Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/13**

Paper 1 Multiple Choice **May/June 2022**

1 hour 15 minutes

You must answer on the multiple choice answer sheet.

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

INSTRUCTIONS

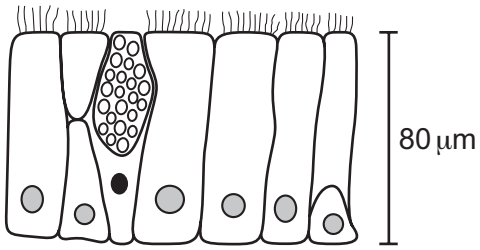
- There are **forty** questions on this paper. Answer **all** questions.
- For each question there are four possible answers **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in soft pencil on the multiple choice answer sheet.
- Follow the instructions on the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

INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark.
- Any rough working should be done on this question paper.

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1 The diagram shows a section through epithelium found in part of the respiratory system.



What is the magnification of the diagram?

A ×35 **B** ×350 **C** ×3500 **D** ×35 000

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

The functions were listed by number.

1 mRNA passes through to the ribosome

2 synthesis of polypeptides

3 packaging of hydrolytic enzymes that will remain in the cell

The appearances were listed by letter.

V membranes which surround an enclosed inner cavity

W non-membrane-bound, spherical structures

X a double membrane interspersed with pores

Y non-membrane-bound, cylindrical structures

Z membrane-bound sacs, arranged as a flattened stack

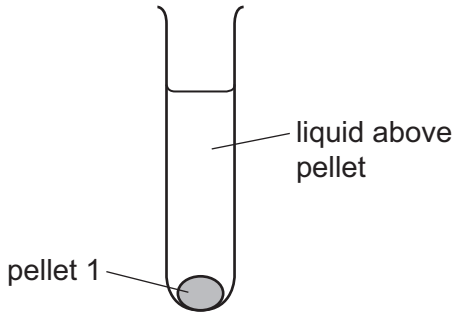
Which student correctly matched the numbered functions with the appearance of the cell structure?

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

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3 An experiment was carried out to separate the cell structures in an animal cell.

The cells were broken open. The extract was filtered and put into a centrifuge tube. This tube was then spun so that the heaviest cell structure sank to the bottom first, forming pellet 1, as shown.



The liquid above pellet 1 was poured into a clean centrifuge tube and spun again 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 to obtain pellet 3 and pellet 4, each containing a single cell structure.

What is a function of the cell structure extracted in pellet 1?

A digestion of old organelles

B production of ATP

C production of mRNA

D synthesis of protein

4 ATP molecules are synthesised in mitochondria.

Which sugar is found in these ATP molecules?

A deoxyribose

B fructose

C glucose

D pentose

5 Which row shows a comparison that is **not** correct between a typical prokaryotic cell and a typical eukaryotic plant cell?

	prokaryotic cell	eukaryotic plant cell
A	DNA not associated with histones	DNA associated with histones
B	no endoplasmic reticulum present	endoplasmic reticulum present
C	peptidoglycan cell walls	cellulose cell walls
D	all ribosomes approximately 18 nm in diameter	all ribosomes approximately 22 nm in diameter

6 It is suggested that primitive prokaryotic cells may be ancestors of certain organelles in eukaryotic cells.

Which organelle is most similar in composition to a typical prokaryote?

A Golgi bodies

B lysosomes

C mitochondria

D nucleoli

7 The concentration of reducing sugar in a solution can be found if an observational measurement is compared to a standard.

Which observational measurement could be used to estimate the concentration of reducing sugar in an unknown solution?

1 the colour of the solution after 20 minutes

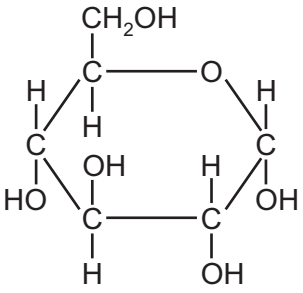
2 the time for the first colour change to occur

3 the rate of formation of solid particles

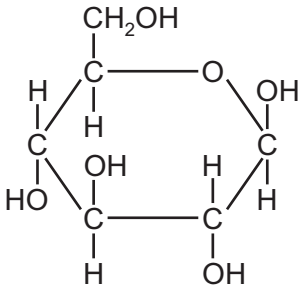
A 1, 2 and 3 **B** 1 and 2 only **C** 2 only **D** 3 only

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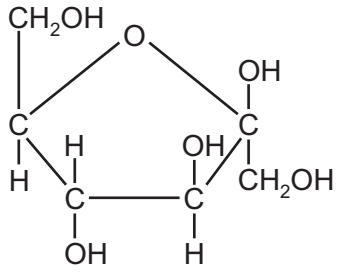
8 The diagram shows three hexose sugars.



