Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/13**

Paper 1 Multiple Choice **October/November 2016**

1 hour

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

3184501009

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 **17** printed pages and **3** blank pages.

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1 Which structure is **only** found in typical eukaryotic animal cells?

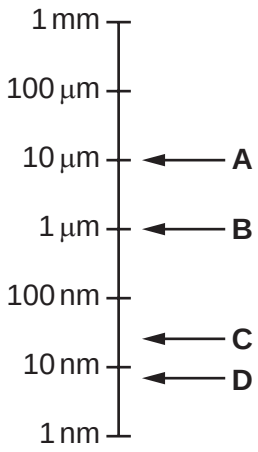
A cell surface membrane

B centriole

C Golgi body

D ribosome

2 Which letter on the logarithmic scale corresponds to the size of a typical prokaryote?



3 Which calculation is used to find the actual length of an organelle from an image?

A image size ÷ magnification

B image size × magnification

C image size × resolution

D magnification ÷ image size

4 Which statement is correct?

A Prokaryotes and chloroplasts have circular DNA where genes carrying the code for cell walls are located.

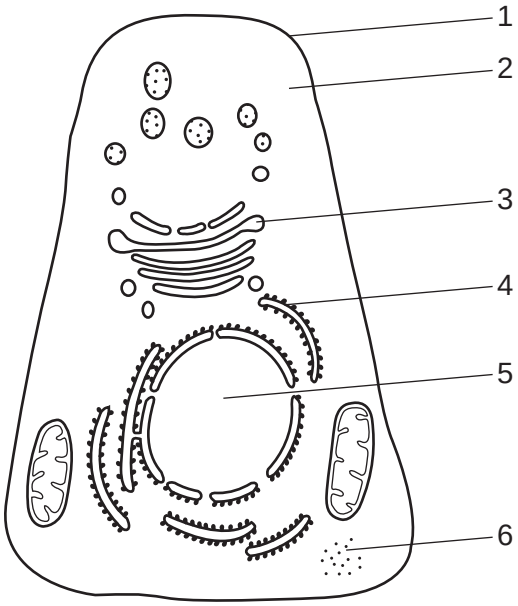
B Prokaryotes and chloroplasts have 70S ribosomes that are the sites for translation and polypeptide synthesis.

C Prokaryotes and mitochondria have an outer membrane and a separate inner, folded membrane where ATP synthesis occurs.

D Prokaryotes and mitochondria have double-stranded linear DNA where genes carrying coded information are located.

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5 The diagram shows a typical animal cell.



Which features are also found in **both** plant cells and prokaryotic cells?

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

key
✓ = present
✗ = absent

6 A student carried out the Benedict's test on four different concentrations of glucose solution and then recorded the time taken for the first appearance of a colour change (the end-point).

The student found it difficult to identify the first appearance of a colour change and consistently timed each solution for two seconds after it had appeared. This introduced a source of error into the experiment.

Which statements about this error are correct?

1 The effect of the error will be reduced if the student performs three repeats at each concentration of glucose.

2 The error will prevent the student from identifying which solution has the highest concentration of glucose.

3 The error is systematic as the student consistently timed each solution for two seconds after the end-point.

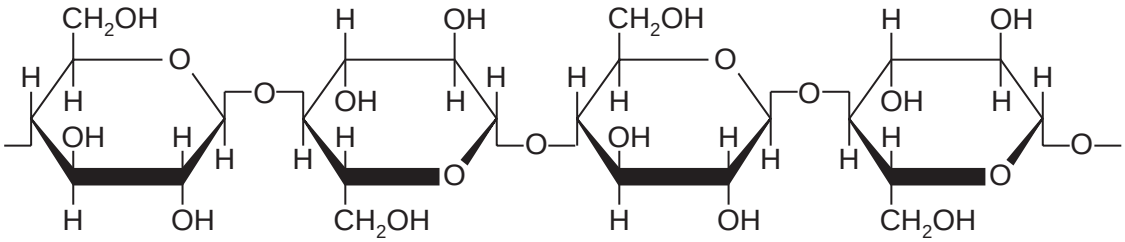
A 1 and 2 **B** 1 and 3 **C** 2 and 3 **D** 3 only

