UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

BIOLOGY **9700/11**

Paper 1 Multiple Choice **May/June 2012**

1 hour

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

* 5 2 8 7 5 2 6 5 0 5 *

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, 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.

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.

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1 Which group of structures are visible in a suitably stained plant cell using a high power (x400) light microscope?

	centriole	chromosomes	mitochondria	starch grains
A	✓	✓	✗	✓
B	✓	✓	✗	✗
C	✗	✓	✓	✗
D	✗	✗	✓	✓

key

✓ = visible

✗ = not visible

2 What are **always** present in prokaryote cells?

A capsules

B flagella

C pili

D ribosomes

3 The following are all features of eukaryotic cells.

1 chloroplast

2 endoplasmic reticulum

3 lysosome

4 mitochondrion

5 nucleus

Which of these have a double membrane?

A 1, 2 and 4

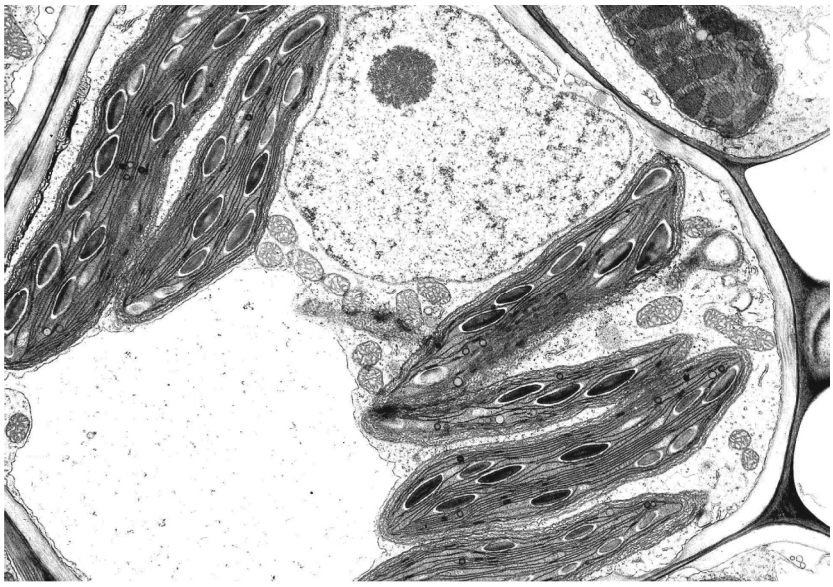
B 1, 3 and 5

C 1, 4 and 5

D 2, 3 and 5

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4 The magnification of the photomicrograph is ×4000.



What is the actual size of the nucleolus?

A 1 μm **B** 2 μm **C** 5 μm **D** 20 μm

5 A microscope has a resolution of 200 nm. Which of the following organelles would **not** be resolved using this microscope?

A chloroplasts

B lysosomes

C mitochondria

D ribosomes

6 Tests were performed on samples from a mixture of biological molecules.

When iodine in potassium iodide solution was added to a sample, the mixture turned black.

When the biuret test was carried out on another sample, the mixture turned purple.

Which biological molecules were in the mixture?

A amylase and starch

B cellulose and starch

C phospholipid and cellulose

D starch and phospholipid

7 Which of the statements about polysaccharides can be used to describe both amylopectin and cellulose?

1 adjacent glucose molecules are rotated by 180°

2 contains 1,4 glycosidic bonds

3 polymer of α–glucose

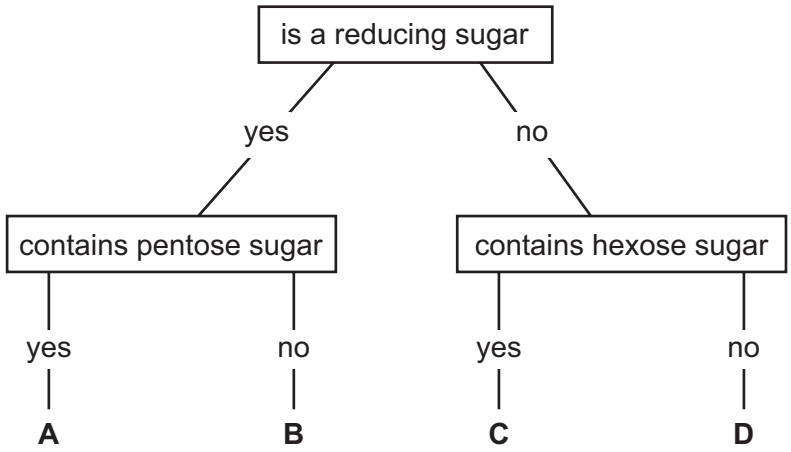
A 2 only

B 3 only

C 1 and 2

D 1 and 3

8 Which molecule in the key is sucrose?



9 Which molecules have a structural formula that contains C=O bonds?

1 fatty acids

2 glucose

3 glycerol

A 1 and 2 only

B 1 and 3 only

C 2 and 3 only

D 1, 2 and 3

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10 Which level of protein structure maintains the globular shapes of enzymes?

A primary

B secondary

C tertiary

D quaternary

11 Which substances contain carbon, hydrogen, oxygen and nitrogen?

1 collagen

2 amylopectin

3 deoxyribonucleic acid

A 2 only

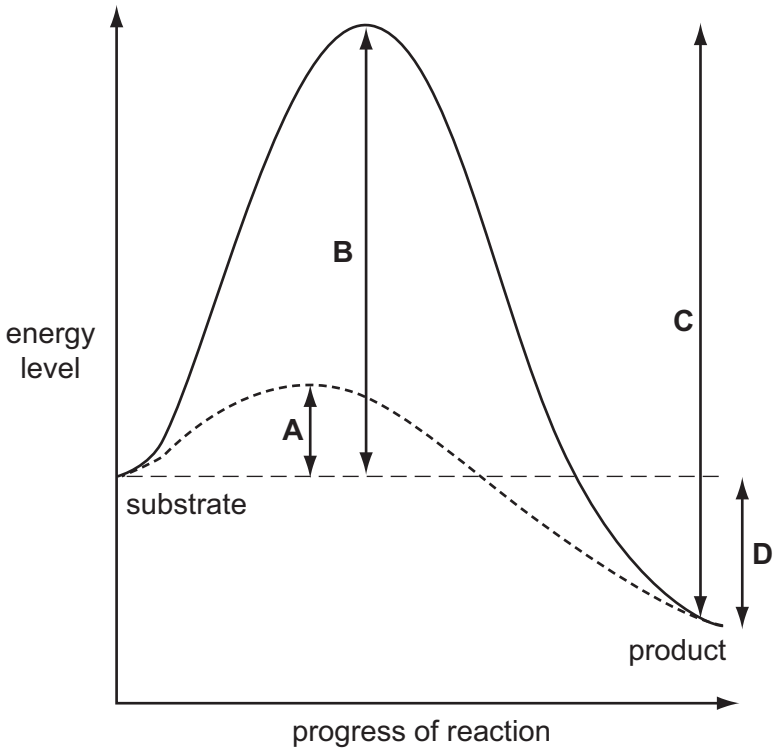
B 1 and 3 only

C 2 and 3 only

D 1, 2 and 3

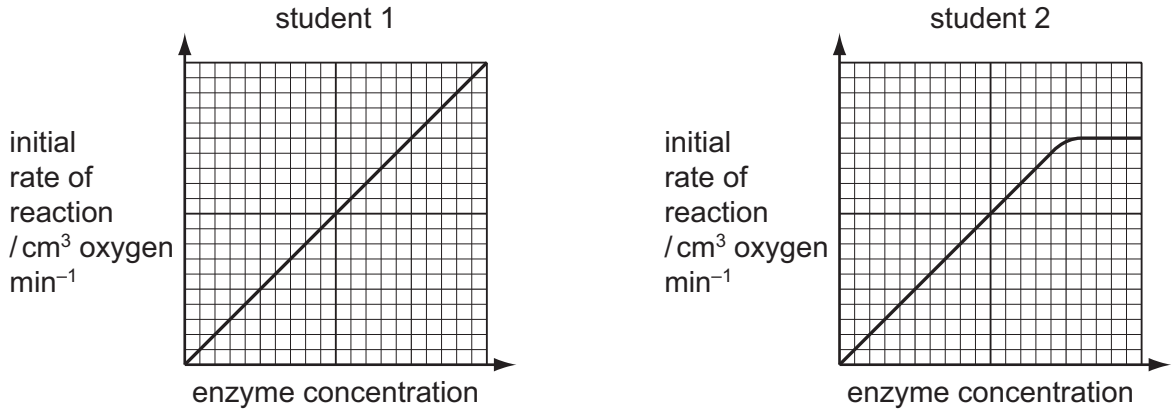
12 The graph shows the progress of a reaction in the presence and absence of an enzyme.

What is the activation energy of the reaction in the presence of the enzyme?



13 Catalase is an enzyme that catalyses the conversion of hydrogen peroxide into water and oxygen.

Two students investigated the effect of enzyme concentration on the rate of reaction of the enzyme catalase. The students predicted their results would show the same trend. The graphs show the rates obtained by each student.



Which statement explains the different trend shown by student 2's results?

A Student 2 included a competitive inhibitor in the investigation.

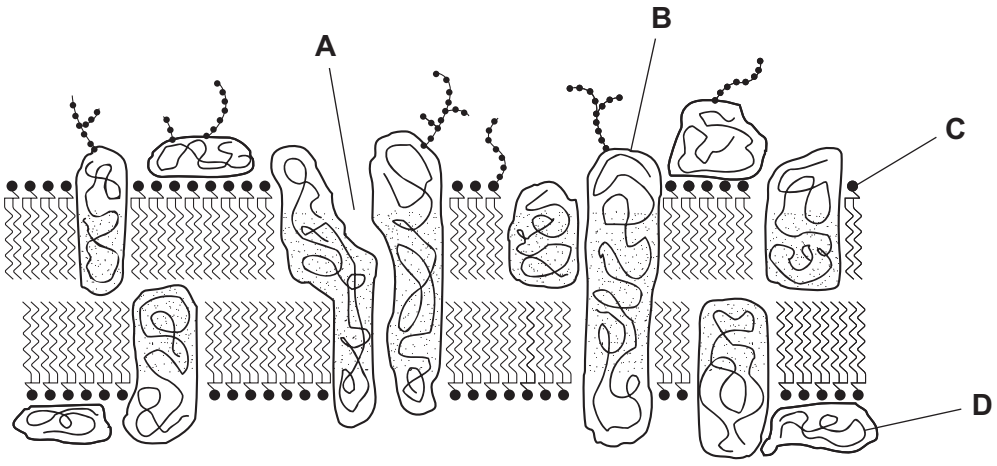
B Student 2 performed the investigation at a higher temperature.

C Student 2 performed the investigation at pH6 compared to pH8.

D Student 2 used a lower concentration of substrate in the investigation.

14 The diagram shows the fluid mosaic model of membrane structure.

Which would enable a hormone to recognise its target cell?



15 Which of the following ways of moving substances across cell surface membranes allows movement in both directions?

1 active transport

2 diffusion

3 facilitated diffusion

4 osmosis

A 2 only

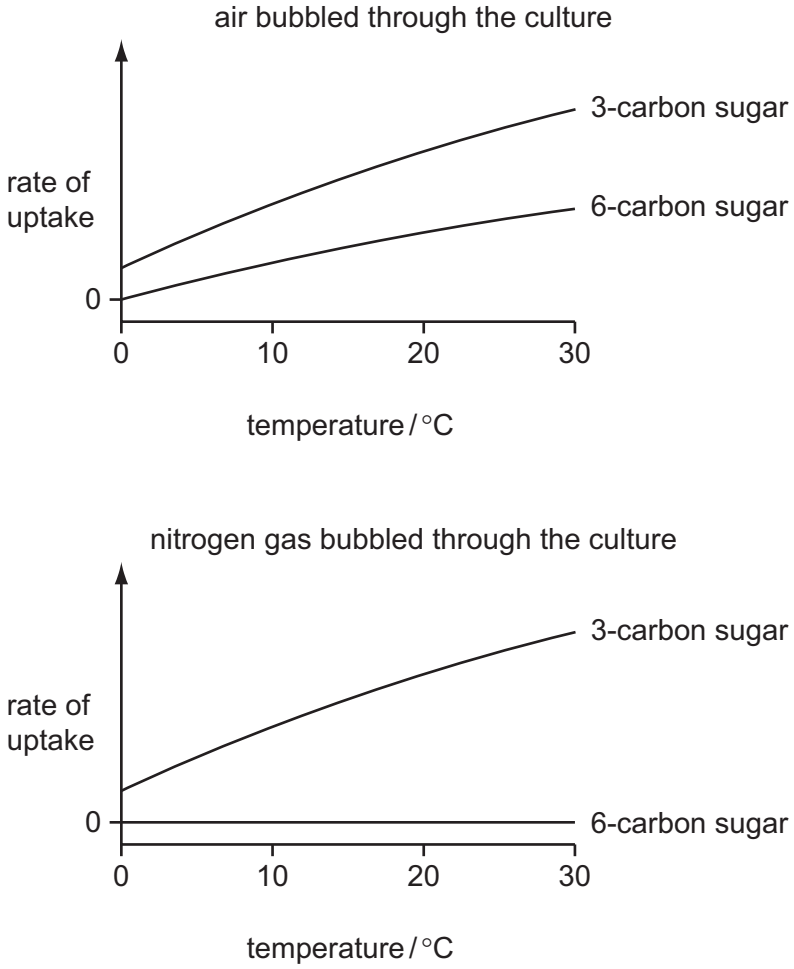
B 1 and 4 only

C 2 and 3 only

D 1, 2, 3 and 4

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16 The graphs show the rate of uptake of sugars by a culture of animal cells, under different conditions.



