Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/11**

Paper 1 Multiple Choice **May/June 2018**

1 hour

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

5924034730

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 **20** printed pages.

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CAMBRIDGE International Examinations

1 Which statements about resolution and magnification are correct?

	resolution	magnification
A	the ability to distinguish between two separate objects that are very close together	the number of times larger an image is compared with the real size of the object
B	the clarity of the image formed by the microscope	the power of the microscope to focus on very small objects
C	the number of times larger an image is compared with the real size of the object	the ability to distinguish between two separate objects that are very close together
D	the power of the microscope to focus on very small objects	the clarity of the image formed by the microscope

2 An eyepiece graticule has a scale with 100 divisions. A stage micrometer has a scale with 50 divisions, each of which is 0.040 mm apart.

Using a ×40 objective lens, the whole length of this stage micrometer scale lines up with 15 divisions of the eyepiece graticule.

What is the actual length of the 100 division scale of the eyepiece graticule?

A 1.3 mm **B** 13 mm **C** 75 μm **D** 750 μm

3 A prokaryotic cell which is 1 μm in diameter, is magnified 50 000 times in an electron micrograph.

What is the diameter of the cell in the electron micrograph?

A 5×10^{-1} mm

B 5×10^{0} mm

C 5×10^{1} mm

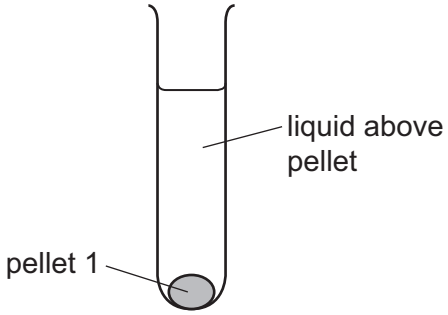
D 5×10^{2} mm

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4 A scientist carried out an experiment to separate cell structures in animal cells.

The cells were broken open to release the cell structures.

This extract was filtered into a centrifuge tube and then spun in a centrifuge. The heaviest cell structure sank to the bottom forming pellet 1, as shown in the diagram.



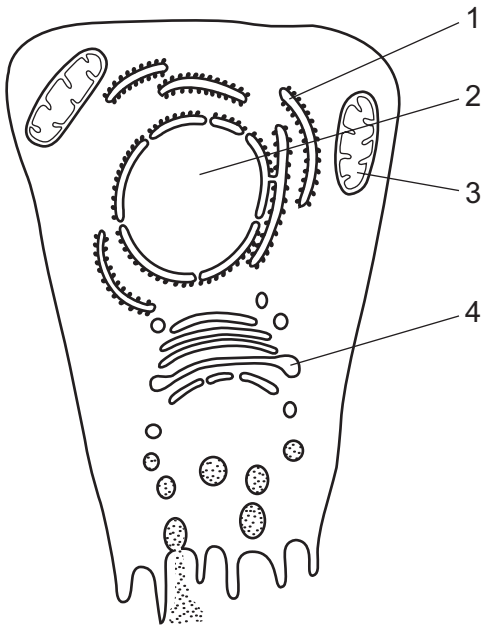
The liquid above pellet 1 was poured into a clean centrifuge tube and spun in the centrifuge at a higher speed to separate the next heaviest cell structure. This cell structure sank to the bottom, forming pellet 2.

This procedure was repeated twice more to obtain pellet 3 and pellet 4, each containing a single type of cell structure.

Which row shows the order in which the cell structures were collected?

	pellet 1	pellet 2	pellet 3	pellet 4
A	nucleus	lysosomes	mitochondria	ribosomes
B	nucleus	mitochondria	lysosomes	ribosomes
C	ribosomes	lysosomes	mitochondria	nucleus
D	ribosomes	mitochondria	lysosomes	nucleus

5 Radioactively-labelled nucleotides are introduced into a cell.



In which cell structures will the radioactivity first become concentrated?

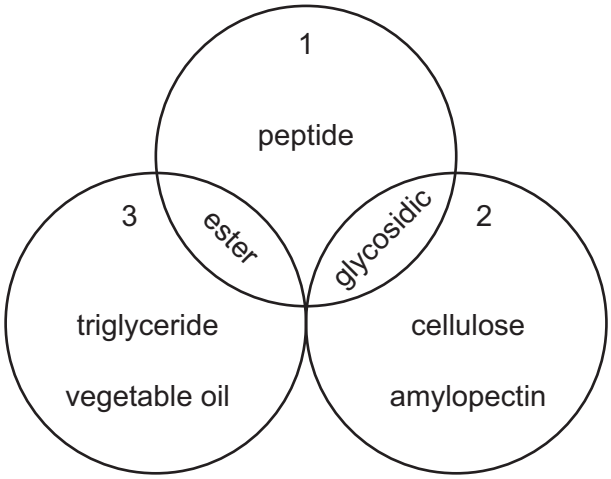
A 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

6 What is the general formula for amylose?

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

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7 The diagram shows relationships between some important molecules and bonds.



What is represented by circles numbered 1, 2 and 3?

	1	2	3
A	bonds formed by condensation	carbohydrates	lipids
B	bonds formed by condensation	lipids	carbohydrates
C	bonds formed by hydrolysis	carbohydrates	lipids
D	bonds formed by hydrolysis	lipids	carbohydrates

8 In unsaturated lipid molecules, where are double bonds located?

A between fatty acids and glycerol

B within fatty acids and within glycerol

C within fatty acids only

D within glycerol only

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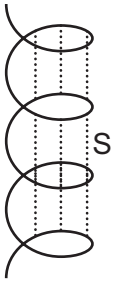
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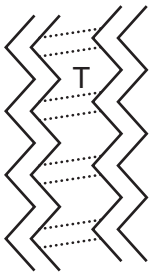
9 Phospholipids and triglycerides are important biological molecules.

Which properties are correct for these molecules?

	non-polar	partially hydrophobic
A	phospholipid	phospholipid
B	phospholipid	triglyceride
C	triglyceride	phospholipid
D	triglyceride	triglyceride

10 The diagrams show two arrangements of amino acids in a protein.





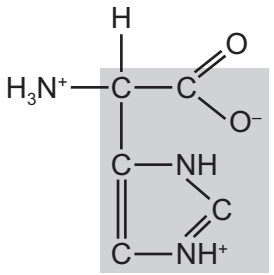
Which row correctly names the bonds at S or T?

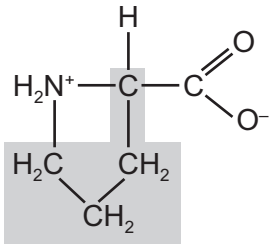
	ionic bond	hydrogen bond
A	absent	S and T
B	S only	T only
C	S and T	absent
D	T only	S and T

11 Students were asked to highlight only the R groups of two ring-shaped amino acids.

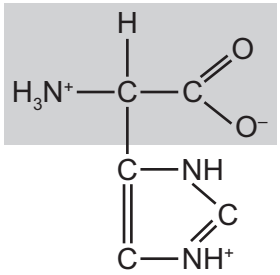
Which pair of diagrams are correct for both amino acids?

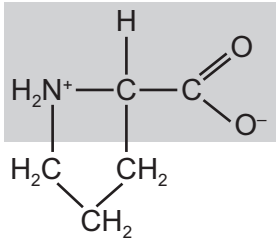
A



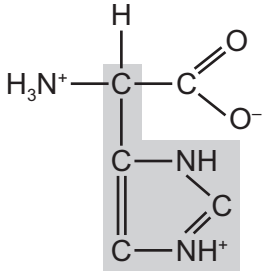


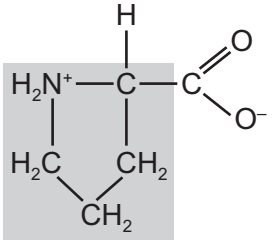
B



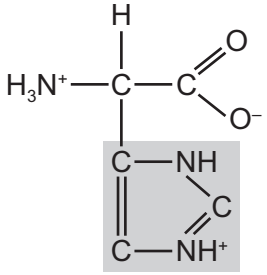


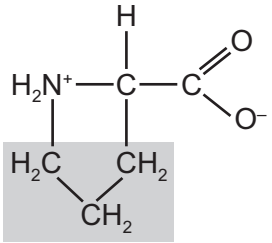
C





D





12 Which words from the table correctly complete the paragraph about enzymes?

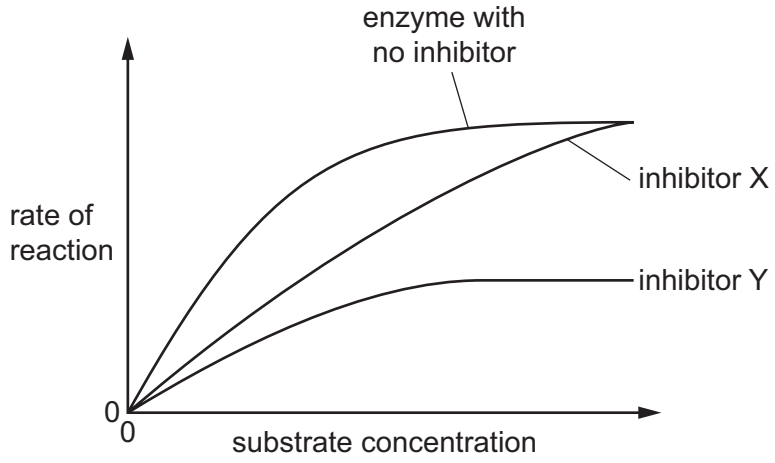
When the pH of an environment is decreased below the optimum pH of an enzyme, ……1…… bonds between adjacent ……2…… groups, holding the ……3…… structure, are disrupted.