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7 Which row is correct for each of the molecules?

	collagen	haemoglobin	sucrose
A	has a structural function, found in blood vessel walls	contains the elements carbon, hydrogen, iron, nitrogen and sulfur	formed by releasing a molecule of water in a hydrolysis reaction
B	molecules consist of three polypeptide chains, linked by ionic bonds	each non-protein haem group contains a central iron ion	composed of two monosaccharides linked by a glycosidic bond
C	molecules lie parallel to each other, with cross-links and staggered ends	has two identical α chains and two identical β chains	formed by condensation of two identical monosaccharides
D	polypeptide chains interact to produce a fibrous protein	has all four levels of protein structure and at least four types of bond	digestion yields glucose and fructose in equal proportions

8 The diagram shows how the β-glucose units of cellulose are linked to each other.



What is the significance of the fact that the OH groups on carbon 2 in adjacent glucose molecules are on opposite sides of the molecule?

A They can cross-link with other cellulose molecules by both hydrogen and glycosidic bonds.

B They can form glycosidic bonds with adjacent OH groups of other cellulose molecules.

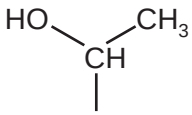
C They can form hydrogen bonds between the CH_2OH and OH on adjacent glucose molecules of the cellulose molecule.

D They can form hydrogen bonds with adjacent OH and CH_2OH groups of other cellulose molecules.

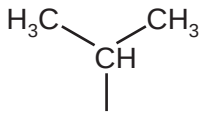
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9 Threonylvaline is a dipeptide formed from the two amino acids, threonine and valine. A peptide bond forms between the carboxyl group of threonine and the amine group of valine.

The side-chains (R groups) of the two amino acids are shown.



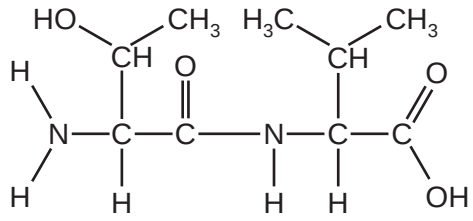
threonine



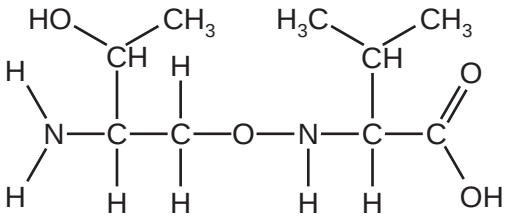
valine

Which molecular structure is threonylvaline?

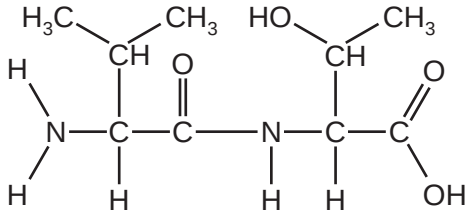
A



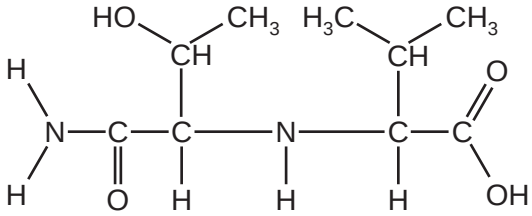
B



C



D



10 Which feature explains why haemoglobin is soluble?

A All four polypeptide chains are linked together to form a spherical molecule.

B Each polypeptide chain folds due to interactions between hydrophobic R groups.

C The hydrophilic R groups are arranged around the outside of the molecule.

D The iron-containing haem group of each polypeptide chain is water soluble.

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11 An investigation into the rate of an enzyme-catalysed reaction was carried out. During the investigation the concentration of the substrate was kept higher than the concentration of the enzyme.

During this investigation, which change in the variables would always lead to an increase in the rate of the reaction?

