Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/13**

Paper 1 Multiple Choice **May/June 2017**

1 hour

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

9519836939

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 **18** printed pages and **2** blank pages.

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CAMBRIDGE International Examinations

1 Where are cisternae found in a cell?

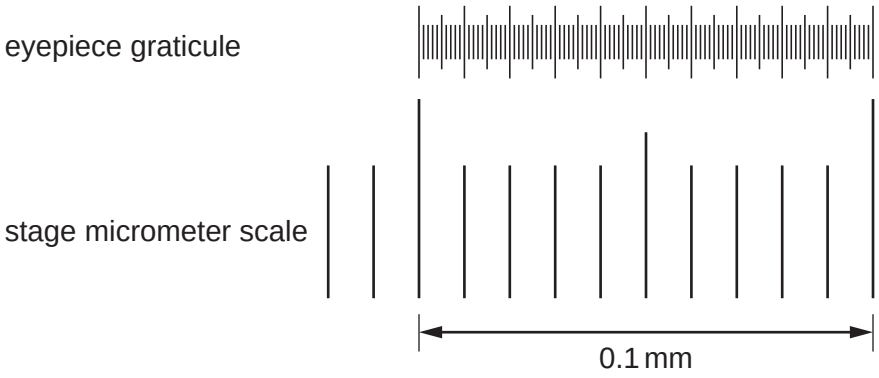
1 endoplasmic reticulum

2 Golgi body

3 mitochondrion

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

2 The diagram shows an eyepiece graticule and part of a stage micrometer scale as seen using ×100 magnification.



How is the value, in µm, of one eyepiece graticule unit calculated?

A divide 100 by 0.1 and multiply by 1000

B divide 100 by 0.1 and multiply by 1000 divided by 100

C multiply 0.1 by 1000 and divide by 100

D multiply 0.1 by 1000 and divide by 100 then divide again by 100

3 It is possible for a bacterium to synthesise a eukaryotic protein.

This involves introducing a eukaryotic gene into the bacterial DNA, which can be translated.

What explains why a bacterial cell can produce a eukaryotic protein but cannot produce a eukaryotic glycoprotein?

A Bacteria do not have 70S ribosomes.

B Bacteria do not have a nuclear envelope.

C Bacteria do not have Golgi bodies.

D Bacteria do not have mitochondria.

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4 Which structures are found in **both** typical eukaryotic cells **and** typical prokaryotic cells?

1 70S ribosomes

2 80S ribosomes

3 circular DNA

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

5 Steps 1–4 are used to test for a non-reducing sugar.

1 Put 5 cm^3 of solution into a test-tube.

2 Add a few drops of acid.

3 Neutralise with alkali.

4 Add 6 cm^3 Benedict's solution.

When is the solution boiled?

A between steps 1 and 2

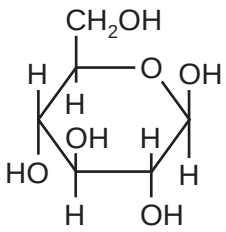
B between steps 2 and 3 and after step 4