	1	2	3
A	hydrogen and ionic	R	tertiary
B	hydrogen	hydroxyl	secondary
C	ionic and peptide	R	primary and tertiary
D	peptide	amine	primary

13 The effect of substrate concentration on an enzyme-catalysed reaction was measured in three different conditions:

- with no inhibitor
- with a competitive inhibitor
- with a non-competitive inhibitor.

The graph shows the results.



Which statement is correct?

A X is a competitive inhibitor which binds to a site other than the active site of the enzyme.

B X is a non-competitive inhibitor which has a similar shape to the active site of the enzyme.

C Y is a competitive inhibitor which has a similar shape to the active site of the enzyme.

D Y is a non-competitive inhibitor which binds to a site other than the active site of the enzyme.

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14 Which statements about the cell surface membrane are correct?

1 Channel proteins allow water soluble ions and molecules across the membrane.

2 Glucose can pass into the cell via carrier proteins.

3 Oxygen passes freely through the membrane as it is soluble in lipids.

4 Some glycoproteins act as antigens.

A 1, 2, 3 and 4

B 1, 3 and 4 only

C 1 and 2 only

D 2, 3 and 4 only

15 Which of these features increase the efficiency of ion uptake by a root hair cell?

1 many mitochondria in the cell

2 high concentration of ions in the vacuole

3 protein carriers in the cell surface membrane

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

16 What can increase the fluidity of the cell surface membrane at low temperatures?

1 double bonds between carbon atoms in the fatty acid chains

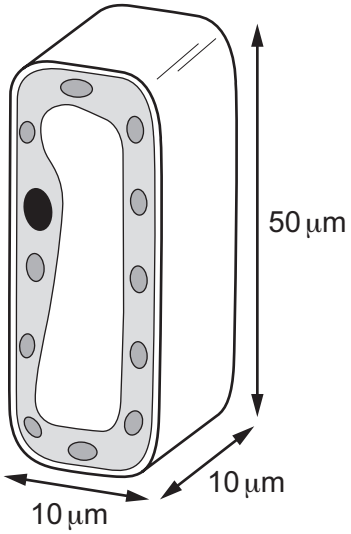
2 cholesterol

3 fatty acids having shorter chains

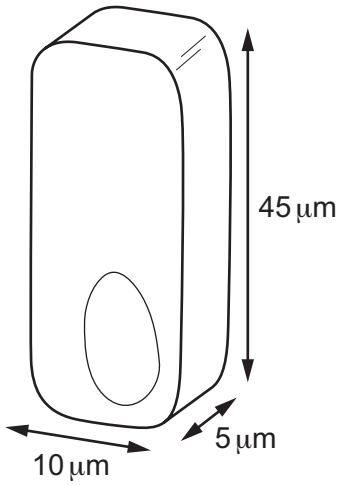
A 1, 2 and 3 **B** 1 and 3 only **C** 1 only **D** 2 and 3 only

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17 The diagrams show the shape and size of two types of cell.



palisade mesophyll cell
surface area = 2200 μm^2



columnar epithelial cell
volume = 2250 μm^3

Which statement is correct about the palisade cell and epithelial cell shown in the diagrams?

A An increase in surface area reduces the distance for gases to reach the centre of the cell.

B The surface area of the palisade mesophyll cell is 500 μm^2 greater than the columnar epithelial cell.

C The surface area to volume ratio is greater in the columnar epithelial cell than the palisade mesophyll cell.

D The volume of the palisade mesophyll cell is 2500 μm^3 greater than that of the columnar epithelial cell.

18 A student observed the cells in the growing region (meristem) of an onion root and obtained the data shown.

stage	number of cells
interphase	886
prophase	73
metaphase	16
anaphase	14
telophase	11

Which percentage of cells contains chromosomes that appear as two chromatids?

A 7.3 **B** 8.9 **C** 95.9 **D** 97.5

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19 Which of these events are part of mitosis?

1 interphase

2 telophase

3 cytokinesis

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

20 During which phase of the cell cycle does DNA replication take place?

A G_1 **B** G_2 **C** M **D** S

21 Which row is correct for guanine?

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

key

✓ = correct

✗ = incorrect

22 Meselsohn 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 in the medium containing light nitrogen and their DNA was analysed.

Hybrid DNA contains both heavy and light DNA.

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

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

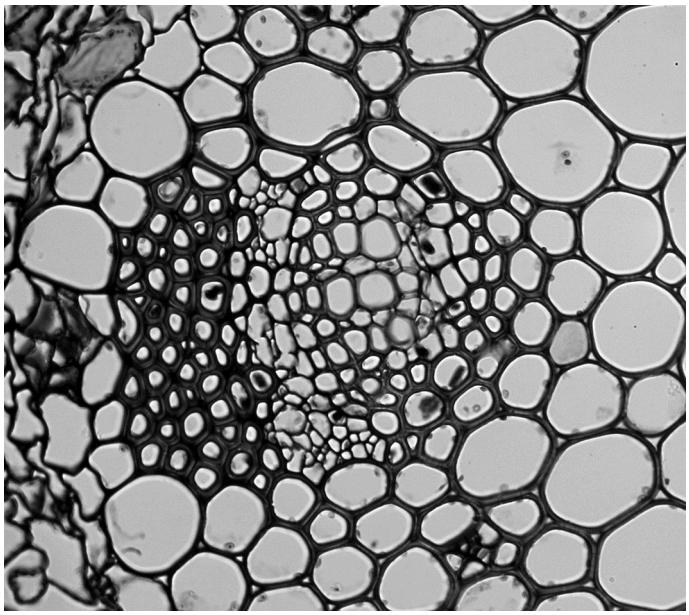
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23 Which is the correct DNA triplet on the original DNA template that codes for the amino acid histidine (His)?

amino acid	anticodon
Ala	CGU
His	GUA
Ser	UCA

A CAU **B** CGT **C** GTA **D** GUA

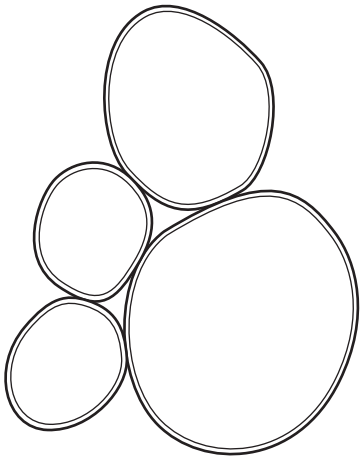
24 The photomicrograph shows tissues in a stained transverse section of a plant stem.



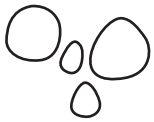
Students are asked to draw four adjacent xylem vessel elements.

Which drawing, all drawn to the same scale, is correct?

A



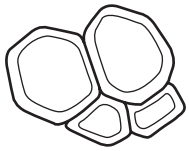
B



C



D



25 What is a function of the hairs (trichomes) on xerophytic leaves?

A adding a waterproof layer

B protecting the stomata

C reducing the surface area

D trapping a layer of moist air

26 Which features of companion cells are essential to their function?

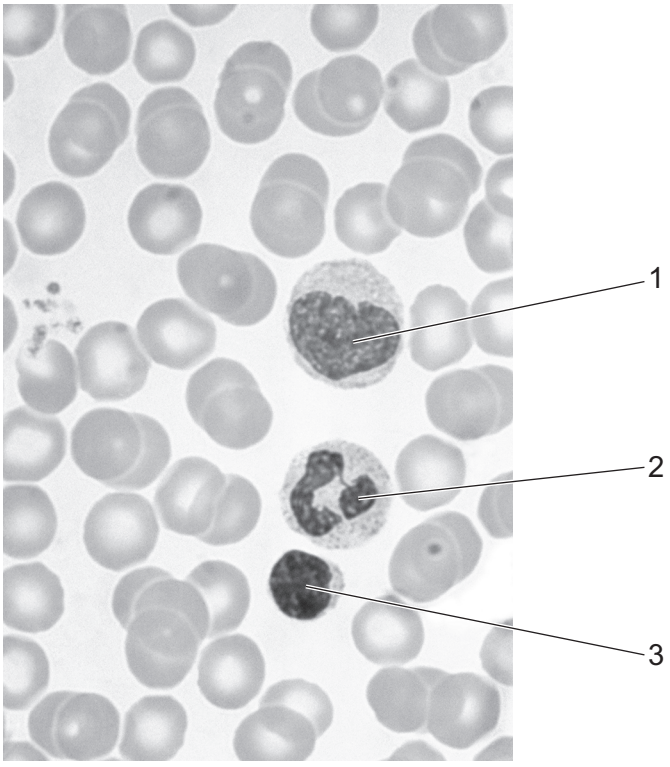
1 They are connected by plasmadesmata to the sieve tube elements.

2 They have a thinner cell wall than a sieve tube element.

3 They contain a nucleus and mitochondria.

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

27 The photomicrograph shows a human blood smear.

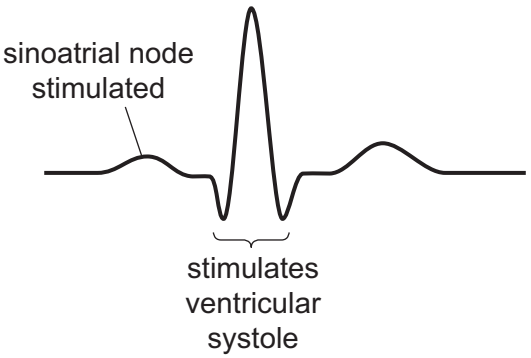


Which row identifies the labelled cells?

	1	2	3
A	lymphocyte	monocyte	neutrophil
B	lymphocyte	neutrophil	monocyte
C	monocyte	lymphocyte	neutrophil
D	monocyte	neutrophil	lymphocyte

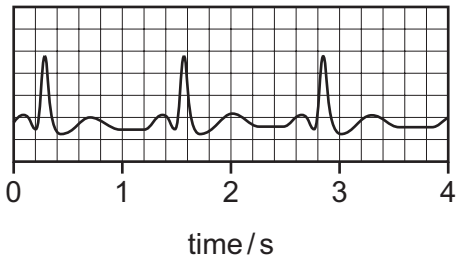
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28 The diagram shows the changes in electrical activity in the heart muscle during one cardiac cycle. This is called an electrocardiograph (ECG).