1 increase in enzyme concentration

2 increase in pH

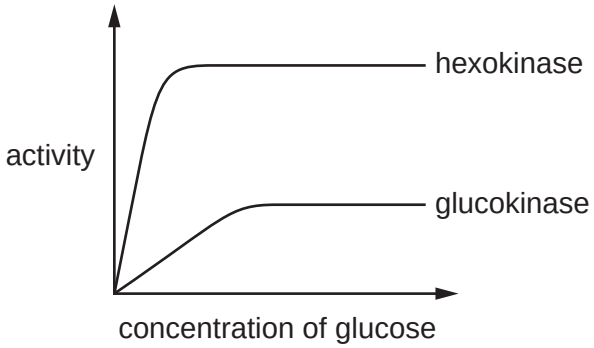
3 increase in temperature

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

12 The enzymes glucokinase in the liver and hexokinase in the brain both catalyse the phosphorylation of glucose:

$$\text{glucose} + \text{ATP} \rightarrow \text{glucose phosphate} + \text{ADP}$$

The activity of each enzyme was measured at different concentrations of glucose. The graph shows the results.



What describes the different activities of the two enzymes?

A Both enzymes hold glucose and ATP molecules together at the active site.

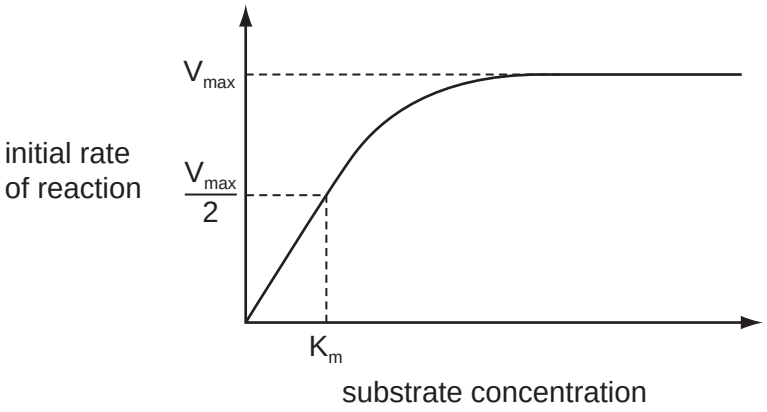
B Glucokinase becomes saturated with glucose at a lower concentration of glucose than hexokinase.

C Glucokinase phosphorylates more molecules of glucose per minute.

D The affinity of hexokinase for glucose is greater than that of glucokinase.

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13 The value K_m is the substrate concentration at which the rate of an enzyme-catalysed reaction is half its maximum rate, $\frac{V_{max}}{2}$.



The K_m was measured in the presence of a competitive inhibitor and in the presence of a non-competitive inhibitor.

What could be the value of K_m with inhibitor compared to the value of K_m with no inhibitor?

	value of K_m in presence of	
	competitive inhibitor	non-competitive inhibitor
A	less	less
B	less	more
C	more	less
D	the same	more

