Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/12**

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

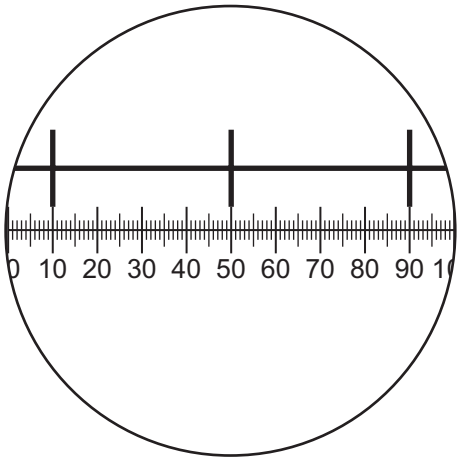
- There are **forty** questions on this paper. Answer **all** questions.
- For each question there are four possible answers **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in soft pencil on the multiple choice answer sheet.
- Follow the instructions on the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

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1 The diagram shows a stage micrometer, with divisions 0.10 mm apart, viewed through an eyepiece containing a graticule.



The area of the field of view of the microscope can be calculated using this formula.

$$\text{area} = \pi r^2$$

A student calculated the area of the field of view of the microscope using the information provided and a value for π of 3.142.

Which answer has been rounded correctly to an appropriate number of significant figures?

A $0.04909\,\text{mm}^2$

B $5 \times 10^{-2}\,\text{mm}^2$

C $4.909 \times 10^{4}\,\mu\text{m}^2$

D $4.91 \times 10^{4}\,\mu\text{m}^2$

2 Where are cisternae found in a cell?

1 endoplasmic reticulum

2 Golgi body

3 mitochondria

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

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3 Which row matches the functions to the cell structures?

	vacuole	nucleolus	ribosomes	lysosomes
A	stores water, sugar and pigment	manufactures messenger RNA	protein synthesis	involved in cell recognition
B	exports proteins	manufactures ribosomal RNA	lipid synthesis	involved in cell recognition
C	stores water, sugar and pigment	manufactures ribosomal RNA	protein synthesis	contains enzymes
D	exports proteins	manufactures messenger RNA	lipid synthesis	contains enzymes

4 Which structures are found in prokaryotes **and** eukaryotes?

A cell membrane and nucleus

B cell membrane and ribosomes

C nucleus and mitochondria

D mitochondria and ribosomes

5 Which molecules are present in all viruses?

1 thymine

2 adenine

3 cytosine

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

6 The table shows the observations recorded from tests for biological molecules on four samples, **A**, **B**, **C** and **D**.

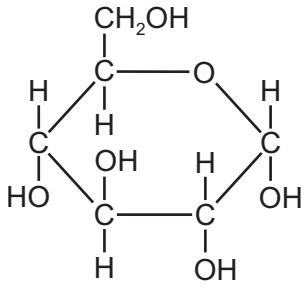
Which conclusion is correct?

	Benedict's solution	biuret reagent	iodine solution	conclusion
A	blue	blue	blue-black	contains starch only
B	blue	purple	orange	contains reducing sugar only
C	green	blue	orange	contains reducing sugar and protein
D	red	blue	blue-black	contains starch and protein

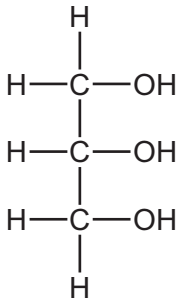
7 The diagrams show some biological molecules.

Which biological molecule forms a polymer with a structural role in plants?