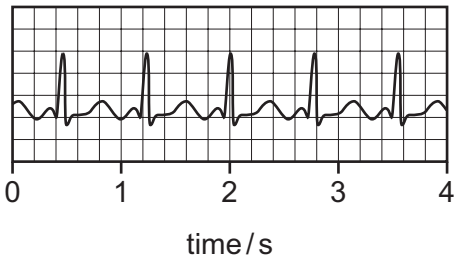


Which electrocardiogram shows a rate of 75 beats per minute?

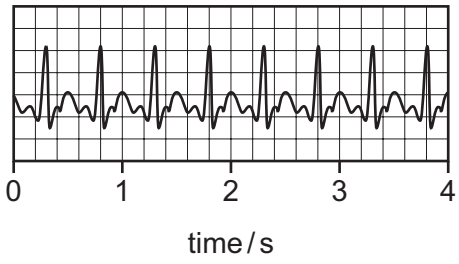
A



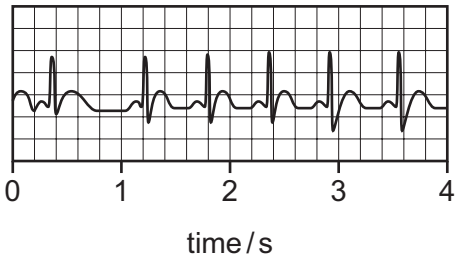
B



C



D



29 Which effect could be due to a reduced concentration of carbonic anhydrase?

A Carbaminohaemoglobin concentrations will decrease.

B Less oxygen is released from oxyhaemoglobin for active tissues.

C The pH of the blood will be lowered.

D The rate of dissociation of carbonic acid is increased.

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30 Which statement correctly compares blood plasma and tissue fluid in a healthy person?

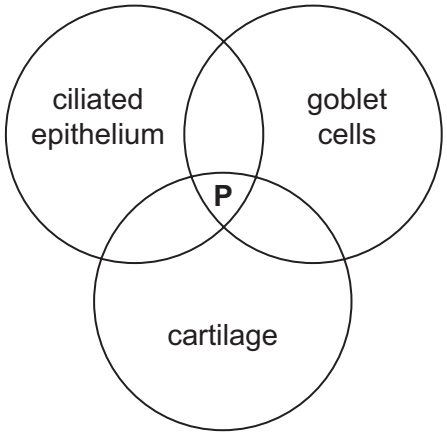
A Blood plasma contains more protein than tissue fluid.

B Both blood plasma and tissue fluid contain red blood cells.

C Tissue fluid contains white blood cells whereas blood plasma does not.

D Tissue fluid is formed from blood plasma and is not returned to blood plasma.

31 The diagram shows three features found in tissues of the gas exchange system.



Which tubes of the gas exchange system could be represented at position **P** in the diagram?

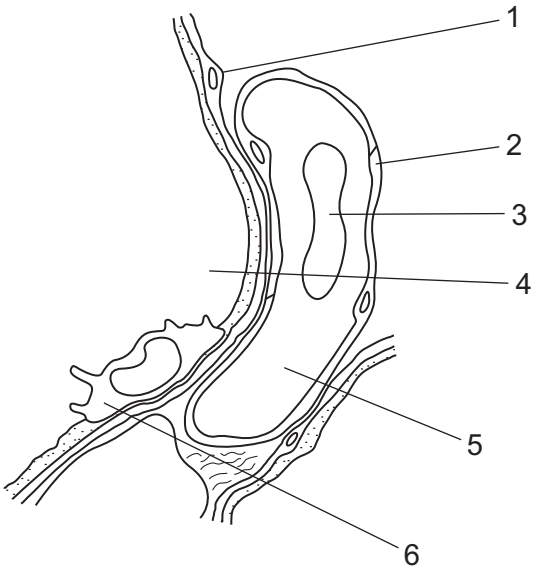
	bronchus	bronchiole	trachea
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✓	✓

key

✓ = yes

✗ = no

32 The diagram shows a magnified section of part of the lungs containing specialised tissues.



Which row is correct for structures labelled 1 to 6?

	contains high proportion of		
	carbonic anhydrase	HCO_3^- ions	lysosomes
A	1	3	4
B	2	4	5
C	3	5	6
D	4	6	1

33 A short-term effect of smoking is a decreased blood supply to the fingers and toes.

Which component of cigarette smoke causes this effect?

A carbon monoxide

B carcinogens

C nicotine

D tar

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34 The symptoms of two diseases are listed.

disease 1	disease 2
coughing up blood pain when breathing loss of weight	shortness of breath difficulty breathing out fatigue

Which row identifies diseases 1 and 2?

	disease 1	disease 2
A	chronic bronchitis	emphysema
B	emphysema	lung cancer
C	lung cancer	chronic bronchitis
D	lung cancer	emphysema

35 Which statements about a non-infectious disease may be correct?

1 It can result from a mutation.

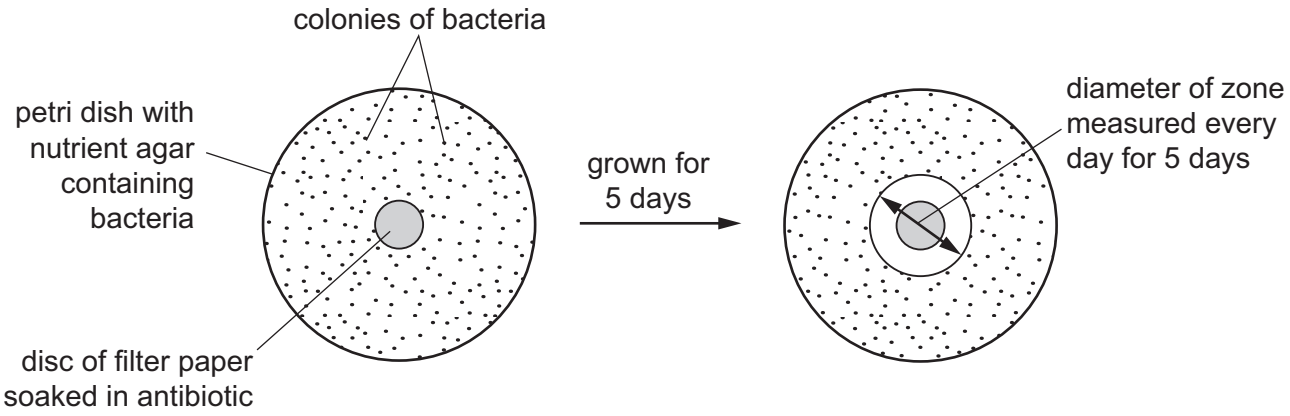
2 It can be transmitted by an insect vector.

3 It can be transmitted from mother to child.

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

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36 The diagram shows one way of testing the effect of an antibiotic on bacteria.



The table shows the results of testing five different types of bacteria.

Zones of less than 13.0 mm show the presence of resistant bacteria.

type of bacteria	diameter of zone / mm				
	day 1	day 2	day 3	day 4	day 5
1	24.1	21.9	19.0	17.6	14.3
2	18.6	15.4	12.2	9.0	2.0
3	17.9	12.8	12.4	11.1	10.9
4	19.4	15.3	13.2	8.1	2.0
5	22.0	21.0	20.5	20.4	20.4

Which statement can be supported by this data?

A All the types of bacteria become resistant to antibiotics over time.

B Only types 2, 3 and 4 of the bacteria show resistance to the antibiotic.

C The antibiotic can be used to treat types 1 and 3 only.

D Type 5 of the bacteria can never become resistant to the antibiotic.

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37 Some animals have genes that code for small peptides called cathelicidins. These peptides kill a wide range of bacteria by attaching to lipids in bacterial membranes, so weakening or disrupting them.

Scientists have produced a synthetic version of the cathelicidin that kills bacteria that are resistant to a number of antibiotics such as tetracycline.

Which pair of statements explain how this synthetic cathelicidin might help with the problem of antibiotic resistance?

1 It is synthetic so bacteria can never become resistant to it.

2 It could be used instead of tetracycline, allowing tetracycline resistance to be reduced.

3 The only way a bacterium could develop resistance to it is by altering all the lipids in its membranes.

4 It could be used to kill multidrug-resistant strains of bacteria for which there is no effective antibiotic.

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

38 Hybridomas are used as a basis for the production of large numbers of monoclonal antibodies.

Which statement describes how hybridomas are made?

A fusing activated T-lymphocytes with cancer cells

B fusing B-lymphocytes with cancer cells

C fusing memory cells with cancer cells

D fusing T-lymphocytes with cancer cells

39 Which statement about the properties of the antigen binding sites in antibody molecules is correct?

A They are located on the light chains only.

B They have a hinge region to give flexibility for different antigens.

C They have binding sites for receptors on phagocytes.

D They have variable amino acid sequences for different antigens.

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40 The statements describe ways in which different types of monoclonal antibodies can work.

1 binding to proteins on cell surfaces and triggering the immune system

2 blocking molecules on cell surfaces that inhibit T-cells

3 blocking cell signalling receptors that trigger cell division

4 blocking cell signalling receptors that trigger the immune response

Which types of monoclonal antibody could be used to treat cancer?

A 1, 2, 3 and 4

B 1, 2 and 3 only

C 1 and 4 only

D 2, 3 and 4 only

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BIOLOGY **9700/12**

Paper 1 Multiple Choice **May/June 2018**

1 hour

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

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Any rough working should be done in this booklet.
Electronic calculators may be used.