14 Which molecules, found in cell surface membranes, help the immune system to identify cells?

1 cholesterol

2 glycolipids

3 glycoproteins

4 proteins

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

15 The following are all processes by which substances can enter a cell.

1 endocytosis

2 facilitated diffusion

3 osmosis

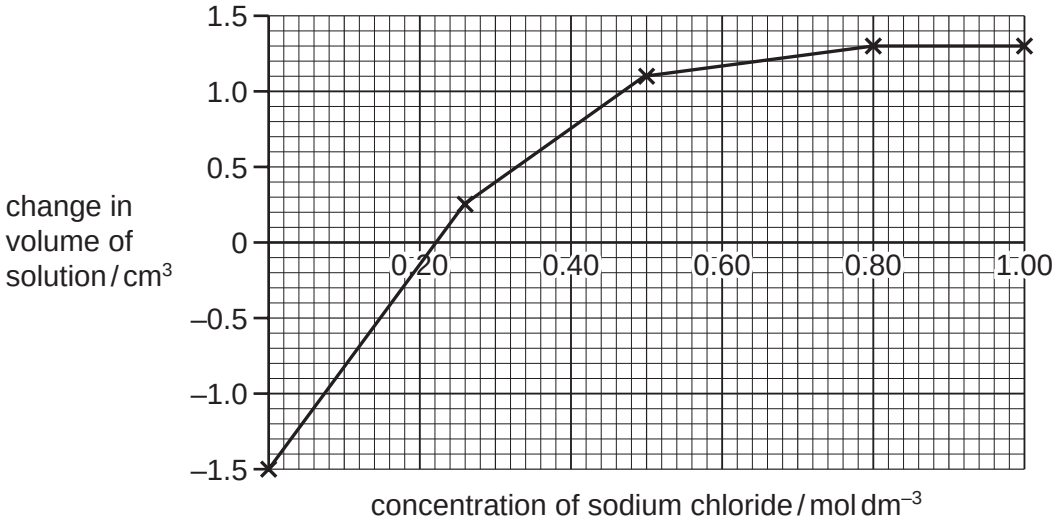
Which processes are passive?

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

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16 Equal volumes of five concentrations of sodium chloride solution were placed into five containers. An identical piece of plant tissue was placed into each container and left for 48 hours.

The plant tissues were removed and the volumes of the sodium chloride solution were accurately measured. The results are shown below.



Which statements explain the results from 0.80 to 1.00 mol dm^{-3} sodium chloride?

1 There was no net movement of water into or out of the plant tissues.

2 The plant root tissues had a water potential of zero.

3 The plant tissues were fully plasmolysed.

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

17 Chromosome telomeres are essential for DNA replication and are **not** completely replaced during mitosis.

Substance X completely replaces telomeres during mitosis.

What will be the effect of growing cells with and without substance X?

	with substance X	without substance X
A	cells divide continually	cell division eventually slows and stops
B	cells divide more rapidly	cells divide continually
C	cell division eventually slows and stops	cell division stops immediately
D	cell division stops immediately	cells divide continually

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18 Gene mutations in either the *BRCA1* or the *BRCA2* genes are responsible for the majority of hereditary breast cancer in humans.

The proteins produced by the two genes migrate to the nucleus where they interact with other proteins, such as those produced by the tumour suppressor gene, *p53*, and the DNA repair gene, *RAD51*.

Which combination of gene activity is most likely to result in breast cancer?

	gene		
	BRCA1 or *BRCA2*	*p53*	*RAD51*
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✗	✗

key

✓ = gene produces normal protein

✗ = gene produces abnormal protein or no protein

19 The information describes some events of mitosis.

1 chromosomes undergo condensation and spiralisation

2 centromeres are pulled by shortening of spindle fibres

3 sister chromatids are orientated across the centre of the cell

4 centrioles separate from each other

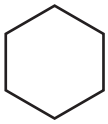
5 spindle fibres disperse

Which row correctly identifies the stages of mitosis in which these events occur?

	1	2	3	4	5
A	metaphase	telophase	prophase	metaphase	anaphase
B	prophase	anaphase	metaphase	prophase	telophase
C	prophase	metaphase	anaphase	telophase	telophase
D	telophase	metaphase	prophase	anaphase	prophase

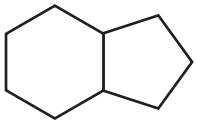
20 Which diagram shows a correct ring structure and named nucleic acid base?

A



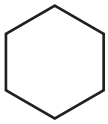
adenine

B



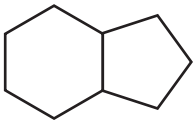
cytosine

C



thymine

D



uracil

21 The diagram shows the nucleotide sequence of a small section of a gene which is transcribed.

GCGCGCGGCCGC

The table shows the amino acids coded for by 10 mRNA codons.

mRNA codon	amino acid
AAG	Lys
ACG	Thr
CGG CGC CGU	Arg
CCG	Pro
GCC GCG	Ala
GGC	Gly
UGC	Cys

What is the order of the four amino acids in the polypeptide translated from this small section of a gene?

