Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/11**

Paper 1 Multiple Choice **October/November 2014**

1 hour

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

8667272227

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 **15** printed pages and **1** blank page.

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1 When making measurements in experiments, which methods could 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** 1 and 3 only **C** 2 and 3 only **D** 1, 2 and 3

2 Which part of the cell is often continuous with the rough endoplasmic reticulum?

A cell surface membrane

B Golgi apparatus

C mitochondrion

D nuclear envelope

3 Which structures are found in both chloroplasts and mitochondria?

1 70S ribsomes

2 80S ribsomes

3 circular DNA

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

4 Tay-Sachs disease occurs when cells are unable to produce an enzyme, leading to a build up of certain lipids in cells.

Which cell structure would **not** function correctly, resulting in the disease?

A Golgi apparatus

B lysosome

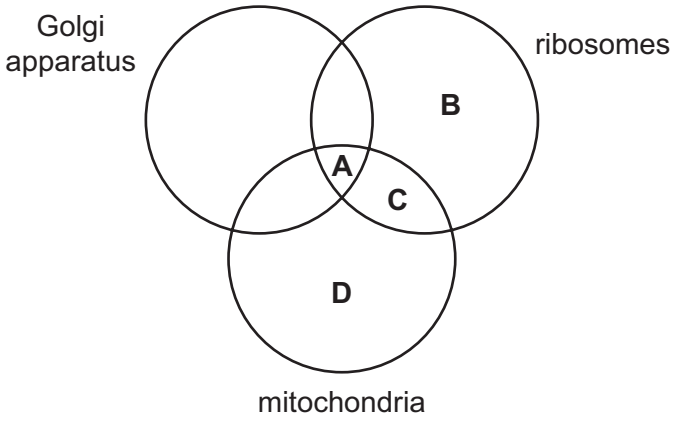
C mitochondrion

D smooth endoplasmic reticulum

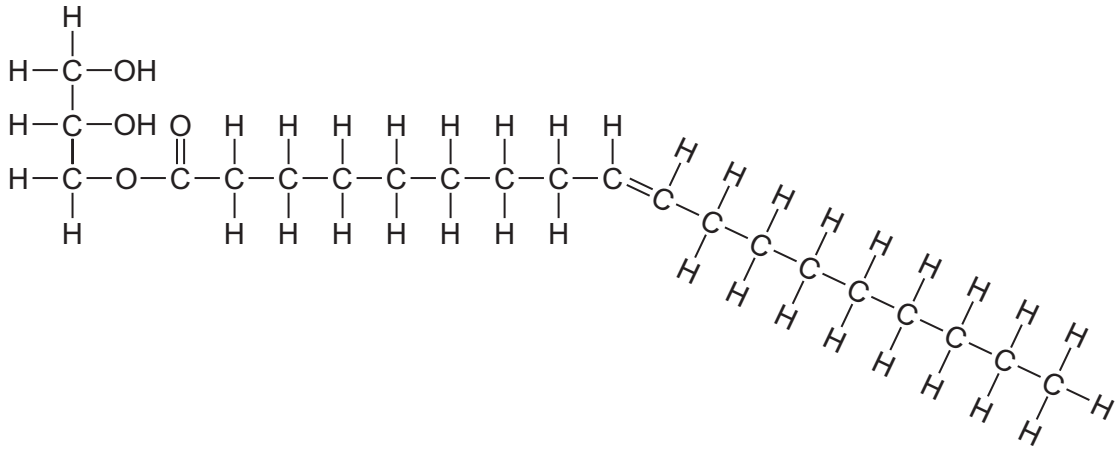
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5 Which structures are present in a cell of *Plasmodium*?



6 The diagram shows a triglyceride molecule that has been partially hydrolysed.



What will be the products of the total hydrolysis of the molecule shown?

A a molecule of glycerol and a saturated fatty acid molecule only

B a molecule of glycerol and an unsaturated fatty acid molecule only

C a molecule of water, a molecule of glycerol and a saturated fatty acid molecule

D a molecule of water, a molecule of glycerol and an unsaturated fatty acid molecule

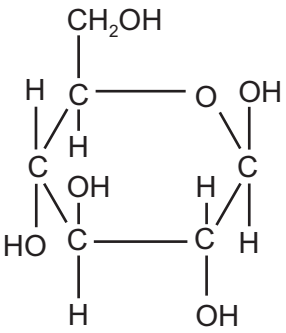
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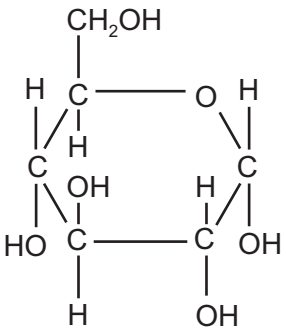
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7 Which shows α-glucose?

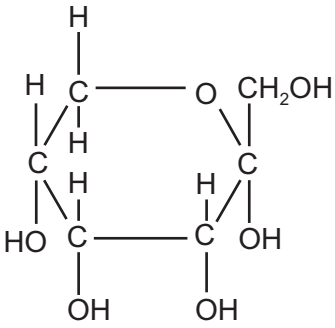
A



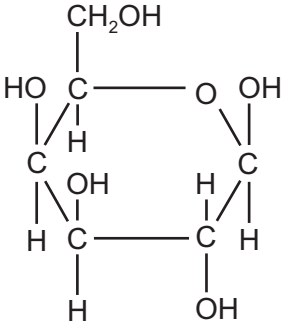
B



C



D



8 Which correctly matches the functional and structural features of cellulose, collagen, glycogen or triglyceride?

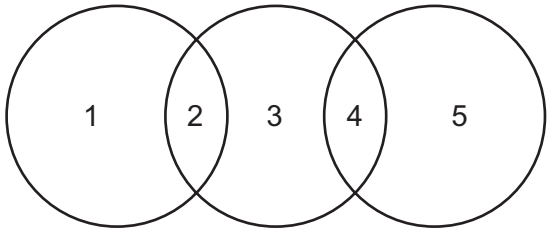
		function	structure		
			fibrous	molecule held together by hydrogen bonds	branched chains
A	cellulose triglyceride	support energy source	✓ ✗	✓ ✗	✗ ✗
B	collagen cellulose	strengthening support	✓ ✓	✓ ✗	✗ ✓
C	collagen glycogen	strengthening storage	✓ ✗	✓ ✗	✓ ✓
D	glycogen triglyceride	storage energy source	✗ ✗	✓ ✓	✓ ✗

key ✓ = true ✗ = false

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9 The diagram shows the relationship between the levels of protein structure and bonds.



Which row is correct?

	1	2	3	4	5
A	primary	peptide	secondary	ionic	tertiary
B	secondary	hydrogen	tertiary	peptide	primary
C	tertiary	ionic	primary	peptide	quaternary
D	quaternary	ionic	tertiary	ionic	secondary

10 How many molecules of oxygen are bound to one molecule of haemoglobin, when it is fully saturated with oxygen?

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

11 Why do large increases in the temperature **or** pH alter enzyme activity?

1 They change the three-dimensional shape of the enzyme.

2 They disrupt hydrogen and ionic bonds in the enzyme.

3 They increase hydrophobic interactions in the enzyme.

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

12 Ethylene glycol is a chemical used to prevent water from freezing. If ethylene glycol is swallowed accidentally, it is metabolised by an enzyme found in liver cells to produce a toxic product.

The enzyme normally catalyses the oxidation of ethanol to a harmless product.

People who have swallowed ethylene glycol are treated with large doses of ethanol. This prevents formation of a toxic product and allows the body to excrete the ethylene glycol.

Which statement describes why this treatment works?

A Ethanol binds near the active site on the enzyme, altering its shape.

B Ethanol binds permanently to the active site of the enzyme, blocking it.

C Ethanol changes the tertiary structure of the enzyme, denaturing it.

D Ethanol is more likely to bind to the active site on the enzyme.

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13 Increasing which type of bond helps to increase the fluidity of the cell surface membrane?

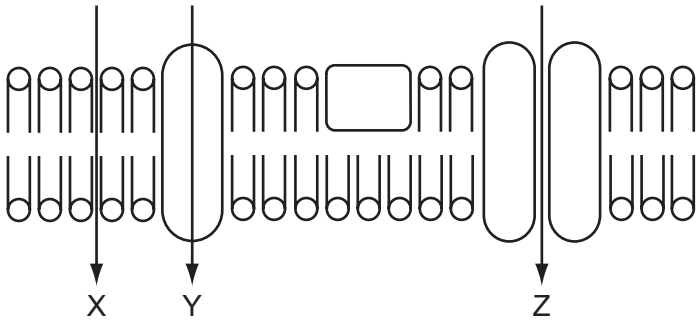
A C—O—C

B C—N

C C=C

D hydrogen

14 The diagram shows three routes, X, Y and Z, through which substances can pass across a cell surface membrane.



Which correctly shows the routes for vitamin D, which is fat soluble, and vitamin C, which is water soluble?

	vitamin D	vitamin C
A	Y	X
B	X	Y
C	X	Z
D	Z	Y

15 In plants adapted to cold conditions, their cell surface membranes change as the weather gets colder, allowing the plants to carry out exocytosis.

Which change occurs in their cell surface membranes?

A a decrease in the ratio of proteins to saturated phospholipids

B a decrease in the ratio of unsaturated phospholipids to saturated phospholipids

C an increase in the ratio of proteins to unsaturated phospholipids

D an increase in the ratio of unsaturated phospholipids to saturated phospholipids

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16 Which statement about a diploid cell is **not** correct?

A It can undergo a mitotic division to allow growth to occur.

B It can undergo a mitotic division to repair a cell.

C It can undergo a reduction division to form haploid cells.

D It is one that possesses two complete sets of chromosomes.

17 Laboratory mice whose *p53* genes had been switched off developed tumours.

When their *p53* genes were switched on again, the tumour cells stopped dividing and died within a few days. Healthy cells in the mice were unaffected.

What do these observations suggest?