How are the sugars taken up by the cells when air is bubbled through the culture?

	3-carbon sugar	6-carbon sugar
A	active transport	active transport
B	active transport	diffusion
C	diffusion	active transport
D	diffusion	diffusion

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17 For organisms undergoing sexual reproduction, a reduction division occurs before fertilisation.

Which reasons explain why this is necessary?

1 increase genetic variation

2 prevent doubling of the chromosome number

3 reduce the chances of mutation

A 1 only

B 2 only

C 2 and 3 only

D 1, 2 and 3

18 What occurs during metaphase of mitosis?

A chromosomes attach to the equator of the spindle

B chromosomes become shorter and thicker

C chromatids reach the poles of the spindle

D each chromosome forms two chromatids

19 What are the conditions in a human cell just before the cell enters prophase?

	number of chromatids	number of molecules of DNA in nucleus	spindle present	nuclear envelope present
A	46	46	yes	no
B	92	46	no	yes
C	46	92	yes	yes
D	92	92	no	yes

20 Which statement describes a process that occurs during protein synthesis?

A Transcription is the linking together of a tRNA molecule and a specific amino acid.

B Transcription is the linking together of free DNA nucleotides.

C Translation is the linking together of amino acids coded for by mRNA.

D Translation is the synthesis of an mRNA molecule by base pairing of nucleotides with DNA.

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21 During semi-conservative replication of DNA in eukaryotic cells, the following processes occur.

1 Free nucleotides are hydrogen bonded to those on the exposed strand.

2 Hydrogen bonds are broken between the complementary base pairs.

3 The cell receives the signal to begin to divide.

4 Covalent bonds form between adjacent nucleotides on the same strand.

5 The DNA double helix is unwound.

Which shows the correct order of some of the processes?

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

B $3 \rightarrow 2 \rightarrow 4 \rightarrow 5$

C $5 \rightarrow 2 \rightarrow 1 \rightarrow 4$

D $5 \rightarrow 2 \rightarrow 3 \rightarrow 1$

22 A length of double-stranded DNA contains 120 nucleotides and codes for polypeptide X.

What is the maximum length of polypeptide X?

A 20 amino acids

B 40 amino acids

C 60 amino acids

D 120 amino acids

23 During transpiration, from where does the evaporation of water occur?

A intercellular spaces

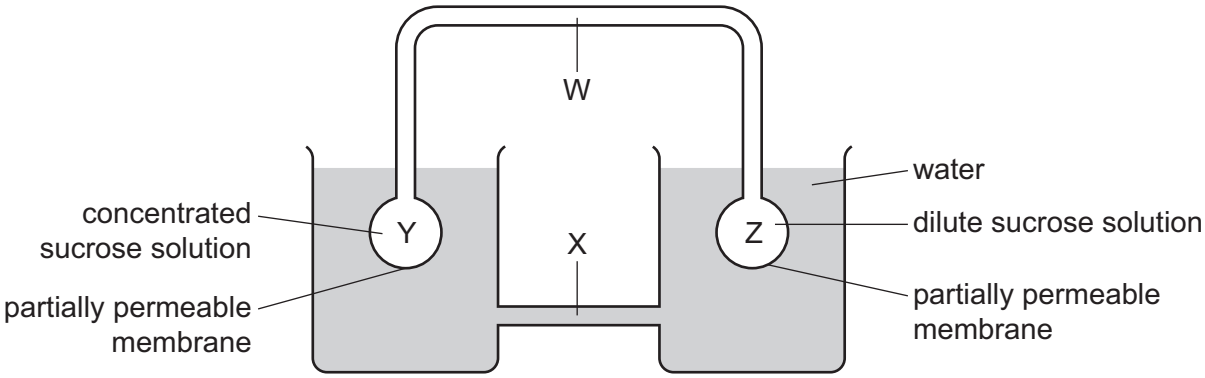
B leaf surface

C mesophyll cell walls

D stomatal pores

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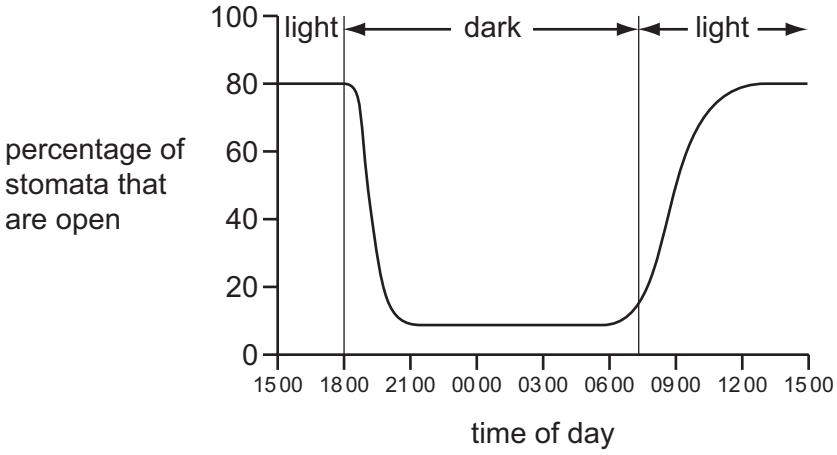
24 The diagram shows a model to demonstrate the mass flow hypothesis of translocation.



In a plant, what are the structures W, X, Y and Z and what is the direction of flow of solution along W?

	phloem	xylem	roots	leaves	direction of flow along W
A	W	X	Y	Z	from Z to Y
B	W	X	Z	Y	from Y to Z
C	X	W	Y	Z	from Y to Z
D	X	W	Z	Y	from Z to Y

25 The graph shows stomatal opening and closing in the leaves of a species of *Pelargonium*, during a 24 hour period.



What can be concluded?

A Gas exchange occurs when stomata are open.

B Stomata open as light intensity increases.

C Stomata open as temperature increases.

D Transpiration does not occur in the dark.

26 When transpiration is at a maximum rate, tree trunks decrease in diameter.

Which statement explains this?

A There is decreased suction pressure in the leaves.

B There is less adhesion between water and xylem vessel walls.

C There is less water in the xylem vessels.

D The water in the xylem vessels is under increased tension.

27 Which statement explains how mass flow arises in sieve tube elements?

A Sucrose actively loaded into sieve tube elements decreases the water potential causing the hydrostatic pressure to increase.

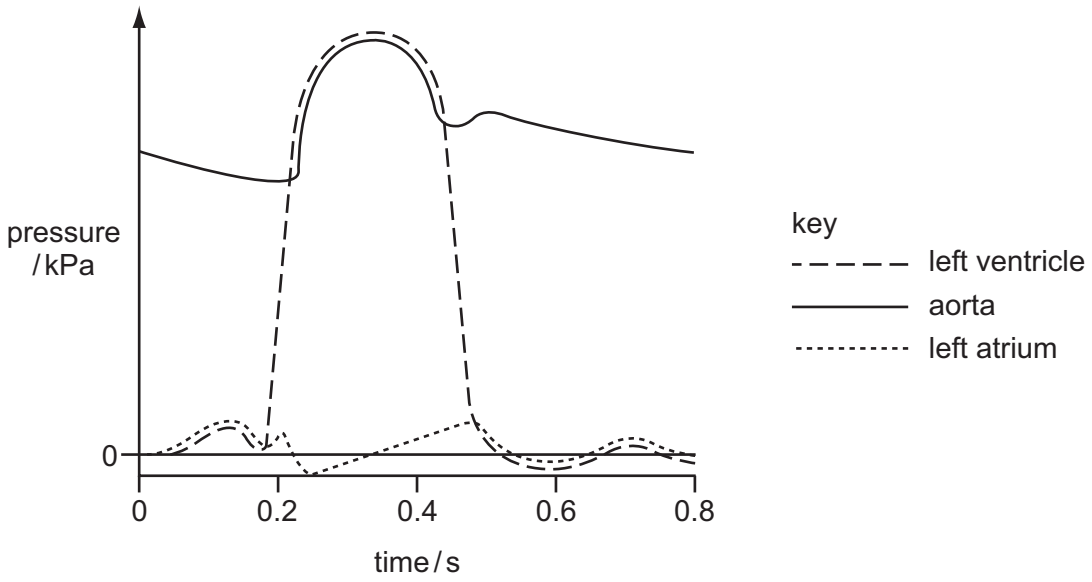
B Sucrose actively loaded into sieve tube elements increases the water potential causing the hydrostatic pressure to decrease.

C Sucrose diffused into sieve tube elements decreases the water potential causing the hydrostatic pressure to increase.

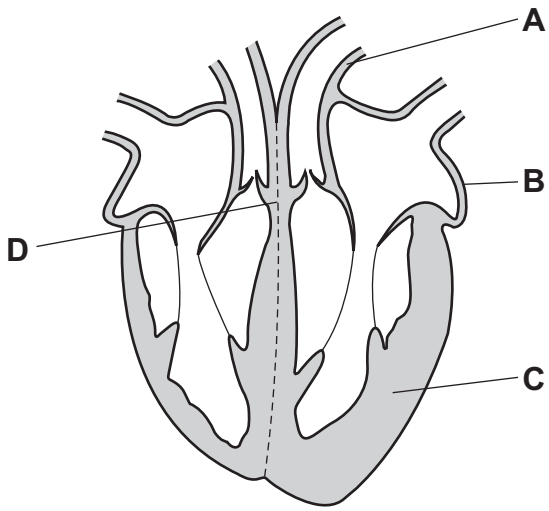
D Sucrose diffused into sieve tube elements increases the water potential causing the hydrostatic pressure to decrease.

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28 The graph shows the pressure in three parts of the heart during one cycle.



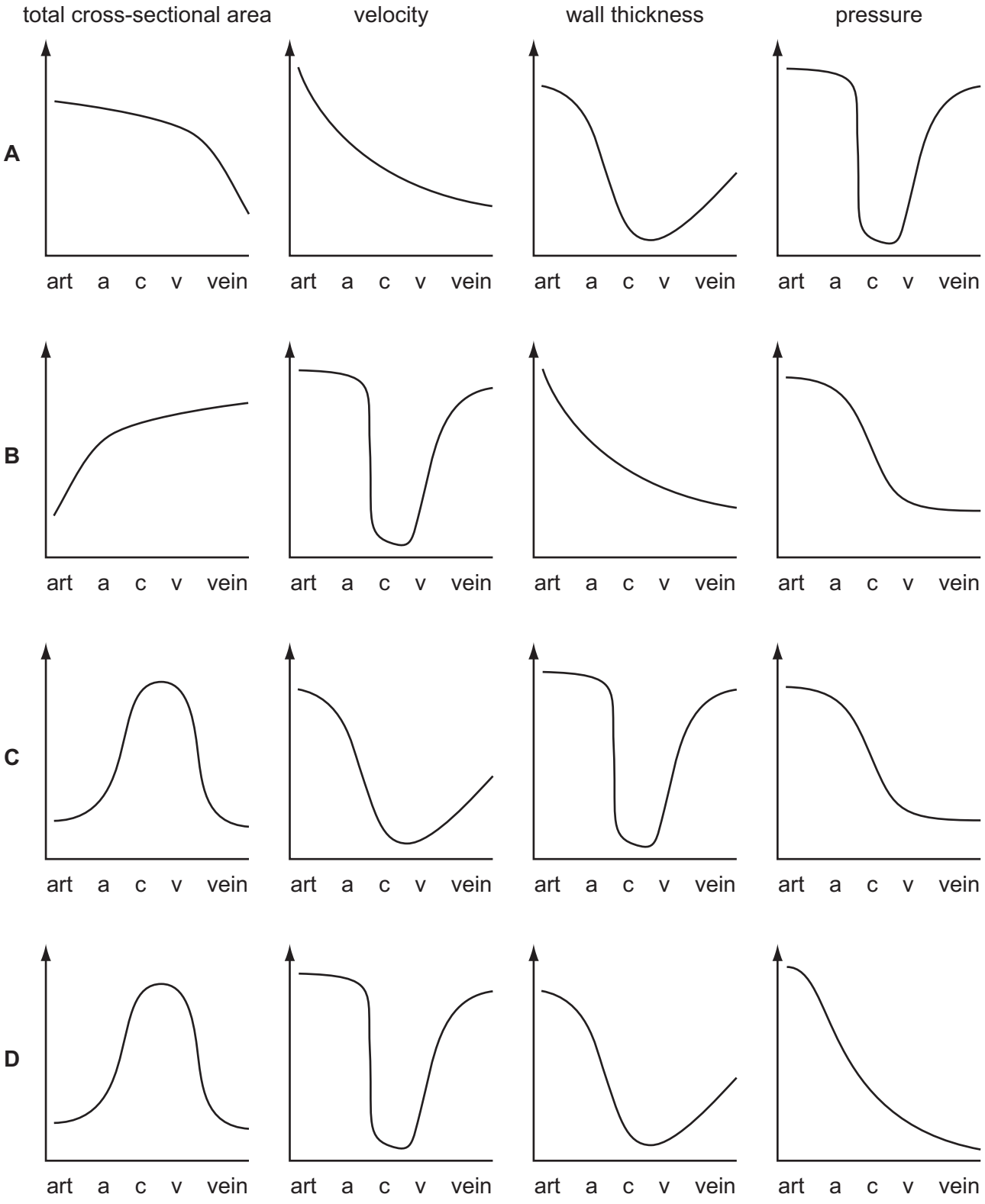
At 0.2 seconds, which part of the heart is responding to the excitatory stimulus?