A Ala-Ala-Cys-Ala

B Ala-Arg-Gly-Ala

C Arg-Ala-Pro-Ala

D Arg-Arg-Thr-Arg

22 The following events occur during transcription.

1 Bonds break between complementary bases.

2 Bonds form between complementary bases.

3 Sugar-phosphate bonds form.

4 Free nucleotides pair with complementary nucleotides.

Before the mRNA molecule leaves the nucleus, which events will have occurred twice?

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

23 Which statements about water movement in plants are correct?

1 Water cannot pass through cellulose.

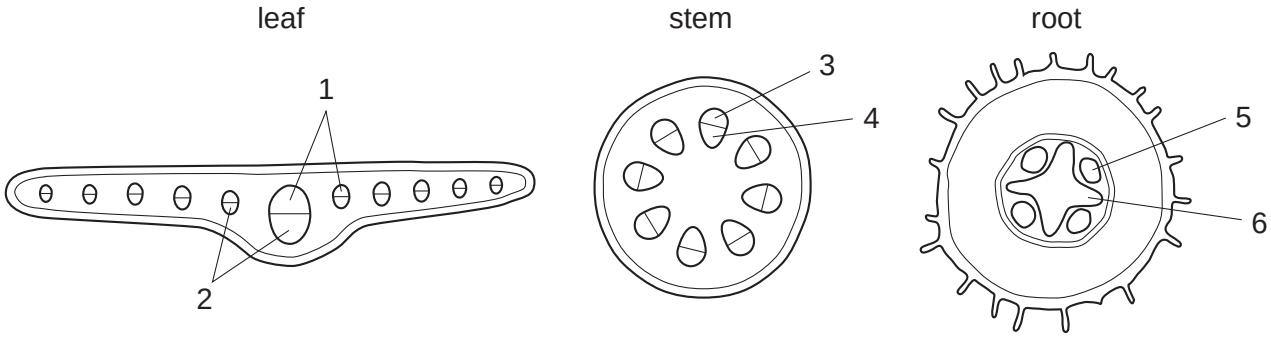
2 Water cannot pass through lignin.

3 Water cannot pass through the Casparian strip.

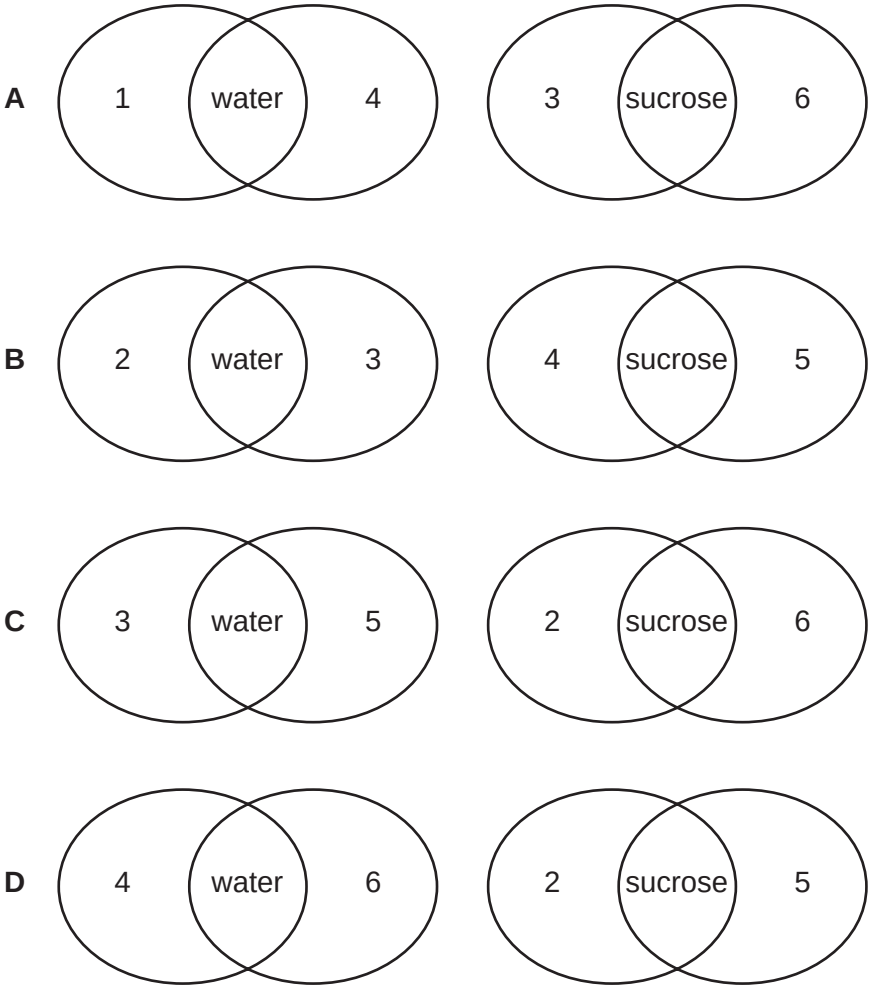
A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

