Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/11**

Paper 1 Multiple Choice **October/November 2019**

1 hour

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

7089765144

READ THESE INSTRUCTIONS FIRST

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

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

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

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

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1 Which cell structure contains cytoplasm?

A chloroplasts

B mitochondria

C plasmodesmata

D smooth endoplasmic reticulum

2 Some cell structures are listed in a particular order.

1 nucleus

2 ribosome

3 Golgi body

4 vesicle

What determines the order in which these cell structures are listed?

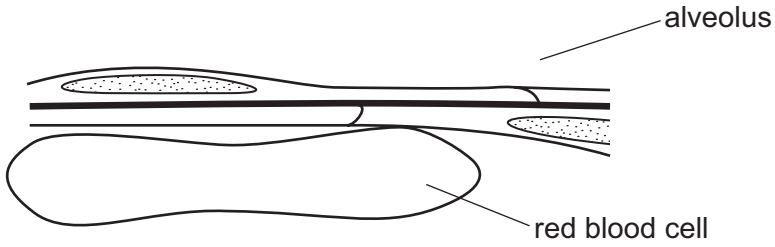
A sequence used in synthesis of a lipid

B sequence used in synthesis of an antibody

C size from largest to smallest

D size from smallest to largest

3 The drawing has been made from a section showing part of an alveolus and a red blood cell in a capillary. The magnification of the drawing is ×5000.



What is the minimum distance that oxygen must diffuse from air in an alveolus into the red blood cell?

A 0.1 nm **B** 1.0 nm **C** 0.1 μm **D** 1.0 μm

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 mRNA passes through to the ribosome

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 interspersed 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?

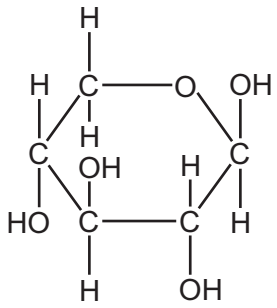
	1	2	3
A	V	X	Y
B	V	Z	Z
C	X	W	Z
D	X	Z	W

5 The antibiotic chloramphenicol inhibits protein synthesis in mitochondria and in some prokaryotes. Chloramphenicol does **not** inhibit protein synthesis in the cytoplasm of eukaryotic cells.

What would be the effect on the cells of a person being treated with chloramphenicol?

	rate of ATP production	transcription of nuclear DNA
A	decreases	decreases
B	decreases	no effect
C	increases	decreases
D	no effect	no effect

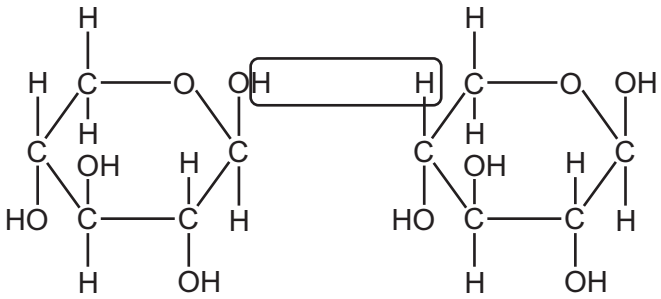
6 The diagram shows the monosaccharide xylose.



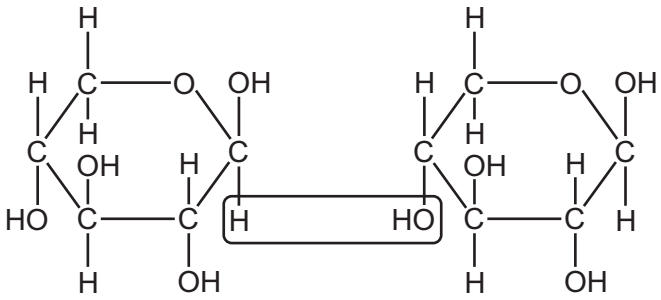
Many xylose monomers can be joined by glycosidic bonds to form a polysaccharide which is found in plant cell walls.

Which diagram shows the formation of a glycosidic bond between two xylose monomers?

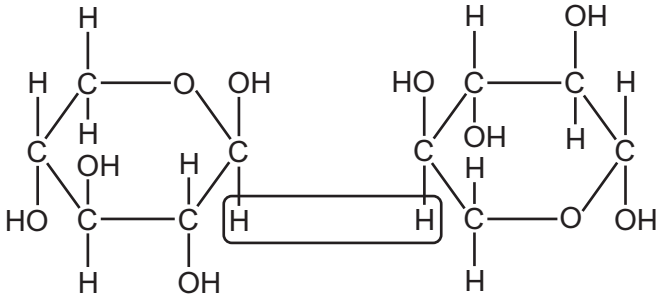
A



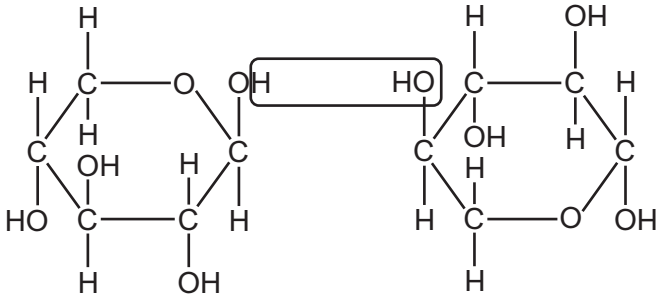
B



C



D



7 Which colour indicates the lowest concentration of reducing sugar present in a solution after testing with Benedict's solution?

A brown

B green

C red

D yellow

8 Which molecules are monomers?

1 ribose

2 glucose

3 deoxyribose

4 sucrose

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

9 Which molecules have properties that are dependent on hydrogen bonds?

1 cellulose

2 glycogen

3 haemoglobin

4 water

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

10 Some features of triglycerides are listed.

1 can be liquid or solid at room temperature

2 contains a high proportion of carbon–hydrogen bonds

3 insoluble in water

4 less dense than water

Which of these features make triglycerides suitable energy stores?

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

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11 Some foods contain hydrogenated vegetable oils. These are unsaturated fats that have been converted to saturated fats.

Which property of the fats will have changed?

A Their hydrocarbon chains will fit together more closely.

B Their solubility in water will increase.

C They will have more double bonds in their molecules.

D They will remain liquid at room temperature.

12 Which statements could be used to describe enzyme molecules **and** antibody molecules?

1 Hydrogen bonds stabilise the structure of the protein and are important for it to function efficiently.

2 Hydrophilic R-groups point in to the centre of the molecule and cause it to curl into a spherical shape.

3 The tertiary structure of the protein molecule plays an important role in the functioning of the protein.

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

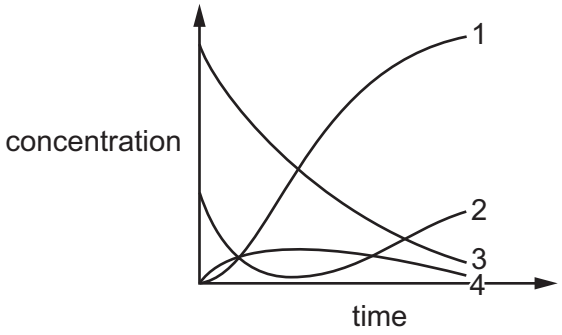
13 The V_{max} and K_m are determined for an enzyme-catalysed reaction.

What will be the effects on the V_{max} and K_m in the presence of a competitive inhibitor?

	V_{max}	K_m
A	decreases	increases
B	increases	decreases
C	stays the same	decreases
D	stays the same	increases

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14 The graph shows how the concentration of components,1, 2, 3 and 4, of an enzyme-catalysed reaction changes with time.



Which row identifies the components of this reaction?

	component 1	component 2	component 3	component 4
A	enzyme–substrate complex	unbound enzyme	product	substrate
B	enzyme–substrate complex	product	substrate	unbound enzyme
C	product	enzyme–substrate complex	unbound enzyme	substrate
D	product	unbound enzyme	substrate	enzyme–substrate complex

15 Which statement suggests that a membrane protein is involved in active transport?

A It allows movement of molecules across a membrane if concentration differences exist.

B It can only function if mitochondria are supplied with sufficient oxygen.

C It has a tertiary structure with a binding site with a specific shape.

D It is found in the cell surface membranes and the mitochondrial membranes.

16 Cell surface receptors used in cell signalling are usually proteins that extend from one side of the membrane to the other side of the membrane.

What is the role of the extracellular part of the protein?

A binding the signalling molecule

B functioning as an enzyme

C increasing the solubility of the receptor

D transmitting the signal from the target cell

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17 Which substances can pass directly through cell surface membranes and do **not** use a carrier protein or channel protein?

1 K^+ and Cl^-

2 CO_2

3 $C_6H_{12}O_6$

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

18 A student put a layer of plant epidermal cells on a microscope slide. The student put a drop of potassium nitrate solution on the layer of cells and observed that:

- the cell surface membrane of many of the cells had separated from the cell wall
- the cytoplasm and cell contents had shrunk.

What explains these observations?

	direction of net water movement	water potential of cells at start / kPa	water potential of solution at start / kPa
A	cells to solution	–100	–500
B	cells to solution	–500	–100
C	solution to cells	–100	–500
D	solution to cells	–500	–100

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

Which cells transcribe a high concentration of telomerase?

