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

BIOLOGY **9700/11**

Paper 1 Multiple Choice **May/June 2010**

1 hour

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

7011271646

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.

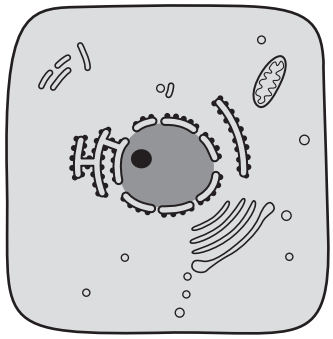
This document consists of **17** printed pages and **3** blank pages.

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1 Which structures are measured using these units?

	10^{-3} m	10^{-6} m	10^{-9} m
A	chloroplast	ribosome	nucleus
B	nucleus	chloroplast	xylem vessel
C	ribosome	xylem vessel	chloroplast
D	xylem vessel	nucleus	ribosome

2 The diagram below is drawn from an electron micrograph of an animal cell.



Which represents the same cell, seen under a light (optical) microscope at ×400 magnification?

A



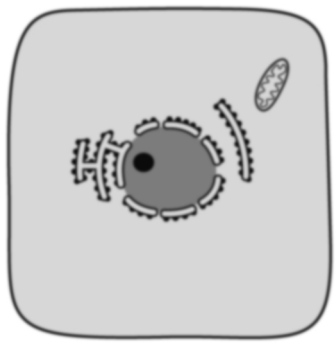
B



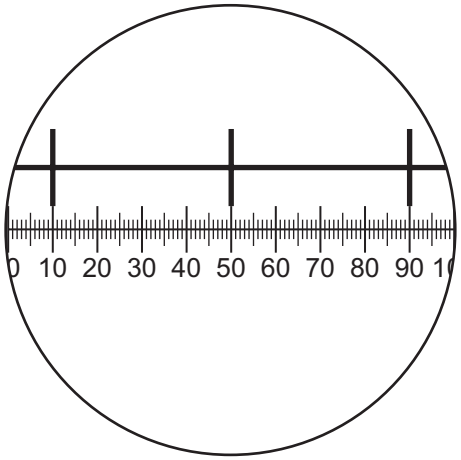
C



D



3 The diagram shows a stage micrometer, 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 $\pi \times 55 \times 55 = 9.5 \times 10^3\ \mu m^2$

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

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

4 Which structures are found in both animal and plant cells?

1 centriole

2 lysosome

3 nucleolus

4 vacuole

A 1 and 3 only

B 2 and 4 only

C 2, 3 and 4 only

D 1, 2, 3 and 4

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5 Which observations suggest that a cell is eukaryotic?

	cytoplasm includes endoplasmic reticulum	protein molecules are associated with the DNA	ribosomes distributed through the cytoplasm
A	✓	✗	✓
B	✗	✓	✗
C	✗	✗	✗
D	✓	✓	✓

key

✓ = found in eukaryotes

✗ = not found in eukaryotes

6 When making measurements in experiments, which methods have parallax errors?

1 using a calibrated eyepiece graticule to measure length

2 using a measuring cylinder to measure volume

3 using a ruler to measure length of a shoot

A 1 and 2 only

B 2 and 3 only

C 3 and 1 only

D 1, 2 and 3

7 A student tested four samples of food, **A**, **B**, **C** and **D**, for the presence of

- lipids
- protein
- reducing sugars
- starch

One of the food samples, milk, was found to contain lipid, protein and reducing sugar.

Which of the food samples, shown in the results below, is milk?

sample	observation			
	adding biuret reagent	adding iodine in potassium iodide solution	boiling with Benedict's solution	mixing with ethanol and adding to water
A	lilac	orange	orange precipitate	milky emulsion
B	lilac	blue-black	blue	milky emulsion
C	pale blue	blue-black	orange precipitate	clear
D	pale blue	orange	blue	clear

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8 Which statement describes how the molecular structure of starch is suited to its function?

A Amylose has a branched structure and amylopectin is coiled to give a compact molecule for transport.

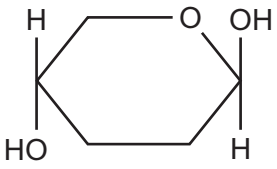
B In the breakdown of amylose and amylopectin, many hydrolysis reactions release stored energy.

C In the formation of amylose and amylopectin, many condensation reactions allow the release of stored energy.

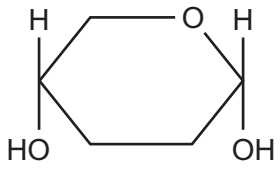
D The final amylose / amylopectin complex is insoluble and does not affect the osmotic properties of the cell.

9 Which diagram represents part of the ring form of a molecule of β-glucose?

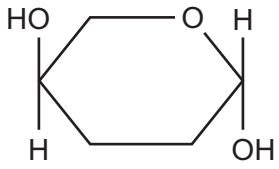
A



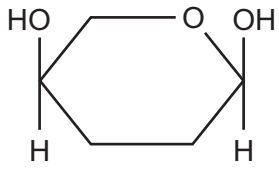
B



C



D



10 How many fatty acid residues are normally present in a phospholipid molecule?

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

11 As a frozen lake warms after a cold winter, mineral nutrients are brought to the surface.

Which properties of water contribute to this process?

1 Its greatest density is at 4 °C.

2 It has high specific heat capacity.

3 It is a solvent.

4 Its molecules form hydrogen bonds.

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

12 Which feature distinguishes starch from glycogen?

A Starch contains α-glucose.

B Starch contains 1,6 glycosidic bonds.

C Starch has an unbranched component.

D Starch is a polysaccharide.

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13 Which feature of haemoglobin makes it a globular protein?

A It has four cross-linked polypeptide chains forming a quaternary structure.

B It has hydrophobic groups on the inside and hydrophilic groups on the outside.

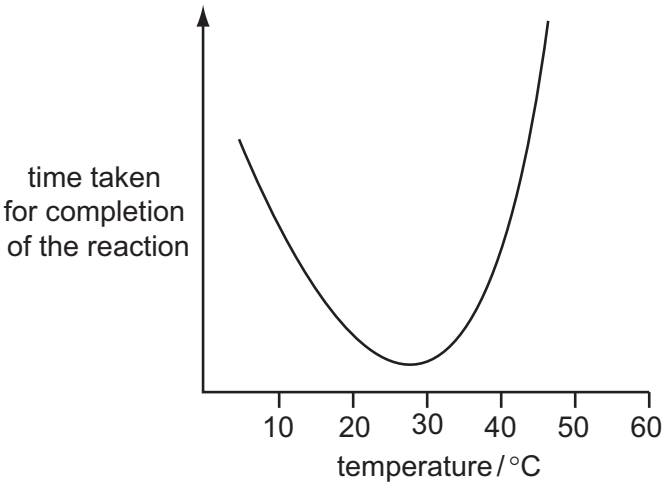
C It has hydrophobic interactions and is insoluble in water.

D It has polypeptide chains which are cross-linked to form sheets.

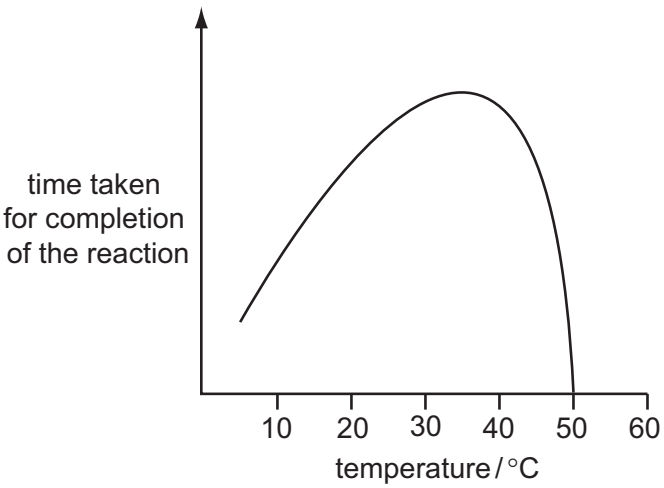
14 An enzyme is completely denatured at 50 °C. A fixed concentration of this enzyme is added to a fixed concentration of its substrate. The time taken for completion of the reaction is measured at different temperatures.

Which graph shows the results?

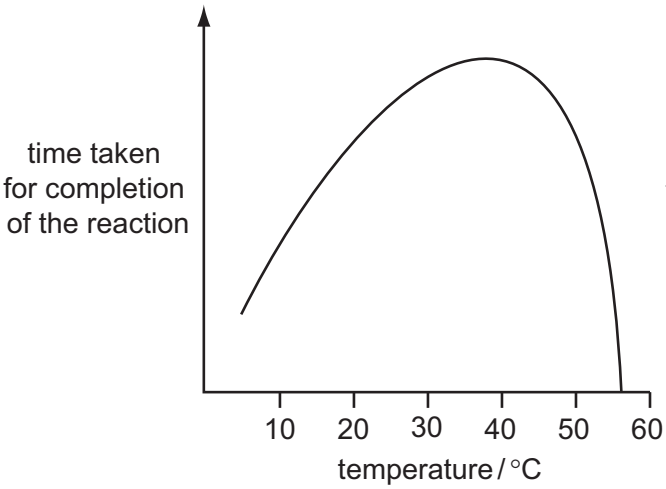
A



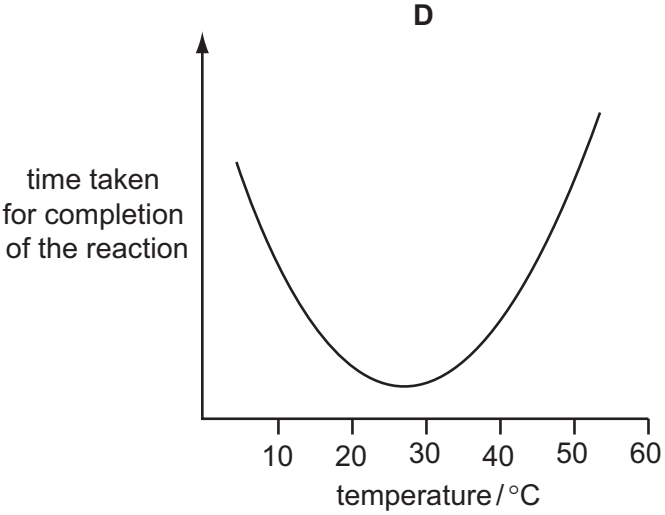
B



C



D



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15 The enzyme lysozyme secreted from tear glands forms deposits on contact lenses.

Which ingredient would be effective in a contact lens cleaner for removing these deposits?

A ethanol

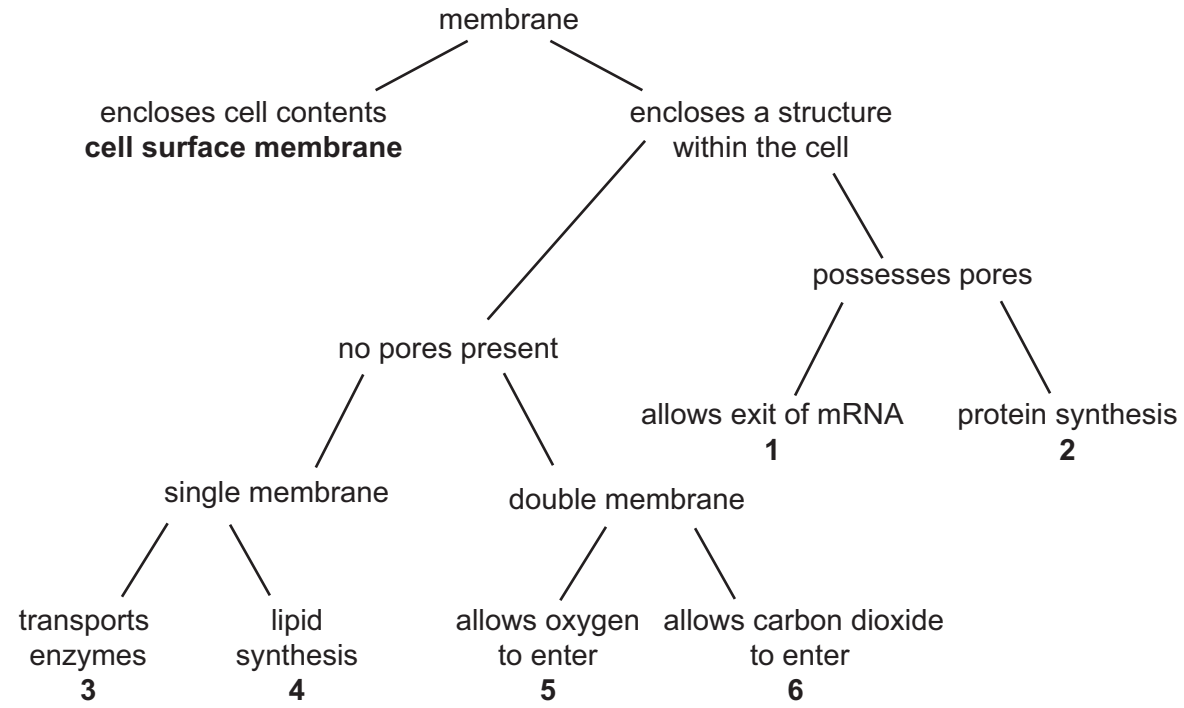
B lysosomes

C pH buffers

D proteases

16 Membranes within and at the surface of cells have different roles.

The diagram allows the identification of the various organelles within the cell, by describing the membrane structure and function.



