Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/12**

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)

1003441361

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 **16** printed pages.

1 Until recently, the typical viruses known to science were 20 – 150 nm in size.

In 2003, the Mimivirus was discovered with a size of approximately 680 nm.

In 2013, the Pandoravirus was discovered which has a size of over 1000 nm.

Which viruses can be seen using **both** a light microscope with a maximum resolution of 0.25 μm and an electron microscope?

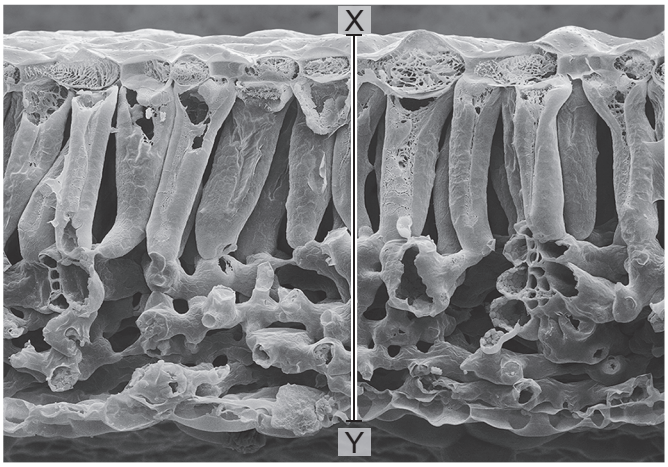
	typical virus	Mimivirus	Pandoravirus
A	✓	✓	✓
B	✗	✓	✓
C	✗	✗	✓
D	✗	✗	✗

key

✓ = can be seen

✗ = cannot be seen

2 This electron micrograph of a section of a leaf has a magnification of × 210.



What is the actual length along the line X–Y?

A 2.43 μm **B** 24.3 μm **C** 243.0 μm **D** 2430 μm

3 What is the correct order in which organelles function to make and secrete an enzyme?

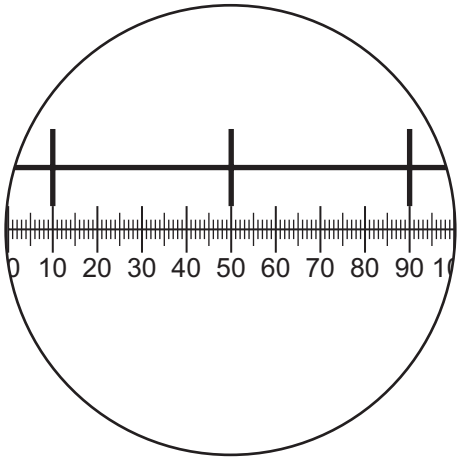
A nucleolus → ribosome → Golgi body → vesicle

B nucleolus → smooth endoplasmic reticulum → lysosome → vesicle

C nucleus → rough endoplasmic reticulum → Golgi body → vesicle

D nucleus → smooth endoplasmic reticulum → lysosome → vesicle

4 The diagram shows a stage micrometer scale, with divisions 0.1 mm apart, viewed through an eyepiece containing a graticule.



What is the area of the field of view of the microscope at this magnification? (π = 3.14)

A $\pi \times 12.5 \times 12.5 = 4.9 \times 10^2\ \mu m^2$

B $\pi \times 50 \times 50 = 7.9 \times 10^3\ \mu m^2$

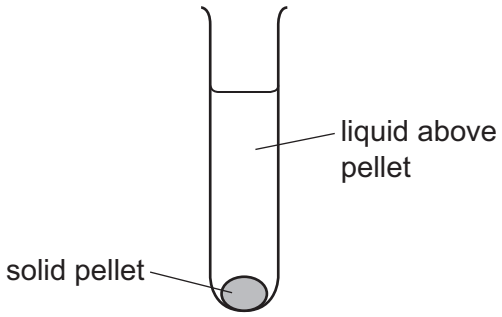
C $\pi \times 125 \times 125 = 4.9 \times 10^4\ \mu m^2$

D $\pi \times 250 \times 250 = 2.0 \times 10^5\ \mu m^2$

5 A scientist carried out an experiment to separate the organelles in an animal cell by mass.

The scientist mixed the cells with a buffer solution which had the same water potential as the cells. He then broke the cells open with a blender to release the organelles.