1 neutrophils

2 mature red blood cells

3 activated memory T-lymphocytes

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

20 At which stage of mitosis do these events occur?

	centromeres separate	chromosomes become shorter and thicker
A	anaphase	interphase
B	anaphase	prophase
C	metaphase	interphase
D	metaphase	prophase

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21 Which components could be found in nucleotides of rRNA?

1 any one of two different nitrogenous bases with a double ring structure

2 any one of two different purine bases

3 any one of three different nitrogenous bases with a single ring structure

4 any one of three different pyrimidine bases

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

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

1 the process takes place in the cytoplasm

2 an adenine nucleotide will line up against a uracil on the template strand

3 each new DNA molecule will contain one strand from the parent molecule

4 if the parent molecule contained 40% guanine nucleotides each new DNA molecule will contain 20% guanine nucleotides

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

23 Sickle cell anaemia is caused by a mutation in an allele of the gene that codes for the β-globin polypeptide of haemoglobin.

The diagram shows the sequence of bases in a small section of the coding strand of DNA for both the Hb^A (normal) and Hb^S (sickle cell) β-globin alleles.

Hb^A CTGACTCCTGAGGAGAAGTCT

Hb^S CTGACTCCTGTGGAGAAGTCT

How will the mutation in the allele result in the production of an altered version of the β-globin polypeptide?

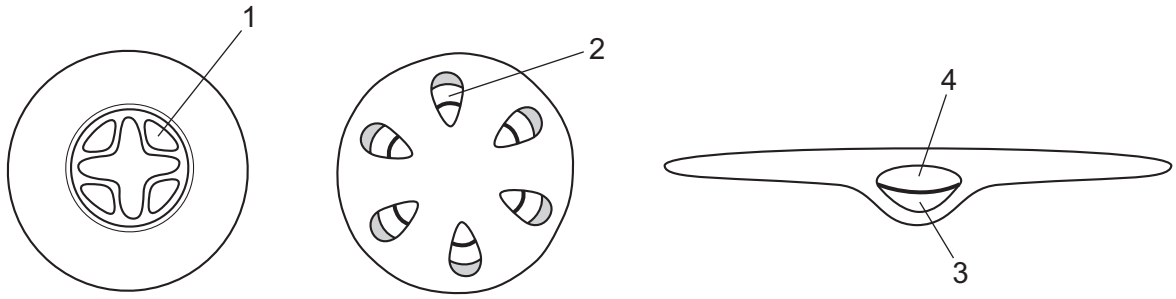
A A tRNA molecule with the anticodon GUG will hydrogen bond to the altered codon on mRNA.

B All the amino acids coded for after the mutation will differ from those in the Hb^A protein.

C mRNA transcribed from the Hb^S allele will contain the codon CAC instead of the codon CTC.

D The ribosome will be unable to continue translation of the Hb^S mRNA after the altered codon.

24 The diagrams show some tissue types in plant organs.



Which row identifies the tissue types?

	1	2	3	4
A	phloem	phloem	phloem	xylem
B	phloem	xylem	phloem	xylem
C	xylem	phloem	xylem	phloem
D	xylem	xylem	phloem	xylem

25 Which row correctly describes the adaptations of companion cells, phloem sieve tube elements and xylem vessel elements for their roles?

	companion cell	phloem sieve tube element	xylem vessel element
A	a thin layer of cytoplasm to reduce resistance to flow	strong, lignified cell walls for supporting the plant	many plasmodesmata for communication between cells
B	empty cells allowing water to flow freely	many plasmodesmata for communication between cells	strong, lignified cell walls for supporting the plant
C	many plasmodesmata for communication between cells	a thin layer of cytoplasm to reduce resistance to flow	empty cells allowing water to flow freely
D	strong, lignified cell walls for supporting the plant	empty cells allowing water to flow freely	a thin layer of cytoplasm to reduce resistance to flow

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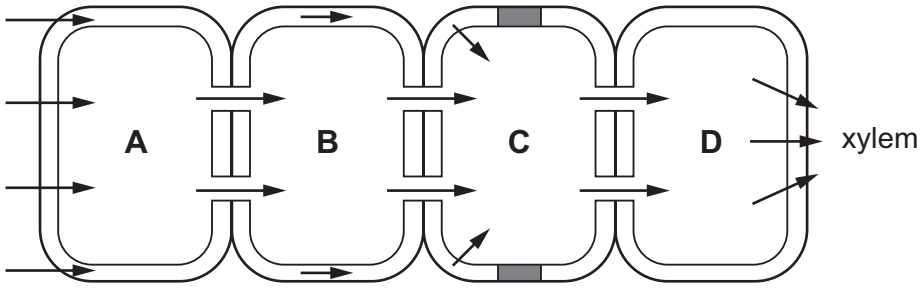
26 Irrigating crop plants with water containing low concentrations of salt causes an increase in the concentration of salt in the soil.

What explains why the increase in salt concentration could eventually kill the crop?

	water potential in roots	water potential in soil	direction of water movement
A	decreases		out of the roots
B	increases		into the roots
C		decreases	out of the roots
D		increases	into the roots

27 The diagram shows the pathway of water across root cells to the xylem.

Which cell is in the endodermis?



28 Which row shows the cause of mass flow in the phloem and the direction of movement of phloem sap by mass flow?

	cause of mass flow in the phloem	direction of movement of phloem sap by mass flow
A	hydrostatic pressure gradient	sink to source
B	hydrostatic pressure gradient	source to sink
C	water potential gradient	sink to source
D	water potential gradient	source to sink

29 Which statement about oxygen combining with haemoglobin is correct?

A All oxygen molecules which combine stop the haemoglobin molecule changing shape.

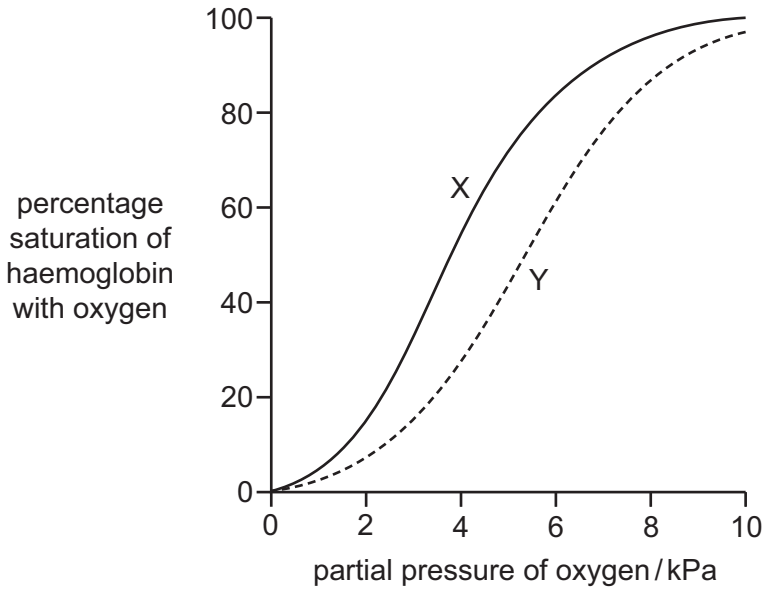
B Four oxygen molecules can combine with each haem group.

C The first oxygen molecule to combine does not affect the shape of haemoglobin.

D The second oxygen molecule to combine makes it easier for the third to combine.

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30 The diagram shows the Bohr effect.



What causes the shift from X to Y?

A decreased concentration of carbon dioxide and high pH

B decreased concentration of carbon dioxide and low pH

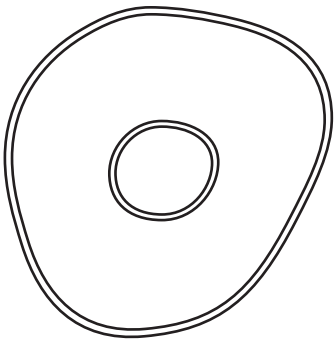
C increased concentration of carbon dioxide and high pH

D increased concentration of carbon dioxide and low pH

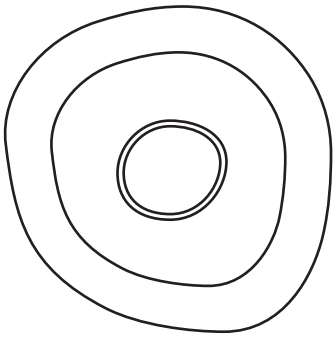
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31 Which plan diagram represents the tissues in a major vein?

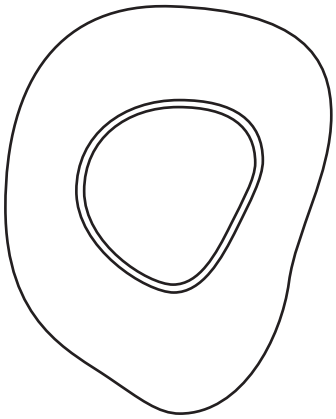
A



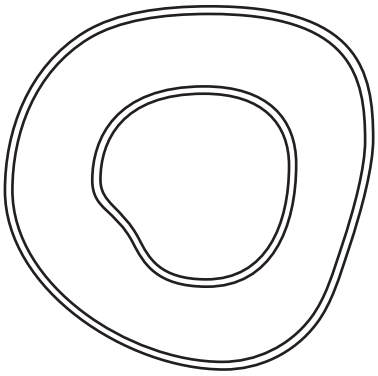
B



C



D



32 Ventricular septal defect (VSD) is a heart defect that people can have from birth. People with VSD have a hole in the wall (septum) that separates the left and right ventricles.

