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)

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?

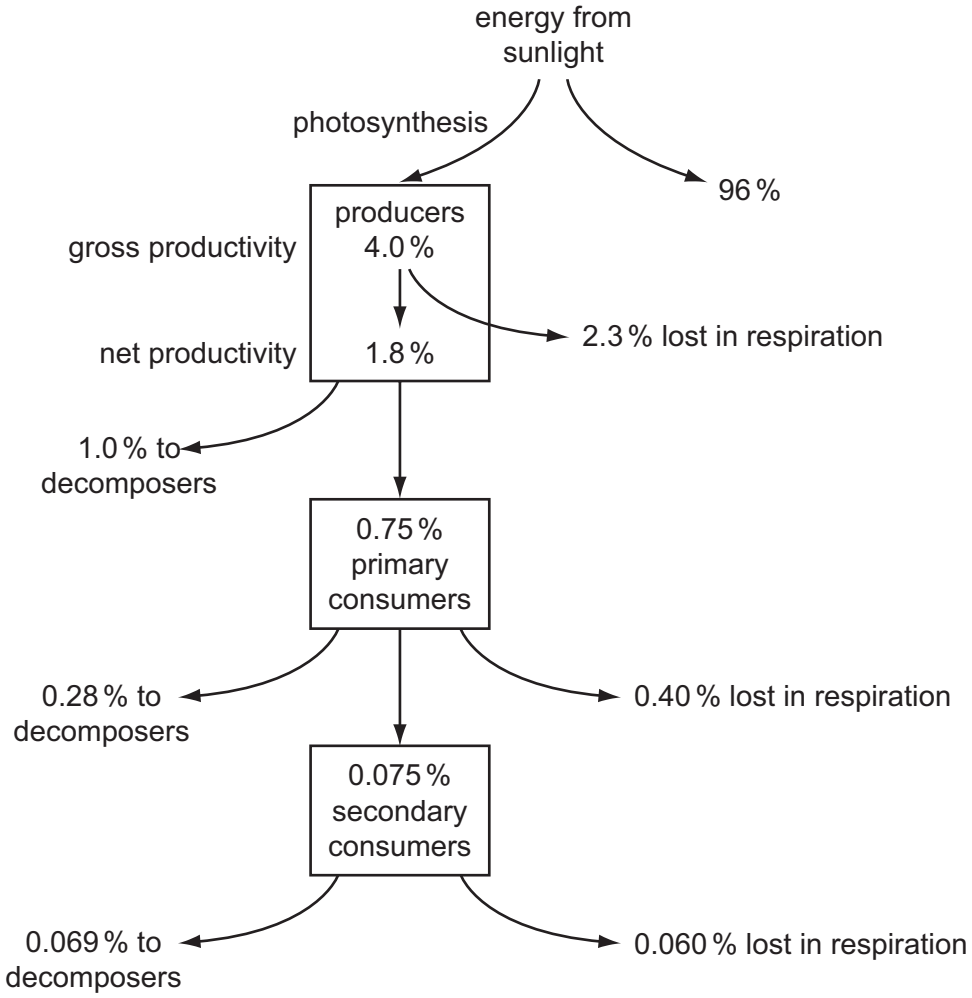
	from →			to
A	R	T	S	U
B	S	T	R	U
C	U	R	S	T
D	U	S	T	R

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

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?