Which of the outcomes shown below correctly identifies the organelles that possess the membrane and function concerned?

	1	2	3	4	5	6
A	chloroplast	vesicle	smooth ER	rough ER	nucleolus	mitochondrion
B	nucleolus	rough ER	vesicle	smooth ER	nucleus	mitochondrion
C	nucleus	rough ER	vesicle	smooth ER	mitochondrion	chloroplast
D	nucleus	smooth ER	mitochondrion	rough ER	vesicle	chloroplast

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17 Which processes allow movement into and out of a cell?

1 active transport

2 diffusion

3 facilitated diffusion

4 osmosis

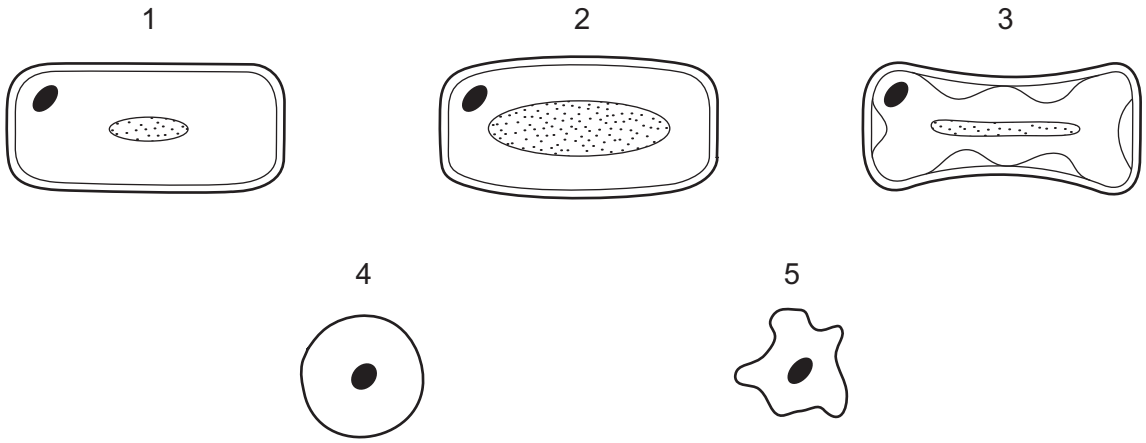
A 2 and 4 only

B 1, 2 and 3 only

C 1, 3 and 4 only

D 1, 2, 3 and 4

18 Some plant and animal cells were placed in different solutions and the results are shown.



Which cells were placed in which solution?

	1.0 mol dm^{-3} sucrose	0.1 mol dm^{-3} salt solution
A	1 and 2	3 and 5
B	1 and 4	3
C	2 and 4	1 and 3
D	3 and 5	2 and 4

19 What occurs in anaphase of mitosis?

A chromatids line up on the equator of the cell

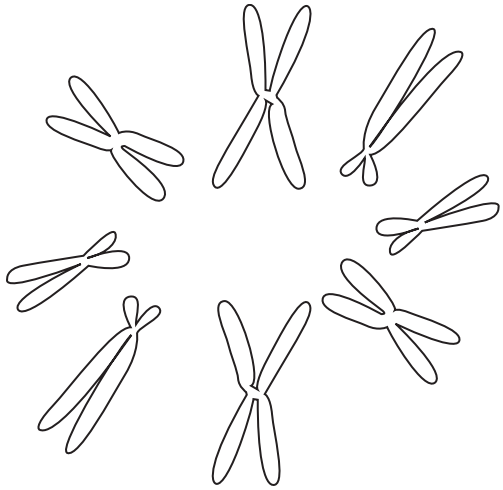
B chromatids reach the poles of the spindle

C chromatids separate and move to opposite poles

D chromatids start to coil up and become visible

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20 The diagram shows chromosomes at metaphase of mitosis.



What are the diploid and haploid numbers for this species?

	diploid	haploid
A	4	8
B	8	4
C	8	16
D	16	8

21 What would be the result of analysing part of a DNA molecule?

A hexose sugars and phosphates in equal proportion, and an equal number of cytosine and guanine bases

B nucleotides and phosphates in equal proportion, and an equal number of adenine and cytosine bases

C pentose sugars and phosphates in equal proportion, and an equal number of adenine and thymine bases

D twice as many phosphates as pentose sugars, and an equal number of adenine and guanine bases

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22 DNA is said to replicate in a semi-conservative way.

Results of Meselson and Stahl's experiments gave overwhelming support to this theory. They used *E. coli* which has a generation time of 50 minutes.

Here are the steps in their experiment but they are in the wrong order.

P All bacteria contain ^{15}N DNA.

Q All bacteria contain hybrid DNA (^{15}N DNA and ^{14}N DNA).

R Bacteria contain either all ^{14}N DNA or hybrid DNA.

S Bacteria grown in a ^{15}N medium for many generations.

T Bacteria transferred to a ^{14}N medium and sampled every 50 minutes.

Which sequence of letters shows the correct order of the steps in the experiment?

A P → Q → R → S → T

B P → S → T → R → Q

C S → P → T → Q → R

D S → R → Q → P → T

23 What is the minimum number of base substitutions required to change the nucleotide sequence of the HbA (normal) allele to the HbS (sickle cell) allele?

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

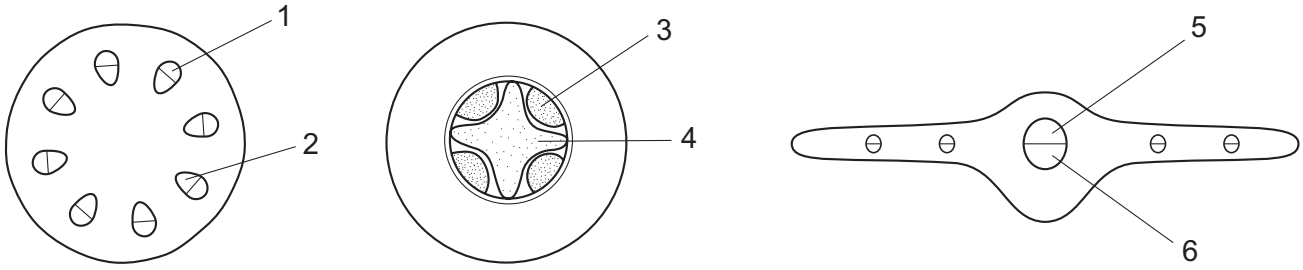
24 In a DNA molecule, the base sequence AGT codes for the amino acid serine.

What is the base sequence of the anti-codon on the tRNA to which serine becomes attached?

A AGU **B** GAU **C** TCA **D** UCA

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25 The diagrams represent the cross section of the stem, root and leaf of a non-woody dicotyledonous plant. In each section the distribution of the tissues is shown.



Which sequence of numbers correctly identifies the distribution of xylem and phloem in the stem, root and leaf?

	xylem			phloem		
A	1	3	5	2	4	6
B	1	4	6	2	4	5
C	2	3	6	1	3	5
D	2	4	5	1	3	6

26 What occurs in the sieve tube elements of a photosynthesising leaf and an actively growing root?

	sieve tube elements in leaf	sieve tube elements in root
A	water potential decreases	sugars are moved in
B	water potential decreases	sugars are moved out
C	water potential increases	sugars are moved in
D	water potential increases	sugars are moved out

27 Some soil-borne fungi cause wilting in crop plants by growing within the xylem vessels.

Which process will be directly affected by these fungi?

A cohesion between water molecules

B development of root pressure

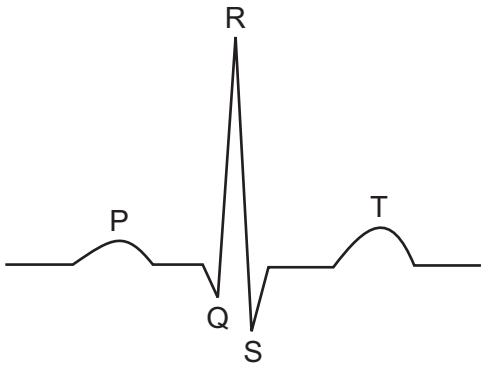
C mass flow during translocation

D uptake of water by root hair cells

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[Turn over

28 The trace represents the electrical activity of the heart during a single heart beat.



Which letters identify the flow of current through the atria and the recovery of the ventricle walls?

A P and R **B** P and T **C** Q and R **D** Q and S

29 What is systolic blood pressure?

A the blood pressure in the arteries when the heart is relaxing

B the blood pressure in the left ventricle at the end of a contraction

C the maximum blood pressure in the arteries

D the maximum blood pressure in the right ventricle

30 Aortic stenosis is a heart valve disorder in which the aortic semi-lunar valve opening is narrow.

Which effect could aortic stenosis have on the heart structure and function?

A The tendons of the heart valves are weakened by blood being forced back through the bicuspid/left atrio-ventricular valve into the left atrium.

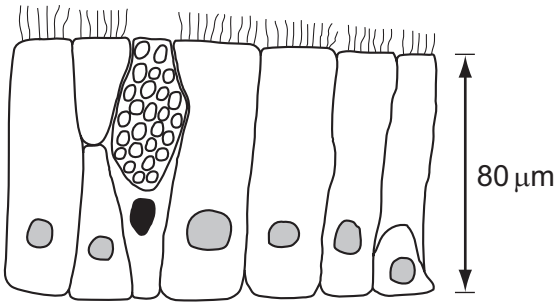
B The cardiac muscle of the left ventricle wall is thinned by blood leaking out of the left ventricle during ventricular diastole.

C There is less cardiac muscle in the left ventricle and reduced diastolic blood pressure, caused by the smaller blood volume entering the left atrium.

D The wall of the left ventricle thickens, leading to an enlarged heart and inability to relax and fill completely during diastole.

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31 The diagram shows a section through a type of epithelium.



Where is this type of epithelium found in the respiratory system?

	trachea	bronchus	all bronchioles	alveolus
A	✓	✓	✓	✗
B	✓	✓	✗	✗
C	✗	✗	✓	✓
D	✗	✗	✗	✓

key
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32 Which statement is an example of epidemiological evidence linking smoking to lung cancer?

A Chemical analysis of tar from cigarettes shows that it contains carcinogens.

B Dogs made to inhale the smoke from cigarettes develop lung tumours.

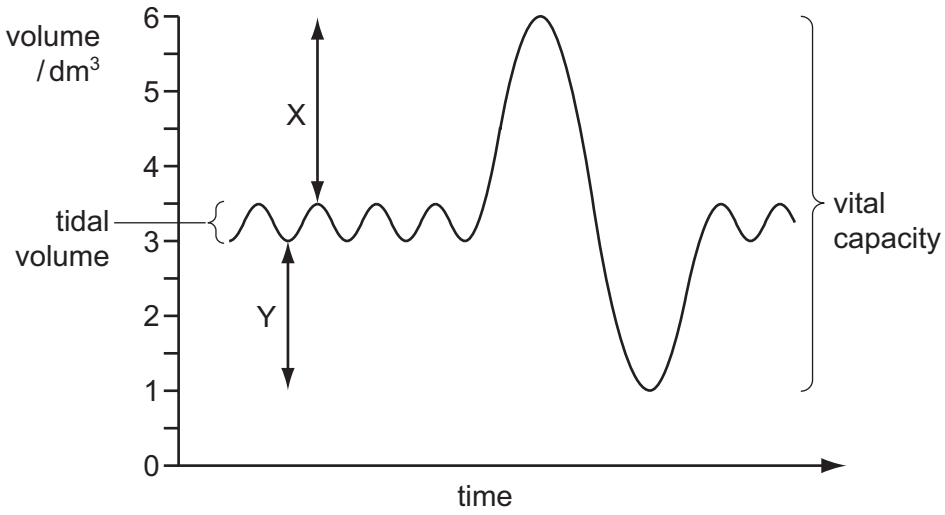
C The incidence of lung cancer increases in a population as more cigarettes are smoked.