This document consists of **15** printed pages and **1** blank page.

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1 Some features of cells are listed.

1 cell wall

2 cell surface membrane

3 ribosomes

Which features can be found in plant cells and in prokaryotic cells?

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

2 Which of these statements about light microscopy are correct?

1 The greater the resolution of a light microscope, the greater the detail that can be seen.

2 The greater the magnification of a light microscope, the greater the detail that can be seen.

3 Increasing the magnification of a light microscope up to its limit of resolution allows more detail to be seen.

4 The shorter the wavelength of light used in a light microscope, the greater the detail that can be seen.

A 1, 2, 3 and 4

B 1, 3 and 4 only

C 1 and 2 only

D 4 only

3 Which type of cell contains the highest proportion of cell structures bound by a single membrane?

A ciliated epithelial cell

B goblet cell

C red blood cell

D smooth muscle cell

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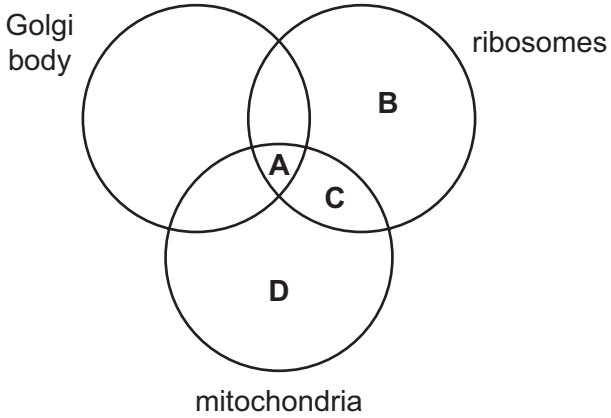
4 The table shows a variety of structures which may be found in cells.

Which row shows structures that could be found in the root cells of a plant?

	plasmodesmata	glycogen granules	Golgi body	mitochondria
A	✓	✓	✗	✗
B	✓	✗	✓	✓
C	✗	✓	✓	✓
D	✗	✗	✓	✓

key
✓ = present
✗ = absent

5 Which of these cell structures are present in *Plasmodium*?

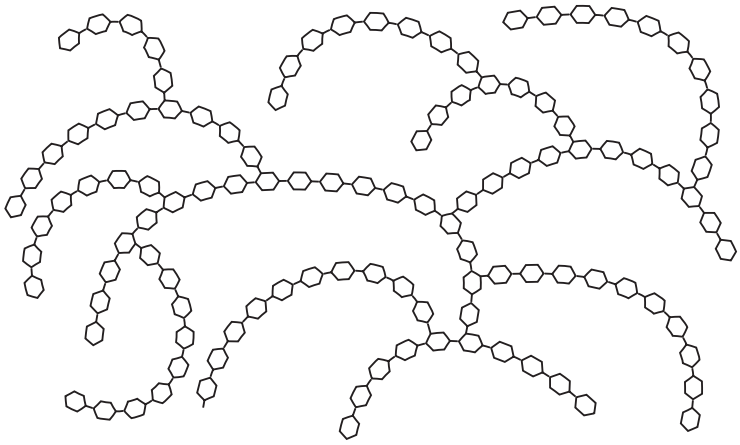


6 A student was asked to estimate the concentration of glucose in a solution using the Benedict's test. The student was provided with a 1.0 mol dm^{-3} glucose solution and was told to make a 0.6 mol dm^{-3} solution by proportional dilution.

Which row shows the correct volumes of both 1.0 mol dm^{-3} glucose solution and distilled water needed to make the 0.6 mol dm^{-3} solution?

	volume of 1.0 mol dm^{-3} glucose solution / cm^3	volume of distilled water / cm^3
A	12	8
B	10	10
C	8	12
D	6	14

7 The diagram shows part of a carbohydrate molecule formed by glucose.



What is the name of the molecule?

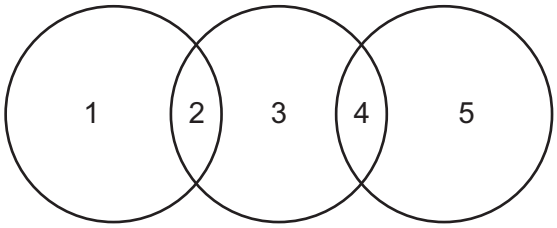
A amylose

B cellulose

C glycogen

D starch

8 The diagram shows the relationship between some biological molecules.



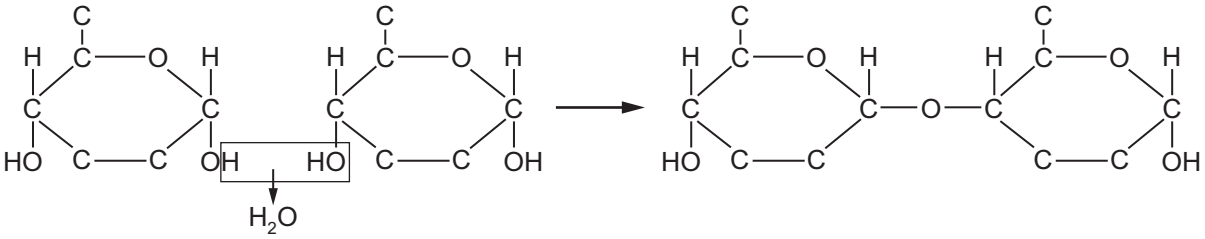
Which row is correct?

	1	2	3	4	5
A	α-glucose	carbohydrate	sucrose	monomer	fructose
B	cellulose	polymer	starch	carbohydrate	amylase
C	fructose	reducing sugar	β-glucose	monomer	amino acid
D	haemoglobin	protein	amylose	polymer	cellulose

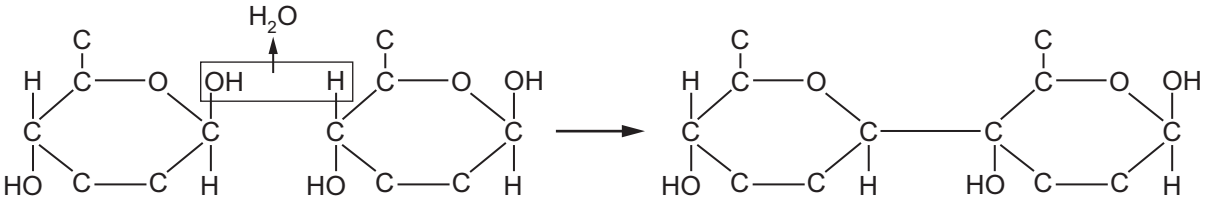
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9 Which diagram shows the reaction that occurs to join two of the monomers that form cellulose?

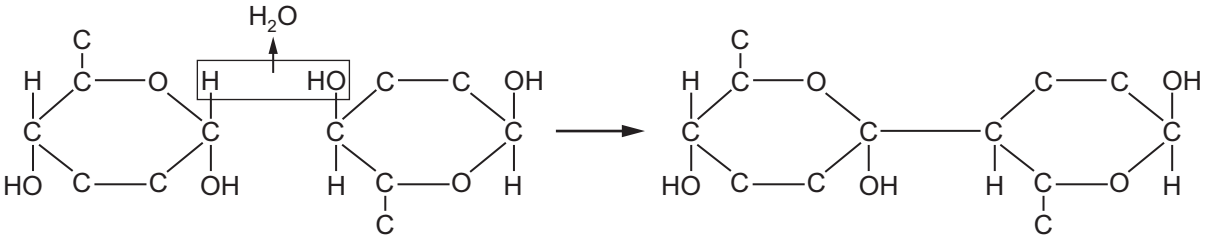
A



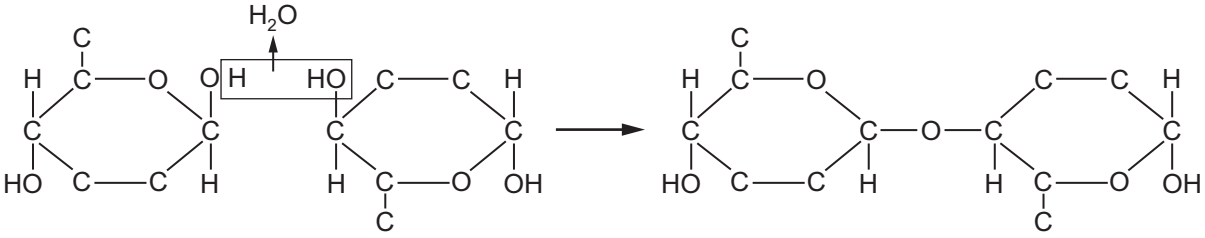
B



C



D



10 Which molecules contain C=O bonds?

1 amino acids

2 fatty acids

3 glycerol

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

11 Which row describes a collagen molecule?

	bonds stabilising the molecule	properties	primary structure	helix
A	disulfide	high temperatures increase flexibility	high proportion of glycine	double
B	disulfide	resistant to stretching	repeat sequences of three amino acids	single
C	hydrogen	high tensile strength	repeat sequences of three amino acids	triple
D	hydrogen	insoluble in water	high proportion of glycine and proline	alpha

12 A student investigated the hydrolysis of the lipid in high-fat milk, using the enzyme lipase.

- 1 cm^3 of enzyme solution was added to 10 cm^3 of high-fat milk.
- The temperature was kept constant.
- The pH of the reaction mixture was recorded at time 0 minutes and every minute for 20 minutes.

Which statements could be supported by the results of the investigation?