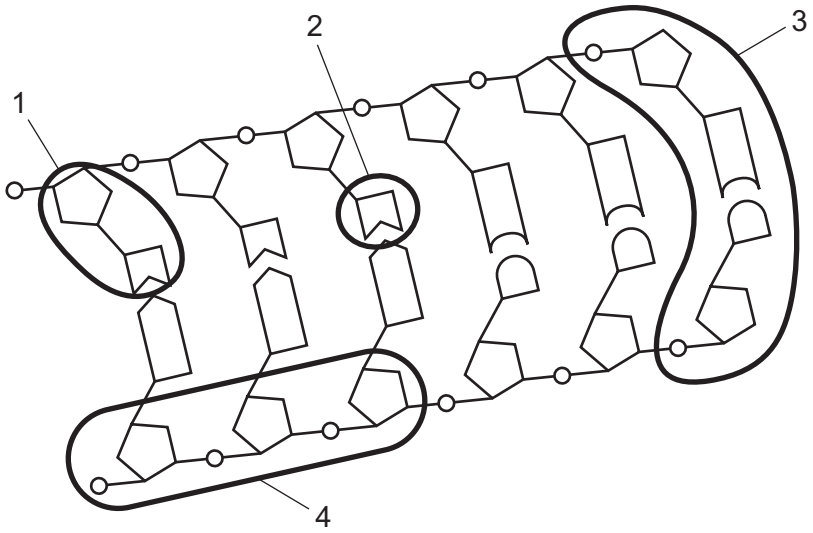
A *p53* protein speeds up the mitotic cell cycle

B *p53* protein causes all cells to die

C the *p53* gene acts as a tumour suppressor gene

D the *p53* gene encourages the growth of tumours

18 The diagram shows part of a DNA molecule.



Which regions contain phosphate groups?

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

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19 Some antibiotics work by binding to ribosomes and preventing protein synthesis.

Which statement explains why these antibiotics kill bacterial cells but not human cells?

A In bacterial cells mRNA is formed in the cytoplasm from naked DNA.

B Ribosomes in human cells have a different structure from those in bacterial cells.

C The antibiotics cannot pass through human cell surface membranes.

D The tRNA molecules in bacterial cells are different from those in human cells.

20 Which statements about tRNA are correct?

1 contains base pairing

2 contains hydrogen bonds

3 is single stranded

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

21 What is the main function of a companion cell in phloem tissue?

A providing cytoplasmic contact with the sieve tube element for loading

B providing structural support for the sieve tube element

C providing the nucleus for cell division in the phloem

D providing the source of assimilates for storage

22 How does sucrose move from chloroplasts to the phloem?

1 mass flow

2 apoplast pathway

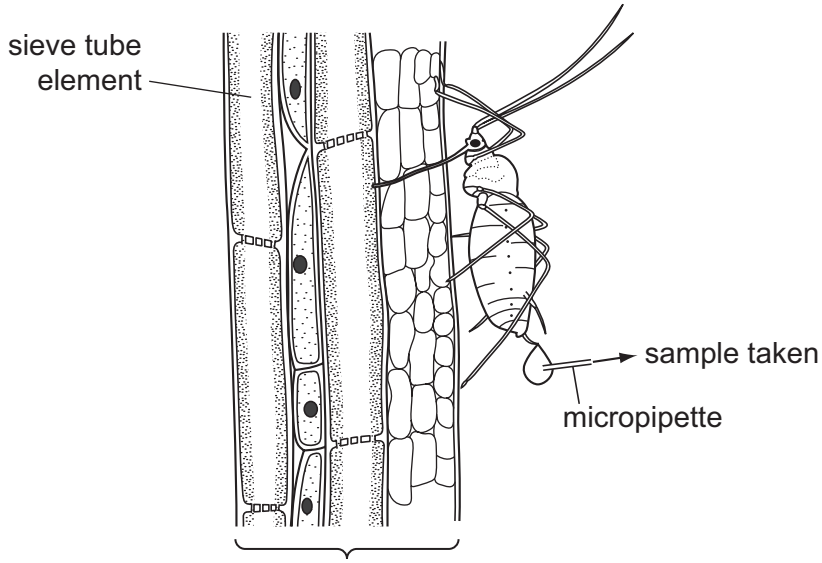
3 symplast pathway

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

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23 A large number of aphids were used to collect samples of the contents of the sieve tube elements of a tomato plant.



(aphid and stem are **not** drawn to the same scale)

Different samples of the sieve tube solution were tested.

Which was the correct result?

	Benedict's test		iodine solution
	before hydrolysis	after hydrolysis	
A	blue	blue	blue-black
B	blue	red	orange
C	red	blue	blue-black
D	red	red	orange

24 Which row is correct for the pulmonary vein?

	blood carried	muscle in walls	lumen size
A	deoxygenated	thick	small
B	deoxygenated	thin	large
C	oxygenated	thick	small
D	oxygenated	thin	large

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25 Which statement describes the Bohr effect?

A In high partial pressure of oxygen and high partial pressure of carbon dioxide, the affinity of haemoglobin for oxygen increases.

B In high partial pressure of oxygen and low partial pressure of carbon dioxide, the affinity of haemoglobin for oxygen decreases.

C In low partial pressure of oxygen and high partial pressure of carbon dioxide, the affinity of haemoglobin for oxygen decreases.

D In low partial pressure of oxygen and low partial pressure of carbon dioxide, the affinity of haemoglobin for oxygen is unchanged.

26 What is produced by the action of carbonic anhydrase?

A carbaminohaemoglobin

B haemoglobinic acid

C hydrogencarbonate ions

D oxyhaemoglobin

27 During the cardiac cycle, the movement of the valves causes sounds that can be heard using a stethoscope.

What causes the first sound after atrial systole in the cardiac cycle?

1 closing of the atrioventricular valves

2 opening of the semilunar valves

3 closing of the semilunar valves

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

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28 The following are all parts of the heart that control the heart action.

1 sinoatrial node (SAN)

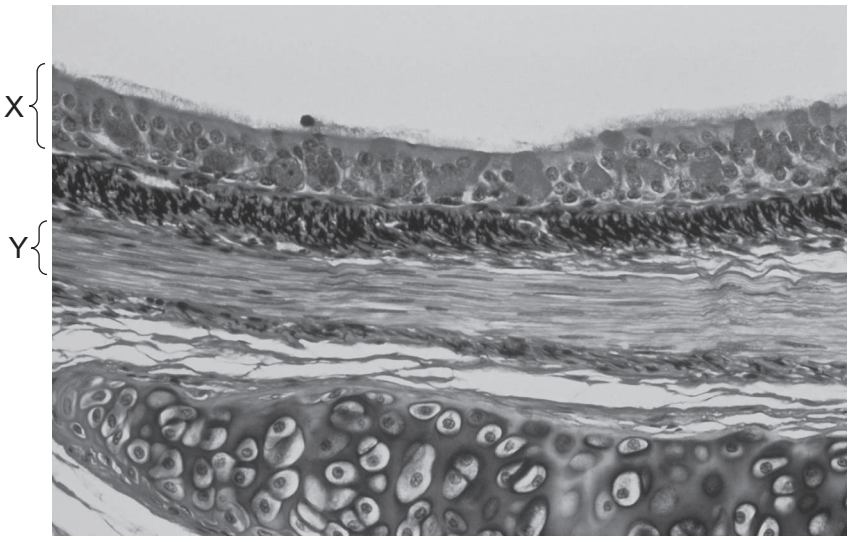
2 atrioventricular node (AVN)

3 Purkyne tissue

Which row for atrial contraction and ventricular contraction is correct?

	atrial contraction	ventricular contraction
A	AVN produces wave of excitation	SAN produces wave of excitation
B	Purkyne tissue carries wave of excitation	AVN produces wave of excitation
C	SAN and AVN node produce wave of excitation	Purkyne tissue carries the wave of excitation
D	SAN produces wave of excitation	Purkyne tissue carries wave of excitation

29 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

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[Turn over

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30 Which component(s) of tobacco smoke cause an increase in blood pressure and clot formation?

1 carcinogens

2 nicotine

3 tar

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

31 Peak Flow is used in hospitals to diagnose some lung diseases. It measures the maximum rate at which air can be breathed out from the lungs.

How will the Peak Flow for a person with emphysema differ from that for a healthy person?

A It falls as carbon monoxide reduces oxygen-carrying capacity of the blood.

B It falls as elastic fibres are damaged in the alveoli.

C It remains constant as the damage to the lungs does not affect the lung volume.

D It rises as larger air spaces make it easier for the air to flow.

32 The following are all methods of transmission of infectious diseases.

1 droplet

2 food

3 contact

4 vector

Which row shows the correct organism and method of transmission of each disease?

	malaria	TB	HIV
A	bacterium 4	virus 1 and 2	virus 3 and 4
B	protoctist 4	bacterium 1 and 2	virus 3
C	protoctist 3	virus 1	bacterium 3
D	bacterium 3	protoctist 1	bacterium 1 and 3

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33 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 of malaria in Africa.

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

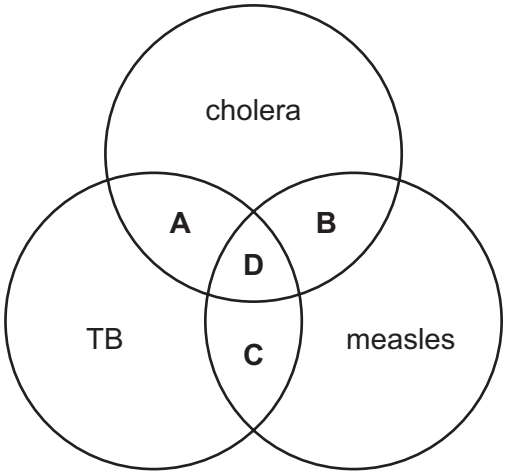
A an increase in drug resistant forms of malaria

B climate change

C difficulty in producing a vaccine

D migration of people because of wars

34 Which diseases are treated with antibiotics?



35 Which are specific immune responses?

1 phagocytosis

2 production of antibodies

3 effect of histamine

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

36 Why has vaccination failed to eradicate cholera?

A The pathogen exists in many strains which mutate.

B The pathogen is present in the lumen of the gut.

C The pathogen is waterborne.

D There is a stage of the life cycle in other mammals.

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37 A person's blood group is determined by antigens present on the red blood cells. Most people have antibodies in their blood plasma even if they have never received a blood transfusion. It is these antibodies in the plasma of the person who receives the blood which makes some blood transfusions unsafe.