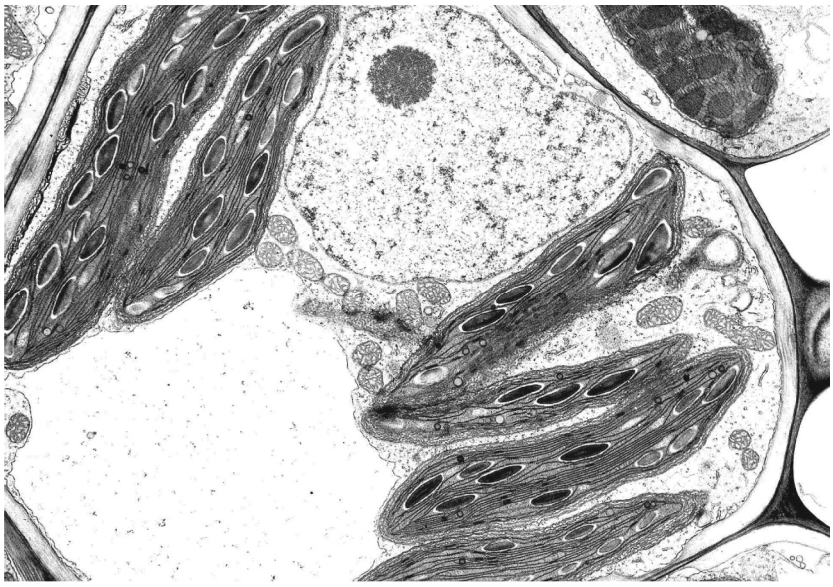
A chloroplasts

B lysosomes

C mitochondria

D ribosomes

8 The magnification of the photomicrograph is ×4000.

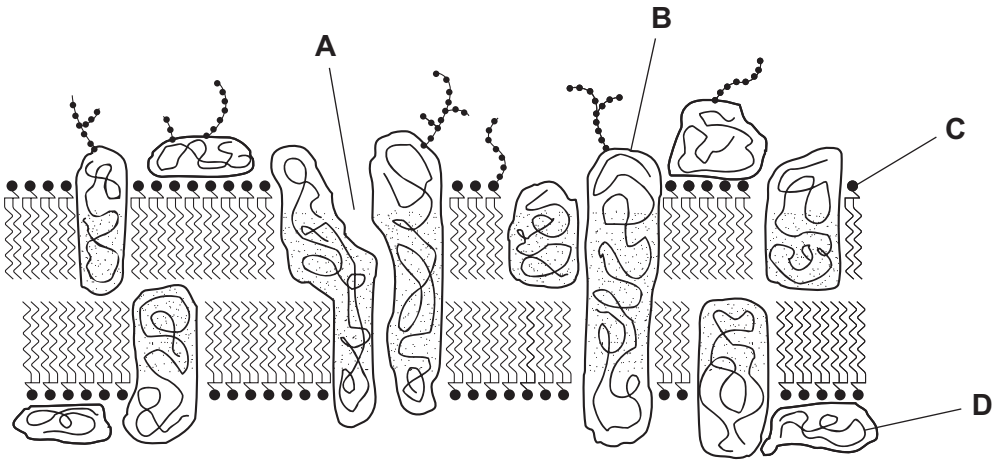


What is the actual size of the nucleolus?