What could happen in a person with VSD?

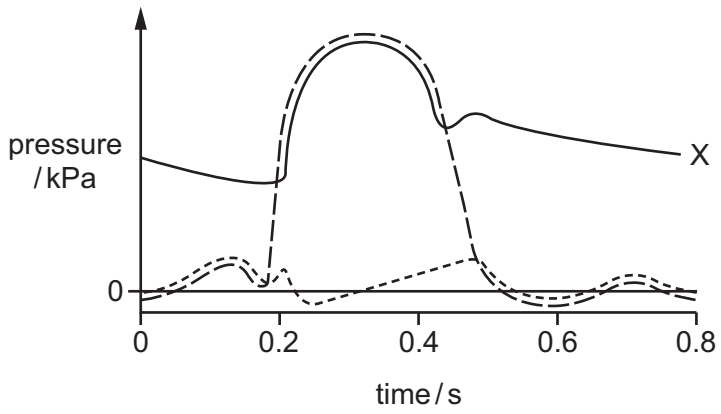
1 Blood will leak through the hole, mostly from right to left.

2 The volume of blood circulating through the lungs will be higher than in a person without VSD.

3 Less oxygen will be delivered to the body tissues.

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

33 The diagram shows the pressure changes in some structures of the **right side** of the heart during the cardiac cycle.



Which structure is represented by X?

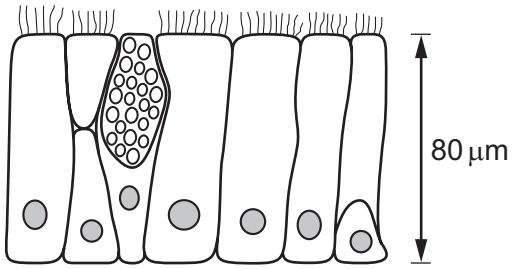
A pulmonary artery

B right atrium

C right ventricle

D vena cava

34 The diagram shows a section through a type of epithelium.



Where is this type of epithelium found in the respiratory system?

	trachea	bronchus	all bronchioles
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✓	✓

key

✓ = present

✗ = not present

35 In chronic obstructive pulmonary disease (COPD), airflow through the airways is reduced.

Which statements explain the reduced airflow?

1 More mucus is secreted into the airways.

2 Airways and alveoli lose their elasticity.

3 Many of the alveoli are destroyed.

4 Carbon monoxide binds irreversibly to haemoglobin.

A 1, 2, 3 and 4

B 1, 2 and 3 only

C 1, 3 and 4 only

D 2, 3 and 4 only

36 Outbreaks of cholera commonly occur in refugee camps that are set up after a major natural disaster such as earthquakes.

The list shows some measures that can be taken to limit the spread of cholera in the refugee camps.

1 treating all drinking water supplies with a high concentration of chlorine

2 setting up an emergency treatment centre to isolate cases of cholera and treat them with antibiotics

3 using concentrated disinfectant to clean sewage disposal areas and infected bedding

4 health workers visiting regularly to detect cases

5 keeping good records of the number of cases and deaths at treatment centres

Which features of these control measures involve an economic factor?

A 1, 2, 3, 4 and 5

B 1, 3 and 5 only

C 2, 3, 4 and 5 only

D 2 and 4 only

37 Which use of antibiotics helps to reduce the spread of resistance in bacteria?

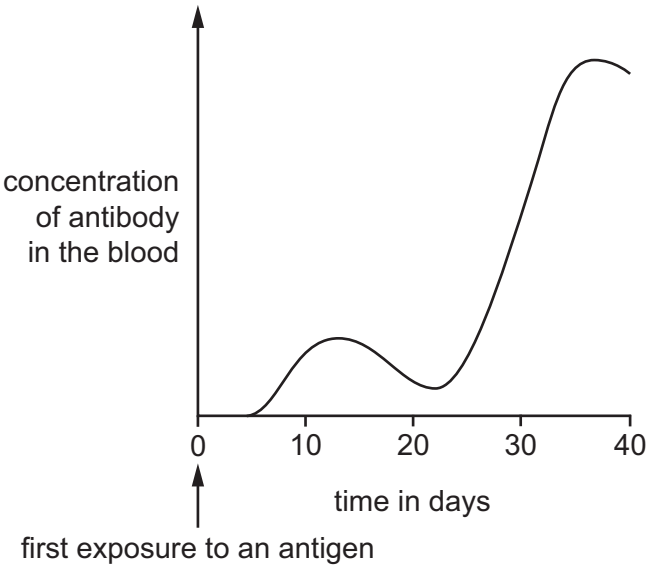
A using high concentrations of the antibiotic to kill all the bacteria

B giving routine preventative antibiotics to people who are having an operation

C regularly changing the type of antibiotic used to treat particular bacterial infections

D giving antibiotics to treat low level infection caused by a bacterium

38 The graph shows the amount of antibody produced in response to an antigen.



From the graph, which statement is correct?

A It takes 25 days to achieve active immunity.

B Memory cells for this antigen are present in the body within 20 days.

C T-helper lymphocytes are activated on day 12.

D The second exposure to the antigen occurred on day 25.

39 Which sequence summarises the hybridoma method for the production of monoclonal antibodies?

A	**B**	**C**	**D**
inject mammal with antibodies	inject mammal with antibodies	inject mammal with antigens	inject mammal with antigens
↓	↓	↓	↓
harvest antibodies from blood	harvest B-lymphocytes from spleen	harvest antibodies from blood	harvest B-lymphocytes from spleen
↓	↓	↓	↓
test for wanted antibody	fuse with cancer cells	test for wanted antibody	fuse with cancer cells
↓	↓	↓	↓
fuse with cancer cells	test for wanted antibody	fuse with cancer cells	test for wanted antibody
↓	↓	↓	↓
large scale culture	large scale culture	large scale culture	large scale culture

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40 The vaccination programme for smallpox was a medical success story which resulted in the World Health Organisation finally declaring the world free from smallpox in 1980.

Which statement correctly identifies the reasons for the success of the smallpox vaccination programme?

A The virus also infected animals making it easy to stop the transmission cycle.

B The virus remained in the body following infection and could become active later.

C The virus was stable and not prone to mutations.

D The virus was unstable and prone to mutations.

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BIOLOGY **9700/12**

Paper 1 Multiple Choice **October/November 2019**

1 hour

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

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Electronic calculators may be used.

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1 A student calibrated the scale on an eyepiece graticule in the eyepiece lens of a light microscope. The student was given a stage micrometer scale to use.

The divisions on the stage micrometer scale were 0.1 mm apart.

Which data must the student collect in order to calibrate the eyepiece graticule?

1 magnification of the eyepiece lens of the microscope

2 number of divisions of the stage micrometer scale seen in one field of view of the microscope

3 number of divisions of the eyepiece graticule scale equivalent to each division of the stage micrometer scale

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

2 The diameter of living cells varies considerably.

The diameter of a typical eukaryotic cell is 1.5×10^1 μm.
The diameter of a typical prokaryotic cell is 7.5×10^2 nm.

Using these measurements, what is the maximum number of each cell type which could fit along a line 1 cm long?

	number of white blood cells	number of *Streptococcus* cells
A	6.7×10^4	1.3×10^2
B	6.7×10^3	1.3×10^5
C	6.7×10^2	1.3×10^4
D	6.7×10^1	1.3×10^3

3 Which structures are found in animal cells and in plant cells?

1 centriole

2 lysosome

3 nucleolus

4 vacuole

A 1 and 3 only

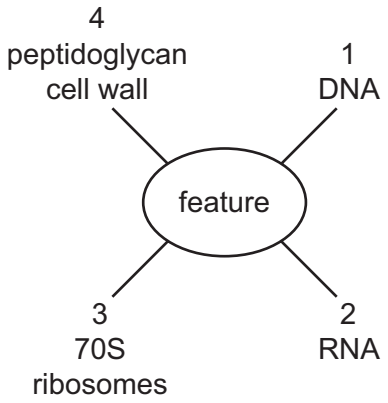
B 2 and 4 only

C 2, 3 and 4 only

D 1, 2, 3 and 4

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4 Which features shown in the diagram can be present in eukaryotes?



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

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 a number.

1 organises microtubules to produce the spindle during cell division

2 synthesis of polypeptides

3 synthesis of lipids

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 interspersed 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	W	X	Z
B	W	Z	V
C	Y	W	V
D	Y	Z	W

6 Which types of RNA are present in prokaryotic cells and in eukaryotic cells?

	mRNA	rRNA	tRNA
A	✓	✓	✓
B	✓	✓	✗
C	✗	✓	✓
D	✗	✓	✗

key

✓ = present

✗ = not present

7 A student carried out four tests for biological molecules on a solution. The results are shown in the table.

test for biological molecules	observation
iodine	orange-brown
biuret	purple
Benedict's	orange
emulsion	clear

Which three molecules may be present in this solution?