The table shows the antigens and antibodies in the blood of people with different blood groups.

blood group	antigens on red blood cells	antibodies in plasma
A	A	antibodies to B
B	B	antibodies to A
AB	A and B	no antibodies to A and B
O	neither A nor B	antibodies to A and B

Which are the blood groups of people who can safely receive blood from a person who has blood group A?

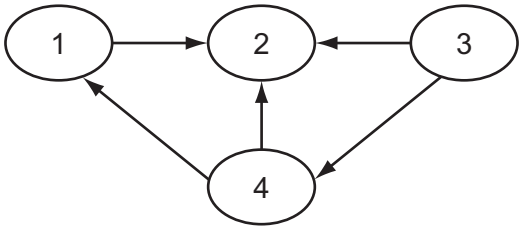
A A and AB

B A and O

C B and O

D AB only

38 The diagram shows the flow of energy between organisms in an ecosystem.



Which correctly identifies each organism in the ecosystem?

	1	2	3	4
A	primary consumers	decomposers	secondary consumers	producers
B	primary consumers	secondary consumers	producers	decomposers
C	secondary consumers	decomposers	producers	primary consumers
D	secondary consumers	primary consumers	decomposers	producers

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39 In a freshwater food chain, which involves the least efficient energy transfer?

A Large fishes feed on the small fishes.

B Small fishes feed on the water fleas.

C Unicellular algae trap sunlight.

D Water fleas feed on the unicellular algae.

40 Which statement concerning events occurring in the nitrogen cycle is **not** correct?

A Free-living nitrogen-fixing bacteria release organic nitrogen compounds into the soil where bacteria convert these to nitrites and nitrates.

B Nitrifying bacteria cause an increase in nitrate ions which are used by plants to make proteins.

C Nitrogen-fixing bacteria use atmospheric nitrogen which is replaced by the action of denitrifying bacteria in waterlogged soil.

D Saprophytic bacteria and fungi decompose organic nitrogen compounds excreted and egested by producers and consumers.

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BIOLOGY **9700/12**

Paper 1 Multiple Choice **October/November 2014**

1 hour

Additional Materials: Multiple Choice Answer Sheet
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* 6 9 4 6 0 5 5 6 9 6 7 *

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Electronic calculators may be used.

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1 Which combination of lenses for a light microscope will give the greatest magnification?

	eyepiece lens	objective lens
A	×5	×100
B	×10	×40
C	×15	×40
D	×15	×100

2 Which steps are needed to find the actual width of a xylem vessel viewed in transverse section using a ×10 objective lens?

1 Convert from mm to μm by multiplying by 10^{-3}.

2 Calibrate the eyepiece graticule using a stage micrometer on ×4 objective lens.

3 Measure the width of the xylem vessel using an eyepiece graticule.

4 Multiply the number of eyepiece graticule units by the calibration of the eyepiece graticule.

A 1, 2, 3 and 4

B 2, 3 and 4 only

C 1 and 2 only

D 3 and 4 only

3 The statements are all descriptions of cell structures.

1 surrounded by a single membrane and enclosing a large fluid-filled space

2 surrounded by a single membrane and enclosing inactivated enzymes

3 formed by two membranes enclosing a matrix, the inner membrane is folded

4 formed by a membrane that has flattened sacs and tubular structures inter-connected throughout the cell

5 formed of nucleic acid and protein attached to membranes or free in the cytoplasm

Which row shows the typical cell in which these cell structures are found?

	plant cell	animal cell
A	1, 2, 3 and 4	1, 2, 3 and 5
B	1, 3, 4 and 5	2, 3, 4 and 5
C	2, 4 and 5	1, 4 and 5
D	3, 4 and 5 only	2, 3 and 5 only

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4 Which structures are found in **both** typical eukaryotic cells **and** typical prokaryotic cells?

1 70S ribsomes

2 80S ribosomes

3 circular DNA

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

5 Which sequence shows some of the stages in the production and secretion of an enzyme?

A Golgi apparatus → ribosome → rough endoplasmic reticulum → mRNA

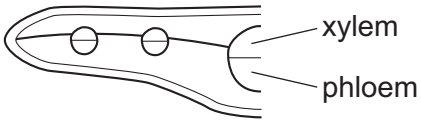
B mRNA → smooth endoplasmic reticulum → Golgi apparatus → vesicle

C ribosome → rough endoplasmic reticulum → vesicle → Golgi apparatus

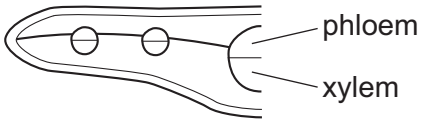
D smooth endoplasmic reticulum → mRNA → vesicle → ribosome

6 Which plan diagram of a transverse section of a dicotyledonous leaf correctly shows the position of xylem and phloem in a palisade mesophyll layer that is twice as thick as the spongy mesophyll layer?

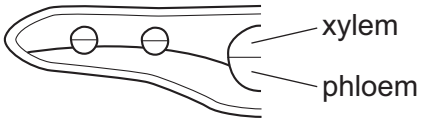
A



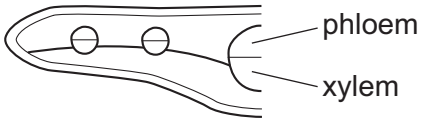
B



C



D



7 Proteases are a group of enzymes that digest proteins.

Which statement about proteases is correct?

A A bacterial protease that is secreted from a disease-causing bacterium could act as an antigen and cause the production of an antibody.

B Bacterial proteases are important in the nitrogen cycle as they are able to catalyse the breakdown of the organic nitrogen molecules nucleotides and urea.

C Non-competitive inhibition of a protease that has an optimum pH of pH2 can be overcome by increasing the substrate concentration and increasing the pH.

D Water molecules are required when peptide bonds that link the monomers together are broken by the action of proteases in condensation reactions.

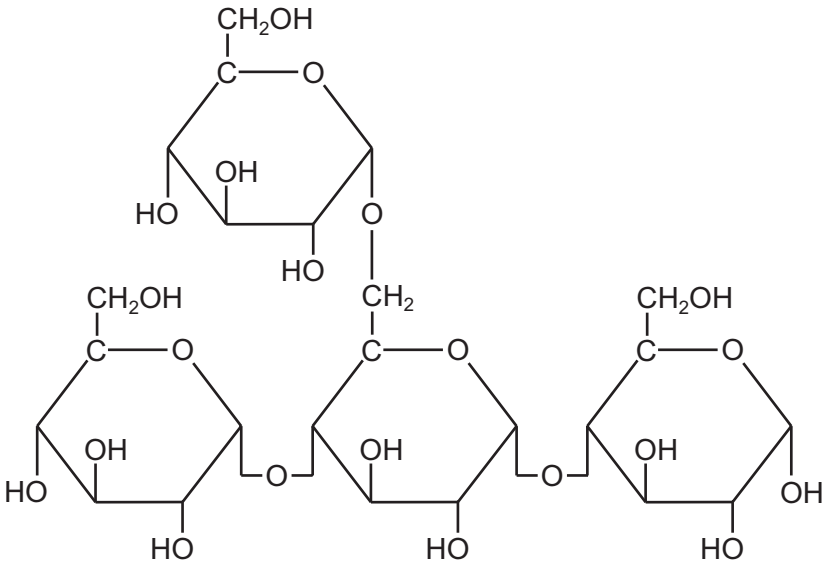
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8 Two disaccharides are maltose and sucrose. Maltose is formed from two molecules of glucose, whilst sucrose is formed from fructose and glucose.

Which row shows the molecular formulae of the two disaccharides?

	maltose	sucrose
A	$C_{12}H_{22}O_{11}$	$C_{12}H_{22}O_{11}$
B	$C_{12}H_{22}O_{11}$	$C_{12}H_{24}O_{12}$
C	$C_{12}H_{24}O_{12}$	$C_{12}H_{22}O_{11}$
D	$C_{12}H_{24}O_{12}$	$C_{12}H_{24}O_{12}$

9 The diagram shows a carbohydrate molecule.



Of which polymers could this be a part?

A amylopectin and cellulose

B amylose and starch

C glycogen and amylose

D starch and glycogen

10 Which of the bonds stabilising the tertiary structure of a protein would be **least** likely to break when the temperature is increased above the optimum for the protein?

A disulfide

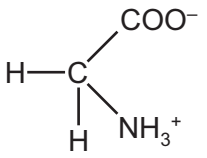
B hydrogen

C hydrophobic

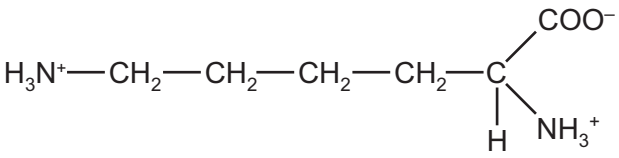
D ionic

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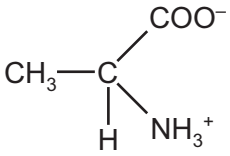
11 The diagram shows the structure of four amino acids in solution.



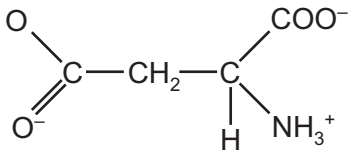
glycine



lysine



alanine



aspartate

Which amino acids have **no** overall charge?

A alanine and aspartate

B alanine and glycine

C aspartate and lysine

D glycine and lysine

12 The statements are about the properties of water.

1 It requires a lot of heat to evaporate.

2 It retains a lot of heat.

3 It is able to form hydrogen bonds with other water molecules.

4 It is able to form hydrogen bonds with other polar and non-polar molecules.

Which properties are important in transpiring plants to prevent enzymes in leaves from being denatured?