1 Less product is made as time proceeds because the substrate is decreasing.

2 The pH of the reaction mixture changes more rapidly in the first few minutes and then changes less rapidly.

3 The product gradually causes more lipase molecules to denature.

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

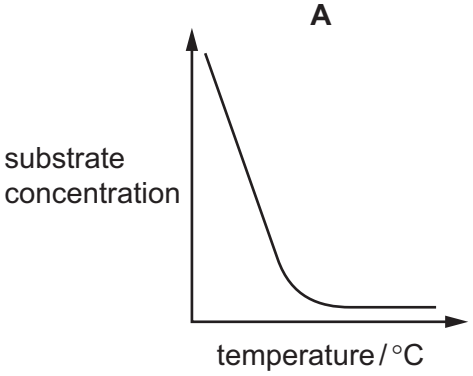
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13 A student carried out an investigation into the effect of temperature on the rate of an enzyme-catalysed reaction.

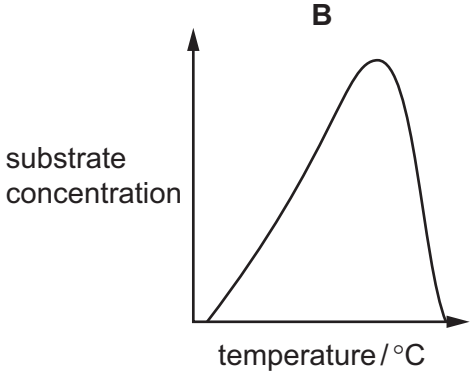
At each temperature, the substrate concentration was measured after 10 minutes. All the other variables were kept constant.

Which graph shows the effect of increasing temperature on the substrate concentration after 10 minutes?

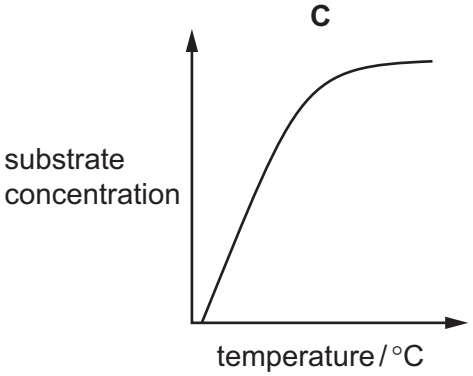
A



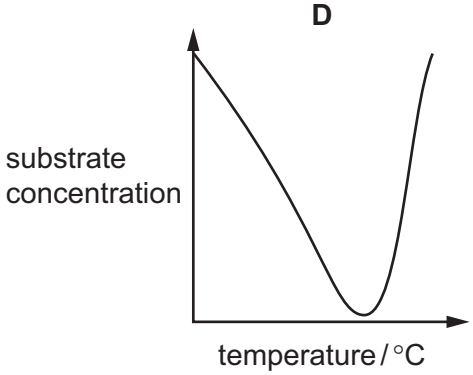
B



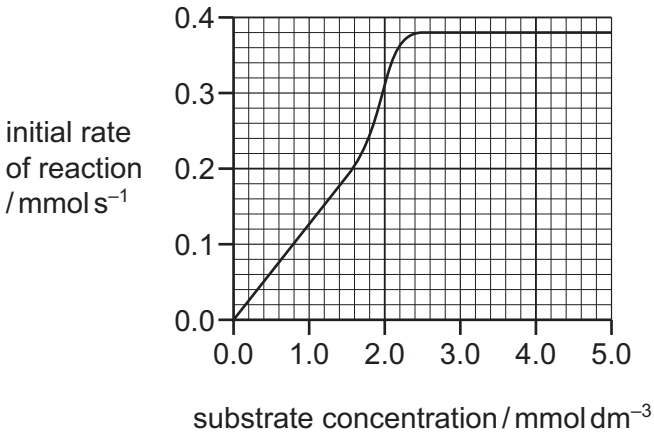
C



D



14 The graph shows how the rate of an enzyme-catalysed reaction depends on the concentration of substrate.



What is the Michaelis-Menten constant (K_m) for this enzyme under these conditions?

A 0.19 mmol dm^{-3}

B 0.38 mmol dm^{-3}

C 1.5 mmol dm^{-3}

D 5.0 mmol dm^{-3}

15 The formula shows how the rate of diffusion across a cell surface membrane can be calculated.

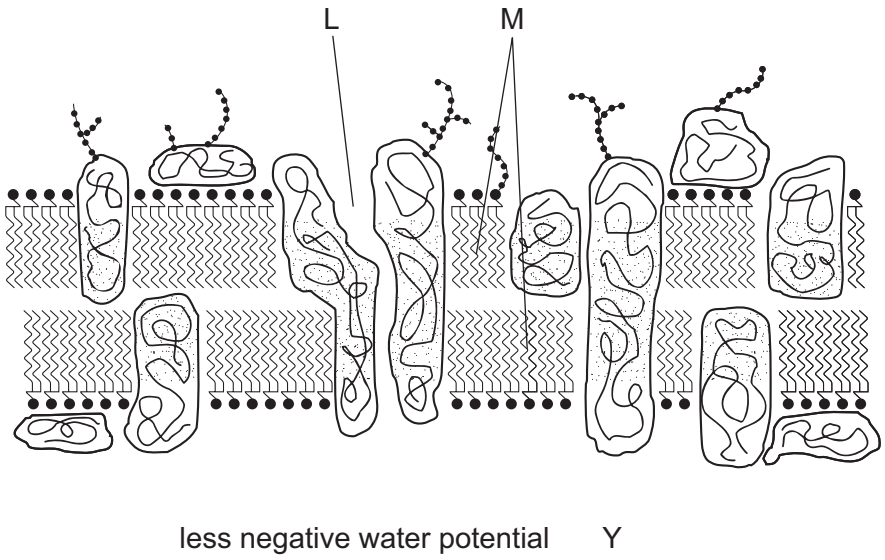
$$\frac{\text{surface area} \times \text{difference in concentration}}{\text{thickness of membrane}}$$

Which row shows how the fastest rate of diffusion can be achieved?

	surface area available	difference in concentration	thickness of membrane
A	high	high	high
B	high	high	low
C	low	high	low
D	low	low	high

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16 The diagram shows part of the cell surface membrane of an active animal cell.



Which statements correctly describe the net movement of molecules across this membrane?

1 Oxygen diffuses through molecules M from X to Y.

2 Carbon dioxide diffuses through molecules M from X to Y.

3 Water moves from Y to X through molecule L.

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

17 Some epidermal cells from a well-watered plant are placed in three solutions which have different water potentials.

Which row correctly shows the state of the plant cells in each of the solutions?

	water potential of solution		
	lower than cells	equal to cells	higher than cells
A	plasmolysed	turgid	plasmolysed
B	plasmolysed	turgid	turgid
C	turgid	plasmolysed	plasmolysed
D	turgid	plasmolysed	turgid

18 One of the chromosomes in a nucleus has a telomere which contains many repeats of the base sequence TTAGGG.

This chromosome was extracted from four different cells and the total number of bases in the telomere was determined.

Which total number of bases was found in the cell that had undergone the most mitotic divisions?

A 5548 **B** 5580 **C** 5645 **D** 5700

19 The chromosome content of each daughter cell must be identical to that of the mother cell for successful cell replacement when repairing tissues.

Which stages of mitosis make sure that each daughter cell receives one chromatid from each chromatid pair?

A prophase and metaphase

B metaphase and anaphase

C anaphase and telophase

D telophase and interphase

20 Which of these statements about cytokinesis is always true?

1 Cell structures replicate.

2 Cell structures are shared between two cells.

3 Nuclear envelope reforms.

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

21 Which statement is correct about the number of telomeres present in prophase of a human body cell?

A 46 as there is one telomere at the end of 46 chromosomes

B 92 as there is one telomere at each end of 46 chromosomes

C 92 as there is one telomere at the end of 92 chromatids

D 184 as there is one telomere at each end of 92 chromatids

22 Which statement explains why DNA replication is described as semi-conservative?

A Half of each original strand is conserved in each new molecule of DNA.

B Half of the base sequence of each strand is conserved in each new molecule of DNA.

C Only one strand of DNA is used as a template during replication.

D The template for each new molecule of DNA is one strand of the original molecule.

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23 A section of a DNA molecule has the coding sequence: AGGCAATGGC.

Which statements are correct?

1 This coding sequence contains 3 pyrimidines.

2 The double-stranded DNA of this section contains 26 hydrogen bonds between complementary bases.

3 The double-stranded DNA of this section has 20 sugar-phosphate bonds.

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

24 XNA is a laboratory-made nucleic acid made of nucleotides in which one component has been replaced by chemical X. The chemical X is not found in nature. The part of the molecule responsible for coding is not changed.

Which organic component of a DNA or RNA nucleotide has been replaced by X?

A five-carbon sugar

B phosphate group

C purine base

D pyrimidine base

25 Which statements about tRNA are correct?

1 Hydrogen bonds between bases temporarily hold tRNA against mRNA.

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

3 The specificity of the tRNA molecule for glycine and the specificity of the enzyme that loads glycine are both necessary for correct loading.

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

26 What is the role of ATP in a companion cell when sucrose is loaded into a sieve tube element?

A moving sucrose into the sieve tube element

B removing protons from the sieve tube element

C removing protons out of the cytoplasm of the companion cell

D taking up sucrose into the cytoplasm of the companion cell

27 A potometer was used to measure the transpiration rate of a leafy shoot.

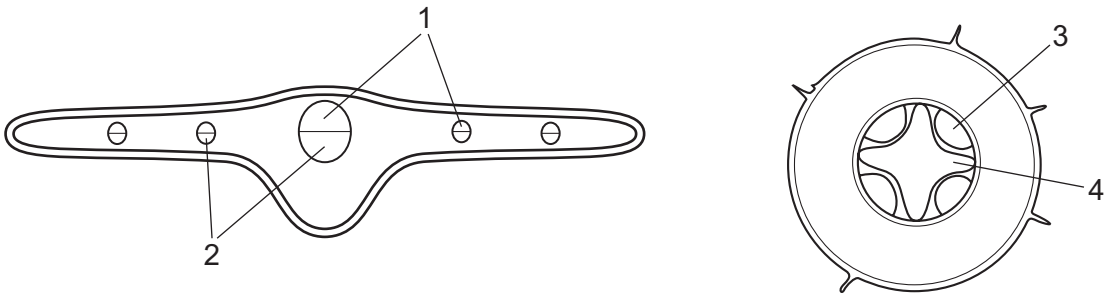
What could be the correct units?