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

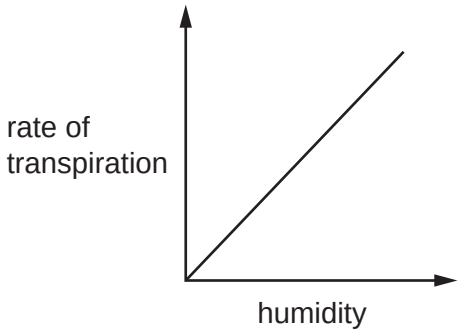


In the transverse sections, which tissues transport water and which tissues transport sucrose?

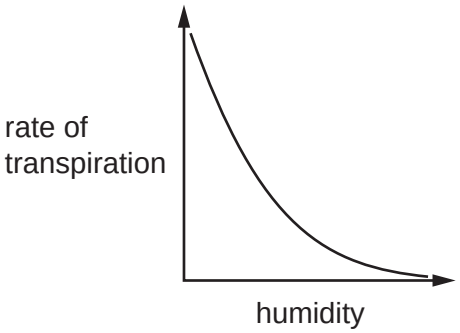


25 Which diagram represents the effect of atmospheric humidity on the rate of transpiration?

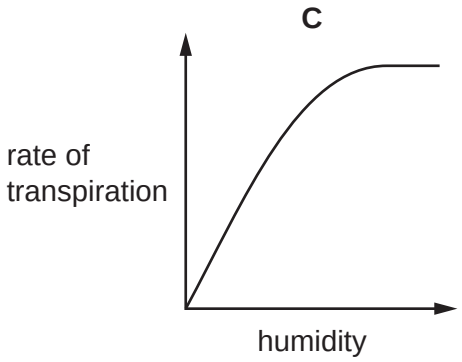
A



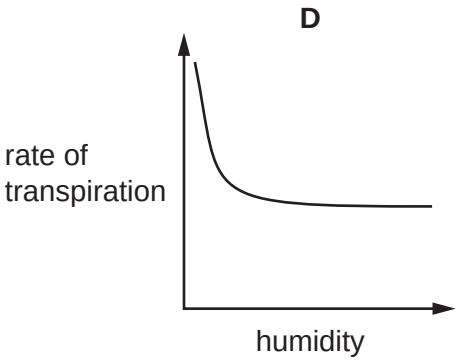
B



C



D



26 Which parts of a plant have plasmodesmata?

1 companion cells

2 phloem sieve tube elements

3 root hair cell

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

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27 The following are all structural components of blood vessels.

1 collagen fibres

2 elastic fibres

3 endothelial cells

4 smooth muscle cells

Which row shows the components in an artery and a vein?

	artery	vein
A	1, 2 and 4	1, 3 and 4
B	2, 3 and 4	1, 3 and 4
C	1, 2, 3 and 4	1, 2, 3 and 4
D	1, 2, 3 and 4	2, 3 and 4

28 Scientists have shown that the oxygen dissociation curves for haemoglobin of smaller mammals are to the right of those of larger mammals.

What does this suggest about the haemoglobin of smaller mammals?

A It carries more oxygen when the partial pressure of oxygen is higher.

B It releases oxygen less easily at lower partial pressures of oxygen.

C It saturates with oxygen more easily.

