-lived cells	always short-lived cells
D	their lysosomal enzymes digest bacteria	secrete cytokines

39 Rabies is usually a fatal disease. Rabies is transmitted to people in the saliva of infected animals.

A person who has been bitten by an infected animal needs immediate treatment.

The treatment is a vaccination against rabies **and** an injection containing antibodies to the rabies antigen.

What type of immunity is given by the injection of antibodies?

A artificial active

B artificial passive

C natural active

D natural passive

40 A graft of tissue, such as skin, from a different person is usually rejected by the body.

Which statement about graft rejection is correct?

A The graft is rejected by B-lymphocytes because they make and release antibodies which react with the surface antigens on the graft cells.

B The graft is rejected by B-lymphocytes because T-lymphocytes are not stimulated to produce antibodies.

C The graft is rejected by T-lymphocytes because the graft tissue causes T-lymphocytes to release antibodies.

D The graft is rejected by T-lymphocytes because they circulate in the blood and can gather at the graft site.

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BIOLOGY **9700/13**

Paper 1 Multiple Choice **October/November 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 **16** pages. Blank pages are indicated.

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1 What are the appropriate units for measuring diameters of alveoli, diameters of white blood cells and the width of cell walls?

	diameters of alveoli	diameters of white blood cells	width of cell walls
A	mm	mm	nm
B	mm	μm	μm
C	μm	mm	μm
D	μm	μm	nm

2 The actual diameter of a prokaryotic cell is 0.5 μm. An electron micrograph of the cell has a magnification of ×50 000.

What is the diameter of the cell in the image?

A 2.5×10^{-1} mm

B 2.5×10^{0} mm

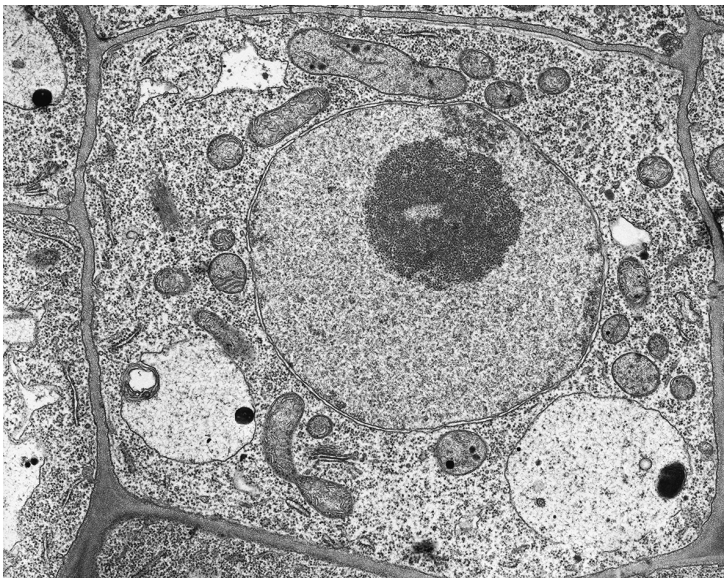
C 2.5×10^{1} mm

D 2.5×10^{2} mm

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3 The electron micrograph shows some cell structures.



Some cell structures are listed.

1 nucleolus

2 chloroplast

3 microtubules

4 ribosomes

5 mitochondria

6 plasmodesmata

Which cell structures can be seen in the electron micrograph?

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

4 Which part of the cell is often continuous with the rough endoplasmic reticulum?

A cell surface membrane

B Golgi body

C mitochondrion

D nuclear envelope

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5 Which statements about ATP are correct?

1 It is produced in chloroplasts.

2 It is used during protein synthesis.

3 It contains deoxyribose.

4 It is used in facilitated diffusion.

5 It is used to load sucrose into companion cells.

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

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

The functions were listed by number.

1 mRNA passes through to the ribosome

2 organises microtubules to produce the spindle during cell division

3 synthesis of lipids

The appearances were listed by letter.

V membranes which surround an enclosed inner cavity

W non-membrane-bound, spherical structures

X a double membrane with pores

Y non-membrane-bound, cylindrical structures

Z membrane-bound sacs, arranged as a flattened stack

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

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

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7 A student carried out tests for biological molecules on the **same** sample of milk.

The tests and their results were as follows.

- Heating to 80 °C with Benedict's solution gave a red colour.
- Boiling with acid, followed by neutralisation, then heating to 80 °C with Benedict's solution also gave a red colour.
- Adding Biuret solution gave a purple colour.
- Adding iodine solution gave a yellow colour.