The extracted mixture was filtered and then spun in a centrifuge at a high speed to separate the heaviest organelle. This sank to the bottom, forming a solid pellet, 1.



The liquid above pellet 1 was poured into a clean centrifuge tube and spun in the centrifuge at a higher speed to separate the next heaviest organelle. This organelle sank to the bottom, forming a solid pellet, 2.

He repeated this procedure twice more to obtain pellet 3 and pellet 4, each containing a single organelle.

What is the function of the organelle extracted in pellet 2?

A digestion of old organelles

B production of ATP

C production of mRNA

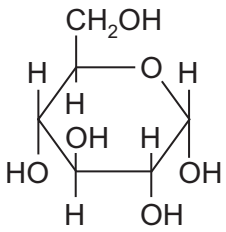
D synthesis of protein

6 Which is a correct comparison between a typical prokaryotic cell and a typical eukaryotic cell?

	prokaryote	eukaryote
A	circular DNA only	linear DNA only
B	naked DNA	DNA associated with protein
C	rough endoplasmic reticulum present	smooth endoplasmic reticulum and rough endoplasmic reticulum present
D	ribosomes approximately 22 nm diameter	ribosomes approximately 18 nm in diameter

7 The diagrams show four monosaccharides with the formula $C_6H_{12}O_6$.

1



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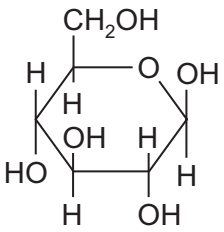

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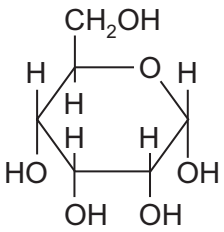

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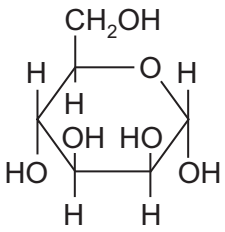


Which diagrams do **not** show glucose molecules?

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

8 Complete digestion of polysaccharides requires all the glycosidic bonds between the monomers to be broken.

Amylase breaks only α-1,4 glycosidic bonds.

How completely can amylase digest molecules of amylose, amylopectin or glycogen?

	carbohydrate		
	amylose	amylopectin	glycogen
A	+	+++	++
B	+	++	+++
C	++	+	+++
D	+++	++	+

key

+	some digestion
++	more digestion
+++	most digestion

9 Which statements about a triglyceride molecule are correct?

1 It always contains unsaturated hydrocarbon tails.

2 It is formed using ester bonds.

3 It does not form hydrogen bonds.

4 It contains a hydrophilic glycerol head.

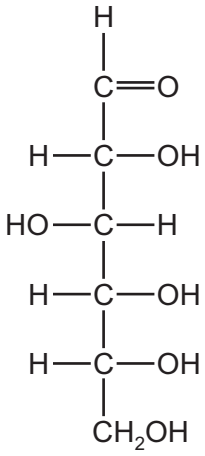
A 1, 2 and 3 **B** 2, 3 and 4 **C** 1 and 4 only **D** 2 and 3 only

10 The table shows some features of collagen and haemoglobin.

Which row is collagen?

	type of protein	number of polypeptides	solubility in water
A	fibrous	three	insoluble
B	fibrous	four	soluble
C	globular	three	insoluble
D	globular	four	soluble

11 The ring structure of sugars can also be represented as a linear structure, as shown in the diagram.



Which of the sugar molecules could be represented by this formula?

1 β-glucose

2 ribose

3 sucrose

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

12 What is the minimum number of carbon atoms in an amino acid?

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

13 HIV-1 protease is an enzyme produced by the HIV virus.

Two identical chains of 99 amino acids form the enzyme. In each chain, amino acids 25, 26 and 27 in the sequence form part of the active site.

Which orders of protein structure control the shape of the active site?

