Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/13**

Paper 1 Multiple Choice **October/November 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.

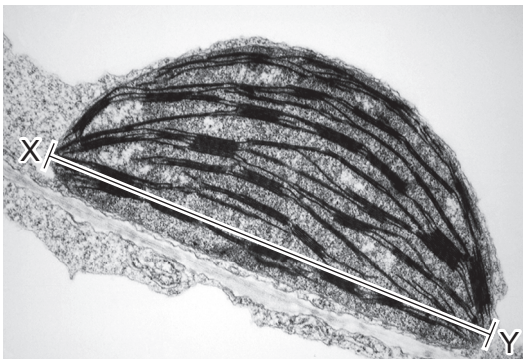
INFORMATION

- 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.

This document has **20** pages. Any blank pages are indicated.

[Turn over

1 The electron micrograph shows a chloroplast from a tobacco leaf.



If the actual length of this chloroplast measured along X–Y is 10 μm, what is the magnification of the image?

A ×6.3 **B** ×63 **C** ×630 **D** ×6300

2 Some cell structures are listed.

1 endoplasmic reticulum

2 Golgi body

3 mitochondrion

4 chloroplast

Which cell structures do **not** contain cristae?

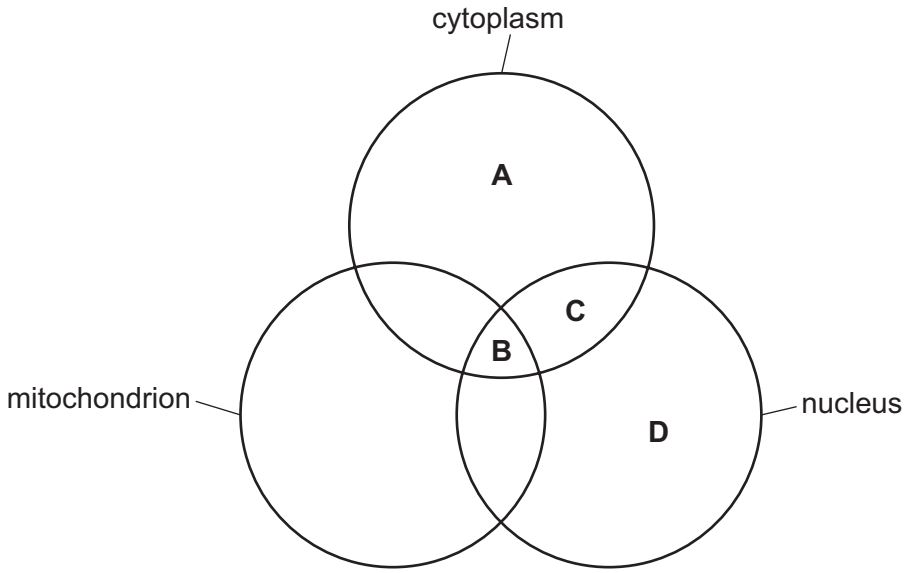
A 1, 2, 3 and 4

B 1, 2 and 4 only

C 1 and 2 only

D 3 and 4 only

3 Which letter represents cell structures where mRNA may be found?



4 Which row is correct for typical prokaryotic cells **and** mitochondria?

	feature	prokaryotic cells	mitochondria
A	70S ribosomes	no	yes
B	circular DNA	yes	no
C	peptidoglycans	yes	no
D	small size, 1–5 μm long	no	no

5 Which statement is correct?

A A virus is composed of a protein coat which surrounds RNA or DNA.

B Suberin and cellulose are found in all plant cell walls.

C Plasmodesmata and centrioles are found in all plant cells.

D Prokaryotic cells contain an endoplasmic reticulum to synthesise proteins.

6 The Benedict's test and ethanol emulsion test were carried out on a sample of biological molecules. The solution became brick-red during the Benedict's test and cloudy during the ethanol emulsion test.

Which molecules did the sample contain?