1



2



3

Which row correctly shows examples of carbohydrates in which these three hexose sugars occur?

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

9 Trehalose is a sugar that gives a negative result when tested with Benedict's solution.

A molecule of trehalose forms two α-glucose molecules when it is hydrolysed.

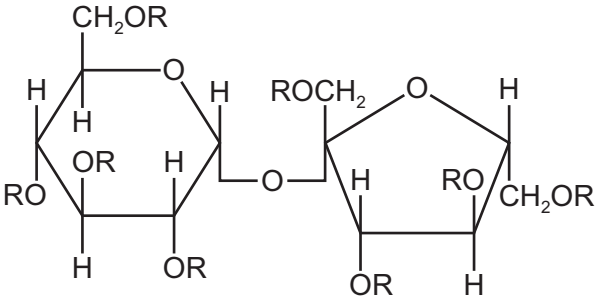
Which row is correct?

	formula of trehalose	sugar that gives the same result with Benedict's as trehalose
A	$C_{12}H_{22}O_{11}$	fructose
B	$C_{12}H_{22}O_{11}$	sucrose
C	$C_{12}H_{24}O_{12}$	fructose
D	$C_{12}H_{24}O_{12}$	sucrose

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10 Olestra is an artificial lipid. It is made by attaching fatty acids, by condensation, to a sucrose molecule.

A simplified diagram of olestra is shown. R represents the position where fatty acids would be attached.



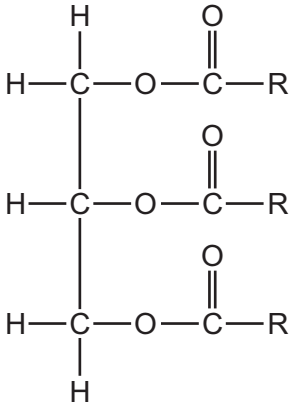
Humans cannot hydrolyse olestra. However, other animals may be able to do so.

How many molecules of water would be needed to hydrolyse one molecule of olestra into fatty acids, fructose and glucose?