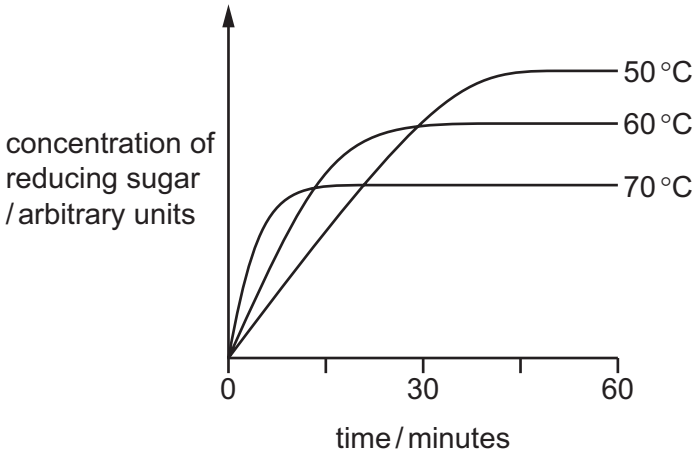
A primary, secondary, tertiary and quaternary

B primary, secondary and tertiary only

C primary and quaternary only

D quaternary only

14 The graph shows the results of an investigation into the effect of amylase on starch at three different temperatures.



Which statements are correct conclusions using these results?

1 The optimum temperature is 50 °C.

2 The initial rate of reaction is highest at 70 °C.

3 The higher the temperature the more quickly the enzyme denatures.

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

15 Substances called furanocoumarins are found in some fruits, where they act as inhibitors of the enzyme CYP3A4. This enzyme is needed to break down toxins in the human digestive system, so dangerous levels of these toxins may develop if these fruits are eaten.

What does this information suggest about molecules of the enzyme CYP3A4?

A They lower the activation energy of the toxin breakdown process.

B They show specificity for a particular substrate found in fruits.

C They will change permanently when acted upon by furanocoumarin molecules.

D They will resume normal activity when levels of furanocoumarins decrease.

16 Which observations support a link between active transport and ATP production?

1 Active transport occurs only in living cells.

2 The rate of active transport decreases in low oxygen concentrations.

3 Companion cells have large numbers of mitochondria.

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

17 A method called freeze-fracture can be used to study the structure of cell membranes. The membrane is frozen and then split down the middle, separating the two layers of phospholipids from each other. Any proteins contained within one layer remain in that layer. Proteins which span the membrane can be found in either layer after freeze-fracture, depending on the properties of the protein.

Which statement about the results of freeze-fracture studies are correct?

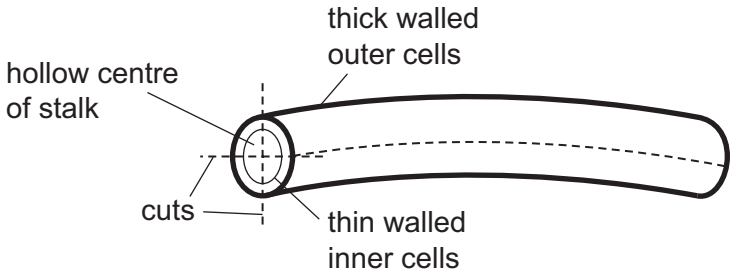
1 It provides evidence for the bilayer nature of membranes.

2 It provides evidence for the arrangement of proteins.

3 It shows that the proteins in the membrane do not contribute to its strength.

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

18 The stalk of a dandelion flower is a hollow tube. Pieces of the stalk are cut as shown and placed in sucrose solutions of different water potentials.



Which diagram shows the piece that is placed in the sucrose solution with the highest water potential?

A

B

C

D

19 Three of the molecules found in prokaryotes are listed below.

1 phospholipid

2 protein

3 peptidoglycan

Which of these molecules are found in prokaryotic cell surface membranes?