A reducing sugars and lipids

B proteins and reducing sugars only

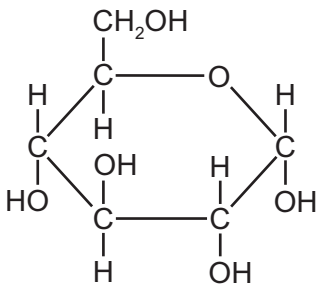
C starch, proteins and reducing sugars

D non-reducing sugars and lipids

[Turn over

7 Which diagram is correct for α-glucose?

A



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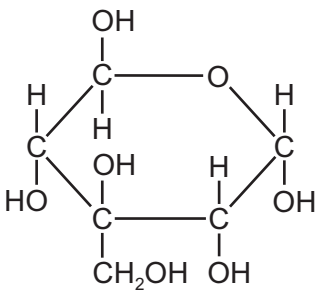

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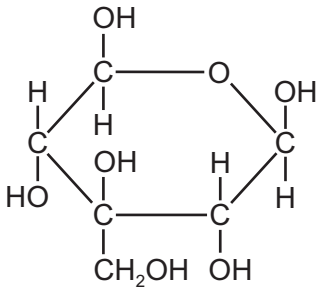
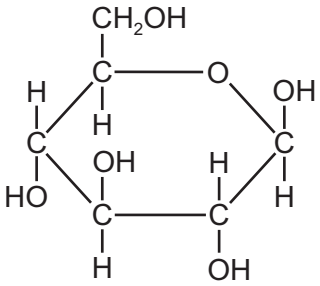


D



8 Which reaction correctly represents one way sucrose can form?

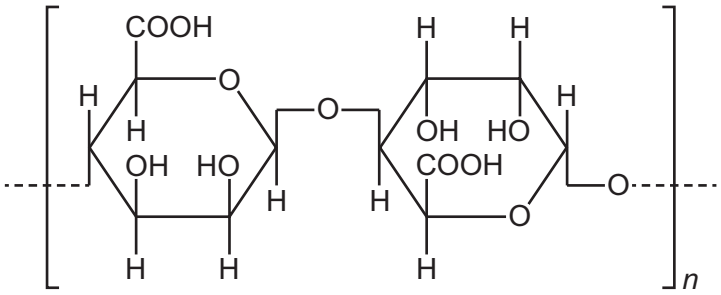
A (α-glucose – OH^-) + (fructose – H^+) → sucrose + H_2O

B (α-glucose + OH^-) + (α-glucose + H^+) → sucrose – H_2O

C (α-glucose – OH^-) + (β-glucose – H^+) → sucrose + H_2O

D (α-glucose + OH^-) + (fructose + H^+) → sucrose – H_2O

9 The diagram represents part of an alginic acid molecule. Alginic acid is a polymer found in the cell walls of brown seaweeds.



Which statement about alginic acid is correct?

A Alginic acid is a linear polysaccharide containing 1,6 glycosidic bonds between each hexose sugar.

B Alginic acid is formed from two monomers joined by 1,4 glycosidic bonds.

C Alternate monosaccharides are arranged in opposite directions; this is also seen in glycogen molecules.

D Hexose sugars and water molecules are joined by condensation reactions to make alginic acid.

10 Which features are correct for triglycerides **and** phospholipids?

1 They have ester bonds between glycerol and fatty acids.

2 Fatty acid chains may have single or double bonds between carbon atoms in the chains.

3 The fatty acid chains are non-polar and hydrophobic.

4 Saturated fatty acid chains allow closer packing of the molecules than unsaturated fatty acid chains.

A 1, 2, 3 and 4

B 1 and 3 only

C 2, 3 and 4 only

D 2 and 4 only

[Turn over

11 A scientist studying the structure of a protein reported that it consists of two polypeptide chains joined by disulfide bonds.

Which feature of protein structure does this describe?