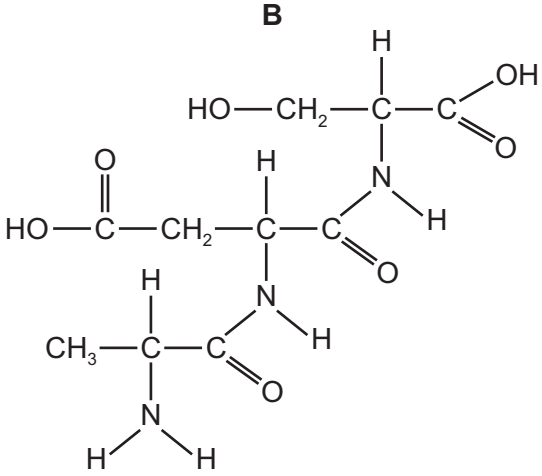
A 11 **B** 10 **C** 9 **D** 8

11 Which molecule contains at least one peptide bond?

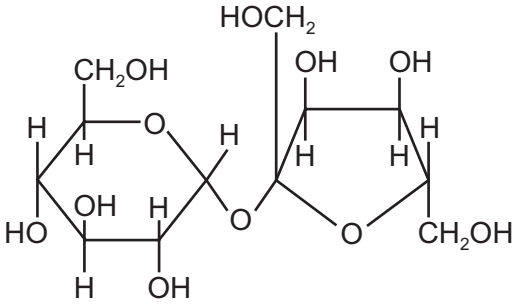
A



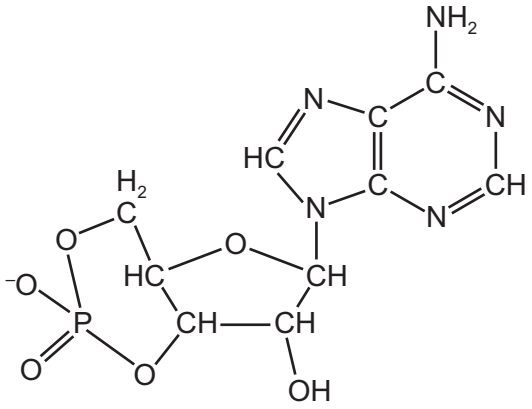
B



C



D



12 RNA polymerase and peptidyl transferase are both enzymes involved in protein synthesis.

Which statements describe similarities between these two enzymes?

1 They are both globular proteins.

2 They both have the same tertiary structure.

3 They are both intracellular enzymes.

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

13 What is a feature of competitive enzyme inhibition?

A The inhibitor binds permanently to the active site.

B Inhibition can be reversed by increasing the concentration of the substrate.

C The inhibitor molecule changes the secondary structure of the enzyme.

D The substrate and the inhibitor are the same shape.

14 Batrachotoxin is a poison found in frogs in the Colombian jungle. The poison is used to produce poison darts.

The poison works by increasing the permeability of the cell surface membrane of nerve and muscle cells to sodium ions, which move out of the cells.

Four students made statements about how the poison affects the cells.

1 Water leaves the cells by osmosis, causing the cells to shrink.

2 Water enters the cells by osmosis, causing the cells to burst.

3 When the sodium ions move out of the cells the intracellular fluid has a more positive water potential than the extracellular fluid.

4 When the sodium ions move out of the cells the extracellular fluid has a more positive water potential than the intracellular fluid.

Which statements are correct for the cells affected by batrachotoxin?

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

15 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

16 An indicator is colourless in acid and pink in alkali.

In an experiment a petri dish of agar was prepared using an acidic solution of this indicator.

A disc of agar 1 cm in diameter was removed from the centre to create a well.

A white card showing circular marker lines 1 cm apart was placed underneath the petri dish.

1 cm^3 alkali solution was put into the well in the agar and a stop-watch was started.

A circular disc of pink colour appeared and spread through the agar. It reached the first marker line in a short time but took longer to reach the second marker line and a very long time to reach the third marker line.

What explains these observations?

A facilitated diffusion of alkali solution

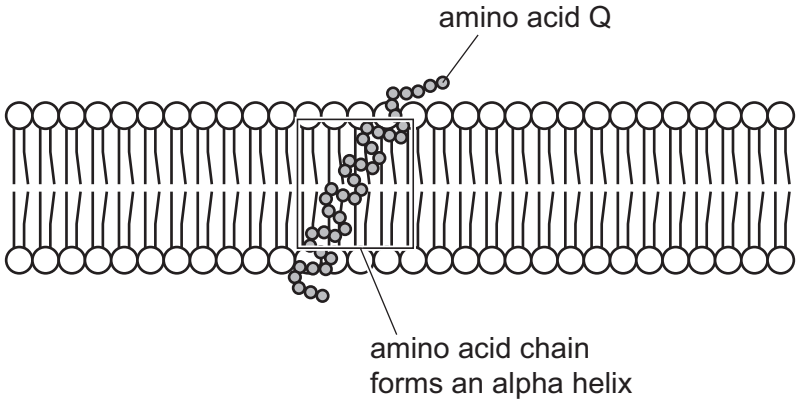
B facilitated diffusion of the indicator

C simple diffusion of alkali solution

D simple diffusion of the indicator

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17 The diagram shows a section of a glycoprotein molecule found embedded in a cell surface membrane. Each of the amino acids is represented by a small shaded circle.



Which row shows a property of the amino acids found in the alpha helix and a property of amino acid Q?

	property of amino acids found in the alpha helix	property of amino acid Q
A	non-polar	polar
B	non-polar	non-polar
C	polar	polar
D	polar	non-polar

18 Some cells are listed.

1 bacterial cells

2 cancer cells

3 lymphocytes

4 mature red blood cells

5 stem cells

Which cells can divide by mitosis?

A 1, 2, 4 and 5

B 1, 2 and 3

C 2, 3 and 5

D 3, 4 and 5

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19 Which statements about mitosis are correct?