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

20 Which row correctly shows the behaviour of the nuclear envelope, the centrioles and the spindle during a stage of mitosis?

	stage of mitosis	behaviour of organelle		
		nuclear envelope	centrioles	spindle
A	prophase	disappears	replicate	spindle microtubules begin to form
B	metaphase	not present	begin to move to poles of cell	spindle microtubules fully formed
C	anaphase	begins to reform	at opposite poles of the cell	some spindle microtubules shorten
D	telophase	reforms	one beside each nucleus	spindle microtubules break down

21 Which group of cells can all divide by mitosis?

A bacterial cells, cancer cells, stem cells

B bacterial cells, lymphocytes, stem cells

C cancer cells, lymphocytes, red blood cells

D cancer cells, lymphocytes, stem cells

22 Which row represents the correct features of the nitrogenous base cytosine?

	has a single ring structure	is a purine	joins its complementary base by three hydrogen bonds
A	✓	✓	✗
B	✓	✗	✓
C	✗	✓	✗
D	✗	✗	✓

key

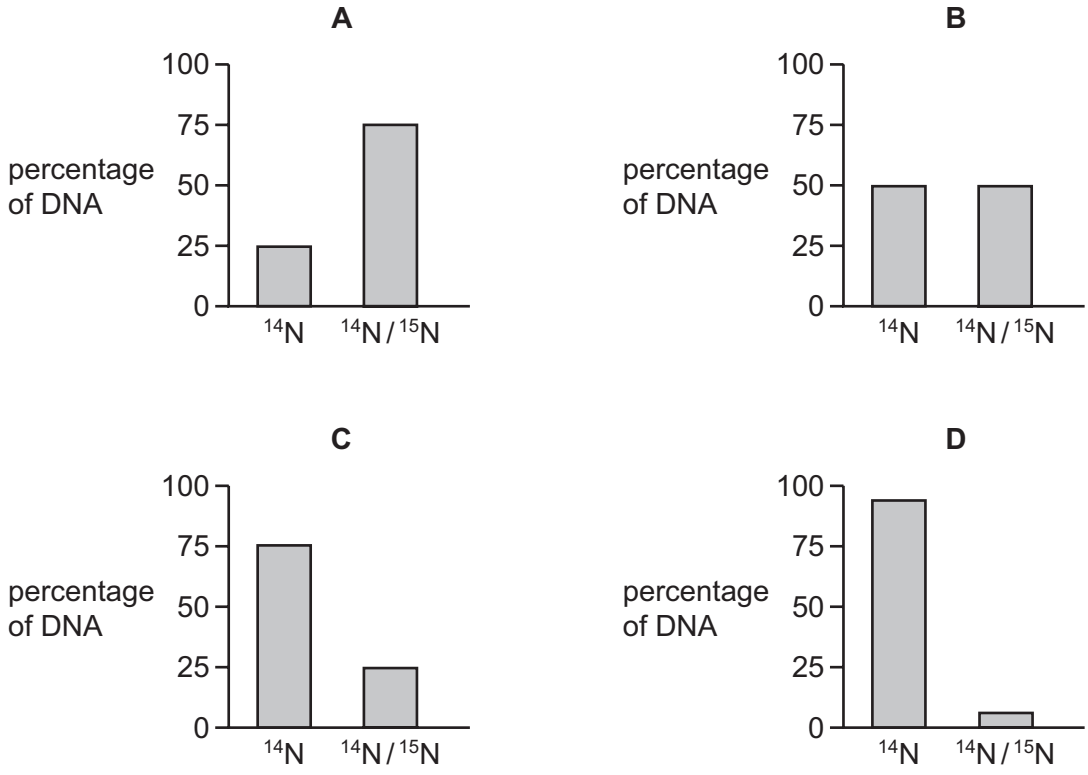
✓ = true

✗ = false

23 Bacteria were grown in a medium containing ^{15}N. After several generations, all of the DNA contained ^{15}N. Some of these bacteria were transferred to a medium containing the common isotope of nitrogen, ^{14}N. The bacteria were allowed to divide once. The DNA of some of these bacteria was extracted and analysed. This DNA was all hybrid DNA containing equal amounts of ^{14}N and ^{15}N.

In another experiment, some bacteria from the medium with ^{15}N were transferred into a medium of ^{14}N. The bacteria were allowed to divide three times. The DNA of some of these bacteria was extracted and analysed.

What is the composition of this DNA?