A primary structure

B secondary structure

C tertiary structure

D quaternary structure

12 Some molecules fluoresce when illuminated with ultraviolet light. Changes in the structure or shape of such molecules can change the intensity of the fluorescence.

The enzyme tryptophan synthase fluoresces bluish-green because of a phosphate group associated with the active site. The enzyme catalyses the reaction shown.

$$\text{serine} + \text{indole} \rightarrow \text{tryptophan}$$

Adding serine to the enzyme increases the intensity of the fluorescence, but when indole is also added the bluish-green fluorescence decreases in intensity.

What may be concluded from these observations?

1 Serine and indole attach to the active site of the enzyme.

2 An enzyme–serine complex is formed.

3 An enzyme–serine–indole complex is formed.

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

13 Yeast contains the enzyme catalase which catalyses the breakdown of hydrogen peroxide (H_2O_2) as shown.

$$2H_2O_2 \xrightarrow{\text{catalase}} 2H_2O + O_2$$

Yeast was added to a solution of hydrogen peroxide and the total volume of oxygen released was recorded every 30 seconds for 2 minutes. All other variables were standardised.

The data is shown in the table.

time / s	total volume of O_2 / cm^3
30	157
60	251
90	283
120	285

What explains the pattern of the data?

A The rate of reaction increases as more enzyme–substrate complexes are formed.

B The rate of reaction increases as the enzyme reaches its maximum velocity (V_{max}).

C The volume of oxygen released decreases as the enzymes begin to denature.

D The volume of oxygen released decreases as more substrate is converted into product.

14 The Michaelis–Menten constant, K_m, is a measure of the affinity of an enzyme for its substrate.

1 The higher the affinity, the lower the K_m.

2 The lower the affinity, the slower the reaction will be.

3 At K_m, half the active sites of the enzyme are occupied by the substrate.

Which statements about K_m are correct?

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

15 Which features are correct for active transport **and** facilitated diffusion?

1 The movement of molecules and ions depends on ATP.

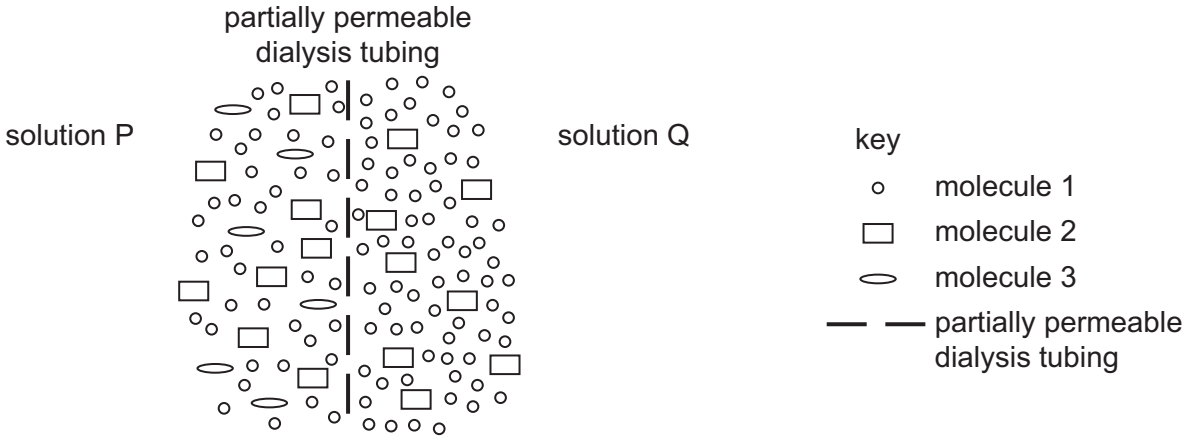
2 They are specific for one type of molecule or ion.