29 Each set of graphs represents data for blood vessels in the sequence:

art	a	c	v	vein
artery	arterioles	capillaries	venules	veins

Which set is correct?



30 An increase in carbon dioxide in human blood shifts the oxyhaemoglobin dissociation curve to the right.

What is the explanation for this effect?

A An increase in carbon dioxide concentration increases the ventilation rate.

B Carbon dioxide is more soluble than oxygen and displaces it.

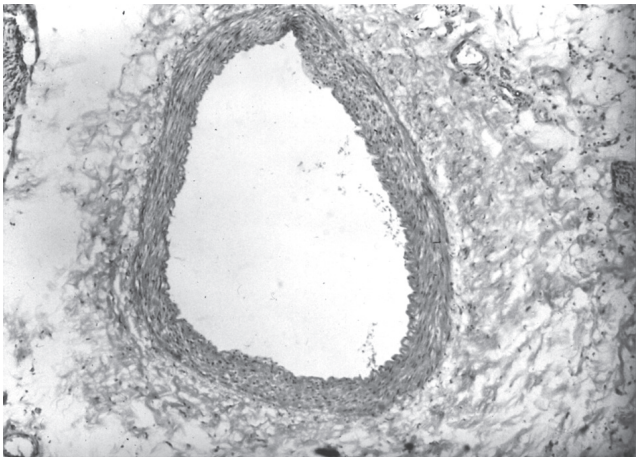
C Diffusion of carbon dioxide between the alveoli and the blood is more rapid.

D Increasing the H^+ concentration decreases haemoglobin affinity for oxygen.

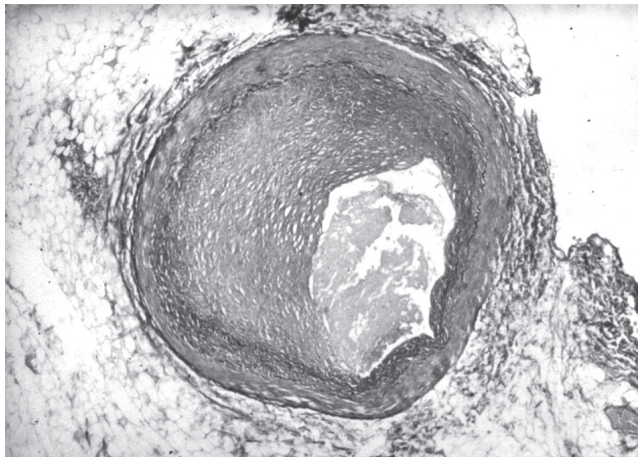
31 Which is correct about the affinity between haemoglobin and the gases carbon dioxide, carbon monoxide and oxygen?

	highest affinity → lowest affinity		
A	carbon monoxide	carbon dioxide	oxygen
B	carbon monoxide	oxygen	carbon dioxide
C	oxygen	carbon dioxide	carbon monoxide
D	oxygen	carbon monoxide	carbon dioxide

32 The photomicrographs show transverse sections of arteries from a non-smoker and a smoker.



non-smoker



smoker

From the evidence above, which disease is most likely to occur in the smoker?

A cardiovascular disease

B chronic obstructive pulmonary disease (COPD)

C emphysema and chronic bronchitis

D lung cancer

33 What would be seen in an electron micrograph of a bronchus wall?

1 cartilage cells

2 ciliated cells

3 exocytotic vesicles

A 1 and 2 only

B 1 and 3 only

C 2 and 3 only

D 1, 2 and 3

34 Which cells become memory cells in the immune response?

1 B-lymphocytes

2 T-lymphocytes

3 phagocytes

A 1 only

B 2 only

C 1 and 2 only

D 1, 2 and 3

35 Which of the following increases the risk of contracting cholera?

1 drinking unpasteurised milk

2 eating shellfish which have fed on raw sewage

3 living in overcrowded conditions

A 2 only

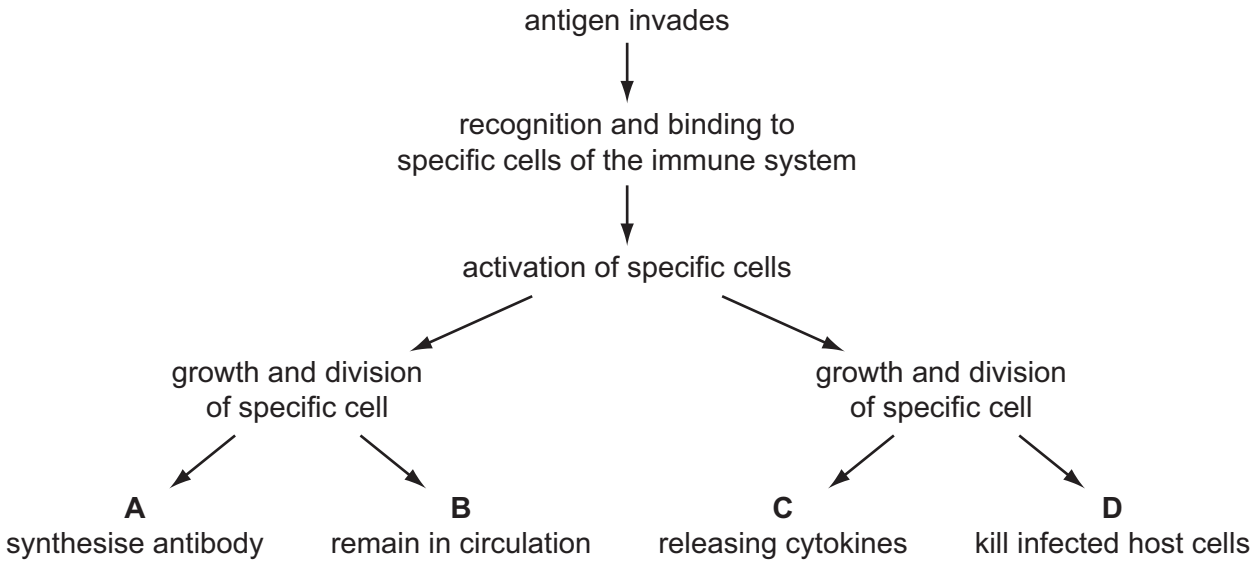
B 1 and 2

C 1 and 3

D 2 and 3

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36 Which describes a T-helper lymphocyte?



37 Antibodies can act in a number of ways to protect the body from pathogenic bacteria.

Which event will **not** occur following antigen-antibody binding?

A agglutination of bacteria to reduce their spread

B increased susceptibility to phagocytosis

C neutralisation of toxins to make them harmless

D secretion of histamine to produce an allergic reaction

38 What is the ecological definition of the term *community*?

A all the food webs in an ecosystem

B all the individuals of one species in an area

C all the organisms in an area

D the living organisms and their non-living environment

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[Turn over

39 The table shows the results of a field study of four species in a food chain in an area of woodland.

species	number of individuals	biomass of one individual / arbitrary units	energy value per unit mass / arbitrary units
R	10 000	0.1	1.0
S	5	10.0	2.0
T	500	0.002	1.8
U	3	300 000.0	0.5

What is the energy flow in the food chain?

	from → to			
A	R	T	S	U
B	S	T	R	U
C	U	R	S	T
D	U	S	T	R

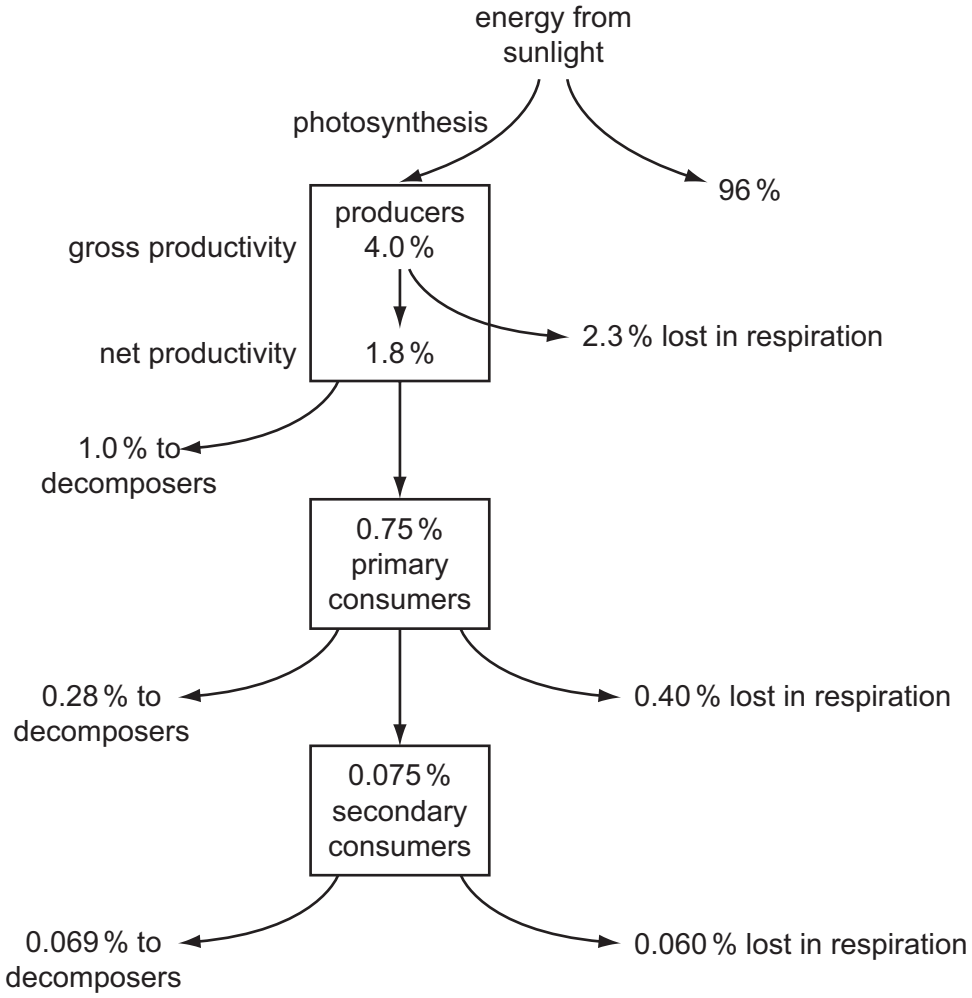
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40 The diagram shows the flow of energy through an ecosystem. Photosynthesis is the **gross productivity**. Producers lose some energy in respiration and the energy left is the **net productivity**.

This can also be expressed as an equation:

net productivity = gross productivity – respiration

Some of the net productivity passes to herbivores.



Which calculation gives the proportion of **net** productivity passing to herbivores?

A $\frac{0.075}{1.8}$ **B** $\frac{0.75}{1.8}$ **C** $\frac{0.75}{4.0}$ **D** $\frac{(0.75+0.075)}{1.8}$

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General Certificate of Education
Advanced Subsidiary Level and Advanced Level

BIOLOGY **9700/12**

Paper 1 Multiple Choice **May/June 2012**

1 hour

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1 Which range of sizes would include most eukaryotic cells?

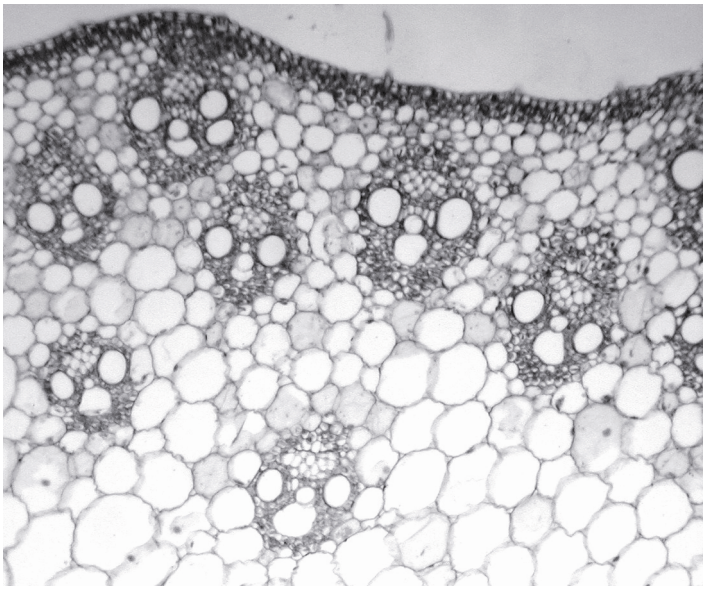
A 1×10^2 nm to 1 μm

B 1 μm to 1×10^1 μm

C 1×10^1 μm to 1×10^2 μm

D 1×10^2 μm to 1×10^3 μm

2 A student was asked to draw a plan diagram of the plant tissue shown in the photomicrograph and to annotate two observable features.



What are the correct annotations?

A epidermis darkly stained layer of cells, xylem hollow vessels

B epidermis formed of single layer of cells, xylem strengthened by lignin

C phloem small cells, xylem empty cells to transport water

D vascular bundles arranged in a regular pattern, xylem large dead cells

3 Which structure is present in **all** eukaryotic cells but **not** present in prokaryotic cells?

A 70S ribosome

B cell wall

C chromatin

D plasmid

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4 What restricts the resolution of the light microscope?

