Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/13**

Paper 1 Multiple Choice **October/November 2017**

1 hour

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

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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.

CAMBRIDGE International Examinations

1 Which statement about the light microscope is correct?

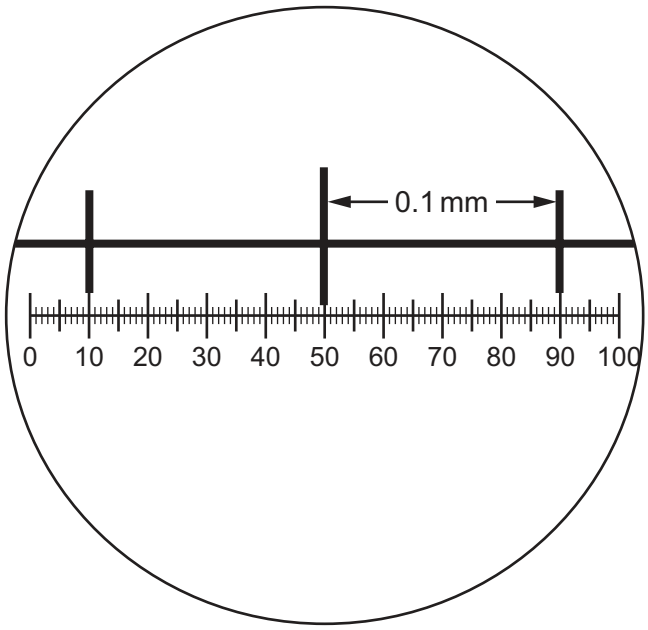
A As the smallest distance to see two points as distinct separate points decreases, the resolution also decreases.

B If the resolution is 220 nm, then a bacterium 0.2 μm in diameter will not be visible.

C If the wavelength of light is 600 nm, then two membranes 300 nm apart will be visible as two distinct membranes.

D Using visible light of a longer wavelength, such as red light, will improve the resolution.

2 The diagram shows a stage micrometer scale viewed with an eyepiece graticule, using a magnification of ×200.



Using the same magnification, a chloroplast is measured as 4 eyepiece graticule divisions long.

How long is the chloroplast?

A 1.0×10^{1} μm

B 4.0×10^{2} μm

C 2.5×10^{-1} μm

D 2.5×10^{-2} μm

3 A cell was supplied with cytosine labelled with radioactive carbon.

In which cell structure would radioactivity be detected first?

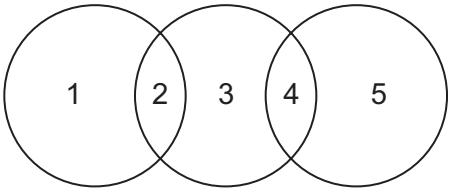
A endoplasmic reticulum

B Golgi body

C nucleus

D ribosome

4 The diagram shows some similarities between chloroplasts, mitochondria and typical prokaryotes.



Which row is correct?

	1	2	3	4	5
A	chloroplasts	circular DNA	mitochondria	80S ribosomes	prokaryotes
B	chloroplasts	80S ribosomes	mitochondria	circular DNA	prokaryotes
C	prokaryotes	circular DNA	mitochondria	circular DNA	chloroplasts
D	prokaryotes	70S ribosomes	chloroplasts	80S ribosomes	mitochondria

5 Which statement supports the fact that mature plant cells can carry out the same role as lysosomes?

A A range of hydrolytic enzymes can be found within mature plant vacuoles.

B Glycogen, found within vesicles, can be hydrolysed to glucose molecules.

C Single membrane-bound vesicles are formed from plant Golgi bodies.

D Vesicles, formed from smooth endoplasmic reticulum, contain enzymes.

6 A student carried out four tests for biological molecules on a sample of milk.

The tests and their results were as follows.

- Heating to 80 °C with Benedict's solution gave a green colour.
- Adding Biuret solution gave a purple colour.
- Adding iodine solution gave an orange colour.
- Boiling with acid, followed by neutralisation, then heating to 80 °C with Benedict's solution gave a brick red colour.

Which conclusion about these results is correct?