A cm min **B** $cm^2\,min^{-1}$ **C** $cm^3\,g^{-1}\,min$ **D** $cm^3\,min^{-1}$

28 Which combination of features is characteristic of a phloem sieve tube element as it is loaded from a source?

	water potential of the phloem sieve tube element	lignification of the cell wall
A	higher than source	absent
B	higher than source	present
C	lower than source	absent
D	lower than source	present

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



Which structures, labelled 1 to 4, transport water **and** sucrose?

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

key
✓ = correct
✗ = incorrect

30 Which statement explains why the ventricles contract after the atria?

A The band of fibres between the atria and the ventricles conducts the excitation wave slowly.

B The excitation wave has to pass through a small area of conducting fibres in the septum.

C The excitation wave has to travel further to reach the base of the ventricles than to spread across the atria.

D The excitation wave travels slowly through the Purkyne tissue to reach the base of the septum.

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31 If the left atrioventricular valve in the heart does not close completely it results in blood flowing back into the atrium during ventricular systole.

What would be the immediate effect of this back flow?

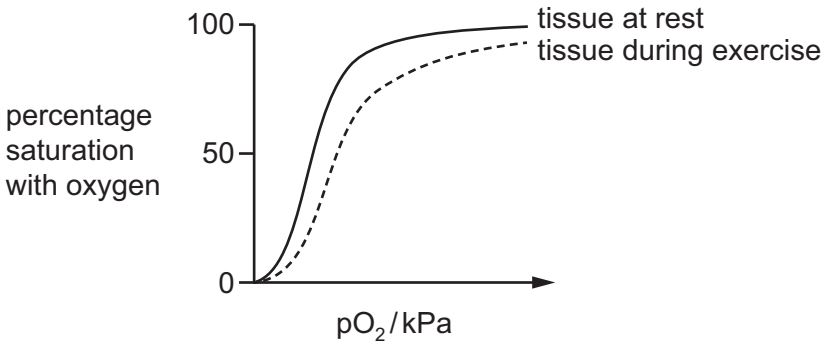
A blood flowing from the heart carries less oxygen because less blood enters the lungs

B diastolic pressure in the left ventricle falls because less blood enters the pulmonary artery

C lower systolic pressure in the left atrium and less blood enters the pulmonary artery

D raised pressure in the left atrium and less blood enters the aorta

32 The graph shows two oxygen dissociation curves, one for a tissue at rest and one for the same tissue during exercise.



What factors have caused the difference in the position of the dissociation curve during exercise compared with the dissociation curve for the tissue at rest?

1 increase in pH

2 decrease in pH

3 increase in haemoglobin affinity for O_2

4 decrease in haemoglobin affinity for O_2

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

33 Which of these statements about the formation of haemoglobinic acid are correct?

1 It can only occur with the dissociation of oxygen from haemoglobin.

2 It removes excess hydrogen ions preventing blood becoming too acidic.

3 It is linked to the action of carbonic anhydrase.

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

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34 Which of these structures contain cartilage and cilia?

1 bronchi

2 bronchioles

3 trachea

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

35 What correctly describes the effect of carcinogens on lung tissue that causes a tumour to develop?

A Cells in damaged alveoli walls divide more rapidly to replace damaged areas.

B Cilia are paralysed and mucus accumulates in the lungs causing DNA to change.

C DNA changes, causing bronchial epithelial cells to divide by mitosis in an uncontrolled way.

D Haemoglobin carries less oxygen, causing bronchial cells to divide by mitosis in an uncontrolled way.

36 Which row identifies both the type of pathogen that causes cholera and the way in which cholera is transmitted from person to person?

	type of pathogen	method of transmission
A	bacteria	drinking water contaminated with the pathogen
B	bacteria	inhaling water droplets contaminated with the pathogen
C	virus	drinking water contaminated with the pathogen
D	virus	inhaling water droplets contaminated with the pathogen

37 Why do people with HIV/AIDS have a higher occurrence of malaria than people without HIV/AIDS?

A HIV/AIDS and malaria are both diseases where the pathogen travels in blood.

B HIV/AIDS and malaria are both transmitted in blood.

C HIV/AIDS infects T-lymphocytes which are used by the malaria pathogen.

D HIV/AIDS suppresses the immune response to the malaria pathogen.

38 How many variable regions are there on a typical Y-shaped antibody molecule?

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

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39 Where are antigens found?

	on the surface of pathogen	on the surface of macrophage
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

key

✓ = antigens found

✗ = antigens not found

40 When an organ is transplanted from one person to another, rejection of the non-self organ must be avoided. At the same time, the immune system of the recipient must be maintained to prevent death from infections.

What prevents rejection of the transplanted organ?

A continued activity of B-lymphocytes

B natural active immunity

C natural passive immunity

D suppression of T-lymphocyte activity

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BIOLOGY **9700/13**

Paper 1 Multiple Choice **May/June 2018**

1 hour

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

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Electronic calculators may be used.

This document consists of **16** printed pages.

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CAMBRIDGE International Examinations

1 Which steps are needed to find the actual width of a xylem vessel viewed in transverse section using a ×10 objective lens?

1 Convert from mm to μm by multiplying by 10^{-3}.

2 Calibrate the eyepiece graticule using a stage micrometer on ×4 objective lens.

3 Measure the width of the xylem vessel using an eyepiece graticule.

4 Multiply the number of eyepiece graticule units by the calibration of the eyepiece graticule.

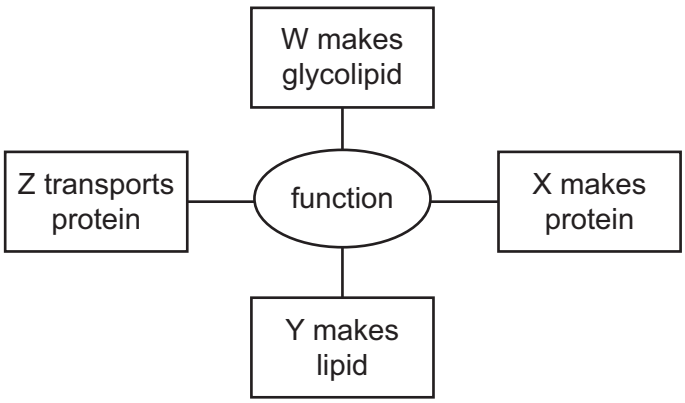
A 1, 2, 3 and 4

B 1 and 2 only

C 2, 3 and 4 only

D 3 and 4 only

2 The diagram shows functions of four cell structures, W, X, Y and Z.



Which row correctly matches the cell structure with the letter representing a function?

	Golgi body	ribosome	rough endoplasmic reticulum	smooth endoplasmic reticulum
A	W	X	Z	Y
B	X	Z	Y	W
C	Y	W	X	Z
D	Z	Y	W	X

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3 Which cell structures produce ATP?

1 chloroplasts

2 mitochondria

3 nucleus

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

4 When mucus is secreted from a goblet cell these events take place.

1 addition of carbohydrate to protein

2 fusion of the vesicle with the cell surface membrane

3 secretion of a glycoprotein

4 separation of a vesicle from the Golgi body

What is the sequence in which these events take place?

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

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

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

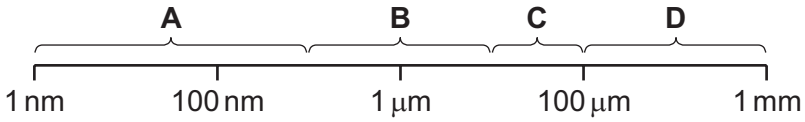
D $4 \rightarrow 1 \rightarrow 3 \rightarrow 2$

5 Which row could be correct for a virus?

	carbohydrate	DNA	phospholipid	lipid	protein	RNA
A	✓	✓	✓	✓	✓	✓
B	✓	✗	✓	✗	✗	✓
C	✗	✓	✗	✗	✗	✓
D	✗	✓	✗	✗	✓	✗

key
✓ = present
✗ = not present

6 Which size range would include most prokaryotic cells?



7 Solutions of three biological molecules are tested for sugars. The table shows the colours of the solutions after testing.

solution	heated with Benedict's solution	boiled with hydrochloric acid, neutralised, then heated with Benedict's solution
1	blue	orange
2	green	green
3	orange	red

Which solutions contained glucose before testing?

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

8 A solution containing equal masses of amylose and amylopectin is completely hydrolysed.

Which molecules will be found after the hydrolysis?

A α-glucose only

B β-glucose only

C equal masses of α-glucose and β-glucose

D more α-glucose than β-glucose

9 Which molecules contain the following bonds?

	ester	hydrogen	disulfide
A	amylase	haemoglobin	catalase
B	glycerol	glycogen	collagen
C	lipids	amylopectin	amylose
D	phospholipids	cellulose	antibodies

10 Which feature of phospholipids enables a bilayer to form?

A They are insoluble in water.

B They are polar molecules.

C They have hydrophobic and hydrophilic components.

D They may contain saturated or unsaturated fatty acids.

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11 Which description is correct for collagen?

A A collagen molecule has a high proportion of the amino acid glycine, which has a very small R group.

B A group of three collagen fibres forms a strong, insoluble coiled structure termed a triple helix.

C Each of the collagen polypeptides in a collagen molecule has a regular spiral arrangement of many alpha helices.

D Peptide bonds are present between amino acids of the different polypeptides forming the collagen molecule.