3 They use membrane proteins.

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

[Turn over

16 The diagram represents two solutions, P and Q, that were separated by a partially permeable dialysis tubing.



What will be the initial movement of the molecules, 1, 2 and 3, between solution P and solution Q?

	net movement from Q to P	net movement from P to Q	no net movement
A	molecule 1	molecule 2	molecule 3
B	molecule 1	molecule 3	molecule 2
C	molecule 2	molecule 3	molecule 1
D	molecule 3	molecule 1	molecule 2

17 A student weighed a cylinder of potato and then put it into a test-tube containing a salt solution.

The potato cylinder was removed from the salt solution after one hour. It was blotted dry and then reweighed. The student recorded that the potato had lost mass.

Which row shows the correct explanation for the results the student collected?

	water potential of the potato cells before soaking compared to the water potential after soaking	condition of the potato cells after soaking
A	higher	plasmolysed
B	higher	turgid
C	lower	plasmolysed
D	lower	turgid

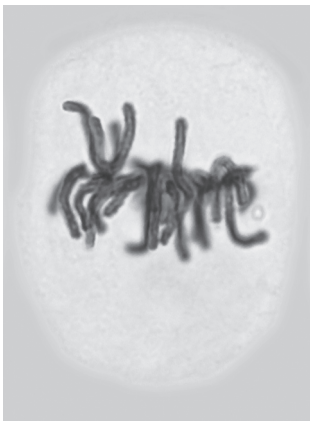
18 Which row shows the correct number of each component in a single chromosome at the start of telophase of mitosis?

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

19 The photomicrographs show cells in various stages of the cell cycle.

In which stage does semi-conservative replication of DNA take place?

A



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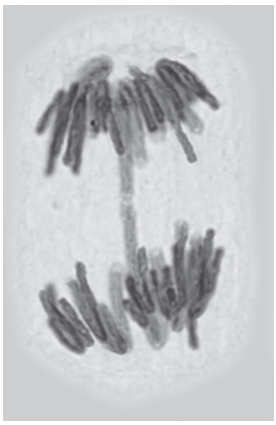

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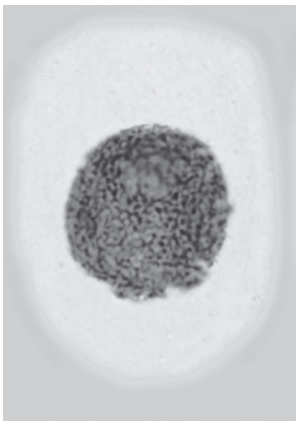

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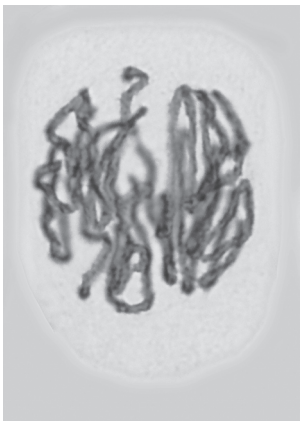
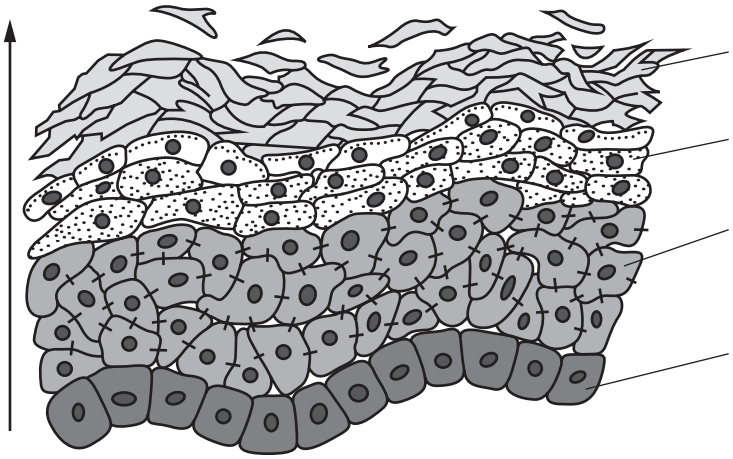