A only protein and reducing sugar present

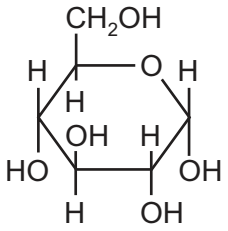
B only protein and non-reducing sugar present

C only protein, reducing sugar and non-reducing sugar present

D only starch, protein and sugar present

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

1



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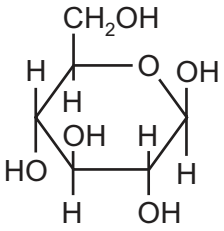

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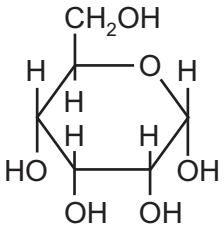

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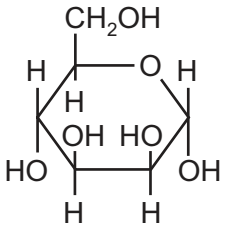


Which diagrams show glucose molecules?

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

8 Which bonds will be broken when a molecule of glycogen is broken down?

1 α-1, 4

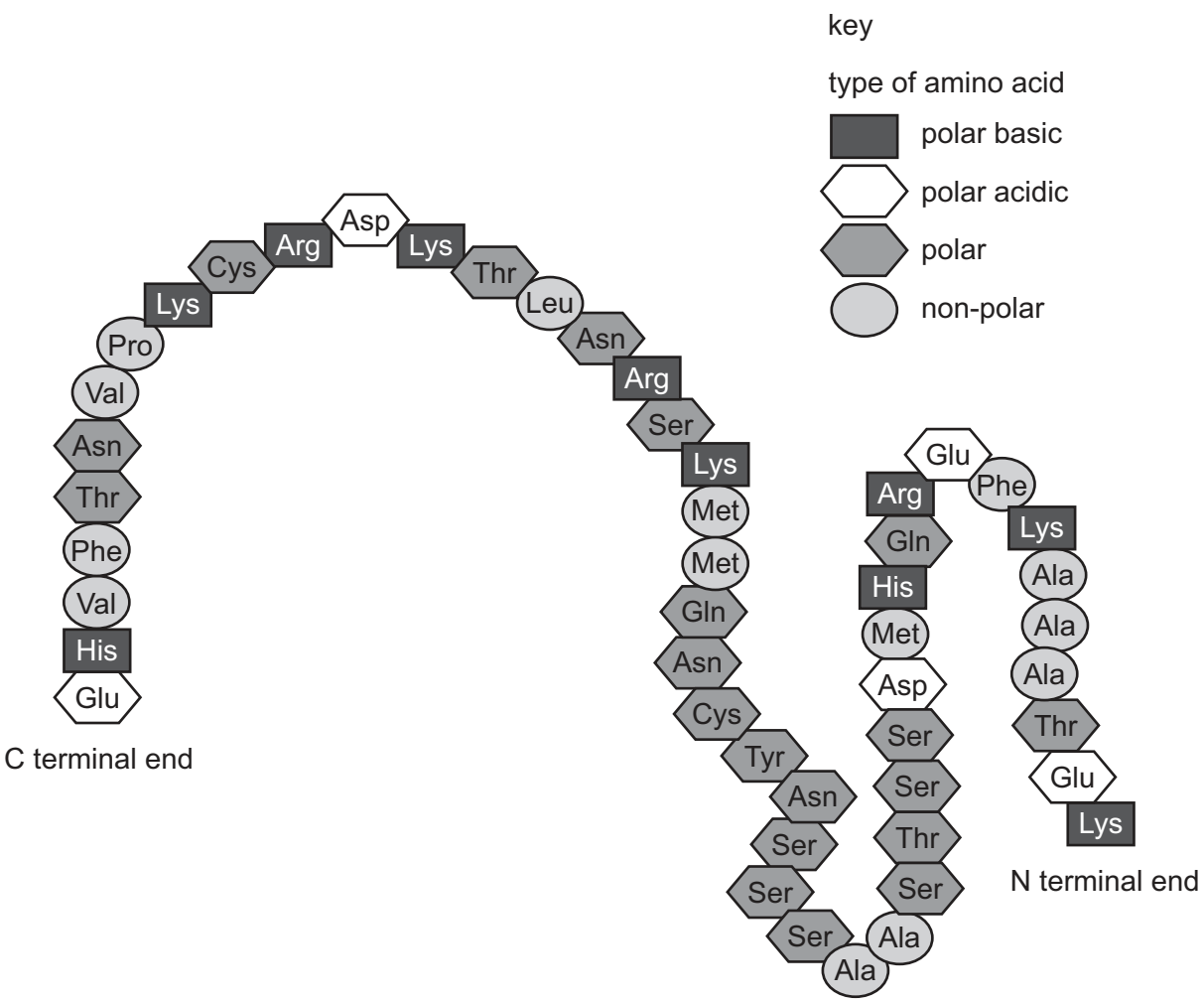
2 β-1, 4

3 α-1, 6

4 β-1, 6

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

9 The diagram shows the amino acids in a polypeptide.



An enzyme catalyses the hydrolysis of **any** peptide bond between a non-polar amino acid **and** any polar amino acid.

How many small peptides and single amino acids will be formed by the action of this enzyme?

	small peptides	single amino acids
A	6	1
B	8	1
C	12	3
D	13	4

10 A person with diabetes is unable to make enough of the protein insulin.