12 Which statement about the properties of water is correct?

A Bonds between hydrogen atoms cause water to have a high specific heat capacity.

B The high latent heat of vaporisation of water is due to the presence of hydrogen bonds.

C The high specific heat capacity of water causes cooling during evaporation.

D Water can dissolve amylopectin as it has hydrophilic side chains.

13 Catechol is a chemical found in a number of fruits. Catechol can be oxidised to a quinone by the enzyme catechol oxidase.

Catechol oxidase is inhibited by parahyroxybenzoic acid (PHBA) which is structurally similar to catechol.

Catechol oxidase is also inhibited by phenylthiourea (PTU) which binds to a copper atom in the enzyme.

How do both these inhibitors reduce the enzyme activity?

1 altering the specificity of the enzyme

2 competing with substrates for the active site

3 decreasing the V_{max} of the reaction

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

14 Four students investigated the effect of catalase on hydrogen peroxide.

Each student started a digital clock at the beginning of the experiment and stopped the clock after 25 bubbles had been counted.

The time recorded on the digital clock is shown below.

hours	minutes	seconds	hundredths of a second
00	01	33	54

Which of the times recorded by the students is appropriate for this experiment?

A 1.34 minutes

B 1 minute 33.54 seconds

C 94 seconds

D 93.54 seconds

15 What is the effect of an enzyme in an enzyme-catalysed reaction?

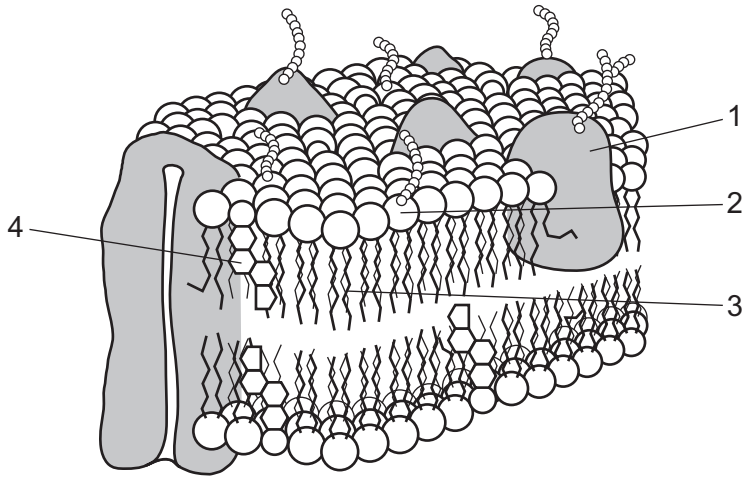
A decreases the activation energy and decreases the energy yield

B decreases the activation energy and has no effect on the energy yield

C increases the activation energy and increases the energy yield

D increases the energy yield and decreases the activation energy

16 The diagram shows part of the cell surface membrane.



Which components act as antigens?

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

17 Which processes use energy in the form of ATP?

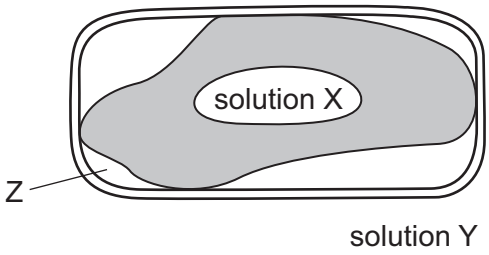
1 endocytosis

2 exocytosis

3 facilitated diffusion

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

18 The diagram shows a partially plasmolysed plant cell.



What is found at Z?

A air

B solution X

C solution Y

D water

19 Which features of an organism are affected by a drug that stops mitosis?

1 cell repair

2 cell replacement

3 number of stem cells

4 tissue repair

5 tumour formation

A 1, 2, 3, 4 and 5

B 1, 2 and 3 only

C 1, 4 and 5 only

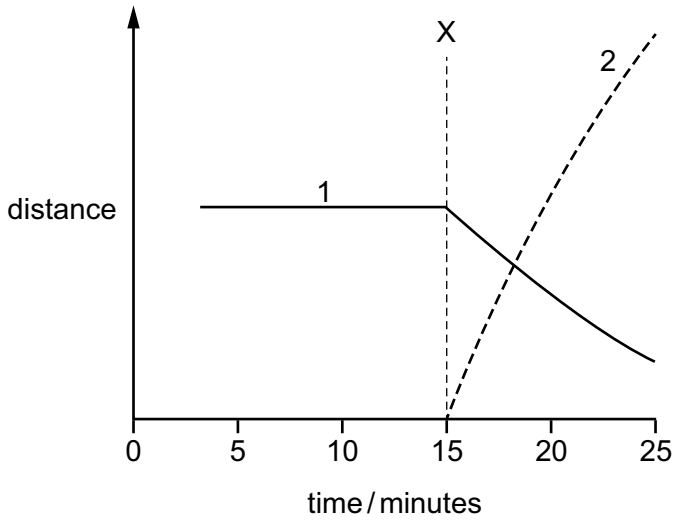
D 2, 3, 4 and 5 only

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20 Which row shows the appearance of a chromosome at the beginning of prophase of mitosis and the number of DNA strands in the chromosome?

	appearance of one chromosome	number of DNA strands
A		2
B		4
C		1
D		2

21 The graph shows measurements taken during one mitotic cell cycle.



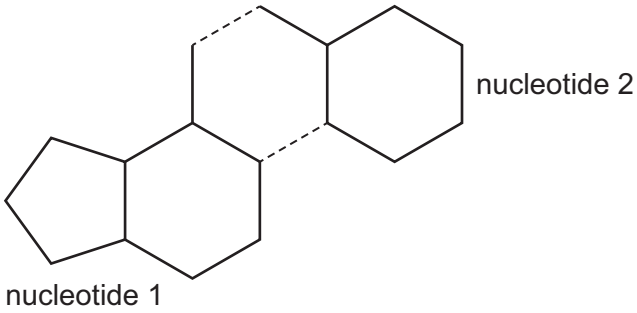
Which stage of mitosis begins at X and which measurements are shown by curves 1 and 2?

	stage beginning at X	distance between centromeres of chromosomes and poles of spindle	distance between centromeres of sister chromatids
A	anaphase	1	2
B	anaphase	2	1
C	metaphase	1	2
D	metaphase	2	1

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22 The diagram shows the outline structure of two nucleotide bases which occur in DNA.

This pair is held together by two hydrogen bonds, shown as dashed lines.



Which row correctly identifies these two nucleotide bases?

	nucleotide 1	nucleotide 2
A	adenine	thymine
B	cytosine	guanine
C	guanine	cytosine
D	thymine	adenine

23 DNA polymerase catalyses condensation reactions between molecules during semi-conservative replication of DNA.

Which two molecules are joined by DNA polymerase?

A base and base

B base and nucleotide

C nucleotide and nucleotide

D phosphate and deoxyribose

24 What occurs during each of DNA replication and transcription and translation?

1 ATP provides energy.

2 Condensation reactions occur to form a polymer.

3 Hydrogen bonds form between purine and pyrimidine bases.

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

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25 Part of a sequence of DNA from a person with a genetic disease is:

TAGTAACCACAAAGG

The corresponding sequence of DNA from a person without this genetic disease is:

TAGTAAAAACCACAAAGG

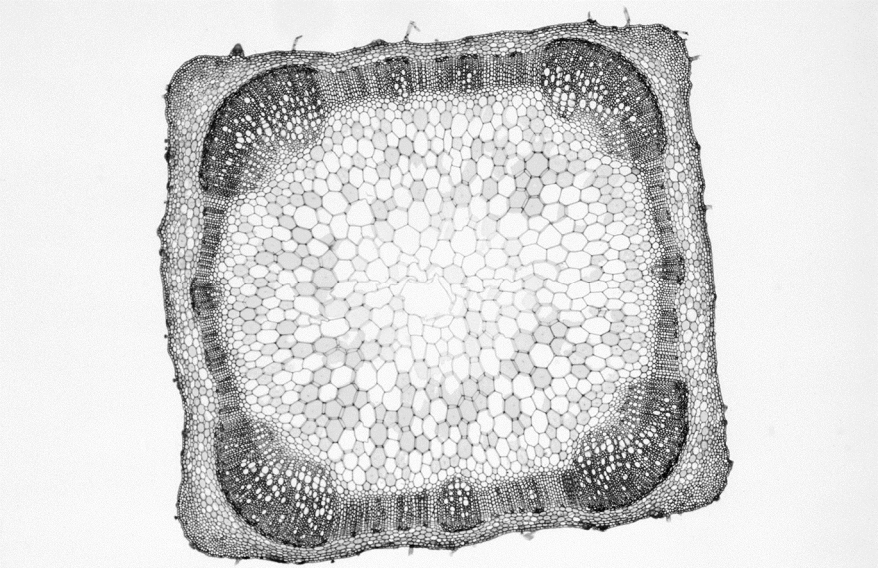
The possible mRNA codons for some amino acids are shown in the table.

amino acid	mRNA codons			
1	GGU	GGC	GGA	GGG
2	AUU	AUC	AUA	
3	UUU	UUC		
4	UCU	UCC	UCA	UCG

Which amino acid is missing from a person with this genetic disease?

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

26 The photomicrograph shows a section through a plant organ.



Which statement could be used to describe this organ?

A The central region of this organ has supporting tissue.

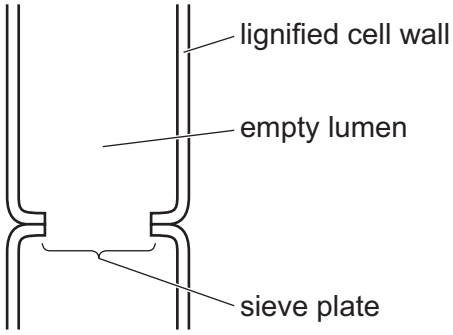
B The endodermis tissue is a thick layer around the edge of the organ.