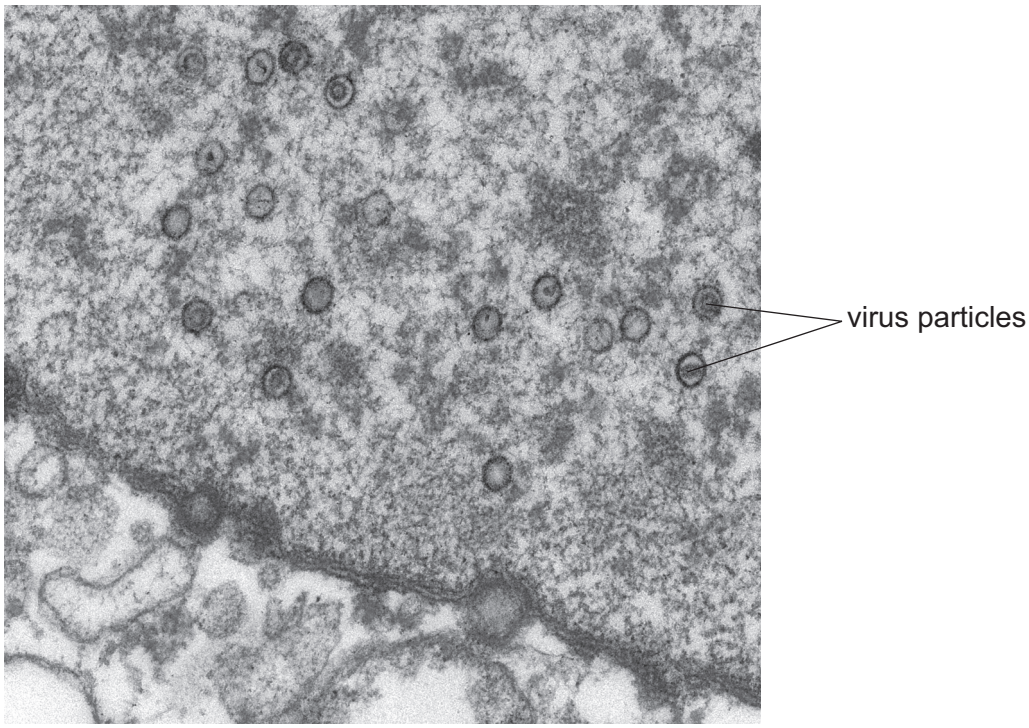
A the inability to cut very thin sections

B the low light intensity of microscope lamps

C the low magnification produced by glass

D the wavelengths of visible light

5 The diagram shows an electron micrograph of virus particles in a human nucleus.



×24 000

What is the diameter of the labelled virus particles?

A $1.5 \times 10^{0}\,\mu m$ **B** $1.5 \times 10^{-2}\,\mu m$ **C** $1.5 \times 10^{0}\,nm$ **D** $1.5 \times 10^{2}\,nm$

6 A student carried out a series of tests on an extract from a plant.

The table shows the results of the tests.

reagent	observation
ethanol and water	white emulsion
Benedict's solution	brick red precipitate
Biuret	blue colour

Which row shows the molecules found in the plant extract?

	protein	fatty acids	reducing sugar
A	✓	✓	✓
B	✗	✓	✓
C	✗	✓	✗
D	✗	✗	✓

key

✓ = present

✗ = absent

7 Glycogen is a polymer of glucose.

Which description summarises its structure?

A α-glucose joined by glycosidic bonds involving carbons 1 and 4

B α-alpha glucose joined by glycosidic bonds involving carbons 1, 4 and 6

C β-beta glucose joined by glycosidic bonds involving carbons 1 and 4

D β-beta glucose joined by glycosidic bonds involving carbons 1, 4 and 6

8 Which molecules contain C=O bonds?

1 amino acids

2 fatty acids

3 proteins

A 1 and 2 only

B 1 and 3 only

C 2 and 3 only

D 1, 2 and 3

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9 Which of the statements about polysaccharides can be used to describe both amylose and amylopectin?

1 contains 1,4 glycosidic bonds

2 contains 1,6 glycosidic bonds

3 polymer of α-glucose

A 1 only

B 1 and 3 only

C 2 and 3 only

D 1, 2 and 3

10 Which carbohydrate gives a brick red colour when heated with Benedict's solution?

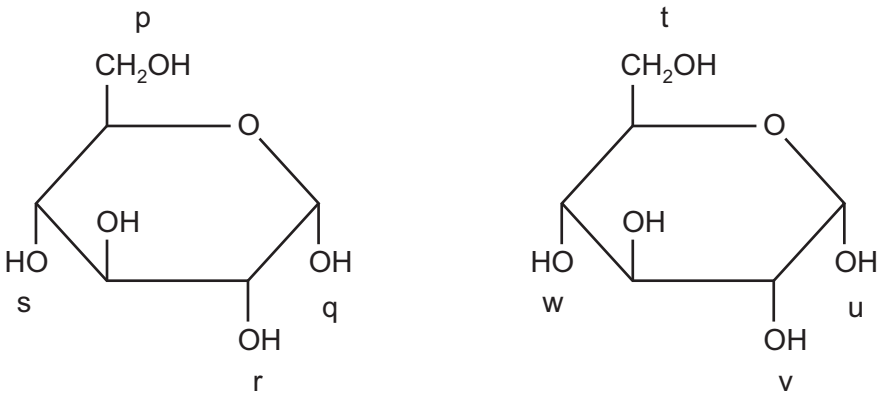
A cellulose

B fructose

C glycogen

D sucrose

11 The diagram shows two molecules of glucose. Four possible bonding positions are labelled p, q, r, and s, and t, u, v, w.



When these two molecules condense during the formation of a glycogen molecule, where could bonds form?

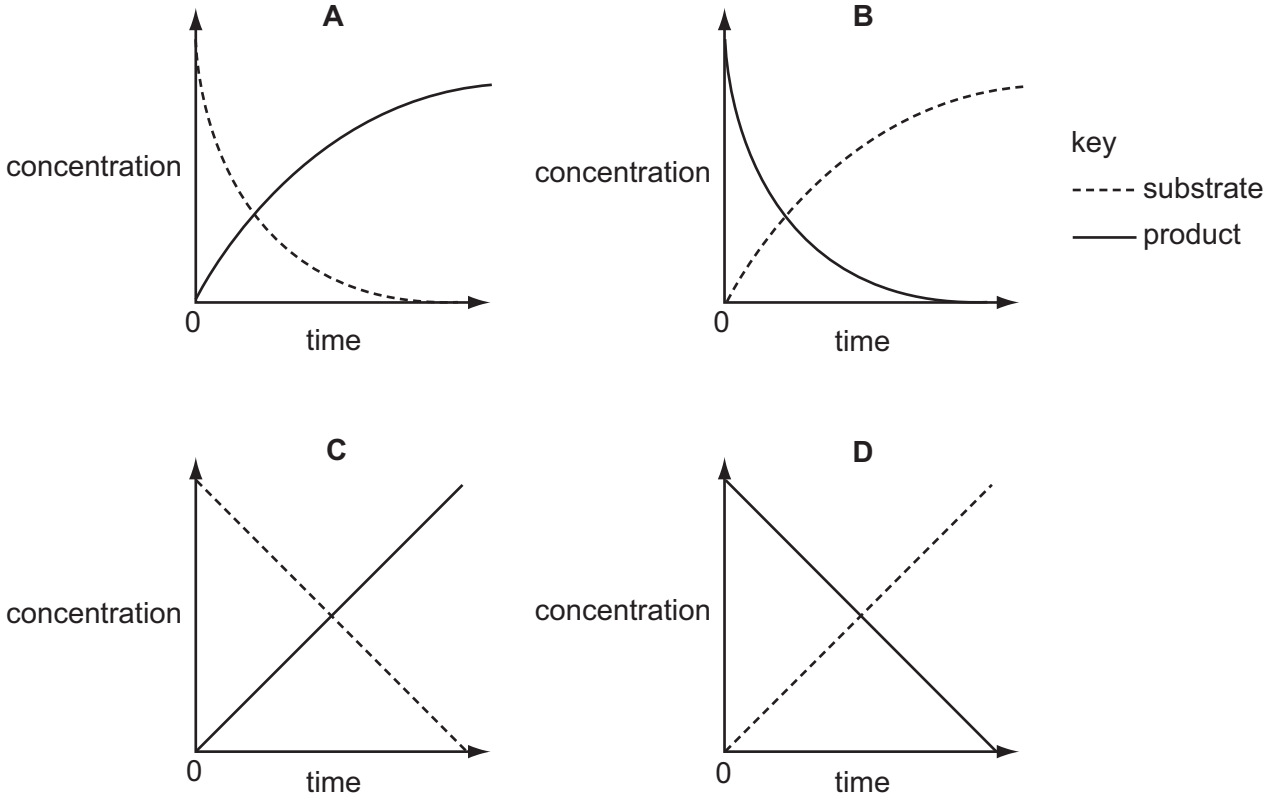
A p – u or q – w

B q – w or p – v

C r – t or q – u

D s – w or r – v

12 Which graph represents the changes in concentration of a substrate and its product in the same enzyme-catalysed reaction?



13 Glucose in urine can be detected using a biochemical test. When the end of a test strip, which is impregnated with the enzyme glucose oxidase, is dipped into urine, the development of a blue colour indicates that glucose is present.

This is a reliable test that people with diabetes can carry out at home.

Which feature of the enzyme makes this test so reliable?

A It is heat stable.

B It is specific.

C It lowers the activation energy of the reaction.

D It only works at low pH range.

14 What is the role of cholesterol in the cell surface membrane?

A to assist active transport

B to assist facilitated diffusion

C to provide hydrophilic channels

D to regulate fluidity of the membrane

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

1 endocytosis

2 facilitated diffusion

3 osmosis

Which processes are passive?

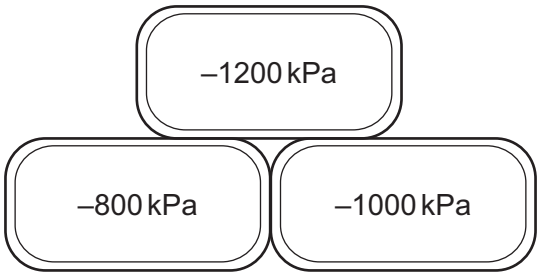
A 2 only

B 3 only

C 2 and 3 only

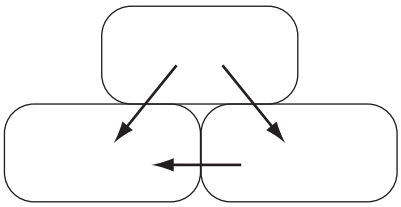
D 1, 2 and 3

16 The diagram shows the water potential of three adjacent plant cells.

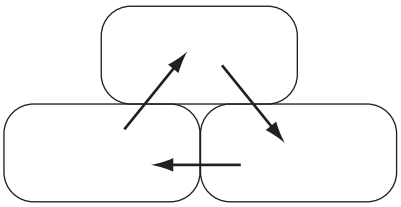


In which directions will there be net movement of water by osmosis?

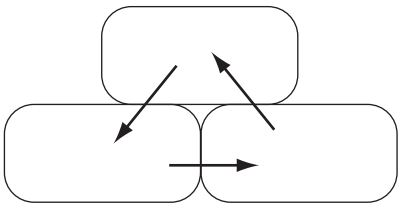
A



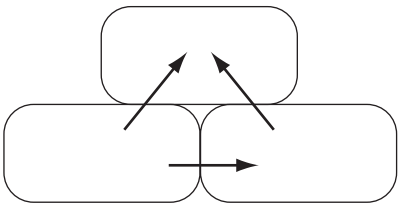
B



C



D



17 Each of the following events takes place during mitosis.

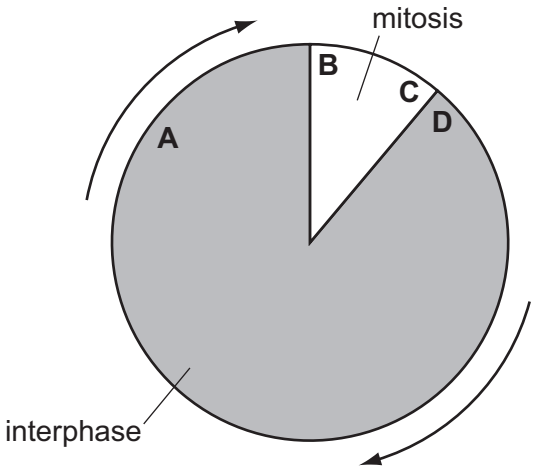
1 centromeres divide
2 chromatids move to opposite poles of the cell
3 chromosomes line up along the equator of the spindle
4 chromosomes uncoil
5 two chromatids are joined by a centromere

In which order do the events take place?

	first →				last
A	1	2	4	5	3
B	3	1	2	4	5
C	4	5	3	1	2
D	5	3	1	2	4

18 The diagram shows the cell cycle.

When radioactive nucleotides are supplied to dividing cells, at which point will they be incorporated into the chromosomes?



19 What does the process of transcription require?

A ATP, DNA and free nucleotide bases

B DNA, mRNA and RNA polymerase

C mRNA, ribosomes and RNA polymerase

D ribosomes, tRNA and ATP

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20 A peptide consists of ten amino acids of four different kinds.

What is the theoretical minimum number of different tRNA molecules required to translate the mRNA for this peptide?

A 4 **B** 10 **C** 12 **D** 30

21 Which statements about tRNA structure are correct?

1 There is a binding site for the attachment of a specific amino acid, as well as a different binding site for the attachment to the ribosome, in order to allow translation to occur.