Some forms of diabetes can be treated by using insulin produced by animals. Scientists have compared the amino acids in insulin produced by animals to human insulin.

Which level of protein structure were the scientists studying?

A primary

B secondary

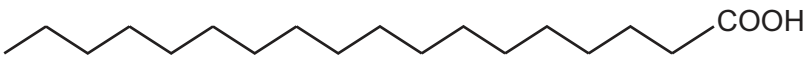
C tertiary

D quaternary

11 The diagrams show four fatty acids, each with a chain of 18 carbon atoms.

Which fatty acid, as part of a phospholipid molecule, would contribute most to the fluidity of a cell surface membrane?

A



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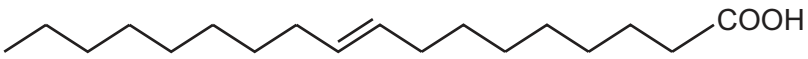

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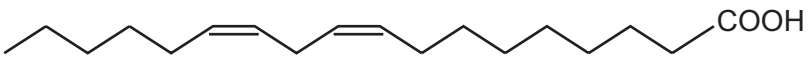

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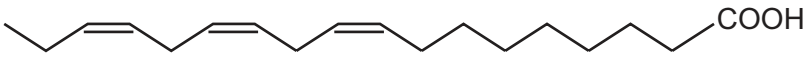


12 Which levels of protein structure are maintained by disulfide bonds?

A secondary, tertiary and quaternary

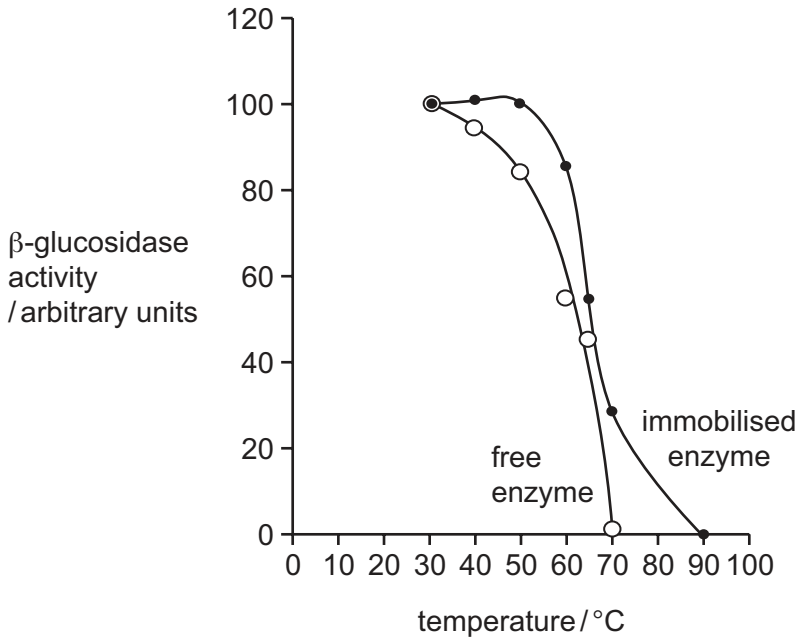
B tertiary and quaternary only

C quaternary only

D tertiary only

13 An experiment was conducted to investigate the effect of temperature on the activity of the enzyme β-glucosidase. The enzyme was tested when in solution (free) and when immobilised in alginate beads.