C The epidermis tissue in this organ has unicellular extensions (trichomes).

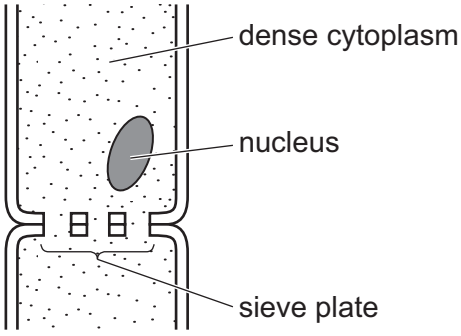
D The xylem tissue is found in greatest density in the centre of the organ.

27 Which diagram correctly represents part of a sieve tube element?

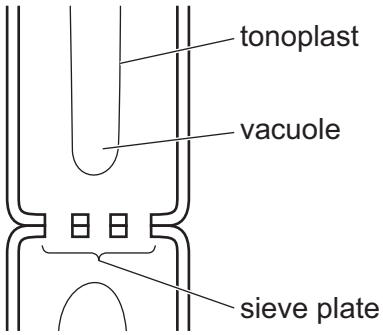
A



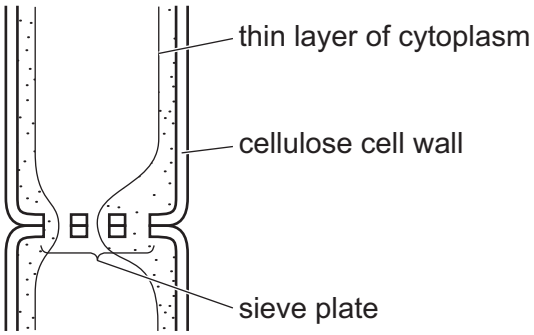
B



C



D



28 Which of the processes involved in water movement through xylem vessels depends on hydrogen bonding between water molecules?

A adhesion

B cohesion

C evaporation

D hydrostatic pressure

29 Which statements about water movement in plants are correct?

1 Water can pass through cellulose.

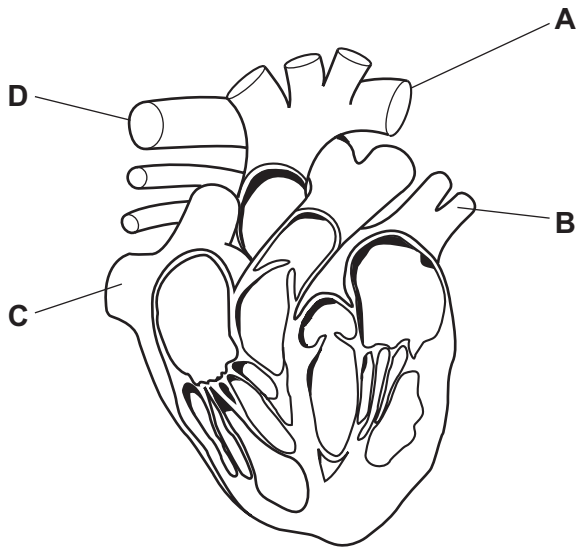
2 Water cannot pass through lignin.

3 Water can pass through suberin.

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 Which blood vessel has the thickest walls?



31 Which statement about the role in the mammalian circulatory system of the heart, blood vessels and blood is correct?

A The contraction of heart muscle causes blood to enter arteries that pump the blood to organs, causing the formation of tissue fluid between cells before returning to the heart in veins.

B The heart connects two sets of blood vessels so that oxygen from the lungs can be distributed by red blood cells and wastes can be collected from tissues by blood plasma for removal.

C The heart muscle contracts and relaxes causing blood, carrying materials from one part of the body to another, to move through blood vessels that connect the different parts of the body.

D The heart provides enough pressure to push blood through arteries to capillaries between cells causing filtration of blood and the formation of tissue fluid which diffuses back into veins.

32 What explains how the maximum uptake of oxygen occurs as blood passes through the capillaries of the lungs?

A Each haemoglobin molecule can temporarily bind to four oxygen atoms.

B Oxyhaemoglobin formation increases the capacity of red blood cells to transport oxygen.

C The binding of the first oxygen molecule to haemoglobin decreases the molecule's affinity for binding other oxygen molecules.

D The dissociation of carbon dioxide from carboxyhaemoglobin allows more haemoglobin to be available for oxygen binding.

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33 At high altitudes, the oxygen content of the air may be a third of that at sea level.

As a person climbs a mountain, their body gradually adjusts to the high altitude.

What is increased during this period of adjustment?

A the concentration of haemoglobin in the red blood cells

B the oxygen-carrying capacity of the haemoglobin

C the number of red blood cells per mm^3 of blood

D the rate at which haemoglobin releases oxygen to the tissues

34 What helps to maintain a concentration gradient between blood and the air in the alveolus?

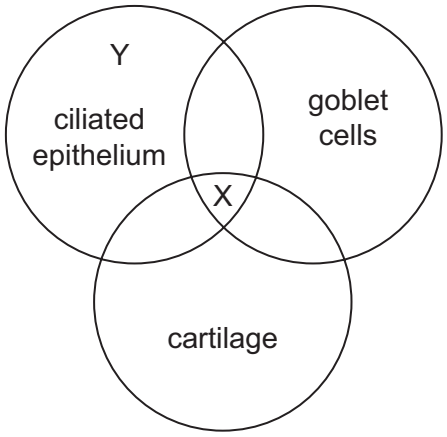
A the flow of blood through the lungs

B the presence of haemoglobin in blood cells

C the single-celled alveolar walls

D the squamous epithelium of capillaries

35 The diagram shows three features found in the tissues of the gas exchange system.



Which structures of the gas exchange system could be represented at position X and at position Y in the diagram?

1 bronchiole

2 trachea

3 bronchus

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

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36 Blood tests on people who regularly smoke cigarettes show that approximately 5% of their haemoglobin carries carbon monoxide.

People who smoke e-cigarettes inhale a vapour with no carbon monoxide. A person who smokes cigarettes regularly, switches to e-cigarettes and a blood test is carried out after a month.

Which chemical in the blood would be found in a lower concentration in this blood test?

A carbaminohaemoglobin

B carbonic anhydrase

C carboxyhaemoglobin

D hydrogencarbonate ions

37 Emphysema is a type of chronic obstructive pulmonary disease, COPD. People with emphysema have a very low level of a plasma protein which inhibits the enzyme elastase.

Elastase breaks down the elastic fibres in the bronchioles and alveoli.

Which are effects of the low levels of inhibitor in people with emphysema?

1 alveoli do not stretch and recoil properly during inhalation and exhalation

2 blood is poorly oxygenated resulting in a rapid breathing rate

3 bronchioles collapse during exhalation trapping air in the alveoli

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

38 Some antibiotics work by binding to ribosomes.

Which statement explains why these antibiotics kill bacteria cells but do not kill most human cells?

A mRNA in bacteria is formed in the cytoplasm from naked DNA.

B The antibiotics cannot pass through human cell membranes.

C The codes used for amino acids in bacteria are different from those used by humans.

D The ribosomes of bacteria have a different structure from those of humans.

39 Where are antigens found?

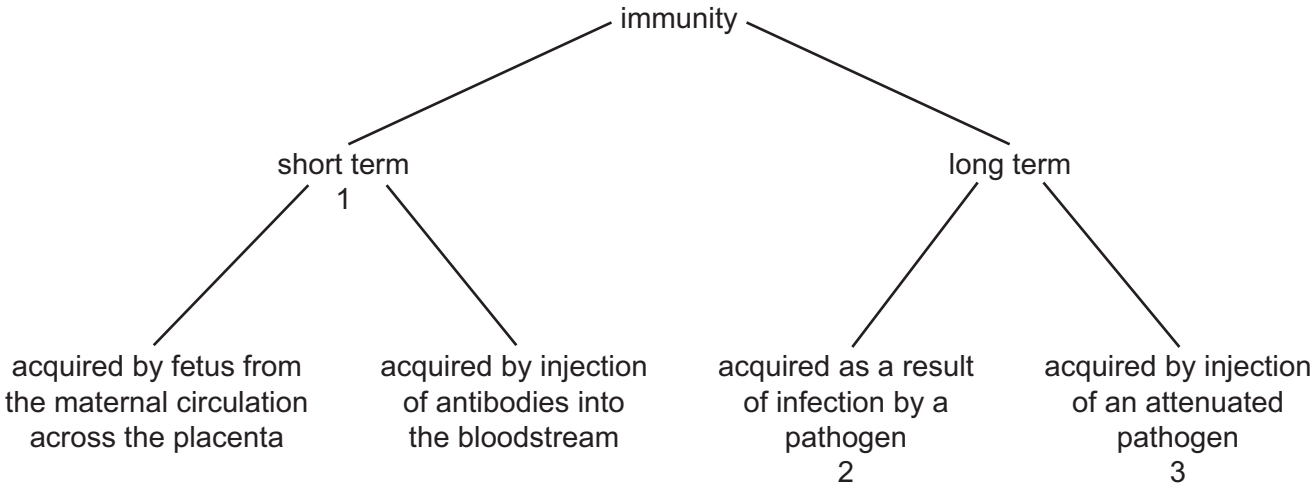
	on the surface of pathogen	on the surface of macrophage	in blood plasma
A	✓	✓	✗
B	✓	✗	✓
C	✗	✓	✗
D	✗	✗	✓

key

✓ = antigens found

✗ = antigens not found

40 The diagram allows the identification of different types of immunity.



Which row correctly identifies the types of immunity labelled 1, 2 and 3?

	1	2	3
A	active	artificial	natural
B	active	natural	artificial
C	passive	artificial	natural
D	passive	natural	artificial

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