1 At the end of telophase, two nuclei are formed.

2 Centrioles attach chromosomes to the spindle during metaphase.

3 Chromatids are pulled apart during anaphase.

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

20 Which statement about telomeres is correct?

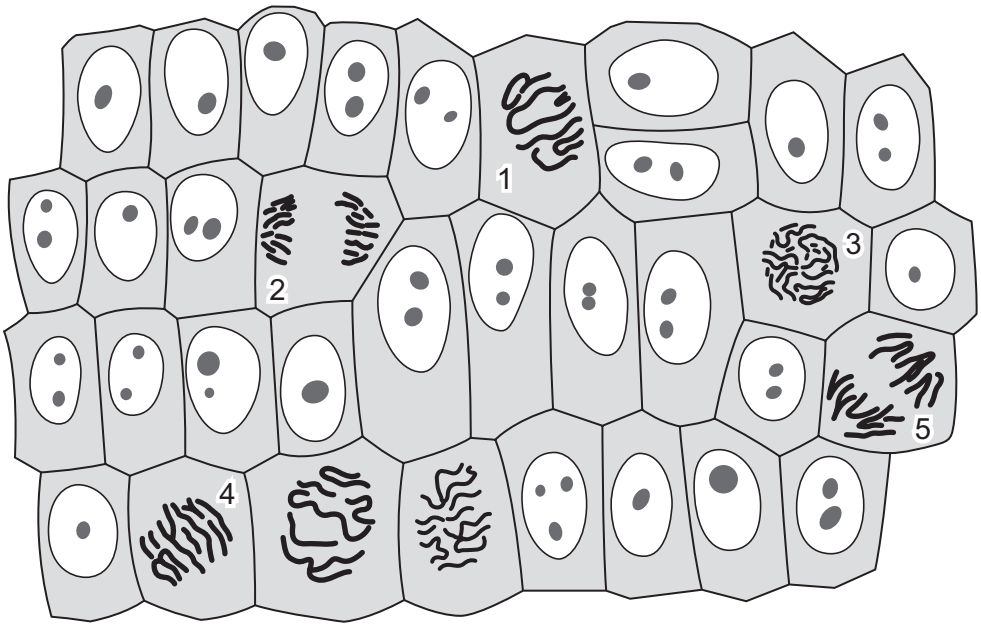
A They allow cells in culture from any age of donor to divide a fixed number of times.

B They are genes which are present on the 5′ end of every chromosome.

C They are unpaired regions of DNA on the 3′ end of every chromosome.

D They prevent introns and exons being lost from genes during cell division.

21 The diagram shows stages of mitosis.



What is the correct sequence of the stages of mitosis numbered on the diagram?

A 1 → 3 → 4 → 2 → 5

B 1 → 3 → 4 → 5 → 2

C 3 → 1 → 4 → 5 → 2

D 3 → 4 → 1 → 2 → 5

22 Which statement about the transcription and translation of a gene is correct?

A The non-transcribed strand of DNA has a base sequence that is identical to the mRNA produced in transcription.

B The template strand of DNA has a base sequence that is identical to the mRNA produced in transcription.

C The non-transcribed strand of DNA has a base sequence that is complementary to the tRNA molecules required in translation.

D The template strand of DNA has a base sequence that is complementary to the tRNA molecules required in translation.

23 Which statement about mRNA is correct?

A The primary transcript becomes modified by the joining of introns to become mRNA.

B The primary transcript is synthesised and then modified to mRNA in the nucleus.