C between steps 2 and 3 only

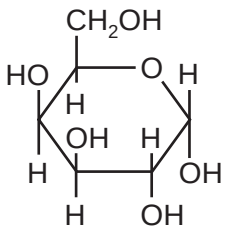
D after step 4 only

6 Which diagram shows the monomer of cellulose?

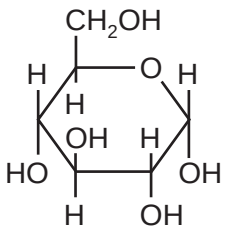
A



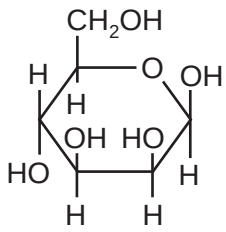
B



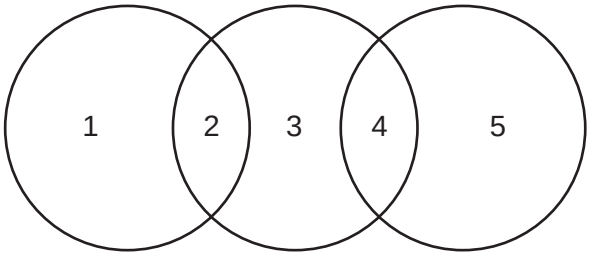
C



D



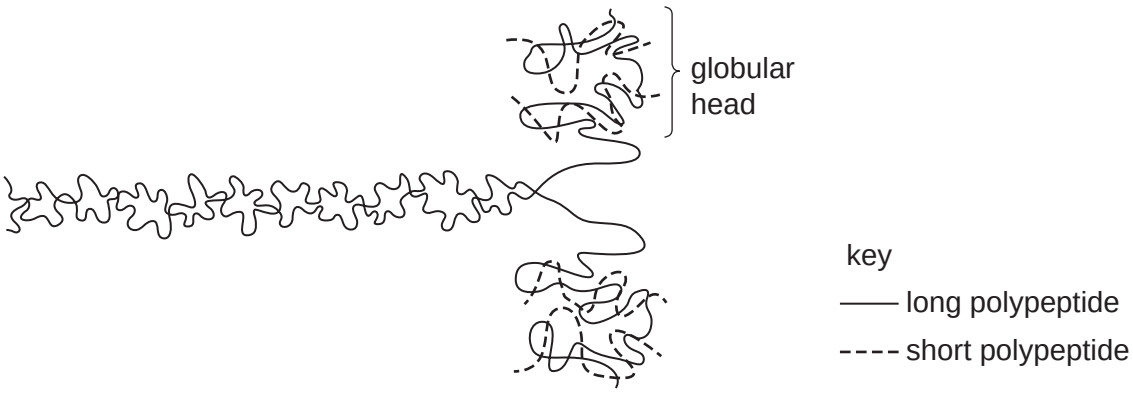
7 The diagram shows some of the relationships between cellulose, collagen and haemoglobin.



Which row is correct?

	1	2	3	4	5
A	cellulose	carbohydrate	collagen	protein	haemoglobin
B	cellulose	fibrous	haemoglobin	structural	collagen
C	haemoglobin	globular	cellulose	carbohydrate	collagen
D	haemoglobin	protein	collagen	structural	cellulose

8 The diagram shows a protein molecule.



Two long polypeptides each form α-helices for much of their length and these twist together into a fibre.

At one end, each of these polypeptides coils into a globular head.

Two short polypeptides bind to each head.

What describes the protein structure of this molecule?

A quaternary structure because each molecule consists of six polypeptides

B secondary structure because the long polypeptides form α-helices

C tertiary structure because the α-helices form a fibre

D tertiary structure because the heads form globular proteins

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9 Which statements about **both** amylose and amylopectin are correct?

1 They are polymers.

2 They are formed by hydrolysis reactions.

3 They are linear molecules.

4 They contain α-1,4 glycosidic bonds.

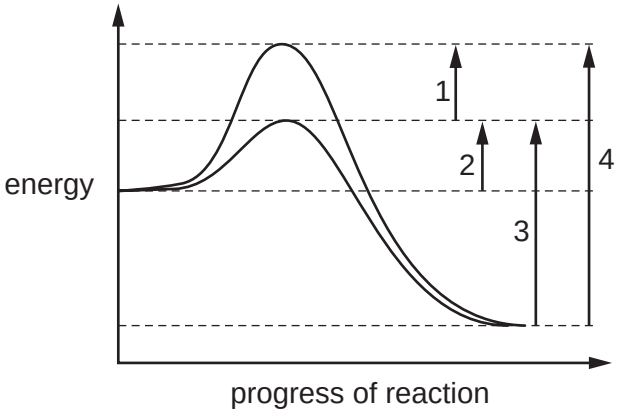
A 1, 2, 3 and 4

B 1, 2 and 4 only

C 1 and 4 only

D 2 and 3 only

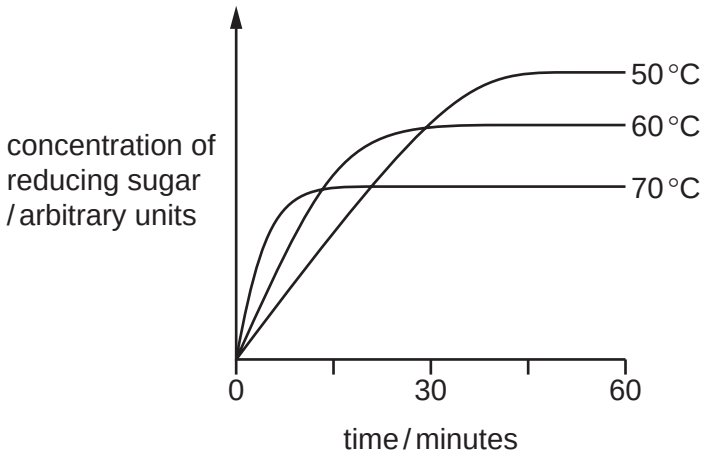
10 The graph shows energy changes in a chemical reaction.