24 Which processes are involved in the mass movement of water through xylem vessels?

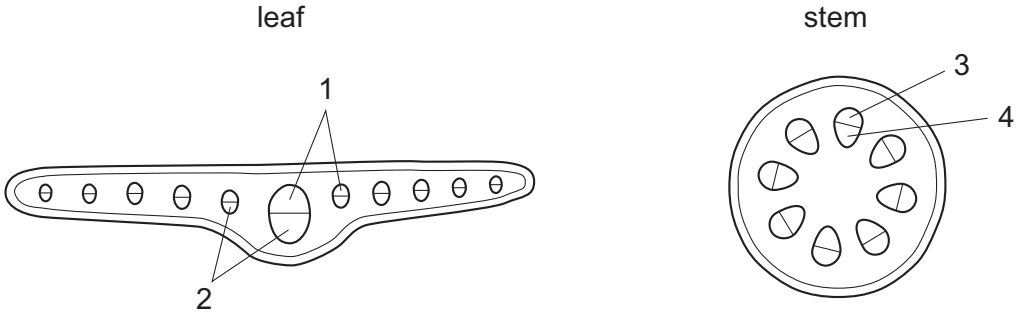
1 hydrogen bonding between water molecules

2 cohesion between water molecules

3 adhesion between water molecules and lignin

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

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



In the transverse sections, which tissues transport most mineral ions?

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

key
✓ = yes
✗ = no

26 Which changes to the water potential and the volume of liquid in the phloem occur when amino acids are transferred from leaves to be transported to a sink in the phloem sieve tube element?

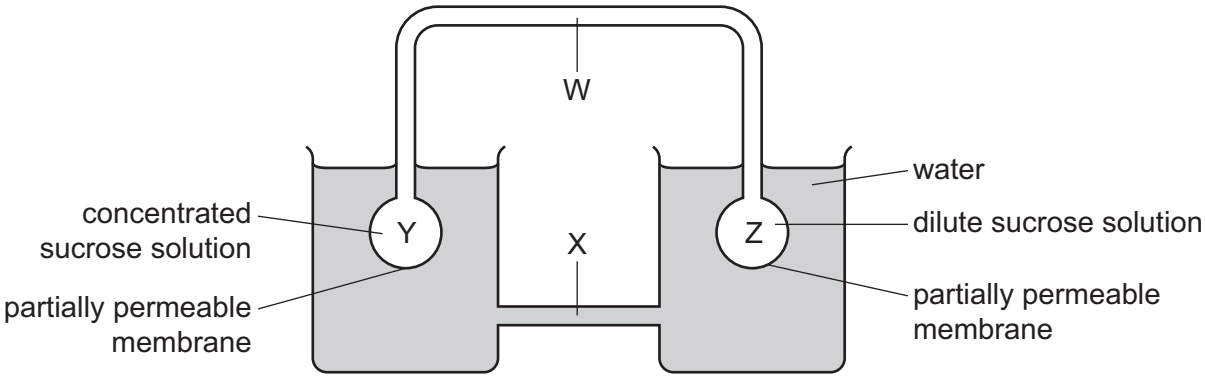
	water potential in phloem sieve tube element	volume of liquid in phloem sieve tube element
A	higher	decreases
B	higher	increases
C	lower	decreases
D	lower	increases

27 External factors change the rate of transpiration, which also affects the water potential gradient of cells in the leaf.

Which combination of statements is correct?

	external factor changing the rate of transpiration	water potential gradient in the leaf
A	decreasing temperature	increases
B	decreasing wind speed	increases
C	increasing relative humidity	decreases
D	increasing sunlight	decreases

28 The diagram shows a model to demonstrate mass flow.



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

29 Which blood vessels carry blood into the atria of the heart?

A coronary artery and pulmonary artery

B pulmonary artery and vena cava

C pulmonary vein and vena cava

D vena cava and coronary artery

30 Which statement describes the effect of increased carbon dioxide concentration on the oxygen dissociation curve of human haemoglobin and its significance?

A The curve shifts to the left allowing haemoglobin to bind more oxygen in active tissues.

B The curve shifts to the left allowing haemoglobin to offload more oxygen in active tissues.

C The curve shifts to the right allowing haemoglobin to bind more oxygen in active tissues.

D The curve shifts to the right allowing haemoglobin to offload more oxygen in active tissues.