20 The diagram shows the epidermis of human skin. This is formed of four layers of cells.

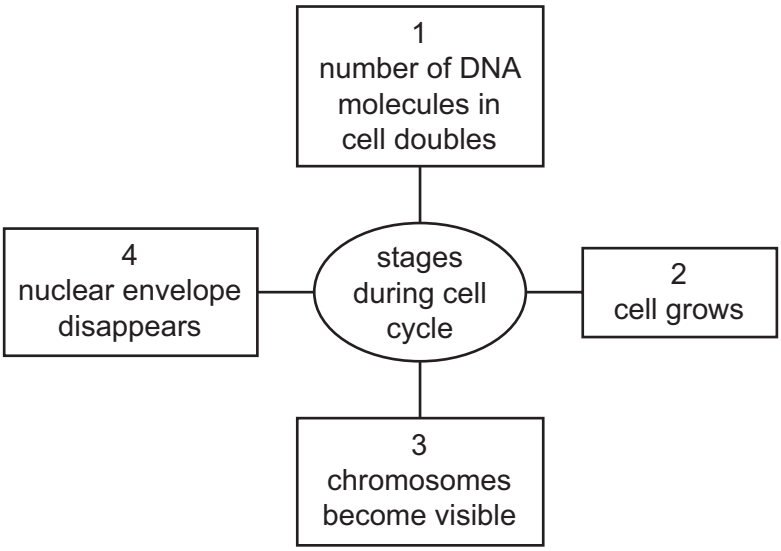
Cells in each layer have specific functions which are outlined on the diagram. As the cells are produced, they move upwards as shown by the arrow.



Which row shows cells that are acting as stem cells in the skin epidermis and an organelle needed by the keratinocytes?

	cells that are acting as stem cells	organelle needed by the keratinocytes
A	basal cells only	centrioles
B	basal cells only	Golgi body
C	basal cells and keratinocytes	centrioles
D	basal cells and keratinocytes	Golgi body

21 The diagram shows some of the stages that take place during the cell cycle.



Which two stages take place during interphase?

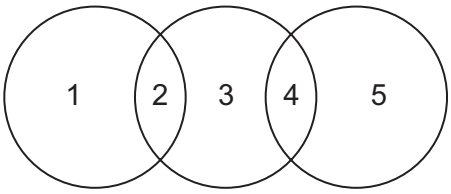
A 1 and 2 **B** 1 and 3 **C** 2 and 4 **D** 3 and 4

22 What does a nucleotide contain?

1 an amino acid
2 a codon
3 a nitrogenous base
4 a sugar

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

23 A diagram can be used to show some relationships between different nucleic acid bases.



Which row is correct for the words that can be placed at positions 1–5?

	1	2	3	4	5
A	adenine	purine	cytosine	pairs with	guanine
B	cytosine	purine	guanine	pairs with	uracil
C	guanine	pairs with	cytosine	pyrimidine	thymine
D	thymine	pairs with	uracil	pyrimidine	adenine

24 The bacterium *Escherichia coli* divides once every 50 minutes at 36 °C.

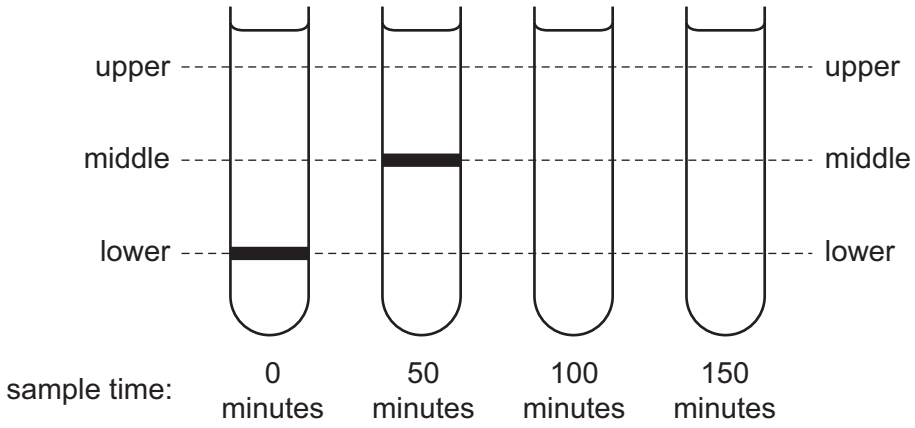
E. coli were grown on a medium containing only heavy nitrogen, ^{15}N, until all of the bacterial DNA contained heavy nitrogen.