What is the activation energy when an enzyme is added?

A 1 + 2 **B** 2 only **C** 3 – 2 **D** 4

11 The graph shows the results of investigations into the effect of amylase on the hydrolysis of starch at three different temperatures.



In each investigation the concentration and volume of the solutions was kept constant.

Which conclusion may be drawn?

A 50 °C is the optimum temperature of amylase.

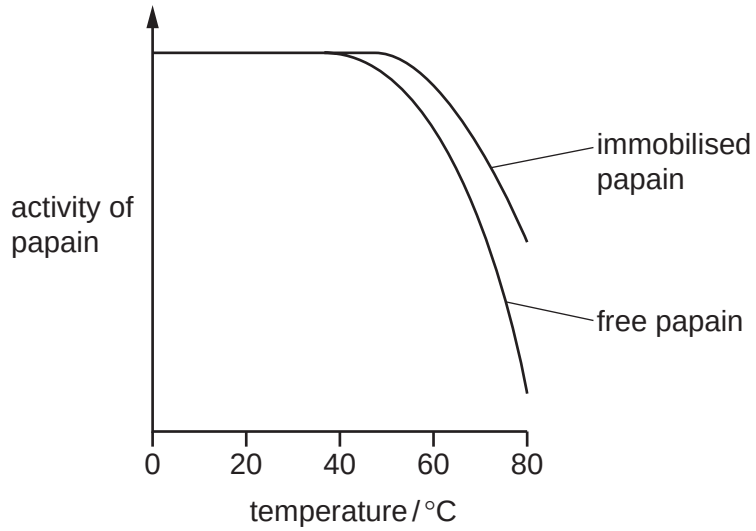
B At 60 °C all the starch is hydrolysed after 30 minutes.

C At 70 °C the amylase is denatured before hydrolysis is complete.

D The rate of hydrolysis of starch is faster at 50 °C than at 70 °C.

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12 The graph compares the effect of temperature on the activity of the protease enzyme, papain, when in solution (free) and when immobilised in alginate beads.



Which statement about the effect of immobilisation of papain is correct?

A It alters the shape of papain's active site at higher temperatures.

B It decreases the activity of papain at higher temperatures.

C It increases the stability of papain at higher temperatures.

D It reduces the number of collisions of papain with the substrate.

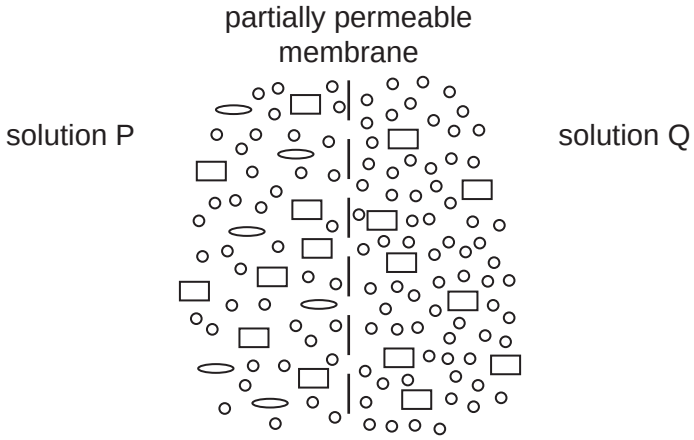
13 Which row is correct for facilitated diffusion of molecules or ions into a cell?

A	ATP required	movement against the concentration gradient	membrane protein required
B	ATP required	movement down the concentration gradient	membrane protein not required
C	ATP not required	movement against the concentration gradient	membrane protein not required
D	ATP not required	movement down the concentration gradient	membrane protein required

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[Turn over

14 The diagram represents an experiment where two solutions, P and Q, were separated by a partially permeable membrane.



What is correct about the initial movement of the molecules ○, □ and ⬭ between the two solutions, P and Q?