D It unloads oxygen more easily.

29 Which row could be correct for the average blood pressure in different parts of the human circulatory system?

	blood pressure				
	right atrium	artery in arm	vein in arm	capillary in arm	key
A	+	++++	++	+++	++++
B	++	++++	+++	+	+++
C	+++	++	++++	+	++
D	++++	+++	+	++	+

highest average blood pressure

↓

lowest average blood pressure

30 Which statements are correct?

1 The activity of carbonic anhydrase increases the hydrogen ion concentration in blood passing through active tissue.

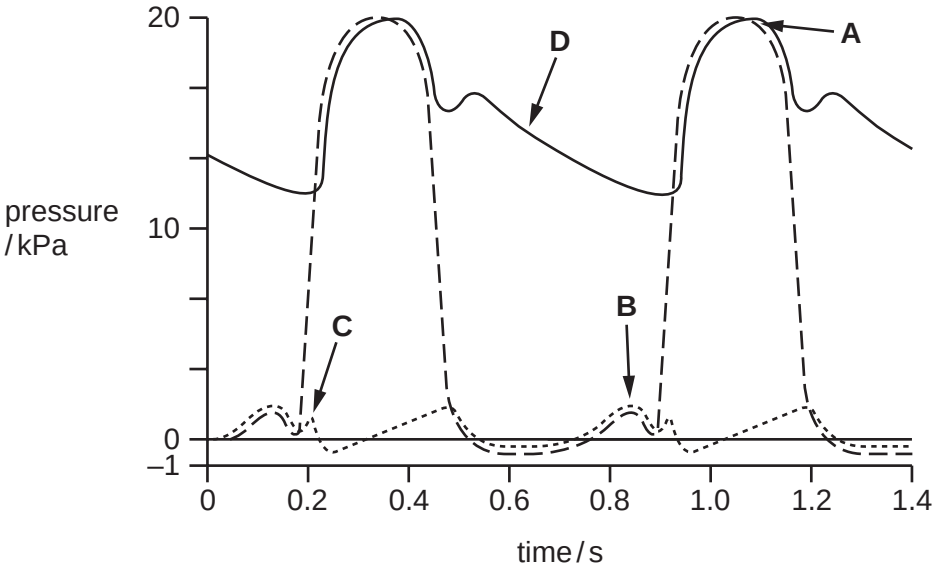
2 Carbon dioxide can react with haemoglobin in red blood cells to form carboxyhaemoglobin.

3 When haemoglobin binds with the hydrogen ion its affinity for oxygen decreases.

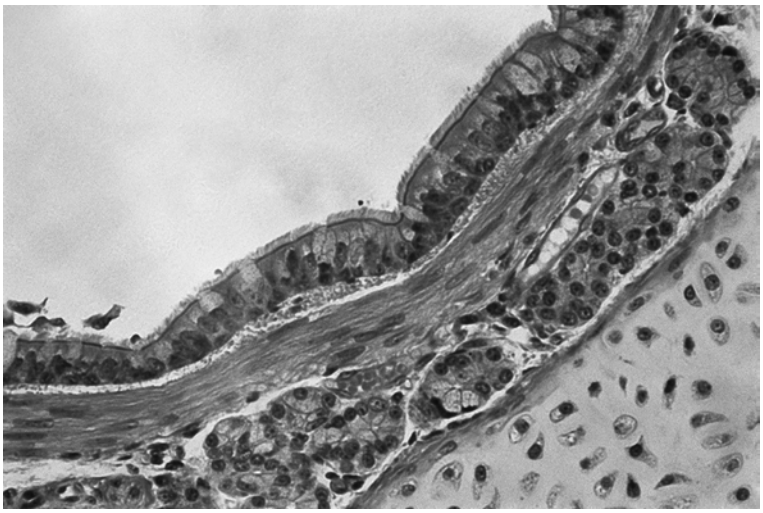
A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

31 The diagram shows pressure changes during the cardiac cycle.

Which arrow indicates atrial systole?



32 The image shown is a photomicrograph of a transverse section of part of the gas exchange system.



What describes the image?

