Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/11**

Paper 1 Multiple Choice **May/June 2014**

1 hour

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

6547058302

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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1 What best describes an electron microscope in comparison with a light microscope?

	magnification	resolution
A	higher	higher
B	higher	lower
C	lower	higher
D	lower	lower

2 Where would cisternae be found in a cell?

1 endoplasmic reticulum

2 Golgi apparatus

3 mitochondrion

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

3 Which adaptation would increase active transport of carbohydrates from a plant cell?

A areas where the cell wall is thin

B increased permeability of the cell wall

C large surface area of the cell surface membrane

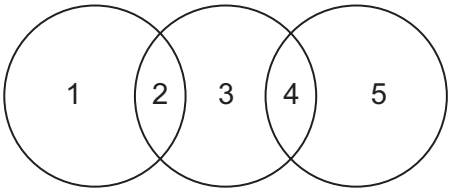
D selective permeability of the vacuole membrane

4 What is the order of size of cell structures?

	largest →			smallest
A	centrioles	ribosomes	lysosomes	nucleoli
B	lysosomes	nucleoli	centrioles	ribosomes
C	nucleoli	lysosomes	centrioles	ribosomes
D	nucleoli	centrioles	ribosomes	lysosomes

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



Which row is correct?

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

6 A student carried out four tests for biological molecules on a solution. The results are shown in the table.

test for biological molecules	observation
iodine solution	orange-brown
biuret	purple
Benedict's	orange
emulsion	clear

Which three molecules may be present in this solution?

A glucose, starch, globin

B globin, glucose, collagen

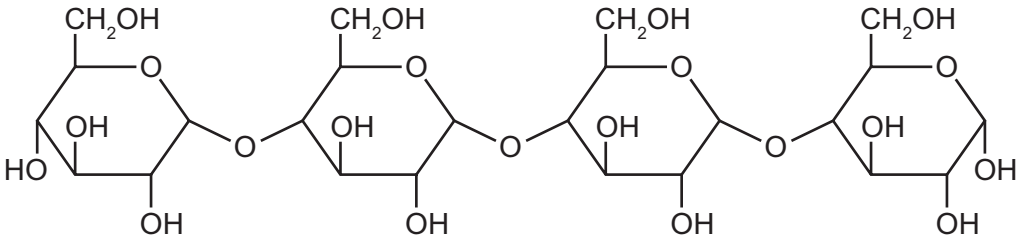
C starch, sucrose, collagen

D sucrose, globin, collagen

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[Turn over

7 The molecule shown is a polymer of reducing sugars.



Which procedures could be carried out in order to test for the presence of the reducing sugars in this molecule?

1 Add hydrolytic enzyme and then heat with Benedict's reagent.

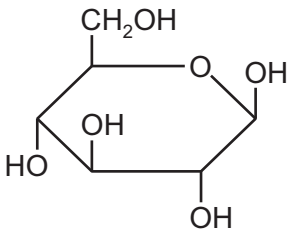
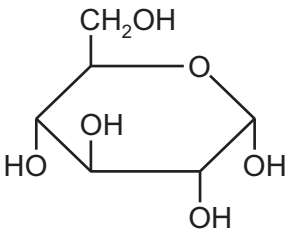
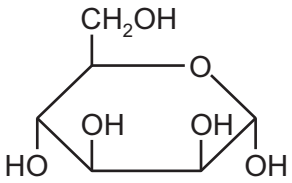
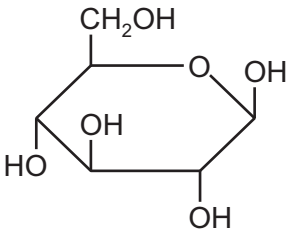
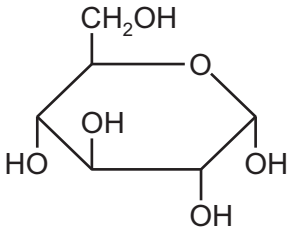
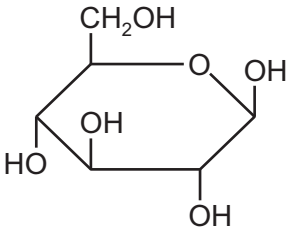
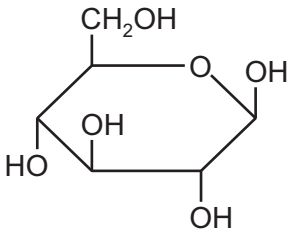
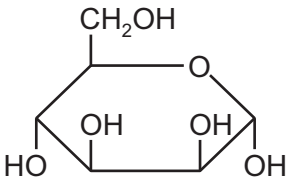
2 Dissolve in water, neutralise and then heat with Benedict's reagent.