The results are shown in the graph below.



Which statement about the effect of immobilisation of β-glucosidase is correct?

A It increases the kinetic energy of the enzyme.

B It inhibits the activity of the enzyme.

C It reduces the optimum temperature of the enzyme.

D It stabilises the enzyme against denaturation.

14 An investigation was carried out into the effect of an increasing concentration of substrate molecules on the rate of an enzyme-catalysed reaction. All other variables were standardised.

Which statement is correct?

A The rate increases to a maximum and then levels off.

B The rate increases to an optimum and then decreases.

C The value of K_m will increase.

D The V_{max} will never be reached.

15 Which features are correct for a competitive inhibitor of an enzyme-catalysed reaction?

	binds to active site	changes shape of enzyme	similar shape to substrate	rate of reaction affected by concentration of inhibitor
A	✓	✗	✓	✓
B	✓	✗	✗	✓
C	✗	✓	✓	✗
D	✗	✓	✗	✗

key

✓ = correct

✗ = incorrect

16 Liver cells contain membrane-bound organelles called peroxisomes, which contain the enzyme catalase. This enzyme hydrolyses hydrogen peroxide into water and oxygen gas.

A student cut two identical sized pieces of liver and placed one in a refrigerator at 5 °C and the other in a freezer at –18 °C.

After 12 hours both pieces were raised to room temperature and placed in equal volumes of hydrogen peroxide.

The liver that had been at –18°C produced bubbles of oxygen more rapidly than the liver that had been at 5 °C.

Which statement explains why the liver that had been at –18 °C produced bubbles of oxygen more rapidly than the liver that had been at 5 °C?

A At 5 °C the cell surface membrane allowed water to enter cells and dilute the catalase.

B Freezing at –18 °C made the cell walls more permeable to hydrogen peroxide.

C Ice crystals damaged the cell membranes of the liver cells at –18 °C.

D The higher temperature had denatured some of the catalase.

17 Which of these processes allow movement in both directions across cell surface membranes?

1 active transport

2 diffusion

3 facilitated diffusion

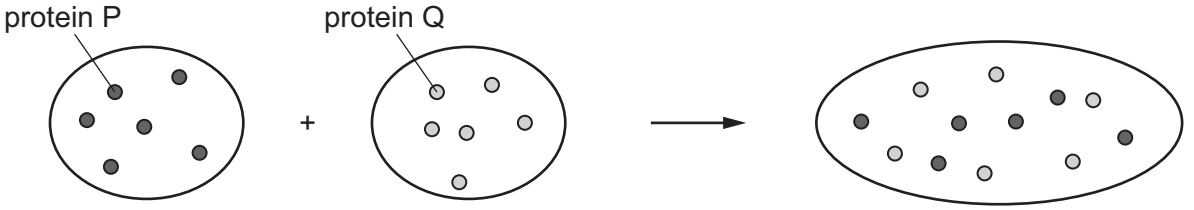
4 osmosis

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

18 The diagram shows an experiment in which two different cell surface membranes were joined to form a single large membrane.

The outer surface of one membrane contained molecules of protein P and the outer surface of the other membrane contained molecules of protein Q.

The positions of the two proteins in each membrane were observed just before they were joined together and 1 hour after they were joined.



Which statements are correct?

1 This provides evidence for the fluid mosaic model of cell membranes.

2 This shows that proteins can move freely in cell membranes.

3 This shows that the membrane is fluid but the proteins are not.

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

19 Which row describes osmosis across a cell surface membrane?

	molecule moved	uses energy from ATP	moves molecule down a concentration gradient
A	solute	✓	✓
B	solute	✓	✗
C	solvent	✗	✓
D	solvent	✗	✗

key
✓ = correct
✗ = incorrect

20 What describes a telomere?

A a cell structure composed mainly of protein and involved in cell division

B a protein that associates with DNA to help condense it

C a region of DNA that links two sister chromatids together

D a region of repetitive nucleotide sequences at the end of a chromatid

21 Uncontrolled cell division can form tumours.

Which statement is correct for tumour cells **only**?

A Metaphase does not take place.

B Cytokinesis does not occur.