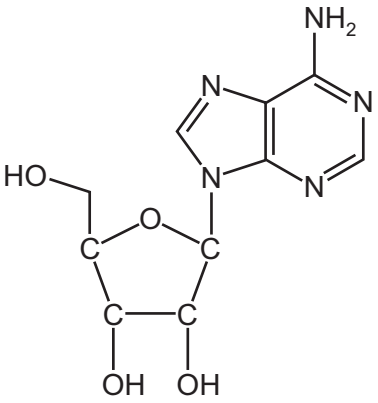
A



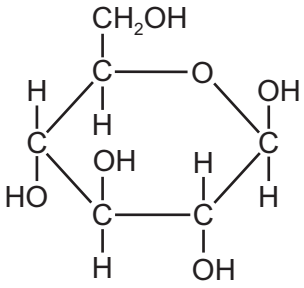
B



C



D



8 Which molecule is a disaccharide **and** a reducing sugar?

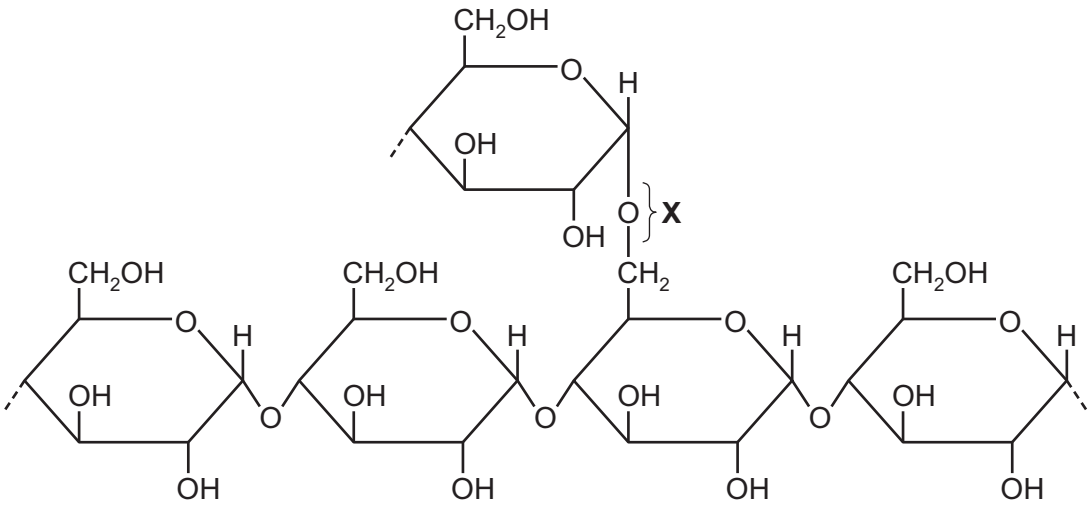
A fructose

B glucose

C maltose

D sucrose

9 The diagram shows bonding in part of a polysaccharide.



Which type of glycosidic bond is shown at position **X**?

A α-1,4 **B** α-1,6 **C** β-1,4 **D** β-1,6

10 Which statements about triglycerides **and** phospholipids are correct?

1 Fatty acids in a triglyceride may be saturated or unsaturated but in a phospholipid they are always saturated.

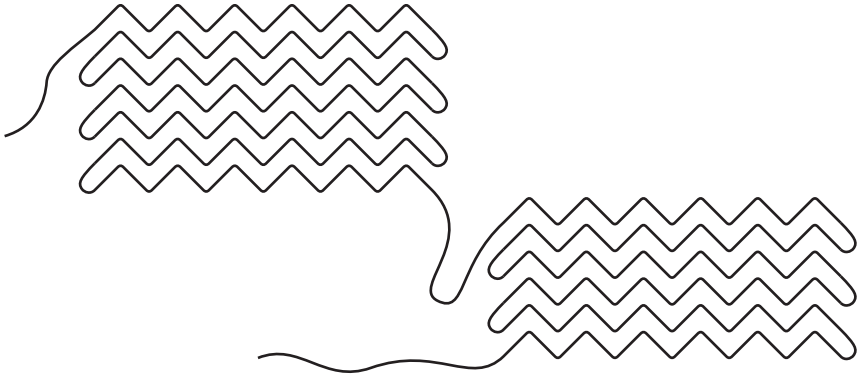
2 Triglycerides and phospholipids both have a hydrophobic region.

3 Triglycerides are non-polar molecules and phospholipids are polar molecules.

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

11 Silk moth caterpillars have been genetically modified to produce a mixture of their own silk and the much stronger spider silk of the golden orb web spider.