Some of the bacteria were moved from a heavy nitrogen medium and cultured in a medium with only light nitrogen, ^{14}N (0 minutes).

These bacteria continued to reproduce and samples were extracted and centrifuged at regular intervals.

Hybrid DNA contains both heavy and light nitrogen.

The diagram shows the possible positions (upper, middle and lower) of the bands of DNA. The actual positions of bands in the first two samples are shown.



Which proportion of the DNA of the sample taken at 150 minutes will be at the upper position?

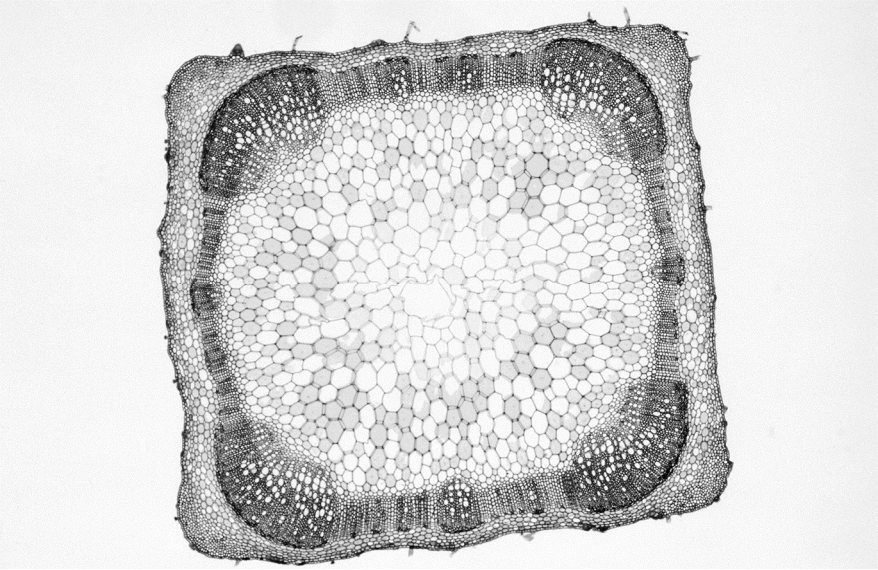
A 25% **B** 50% **C** 75% **D** 100%

25 Following translation, the alpha polypeptide chain of haemoglobin, α-globin, undergoes modification. During this modification, the first amino acid is removed, leaving 141 amino acid residues.

How many nucleotides does the mRNA coding for α-globin contain?

A 141 **B** 142 **C** 423 **D** 426

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 extensions (trichomes).

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

27 The statements describe some of the properties of water.

1 requires a lot of heat energy to evaporate

2 retains a lot of heat energy

3 is able to form hydrogen bonds with other water molecules

4 is able to form hydrogen bonds with other polar and non-polar molecules

Which properties are **also** important for transport in xylem?