A a thin inner layer of ciliated epithelial cells on top of a layer containing cartilage and supported by elastic fibres

B a very thin epithelial lining with walls containing elastic fibres, surrounded by many blood vessels

C an inner layer of ciliated epithelial and goblet cells on top of elastic fibres and supported by an outer layer consisting of blocks of cartilage

D an inner layer of ciliated epithelial and goblet cells on top of loose tissue with mucous glands supported by an outer layer of cartilage

33 The table lists some of the effects of smoking.

Which row shows the effect of nicotine and carbon monoxide?

	nicotine	carbon monoxide
A	decreases heart rate	decreases blood pressure
B	increases blood flow to the feet	increases blood pressure
C	increases blood pressure	combines with haemoglobin
D	increases blood pressure	increases heart rate

34 Which statement about chronic obstructive pulmonary disease (COPD) is correct?

A The disease can often be reversed by treatment.

B The disease occurs in people of all ages.

C The patient coughs a lot, bringing up mucus.

D The patient's symptoms change over time.

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35 Which row is correct?

	disease	pathogen	method of infection
A	cholera	bacterium	food borne
B	malaria	prokaryote	insect bite
C	measles	bacterium	water borne
D	tuberculosis (TB)	virus	airborne

36 What do pathogens of HIV / AIDS, malaria and TB have in common?

	they have a cell surface membrane	they have genes	they have ribosomes
A	✓	✓	✓
B	✓	✗	✗
C	✗	✓	✓
D	✗	✓	✗

key

✓ present in each causative agent

✗ not present in each causative agent

37 Which factor might have contributed to the spread of HIV / AIDS?

A few clinics and hospitals

B insufficient education

C malnutrition

D poor sanitation

38 Which event will occur following antigen-antibody binding?

A agglutination of bacteria to reduce their spread

B decreased susceptibility to phagocytosis

C more helper T cells are activated by the release of cytokines

D more plasma cells are cloned to produce more antigens

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39 Which statements about macrophages are correct?

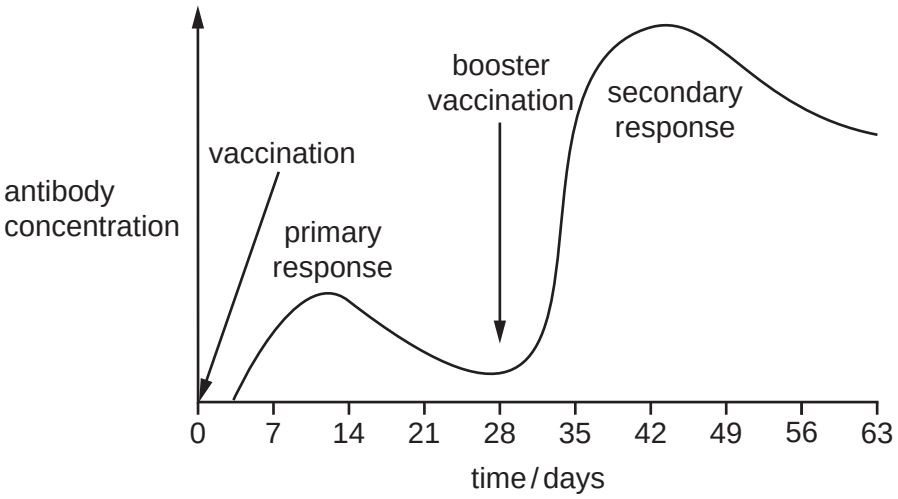
1 More are found in tissues such as the lungs, than in the blood.

2 They have a role in antigen presentation.

3 They can engulf pathogens, dust particles and damaged body cells.

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

40 The graph shows the antibody concentration in blood following vaccination and a booster vaccination 28 days later.



Which statements about the changes in antibody concentration are correct?

1 Antibody concentration falls after the primary response because antibodies are broken down and are no longer being produced.

2 The secondary response is more rapid due to memory B cells produced from activated B cells in the primary response.

3 The secondary response lasts longer than the primary response because memory B cells live longer than plasma B cells.

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

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