The spider silk polypeptide chain has many repeated sequences of two amino acids, glycine and alanine, arranged in a crystalline structure.



What correctly describes the structure of spider silk?

A primary protein structure with regions of α-helices

B secondary protein structure with regions of β-pleated sheets

C tertiary protein structure with regions of α-helices

D quaternary protein structure with regions of β-pleated sheets

12 Which property of the tertiary structure of a globular protein enables it to catalyse a metabolic reaction?

A It has hydrophobic amino acid R groups on the outside.

B It will be denatured by high temperatures.

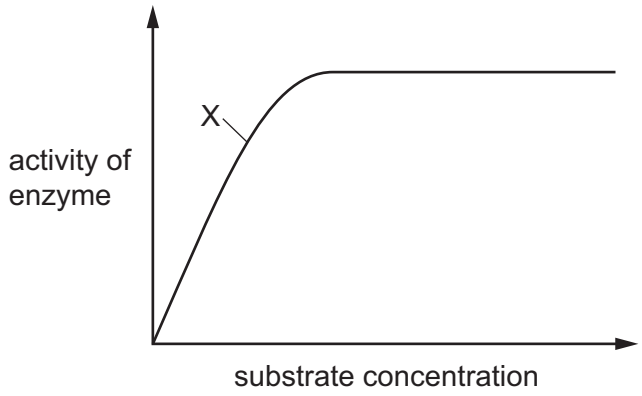
C The R groups of some amino acids form bonds with a substrate.

D The three-dimensional shape depends on hydrogen bonding.

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13 A student investigated the effect of substrate concentration on the activity of an enzyme.

The graph shows the results of this investigation.



An increase in which factors could lead to a change in the activity of the enzyme at point X on the graph?

1 pH

2 substrate concentration

3 temperature

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

14 The Michaelis–Menten constant, K_m, is the substrate concentration at which an enzyme works at half its maximum rate.

What is correct when the K_m value is low?

A The enzyme has a low affinity for the substrate and the quicker the reaction will proceed to its maximum rate.

B The enzyme has a low affinity for the substrate and the slower the reaction will proceed to its maximum rate.

C The enzyme has a high affinity for the substrate and the quicker the reaction will proceed to its maximum rate.

D The enzyme has a high affinity for the substrate and the slower the reaction will proceed to its maximum rate.

15 Which functions are performed by glycoproteins on the surface of a cell surface membrane?

1 to act as enzymes catalysing reactions in the membrane

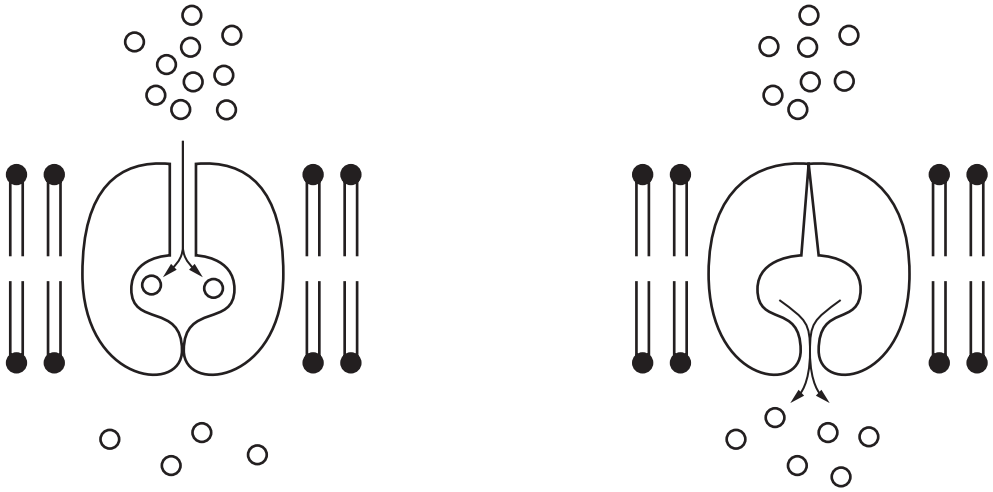
2 to have a specific site where chemicals can bind

3 to secrete specific chemicals used for cell signalling

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

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16 The diagram represents a process by which molecules move out of a cell through a cell surface membrane.