A glucose, starch, globin

B globin, glucose, collagen

C starch, sucrose, collagen

D sucrose, globin, collagen

8 A student was asked to estimate the concentration of reducing sugar in an unknown solution using the Benedict's test. Five reducing sugar solutions with different concentrations were provided in order to produce a calibration curve.

The student added 2 cm^3 of Benedict's solution to each of the reducing sugar solutions, heated them in a water-bath and recorded the time taken for the first appearance of a colour change.

Which variables should the student standardise, when carrying out the Benedict's test on each reducing sugar solution, to ensure the results are comparable?

1 volume of reducing sugar used

2 the temperature of the water-bath

3 the time the solutions are heated

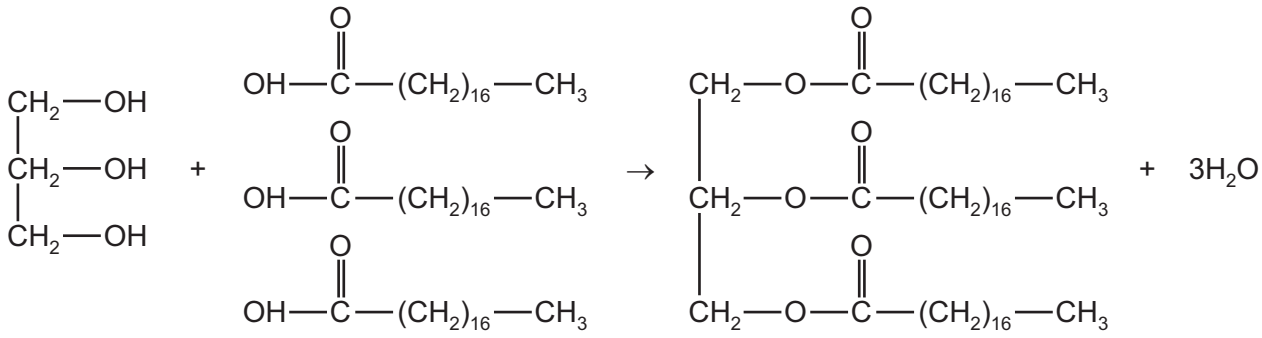
A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 3 only

9 Which rows show the chemical groups present in the biological molecules listed?

	biological molecule	presence of carboxyl (COOH) groups	presence of two or more hydroxyl (OH) groups
1	amino acid	yes	no
2	β-glucose	no	yes
3	glycerol	no	no
4	fatty acid	yes	no

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

10 The diagram shows the formation of a biological macromolecule.



Which type of bonds are formed in the macromolecule product?

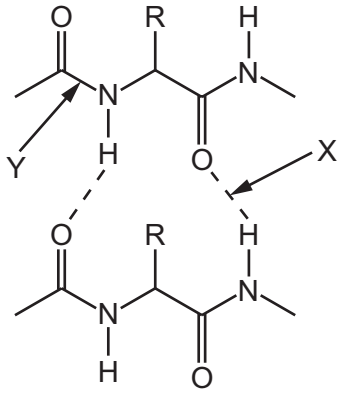
A ester bonds

B glycosidic bonds

C hydrogen bonds

D peptide bonds

11 Fibrous proteins are composed of chains of amino acids held together by bonds. An example of part of a fibrous protein is shown.



Which type of bond is at X and Y?

	X	Y
A	disulfide	hydrophobic interaction
B	hydrogen	peptide
C	hydrophobic interaction	ionic
D	ionic	peptide

12 Which row about the structure of proteins is correct?

	primary structure	secondary structure	quaternary structure
A	is the number of amino acids present in a protein	is the left-handed spiral formed by the primary structure	is the sub-unit polypeptides that link together to form a protein
B	is the order of amino acids present in a protein encoded by DNA	is the coiling of a chain of amino acids to form a β-pleated sheet or α-helix	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	occurs because of attraction between hydrogen and oxygen atoms in the peptide bonds	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 by hydrogen bonding between amino acids forming the primary structure	is formed by the linking together of more than one polypeptide to form a protein

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13 A student wrote four statements about water.

1 Water has a high specific heat capacity which maintains the temperature of water within cells.

2 Mammals rely on water having a relatively low latent heat of vapourisation to keep them cool.

3 When a negatively charged ion is added to water, the δ^+ charge on the hydrogen atom is attracted to the ion.

4 When surrounded by water, non-polar molecules tend to be pushed apart from one another.

Which statements are correct?

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

key

✓ = correct

✗ = not correct

14 Which statement about the active site of an enzyme is correct?

A It always has a specific fixed shape.

B It reduces the total energy of the product.

C It does not form chemical bonds with its substrate.

D It is determined by the primary structure of the enzyme.

15 When investigating the rate of reaction of the enzyme lipase on the hydrolysis of triglycerides, the pH must be maintained at an optimum to prevent the lipase denaturing.

What is the reason for this?

A The addition of water molecules produced by hydrolysis increases the pH.

B The products of hydrolysis decrease the pH.

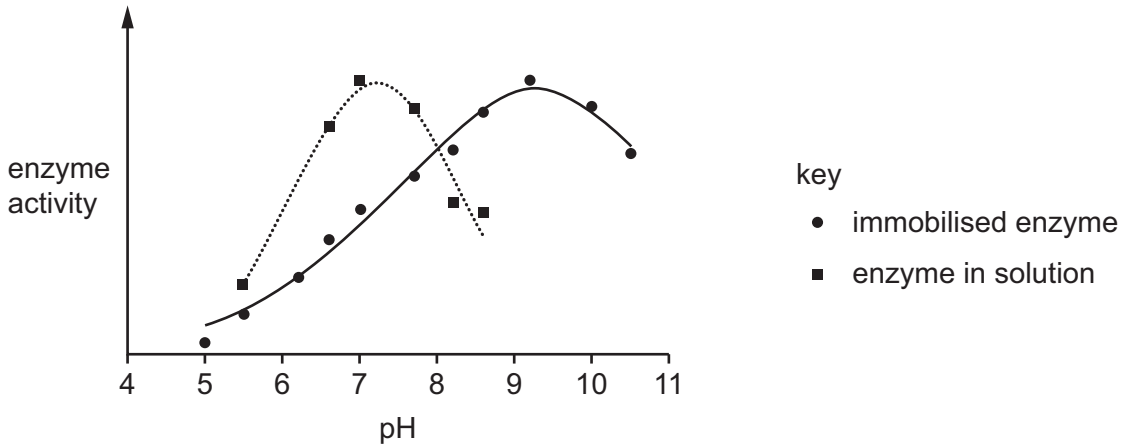
C The products of hydrolysis increase the pH.

D The removal of water molecules used in hydrolysis decreases the pH.

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16 An experiment was carried out to compare the effect of pH on the activity of an enzyme that was in solution and the same enzyme that had been immobilised on a gel. All other variables were kept the same.

The results are shown in the graph.



Which statement explains these results when the enzyme is immobilised?

A The primary structure has changed.

B The secondary structure has changed.

C The tertiary structure has changed.

D The quaternary structure has changed.

17 High concentrations of ethanol can disrupt cell membrane structure and make the cell surface membrane leaky.

Yeast cells release ethanol as a waste product of metabolism.

Yeast cells can alter the composition of the cell surface membrane to reduce the effect of ethanol.

- A saturated fatty acid, X, is replaced by an unsaturated fatty acid, Y.
- Y has a shorter hydrocarbon chain than X.
- There is an increase in the phospholipid to protein ratio.

Which statement would explain why the effect of ethanol is reduced?

A A greater proportion of phospholipid may increase the entry of ethanol via channel proteins.

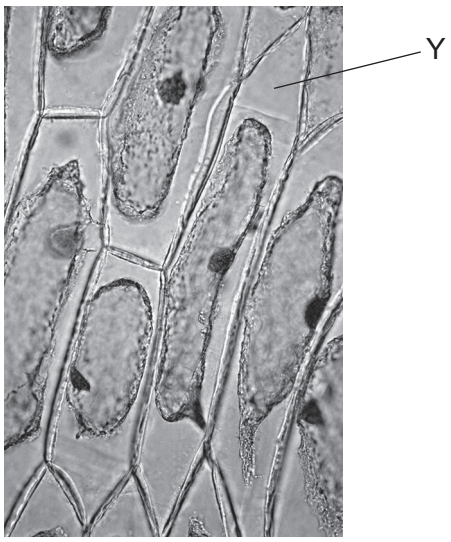
B An increase in hydrophobic interaction by phospholipid tails improves membrane stability.

C An increase in the proportion of fatty acids with double bonds decreases membrane fluidity.

D The shorter hydrocarbon chain of Y decreases membrane fluidity.

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18 The photomicrograph shows the appearance of onion epidermal cells after they have been soaked in solution X for one hour.



What fills the space labelled Y?

A air

B cytoplasm

C solution X

D water

19 Equal sized potato pieces were placed into a test-tube and covered with a sucrose solution. The test tube was left for 30 minutes. All other variables were controlled.