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

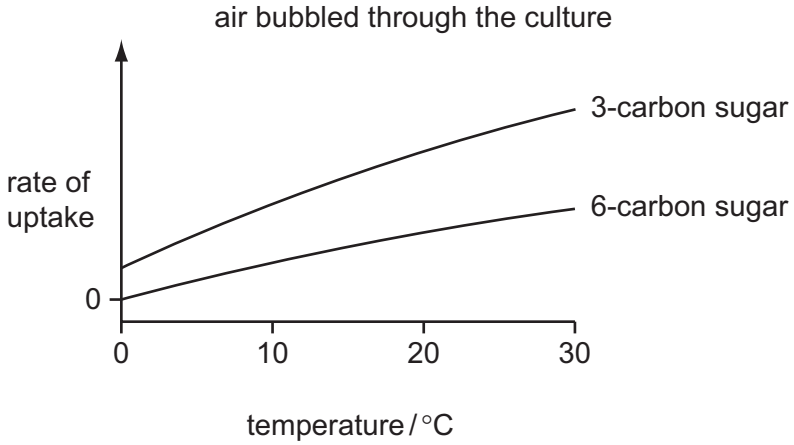
A 2 only

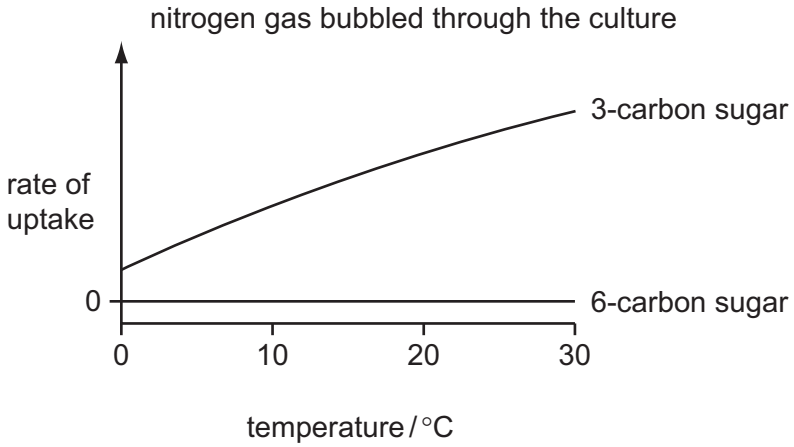
B 1 and 4 only

C 2 and 3 only

D 1, 2, 3 and 4

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

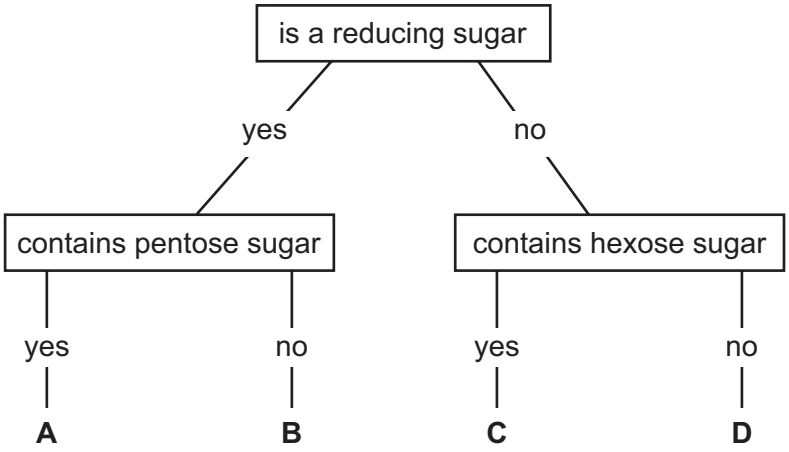




How are the sugars taken up by the cells when air is bubbled through the culture?

	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

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

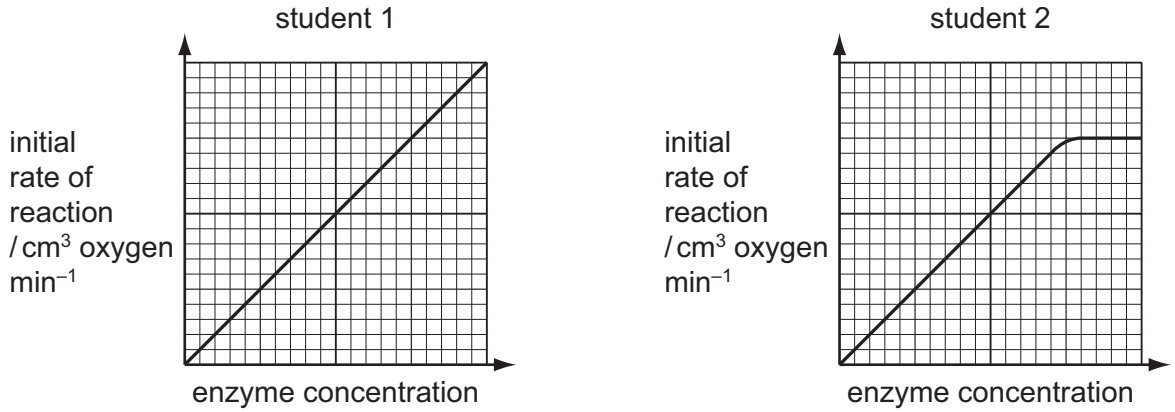
A 1 and 2 only
B 1 and 3 only
C 2 and 3 only
D 1, 2 and 3

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

A primary
B secondary
C tertiary
D quaternary

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.