D When tar from cigarettes is rubbed onto the skin of mice, the mice develop skin tumours.

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[Turn over

33 The diagram shows a spirometer trace with tidal volume and vital capacity.



What happens to the volumes labelled X and Y during moderate exercise?

	volume X	volume Y
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

34 What are the causative agents of cholera, malaria and TB?

	cholera	malaria	TB
A	bacterium	insect	virus
B	bacterium	protoctist	bacterium
C	virus	insect	virus
D	virus	protoctist	bacterium

35 40 % of the world's population live in an area where malaria is a threat to health. In recent years there have been many more cases in Africa.

What is the social factor that is letting the spread of malaria get out of control?

A an increase in drug resistant forms of malaria

B climate change

C difficulty in producing a vaccine

D migration of people because of wars

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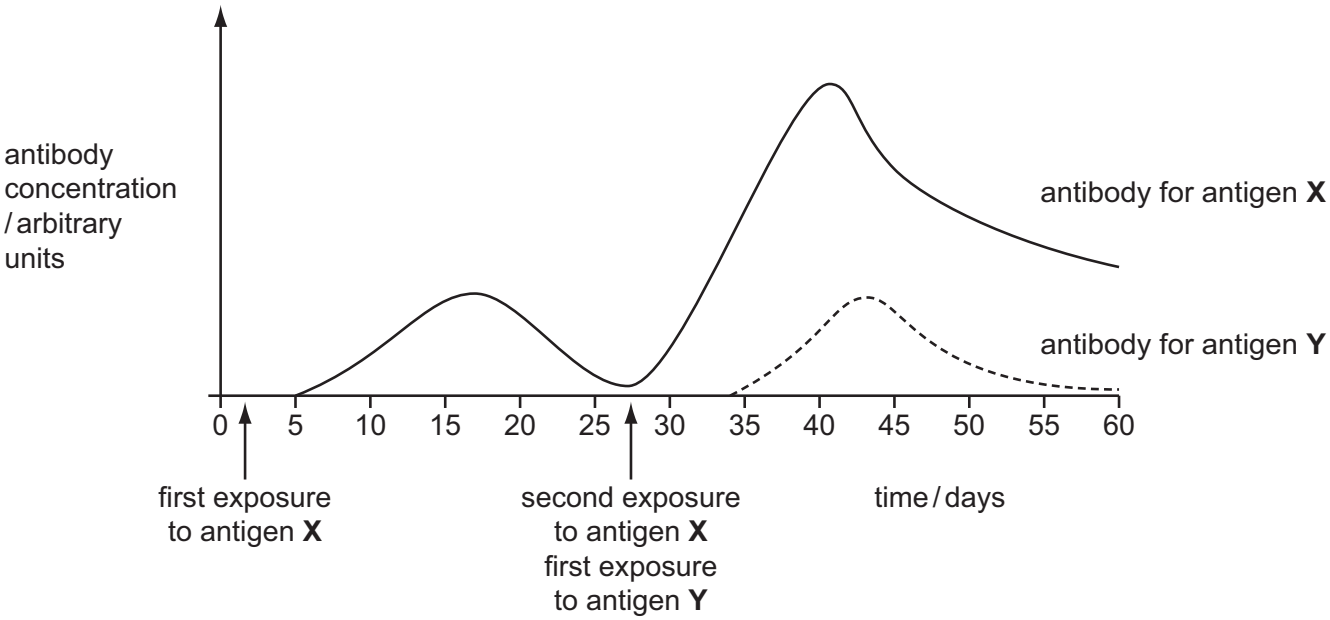
36 What is a difference between T-lymphocytes and B-lymphocytes in the immune system?

	T-lymphocytes	B-lymphocytes
A	do not form plasma cells	form plasma cells which secrete antibodies into the blood stream
B	do not stimulate macrophages to carry out phagocytosis	stimulate macrophages to carry out phagocytosis
C	formed from cells in the thymus	formed from bone marrow cells
D	produce memory cells	do not produce memory cells

37 In an investigation into the immune response, a volunteer was exposed to two different antigens, **X** and **Y**.

The relative antibody concentration in the blood was measured at regular intervals over 60 days.

The graph shows the time when the volunteer was exposed to each antigen and the antibody concentration against time for antigens **X** and **Y**.



What is the explanation for the results displayed on the graph?

A A primary and secondary immune response against antigen **X** occurred, with the memory B-lymphocytes inhibiting the secondary immune response against antigen **Y**.

B A primary immune response to antigen **Y** occurred and memory B-lymphocytes specific to antigen **Y** enhanced the secondary immune response to antigen **X**.

C Memory B-lymphocytes specific to antigen **X** enabled a secondary immune response to occur; different B-lymphocytes were activated for a primary immune response for antigen **Y**.

D Plasma cells remaining from the first exposure to antigen **X** undergo rapid clonal selection to produce high levels of antibody against antigen **X** and lower levels of antibody against antigen **Y**.

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38 The diagram shows a tropical ocean food chain with 10 % efficiency of energy transfer between trophic levels.

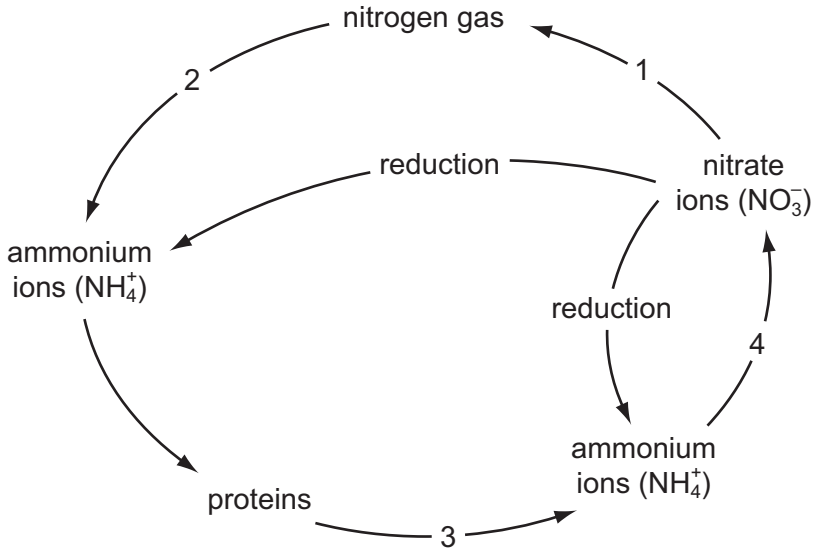
phytoplankton → herbivorous zooplankton → carnivorous zooplankton → small fish → tuna

Net primary production of phytoplankton is $1300\,g\,m^{-3}\,yr^{-1}$.

What is the net primary production per year for the carnivorous zooplankton and the tuna?

	net primary production of carnivorous zooplankton / $g\,m^{-3}\,yr^{-1}$	net primary production of tuna / $g\,m^{-3}\,yr^{-1}$
A	1.3×10^{1}	1.3×10^{-1}
B	1.3×10^{0}	1.3×10^{-2}
C	1.3×10^{-1}	1.3×10^{-2}
D	1.3×10^{-2}	1.3×10^{-4}

39 The diagram shows part of the nitrogen cycle.



Which sequence of numbers correctly shows the roles of different types of microorganism in the nitrogen cycle?

	decomposing (putrefying) bacteria	denitrifying bacteria	nitrifying bacteria
A	2	4	3
B	3	1	2
C	3	1	4
D	4	2	1

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40 Two species of animal are found in the same area of forest and grassland. In the spring and summer they eat the same plant food. However, in the autumn and winter one eats nuts in the forest and the other eats roots on the grassland.

Both species are preyed upon by the same predator. Numbers of root-eating animals are reduced most by this, but they recover faster since they reproduce faster.

What can be concluded about these two species of animals?

1 They are part of the same community.

2 They are at different trophic levels.

3 They occupy different habitats.

4 They have different niches.

A 1 and 2 only

B 1 and 4 only

C 2, 3 and 4 only

D 1, 3 and 4 only

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General Certificate of Education
Advanced Subsidiary Level and Advanced Level

BIOLOGY **9700/12**

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1 hour

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* 3 1 8 3 4 1 2 7 4 7 *

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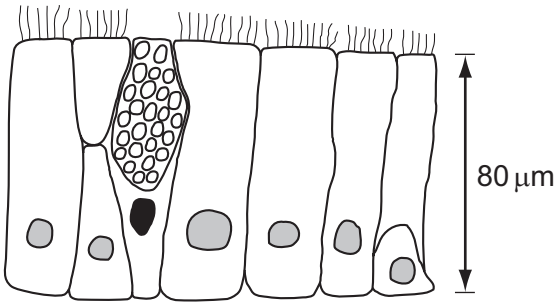
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1 The diagram shows a section through a type of epithelium.



Where is this type of epithelium found in the respiratory system?

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A	✓	✓	✓	✗
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C	✗	✗	✓	✓
D	✗	✗	✗	✓

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C It has hydrophobic interactions and is insoluble in water.

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4 Which processes allow movement into and out of a cell?

1 active transport

2 diffusion

3 facilitated diffusion

4 osmosis

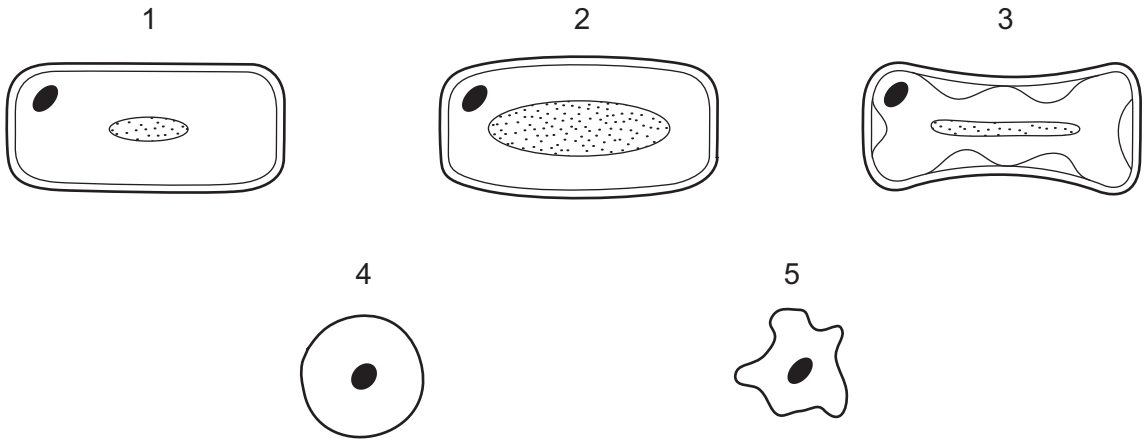
A 2 and 4 only

B 1, 2 and 3 only

C 1, 3 and 4 only

D 1, 2, 3 and 4

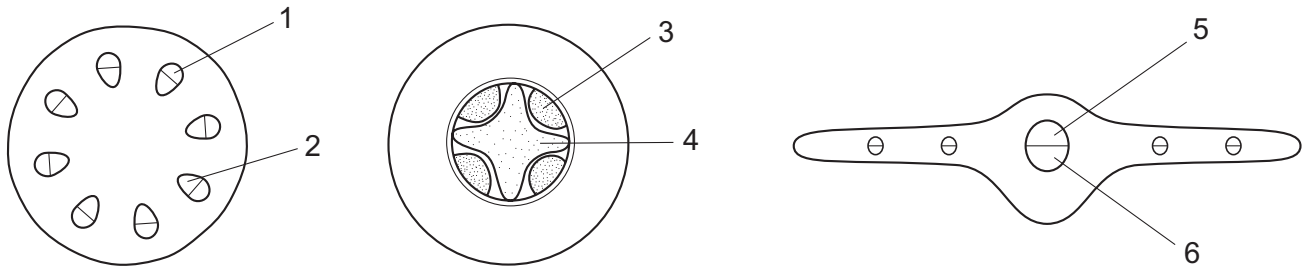
5 Some plant and animal cells were placed in different solutions and the results are shown.