After 30 minutes, the potato piece had not changed in size.

What can be concluded from this result?

A The concentration of sucrose is the same in the potato and in the solution and there is no more movement of water into or out of the potato.

B The concentration of sucrose is the same in the potato and in the solution and there is no net movement of water into the potato.

C The water potential is the same in the potato and in the sucrose solution and there is no more movement of water into or out of the potato.

D The water potential is the same in the potato and in the sucrose solution and there is no net movement of water into or out of the potato.

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20 Which row shows the correct number of each component of a single chromosome during prophase of mitosis?

	centromeres	chromatids	polynucleotide strands	telomeres
A	1	0	2	2
B	1	2	4	4
C	2	0	4	2
D	2	2	2	4

21 The cell cycle includes mitosis.

Which are features of nuclear division?

1 forms cells of equal size to the parent cell

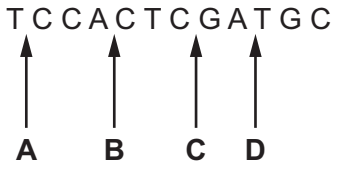
2 forms genetically identical nuclei

3 semi-conservative replication of DNA

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

22 The RNA triplet UAG acts as a stop codon terminating the synthesis of a polypeptide. The diagram shows a strand of DNA which codes for four amino acids.

Where would an insertion mutation of a thymine nucleotide result in the termination of translation?



23 What is correct for uracil?

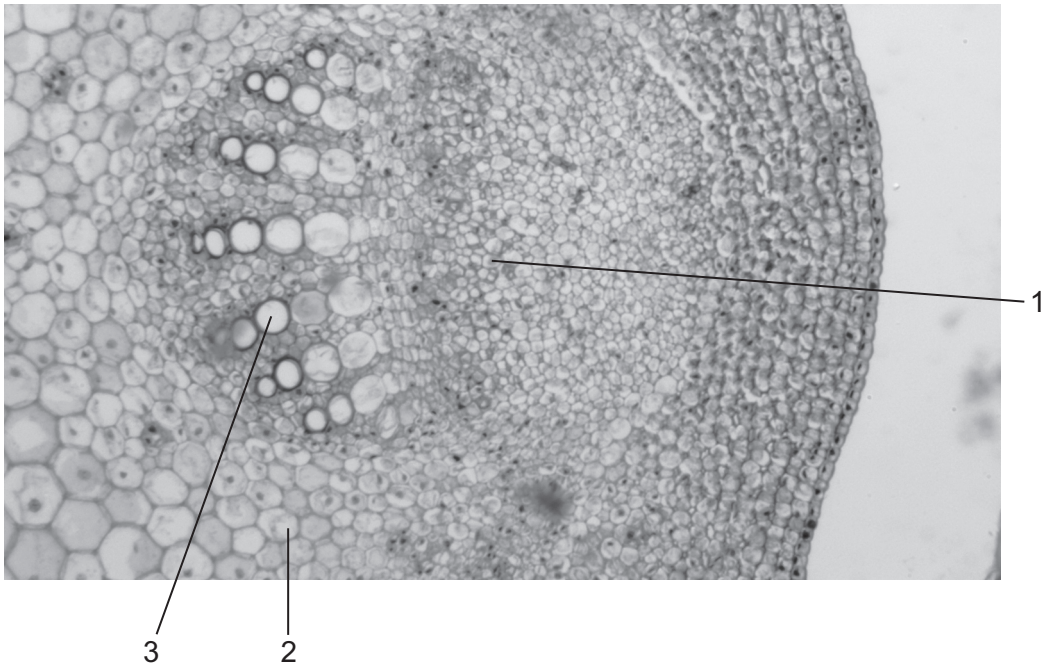
	It has a single ring structure	It is a purine	It joins its complementary base with 2 hydrogen bonds
A	✓	✓	✓
B	✓	✗	✓
C	✗	✓	✗
D	✗	✗	✓

key

✓ = correct

✗ = not correct

24 The photomicrograph shows a vascular bundle.



Which describes the relationship of water potential in the labelled cells?

A Cell 3 is less negative than cell 1.

B Cell 2 is less negative than cell 3.

C Cell 3 is more negative than cells 1 and 2.

D Cells 1, 2 and 3 have the same water potential.

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

1 capillary action

2 cohesion

3 hydrogen bonding

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

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26 What is a definition of transpiration?

A the evaporation of water vapour from a leaf due to the diffusion of water from an area of low water potential to high water potential

B the loss of water vapour from a plant to its environment by diffusion down a water potential gradient

C the movement of water from root to leaf due to the adhesion of water molecules to one another

D the uptake of water by plant roots by movement of water down a continuous water potential gradient from air to soil

27 Which are present in the walls of arteries?

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

key
✓ = present
✗ = not present

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

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

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.

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

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29 Which row correctly identifies the molecules or cells that are present in the different locations?

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

key

✓ = present

✗ = not present

30 When active tissues have high carbon dioxide concentrations, oxyhaemoglobin releases oxygen to these tissues.

What encourages this release in the presence of high concentrations of carbon dioxide?

1 carboxyhaemoglobin forms more readily

2 oxyhaemoglobin dissociates more readily

3 haemoglobin needs higher concentrations of oxygen to become saturated

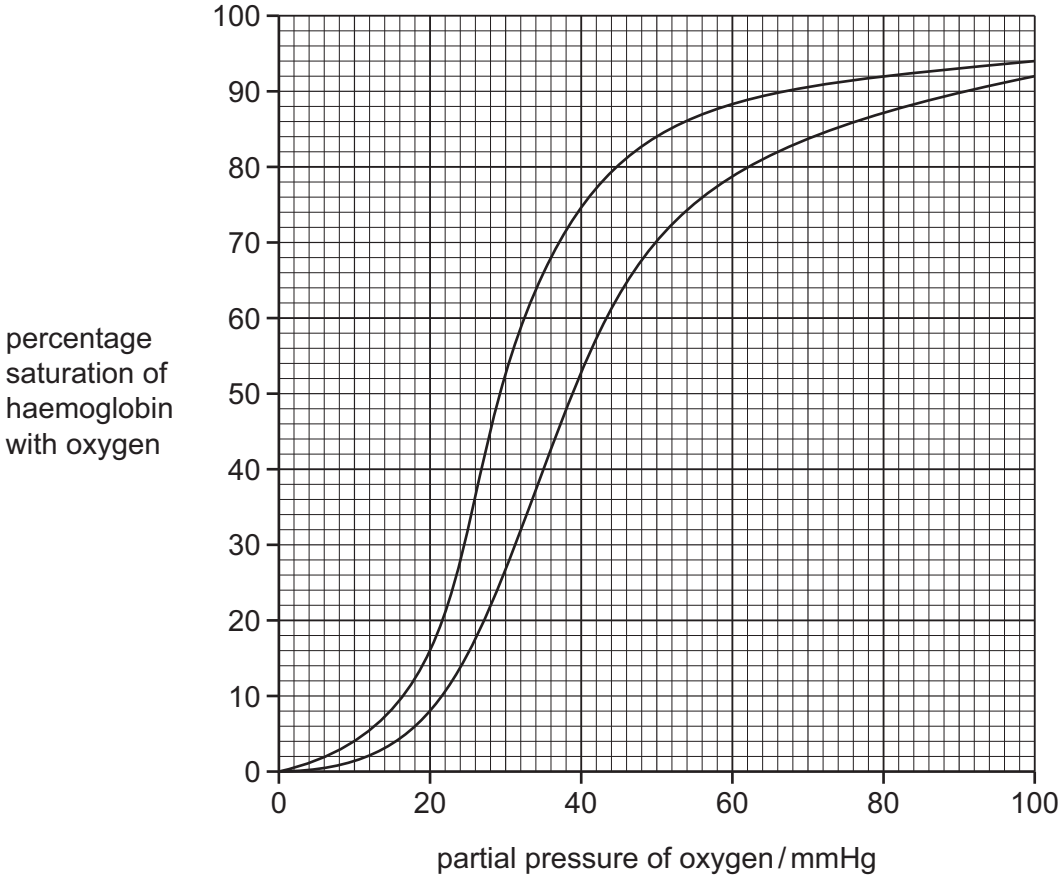
A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

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31 The graph shows oxygen dissociation curves of haemoglobin at two different carbon dioxide concentrations.

The partial pressure of oxygen in the lungs is 100 mmHg.

The partial pressure of oxygen in metabolically active tissues is 35 mmHg.



What is the percentage saturation of haemoglobin with oxygen at the lungs and in metabolically active tissues?

	percentage saturation of haemoglobin with oxygen	
	lungs	metabolically active tissue
A	92	40
B	92	66
C	94	40
D	94	66

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32 Which statement is correct?

A Alveoli have goblet cells to produce mucus to trap pathogens from the air.

B Cartilage in the bronchi keeps the bronchi open and allows air to flow through freely.

C Complete rings of cartilage in the bronchioles make sure that air can reach the alveoli.

D During exercise, muscles in the bronchioles and alveoli relax to allow a greater flow of air.