3 Boil with hydrochloric acid, neutralise and then heat with Benedict's reagent.

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

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8 Which molecules show the structure of α-glucose and of β-glucose?

	α-glucose	β-glucose
A		
B		
C		
D		

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

A between fatty acids and glycerol

B within fatty acids and within glycerol

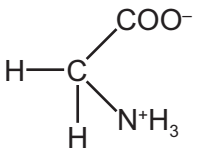
C within fatty acids only

D within glycerol only

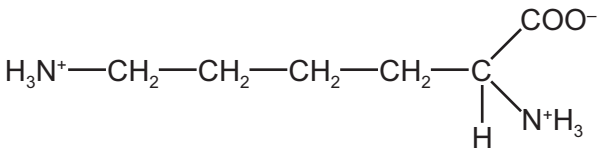
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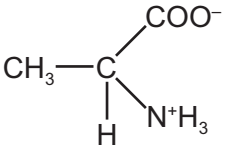
10 The diagram shows the structure of four amino acids in solution.



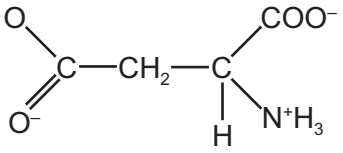
glycine



lysine



alanine



aspartate

Which of these four amino acids have an overall charge?

A alanine and aspartate

B alanine and glycine

C aspartate and lysine

D glycine and lysine

11 Which level of organisation of a haemoglobin molecule is coded by a DNA molecule?

A primary structure

B secondary structure

C tertiary structure

D quaternary structure

12 The statements are about enzymes.

1 They are globular proteins.

2 They are formed in the smooth endoplasmic reticulum.

3 They are only found attached to plasma membranes in the cell.

4 They can be inhibited by competitive inhibitors.

Which statements are correct for **all** enzymes?

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

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13 An unusual enzyme has been found in a tropical grass.

- It catalyses the hydrolysis of the fungal polysaccharide, chitin, into amino sugars.
- It also inhibits the activity of an enzyme in locust guts which catalyses the digestion of amylose.

What describes the actions of this unusual enzyme?

	reaction catalysed	reaction inhibited
A	hydrolysis of glycosidic bonds	condensation of glycosidic bonds
B	hydrolysis of glycosidic bonds	hydrolysis of glycosidic bonds
C	hydrolysis of peptide bonds	condensation of glycosidic bonds
D	hydrolysis of peptide bonds	hydrolysis of glycosidic bonds

14 The fluidity of the cell surface membrane can be changed by a number of factors.

As the fluidity of cell surface membranes decreases, which process would be **least** changed?

A active transport

B diffusion

C endocytosis

D osmosis

15 Which molecules in cell surface membranes contribute to cell recognition?

A cholesterol, glycolipids, phospholipids

B cholesterol, phospholipids, proteins

C glycolipids, glycoproteins, proteins

D phospholipids, glycoproteins, proteins

16 Which is correct for facilitated diffusion **and** active transport?

A both depend on the solubility of the transported molecule in the lipid bilayer

B both increase as the concentration of the transported molecule increases

C both require the use of ATP

D both require the use of membrane proteins

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17 Which features increase the efficiency of ion uptake by a root hair cell?