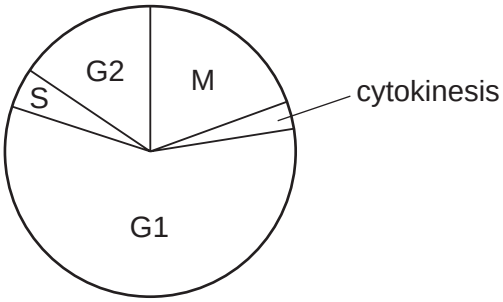
	net movement from Q to P	net movement from P to Q	no net movement
A	○	□	⬭
B	○	⬭	□
C	□	⬭	○
D	⬭	○	□

15 Which functions are correct for components of the cell surface membrane?

	stabilising the hydrophobic layer	allowing osmosis to occur	barrier to dissolved ions
A	cholesterol	phospholipids and proteins	phospholipids
B	glycolipids	phospholipids	proteins
C	phospholipids	proteins	cholesterol
D	proteins	glycoproteins and glycolipids	glycolipids

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16 The diagram shows the cell cycle of a mammalian cell.



Checkpoints in the cell cycle of mammals prevent the cycle from continuing when mistakes are made or DNA is damaged.

Four of the checkpoints are described.

1 Mitosis is blocked if DNA replication is incomplete.

2 Anaphase is blocked if the assembly of chromatids on the spindle is unsuccessful.

3 DNA replication is blocked if DNA is damaged.

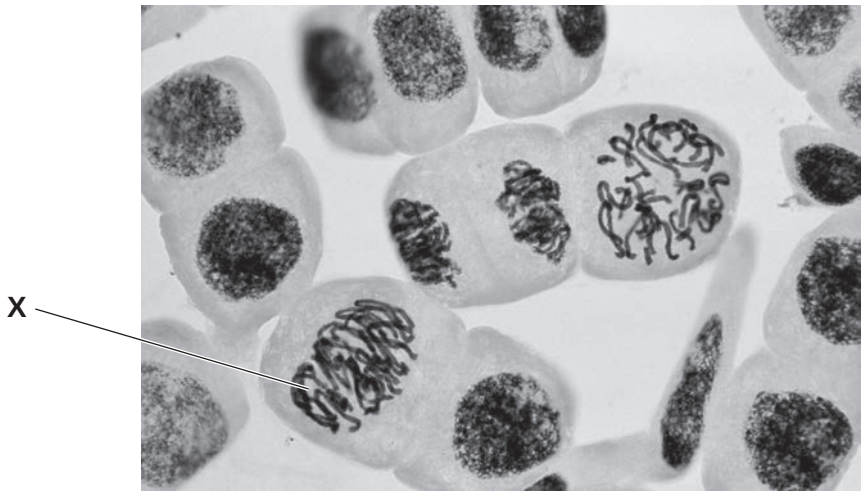
4 DNA replication stops if damage to DNA has not been repaired.

In which phases of the cell cycle do these checkpoints occur?

	checkpoint			
	1	2	3	4
A	M	G1	S	G2
B	G2	M	G1	S
C	G2	S	G1	M
D	S	G2	M	G1

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17 The photomicrograph shows cells undergoing mitosis.



Which statement describes what will happen next in cell **X**?

A Chromatin coils up tightly, and the nuclear envelope breaks down.

B Chromosomes line up along the equator of the cell and attach to the spindle.

C Sister chromatids move towards opposite poles, pulled by the spindle fibres.

D Spindle fibres break down, and the cell prepares for cytokinesis.

18 Which statement about nucleotides is correct?

A Adenine and guanine are pyrimidines.

B ATP is a phosphorylated nucleotide.

C Purines have a single ring structure.

D Uracil replaces cytosine in RNA.

19 Scientists have made a nucleic acid (HNA) that has a sugar with the same number of carbon atoms as glucose instead of deoxyribose. Although genetic information can be stored by HNA, naturally occurring DNA polymerase cannot replicate HNA.

Which statements could explain why naturally occurring DNA polymerase cannot replicate HNA?