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

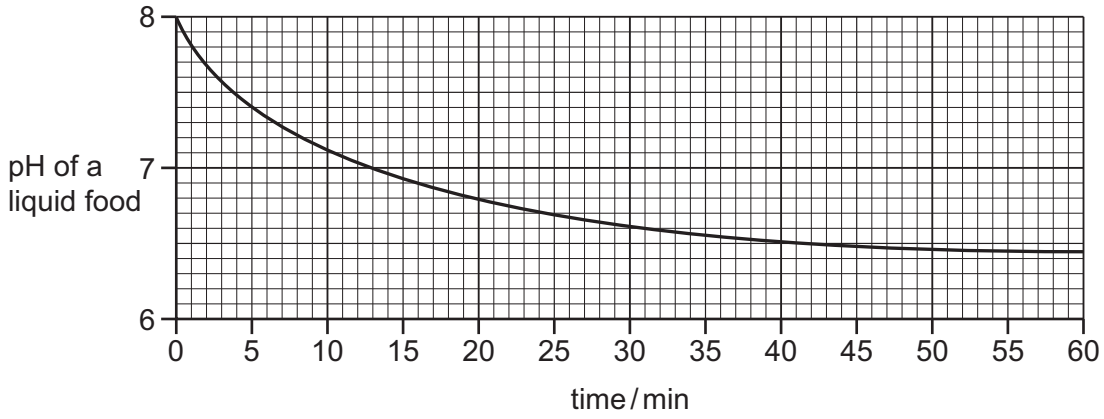
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13 Which words from the table correctly complete the paragraph about enzymes?

When the pH of an environment is decreased below an enzyme's optimum pH, ……1…… bonds between adjacent ……2…… groups, holding the ……3…… structure, are disrupted.

	1	2	3
A	hydrogen and ionic	R	tertiary
B	hydrogen	hydroxyl	secondary
C	ionic and peptide	R	primary and tertiary
D	peptide	amine	primary

14 Lipase is a digestive enzyme produced by the pancreas that catalyses the hydrolysis of dietary lipids. The table shows how the pH of a liquid food containing a high proportion of lipids decreases over time.



Which statements are possible explanations of the results of the experiment between 50 and 60 minutes?

1 Enzyme concentration becomes the limiting factor.

2 Substrate concentration becomes the limiting factor.

3 All the enzyme active sites are saturated.

4 Denaturation of the enzyme by the products.

5 Products are acting as competitive inhibitors.

A 1, 2 and 3 **B** 1, 4 and 5 **C** 2, 3 and 4 **D** 2, 4 and 5

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15 The AIDS virus produces a long polypeptide that is hydrolysed by a protease enzyme, producing several smaller peptides. This viral protease is the target of anti-AIDS drugs.

Which feature is essential for the success of these drugs?

A a complex structure that inhibits many types of viral enzyme

B a molecule containing a heavy metal atom that is a non-competitive inhibitor of enzymes

C a protein that can act as a competitive inhibitor of protease enzymes

D a specific structure that inhibits only viral protease

16 What is the width of the cell surface membrane?

A 0.5 – 1.0 nm **B** 5 – 10 nm **C** 50 – 100 nm **D** 0.5 – 1 μm

17 Some functions of molecules found in cell surface membranes are listed.

1 cell recognition

2 ion transport

3 maintaining fluidity

4 mechanical stability

Which are functions of cholesterol?

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

18 The enzyme lactase is found in the membranes of epithelial cells lining the small intestine.

The enzyme is formed by a single polypeptide that folds to give three regions.

- an active site with the free amino group outside the cell
- a short section inside the membrane
- a short section inside the cell

What type of amino acid would be found in each of the three regions?

	outside cell	inside the membrane	inside the cell
A	hydrophilic	hydrophobic	hydrophilic
B	hydrophilic	hydrophobic	hydrophobic
C	hydrophobic	hydrophilic	hydrophobic
D	hydrophobic	hydrophobic	hydrophilic

19 A student examined the cells in the growing region (meristem) of an onion root and obtained the data below.

stage	number of cells
interphase	886
prophase	73
metaphase	16
anaphase	14
telophase	11

What percentage of cells contain chromosomes that appear as two chromatids?

A 97.5% **B** 95.9% **C** 8.9% **D** 7.3%

20 Which definitions of *diploid* and *haploid* are true for typical eukaryotic cells?

1 *diploid* – any cell with an even number of homologous chromosomes

2 *diploid* – any cell with two copies of each homologous chromosome

3 *haploid* – any cell with half the diploid number of homologous chromosomes

4 *haploid* – any cell with one copy of each homologous chromosome

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

21 Which type of sugar and types of bonds are found in a DNA molecule?

	type of sugar	types of bonds
A	non-reducing	hydrogen and ionic
B	non-reducing	hydrogen and peptide
C	reducing	covalent and hydrogen
D	reducing	hydrogen and peptide

22 Which nucleic acid bases are purines?

A adenine and cytosine

B cytosine and thymine

C guanine and adenine

D uracil and cytosine

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23 A short piece of DNA 15 base pairs long was analysed to find the number of nucleotide bases in each of the polynucleotide strands. Some of the results are shown below.

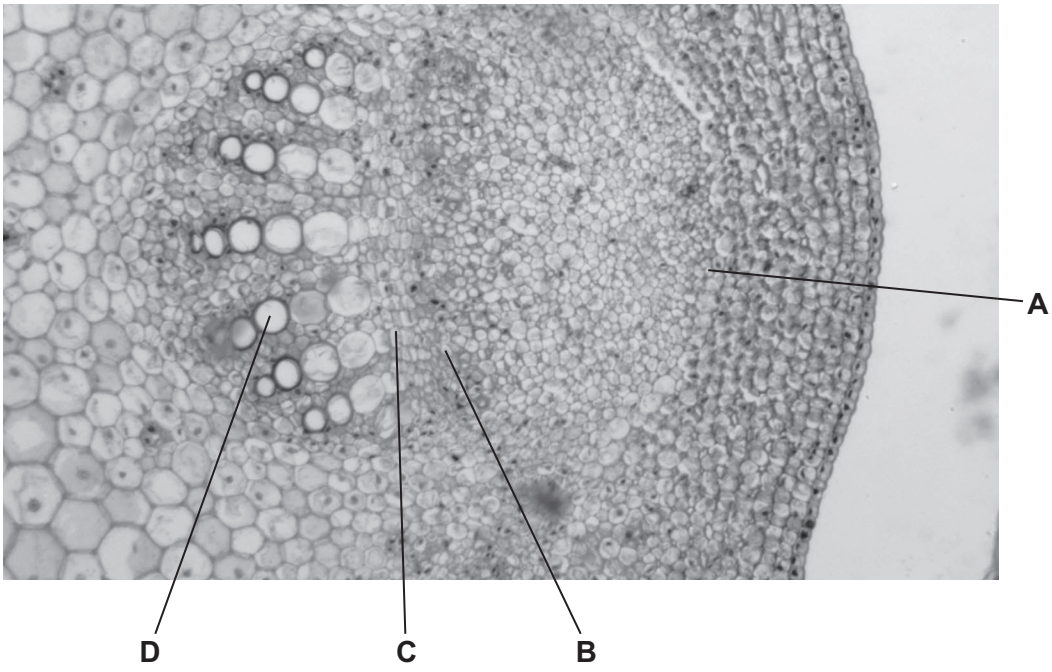
	number of nucleotide bases			
	A	C	G	T
strand 1		6		3
strand 2				4

How many nucleotides containing guanine were present in strand 1?

A 2 **B** 3 **C** 4 **D** 6

24 The diagram shows a transverse section of a stem.

Which area is the phloem?



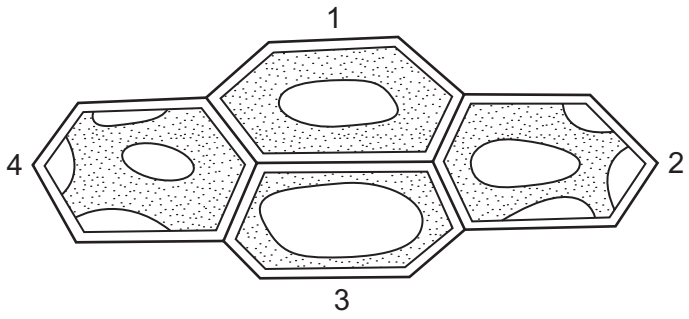
25 A leafy shoot was attached to a potometer and exposed to a variety of conditions. The time taken for the meniscus to move 50 mm along the capillary tubing was recorded for each set of conditions.

temperature / °C	humidity	air movement	time taken to move 50 mm / s
20	dry	still	125
20	dry	moving	71
30	dry	still	40
20	humid	still	166
20	humid	moving	83
30	humid	still	55

Which shows the slowest and fastest rates of water uptake?

	slowest / mm s^{-1}	fastest / mm s^{-1}
A	0.3	1.3
B	0.3	3.3
C	3.3	0.3
D	1.3	0.8

26 The diagram shows four plant cells.



In which direction could there be net movement of water by osmosis?

A 1 to 2 and 1 to 4

B 1 to 3 and 1 to 2

C 2 to 1 and 1 to 4

D 4 to 1 and 2 to 3

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27 How will the root pressure in a plant be affected by waterlogged soil?

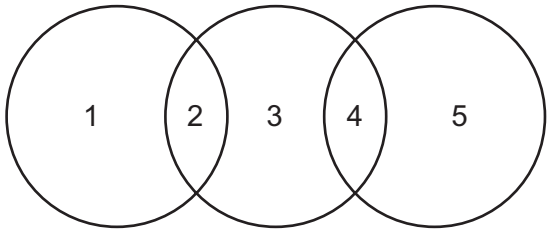
A It will not be affected.

B It will decrease due to a lack of oxygen in the soil.

C It will increase due to a lower water potential in the soil.

D It will increase due to a higher rate of transpiration.

28 The diagram shows the relationship between phloem sieve tube elements, xylem vessel elements and companion cells.



Which is correct?

	1	2	3	4	5
A	companion cells	endoplasmic reticulum	phloem sieve tube elements	nucleus absent	xylem vessel elements
B	companion cells	nucleus	phloem sieve tube elements	cytoplasm	xylem vessel elements
C	phloem sieve tube elements	mitochondria	companion cells	nucleus	xylem vessel elements
D	xylem vessel elements	cytoplasm absent	phloem sieve tube elements	vacuole	companion cells

29 Small arteries (arterioles) are found near tissues. One function of an arteriole is to increase or decrease the flow of blood to the tissues.

Which tissues would be present in an arteriole wall to allow this function?