1 many mitochondria in the cell

2 high concentration of ions in the vacuole

3 protein carriers in the cell surface membrane

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

18 Which processes occur by mitosis?

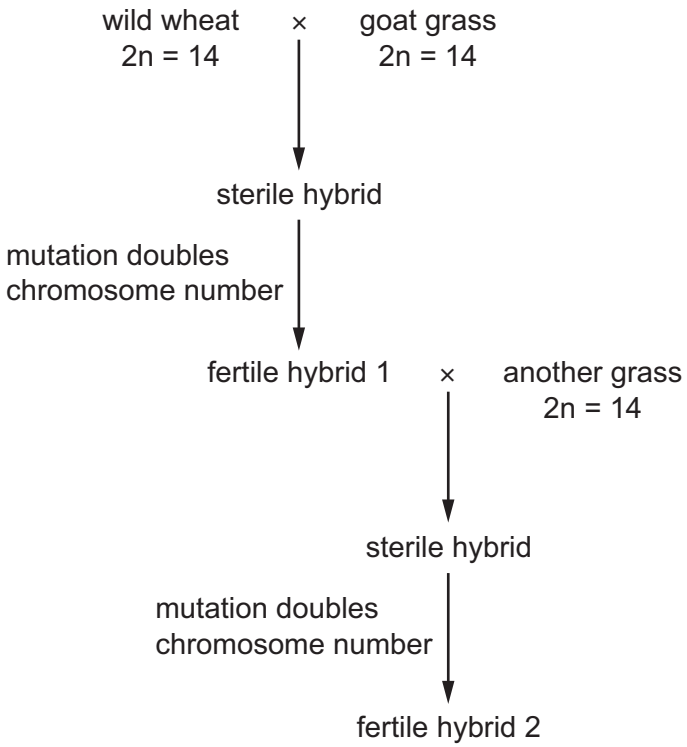
1 cloning of plasma cells

2 gamete production

3 replacing damaged cells

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

19 The diagram shows crosses between wild wheat and two types of grass.

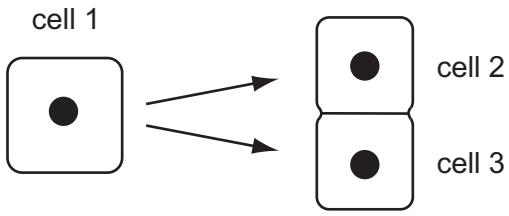


What is the chromosome number of the fertile hybrid 2?

A 28 **B** 42 **C** 56 **D** 140

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20 The diagram shows a human cell (2n = 46) at the end of prophase of mitosis (cell 1) and the daughter cells just after telophase (cells 2 and 3).

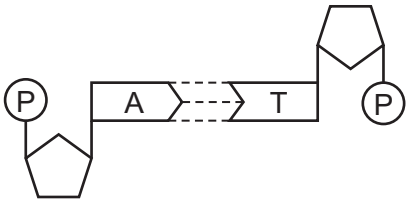


How many DNA molecules are there in the nucleus of cell 1 and cell 2?

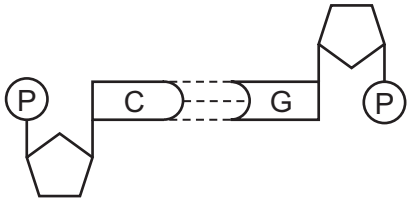
	cell 1	cell 2
A	46	23
B	46	46
C	92	23
D	92	46

21 Which diagram represents a correct base pair of DNA?

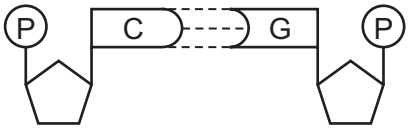
A



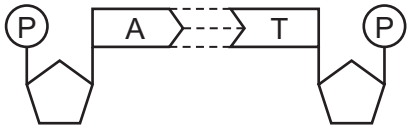
B



C



D



22 Part of the amino acid sequences in normal and sickle cell haemoglobin are shown.

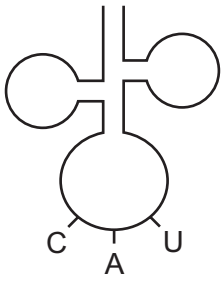
normal haemoglobin	sickle cell haemoglobin
thr-pro-glu-glu	thr-pro-val-glu

Possible mRNA codons for these amino acids are shown below.

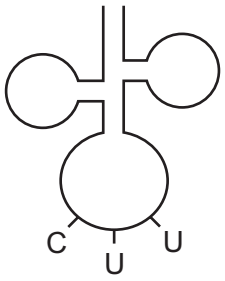
glutamine (glu) GAA GAG	proline (pro) CCU CCC
threonine (thr) ACU ACC	valine (val) GUA GUG

Which tRNA molecule is **not** involved in the formation of this part of the sickle cell haemoglobin?