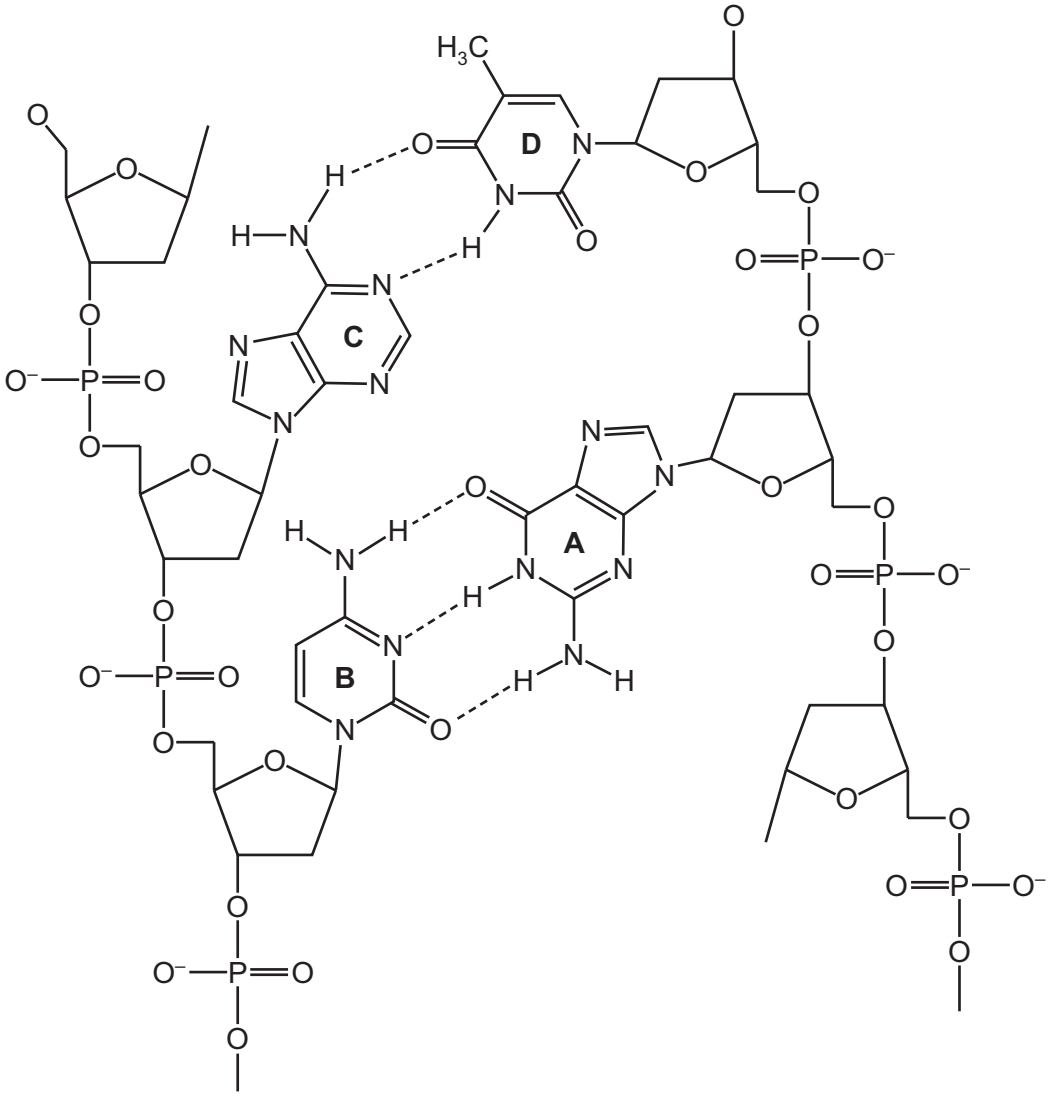
C mRNA contains nucleotides containing the sugar deoxyribose.

D The bases in mRNA are held together by covalent bonds.

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[Turn over

24 The diagram shows part of a DNA molecule.



Which label is correct?

A adenine

B guanine

C cytosine

D thymine

25 The sequence of bases in DNA coding for the first eight amino acids in the β-polypeptide of adult haemoglobin is:

CAC GTG GAC TGA GGA CTC CTC TTC

However, in haemoglobin C, which is a cause of haemolytic anaemia, it becomes:

CAC GTG GAC TGA GGA TTC CTC TTC

Some of the DNA triplets that code for the amino acids are listed in the table.

amino acid	DNA triplet
Glu	CTC
His	GTG
Leu	GAG
Lys	TTC
Pro	GGA
Thr	TGA

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

A Glutamic acid is changed to lysine.