1 collagen

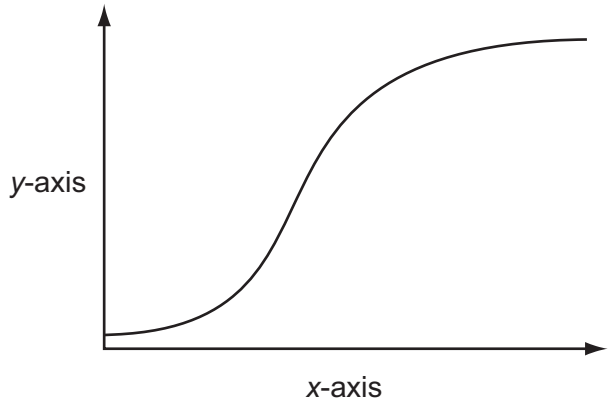
2 elastic

3 muscle

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

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30 The graph shows a dissociation curve for haemoglobin.



Which are suitable labels for the *x*-axis and the *y*-axis?

	x-axis	*y*-axis
A	partial pressure of carbon dioxide	percentage of haemoglobin
B	partial pressure of oxygen	percentage saturation of haemoglobin with oxygen
C	percentage of haemoglobin	partial pressure of oxygen
D	percentage saturation of haemoglobin with oxygen	partial pressure of carbon dioxide

31 One type of congenital heart defect is called atrial septal defect (ASD) where the left and right atria are not completely separated.

ASD usually results in blood moving from the left atrium into the right atrium. This will cause increased blood pressure in the right atrium and decreased blood pressure in the left atrium.

Which row describes the other effects of ASD on blood pressure and oxygenation?

	blood pressure in pulmonary artery	blood pressure in aorta	% oxygenation of blood in pulmonary artery
A	decreased	increased	decreased
B	decreased	increased	increased
C	increased	decreased	decreased
D	increased	decreased	increased

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32 Which are effects on the body of carbon monoxide in tobacco smoke?

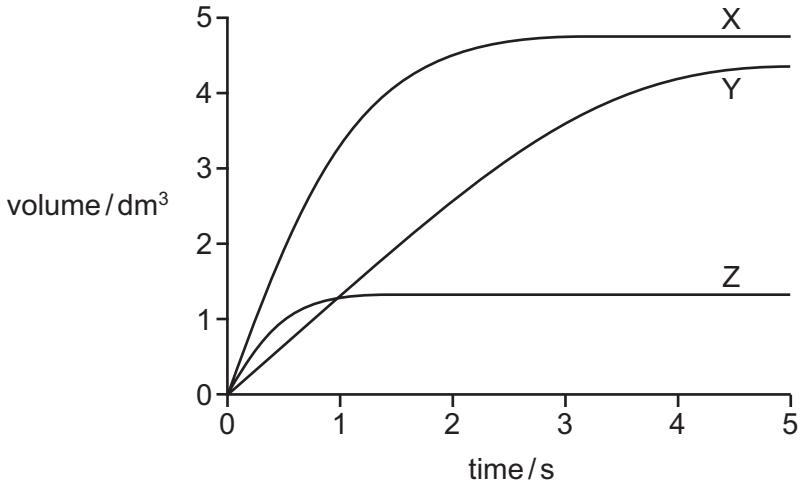
1 It reduces the amount of haemoglobin available to transport oxygen.

2 It reduces the rate of diffusion of oxygen from the alveoli into the blood.

3 It inhibits the release of oxygen from haemoglobin.

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

33 The graph shows the volume of air breathed out quickly and with force, following a deep breath in, for three different people, X, Y and Z.



What is a possible explanation for the differences in the volume of air breathed out by these people shown?

	chronic bronchitis	emphysema	normal lung function
A	X	Z	Y
B	Y	X	Z
C	Y	Z	X
D	Z	Y	X

34 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

35 Which statements about people infected with HIV / AIDS are correct?

1 They can be treated and completely cured.

2 They may live for many years after infection.

3 They will have symptoms.

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

36 The statements refer to polio and tuberculosis (TB).

1 Macrophages present antigens in vaccines to stimulate an immune response.

2 The TB antigens necessary to produce an immune response are proteins which would be digested in the stomach and small intestine.

3 There are no B-lymphocytes and T-lymphocytes in the stomach.

Which explains why polio vaccine can be taken by mouth but TB vaccine has to be injected?

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

37 Which explains why sickle cell anaemia has not been eradicated?

A Identification of carriers is too difficult as they show no symptoms.

B Sickle cell anaemia gives the individual some resistance against malaria.

C Sickle cell anaemia is an inherited disease, so vaccination is not possible.

D The gene responsible for sickle cell anaemia has a high rate of mutation.

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38 Which method of gaining immunity can be described as natural active immunity?

A feeding on colostrum

B inhaling the chicken pox virus

C injection with antibodies

D through the placenta

39 Which stage of energy transfer has the lowest efficiency?

A sunlight → producer

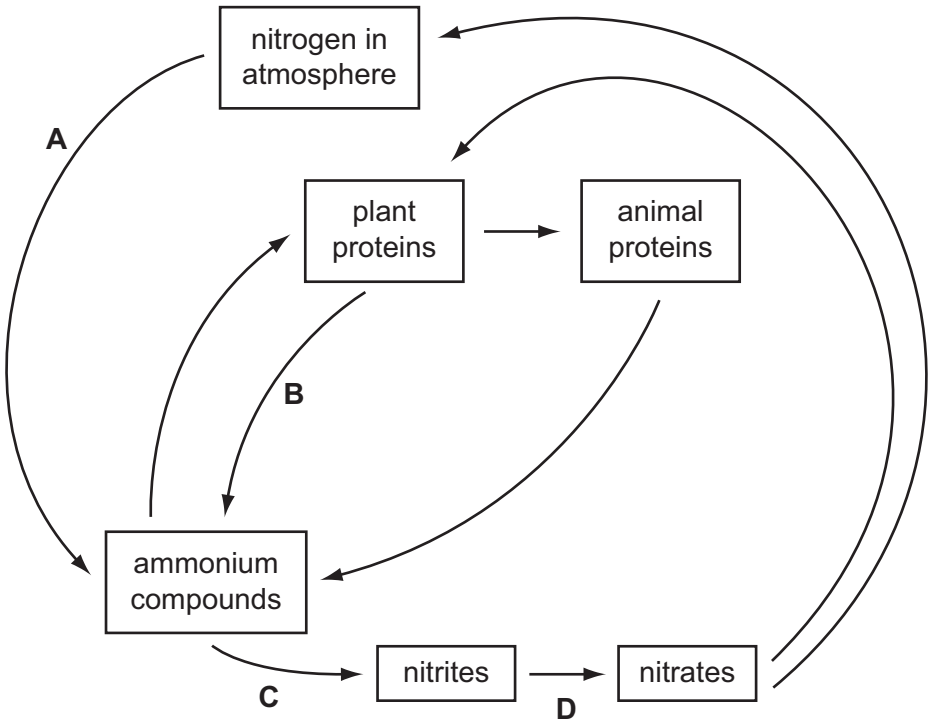
B producer → primary consumer

C primary consumer → secondary consumer

D secondary consumer → tertiary consumer

40 The diagram shows a simplified nitrogen cycle.

During which stage does decomposition take place?



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BIOLOGY **9700/13**

Paper 1 Multiple Choice **October/November 2014**

1 hour

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

9483777787

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 **18** printed pages and **2** blank pages.

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CAMBRIDGE International Examinations

1 The eyepiece of a microscope is fitted with an eyepiece graticule and a stage micrometer scale is placed on the microscope.

Which statements about the stage micrometer scale are correct?

1 It allows you to measure the actual length of cells.

2 It allows you to calibrate the eyepiece graticule.

3 It changes in size as the objective lens changes from ×10 to ×40.

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

2 Density gradient centrifuges are used to separate cell structures by their relative density. Larger cell structures have greater density and sink further down the centrifuge tube.

What is the correct order of the cell structures, starting from the top of the centrifuge tube?

A chloroplasts → nuclei → mitochondria → ribosomes

B nuclei → chloroplasts → mitochondria → ribosomes

C ribosomes → chloroplasts → mitochondria → nuclei

D ribosomes → mitochondria → chloroplasts → nuclei

3 Red blood cells have a diameter of 7000 nm.

Pancreatic cells have a diameter of diameter 35 μm.

What is correct about the relative sizes of these cells?

A The red blood cells are 5 times larger.

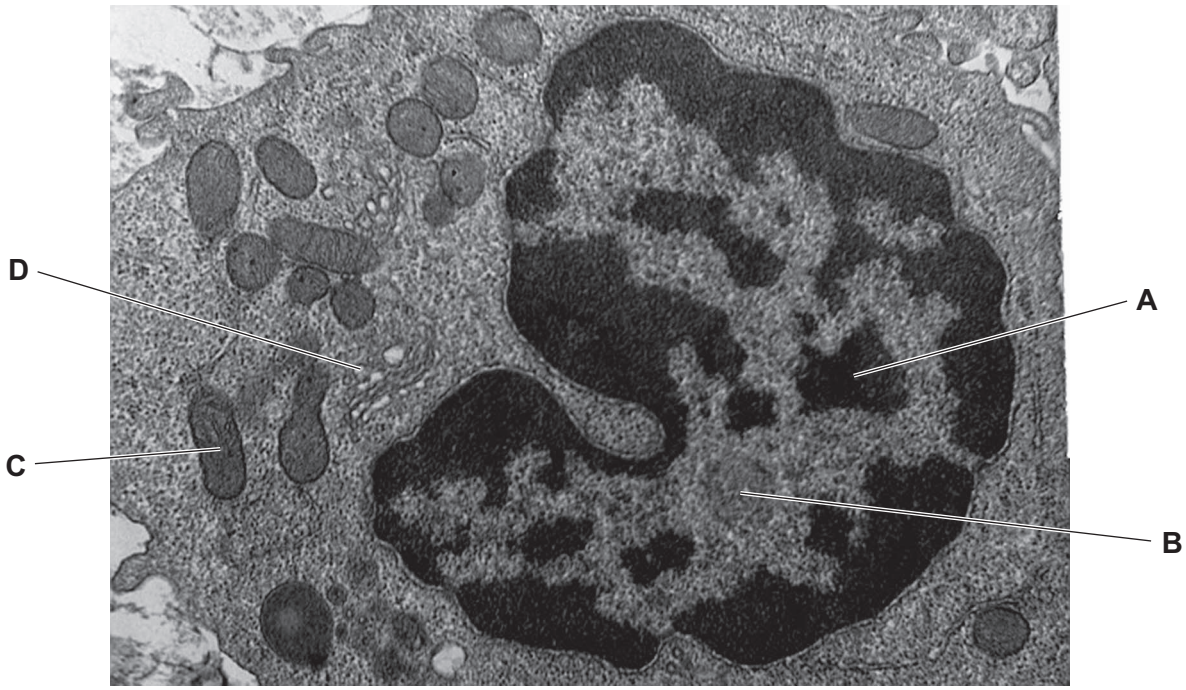
B The red blood cells are 50 times larger.