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

[Turn over

28 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

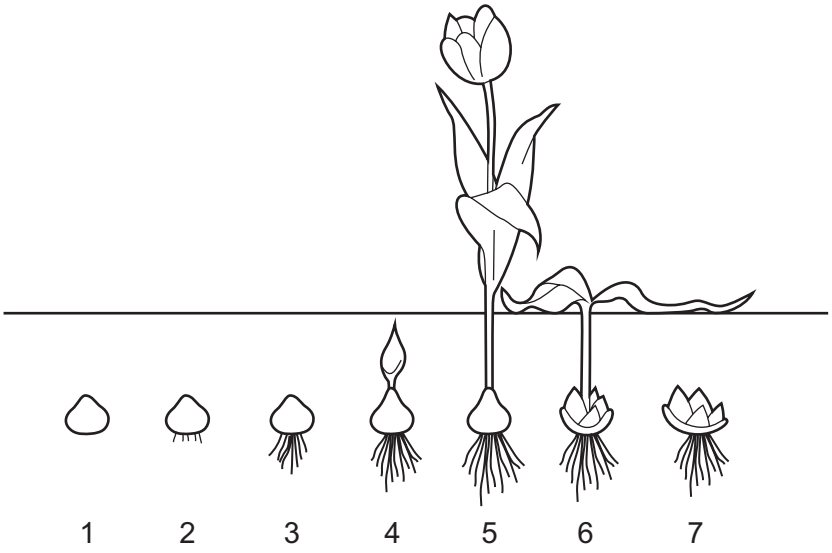
A 1, 2, 3, 4 and 5

B 1, 2 and 3 only

C 1, 3 and 4 only

D 2 and 5 only

29 The diagram shows seven stages of a tulip bulb's growth.



Which row identifies the correct stages in which the tulip bulb is acting as a source only or as a sink only?

	source only	sink only
A	1	5
B	3	4
C	4	6
D	5	7

30 What would be changed if mitochondrial activity was inhibited by a metabolic poison acting on cells in the phloem tissue?

1 concentration of hydrogen ions in the cell wall of companion cells

2 concentration of sucrose in the cytoplasm of cells in a leaf

3 hydrostatic pressure gradient in the phloem sieve tube

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

31 By which process does sucrose move through phloem sieve tube elements?

A active transport

B diffusion

C facilitated diffusion

D mass flow

32 Which blood vessels carry blood into the atria?

1 coronary artery

2 vena cava

3 pulmonary artery

4 pulmonary vein

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

33 Which statements about the cardiac cycle are correct?

1 The atrioventricular valves close during atrial systole.

2 The left and right ventricles contract together.

3 There is a time delay as the electrical impulse passes from the atrioventricular node to the sinoatrial node.

4 Electrical impulses pass along the Purkyne tissue to the ventricles.

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

[Turn over

34 At one point in the cardiac cycle, the pressure in the right ventricle is lower than that in the right atrium and lower than that in the pulmonary artery.

Which row is correct?

	atrioventricular valve	semilunar valve
A	closed	closed
B	closed	open
C	open	closed
D	open	open

35 Which statements about the formation of haemoglobinic acid are correct?

1 It is linked to the action of carbonic anhydrase.

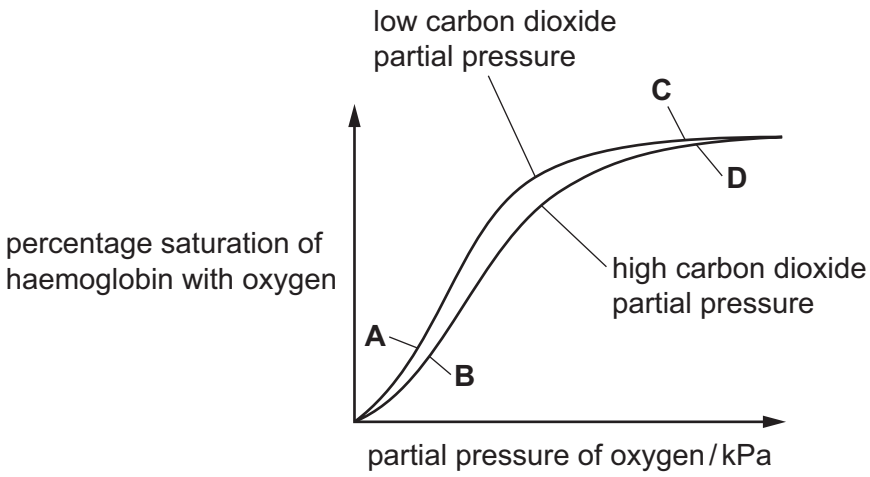
2 It prevents blood from becoming too acidic by removing excess hydrogen ions.