Which process does this represent?

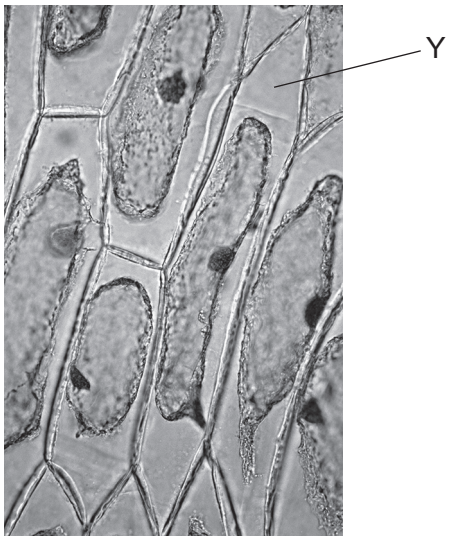
A exocytosis

B diffusion

C facilitated diffusion

D osmosis

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



What fills the space labelled Y?

A air

B cytoplasm

C solution X

D water

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

Which cells need to transcribe telomerase enzyme?

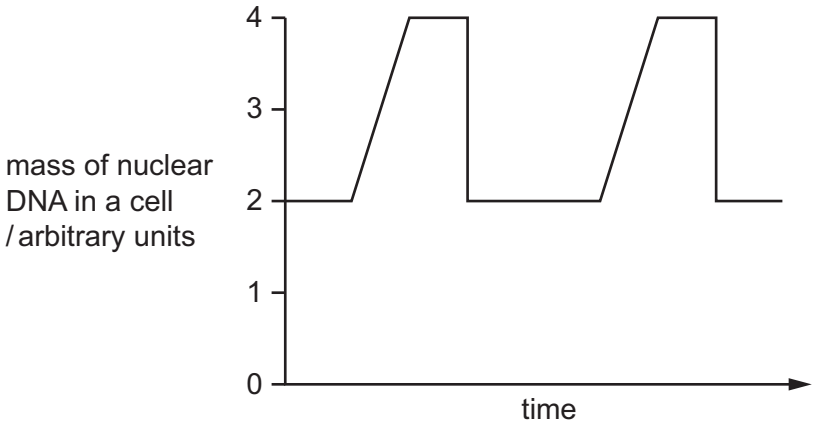
1 cancer cells

2 stem cells

3 activated memory B-lymphocytes

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

19 Which processes that occur in the cell cycle are represented in the diagram?



A DNA replication and nuclear division only

B DNA replication, nuclear division and cytokinesis

C mitosis and cytokinesis

D mitosis only

20 A gene codes for the production of a protein, p53, that binds to damaged DNA during interphase and prevents its replication. A carcinogen in cigarette smoke mutates the gene coding for the p53 protein, preventing production of the protein.

Which statement explains why this mutation may cause cancer?

A Cells with no p53 are able to undergo mitosis.

B Cells with no p53 replicate their damaged DNA.

C The carcinogen in cigarette smoke increases the rate of cell division.

D The mutated p53 causes uncontrolled cell division.