C Interphase takes less time.

D They have mutated DNA.

22 Which of these events are part of mitosis?

1 interphase

2 anaphase

3 cytokinesis

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

23 Rifampicin is an antibiotic used to treat tuberculosis.

It works by inhibiting RNA polymerase in bacteria.

Which of these processes are prevented by this antibiotic?

1 DNA replication

2 transcription

3 translation

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

24 A gene codes for the sequence of amino acids in a single polypeptide. Haemoglobin consists of two α-globins and two β-globins.

How many genes are needed to code for a single haemoglobin molecule?

A 1 **B** 2 **C** 4 **D** 8

25 A single substitution in an allele of the gene coding for haemoglobin results in sickle cell haemoglobin.

The mRNA sequence for three amino acids for normal haemoglobin is shown.

CCUGAAGAG

The mRNA sequence for sickle cell haemoglobin is shown.

CCUGUAGAG

The table shows some of the triplet codes for two amino acids.

DNA triplet codes	amino acid
CTC	Glu
CTT	Glu
CAT	Val
CAC	Val

Which row is correct for the substituted DNA nucleotide of the allele and the substituted amino acid of the protein?

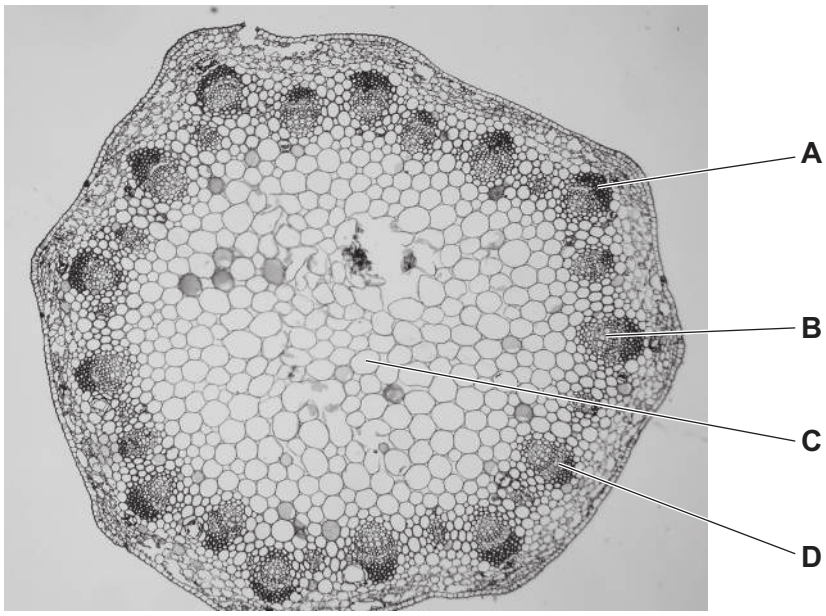
	DNA nucleotide	new amino acid
A	A	Glu
B	A	Val
C	T	Glu
D	T	Val

26 What is the **minimum** number of hydrogen bonds in a length of DNA containing 700 base pairs?

A 350 **B** 700 **C** 1400 **D** 2100

27 The photomicrograph is a section through a plant organ.

Which label identifies the xylem vessels?



28 Which of these statements correctly describe transport pathways in dicotyledonous plants?

1 In the apoplast pathway, water may move through plasmodesmata.

2 In the symplast pathway, water may move through intercellular spaces.

3 The apoplast pathway may be blocked by the Casparian strip.

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

29 Mass flow is the bulk movement of materials from one place to another.

Which vessels carry fluids by mass flow?

1 artery

2 phloem sieve tube

3 vein

4 xylem vessel

A 1, 2, 3 and 4

B 1, 2 and 3 only

C 1 and 3 only

D 2 and 4 only

30 Amino acids move from a phloem sieve tube element into a root cell.

Which changes to the water potential and the volume of liquid in the phloem sieve tube element are correct?

	water potential	volume of liquid
A	becomes higher	decreases
B	becomes higher	increases
C	becomes lower	decreases
D	becomes lower	increases

31 The table shows the volume of water taken up over a 10 minute period for two species of plant, X and Y.

time / minutes	water uptake / mm^3	
	X	Y
2	4.2	1.2
4	7.8	2.3
6	10.9	3.7
8	13.3	4.4
10	16.9	4.9

Both plants were tested at the same time, in the same room and using identical potometers. A student concluded that Y was a xerophyte so lost less water.