3 It can only occur when oxygen associates with haemoglobin.

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

36 The graph shows the dissociation curves for haemoglobin at two different partial pressures of carbon dioxide.

At which position on the graph would most chloride ions be found in the red blood cells?



37 Oedema is caused by the accumulation of tissue fluid around body cells.

What would increase the amount of tissue fluid around body cells?

A lower blood pressure than normal

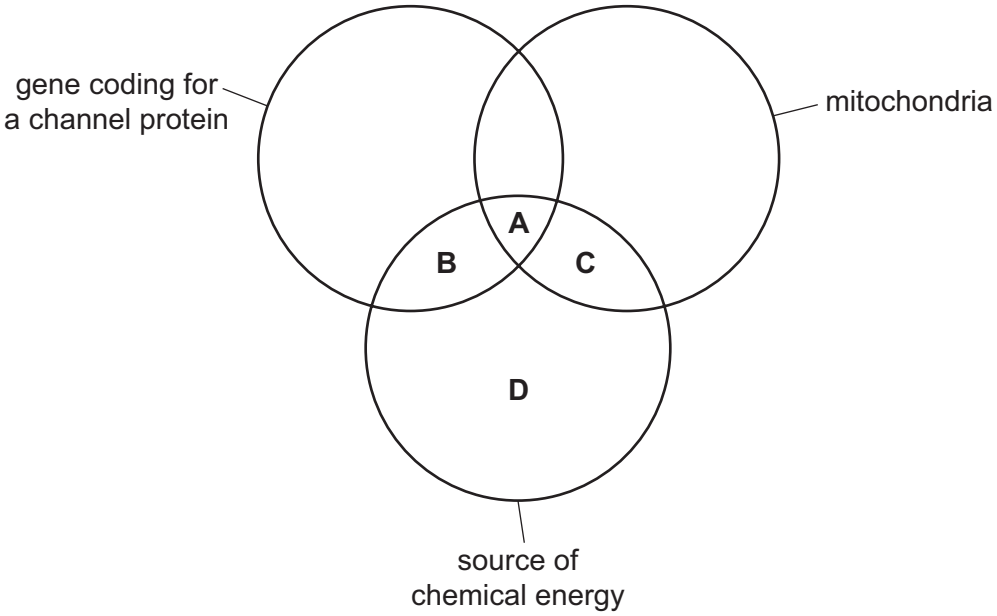
B lower blood plasma protein concentration than normal

C higher blood plasma protein concentration than normal

D lower tissue fluid protein concentration than normal

38 Certain bacteria develop resistance to an antibiotic by actively transporting the antibiotic out of the cell. This prevents the antibiotic building up to toxic concentrations.

What must be found in a bacterial cell to allow it to develop this form of antibiotic resistance?



39 Which statements explain the differences between a primary and a secondary response to exposure to the same antigen?

1 The primary response is slow, because there are only a few B-lymphocytes that are specific to the antigen.

2 The secondary response is faster, because there are many memory cells specific to the antigen.

3 More antibodies are produced during the secondary response, because many of the memory cells differentiate into plasma cells specific to the antigen.

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

40 Which statement about B-lymphocytes **and** T-lymphocytes is correct?

A They become active only when a specific antibody binds to their surface receptor.

B They divide to form clones when meeting an antitoxin in a cell.

C They produce memory cells to respond to an antigen when exposed in the future.

D They release hormone-like cytokines which stimulate release of antibodies.

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