21 Stained onion cells undergoing mitosis were observed using a microscope.

Which row is correct for mitosis in plant cells?

	prophase	metaphase	anaphase	telophase
A	centrioles visible	chromosomes pair up at the equator	two telomeres are visible on each chromatid	two nuclear membranes form
B	centromeres present	chromosomes align at the equator	chromosomes replicate to form chromatids	centrioles disappear
C	each chromosome is visible as two chromatids	centromeres attach to spindle fibres	chromatids separate and migrate to opposite poles	chromosomes decondense
D	spindle fibres formed by centrioles	centromeres attach to spindle fibres	chromatids are pulled apart by centrioles	spindle fibres form new nuclear membranes

22 How many statements about semi-conservative replication of DNA in a eukaryotic cell are correct?

1 The process takes place in the cytoplasm.

2 An adenine nucleotide will line up against uracil on the template strand.

3 Each daughter molecule will contain half of the original DNA molecule.

4 If the DNA molecule contained 40% guanine nucleotides, each daughter molecule will contain 20% guanine nucleotides.

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

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23 A section of the polypeptide coding for the haemoglobin β-chain contains the following amino acids.

– Pro – Glu – Glu –

Patients with sickle cell anaemia have mutated β-polypeptide chains. The section of the mutated polypeptide contains the following amino acids.

– Pro – Val – Glu –

The table shows the possible anticodons for Val.

amino acid	anticodon
Val	C A A
Val	C A G
Val	C A C
Val	C A U

What is the corresponding DNA triplet code for the substituted amino acid in the mutated polypeptide?

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

24 Which diagram correctly represents temporary hydrogen bonding during transcription?

A

A ------ U

B

C ------ G

C

G ------ C

D

T ------ U

25 The diagram shows part of the DNA sequence of a gene and a mutated sequence of the same gene.

normal DNA sequence ...CCG GAT TAT TGC GAG AAA TGG CAT TCT AGG...

mutated DNA sequence ...CCG GAT GTA TTG CGA GAA ATG CAT TCT AGG...

What are possible effects of the mutated sequence?

1 the presence of mRNA stop codons, UAG, UAA or UGA

2 a change in the sequence of amino acids

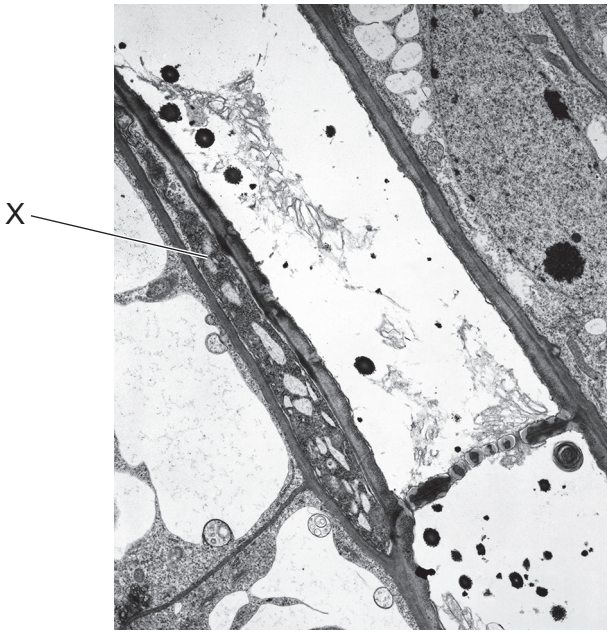
3 a non-functional protein

4 ribosomes cannot translate the mRNA

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

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26 The electron micrograph shows a longitudinal section through part of a plant stem.



What is X?

A xylem vessel element

B stem cell

C phloem sieve tube element

D companion cell

27 Sodium chloride is added to a culture solution containing freshwater single-celled plant cells.

What happens to the water potential of the culture solution when the sodium chloride is added and what may happen to the plant cells after 5 minutes?

	water potential of the culture solution when sodium chloride added	single-celled plant cells after 5 minutes
A	becomes less negative	become plasmolysed
B	becomes less negative	become turgid
C	becomes more negative	become plasmolysed
D	becomes more negative	become turgid

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28 Which statements correctly describe transport pathways in dicotyledonous plants?

1 In the apoplast pathway, water may move through plasmodesmata.

2 In the symplast pathway, water may move through intercellular spaces.

3 The apoplast pathway may be blocked by the Casparian strip.

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

29 Which statement about the movement of water from roots to leaves is **not** correct?

A A continuous column of water is partly maintained by the attraction of water molecules to cellulose.