2 There is a ribose-phosphate backbone with strong covalent phosphodiester bonds and areas within the polynucleotide chain where base-pairing by hydrogen bonding occurs.

3 There is a section known as an anticodon that contains the same triplet of bases as the triplet of DNA bases that has been transcribed to produce the mRNA codon.

A 1 only

B 1 and 2 only

C 2 and 3 only

D 1, 2 and 3

22 Which statements describe why a large animal has had to evolve a transport system?

1 diffusion occurs slowly over long distances

2 it has a high rate of gas exchange

3 it has a large surface area to volume ratio

A 1 only

B 3 only

C 1 and 2 only

D 1, 2 and 3

23 Which row identifies the tissue that contains the Casparian strip and the molecule forming this strip?

	tissue	molecule
A	cortex	lignin
B	endodermis	suberin
C	epidermis	cellulose
D	xylem	lignin

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24 Which of the following are included in the apoplast pathway?

1 living components

2 plant vacuoles

3 cell walls

4 xylem vessels

A 3 only

B 1 and 2 only

C 3 and 4 only

D 1, 2 and 4 only

25 Which statement explains why the circumference (girth) of a tree is less in the middle of the day than at night?

A Mineral uptake by the root hair cells decreases during the night because root pressure has decreased.

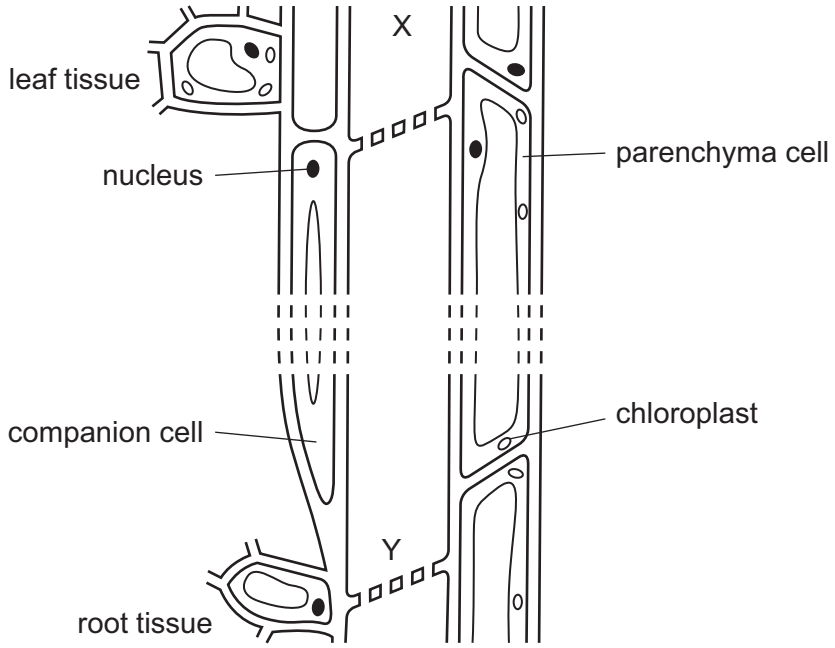
B Stomata close during the night and there is a build-up of water in the vascular tissue within the stem.

C The phloem sieve tubes fill with dissolved solutes because the translocation rate is reduced at night.

D There is less tension in the xylem vessels at night because the rate of transpiration is at a minimum.

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26 Sucrose is transported in solution in the phloem of plants. Transport takes place from sources to sinks. The process depends on differences in hydrostatic pressure between the sources and the sinks.



Which tissues are either a source or a sink and what is the hydrostatic pressure at X and Y within the phloem?

	tissue		hydrostatic pressure	
	leaf	root	high	low
A	sink	source	X	Y
B	sink	source	Y	X
C	source	sink	X	Y
D	source	sink	Y	X

27 Which of the following are found in **all** blood vessels, lymph and tissue fluid?

1 carbon dioxide

2 glucose

3 white blood cells

4 antibodies

A 2 and 4 only

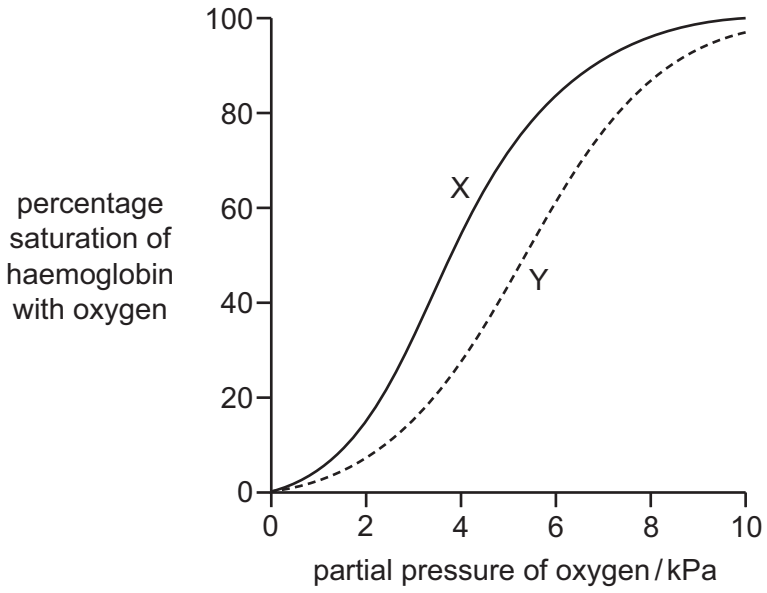
B 1, 2 and 3 only

C 1, 3 and 4 only

D 1, 2, 3 and 4

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28 The diagram shows the Bohr effect.



What causes the shift from X to Y?

A decreased concentration of carbon dioxide and high pH

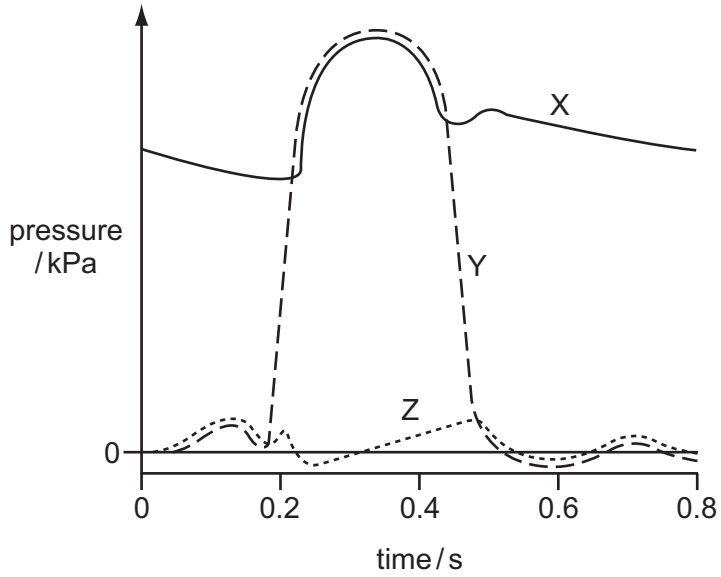
B decreased concentration of carbon dioxide and low pH

C increased concentration of carbon dioxide and high pH

D increased concentration of carbon dioxide and low pH

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29 The graph shows the pressure changes in different areas of the left side of the heart during one cardiac cycle.



Which row shows the pressure changes in each part of the heart?

	left atrium	left ventricle	aorta
A	X	Y	Z
B	Y	Z	X
C	Z	X	Y
D	Z	Y	X

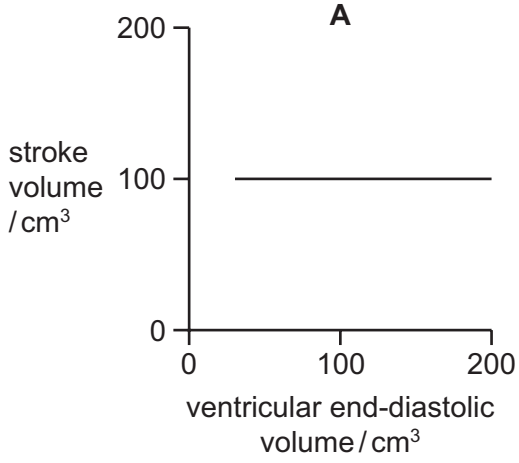
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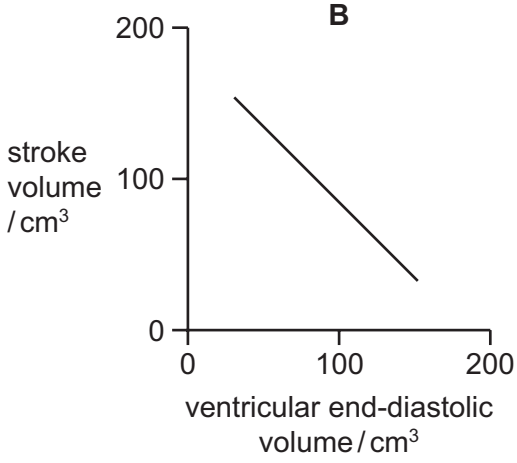
30 The stroke volume is the volume of blood pumped by each contraction of a ventricle. The ventricular end-diastolic volume is the volume of blood in the ventricle just before systole.

Which graph shows the relationship between the stroke volume and the ventricular end-diastolic volume?

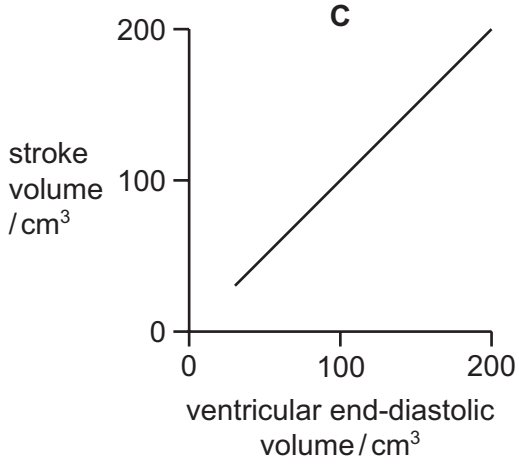
A



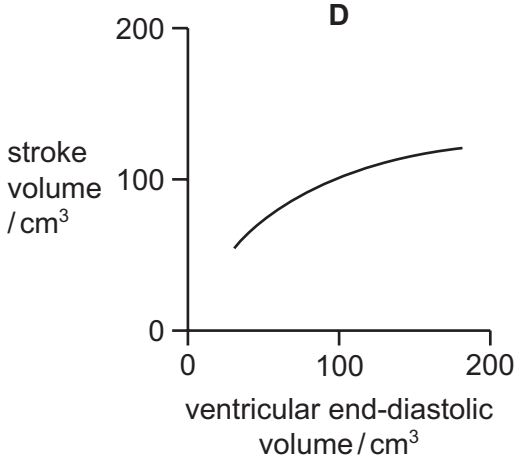
B



C



D



31 Which component of tobacco smoke causes an increase in blood pressure?

A carbon monoxide

B carcinogens

C nicotine

D tar

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32 Which statements about chronic obstructive pulmonary disease (COPD) are correct?

1 The patient coughs a lot, bringing up mucus.

2 The patient's symptoms normally do not change.

3 The patient is normally over 30 years old.

4 The disease can often be reversed by treatment.

A 1, 2 and 3 only

B 1, 2 and 4 only

C 2, 3 and 4 only

D 1, 2, 3 and 4

33 What would be seen in a photomicrograph of the wall of the trachea?

	tissue		
	elastic fibres	epidermis	smooth muscle
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✓	✗

key

✓ = present

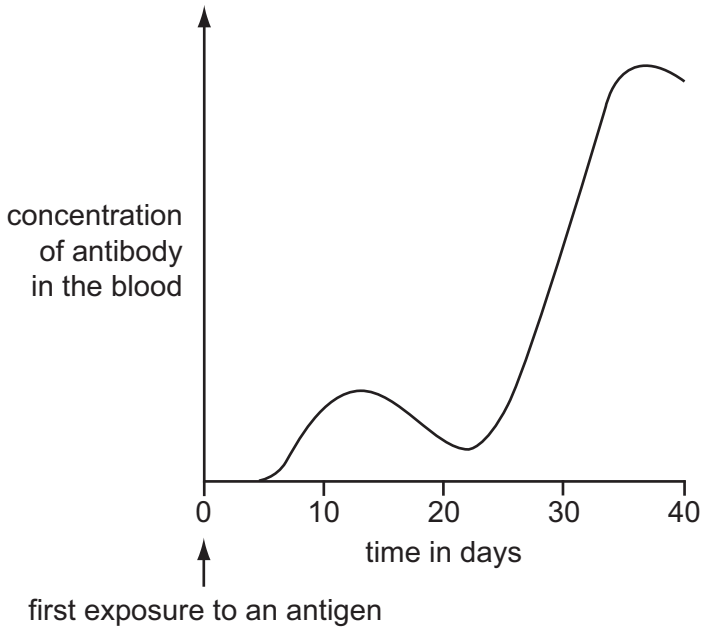
✗ = absent

34 To prevent a disease, dead bacteria may be injected into the body.

What type of immune response is produced?

	passive	artificial
A	no	no
B	no	yes
C	yes	no
D	yes	yes

35 The graph shows the amount of antibody produced in response to an antigen.



From the graph, which statement is correct?

A It takes 25 days to achieve active immunity.

B Memory cells for this antigen are present in the body within 20 days.

C T-helper lymphocytes are activated on day 12.

D The second exposure to the antigen occurred on day 25.