Which biological molecules **must** be present in the milk?

1 non-reducing sugars
2 protein
3 reducing sugars
4 starch

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

8 Which row is correct for carbohydrates?

	monomer	polymer	macromolecule
A	fructose	amylose	cellulose
B	glucose	deoxyribose	amylopectin
C	monosaccharide	glycogen	deoxyribose
D	sucrose	starch	glycogen

9 Which molecules contain 1,6 glycosidic bonds?

1 amylopectin
2 glycogen
3 starch

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 Which row correctly shows the ratio of carbon atoms to hydrogen atoms for glucose, a saturated fatty acid and sucrose?

	ratio of carbon atoms to hydrogen atoms		
	glucose	saturated fatty acid	sucrose
A	1 : 2	1 : 2	1 : 1.8
B	1 : 2	4 : 1	1 : 2
C	2 : 1	1 : 4	2 : 1
D	2 : 1	2 : 1	1.8 : 1

11 Which row shows a correct comparison between a phospholipid molecule and a triglyceride molecule?

	phospholipid molecule	triglyceride molecule
A	contains a hydrophobic phosphate group	is a hydrophobic molecule
B	contains one glycerol molecule	contains three glycerol molecules
C	fewer ester bonds	more ester bonds
D	more fatty acids	fewer fatty acids

12 Adult human haemoglobin typically consists of two α chains and two β chains.

Approximately 5% of humans have one amino acid in the β chain that has been changed. This change affects the structure and stability of haemoglobin.

Which levels of protein structure could be affected in the haemoglobin of the humans with the changed amino acid?

A primary only

B primary and quaternary only

C secondary, tertiary and quaternary only

D primary, secondary, tertiary and quaternary

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13 Lysozyme occurs in human tears, saliva, milk and mucus.

Lysozyme has a role in the immune system and hydrolyses peptidoglycan.

Which description of lysozyme is correct?

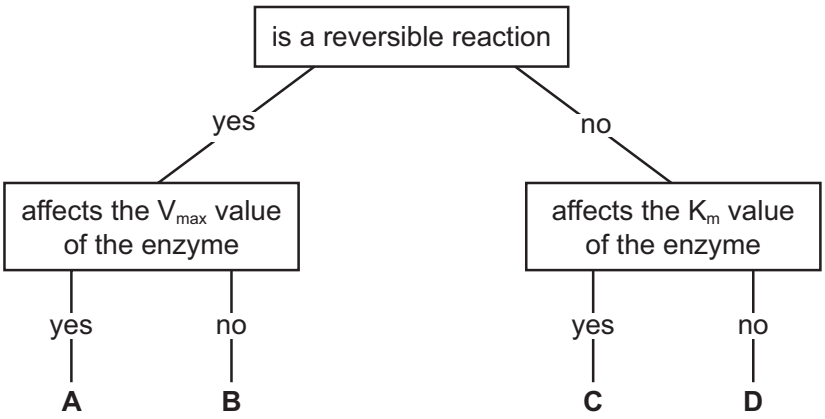
A It is an extracellular antibody.

B It is an intracellular antibody.

C It is an extracellular antibacterial protein.

D It is an intracellular antibacterial protein.

14 Which letter in the flow diagram shows the effect of adding a competitive inhibitor to an enzyme-catalysed reaction?



15 The cell surface membrane structure is described as a 'fluid mosaic'.

Which statement describes the 'mosaic' part of the cell surface membrane?

A the different patterns that are obtained by the moving phospholipid molecules

B the random distribution of cholesterol molecules within the phospholipid bilayer

C the regular pattern produced by the phospholipid heads and membrane proteins

D the scattering of the different proteins within the phospholipid bilayer

16 Solute X is at a higher concentration outside a cell than in the cytoplasm.

Which processes may allow solute X to be moved through the cell surface membrane?

A active transport, diffusion and facilitated diffusion

B active transport, diffusion and osmosis

C diffusion, facilitated diffusion and osmosis

D exocytosis, facilitated diffusion and osmosis

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17 Three molecules found in prokaryotes are listed.

1 phospholipid

2 protein

3 peptidoglycan

Which molecules are found in prokaryotic cell surface membranes?

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

18 What happens to the surface area to volume ratio of a cube when the length of each side is doubled?

A The ratio decreases by a quarter.

B The ratio decreases by half.

C The ratio doubles.

D The ratio increases by four times.