1 DNA polymerase cannot form bonds between the sugars of two HNA nucleotides.

2 DNA polymerase cannot form hydrogen bonds between two HNA nucleotides.

3 HNA nucleotides do not fit into the active site of DNA polymerase.

4 The shape of an HNA nucleotide is slightly larger than that of a DNA nucleotide.

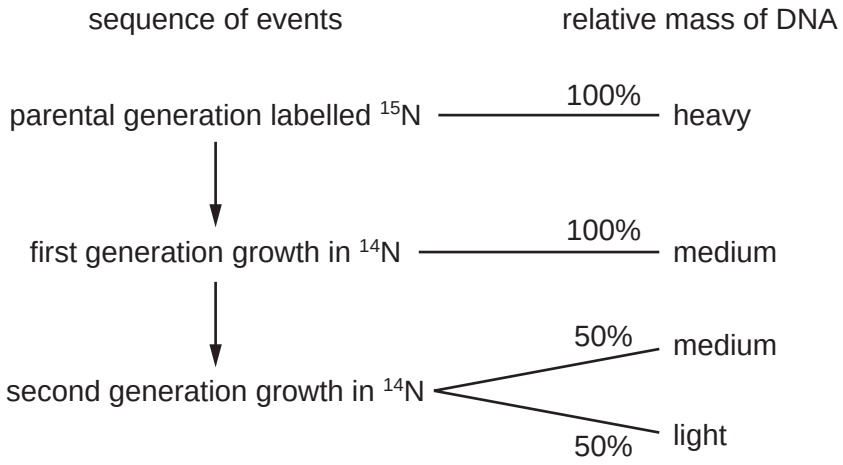
A 1, 2, 3 and 4 **B** 1 and 4 only **C** 2 and 3 only **D** 3 and 4 only

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20 Meselson and Stahl investigated DNA replication by growing bacteria in a culture containing heavy nitrogen, ^{15}N, until all the DNA was labelled.

These bacteria, the parental generation, were then transferred to a culture containing only light nitrogen, ^{14}N, and allowed to replicate for two generations.

DNA was extracted from each generation of bacteria and its relative mass estimated. The flow diagram shows the results.



Which row explains the relative mass of the DNA in the second generation grown in ^{14}N?

	50% medium DNA molecules		50% light DNA molecules	
	strand 1	strand 2	strand 1	strand 2
A	only ^{15}N	only ^{14}N	only ^{14}N	only ^{14}N
B	only ^{15}N	only ^{15}N	only ^{14}N	only ^{14}N
C	only ^{15}N	only ^{15}N	only ^{14}N	only ^{15}N
D	only ^{15}N	half ^{14}N, half ^{15}N	only ^{14}N	half ^{14}N, half ^{15}N

21 Which statement is correct?

A During transcription, mRNA is synthesised from DNA nucleotides to have the same sequence of nucleotides as the DNA strand on which it was made.

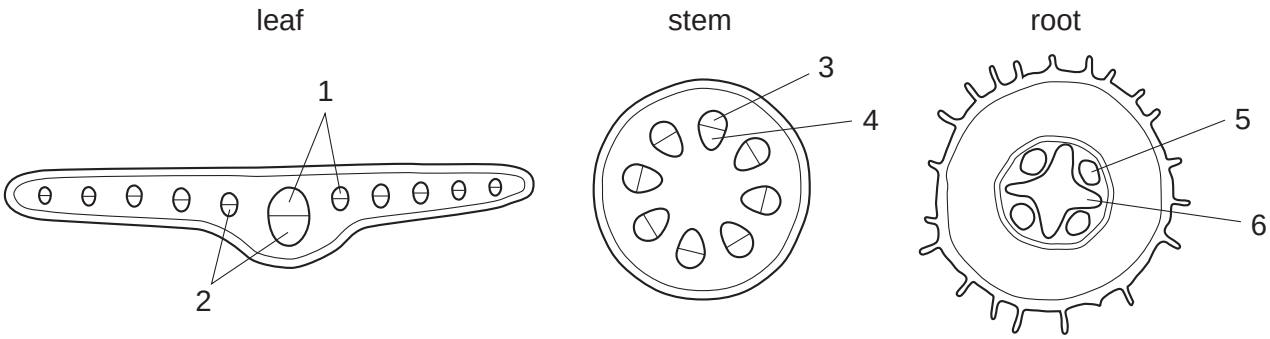
B During transcription, tRNA is synthesised from RNA nucleotides and carries codons that are complementary to the sequence of nucleotides on the DNA strand on which it was made.

C During translation, mRNA is synthesised from RNA nucleotides to have the complementary sequence of nucleotides to that of the DNA strand on which it was made.

D During translation, ribosomes join amino acids in a sequence determined by mRNA with the complementary sequence of nucleotides to that of the DNA strand on which it was made.