What feature of the experiment could bring this conclusion into doubt?

A The student did not control air flow or temperature surrounding the plants.

B The student did not leave the plants to acclimatise to their surroundings.

C The student did not take measurements at 0 minutes.

D The student did not take account of the area of leaves.

32 What happens during left ventricular systole?

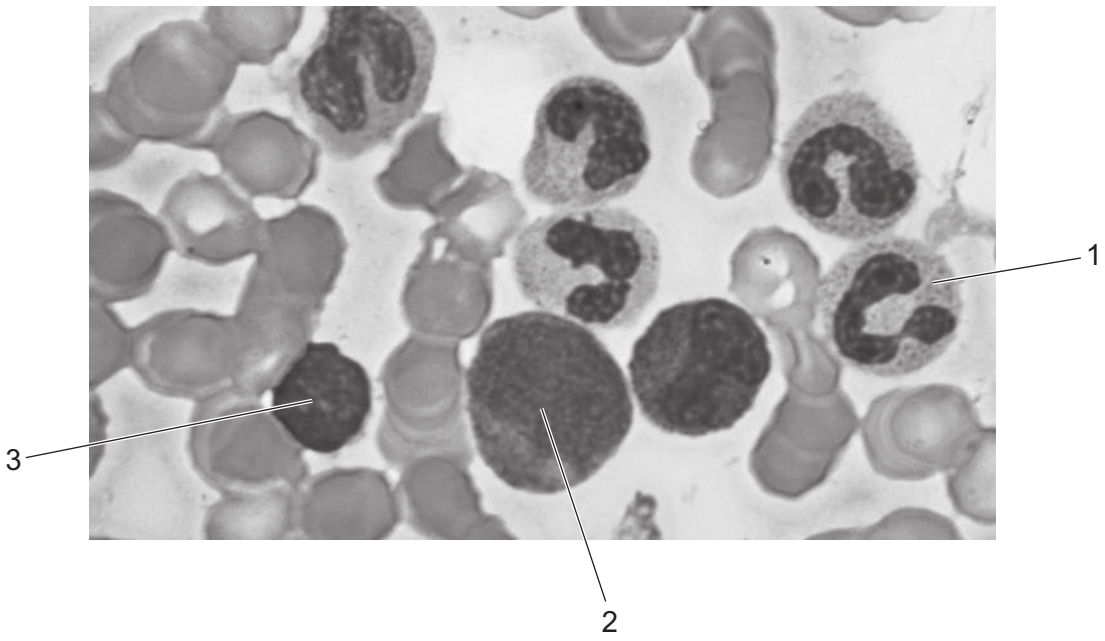
A The atrioventricular node causes the immediate contraction of the ventricle, causing the atrioventricular valve to close.

B The Purkyne tissue between the atrium and ventricle causes the ventricle to contract, closing the atrioventricular valve and opening the semilunar valve.

C The sinoatrial node causes the atrium to stop contracting and the blood pressure in the ventricle to increase above that in the atrium.

D The wave of excitation causes the ventricle to contract so that the blood pressure in the ventricle is higher than in the aorta, opening the semilunar valve.

33 The photograph shows blood cells as seen using a high power light microscope.



Which row correctly identifies the different types of white blood cell?

	1	2	3
A	lymphocyte	monocyte	neutrophil
B	monocyte	neutrophil	macrophage
C	neutrophil	monocyte	lymphocyte
D	phagocyte	lymphocyte	monocyte