36 Which of the following two diseases are caused by viruses?

A HIV and cholera

B malaria and cholera

C measles and smallpox

D TB and HIV

37 Cholera is no longer common in many countries. What is the reason for this?

A education of the citizens about the spread of the disease

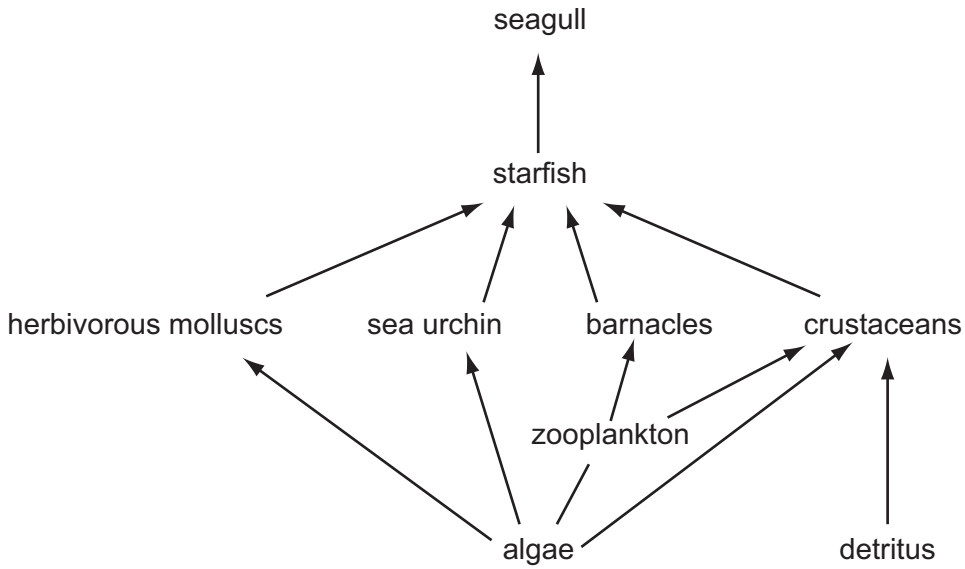
B routine vaccination by local health authorities

C treatment of water supplies and separate sewage treatment

D treatment of water to control mosquitoes

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38 The diagram shows a food web.



How many trophic levels are represented in the food web?

A 3 **B** 4 **C** 5 **D** 6

39 What is the role of decomposers in the nitrogen cycle?

A They convert proteins to ammonium compounds.

B They fix atmospheric nitrogen.

C They oxidise ammonium compounds to nitrites.

D They oxidise nitrites to nitrates.

40 Why could only 4 % of the energy from sunlight be fixed by producers during photosynthesis?

A A lot of energy is lost as energy passes from one trophic level to the next in food chains.

B A lot of sunlight reflects off clouds, is absorbed by pond water or does not strike chloroplasts.

C Some energy passes from dead plants to decomposers such as bacteria and fungi.

D Some parts of plants are not eaten or cannot be digested by herbivores.

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

BIOLOGY **9700/13**

Paper 1 Multiple Choice **May/June 2012**

1 hour

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

* 7 3 9 2 6 3 3 2 0 7 *

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, 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.

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.

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UNIVERSITY of CAMBRIDGE International Examinations

1 What is the ecological definition of the term *community*?

A all the food webs in an ecosystem

B all the individuals of one species in an area

C all the organisms in an area

D the living organisms and their non-living environment

2 The table shows the results of a field study of four species in a food chain in an area of woodland.

species	number of individuals	biomass of one individual / arbitrary units	energy value per unit mass / arbitrary units
R	10 000	0.1	1.0
S	5	10.0	2.0
T	500	0.002	1.8
U	3	300 000.0	0.5

What is the energy flow in the food chain?

	from →			to
A	R	T	S	U
B	S	T	R	U
C	U	R	S	T
D	U	S	T	R

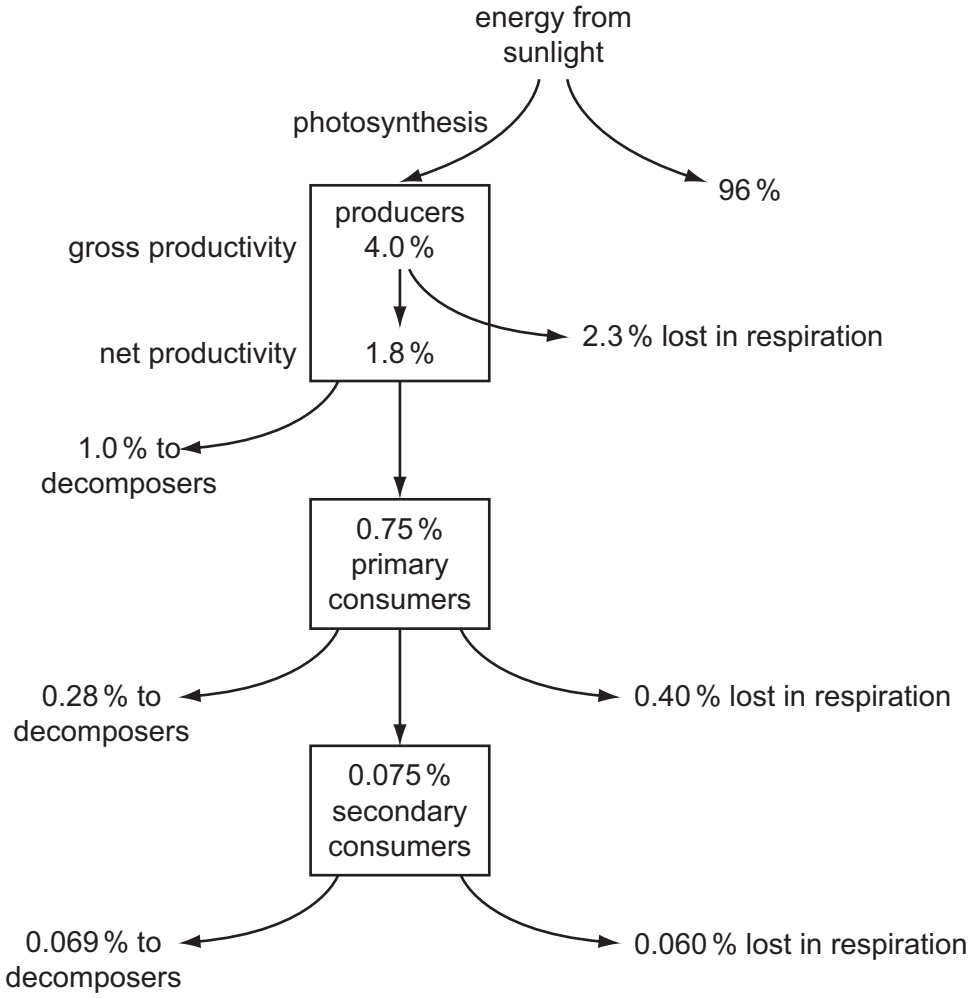
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3 The diagram shows the flow of energy through an ecosystem. Photosynthesis is the **gross productivity**. Producers lose some energy in respiration and the energy left is the **net productivity**.

This can also be expressed as an equation:

net productivity = gross productivity – respiration

Some of the net productivity passes to herbivores.



Which calculation gives the proportion of **net** productivity passing to herbivores?

A $\frac{0.075}{1.8}$ **B** $\frac{0.75}{1.8}$ **C** $\frac{0.75}{4.0}$ **D** $\frac{(0.75+0.075)}{1.8}$

4 What are **always** present in prokaryote cells?

A capsules

B flagella

C pili

D ribosomes

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5 The following are all features of eukaryotic cells.

1 chloroplast

2 endoplasmic reticulum

3 lysosome

4 mitochondrion

5 nucleus

Which of these have a double membrane?

A 1, 2 and 4

B 1, 3 and 5

C 1, 4 and 5

D 2, 3 and 5

6 Which group of structures are visible in a suitably stained plant cell using a high power (x400) light microscope?

	centriole	chromosomes	mitochondria	starch grains
A	✓	✓	✗	✓
B	✓	✓	✗	✗
C	✗	✓	✓	✗
D	✗	✗	✓	✓

key

✓ = visible

✗ = not visible

7 A microscope has a resolution of 200 nm. Which of the following organelles would **not** be resolved using this microscope?

A chloroplasts

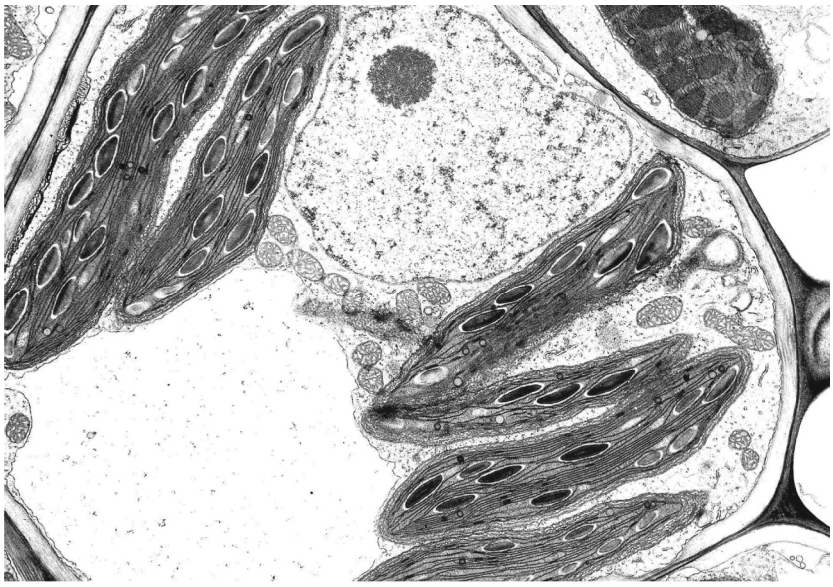
B lysosomes

C mitochondria

D ribosomes

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8 The magnification of the photomicrograph is ×4000.

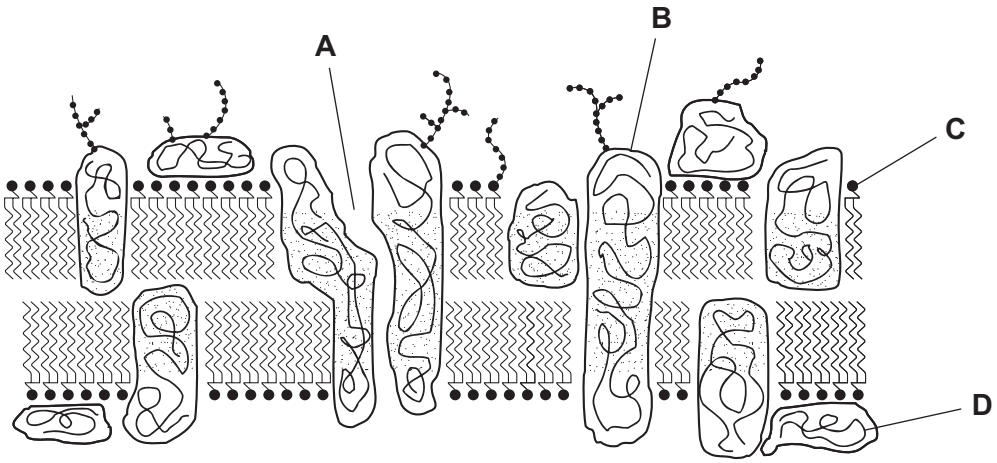


What is the actual size of the nucleolus?

A 1 μm **B** 2 μm **C** 5 μm **D** 20 μm

9 The diagram shows the fluid mosaic model of membrane structure.

Which would enable a hormone to recognise its target cell?



10 Which of the following ways of moving substances across cell surface membranes allows movement in both directions?

1 active transport

2 diffusion

3 facilitated diffusion

4 osmosis

A 2 only

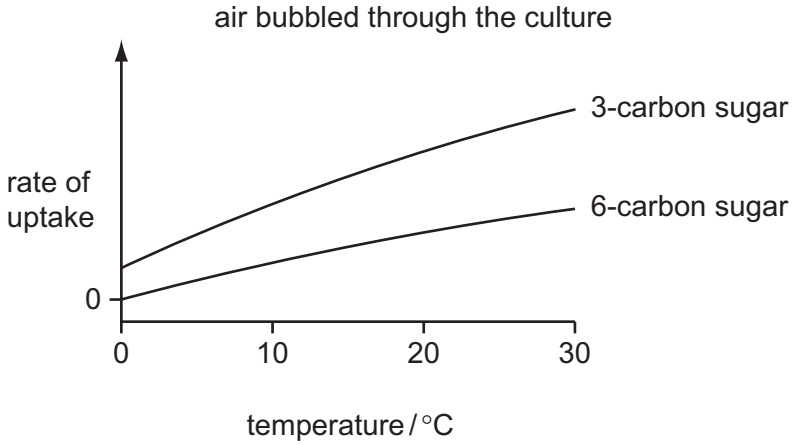
B 1 and 4 only

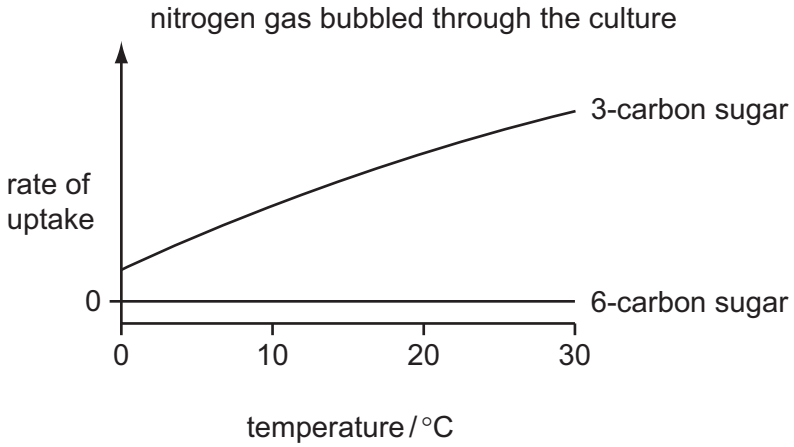
C 2 and 3 only

D 1, 2, 3 and 4

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11 The graphs show the rate of uptake of sugars by a culture of animal cells, under different conditions.