33 Four types of cell in the gas exchange system are listed.

J alveolus epithelium cell

K ciliated cell

L goblet cell

M smooth muscle cell

The ticks (✓) in the table show specialised features of three of these types of cell.

	many mitochondria	lots of endoplasmic reticulum	many Golgi bodies
1	✓		
2	✓		
3	✓	✓	✓

Which row correctly matches the specialised feature with the correct cell?

	1	2	3
A	J	M	K
B	K	J	M
C	K	M	L
D	M	K	J

34 Some symptoms of chronic obstructive pulmonary disease (COPD) are listed.

1 bursting of alveoli

2 loss of elastic fibres

3 increase in secretion of mucus

4 reduction in surface area for gaseous exchange

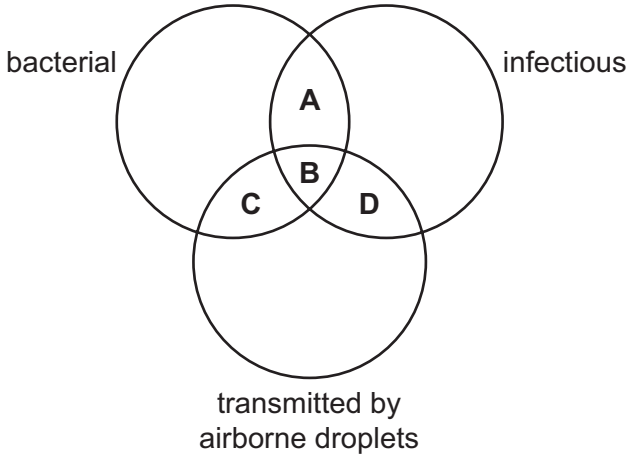
5 narrowing of airways

Which of these are also the symptoms of emphysema?

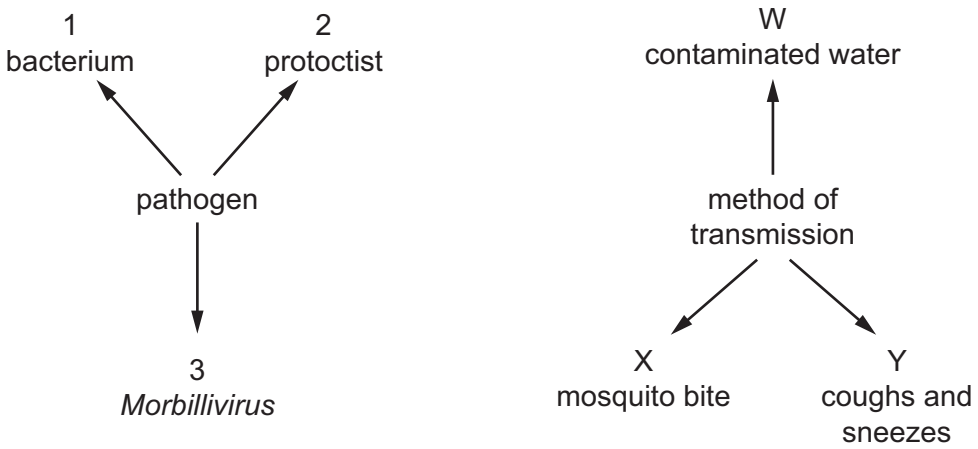
A 1, 2 and 4 **B** 1, 3 and 5 **C** 2, 3 and 5 **D** 3, 4 and 5

35 The diagram shows properties of diseases.

Which shows the properties that are common to tuberculosis (TB) and measles?



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



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

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

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37 Different antibiotics function in different ways. It is important that the antibiotic kills the bacteria, but does not harm the infected human.

The antibiotic tetracycline has been found to affect the way in which human mitochondria function.

Which statements could explain why human mitochondria function is affected by tetracycline?

A The antibiotic prevents the synthesis of peptidoglycan cell walls.

B The antibiotic prevents synthesis of linear DNA.

C The antibiotic prevents translation of circular DNA.

D The antibiotic prevents translation by binding to 70S ribosomes.

38 Immune response to a vaccination against a virus can be assessed by making three measurements:

1 the concentration of anti-virus antibody in the blood

2 the time taken to increase the antibody concentration significantly after a booster vaccination

3 the number of virus-specific lymphocytes per cm^3 blood.

What describes the immunity of an individual when the values of 1, 2 and 3 are all low ten years after vaccination?

A active immunity due to the presence of memory cells

B low immunity due to the absence of antibodies

C low immunity due to the absence of memory cells

D passive immunity due to the presence of antibodies

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

Which types of white blood cell involved in an autoimmune condition will contain active telomerase?

	mature B-lymphocyte plasma cells	neutrophils	helper T-lymphocyte memory cells
A	✓	✓	✓
B	✓	✓	✗
C	✗	✗	✓
D	✗	✓	✓

key

✓ = contain active telomerase

✗ = do not contain active telomerase

40 Which features of monoclonal antibodies make them useful in the diagnosis and treatment of disease?

1 A particular monoclonal antibody attaches to a specific antigen.

2 Identical monoclonal antibodies can be produced in large numbers.

3 Binding a monoclonal antibody to its specific antigen may mark that antigen for destruction by white blood cells.

4 Fluorescent or radioactive markers can be attached to a monoclonal antibody to show where the antigen is in the body.

A 1, 2, 3 and 4

B 1, 2 and 3 only

C 2 and 3 only

D 3 and 4 only

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BIOLOGY **9700/13**

Paper 1 Multiple Choice **October/November 2019**

1 hour

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

5573008854

READ THESE INSTRUCTIONS FIRST

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

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

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

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

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1 Plant cells are stained and then seen with a simple light microscope using daylight as the only light source.

Which cell structures are clearly visible at a magnification of ×400?

A chloroplast grana

B lysosomes

C nucleoli

D ribosomes

2 How many nanometres are there in one millimetre?

A 1000 **B** 10 000 **C** 100 000 **D** 1 000 000

3 Which cell structures contain 70S ribosomes?

1 chloroplasts

2 mitochondria

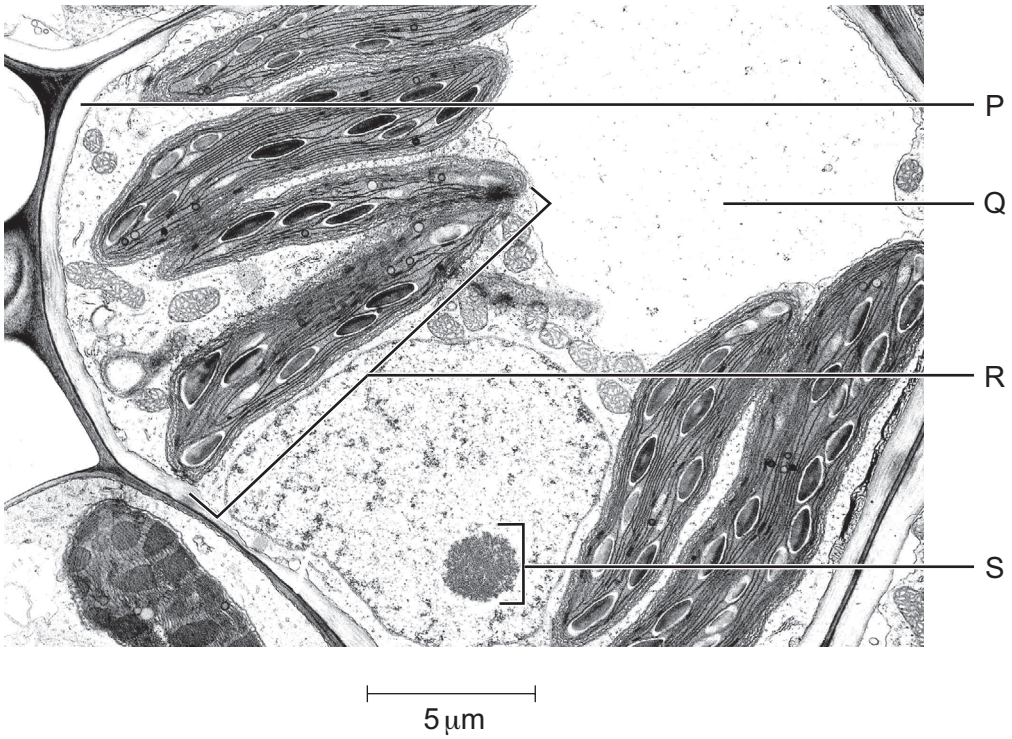
3 nucleus

4 cytoplasm

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

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4 The electron micrograph shows part of a plant cell.



Which combination correctly identifies the labelled cell structures?

	P	Q	R	S
A	cell surface membrane	cytoplasm	mitochondrion	nucleus
B	cell surface membrane	vacuole	chloroplast	nucleus
C	cell wall	cytoplasm	mitochondrion	nucleolus
D	cell wall	vacuole	chloroplast	nucleolus

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[Turn over

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 a number.

1 mRNA passes through to the ribosome

2 organises microtubules to produce the spindle during cell division

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 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?