Which cells were placed in which solution?

	1.0 mol dm^{-3} sucrose	0.1 mol dm^{-3} salt solution
A	1 and 2	3 and 5
B	1 and 4	3
C	2 and 4	1 and 3
D	3 and 5	2 and 4

6 The diagrams represent the cross section of the stem, root and leaf of a non-woody dicotyledonous plant. In each section the distribution of the tissues is shown.



Which sequence of numbers correctly identifies the distribution of xylem and phloem in the stem, root and leaf?

	xylem			phloem		
A	1	3	5	2	4	6
B	1	4	6	2	4	5
C	2	3	6	1	3	5
D	2	4	5	1	3	6

7 What occurs in the sieve tube elements of a photosynthesising leaf and an actively growing root?

	sieve tube elements in leaf	sieve tube elements in root
A	water potential decreases	sugars are moved in
B	water potential decreases	sugars are moved out
C	water potential increases	sugars are moved in
D	water potential increases	sugars are moved out

8 Some soil-borne fungi cause wilting in crop plants by growing within the xylem vessels.

Which process will be directly affected by these fungi?

A cohesion between water molecules

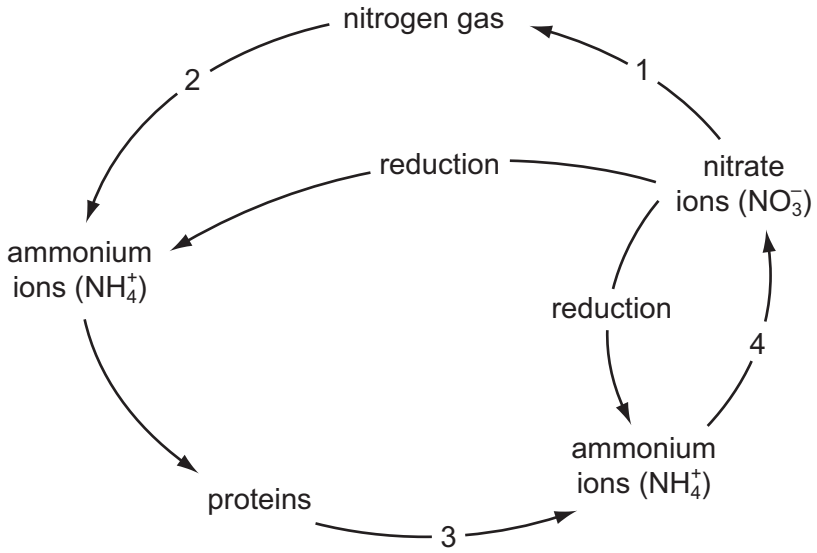
B development of root pressure

C mass flow during translocation

D uptake of water by root hair cells

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9 The diagram shows part of the nitrogen cycle.



Which sequence of numbers correctly shows the roles of different types of microorganism in the nitrogen cycle?

	decomposing (putrefying) bacteria	denitrifying bacteria	nitrifying bacteria
A	2	4	3
B	3	1	2
C	3	1	4
D	4	2	1

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10 Two species of animal are found in the same area of forest and grassland. In the spring and summer they eat the same plant food. However, in the autumn and winter one eats nuts in the forest and the other eats roots on the grassland.

Both species are preyed upon by the same predator. Numbers of root-eating animals are reduced most by this, but they recover faster since they reproduce faster.

What can be concluded about these two species of animals?

1 They are part of the same community.

2 They are at different trophic levels.

3 They occupy different habitats.

4 They have different niches.

A 1 and 2 only

B 1 and 4 only

C 2, 3 and 4 only

D 1, 3 and 4 only

11 The diagram shows a tropical ocean food chain with 10 % efficiency of energy transfer between trophic levels.



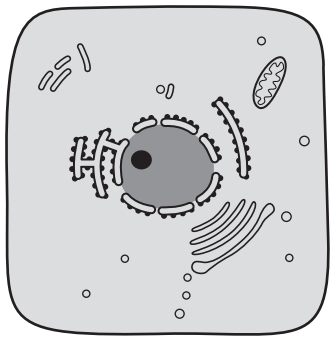
Net primary production of phytoplankton is $1300\,g\,m^{-3}\,yr^{-1}$.

What is the net primary production per year for the carnivorous zooplankton and the tuna?

	net primary production of carnivorous zooplankton / $g\,m^{-3}\,yr^{-1}$	net primary production of tuna / $g\,m^{-3}\,yr^{-1}$
A	1.3×10^{1}	1.3×10^{-1}
B	1.3×10^{0}	1.3×10^{-2}
C	1.3×10^{-1}	1.3×10^{-2}
D	1.3×10^{-2}	1.3×10^{-4}

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12 The diagram below is drawn from an electron micrograph of an animal cell.



Which represents the same cell, seen under a light (optical) microscope at ×400 magnification?

A



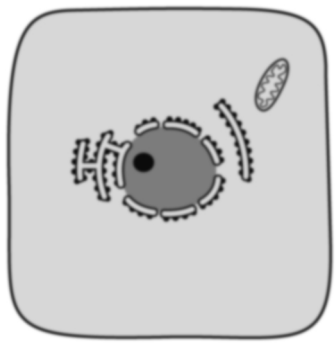
B



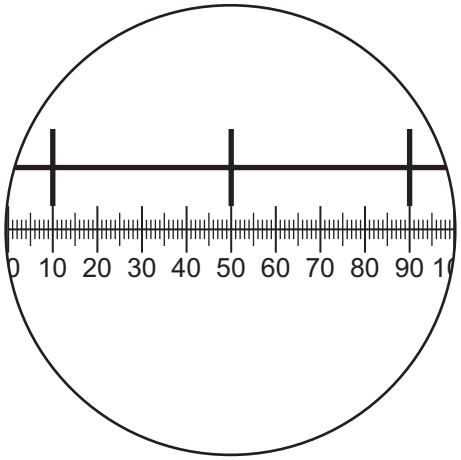
C



D



13 The diagram shows a stage micrometer, 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 $\pi \times 55 \times 55 = 9.5 \times 10^3\ \mu m^2$

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

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

14 Which observations suggest that a cell is eukaryotic?

	cytoplasm includes endoplasmic reticulum	protein molecules are associated with the DNA	ribosomes distributed through the cytoplasm
A	✓	✗	✓
B	✗	✓	✗
C	✗	✗	✗
D	✓	✓	✓

key

✓ = found in eukaryotes

✗ = not found in eukaryotes

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15 Which structures are found in both animal and plant cells?

1 centriole
2 lysosome
3 nucleolus
4 vacuole

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

16 Which structures are measured using these units?

	10^{-3} m	10^{-6} m	10^{-9} m
A	chloroplast	ribosome	nucleus
B	nucleus	chloroplast	xylem vessel
C	ribosome	xylem vessel	chloroplast
D	xylem vessel	nucleus	ribosome

17 When making measurements in experiments, which methods have parallax errors?

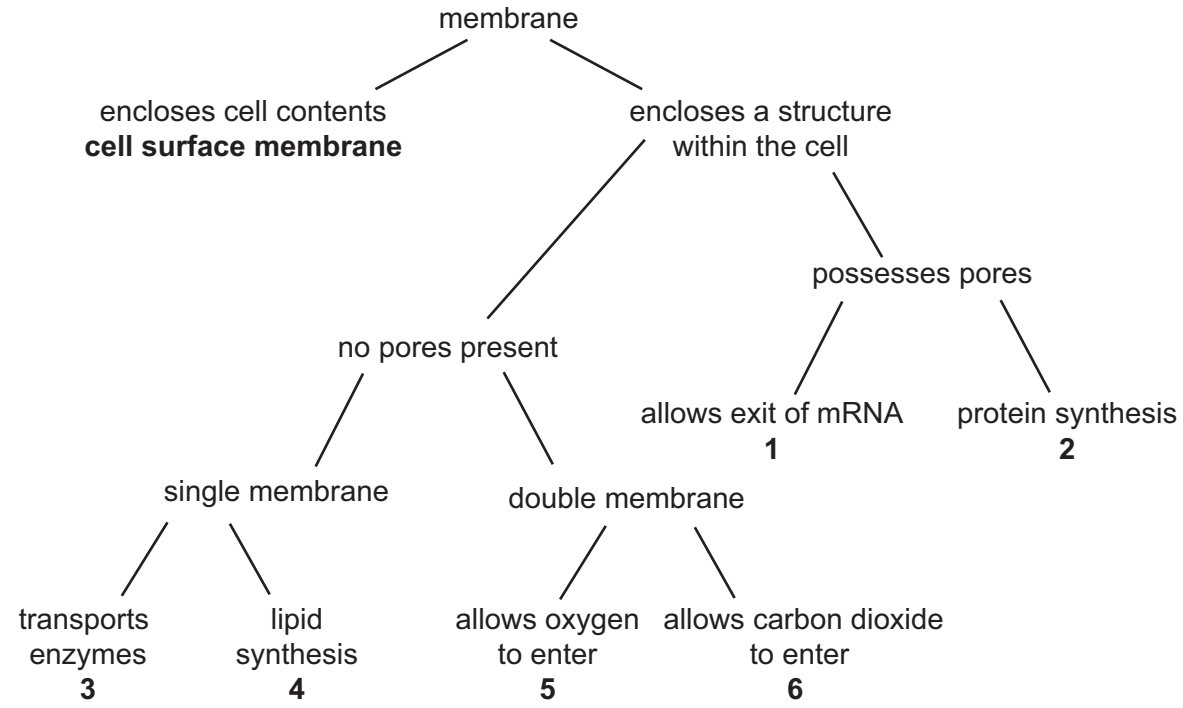
1 using a calibrated eyepiece graticule to measure length
2 using a measuring cylinder to measure volume
3 using a ruler to measure length of a shoot

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

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18 Membranes within and at the surface of cells have different roles.

The diagram allows the identification of the various organelles within the cell, by describing the membrane structure and function.

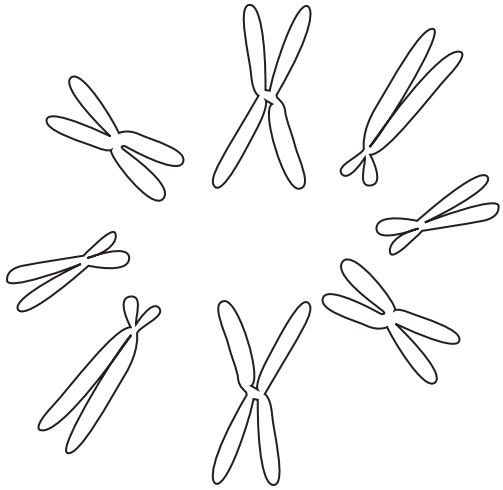


Which of the outcomes shown below correctly identifies the organelles that possess the membrane and function concerned?

	1	2	3	4	5	6
A	chloroplast	vesicle	smooth ER	rough ER	nucleolus	mitochondrion
B	nucleolus	rough ER	vesicle	smooth ER	nucleus	mitochondrion
C	nucleus	rough ER	vesicle	smooth ER	mitochondrion	chloroplast
D	nucleus	smooth ER	mitochondrion	rough ER	vesicle	chloroplast

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19 The diagram shows chromosomes at metaphase of mitosis.



What are the diploid and haploid numbers for this species?

	diploid	haploid
A	4	8
B	8	4
C	8	16
D	16	8

20 DNA is said to replicate in a semi-conservative way.

Results of Meselson and Stahl's experiments gave overwhelming support to this theory. They used *E. coli* which has a generation time of 50 minutes.

Here are the steps in their experiment but they are in the wrong order.

P All bacteria contain ^{15}N DNA.

Q All bacteria contain hybrid DNA (^{15}N DNA and ^{14}N DNA).

R Bacteria contain either all ^{14}N DNA or hybrid DNA.

S Bacteria grown in a ^{15}N medium for many generations.

T Bacteria transferred to a ^{14}N medium and sampled every 50 minutes.

Which sequence of letters shows the correct order of the steps in the experiment?