31 What combines with haemoglobin to form carbaminohaemoglobin?

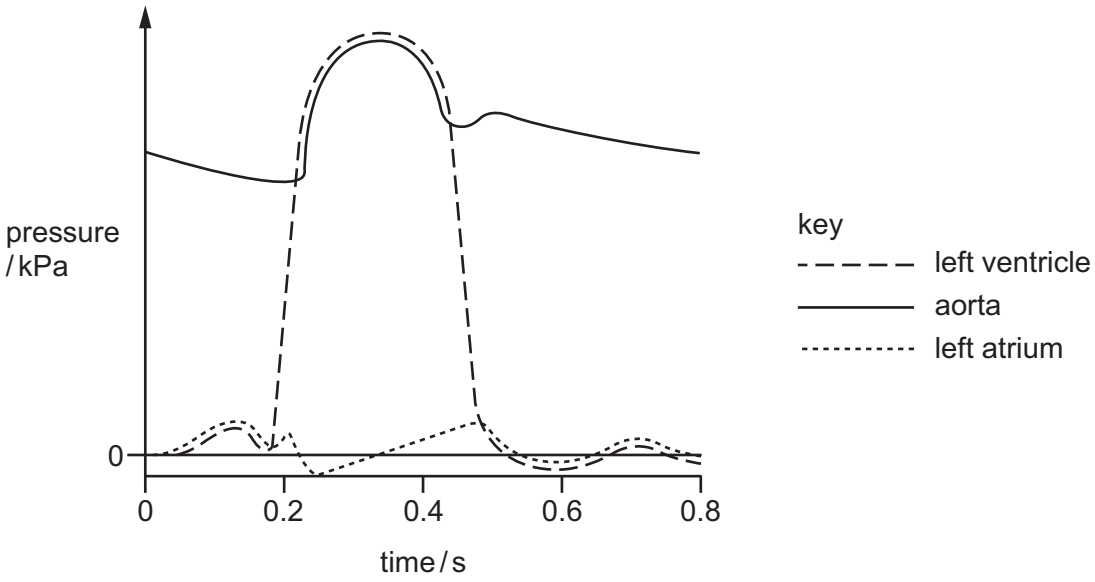
A carbon dioxide

B carbon monoxide

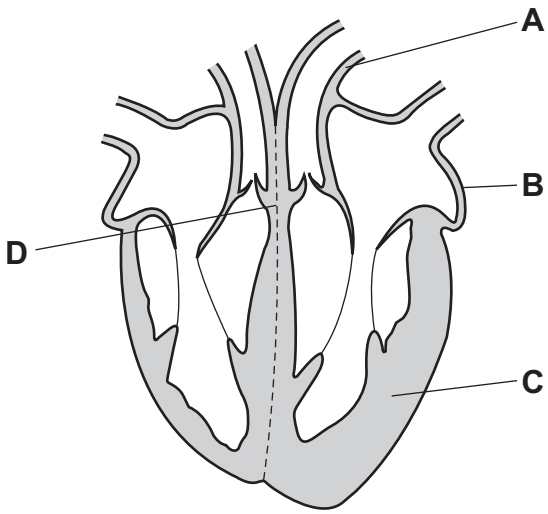
C carbonic acid

D hydrogencarbonate ions

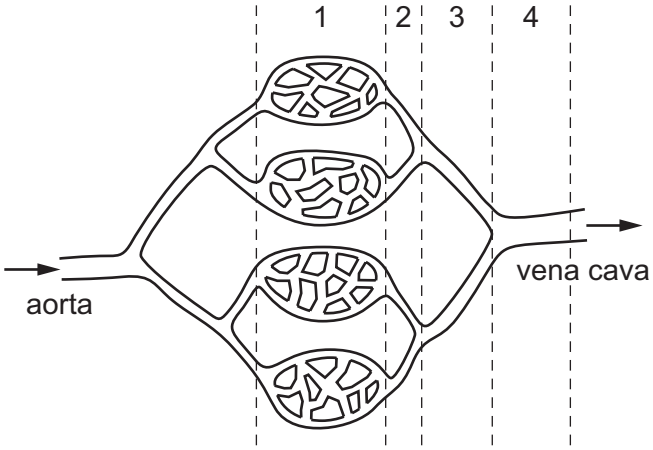
32 The graph shows the pressure in three parts of the heart during one cycle.