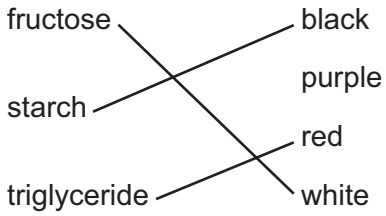
	1	2	3
A	V	W	Y
B	V	Y	Z
C	X	W	Y
D	X	Y	Z

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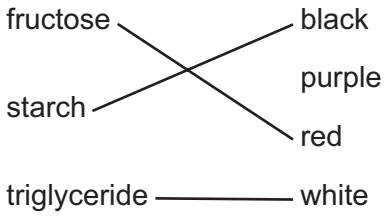
6 Tests for biological molecules were carried out on food samples.

Which correctly matches the biological molecules in the food samples with the colour for a positive result?

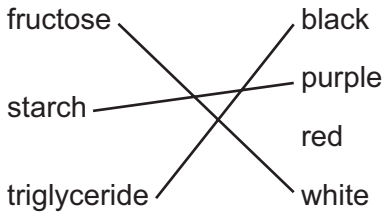
A



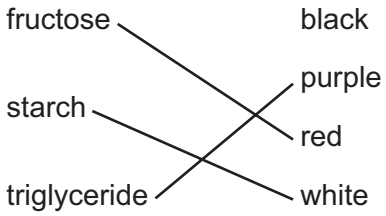
B



C



D



7 What occurs during the formation of a glycosidic bond between two α-glucose molecules?

A a 1, 4 bond is always formed

B a hydrogen bond is always formed

C a molecule of water is always formed

D a hydroxyl (OH) group is always formed

8 What is the maximum number of condensation reactions that occur when a triglyceride is synthesized?

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

9 Three proteins that have a quaternary structure are listed.

- Type IX collagen is formed from three different polymers.
- The main form of haemoglobin contains two alpha globins and two beta globins.
- HIV protease consists of two identical polymers.

Which row shows the correct number of genes needed to code for each protein?

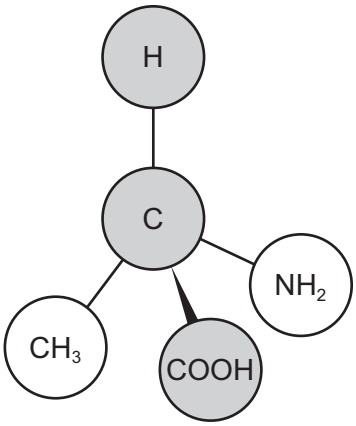
	number of genes		
	type IX collagen	haemoglobin	HIV protease
A	1	2	2
B	1	4	1
C	3	2	1
D	3	4	2

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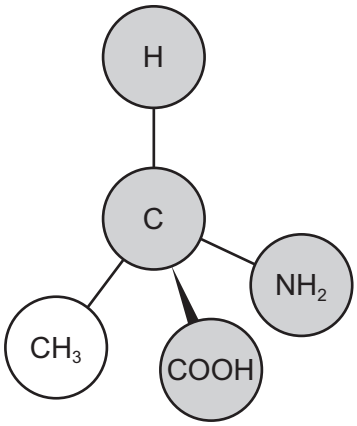
10 The diagrams show the structure of an amino acid with some parts of the molecule shaded.

Which diagram shows the shaded part of the molecule that is common to all amino acids?

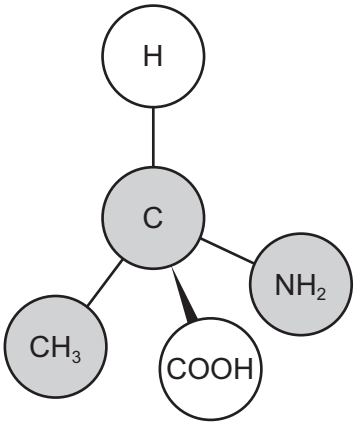
A



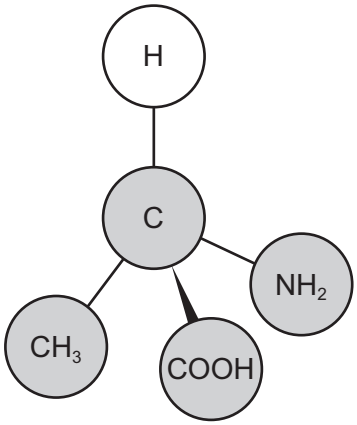
B



C



D



11 Some extracellular protease enzymes are synthesised in an inactive form called zymogen.

Zymogen is converted to the active protease in the Golgi body.

What is the purpose of producing zymogen before converting it to the extracellular protease?

A to avoid unwanted digestion of proteins inside the cell

B to avoid unwanted digestion of proteins outside the cell

C to catalyse digestion of proteins in the cytoplasm

D to catalyse digestion of proteins in the rough endoplasmic reticulum

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[Turn over

12 The Michaelis-Menten constant for an enzyme-catalysed reaction is referred to as K_m, and the maximum velocity of such a reaction is known as V_{max}.

Which statement about K_m and V_{max} is correct?

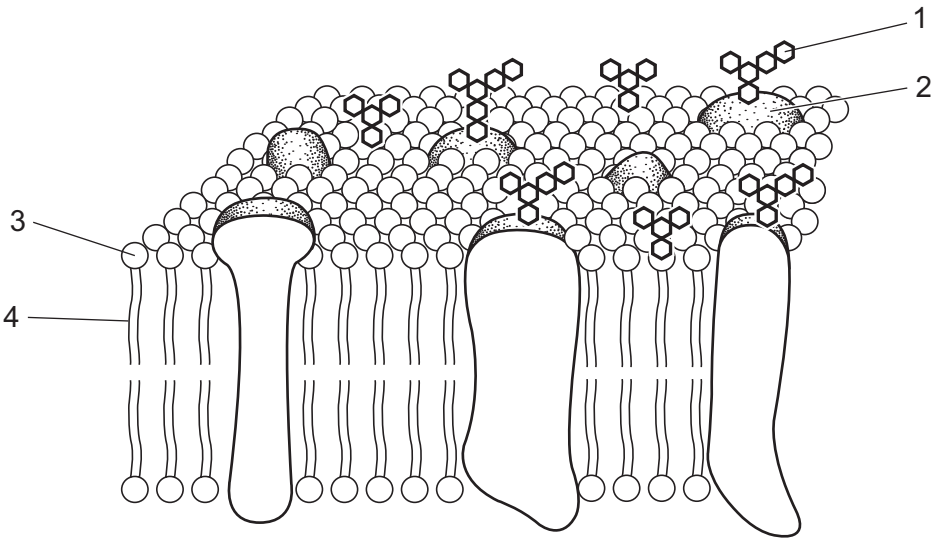
A An enzyme with a high value of K_m can reach its V_{max} at a low substrate concentration.

B An enzyme with a high value of K_m has a high affinity to its substrate.

C An enzyme with a low value of K_m can reach its V_{max} at a high substrate concentration.

D An enzyme with a low value of K_m has a high affinity to its substrate.

13 The diagram represents part of the fluid mosaic model of a cell surface membrane.



Which parts of the membrane are hydrophilic?

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

14 Which statements about the proteins and glycoproteins in cell surface membranes are correct?

1 They can allow cells to bond together to form tissues.

2 They can recognise messenger molecules like hormones.

3 They can be antigens and allow cell to cell recognition.

A 1, 2 and 3

B 1 and 2 only

C 1 and 3 only

D 2 and 3 only

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15 Which pair of factors is inversely proportional to the rate of diffusion?

A concentration gradient and surface area over which diffusion occurs

B distance over which diffusion occurs and size of diffusing molecule

C size of diffusing molecule and concentration gradient

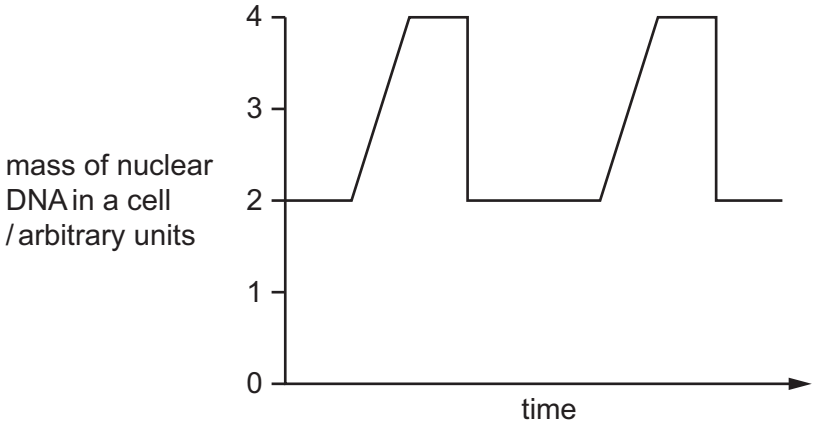
D surface area over which diffusion occurs and distance over which diffusion occurs

16 Raisins are dried fruit that contain high concentrations of sugar.

Which row is correct when raisins are first put into water?

	water potential in the raisin compared to surrounding water	direction of water movement
A	less negative	into the raisin
B	less negative	out of the raisin
C	more negative	into the raisin
D	more negative	out of the raisin

17 Which processes that occur in cell division are represented in the diagram?



A DNA replication and nuclear division only

B DNA replication, nuclear division and cytokinesis

C mitosis and cytokinesis

D mitosis only

18 What happens to the telomeres during mitosis of a cancer cell?

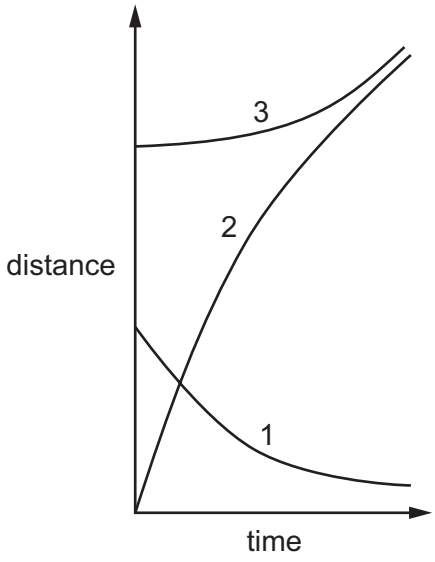
A The length increases.