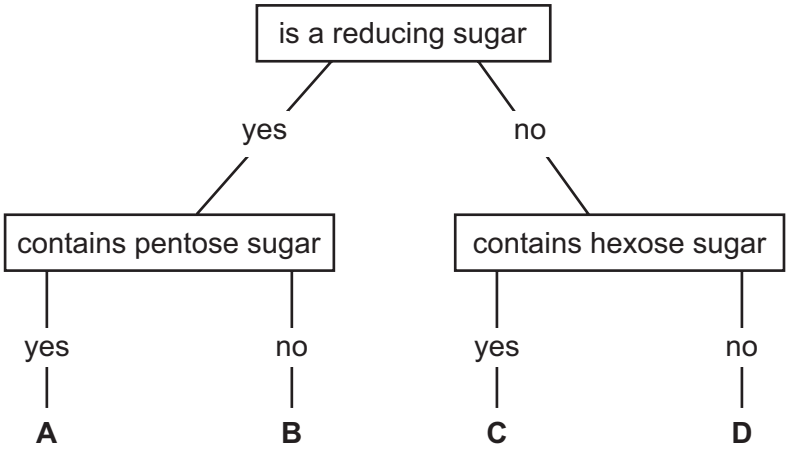




How are the sugars taken up by the cells when air is bubbled through the culture?

	3-carbon sugar	6-carbon sugar
A	active transport	active transport
B	active transport	diffusion
C	diffusion	active transport
D	diffusion	diffusion

12 Which molecule in the key is sucrose?



13 Tests were performed on samples from a mixture of biological molecules.

When iodine in potassium iodide solution was added to a sample, the mixture turned black.

When the biuret test was carried out on another sample, the mixture turned purple.

Which biological molecules were in the mixture?

A amylase and starch

B cellulose and starch

C phospholipid and cellulose

D starch and phospholipid

14 Which of the statements about polysaccharides can be used to describe both amylopectin and cellulose?

1 adjacent glucose molecules are rotated by 180°

2 contains 1,4 glycosidic bonds

3 polymer of α–glucose

A 2 only

B 3 only

C 1 and 2

D 1 and 3

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15 Which substances contain carbon, hydrogen, oxygen and nitrogen?

1 collagen
2 amylopectin
3 deoxyribonucleic acid

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

16 Which molecules have a structural formula that contains C=O bonds?

1 fatty acids
2 glucose
3 glycerol

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

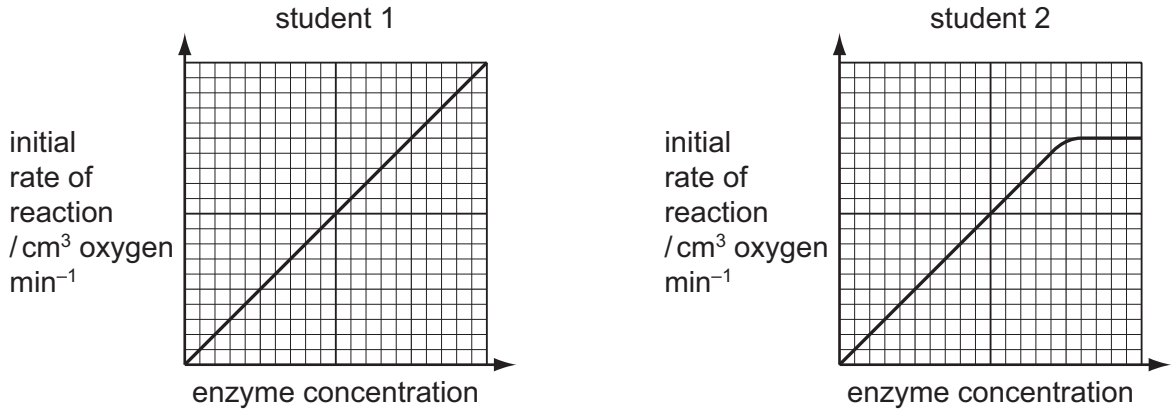
17 Which level of protein structure maintains the globular shapes of enzymes?

A primary
B secondary
C tertiary
D quaternary

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18 Catalase is an enzyme that catalyses the conversion of hydrogen peroxide into water and oxygen.

Two students investigated the effect of enzyme concentration on the rate of reaction of the enzyme catalase. The students predicted their results would show the same trend. The graphs show the rates obtained by each student.



Which statement explains the different trend shown by student 2's results?

A Student 2 included a competitive inhibitor in the investigation.

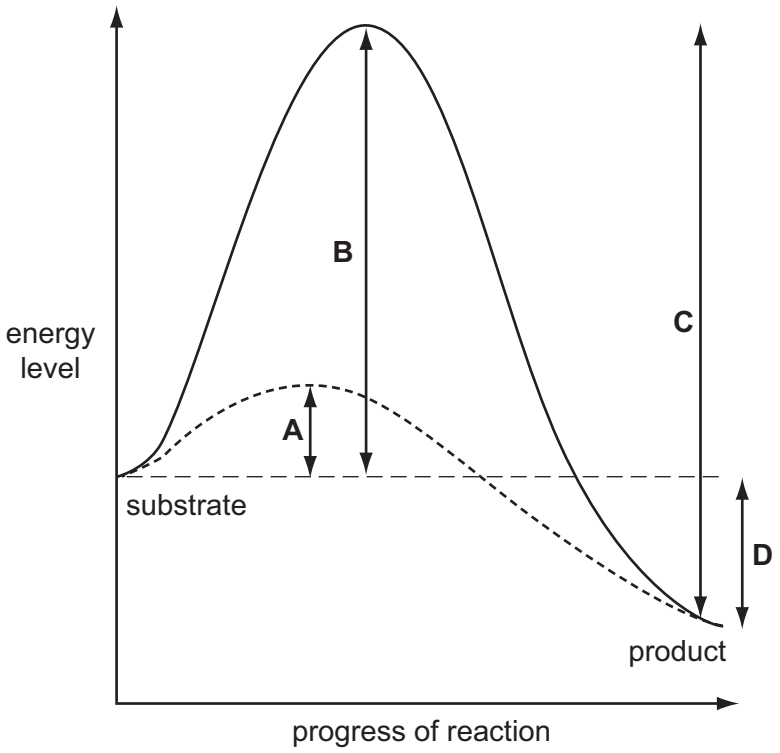
B Student 2 performed the investigation at a higher temperature.

C Student 2 performed the investigation at pH6 compared to pH8.

D Student 2 used a lower concentration of substrate in the investigation.

19 The graph shows the progress of a reaction in the presence and absence of an enzyme.

What is the activation energy of the reaction in the presence of the enzyme?



20 For organisms undergoing sexual reproduction, a reduction division occurs before fertilisation.

Which reasons explain why this is necessary?

1 increase genetic variation

2 prevent doubling of the chromosome number

3 reduce the chances of mutation

A 1 only

B 2 only

C 2 and 3 only

D 1, 2 and 3

21 What occurs during metaphase of mitosis?

A chromosomes attach to the equator of the spindle

B chromosomes become shorter and thicker

C chromatids reach the poles of the spindle

D each chromosome forms two chromatids

22 What are the conditions in a human cell just before the cell enters prophase?

	number of chromatids	number of molecules of DNA in nucleus	spindle present	nuclear envelope present
A	46	46	yes	no
B	92	46	no	yes
C	46	92	yes	yes
D	92	92	no	yes

23 A length of double-stranded DNA contains 120 nucleotides and codes for polypeptide X.

What is the maximum length of polypeptide X?

A 20 amino acids

B 40 amino acids

C 60 amino acids

D 120 amino acids

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24 Which statement describes a process that occurs during protein synthesis?

A Transcription is the linking together of a tRNA molecule and a specific amino acid.

B Transcription is the linking together of free DNA nucleotides.

C Translation is the linking together of amino acids coded for by mRNA.

D Translation is the synthesis of an mRNA molecule by base pairing of nucleotides with DNA.

25 During semi-conservative replication of DNA in eukaryotic cells, the following processes occur.

1 Free nucleotides are hydrogen bonded to those on the exposed strand.

2 Hydrogen bonds are broken between the complementary base pairs.

3 The cell receives the signal to begin to divide.

4 Covalent bonds form between adjacent nucleotides on the same strand.

5 The DNA double helix is unwound.

Which shows the correct order of some of the processes?

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

B $3 \rightarrow 2 \rightarrow 4 \rightarrow 5$

C $5 \rightarrow 2 \rightarrow 1 \rightarrow 4$

D $5 \rightarrow 2 \rightarrow 3 \rightarrow 1$

26 During transpiration, from where does the evaporation of water occur?

A intercellular spaces

B leaf surface

C mesophyll cell walls

D stomatal pores

27 When transpiration is at a maximum rate, tree trunks decrease in diameter.

Which statement explains this?

A There is decreased suction pressure in the leaves.

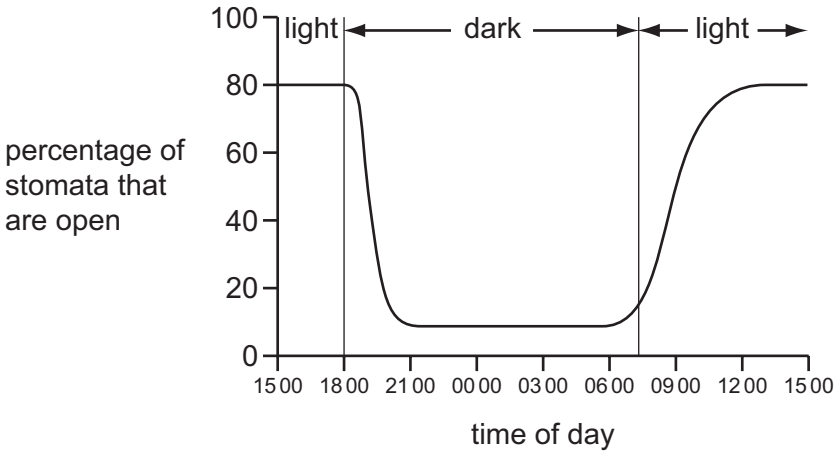
B There is less adhesion between water and xylem vessel walls.

C There is less water in the xylem vessels.

D The water in the xylem vessels is under increased tension.

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28 The graph shows stomatal opening and closing in the leaves of a species of *Pelargonium*, during a 24 hour period.



What can be concluded?

A Gas exchange occurs when stomata are open.

B Stomata open as light intensity increases.

C Stomata open as temperature increases.

D Transpiration does not occur in the dark.

29 Which statement explains how mass flow arises in sieve tube elements?

A Sucrose actively loaded into sieve tube elements decreases the water potential causing the hydrostatic pressure to increase.

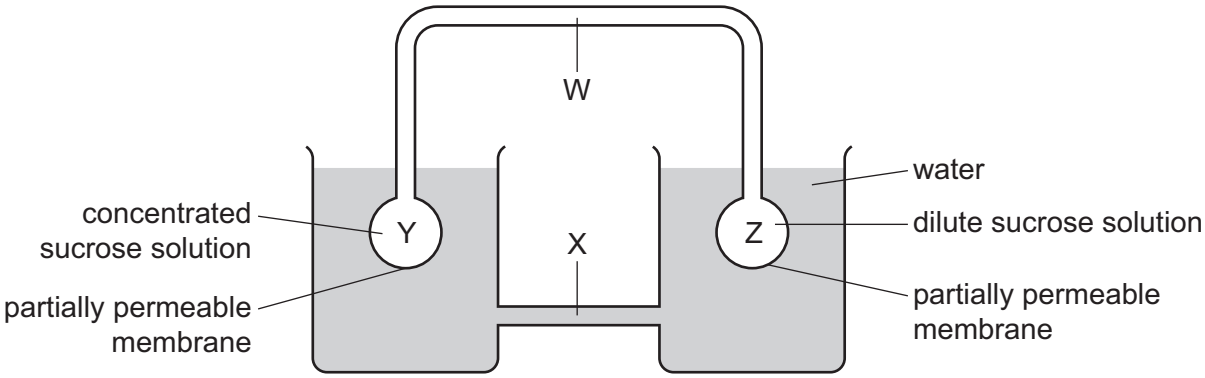
B Sucrose actively loaded into sieve tube elements increases the water potential causing the hydrostatic pressure to decrease.

C Sucrose diffused into sieve tube elements decreases the water potential causing the hydrostatic pressure to increase.

D Sucrose diffused into sieve tube elements increases the water potential causing the hydrostatic pressure to decrease.

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30 The diagram shows a model to demonstrate the mass flow hypothesis of translocation.