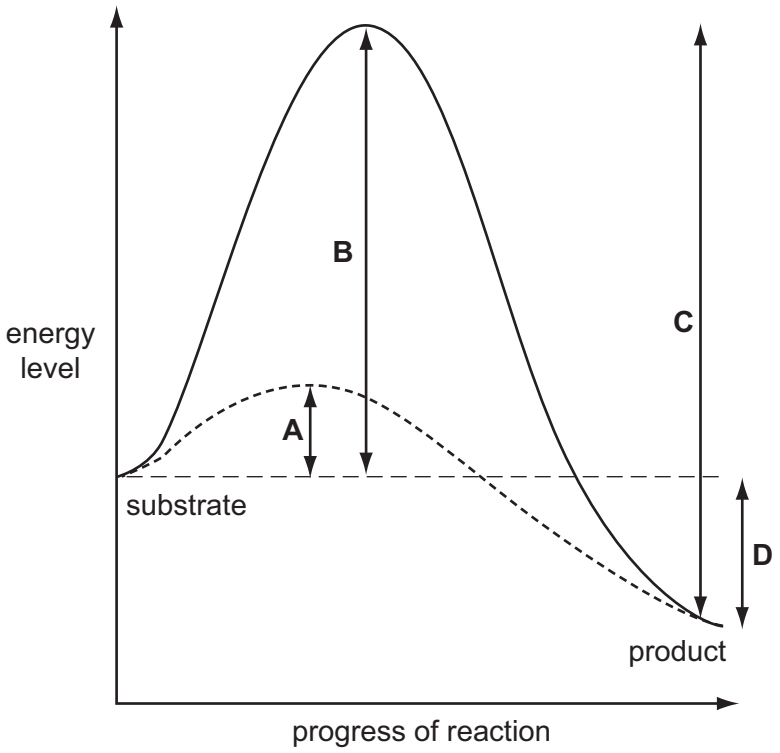
B Student 2 performed the investigation at a higher temperature.

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

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?

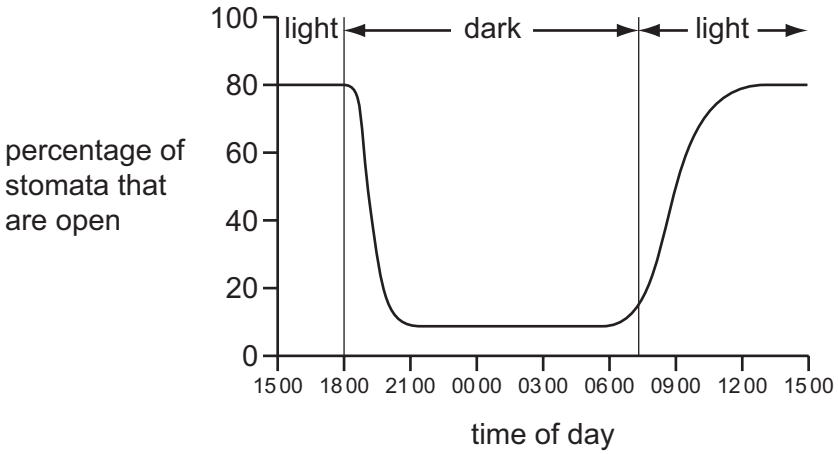
A There is decreased suction pressure in the leaves.

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.

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?

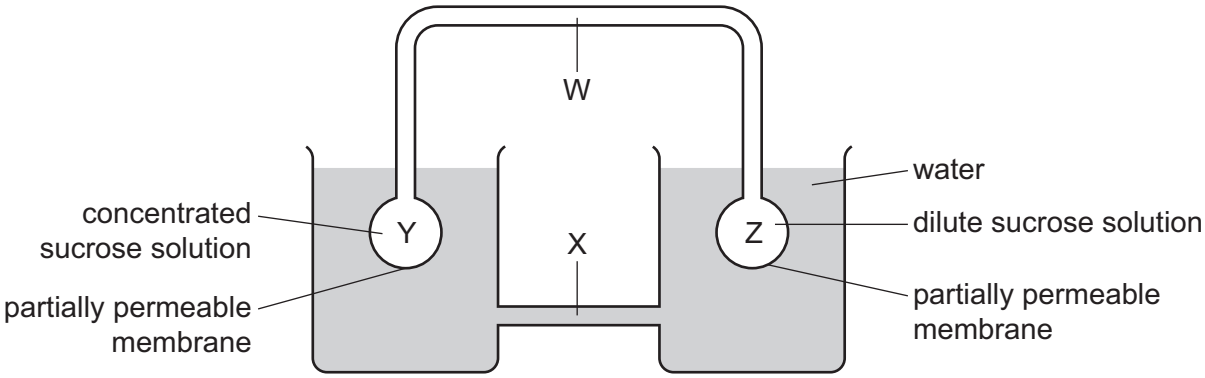
A Sucrose actively loaded into sieve tube elements decreases the water potential causing the hydrostatic pressure to increase.