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

part		function	
p1	centromere	f1	holds the coils of DNA together
p2	histone proteins	f2	holds two chromatids together
p3	telomere	f3	prevents loss of genes

Which part is matched with its correct function?

A p1 and f2 **B** p2 and f2 **C** p2 and f3 **D** p3 and f1

20 Which features of mitosis are important for a single-celled organism?

1 asexual reproduction

2 production of genetically identical cells

3 growth

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

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21 Some events in the cell cycle are listed.

Which events are part of mitosis?

1 interphase

2 metaphase

3 cytokinesis

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

22 Which row represents the correct features of guanine?

	has a single ring structure	is a purine	joins its complementary base via three hydrogen bonds	pairs with thymine
A	✓	✓	✗	✓
B	✓	✗	✓	✗
C	✗	✓	✓	✗
D	✗	✗	✓	✓

key

✓ = correct

✗ = not correct

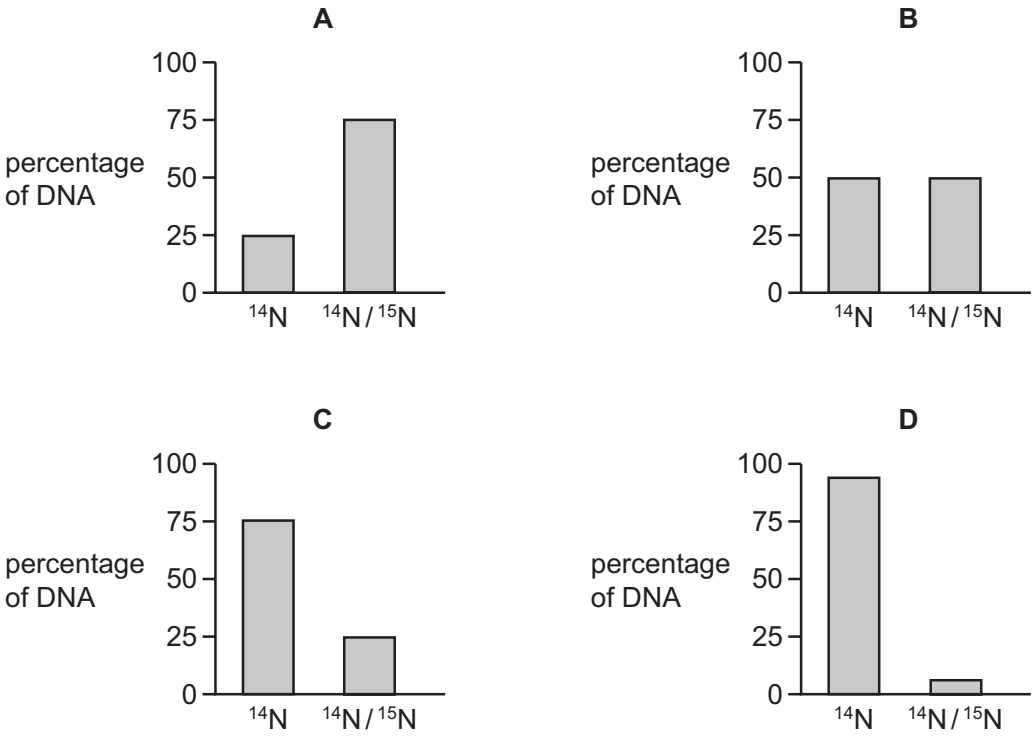
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23 Bacteria were grown in a medium containing ^{15}N. After several generations, all of the DNA contained ^{15}N.

Some of these bacteria were transferred to a medium containing the common isotope of nitrogen, ^{14}N. The bacteria were allowed to divide once. The DNA of some of these bacteria was extracted and analysed. This DNA was all hybrid DNA containing equal amounts of ^{14}N and ^{15}N ($^{14}N/^{15}N$).

In another experiment, some bacteria from the medium with ^{15}N were transferred into a medium of ^{14}N. The bacteria were allowed to divide three times. The DNA of some of these bacteria was extracted and analysed.

What is the composition of this DNA?



24 A molecule of transfer RNA (tRNA) has the anticodon sequence UAC.

What will be the corresponding nucleotide sequence in the DNA?

A ATG **B** AUG **C** TAC **D** TUG

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

1 lignified walls
2 cytoplasm
3 many mitochondria
4 pits
5 plasmodesmata
6 sieve plates

Which of these features are present in xylem vessel elements?