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



33 The diagram shows part of the organisation of the circulation of a mammal.



Where are **both** the blood pressure and speed of flow lowest?

	lowest blood pressure	lowest speed of flow
A	1	4
B	2	3
C	3	2
D	4	1

34 A student made some labelled drawings of lung tissue using the high-power lens of a light microscope, but did not label two airways, P and Q.

The drawing of the lining layer of P showed both ciliated cells and goblet cells, whilst the drawing of the lining layer of Q showed ciliated cells but very few goblet cells.

What are airways P and Q?

	airway	
	P	Q
A	bronchiole	trachea
B	bronchiole	bronchus
C	bronchus	bronchiole
D	trachea	bronchus

35 What maintains the steep concentration gradients needed for successful gas exchange in the lungs?

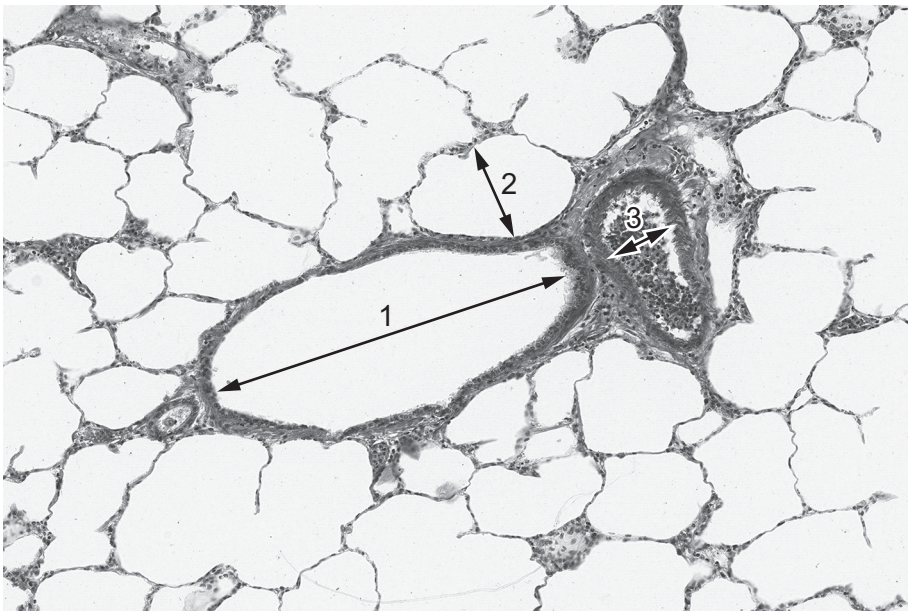
1 Air flow in the alveoli is in the opposite direction to blood flow in the capillaries.

2 Blood arrives in the lungs with a lower oxygen concentration and a higher carbon dioxide concentration than the air in the alveoli.

3 Blood is constantly flowing through and out of the lungs, bringing a fresh supply of red blood cells.

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

36 The photomicrograph shows part of the lung as seen using a light microscope.



Which row is correct for the features labelled 1, 2 and 3?

	1	2	3
A	alveolus	bronchiole	capillary
B	alveolus	capillary	bronchiole
C	bronchiole	alveolus	small artery
D	small artery	alveolus	bronchiole

37 Which disease is **not** likely to be passed directly from parents to child?

A cholera

B malaria

C sickle cell anaemia

D tuberculosis

38 Why is it difficult to control the spread of measles?

1 Global air travel for commerce and tourism has increased.

2 The virus that causes measles rapidly evolves resistance to antibiotics.

3 The virus that causes measles shows great antigenic variability.

4 Civil unrest and poverty result in overcrowded living conditions.

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

39 The following are all responses made by cells of the immune system to a pathogen.

1 mitosis

2 bind to infected cell

3 produce memory cells

4 secrete antibodies

Which of the responses is correct for β-lymphocytes?

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

40 What occurs when active immunity is artificially induced?

A Non-self antibodies attack self antigens.

B Non-self antigens attack self antibodies.

C Self antibodies attack non-self antigens.

D Self antigens attack non-self antibodies.