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.

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

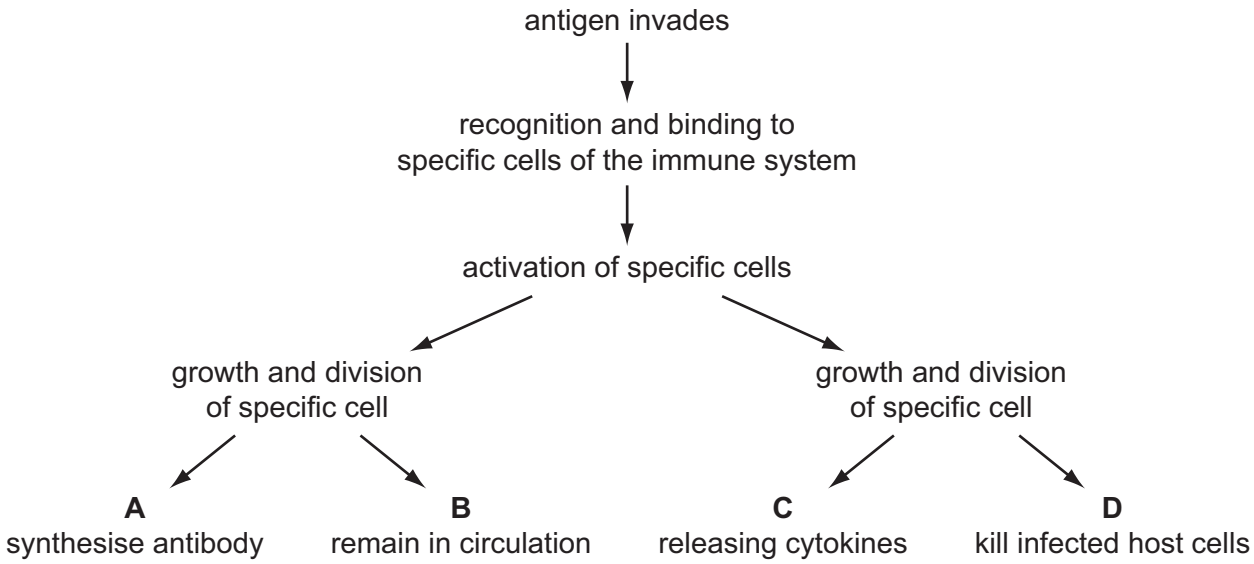
A 1 only

B 2 only

C 1 and 2 only

D 1, 2 and 3

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

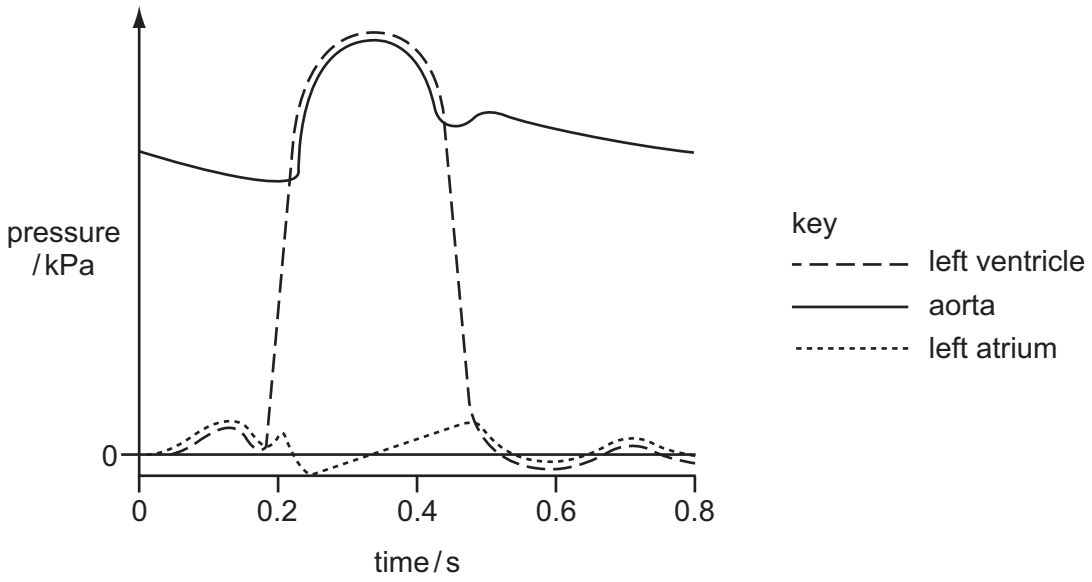
B increased susceptibility to phagocytosis

C neutralisation of toxins to make them harmless

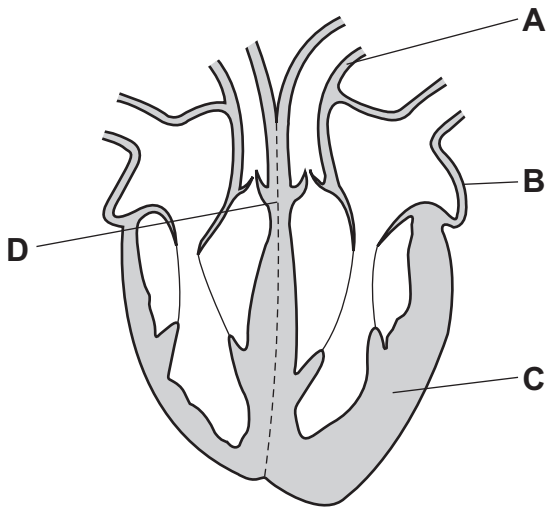
D secretion of histamine to produce an allergic reaction