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



In the transverse sections, which tissues transport most amino acids?

	1	2	3	4	5	6
A	✓	✗	✓	✗	✗	✓
B	✓	✗	✗	✓	✗	✓
C	✗	✓	✓	✗	✓	✗
D	✗	✓	✗	✓	✓	✗

key

✓ = transports most amino acids

✗ = does not transport most amino acids

23 The statements are descriptions of how water moves across the root to the xylem vessel elements in plants.

1 Water enters the intercellular spaces.

2 Water enters the cytoplasm by osmosis.

3 Water moves from cell to cell through plasmodesmata.

4 Water moves through the cell wall.

Which statements are correct for **both** the apoplast pathway **and** the symplast pathway?

A 1, 2, 3 and 4

B 1, 2 and 3 only

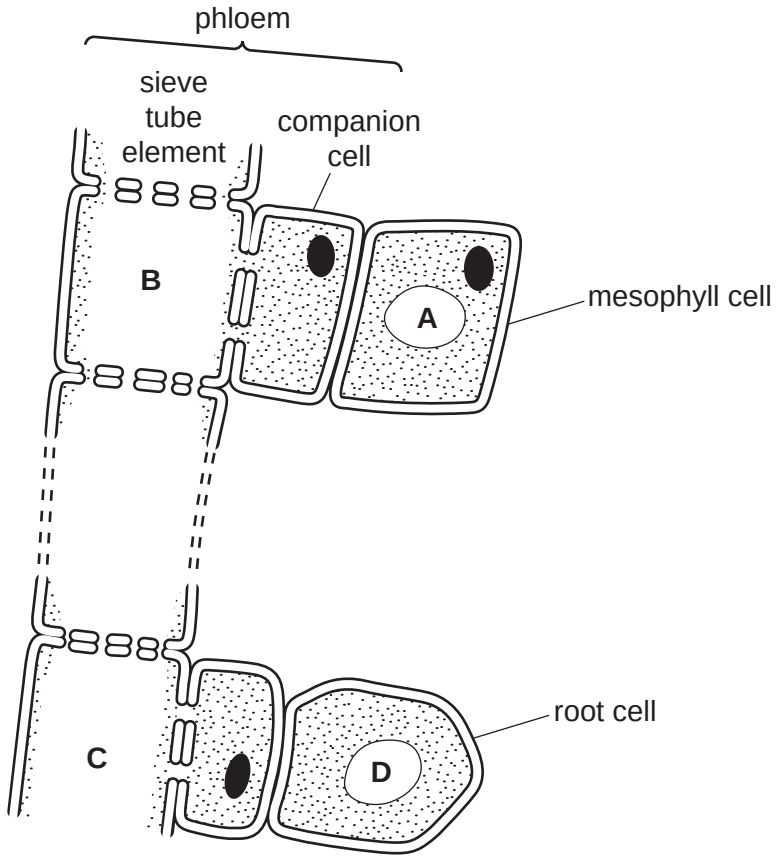
C 2 and 4 only

D 4 only

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24 The diagram shows the tissues involved in the transport of sucrose in a plant.

Where is the highest concentration of sucrose?



25 Which features adapt root hair cells for efficient absorption of water?

1 a large number of mitochondria

2 a large number of protein carriers in the cell surface membrane

3 a large surface area to volume ratio

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

26 Three areas involved in the control of heart action are listed.

1 atrioventricular node

2 Purkyne tissue

3 sinoatrial node

In which order are they involved?

A $1 \rightarrow 2 \rightarrow 3$ **B** $1 \rightarrow 3 \rightarrow 2$ **C** $3 \rightarrow 1 \rightarrow 2$ **D** $3 \rightarrow 2 \rightarrow 1$

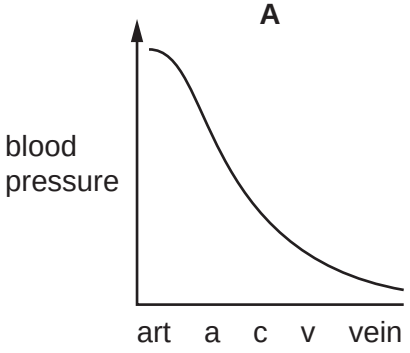
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27 As blood flows from an artery to a vein, the blood pressure in the vessels changes. The four graphs represent data for blood vessels in the sequence shown.