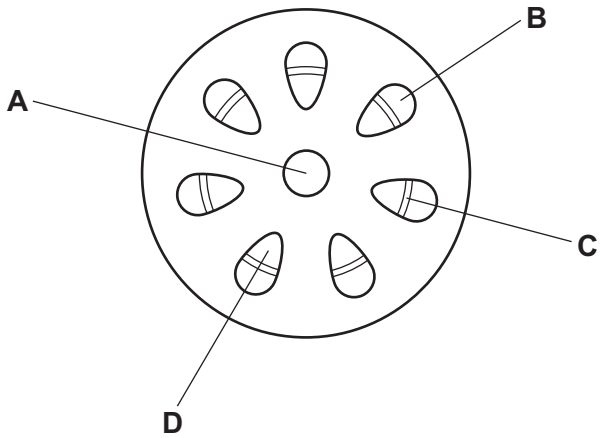
B Histidine is changed to leucine.

C Leucine is changed to lysine.

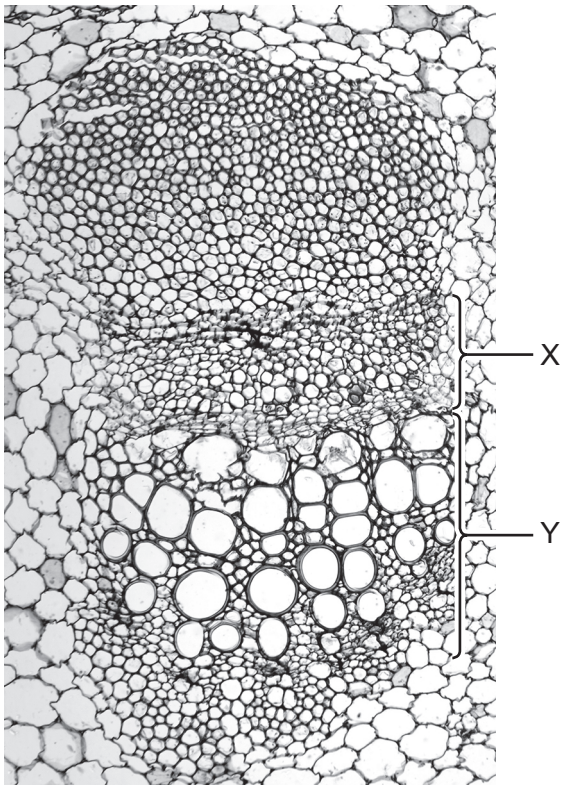
D Proline is changed to threonine.

26 The diagram shows a plant organ.

Which letter correctly labels the xylem?



27 The photomicrograph shows a vascular bundle found in a plant organ.



Which statements about this vascular bundle are correct?

1 The vascular bundle is part of the structure of a root.

2 Some of the cells in region X have very large numbers of mitochondria.

3 Region Y is made up of a number of different cell types.

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

28 Which changes to the water potential and the volume of solution in the phloem sieve tube element occur when sucrose is moved from the phloem sieve tube element to an actively dividing shoot tip?

	water potential in phloem sieve tube element becomes	volume of solution in phloem sieve tube element
A	higher	decreases
B	higher	increases
C	lower	decreases
D	lower	increases

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29 Which processes occur during the loading of sucrose into phloem sieve tubes?

1 Protons are pumped out of the cytoplasm of the companion cell into its cell wall.

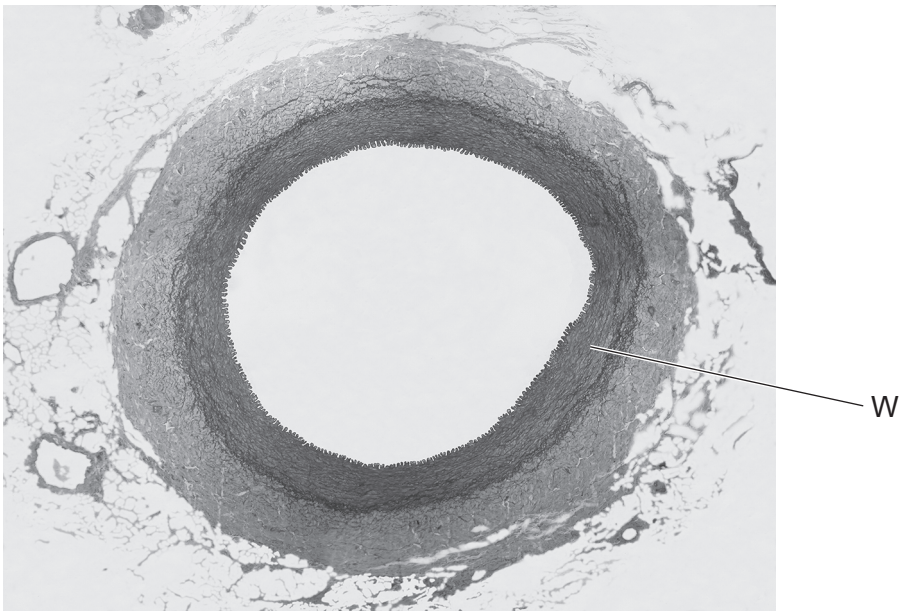
2 There is a higher concentration of protons in the symplastic pathway outside the companion cell.