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

26 The diameter of a tree trunk usually decreases slightly during the day and increases slightly at night.

Which three environmental factors, if increased, could cause the largest decrease in diameter?

A humidity, temperature, wind speed

B humidity, light intensity, temperature

C humidity, light intensity, wind speed

D light intensity, temperature, wind speed

27 Sucrose moves within a phloem sieve tube from a source to a sink by mass flow.

Which type of gradient within the phloem sieve tube between the source and sink causes the movement of sucrose?

A diffusion gradient

B hydrostatic gradient

C concentration gradient

D water potential gradient

28 Which are present in the walls of veins?

	endothelium	smooth muscle	elastic tissue	collagen fibres
A	✓	✗	✓	✓
B	✗	✓	✗	✓
C	✓	✓	✓	✗
D	✓	✓	✓	✓

key
✓ = present
✗ = not present

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29 Which row is correct for the location of a type of molecule or cell?

	type of molecule or cell	blood	lymph	tissue fluid
A	antibodies	✗	✓	✓
B	plasma proteins	✓	✗	✗
C	lymphocytes	✓	✓	✓
D	phagocytes	✓	✗	✓

key
✓ = present
✗ = not present

30 What effect does decreasing carbon dioxide concentration have on haemoglobin?

A It is less efficient at taking up oxygen and less efficient at releasing oxygen.

B It is less efficient at taking up oxygen and more efficient at releasing oxygen.

C It is more efficient at taking up oxygen and less efficient at releasing oxygen.

D It is more efficient at taking up oxygen and more efficient at releasing oxygen.

31 Why does the red blood cell count increase in humans as they start living at high altitude?

A to allow more carbon dioxide to be excreted by the lungs, preventing a fall in blood pH

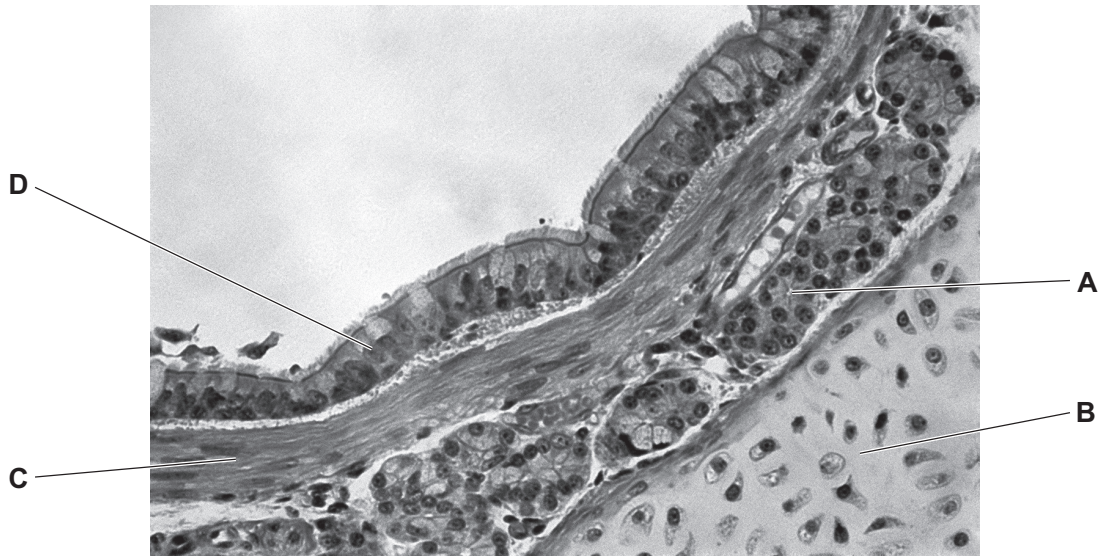
B to allow more oxygen to be taken up by the haemoglobin as the partial pressure of oxygen is lower

C to allow more oxygen to be taken up by the lungs as there is a lower percentage of oxygen in the air

D to allow more oxygen to be transported as the affinity of haemoglobin for oxygen is lowered

32 The diagram shows a photomicrograph of part of a bronchus.

Which label identifies smooth muscle?



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33 Which statements about all bronchioles are correct?