[Turn over

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



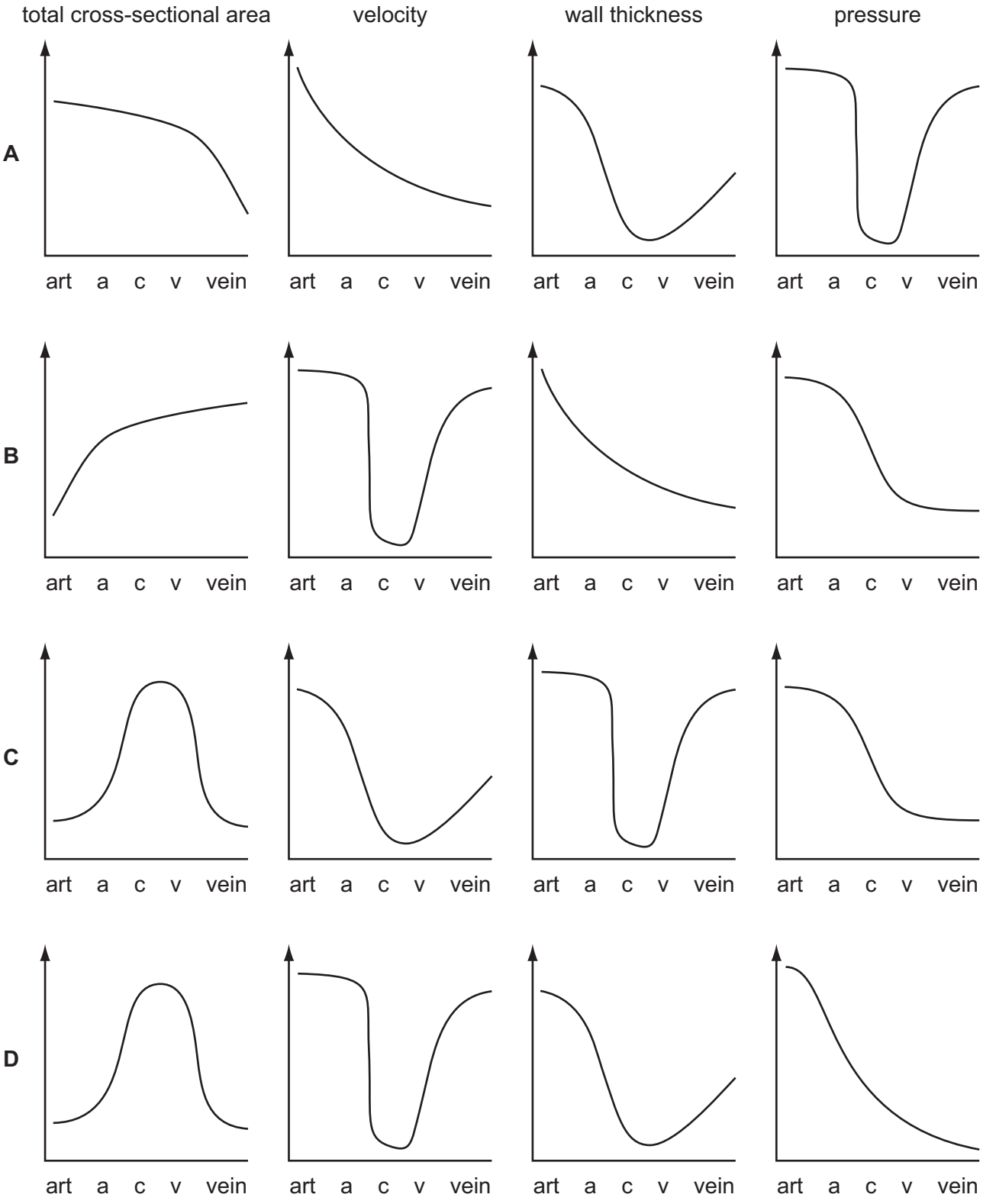
At 0.2 seconds, which part of the heart is responding to the excitatory stimulus?



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