C The red blood cells are 5 times smaller.

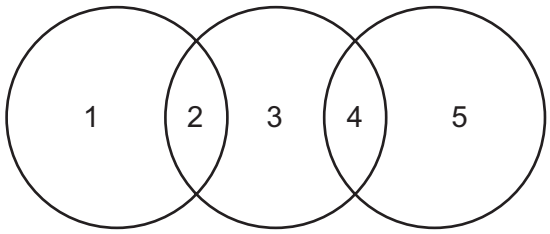
D The red blood cells are 50 times smaller.

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4 Which cell structure shown in the electronmicrograph is the site of protein modification and packaging?



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



Which is correct?

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

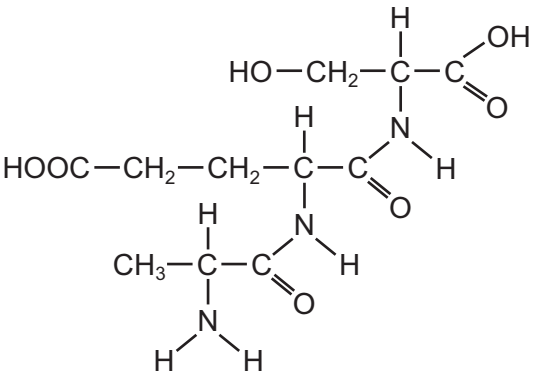
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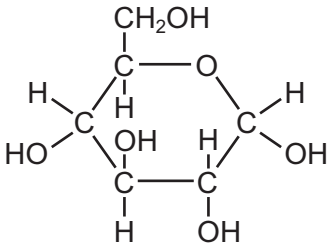
6 Samples of a mixture of biological molecules were tested using Benedict's reagent, biuret solution and ethanol. After testing, the solutions were blue with Benedict's reagent, purple with biuret and cloudy with ethanol.

Which molecules could the mixture contain?

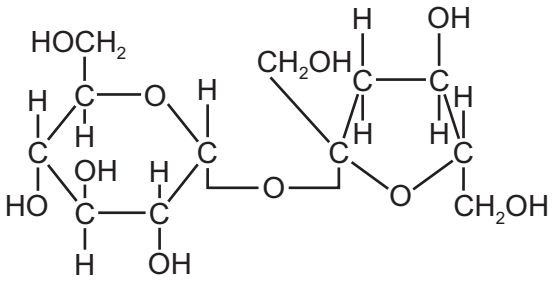
W



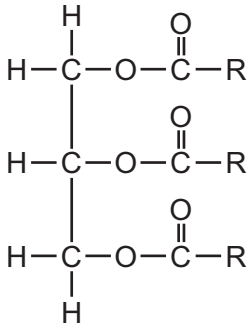
X



Y



Z



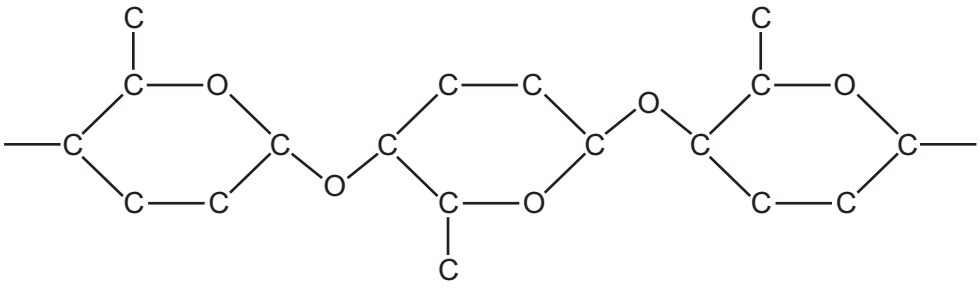
A W, X and Y

B W, X and Z

C W, Y and Z

D X, Y and Z

7 The diagram shows a section of a polysaccharide.



In which polysaccharide(s) could this section be found?

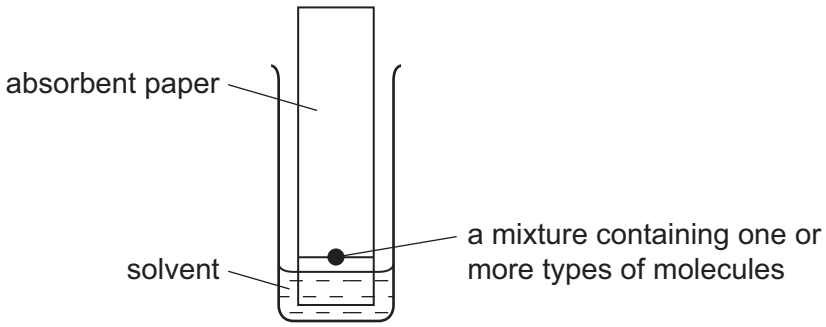
1 amylose

2 cellulose

3 glycogen

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

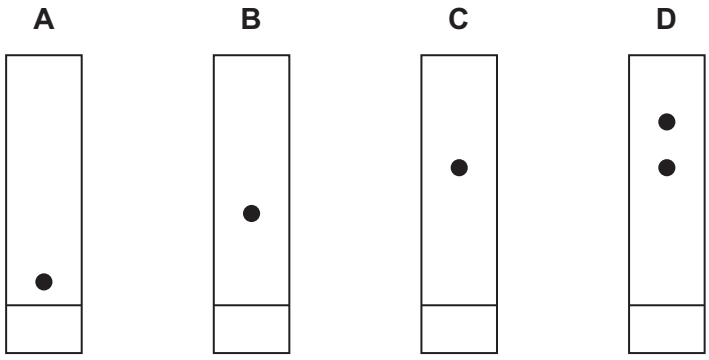
8 Chromatography is a technique used to separate molecules by their solubility. The diagram shows one apparatus used for this technique.



As the solvent rises up the paper, the molecules with the greatest solubility in the solvent travel a fixed distance up the paper. When the solvent reaches the top of the paper, the paper is removed, dried and sprayed with a dye. The different molecules appear as coloured spots.

Chromatography was carried out on four different carbohydrates; sucrose, cellulose, the products of hydrolysis of sucrose and the products of hydrolysis of cellulose.

Which diagram shows the presence of the products of sucrose digestion?



9 In all lipid molecules, where are double bonds located?

A between fatty acids and glycerol

B within fatty acids and within glycerol

C within fatty acids only

D within glycerol only

10 Which of the following terms can be used to describe the secondary structure of a protein?

1 dipeptide

2 specific order of amino acids

3 α-helix

4 fibrous structure

5 β-pleated sheet

A 1, 3, 4 and 5

B 1, 2 and 4

C 2 and 4 only

D 3 and 5 only

11 Why is haemoglobin stated to have a quaternary structure?

A It has four haem groups.

B It has two or more polypeptide chains.

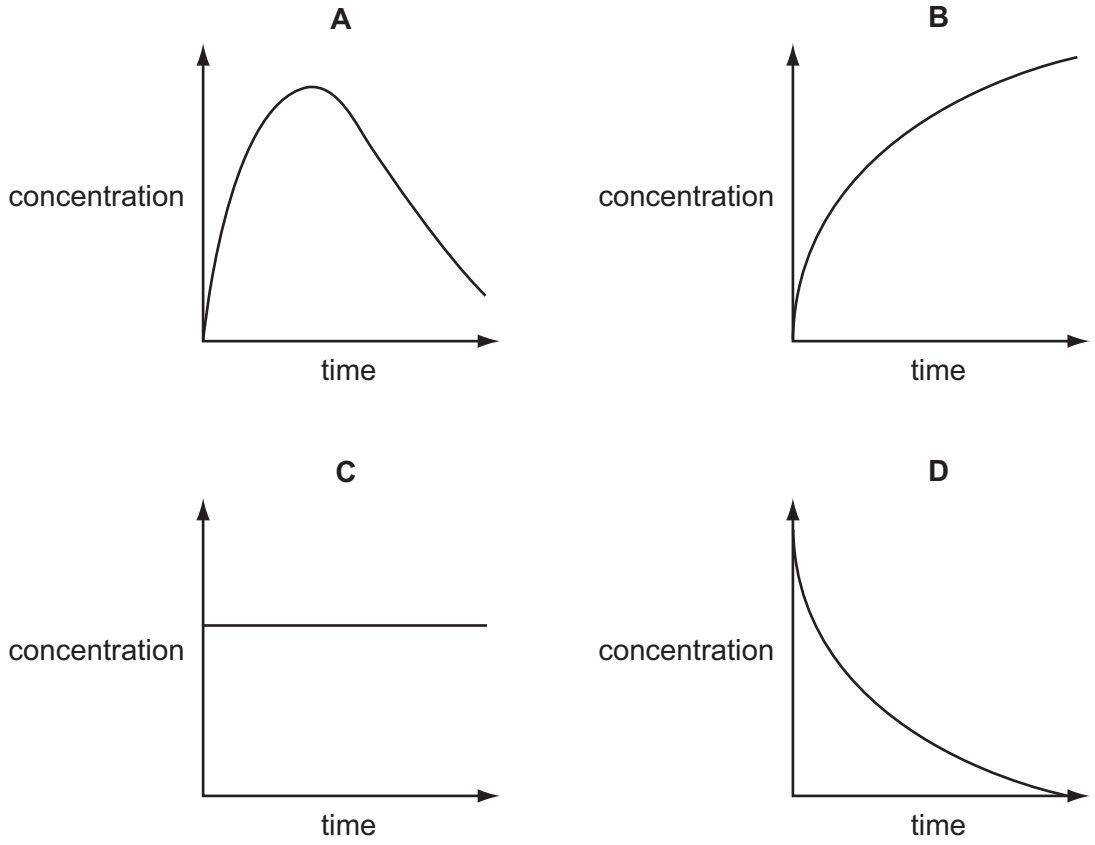
C It is coiled into a precise shape.