B The length decreases.

C They are completely lost.

D They stay the same length.

19 The graph shows three measurements obtained after metaphase of mitosis.

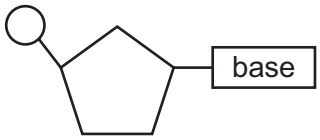


What measurements do the curves represent?

	distance between centromeres and poles of spindle	distance between centromeres of sister chromatids	distance between poles of spindle
A	1	2	3
B	1	3	2
C	3	1	2
D	3	2	1

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20 The diagram represents a nucleotide containing guanine.



Which statements about this nucleotide are correct?

1 The carbohydrate can be ribose or deoxyribose.

2 Base pairing occurs with three hydrogen bonds.

3 Guanine is a purine.

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

21 What is the maximum number of codon-anticodon interactions within one ribosome?

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

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

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

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

Hybrid DNA contains heavy DNA and light DNA.

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

	percentage of light DNA strands	percentage of hybrid DNA molecules
A	25	50
B	50	50
C	50	100
D	75	100

23 Which statements about tRNA structure are correct?

1 There is a binding site for the attachment of a specific amino acid and a different binding site for the attachment to the ribosome, so that translation can occur.

2 There is a ribose-phosphate backbone with strong phosphodiester bonds and areas within the polynucleotide chain where base pairing occurs.

3 There is an anticodon that contains the same triplet of bases as the triplet of DNA bases that has been transcribed to produce the mRNA codon.

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

24 Which row explains why xylem vessels have no cytoplasm?

	to contain a larger volume of water	to transport water faster	to increase the cellulose content of the vessel walls
A	✓	✓	✓
B	✗	✗	✓
C	✓	✓	✗
D	✓	✗	✓

key

✓ = explains

✗ = does not explain

25 What causes water to move from the root hair cells to the endodermis?

A diffusion through cell walls, osmosis down a water potential gradient in the cytoplasm

B diffusion through the symplast, osmosis and root pressure through the apoplast

C osmosis from cell vacuole to cell vacuole, active transport into the endodermis

D osmosis through the intercellular spaces, diffusion in cell walls and cytoplasm

26 What is true about a Casparian strip?

	location	formed from	effect
A	cell wall of cortical cell	lignin	closes symplastic pathway
B	cell wall of endodermis cell	suberin	closes apoplastic pathway
C	cytoplasm of cortical cell	lignin	closes apoplastic pathway
D	cytoplasm of endodermis cell	suberin	closes symplastic pathway

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27 Which xerophytic adaptations reduce the water potential gradient between leaf surface and atmosphere?

1 rolled leaves

2 hairy leaves

3 sunken stomata

4 fewer stomata

5 fleshy leaves

A 1, 2, 3, 4 and 5

B 1, 2 and 3 only

C 1, 3 and 4 only

D 2 and 5 only

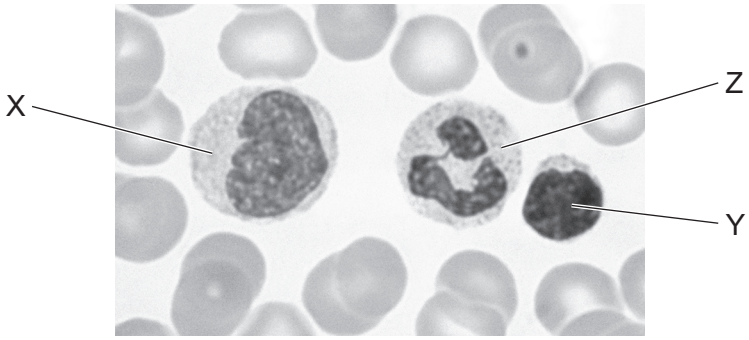
28 When sucrose is loaded into the phloem it has to travel from mesophyll cells to a companion cell and then into the phloem.

In many plants, proton pumps and co-transporter molecules are involved in this process.

Which row shows the relative concentrations of sucrose in each type of cell?

	relative concentration of sucrose / arbitrary units		
	mesophyll cell	companion cell	phloem sieve tube element
A	5	10	15
B	5	15	10
C	15	10	5
D	15	5	10

29 The image 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 Which is the correct sequence for the opening of the valves in the mammalian heart during one cardiac cycle?

A

right atrioventricular valve
↓
pulmonary semilunar valve
↓
left atrioventricular valve
↓
aortic semilunar valve

B

left atrioventricular valve
↓
aortic semilunar valve
↓
right atrioventricular valve
↓
pulmonary semilunar valve

C

left atrioventricular valve
and
aortic semilunar valve
↓
right atrioventricular valve
and
pulmonary semilunar valve

D

left atrioventricular valve
and
right atrioventricular valve
↓
aortic semilunar valve
and
pulmonary semilunar valve

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31 Red blood cells may contain a molecule known as 2,3-bisphosphoglycerate (2,3-BPG).

When 2,3-BPG binds to haemoglobin a higher partial pressure of oxygen is needed to bring about 50% saturation of haemoglobin with oxygen.

Which statements about the effect of 2,3-BPG are correct?

1 2,3-BPG in red blood cells causes the oxygen dissociation curve to shift to the right.

2 The binding of 2,3-BPG to haemoglobin reduces the Bohr effect.

3 The binding of 2,3-BPG to haemoglobin lowers the affinity of the haemoglobin for oxygen.

4 When 2,3-BPG is absent, oxyhaemoglobin is less likely to unload oxygen.

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

32 Aortic stenosis is a heart valve disorder in which the aortic semilunar valve opening is narrow.

Which effect could aortic stenosis have on heart structure and function?

A The cardiac muscle of the left ventricle wall is thinned by blood leaking out of the left ventricle during ventricular diastole.

B There is less cardiac muscle in the left ventricle and reduced diastolic blood pressure, caused by the smaller blood volume entering the left atrium.

C The tendons of the heart valves are weakened by blood being forced back through the left atrioventricular valve into the left atrium.

D The wall of the left ventricle thickens, leading to an enlarged heart and inability to relax and fill completely during diastole.

33 What explains why the red blood cell count of humans increases when they remain at high altitudes?

A Haemoglobin is not saturated with oxygen in the lungs.

B The partial pressure of oxygen in the air is higher.

C The percentage of oxygen in the air has decreased.

D There is more carbon dioxide, increasing the Bohr effect.

34 Which may contain ciliated epithelium?

A trachea only

B trachea and bronchi only

C trachea, bronchi and bronchioles

D bronchi, bronchioles and alveoli

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35 Which row shows the effects of chronic bronchitis?

	lymph glands	alveoli	bronchi	infection
A	destroyed	damaged	inflamed	absent
B	destroyed	inflamed	scarred	present
C	swollen	damaged	scarred	present
D	swollen	inflamed	inflamed	absent

36 The statements refer to the disease tuberculosis (TB).

1 The pathogen lives inside human cells so is not accessible to the immune system.

2 The bacterial pathogen reproduces slowly.

3 The pathogen is not very sensitive to antibiotics.

Which explains why antibiotic treatment for TB takes a long time?

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

37 Scientists studied the multidrug resistant bacterial infections in children, caused by one type of bacteria, between 2007 and 2015. The percentage of multidrug resistant infections rose from 0.2% to 1.5%.

What was the percentage increase in multidrug resistant infections between 2007 and 2015?

A 1.3% **B** 87% **C** 130% **D** 650%

38 Why is it necessary for a person with a bacterial infection to take antibiotics at evenly spaced time intervals?

A to increase the concentration of antibiotic slowly to a level which is lethal to the bacteria

B to maintain a concentration of antibiotic in the body which is lethal to the bacteria

C to prevent the development of resistant strains of bacteria

D to select and kill the resistant strains of bacteria

39 The enzyme telomerase prevents loss of telomeres after many mitotic cell cycles. Three types of cell are used to produce monoclonal antibodies.

1 cancer cells undergoing uncontrolled cell division

2 mature B-lymphocytes

3 hybridoma cells

Which cells involved in this technique contain active telomerase 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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40 What explains why monoclonal antibodies are useful in the diagnosis of disease?

A They bind to and neutralise one type of antibody.

B They bind to and neutralise one type of pathogen.

C Their shape is complementary to one specific antibody.

D Their shape is complementary to one specific antigen.

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