34 Which of these processes are responsible for the Bohr shift?

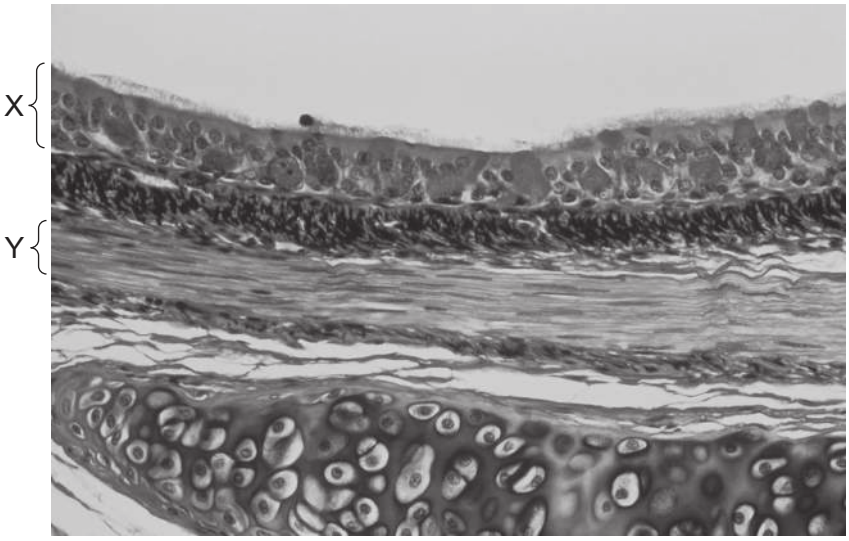
1 Carbon dioxide reacts with haemoglobin to form carbaminohaemoglobin.

2 Carbon dioxide reacts with water to form carbonic acid.

3 Haemoglobinic acid is formed from the dissociation of carbonic acid.

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

35 The photomicrograph shows a cross-section through a bronchus.



What is the function of the tissues X and Y?

	X	Y
A	secrete mucus	prevent collapse of the airway
B	support the airway	dilate airway
C	trap dust and dirt	secrete mucus
D	waft dust and dirt upwards	constrict airway

36 Which flow diagram correctly describes the effect of tar entering the lungs?

A	carcinogens come into contact with DNA	→	mutation occurs	→	uncontrolled cell division	→	mass of cells produced
B	goblet cells secrete more mucus	→	mucus accumulates causing infection	→	phagocytes attracted by inflammation	→	causes irritation and coughing
C	goblet cells secrete more mucus	→	mutation occurs	→	phagocytes attracted by inflammation	→	mass of cells produced
D	phagocytes attracted by inflammation	→	mutation occurs	→	uncontrolled cell division	→	elastase destroys the alveolar walls

37 The antibiotic penicillin prevents the formation of cross-links between peptidoglycans during bacterial cell wall synthesis by blocking the enzyme transpeptidase.

Which statements describe the action of penicillin on bacteria?

1 It is an enzyme inhibitor.

2 It weakens the bacterial cell wall.

3 It will work at any stage during the bacterial life cycle.

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

38 Which pathogens are spread by droplet infection?

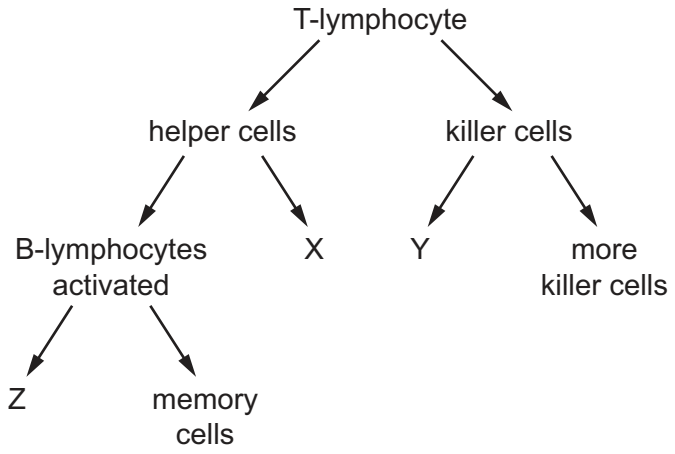
1 *Mycobacterium tuberculosis*

2 *Vibrio cholerae*

3 *Morbillivirus*

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

39 The flow diagram shows the events following activation of a T-lymphocyte by binding to antigens on an infected cell.



Which row correctly identifies X, Y and Z?

	X	Y	Z
A	memory cells	macrophages	antibodies
B	memory cells	memory cells	plasma cells
C	neutrophils	memory cells	plasma cells
D	plasma cells	neutrophil	memory cells

40 Smallpox was eradicated from the human population by a worldwide preventative programme.

Which type of immunity was triggered in people who were treated as part of this programme?

A artificial active immunity

B artificial passive immunity

C natural active immunity

D natural passive immunity

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