D It is held together by four types of bonds.

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12 A quantity of an enzyme was added to a quantity of its substrate. The graphs show the changes in concentration of the enzyme, the substrate, the enzyme-substrate complex and the product over time.

Which graph shows the change in the concentration of the enzyme-substrate complex?



13 Which is correct for a competitive inhibitor of an enzyme?

A	inhibitor binds to a site on the enzyme other than the active site	the substrate concentration has no effect on the level of inhibition
B	inhibitor binds to the active site of the enzyme	increasing the substrate concentration decreases the effect of the inhibitor
C	inhibitor binds to the active site of the enzyme	the substrate concentration has no effect on the level of inhibition
D	inhibitor binds to the enzyme-substrate complex	increasing the substrate concentration decreases the effect of the inhibitor

14 Which two substances maintain the fluidity of the cell membranes?

A cholesterol and glycolipid

B glycolipid and glycoprotein

C glycoprotein and phospholipid

D phospholipid and cholesterol

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15 Membrane proteins are called 'peripheral' if they are temporarily attached to the membrane or 'integral' if they are permanently attached to the membrane.

Integral proteins are described as 'intrinsic' if they extend across the whole bilayer and 'extrinsic' if they are found only in one side of the bilayer.

How would you describe a channel protein?

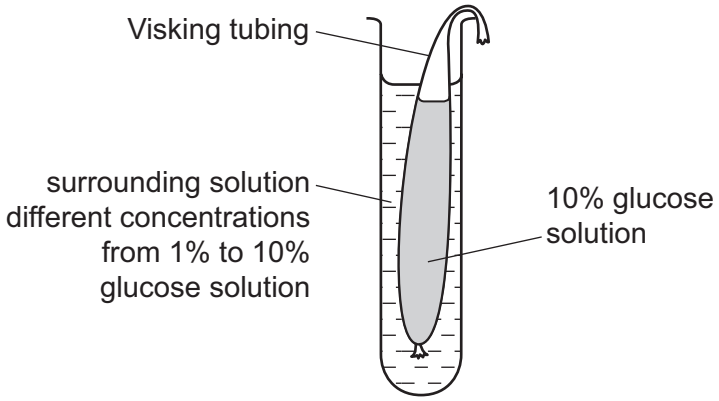
A integral extrinsic

B integral intrinsic

C peripheral extrinsic

D peripheral intrinsic

16 The diagram shows apparatus set up to investigate the effect of changing the concentration of glucose in the surrounding solution on the movement of molecules through a selectively permeable membrane (Visking tubing) in 15 minutes.



As the concentration of glucose solution in the surrounding solution increases, which statements are correct?

1 Net diffusion of water increases.

2 Glucose molecules reach an equilibrium quicker.

3 There is less change in the volume of surrounding solution.

4 Net diffusion of glucose increases.

A 1, 2, 3 and 4

B 1, 2 and 4 only

C 1 and 3 only

D 2 and 3 only

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17 Which is always true of cytokinesis?

1 Cell structures replicate.

2 Cell structures are divided between two cells.

3 Nuclear envelope reforms.

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

18 The statements are about genes and proteins, involved in breast cancer.

- The protein coded by the *BRAC1* gene inhibits the growth of breast cancer cells.
- The protein coded by the *p53* gene suppresses tumours.

Which combination of genes is most likely to result in breast cancer?

	gene	
	BRAC1	*p53*
A	✗	✗
B	✗	✓
C	✓	✗
D	✓	✓

key

✓ = normal active gene

✗ = mutated gene

19 Which structural feature of the DNA molecule varies?

A the arrangement of the sugar-phosphate groups

B the double helical arrangement

C the number of hydrogen bonds between base pairs

D the pairing of the purines with pyrimidines

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 stages occuring in their experiment but they are in the wrong order. ^{14}N DNA contains the 'light' isotope of nitrogen. ^{15}N DNA contains the 'heavy' isotope.

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 stages in the experiment?

A P → S → T → R → Q

B P → T → S → Q → R

C S → P → T → Q → R

D S → T → P → R → Q

21 Which molecules are involved in transcription and which molecules are involved in translation?

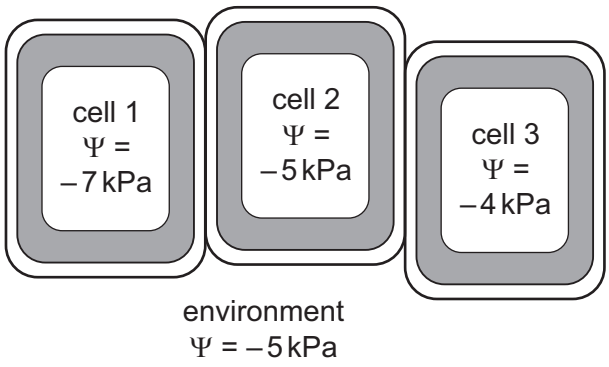
	transcription	translation
A	DNA and mRNA	mRNA and tRNA
B	DNA and tRNA	mRNA and amino acids
C	mRNA and amino acids	DNA and mRNA
D	tRNA and mRNA	amino acids and DNA

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22 Which processes occur in the vascular tissue in leaves and in roots?

	in leaves	in roots
A	sucrose enters phloem and is polymerised to starch	water passes from phloem to xylem by osmosis
B	sucrose enters phloem by active transport and the water potential becomes more negative	sucrose is used or polymerised and the water potential becomes less negative
C	water passes from phloem to xylem by osmosis, making the phloem water potential less negative	active transport of water into the xylem makes the water potential more negative
D	water passes out of xylem and phloem and is lost through transpiration	active transport of ions into the xylem makes the water potential less negative

23 The diagram shows the water potential (Ψ) in some plant cells and in their environment.



Which statements are correct?

1 Water moves into and out of all three cells.

2 There is a net movement of water into cell 1.

3 There is no movement of water from the environment to cell 2.

4 Water moves out of cell 1 so it becomes plasmolysed.

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

24 A region of a plant containing the vascular tissue is treated with a metabolic poison.

How will this treatment affect the transport between roots and leaves via xylem and phloem?

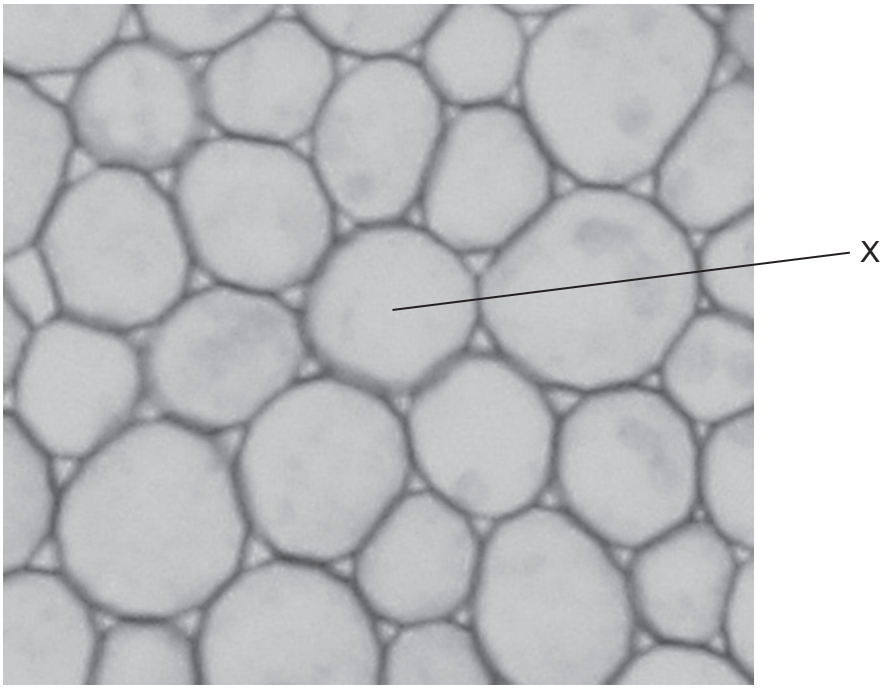
	xylem	phloem
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

key

✓ = transport continues

✗ = transport stops

25 A group of students were asked to look at the photomicrograph of a cross-section of unfamiliar material and make observations.



They described X as

1 circular

2 a hollow tube

3 a spherical structure

Which description(s) are correct?