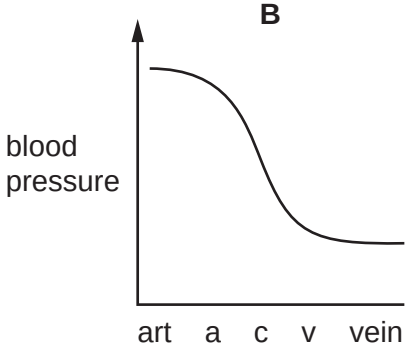
key	artery	arteriole (small artery)	capillaries	venule (small vein)	veins
	art	a	c	v	vein

Which graph shows these changes correctly?

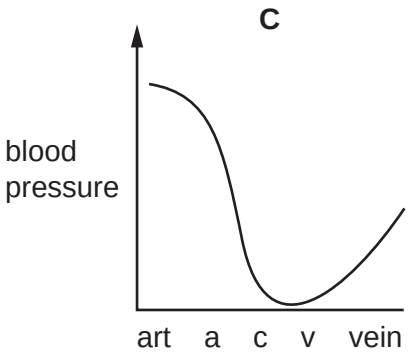
A



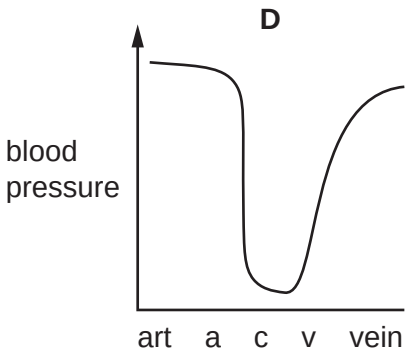
B



C



D



28 How is most carbon dioxide transported in the blood?

A as carbaminohaemoglobin

B as carbonic acid

C as hydrogencarbonate ions

D in solution in cytoplasm

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29 When a doctor or nurse takes a blood sample from a person they use a needle to penetrate a vein, not an artery.

Which reasons explain why veins are used?

1 Arteries carry blood under more pressure than veins.

2 Arteries have a thicker middle layer than veins.

3 Veins carry deoxygenated blood.

4 Veins have a larger lumen than arteries.

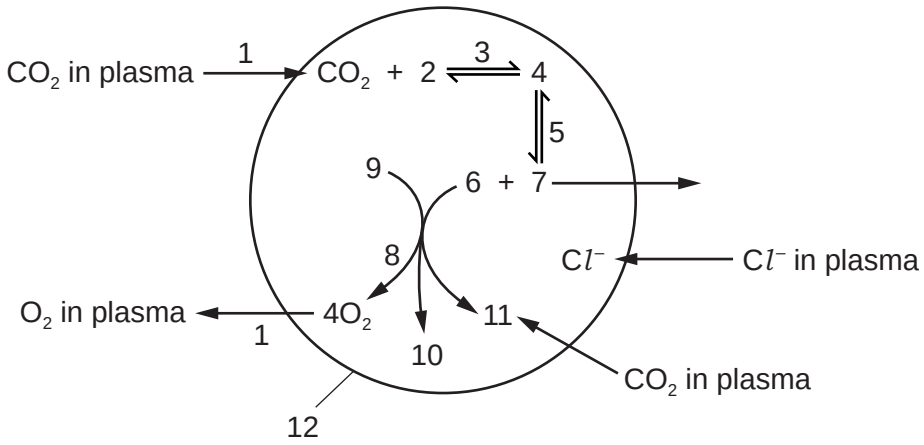
A 1, 2, 3 and 4

B 1, 2 and 3 only

C 1, 2 and 4 only

D 3 and 4 only

30 The diagram is an incomplete summary explaining the role of haemoglobin in the carriage of carbon dioxide.



Which set of labels is correct?

A 1 = facilitated diffusion, 4 = carbonic acid, 7 = hydrogencarbonate ions

B 2 = water, 8 = dissociation, 10 = carbaminohaemoglobin

C 3 = carbonic anhydrase, 9 = oxyhaemoglobin, 11 = carbaminohaemoglobin

D 5 = carbonic anhydrase, 6 = hydrogen ions, 12 = red blood cell

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31 Which description of part of the gas exchange system is correct?

	part of gas exchange system	cartilage	ciliated epithelium	goblet cells	smooth muscle
A	alveolus	✗	✓	✗	✗
B	bronchus	✓	✓	✓	✓
C	bronchiole	✗	✓	✓	✗
D	trachea	✓	✓	✓	✗

key

✓ = present

✗ = absent

32 When a person suffers an asthma attack, the tubes of the gas exchange system narrow and extra mucus is produced.

Which changes occur during an asthma attack?