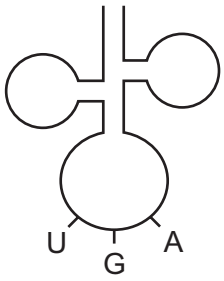
A



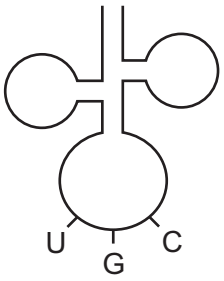
B



C



D

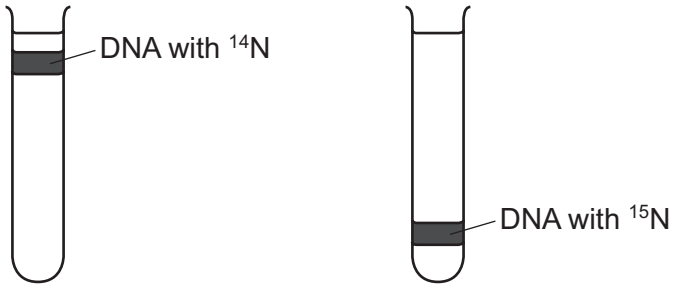


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23 Two sets of bacteria were grown using different types of nitrogen-containing growth media.

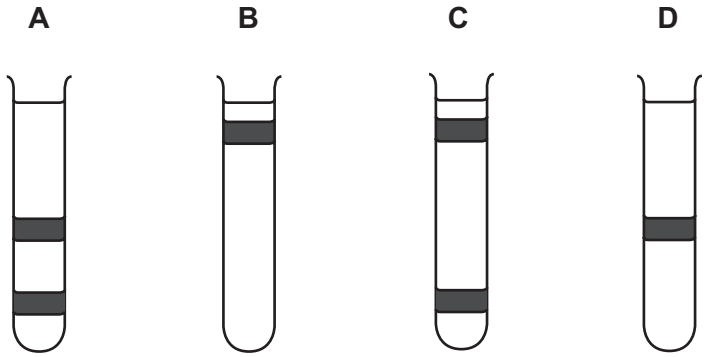
One set was grown in a medium containing the 'heavy' isotope of nitrogen, ^{15}N, until all the DNA was labelled. The other set were grown in a medium containing the 'light' isotope of nitrogen, ^{14}N, until all the DNA was labelled.

The DNA from each set of bacteria was extracted and centrifuged. The diagram shows the position in the centrifuge tubes of this DNA.



Bacteria with ^{15}N labelled DNA were transferred to a medium containing ^{14}N and allowed to reproduce once. The DNA of the new generation of bacteria was extracted and centrifuged.

Which tube shows the position of DNA from this new generation of bacteria?



24 Which processes are involved in transpiration?

1 the diffusion of water vapour from stomata

2 the mass flow of water through the xylem

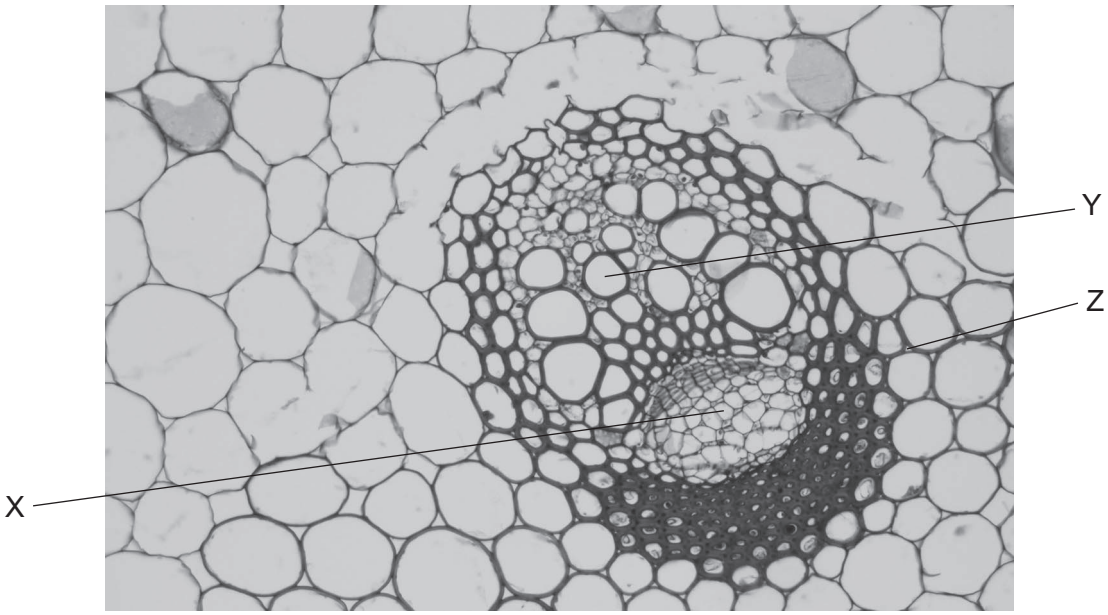
3 the evaporation of water from the surface of mesophyll cells