A P → Q → R → S → T

B P → S → T → R → Q

C S → P → T → Q → R

D S → R → Q → P → T

21 What occurs in anaphase of mitosis?

A chromatids line up on the equator of the cell

B chromatids reach the poles of the spindle

C chromatids separate and move to opposite poles

D chromatids start to coil up and become visible

22 In a DNA molecule, the base sequence AGT codes for the amino acid serine.

What is the base sequence of the anti-codon on the tRNA to which serine becomes attached?

A AGU **B** GAU **C** TCA **D** UCA

23 What is the minimum number of base substitutions required to change the nucleotide sequence of the HbA (normal) allele to the HbS (sickle cell) allele?

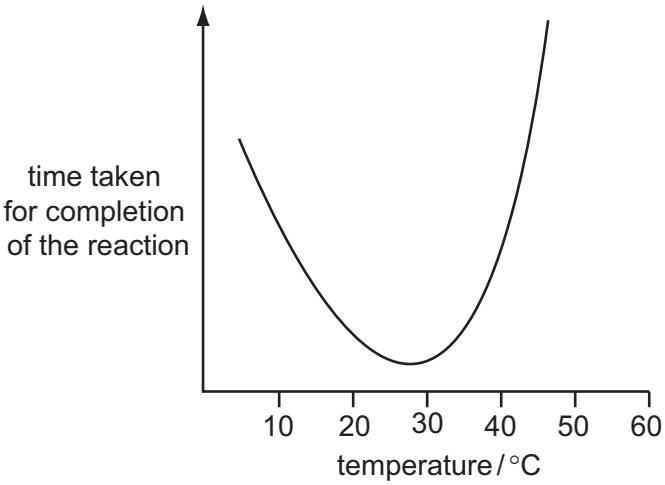
A 1 **B** 2 **C** 3 **D** 4

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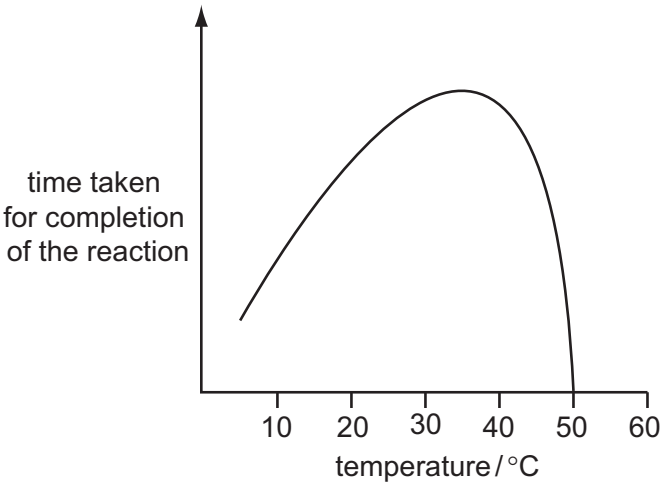
24 An enzyme is completely denatured at 50 °C. A fixed concentration of this enzyme is added to a fixed concentration of its substrate. The time taken for completion of the reaction is measured at different temperatures.

Which graph shows the results?

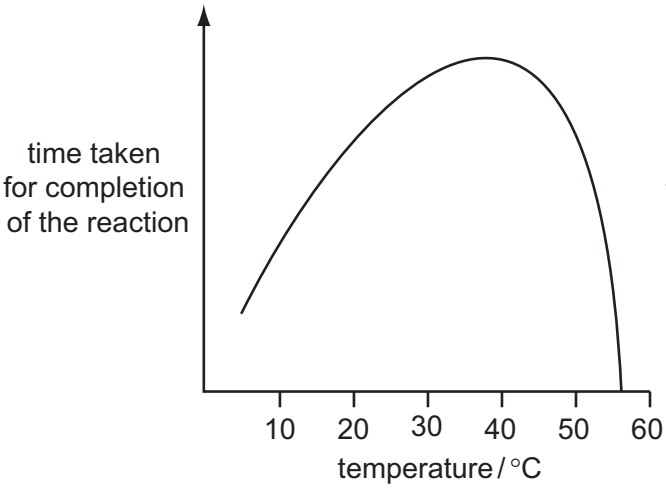
A



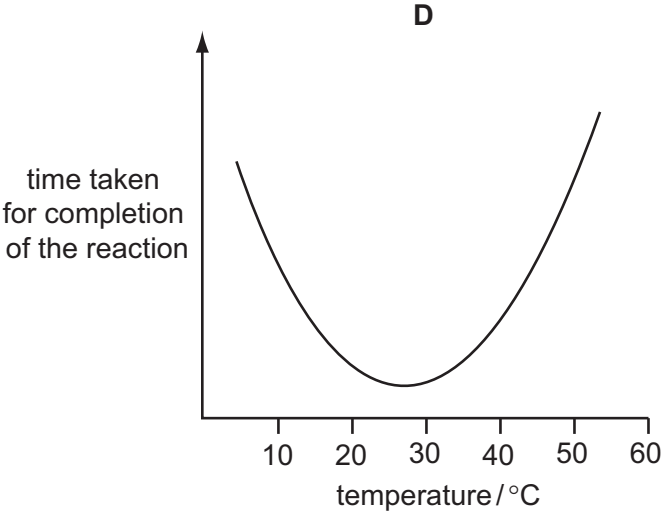
B



C



D



25 The enzyme lysozyme secreted from tear glands forms deposits on contact lenses.

Which ingredient would be effective in a contact lens cleaner for removing these deposits?

A ethanol

B lysosomes

C pH buffers

D proteases

26 A student tested four samples of food, **A**, **B**, **C** and **D**, for the presence of

- lipids
- protein
- reducing sugars
- starch

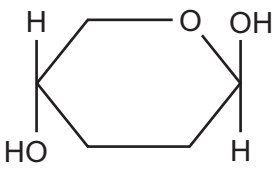
One of the food samples, milk, was found to contain lipid, protein and reducing sugar.

Which of the food samples, shown in the results below, is milk?

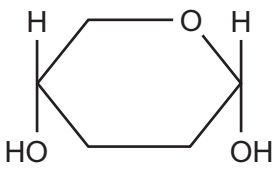
sample	observation			
	adding biuret reagent	adding iodine in potassium iodide solution	boiling with Benedict's solution	mixing with ethanol and adding to water
A	lilac	orange	orange precipitate	milky emulsion
B	lilac	blue-black	blue	milky emulsion
C	pale blue	blue-black	orange precipitate	clear
D	pale blue	orange	blue	clear

27 Which diagram represents part of the ring form of a molecule of β-glucose?

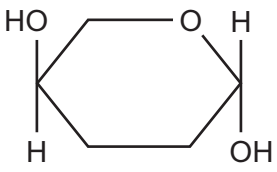
A



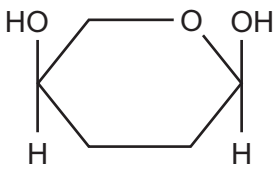
B



C



D



28 Which statement describes how the molecular structure of starch is suited to its function?

A Amylose has a branched structure and amylopectin is coiled to give a compact molecule for transport.

B In the breakdown of amylose and amylopectin, many hydrolysis reactions release stored energy.

C In the formation of amylose and amylopectin, many condensation reactions allow the release of stored energy.

D The final amylose / amylopectin complex is insoluble and does not affect the osmotic properties of the cell.

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29 Which feature distinguishes starch from glycogen?

A Starch contains α-glucose.

B Starch contains 1,6 glycosidic bonds.

C Starch has an unbranched component.

D Starch is a polysaccharide.

30 How many fatty acid residues are normally present in a phospholipid molecule?

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

31 As a frozen lake warms after a cold winter, mineral nutrients are brought to the surface.

Which properties of water contribute to this process?

1 Its greatest density is at 4 °C.

2 It has high specific heat capacity.

3 It is a solvent.

4 Its molecules form hydrogen bonds.

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

32 What would be the result of analysing part of a DNA molecule?

A hexose sugars and phosphates in equal proportion, and an equal number of cytosine and guanine bases

B nucleotides and phosphates in equal proportion, and an equal number of adenine and cytosine bases

C pentose sugars and phosphates in equal proportion, and an equal number of adenine and thymine bases

D twice as many phosphates as pentose sugars, and an equal number of adenine and guanine bases

33 What are the causative agents of cholera, malaria and TB?

	cholera	malaria	TB
A	bacterium	insect	virus
B	bacterium	protoctist	bacterium
C	virus	insect	virus
D	virus	protoctist	bacterium

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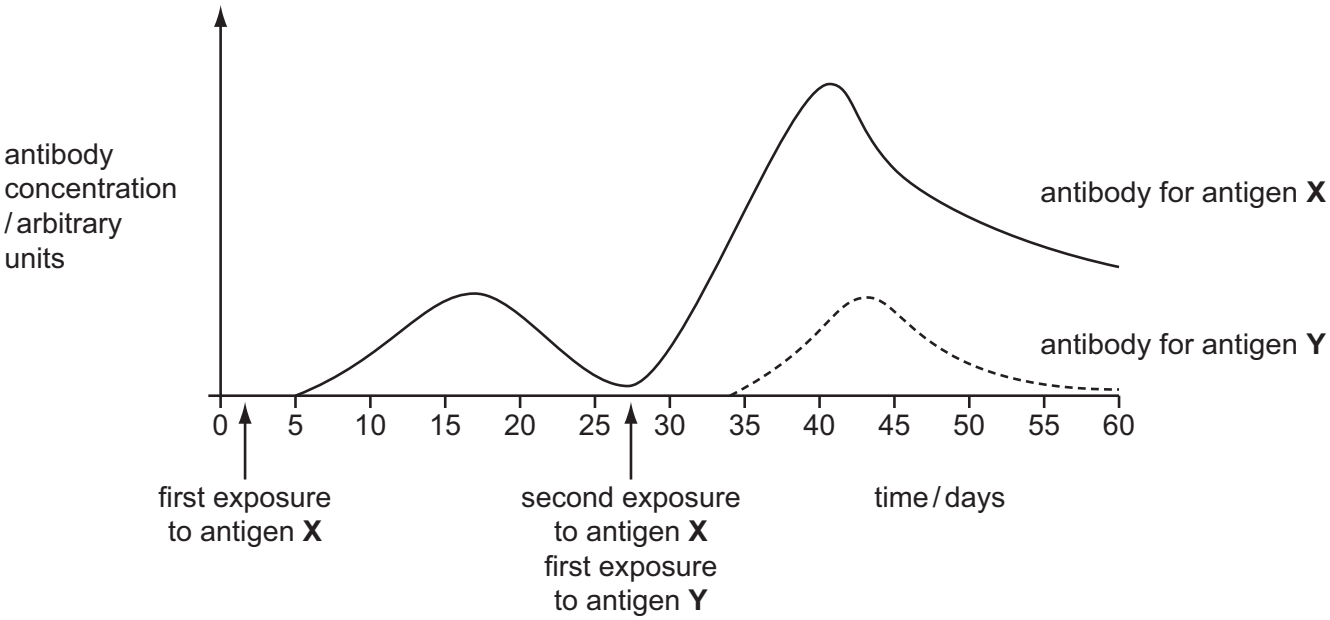
34 What is a difference between T-lymphocytes and B-lymphocytes in the immune system?

	T-lymphocytes	B-lymphocytes
A	do not form plasma cells	form plasma cells which secrete antibodies into the blood stream
B	do not stimulate macrophages to carry out phagocytosis	stimulate macrophages to carry out phagocytosis
C	formed from cells in the thymus	formed from bone marrow cells
D	produce memory cells	do not produce memory cells

35 In an investigation into the immune response, a volunteer was exposed to two different antigens, **X** and **Y**.

The relative antibody concentration in the blood was measured at regular intervals over 60 days.

The graph shows the time when the volunteer was exposed to each antigen and the antibody concentration against time for antigens **X** and **Y**.



What is the explanation for the results displayed on the graph?

A A primary and secondary immune response against antigen **X** occurred, with the memory B-lymphocytes inhibiting the secondary immune response against antigen **Y**.

B A primary immune response to antigen **Y** occurred and memory B-lymphocytes specific to antigen **Y** enhanced the secondary immune response to antigen **X**.

C Memory B-lymphocytes specific to antigen **X** enabled a secondary immune response to occur; different B-lymphocytes were activated for a primary immune response for antigen **Y**.

D Plasma cells remaining from the first exposure to antigen **X** undergo rapid clonal selection to produce high levels of antibody against antigen **X** and lower levels of antibody against antigen **Y**.