1 Activity of ciliated epithelium increases.

2 Endocytosis in goblet cells increases.

3 Smooth muscles are more active.

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

33 Which factors result from paralysis of cilia caused by smoking?

1 accumulation of mucus

2 increased chance of lung infection

3 emphysema

4 scarring of airway lining

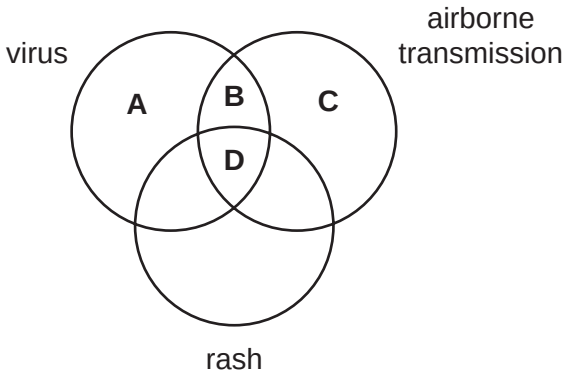
A 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

34 What is the **minimum** number of cell membranes a molecule of carbon dioxide and a molecule of oxygen pass through during gas exchange between alveoli and the plasma in the capillaries?

	carbon dioxide	oxygen
A	2	4
B	3	5
C	4	4
D	4	5

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35 Which is correct for measles?



36 Some antibiotics are used in animal feed to reduce disease.

What explains why these antibiotics should **not** be used in the treatment of human diseases?

A Human cells may stop responding to these antibiotics.

B Humans may be allergic to these antibiotics.

C Pathogenic bacteria may develop resistance to these antibiotics.

D Useful gut bacteria may be killed by these antibiotics.

37 In what order do the following processes occur to produce a population of bacteria that are resistant to a new antibiotic?

1 change in reproductive success of bacteria

2 increase in frequency of the resistance allele in the population

3 increase in genetic variation within the population

4 random mutation occurs in bacterial DNA

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

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

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

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

38 Which type of new vaccine production would be most important in the fight to eradicate measles in **developing** countries?

A a combined vaccine to combat it and other diseases

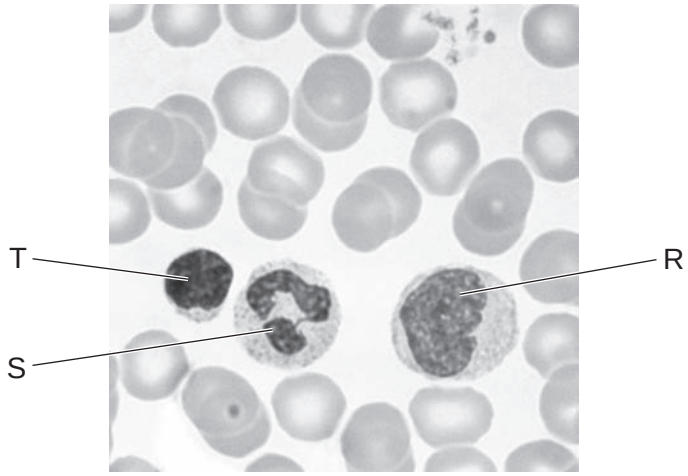
B a single vaccine, without the need for boosters

C a vaccine containing only live measles pathogens

D a vaccine containing monoclonal antibodies

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39 The photomicrograph shows human blood, with three types of white cell labelled.



Which row correctly identifies these white cells?

	cell R	cell S	cell T
A	lymphocyte	lymphocyte	lymphocyte
B	lymphocyte	phagocyte	phagocyte
C	phagocyte	lymphocyte	phagocyte
D	phagocyte	phagocyte	lymphocyte

40 A monoclonal antibody specific for a virus was produced.

This antibody was treated with an enzyme to break the bonds between the variable and constant regions.

The separated variable and constant regions were then added to cells infected with the virus.

Which statements are correct?

1 The constant regions would bind to different parts of the virus antigens.

2 The viruses could be engulfed by phagocytes if they were present.

3 The variable regions would all bind to the same part of the virus antigens.

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

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