3 Protons are unable to move back into the companion cell.

4 A co-transporter molecule acts as a carrier for protons and sucrose.

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

30 The photomicrograph shows a section through a structure found in mammals viewed using a light microscope.



×60

What are the main components of layer W?

A collagen fibres only

B elastic fibres and collagen fibres

C smooth muscle and elastic fibres

D squamous epithelial cells forming an endothelium

31 Which statement correctly links muscular or elastic arteries to their function?

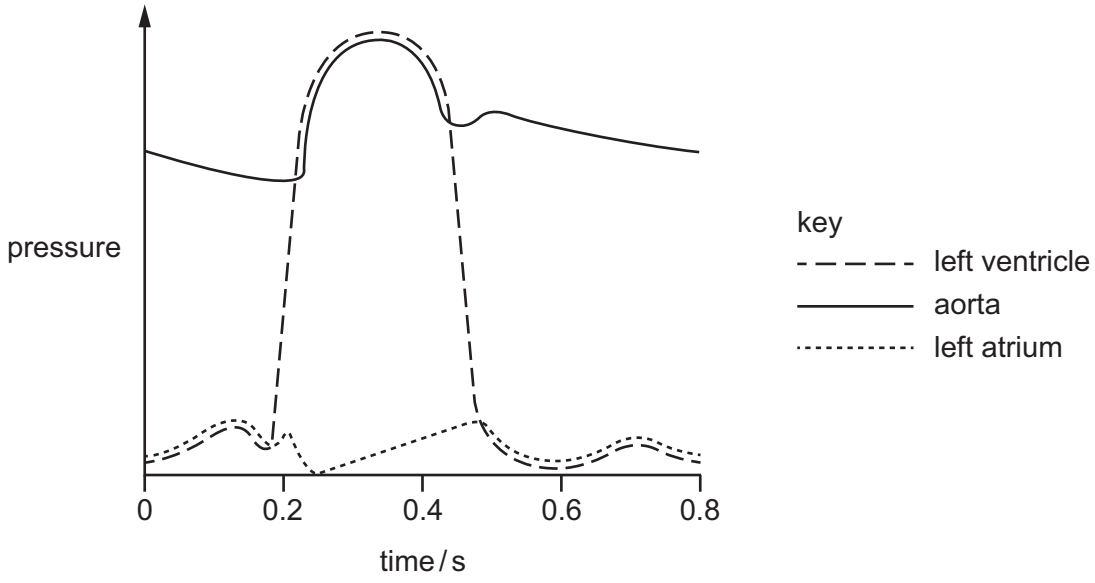
A The aorta is an example of a muscular artery as it transports blood from the left ventricle of the heart.

B Arteries further away from the heart are muscular arteries as they transport blood at high pressure.

C Elastic arteries expand when the heart contracts and then recoil as the heart relaxes to maintain pressure.

D Muscular arteries facilitate smoother blood flow than elastic arteries as their walls expand and recoil.

32 The graph shows the changes in pressure that occur in the left side of the heart during one cardiac cycle.



What is the heart rate in beats per minute?

A 75 **B** 80 **C** 120 **D** 150

33 Which events occur during ventricular systole?

1 Atrioventricular valves close.

2 Muscle in ventricle walls relaxes.

3 Semilunar valves open.

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

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34 Which reactions take place in a capillary in the lungs?