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36 40 % of the world's population live in an area where malaria is a threat to health. In recent years there have been many more cases in Africa.

What is the social factor that is letting the spread of malaria get out of control?

A an increase in drug resistant forms of malaria

B climate change

C difficulty in producing a vaccine

D migration of people because of wars

37 What is systolic blood pressure?

A the blood pressure in the arteries when the heart is relaxing

B the blood pressure in the left ventricle at the end of a contraction

C the maximum blood pressure in the arteries

D the maximum blood pressure in the right ventricle

38 Aortic stenosis is a heart valve disorder in which the aortic semi-lunar valve opening is narrow.

Which effect could aortic stenosis have on the heart structure and function?

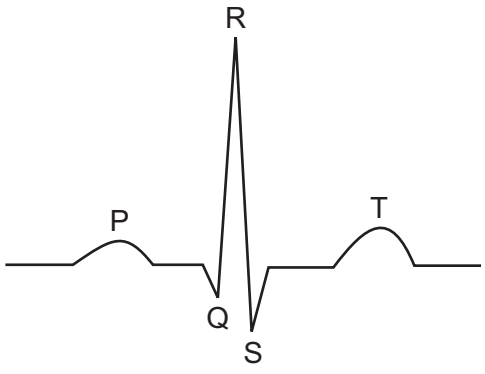
A The tendons of the heart valves are weakened by blood being forced back through the bicuspid/left atrio-ventricular valve into the left atrium.

B The cardiac muscle of the left ventricle wall is thinned by blood leaking out of the left ventricle during ventricular diastole.

C There is less cardiac muscle in the left ventricle and reduced diastolic blood pressure, caused by the smaller blood volume entering the left atrium.

D The wall of the left ventricle thickens, leading to an enlarged heart and inability to relax and fill completely during diastole.

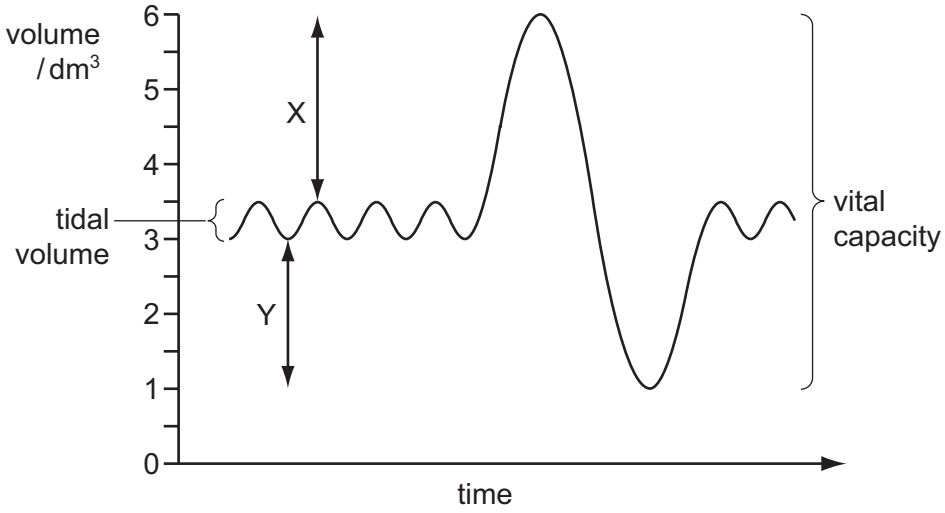
39 The trace represents the electrical activity of the heart during a single heart beat.



Which letters identify the flow of current through the atria and the recovery of the ventricle walls?

A P and R **B** P and T **C** Q and R **D** Q and S

40 The diagram shows a spirometer trace with tidal volume and vital capacity.



What happens to the volumes labelled X and Y during moderate exercise?

	volume X	volume Y
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

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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 2010**

1 hour

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

* 5 4 5 1 6 4 3 9 8 1 *

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.

IB10 06_9700_13/FP
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1 The enzyme lysozyme secreted from tear glands forms deposits on contact lenses.

Which ingredient would be effective in a contact lens cleaner for removing these deposits?

A ethanol

B lysosomes

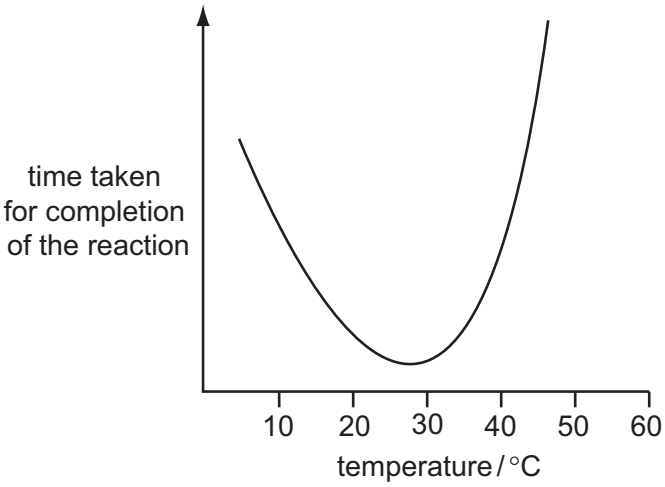
C pH buffers

D proteases

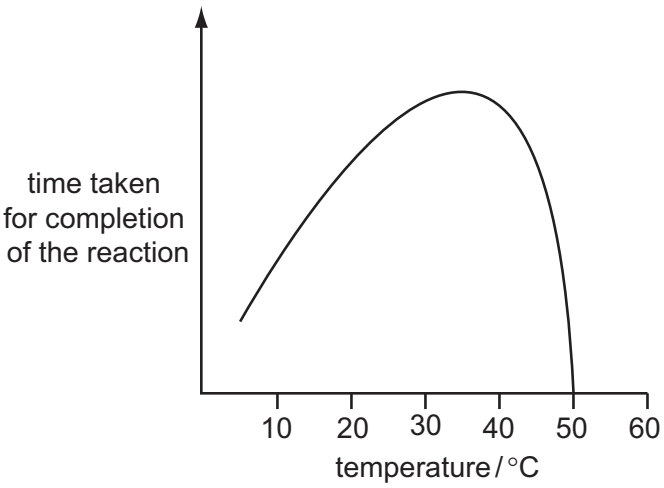
2 An enzyme is completely denatured at 50 °C. A fixed concentration of this enzyme is added to a fixed concentration of its substrate. The time taken for completion of the reaction is measured at different temperatures.

Which graph shows the results?

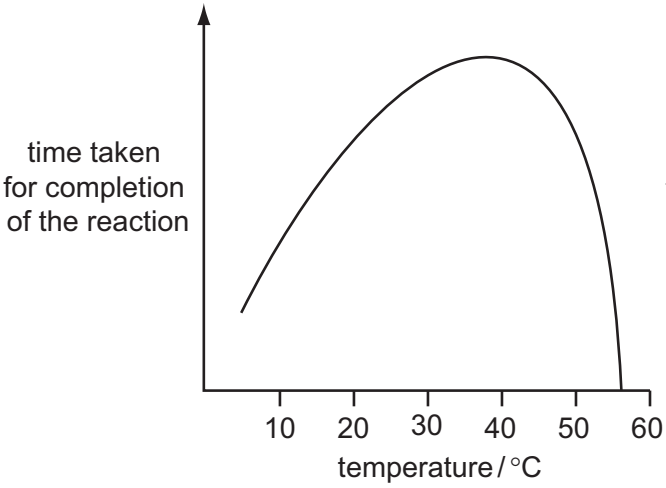
A



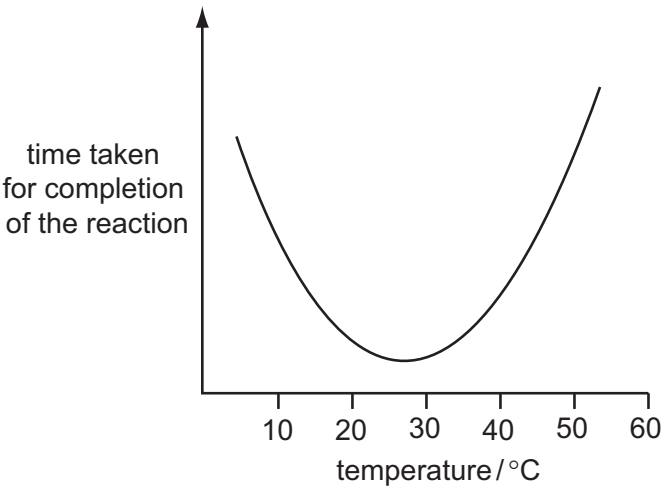
B



C



D



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3 Which feature distinguishes starch from glycogen?

A Starch contains α-glucose.

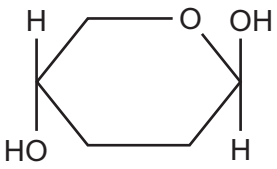
B Starch contains 1,6 glycosidic bonds.

C Starch has an unbranched component.

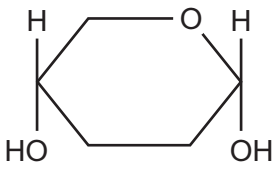
D Starch is a polysaccharide.

4 Which diagram represents part of the ring form of a molecule of β-glucose?

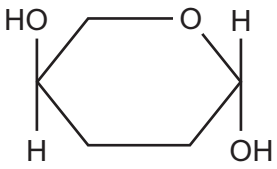
A



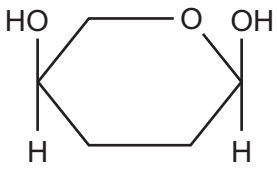
B



C



D



5 What would be the result of analysing part of a DNA molecule?

A hexose sugars and phosphates in equal proportion, and an equal number of cytosine and guanine bases

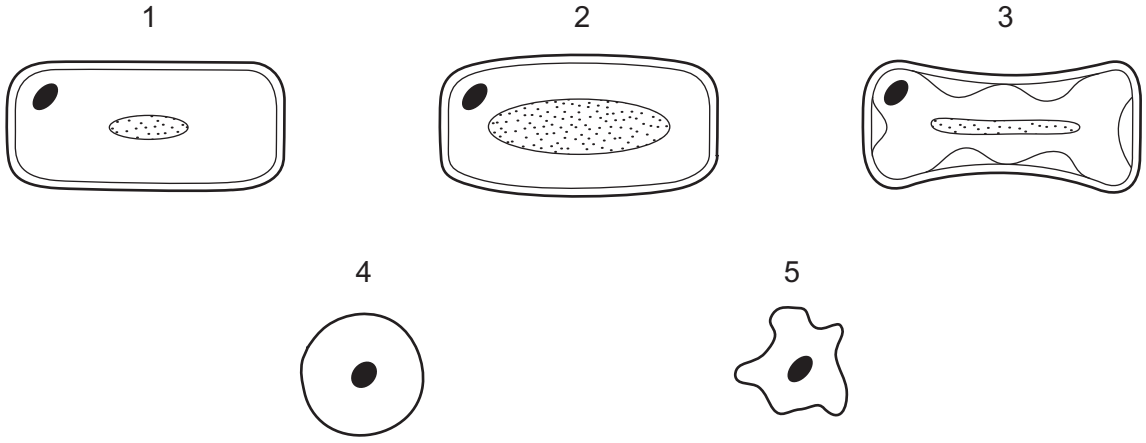
B nucleotides and phosphates in equal proportion, and an equal number of adenine and cytosine bases

C pentose sugars and phosphates in equal proportion, and an equal number of adenine and thymine bases

D twice as many phosphates as pentose sugars, and an equal number of adenine and guanine bases

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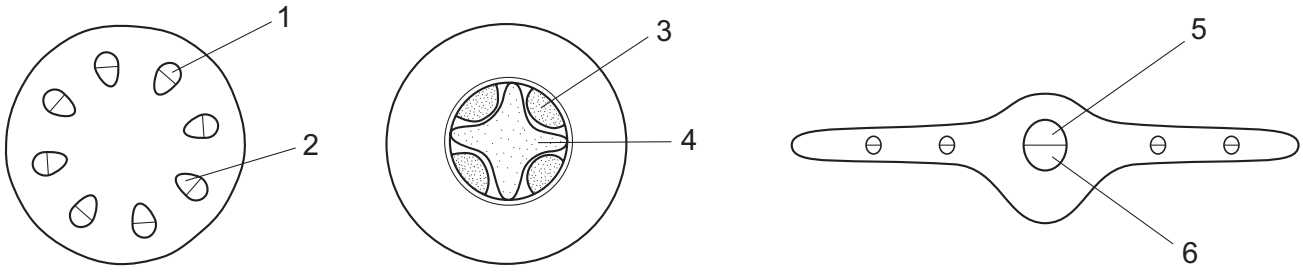
6 Some plant and animal cells were placed in different solutions and the results are shown.