B Hydrogen bonding between water molecules enables mass flow of water.

C Hydrostatic pressure in xylem vessel elements is higher in roots than in leaves.

D Water potential changes throughout the length of the xylem vessel elements.

30 Which terms describe the method by which water is transported within xylem vessel elements?

1 cotransport

2 cohesion-tension

3 osmosis

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

31 What is the main function of a companion cell in phloem tissue?

A providing cytoplasmic contact with the sieve tube element for loading

B providing structural support for the sieve tube element

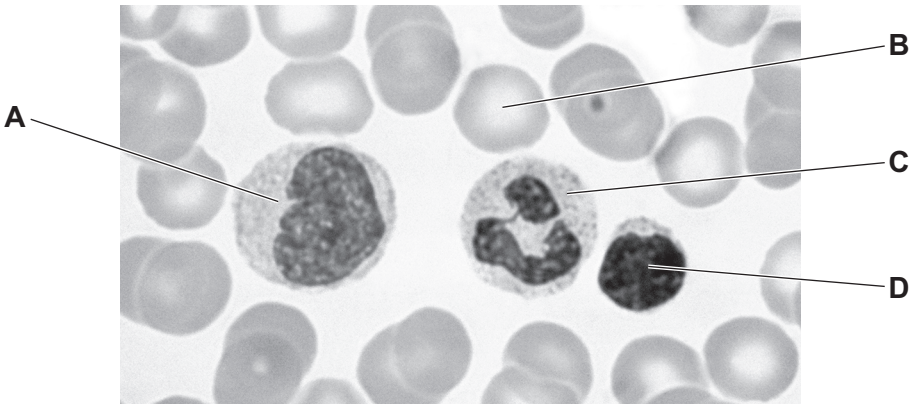
C providing the nucleus for cell division in the phloem

D providing the source of assimilates for storage

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32 The photomicrograph shows a blood smear.

Which cell is a monocyte?



33 The table shows some information about three blood vessels, P, Q and R, from a mammal.

	diameter / mm	wall thickness / mm	percentage composition of wall		
			muscle	collagen	elastic tissue
P	25	2	22	33	40
Q	20	1	25	40	25
R	4	1	35	25	30

Which row identifies blood vessels P, Q and R?

	P	Q	R
A	artery	vein	artery
B	artery	vein	capillary
C	vein	artery	capillary
D	vein	artery	vein

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

What could happen in a person with VSD?

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

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

3 Less oxygen will be delivered to the body tissues.

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

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35 Which statement about the structure of the heart is correct?

A The semilunar valves close when the pressure in the ventricles falls lower than the pressure in the arteries.

B A muscle called the septum separates the atria from the ventricles.

C There is a small patch of tissue in the right atrium that acts to delay the electrical impulse.

D Closure of valves in the veins prevents backflow of blood into the ventricles.

36 What can be found in the wall of an alveolus in the lungs of a human?

	cartilage	cilia	elastic fibres
A	✓	✓	✗
B	✗	✗	✓
C	✓	✗	✗
D	✗	✓	✓

key

✓ = present

✗ = not present

37 What are the functions of cilia in the gas exchange system?

1 to move mucus

2 to trap pathogens and dust

3 to increase the surface area

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

key

✓ = a function

✗ = not a function

38 Cholera and tuberculosis are infectious diseases that can spread when people have to live in overcrowded conditions.

Which strategies would help control the spread of cholera **and** tuberculosis?

1 covering food to prevent flies landing on it

2 providing chlorinated drinking water

3 treating severe cases with antibiotics

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

39 Immunity to certain pathogens develops when a person is given a vaccination.

Which effects of vaccination are correct?

1 production of antibodies to protect against future infections

2 results in artificial active immunity

3 stimulation of appropriate lymphocytes

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

40 A student wrote three statements about antibodies.

1 Their structure depends on peptide, hydrogen and disulfide bonds.

2 They are protein molecules with both tertiary and quaternary structure.

3 Four polypeptides provide four antigen binding sites.

Which statements are correct?

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

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