1 Carbonic acid is formed from carbon dioxide and water.

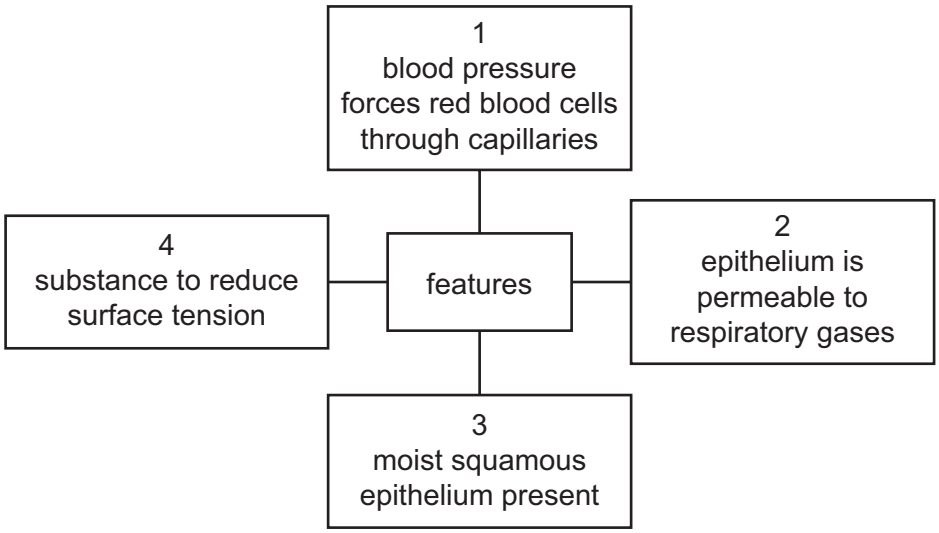
2 Carbaminohaemoglobin is formed from carbon dioxide and haemoglobin.

3 Haemoglobinic acid is formed from haemoglobin and hydrogen ions.

4 Carbon dioxide and water are formed from hydrogencarbonate ions and hydrogen ions.

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

35 Which features are important for the process of diffusion of oxygen out of an alveolus?



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

36 A student viewed three slides at both low magnification and high magnification. Each slide was a section through a different airway of the gas exchange system.

The student observed three features in each slide.

slide	three features observed by student
1	irregular arrangement of cartilage highly folded inner layer cilia on epithelial cells
2	very few goblet cells cilia on epithelial cells thick layer of smooth muscle relative to wall thickness
3	smooth muscle tissue blood vessels many goblet cells

Which row correctly identifies the three slides?

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

37 Which terms can be used to describe the role of mosquitoes in the transmission of malaria?

1 malarial parasite

2 pathogen

3 vector

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

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38 Rheumatoid arthritis is a disease which causes the body's immune system to attack its own cells. The disease can be treated using monoclonal antibodies.

The table shows how five different monoclonal antibodies can work.

monoclonal antibody	mode of action
1	binding to proteins on cell surfaces and triggering the immune system
2	blocking molecules on cell surfaces that inhibit T-lymphocytes
3	blocking cell signalling receptors that trigger cell division
4	binding to antigens on cell surfaces and releasing a drug
5	blocking cell signalling receptors that trigger the immune response

Inflammation and swelling of joints are symptoms of rheumatoid arthritis. The cytokine, TNFalpha, activates cells in the immune system leading to death of cells in the joint.

Which types of monoclonal antibody could be used to treat rheumatoid arthritis?

A 1, 2, 3, 4 and 5

B 1, 2, 3 and 4 only

C 2, 3 and 5 only

D 4 and 5 only

39 A person's blood group is determined by antigens present on the red blood cells. Antibodies in the plasma of the person who receives the blood can make some blood transfusions unsafe.

The table shows the antigens and antibodies in the blood of people with different blood groups.

blood group	presence of A or B antigens on red blood cells	presence of antibodies to A or B in plasma
A	A only	anti-B only
B	B only	anti-A only
AB	A and B	neither
O	neither	anti-A and anti-B

Which blood groups can be given to a person with blood group A?

A A and AB **B** A and O **C** B and O **D** AB only

40 Some of the events during the primary immune response are listed.

1 phagocytosis of a foreign microbe by a macrophage and antigen presentation

2 some T-lymphocytes will become T-killer cells which kill infected body cells

3 the T-helper cell divides by mitosis to produce T-lymphocyte clones

4 a T-helper cell with the complementary receptor binds to the antigens being presented

What is the correct sequence of events during the primary immune response?

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

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

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

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

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