Which cells were placed in which solution?

	1.0 mol dm^{-3} sucrose	0.1 mol dm^{-3} salt solution
A	1 and 2	3 and 5
B	1 and 4	3
C	2 and 4	1 and 3
D	3 and 5	2 and 4

7 The diagrams represent the cross section of the stem, root and leaf of a non-woody dicotyledonous plant. In each section the distribution of the tissues is shown.



Which sequence of numbers correctly identifies the distribution of xylem and phloem in the stem, root and leaf?

	xylem			phloem		
A	1	3	5	2	4	6
B	1	4	6	2	4	5
C	2	3	6	1	3	5
D	2	4	5	1	3	6

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8 Some soil-borne fungi cause wilting in crop plants by growing within the xylem vessels.

Which process will be directly affected by these fungi?

A cohesion between water molecules

B development of root pressure

C mass flow during translocation

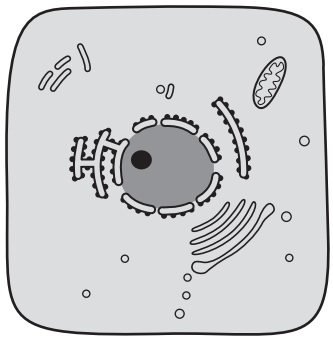
D uptake of water by root hair cells

9 What occurs in the sieve tube elements of a photosynthesising leaf and an actively growing root?

	sieve tube elements in leaf	sieve tube elements in root
A	water potential decreases	sugars are moved in
B	water potential decreases	sugars are moved out
C	water potential increases	sugars are moved in
D	water potential increases	sugars are moved out

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10 The diagram below is drawn from an electron micrograph of an animal cell.



Which represents the same cell, seen under a light (optical) microscope at ×400 magnification?

A



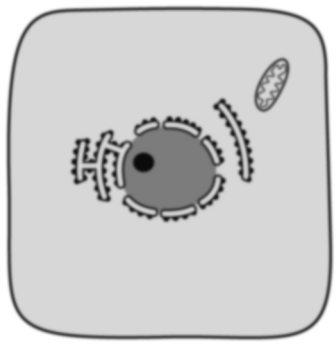
B



C



D



11 Which observations suggest that a cell is eukaryotic?

	cytoplasm includes endoplasmic reticulum	protein molecules are associated with the DNA	ribosomes distributed through the cytoplasm
A	✓	✗	✓
B	✗	✓	✗
C	✗	✗	✗
D	✓	✓	✓

key

✓ = found in eukaryotes

✗ = not found in eukaryotes

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12 Which structures are found in both animal and plant cells?

1 centriole

2 lysosome

3 nucleolus

4 vacuole

A 1 and 3 only

B 2 and 4 only

C 2, 3 and 4 only

D 1, 2, 3 and 4

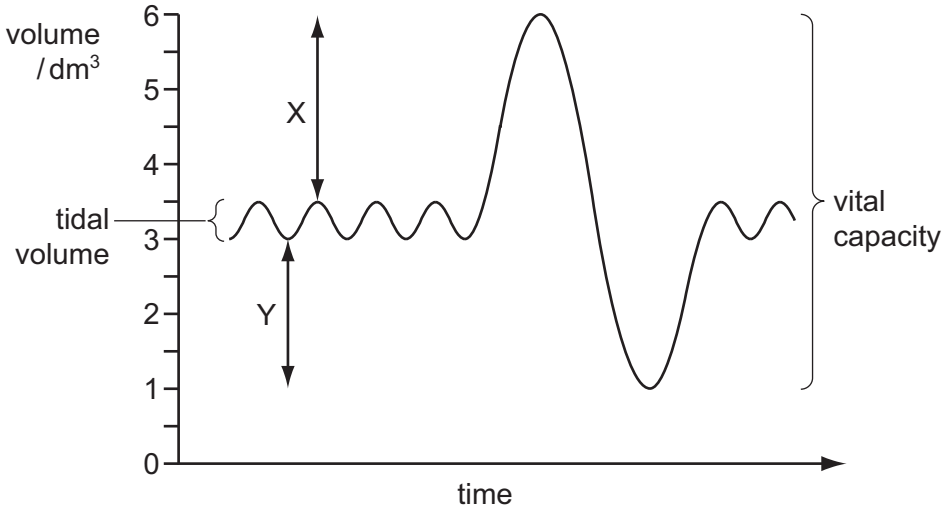
13 Which structures are measured using these units?

	10^{-3} m	10^{-6} m	10^{-9} m
A	chloroplast	ribosome	nucleus
B	nucleus	chloroplast	xylem vessel
C	ribosome	xylem vessel	chloroplast
D	xylem vessel	nucleus	ribosome

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[Turn over

14 The diagram shows a spirometer trace with tidal volume and vital capacity.



What happens to the volumes labelled X and Y during moderate exercise?

	volume X	volume Y
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

15 Aortic stenosis is a heart valve disorder in which the aortic semi-lunar valve opening is narrow.

Which effect could aortic stenosis have on the heart structure and function?

A The tendons of the heart valves are weakened by blood being forced back through the bicuspid/left atrio-ventricular valve into the left atrium.

B The cardiac muscle of the left ventricle wall is thinned by blood leaking out of the left ventricle during ventricular diastole.

C There is less cardiac muscle in the left ventricle and reduced diastolic blood pressure, caused by the smaller blood volume entering the left atrium.

D The wall of the left ventricle thickens, leading to an enlarged heart and inability to relax and fill completely during diastole.

16 What is systolic blood pressure?

A the blood pressure in the arteries when the heart is relaxing

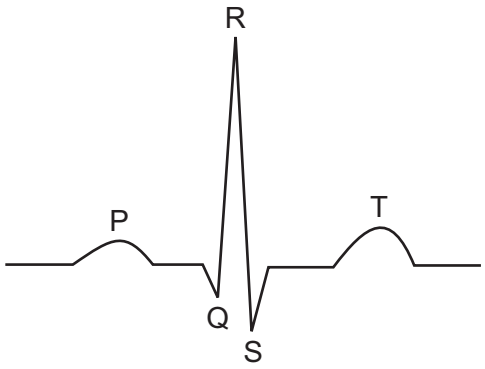
B the blood pressure in the left ventricle at the end of a contraction

C the maximum blood pressure in the arteries

D the maximum blood pressure in the right ventricle

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17 The trace represents the electrical activity of the heart during a single heart beat.



Which letters identify the flow of current through the atria and the recovery of the ventricle walls?

A P and R **B** P and T **C** Q and R **D** Q and S

18 A student tested four samples of food, **A**, **B**, **C** and **D**, for the presence of

- lipids
- protein
- reducing sugars
- starch

One of the food samples, milk, was found to contain lipid, protein and reducing sugar.

Which of the food samples, shown in the results below, is milk?

sample	observation			
	adding biuret reagent	adding iodine in potassium iodide solution	boiling with Benedict's solution	mixing with ethanol and adding to water
A	lilac	orange	orange precipitate	milky emulsion
B	lilac	blue-black	blue	milky emulsion
C	pale blue	blue-black	orange precipitate	clear
D	pale blue	orange	blue	clear

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19 Which statement describes how the molecular structure of starch is suited to its function?

A Amylose has a branched structure and amylopectin is coiled to give a compact molecule for transport.

B In the breakdown of amylose and amylopectin, many hydrolysis reactions release stored energy.

C In the formation of amylose and amylopectin, many condensation reactions allow the release of stored energy.

D The final amylose / amylopectin complex is insoluble and does not affect the osmotic properties of the cell.

20 How many fatty acid residues are normally present in a phospholipid molecule?

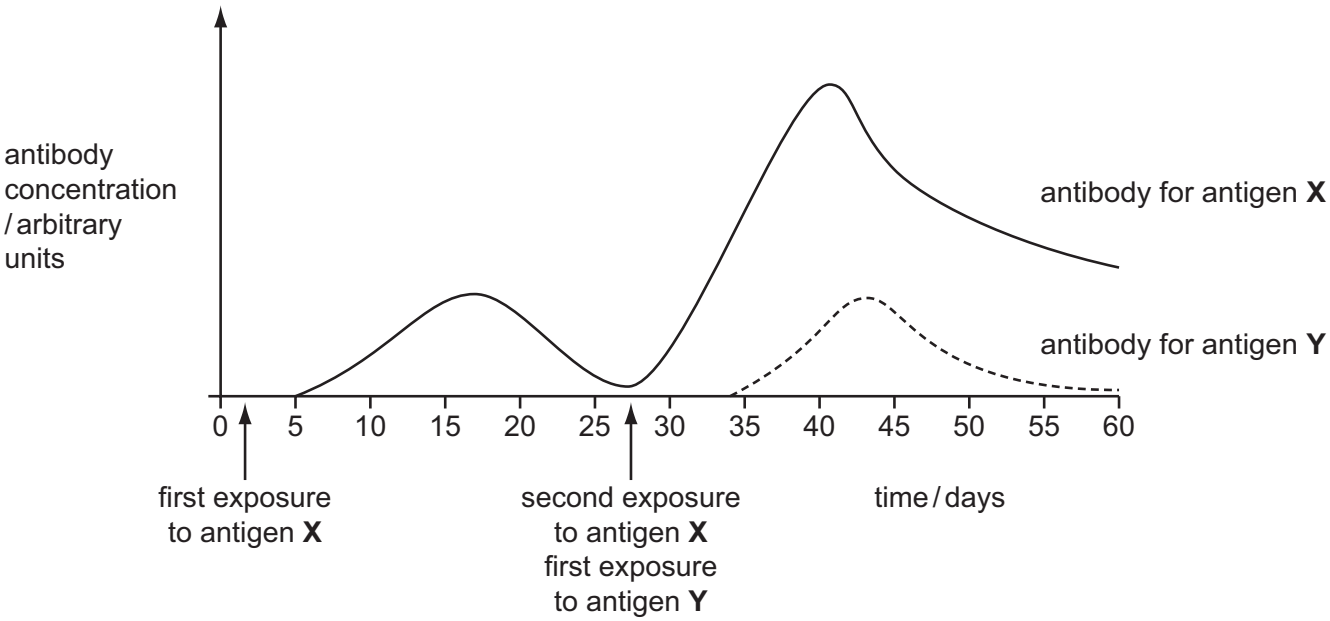
A 1 **B** 2 **C** 3 **D** 4

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21 In an investigation into the immune response, a volunteer was exposed to two different antigens, **X** and **Y**.

The relative antibody concentration in the blood was measured at regular intervals over 60 days.

The graph shows the time when the volunteer was exposed to each antigen and the antibody concentration against time for antigens **X** and **Y**.



What is the explanation for the results displayed on the graph?

A A primary and secondary immune response against antigen **X** occurred, with the memory B-lymphocytes inhibiting the secondary immune response against antigen **Y**.

B A primary immune response to antigen **Y** occurred and memory B-lymphocytes specific to antigen **Y** enhanced the secondary immune response to antigen **X**.

C Memory B-lymphocytes specific to antigen **X** enabled a secondary immune response to occur; different B-lymphocytes were activated for a primary immune response for antigen **Y**.

D Plasma cells remaining from the first exposure to antigen **X** undergo rapid clonal selection to produce high levels of antibody against antigen **X** and lower levels of antibody against antigen **Y**.

22 What is a difference between T-lymphocytes and B-lymphocytes in the immune system?

	T-lymphocytes	B-lymphocytes
A	do not form plasma cells	form plasma cells which secrete antibodies into the blood stream
B	do not stimulate macrophages to carry out phagocytosis	stimulate macrophages to carry out phagocytosis
C	formed from cells in the thymus	formed from bone marrow cells
D	produce memory cells	do not produce memory cells

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23 What are the causative agents of cholera, malaria and TB?

	cholera	malaria	TB
A	bacterium	insect	virus
B	bacterium	protoctist	bacterium
C	virus	insect	virus
D	virus	protoctist	bacterium

24 40 % of the world's population live in an area where malaria is a threat to health. In recent years there have been many more cases in Africa.