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

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26 What is correct for tissue fluid?

	phagocytes	platelets	protein concentration compared to blood plasma
A	✓	✓	higher
B	✗	✗	higher
C	✓	✗	lower
D	✗	✓	lower

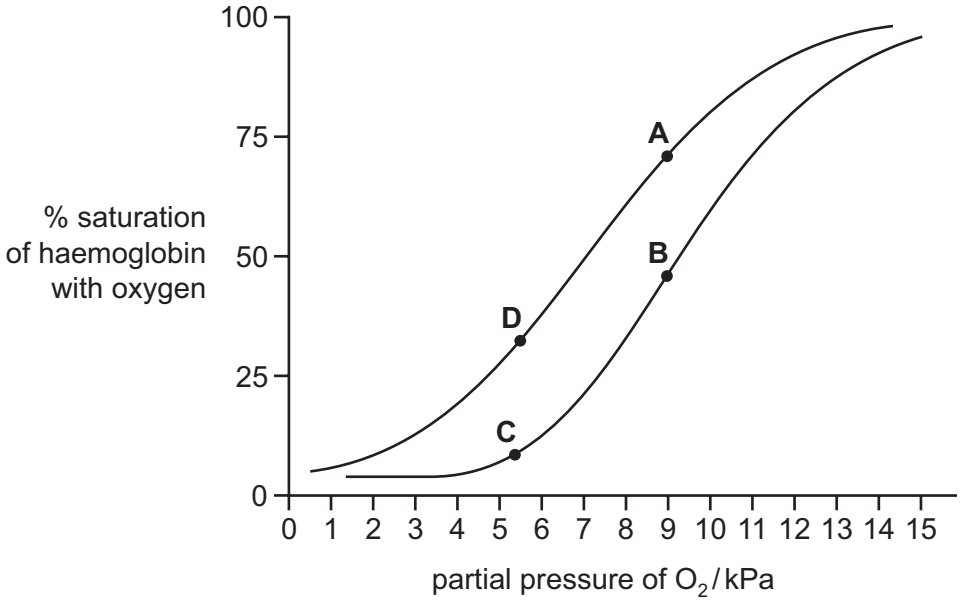
key

✓ = present

✗ = absent

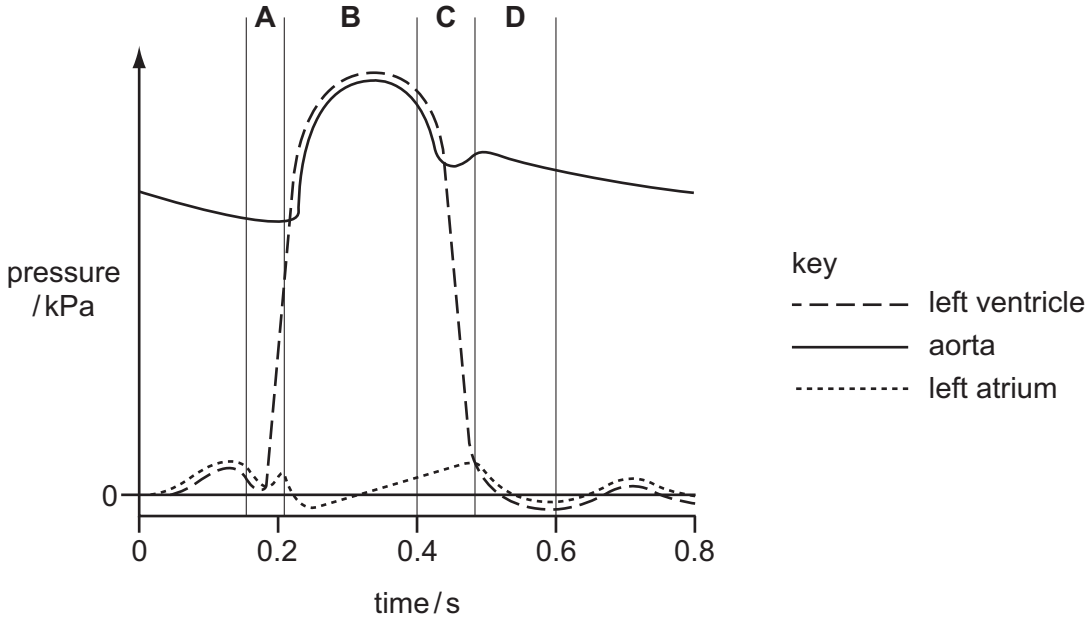
27 The graph shows the dissociation curves for adult haemoglobin at two different (unidentified) concentrations of carbon dioxide.

Which point represents the oxygen concentration in red blood cells as they leave a resting muscle?



28 The diagram shows the pressure changes in various structures of the left side of the heart during the cardiac cycle.

Which letter shows when the ventricle is empty of blood?



29 Which statement concerning events that occur in the heart is correct?

A As the wave of excitation passes through the atrioventricular node there is a time delay before it passes down the Purkyne tissue to the ventricles.

B Movement of blood into the ventricles following atrial contraction causes the ventricular blood pressure to rise above the blood pressure in the atria, closing the atrioventricular valve.

C The band of non-conducting tissue between the atria and ventricles causes the wave of excitation to pass through the Purkyne tissue to reach the atrioventricular node.

D The sinoatrial node in the left atrium, sends out a wave of excitation that spreads across the walls of the atria, resulting in the movement of blood from the atria into the ventricles.

30 Which row correctly shows the areas of the gas exchange system that contain cartilage, ciliated epithelium, goblet cells and smooth muscle?

	cartilage	ciliated epithelium	goblet cells	smooth muscle
A	bronchiole, trachea	bronchiole, trachea	bronchus, trachea	bronchiole, trachea
B	bronchus, trachea	bronchiole, bronchus	bronchus, trachea	bronchiole, trachea
C	bronchiole, trachea	bronchus, trachea	bronchiole, bronchus	bronchiole, bronchus, trachea
D	bronchus, trachea	bronchiole, bronchus, trachea	bronchus, trachea	bronchiole, bronchus, trachea

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31 Which observation would indicate a difference between the structure of the gas exchange system of a cigarette smoker and a non-smoker?

A absence of ciliated epithelium

B decrease in elastic fibres

C enlargement of goblet cells

D increase in smooth muscle

32 Asthma is a lung disease triggered by the inhalation of an allergen such as pollen or dust. The allergen triggers;

- bronchi and bronchioles to become inflamed and narrow
- goblet cells lining these airways to secrete excess mucus.

Which effects will these responses have on the gaseous exchange system of a person with asthma?

1 decrease the diffusion gradient for oxygen in the lungs

2 increase the diffusion distance from the alveoli into the blood

3 increase the risk of developing a lung infection

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

33 A person who returns home after a visit to a foreign country starts to have fevers at regular intervals. Blood tests taken between the fevers and during the fevers show a decrease in the number of red blood cells (anaemia).

Which disease does this person have?

A cholera

B HIV / AIDS

C malaria

D TB

34 Why do people in refugee camps have a high risk of being infected by cholera?

A Drinking water is likely to be contaminated with sewage.

B People live in close contact, increasing the risk of droplet infection.

C There is a shortage of antibiotics.

D There is a shortage of food and water.

35 Which statements explain why cholera has **not** been eradicated by vaccination?

1 Cholera is caused by the bacterium *Vibrio cholerae.*

2 Many people can have the disease, but show no symptoms.

3 People are mobile due to global trade and tourism.

4 The cholera pathogens target cells in the small intestine.

A 1, 2, 3 and 4

B 1 and 2 only

C 2 and 4 only

D 3 and 4 only

36 Cells which divide and give rise to macrophages are called stem cells.

Where in the body do these stem cells divide?

A blood plasma

B bone marrow

C lymph nodes

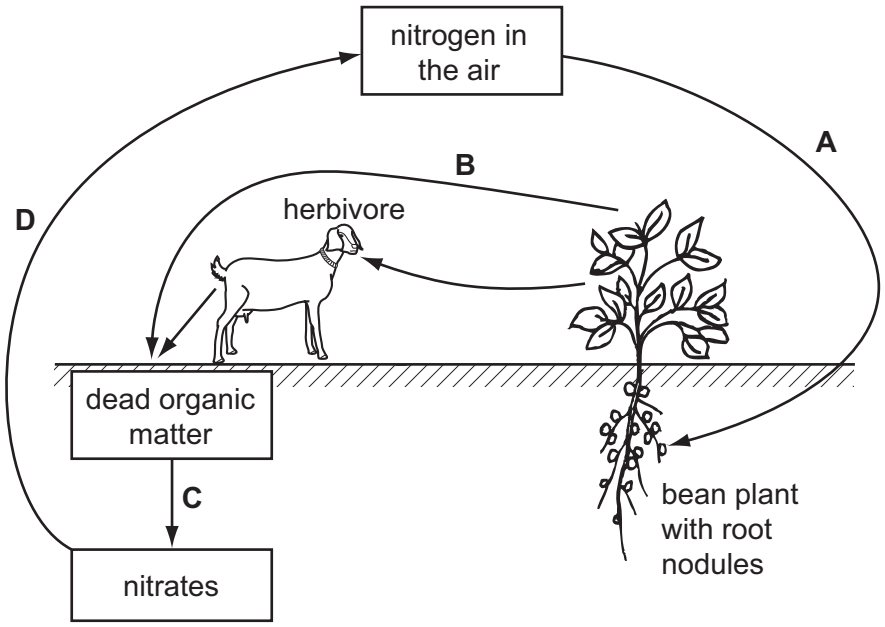
D tissue fluid

37 Which type of immunity occurs following infection by a pathogen?

	natural	artificial
active	**A**	**B**
passive	**C**	**D**

38 The diagram shows part of the nitrogen cycle.

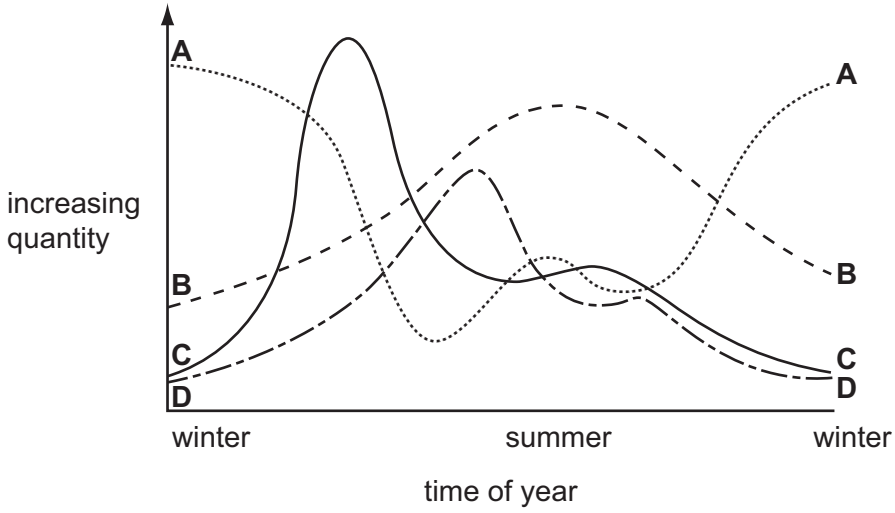
Which process is carried out by denitrifying bacteria?



39 The graph shows the annual changes of the following factors in a lake.

- intensity of light per day
- numbers of producers
- numbers of primary consumers
- quantity of nutrients

Which curve represents the numbers of primary consumers?



40 In a food chain, which link involves the least efficient energy transfer?

A Corn traps sunlight during photosynthesis.

B Mice eat the grain from corn.

C Mongooses feed on snakes.

D Snakes feed on mice.

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