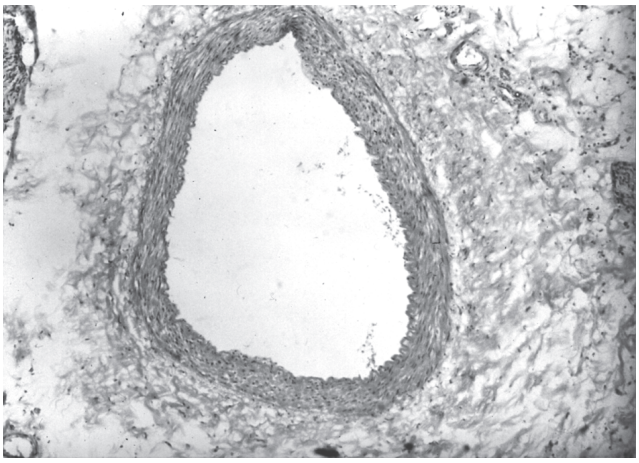
A 1 and 2 only

B 1 and 3 only

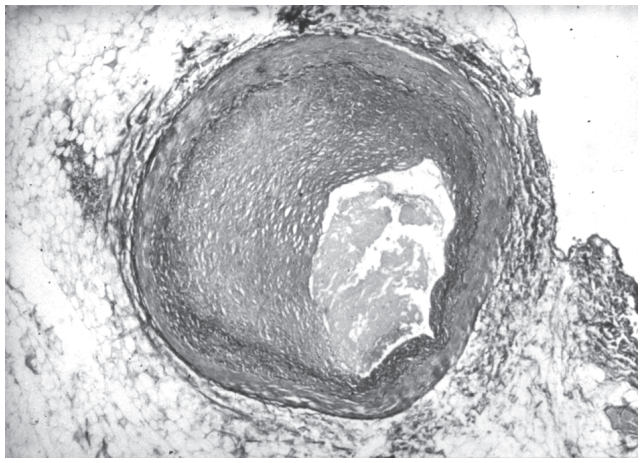
C 2 and 3 only

D 1, 2 and 3

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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