1 They have epithelium.

2 They have goblet cells.

3 They have muscle tissue.

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

34 Which row shows the effects of emphysema?

	alveoli	elastin	number of capillaries
A	burst	less	decrease
B	burst	more	increase
C	shrink	less	increase
D	shrink	more	decrease

35 Which row is correct?

	disease	transmission	infectious or non-infectious
A	HIV/AIDS	genetic	infectious
B	lung cancer	pathogen	infectious
C	sickle cell anemia	genetic	non-infectious
D	TB	pathogen	non-infectious

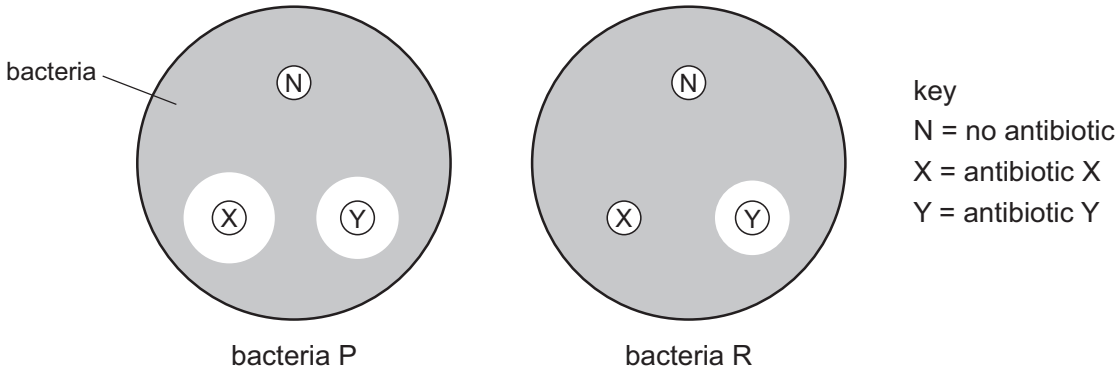
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36 The diagrams show the result of incubating two species of bacteria, P and R, on separate Petri dishes each containing nutrient agar.

Three filter paper discs have been added to each Petri dish.



Which statement is correct?

A Antibiotics X and Y are resistant to bacteria P.

B Bacteria P are resistant to both antibiotics.

C Bacteria R have a mutation that makes them resistant to antibiotic Y.

D N is a control disc showing bacteria R grow when antibiotic Y is not present.

37 The statements are about infectious diseases.

1 Disease may be spread between humans by contact.

2 Disease-causing organism has many antigenic variations.

3 Spread of disease may be influenced by climate.

4 A vaccination programme is available.

Which row matches the correct statement numbers with each disease?

	cholera	measles	malaria
A	1	1 and 2	1 and 3
B	1 and 4	4	2
C	2 and 3	1 and 3	1 and 4
D	4	1 and 4	2 and 3

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38 Muscle cells have cell surface receptors for the neurotransmitter, ACh. These receptors allow the muscle to respond to a nerve impulse.

In the condition myasthenia gravis, the helper T cells stimulate a clone of B cells to become plasma cells and secrete antibodies that bind to and block these ACh receptors. The muscles cannot be stimulated and begin to break down.

A short-term treatment for myasthenia gravis is to inject monoclonal antibodies into the blood.

What is the target of these monoclonal antibodies?

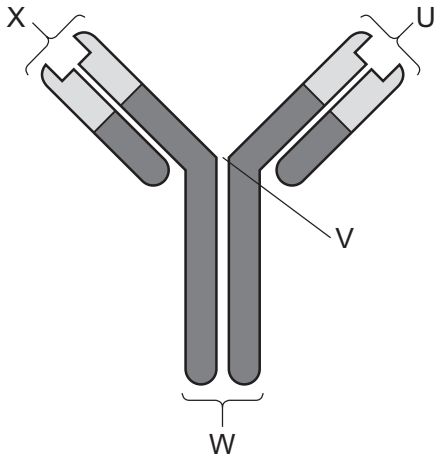
A antibodies that bind to ACh receptors

B muscle cell surface ACh receptors

C plasma cells secreting anti-ACh receptor antibodies

D the stimulating neurotransmitter ACh

39 The diagram shows the simplified structure of an antibody.



Which statement is correct?

A U and X allow the antibody to bind to two different antigens.

B V allows the antibody to fit around the antigen.

C W can bind to one specific antigen.

D X can bind with a specific phagocyte receptor.

40 Why have vaccination programmes eradicated smallpox but not TB?

A Vaccination can provide immunity only for smallpox but not for TB.

B Only TB is associated with poor living conditions.

C The smallpox virus showed little variation of antigens.

D The TB pathogen is a bacterium and the smallpox pathogen is a virus.

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