In a plant, what are the structures W, X, Y and Z and what is the direction of flow of solution along W?

	phloem	xylem	roots	leaves	direction of flow along W
A	W	X	Y	Z	from Z to Y
B	W	X	Z	Y	from Y to Z
C	X	W	Y	Z	from Y to Z
D	X	W	Z	Y	from Z to Y

31 Which of the following increases the risk of contracting cholera?

1 drinking unpasteurised milk

2 eating shellfish which have fed on raw sewage

3 living in overcrowded conditions

A 2 only

B 1 and 2

C 1 and 3

D 2 and 3

32 Which cells become memory cells in the immune response?

1 B-lymphocytes

2 T-lymphocytes

3 phagocytes

A 1 only

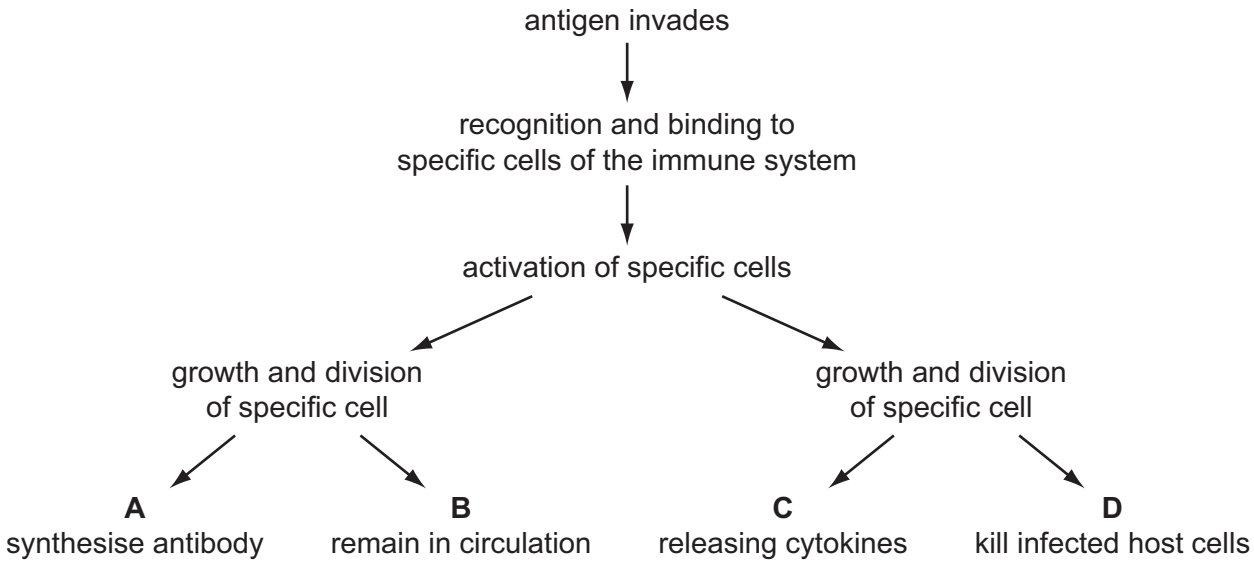
B 2 only

C 1 and 2 only

D 1, 2 and 3

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33 Which describes a T-helper lymphocyte?



34 Antibodies can act in a number of ways to protect the body from pathogenic bacteria.

Which event will **not** occur following antigen-antibody binding?

A agglutination of bacteria to reduce their spread

B increased susceptibility to phagocytosis

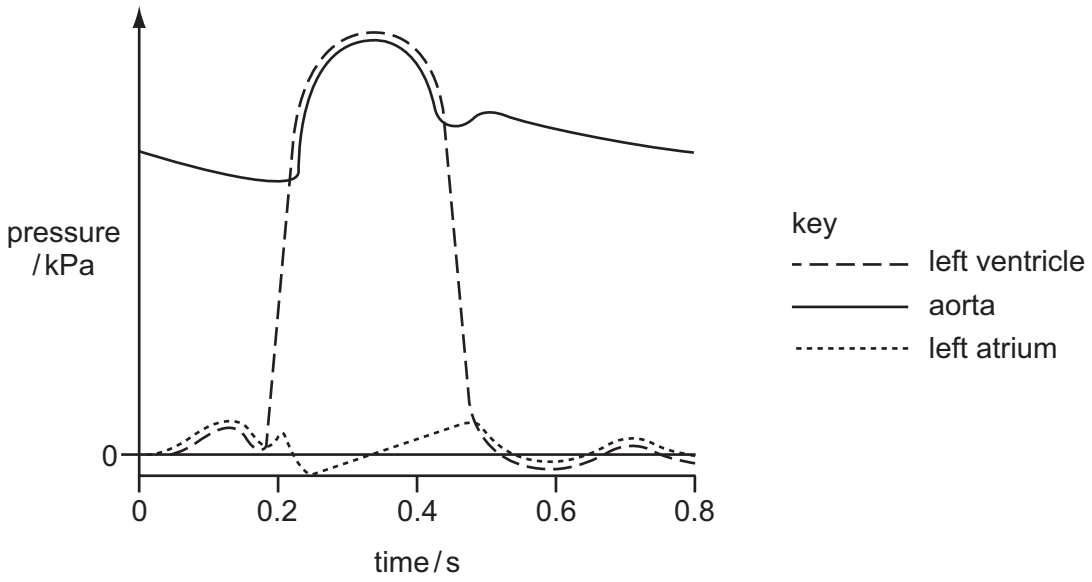
C neutralisation of toxins to make them harmless

D secretion of histamine to produce an allergic reaction

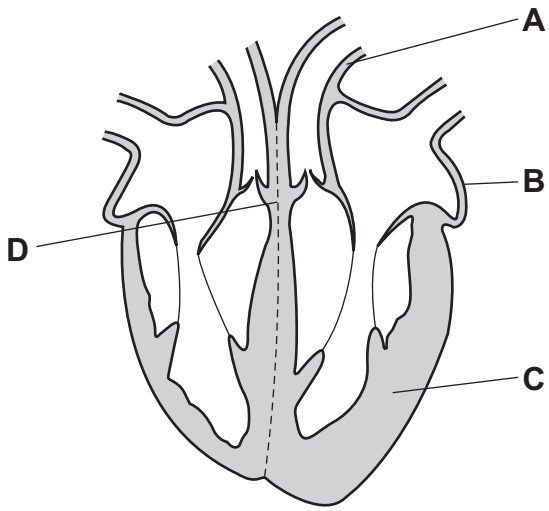
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[Turn over

35 The graph shows the pressure in three parts of the heart during one cycle.



At 0.2 seconds, which part of the heart is responding to the excitatory stimulus?

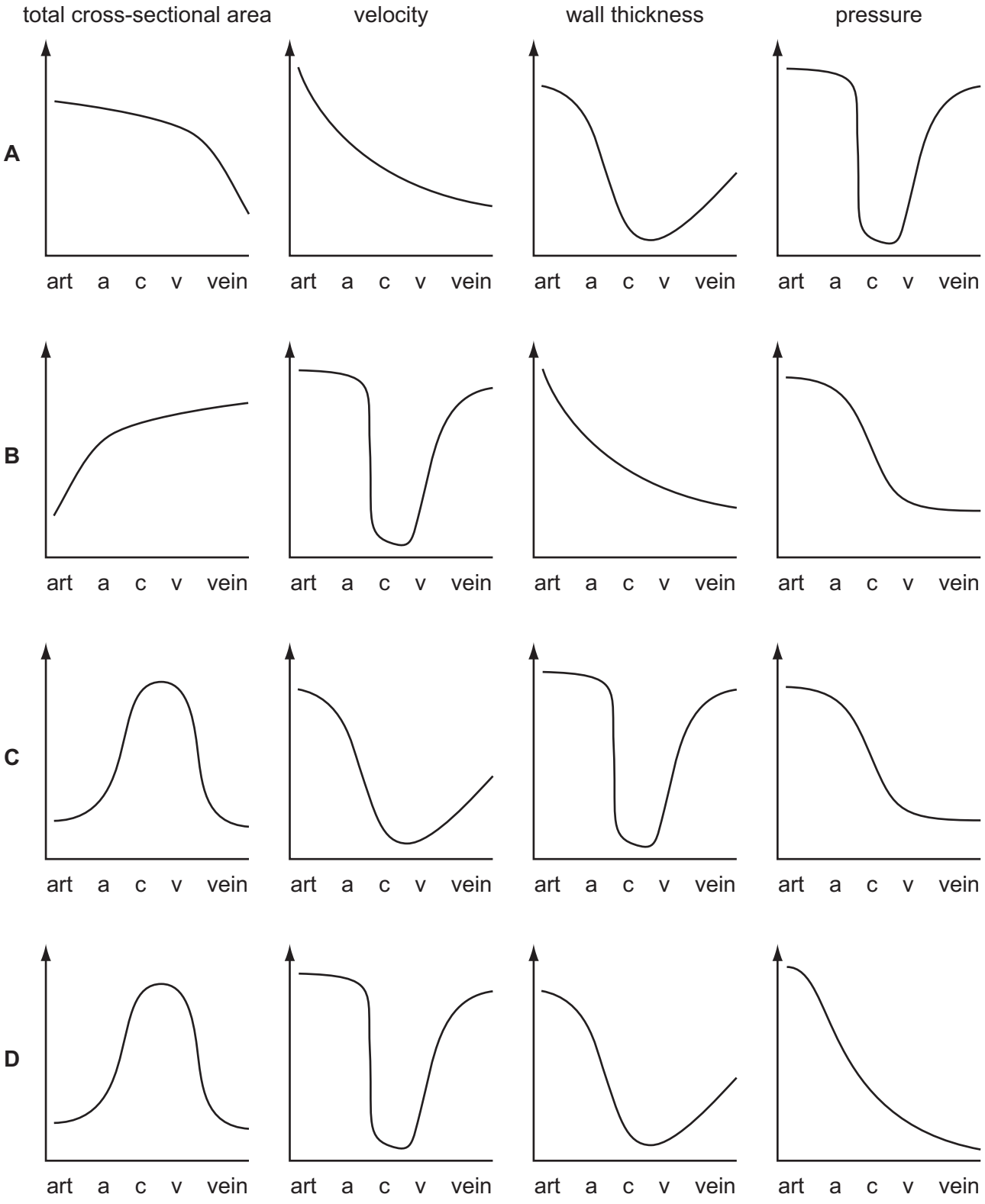


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36 Each set of graphs represents data for blood vessels in the sequence:

art	a	c	v	vein
artery	arterioles	capillaries	venules	veins

Which set is correct?



37 Which is correct about the affinity between haemoglobin and the gases carbon dioxide, carbon monoxide and oxygen?

	highest affinity → lowest affinity		
A	carbon monoxide	carbon dioxide	oxygen
B	carbon monoxide	oxygen	carbon dioxide
C	oxygen	carbon dioxide	carbon monoxide
D	oxygen	carbon monoxide	carbon dioxide

38 An increase in carbon dioxide in human blood shifts the oxyhaemoglobin dissociation curve to the right.

What is the explanation for this effect?

A An increase in carbon dioxide concentration increases the ventilation rate.

B Carbon dioxide is more soluble than oxygen and displaces it.

C Diffusion of carbon dioxide between the alveoli and the blood is more rapid.

D Increasing the H^+ concentration decreases haemoglobin affinity for oxygen.

39 What would be seen in an electron micrograph of a bronchus wall?

1 cartilage cells

2 ciliated cells

3 exocytotic vesicles

A 1 and 2 only

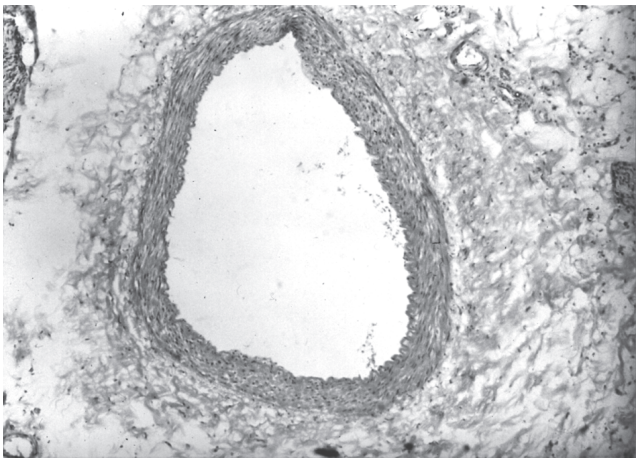
B 1 and 3 only

C 2 and 3 only

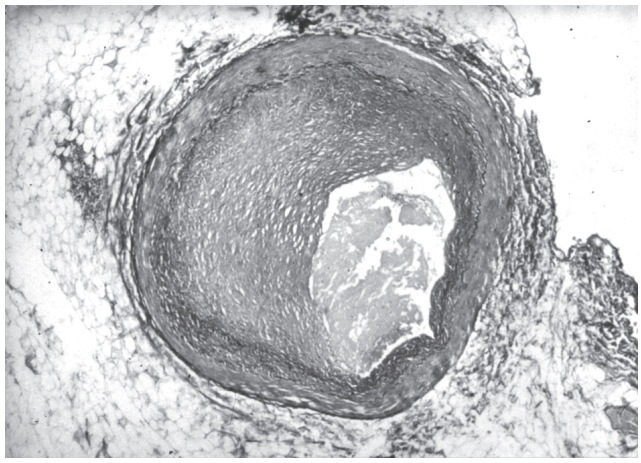
D 1, 2 and 3

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40 The photomicrographs show transverse sections of arteries from a non-smoker and a smoker.



non-smoker



smoker

From the evidence above, which disease is most likely to occur in the smoker?

A cardiovascular disease

B chronic obstructive pulmonary disease (COPD)

C emphysema and chronic bronchitis

D lung cancer

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