What is the social factor that is letting the spread of malaria get out of control?

A an increase in drug resistant forms of malaria

B climate change

C difficulty in producing a vaccine

D migration of people because of wars

25 DNA is said to replicate in a semi-conservative way.

Results of Meselson and Stahl's experiments gave overwhelming support to this theory. They used *E. coli* which has a generation time of 50 minutes.

Here are the steps in their experiment but they are in the wrong order.

P All bacteria contain ^{15}N DNA.

Q All bacteria contain hybrid DNA (^{15}N DNA and ^{14}N DNA).

R Bacteria contain either all ^{14}N DNA or hybrid DNA.

S Bacteria grown in a ^{15}N medium for many generations.

T Bacteria transferred to a ^{14}N medium and sampled every 50 minutes.

Which sequence of letters shows the correct order of the steps in the experiment?

A $P \rightarrow Q \rightarrow R \rightarrow S \rightarrow T$

B $P \rightarrow S \rightarrow T \rightarrow R \rightarrow Q$

C $S \rightarrow P \rightarrow T \rightarrow Q \rightarrow R$

D $S \rightarrow R \rightarrow Q \rightarrow P \rightarrow T$

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26 What occurs in anaphase of mitosis?

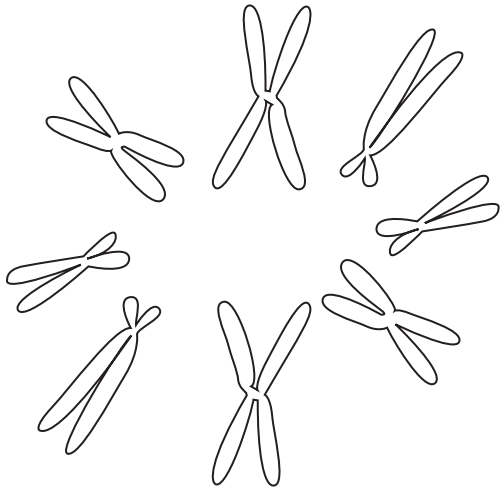
A chromatids line up on the equator of the cell

B chromatids reach the poles of the spindle

C chromatids separate and move to opposite poles

D chromatids start to coil up and become visible

27 The diagram shows chromosomes at metaphase of mitosis.



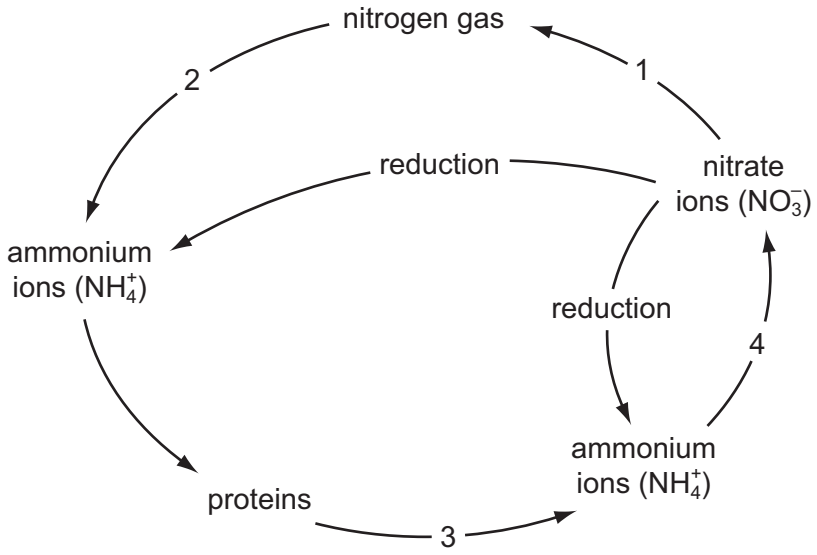
What are the diploid and haploid numbers for this species?

	diploid	haploid
A	4	8
B	8	4
C	8	16
D	16	8

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[Turn over

28 The diagram shows part of the nitrogen cycle.



Which sequence of numbers correctly shows the roles of different types of microorganism in the nitrogen cycle?

	decomposing (putrefying) bacteria	denitrifying bacteria	nitrifying bacteria
A	2	4	3
B	3	1	2
C	3	1	4
D	4	2	1

29 The diagram shows a tropical ocean food chain with 10 % efficiency of energy transfer between trophic levels.

phytoplankton → herbivorous zooplankton → carnivorous zooplankton → small fish → tuna

Net primary production of phytoplankton is $1300\,g\,m^{-3}\,yr^{-1}$.

What is the net primary production per year for the carnivorous zooplankton and the tuna?

	net primary production of carnivorous zooplankton / $g\,m^{-3}\,yr^{-1}$	net primary production of tuna / $g\,m^{-3}\,yr^{-1}$
A	1.3×10^{1}	1.3×10^{-1}
B	1.3×10^{0}	1.3×10^{-2}
C	1.3×10^{-1}	1.3×10^{-2}
D	1.3×10^{-2}	1.3×10^{-4}

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30 Two species of animal are found in the same area of forest and grassland. In the spring and summer they eat the same plant food. However, in the autumn and winter one eats nuts in the forest and the other eats roots on the grassland.

Both species are preyed upon by the same predator. Numbers of root-eating animals are reduced most by this, but they recover faster since they reproduce faster.

What can be concluded about these two species of animals?

1 They are part of the same community.

2 They are at different trophic levels.

3 They occupy different habitats.

4 They have different niches.

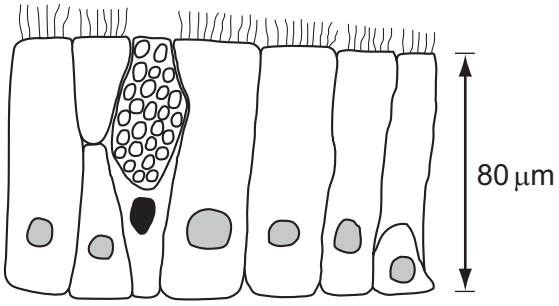
A 1 and 2 only

B 1 and 4 only

C 2, 3 and 4 only

D 1, 3 and 4 only

31 The diagram shows a section through a type of epithelium.



Where is this type of epithelium found in the respiratory system?

	trachea	bronchus	all bronchioles	alveolus
A	✓	✓	✓	✗
B	✓	✓	✗	✗
C	✗	✗	✓	✓
D	✗	✗	✗	✓

key

✓ = present

✗ = absent

32 Which statement is an example of epidemiological evidence linking smoking to lung cancer?

A Chemical analysis of tar from cigarettes shows that it contains carcinogens.

B Dogs made to inhale the smoke from cigarettes develop lung tumours.

C The incidence of lung cancer increases in a population as more cigarettes are smoked.

D When tar from cigarettes is rubbed onto the skin of mice, the mice develop skin tumours.

33 Which processes allow movement into and out of a cell?

1 active transport

2 diffusion

3 facilitated diffusion

4 osmosis

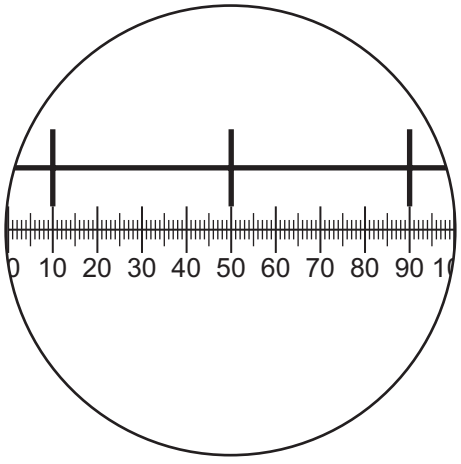
A 2 and 4 only

B 1, 2 and 3 only

C 1, 3 and 4 only

D 1, 2, 3 and 4

34 The diagram shows a stage micrometer, 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 $\pi \times 55 \times 55 = 9.5 \times 10^3\,\mu m^2$

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

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

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35 When making measurements in experiments, which methods have parallax errors?

1 using a calibrated eyepiece graticule to measure length

2 using a measuring cylinder to measure volume

3 using a ruler to measure length of a shoot

A 1 and 2 only

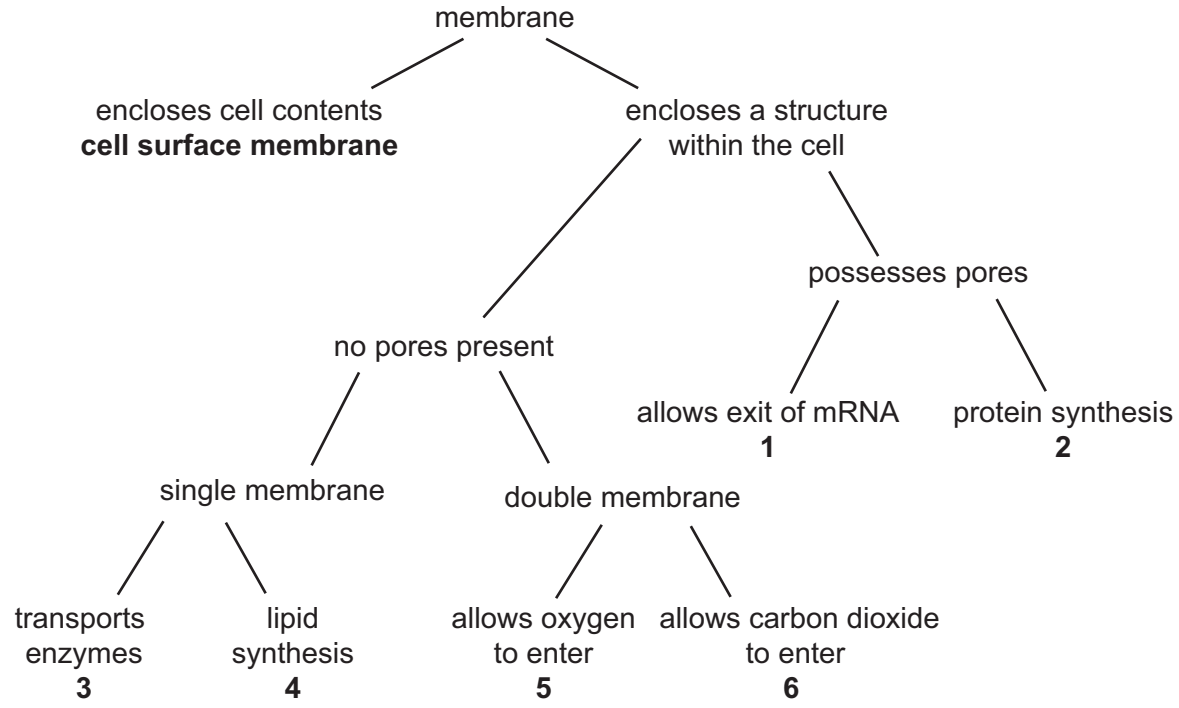
B 2 and 3 only

C 3 and 1 only

D 1, 2 and 3

36 Membranes within and at the surface of cells have different roles.

The diagram allows the identification of the various organelles within the cell, by describing the membrane structure and function.



Which of the outcomes shown below correctly identifies the organelles that possess the membrane and function concerned?

	1	2	3	4	5	6
A	chloroplast	vesicle	smooth ER	rough ER	nucleolus	mitochondrion
B	nucleolus	rough ER	vesicle	smooth ER	nucleus	mitochondrion
C	nucleus	rough ER	vesicle	smooth ER	mitochondrion	chloroplast
D	nucleus	smooth ER	mitochondrion	rough ER	vesicle	chloroplast

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37 As a frozen lake warms after a cold winter, mineral nutrients are brought to the surface.

Which properties of water contribute to this process?

1 Its greatest density is at 4 °C.
2 It has high specific heat capacity.
3 It is a solvent.
4 Its molecules form hydrogen bonds.

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

38 Which feature of haemoglobin makes it a globular protein?

A It has four cross-linked polypeptide chains forming a quaternary structure.

B It has hydrophobic groups on the inside and hydrophilic groups on the outside.

C It has hydrophobic interactions and is insoluble in water.

D It has polypeptide chains which are cross-linked to form sheets.

39 What is the minimum number of base substitutions required to change the nucleotide sequence of the HbA (normal) allele to the HbS (sickle cell) allele?

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

40 In a DNA molecule, the base sequence AGT codes for the amino acid serine.

What is the base sequence of the anti-codon on the tRNA to which serine becomes attached?

A AGU **B** GAU **C** TCA **D** UCA

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