4 the evaporation of water vapour from air spaces

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

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25 The photomicrograph shows a vascular bundle from the stem of a plant.

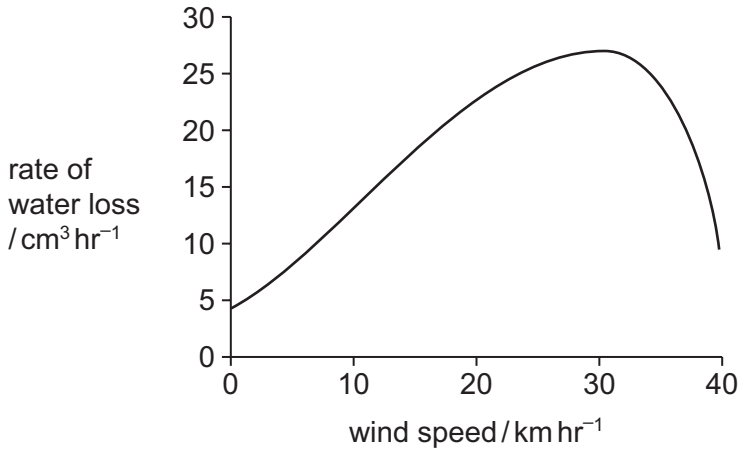


What are the correct labels for structures X, Y and Z?

	X	Y	Z
A	companion cell	sieve tube element	air space
B	sieve tube element	xylem vessel element	air space
C	xylem vessel element	companion cell	sieve tube element
D	xylem vessel element	sieve tube element	companion cell

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26 The graph shows the results of using a potometer to measure the effect of wind speed on the rate of water loss in a plant.



Which statement explains the results obtained from the investigation?

A As wind speed increases, it becomes harder for the plant to obtain carbon dioxide. At high wind speeds the stomata are fully open so rate of water loss is high.

B As wind speed increases, moist air around the stomata is removed and replaced by dry air. At high wind speeds the transpiration rate is lower.

C As wind speed increases, the rate of water loss increases due to an increased diffusion gradient. At high wind speeds, the stomata close.

D As wind speed increases, transpiration rate and rate of photosynthesis increases. At high wind speeds more water is used for photosynthesis.

27 Land flooded by the sea is not suitable for growing plants after the salty flood water has drained away.

Which values of water potential in the xylem and soil water help to explain why the land flooded with salty water is unsuitable for growth of plants?

	water potential / kPa	
	xylem	soil water
A	–1800	–700
B	–700	–1800
C	–700	–300
D	0	–1800

28 What is the role of ATP in a companion cell when sucrose is loaded into a sieve tube element?

A moving sucrose into the sieve tube element

B removing protons out of the cytoplasm of the companion cell

C removing protons from the sieve tube element

D taking up sucrose into the cytoplasm of the companion cell

29 Which features allow an artery to resist changes in the pressure of blood flowing through it?

1 smooth endothelium

2 thick elastic layer in the artery wall

3 thick layer of muscle in the artery wall

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

30 Which reactions will be taking place in blood in a capillary next to an alveolus?

1 $Hb + 4O_2 \rightarrow HbO_8$

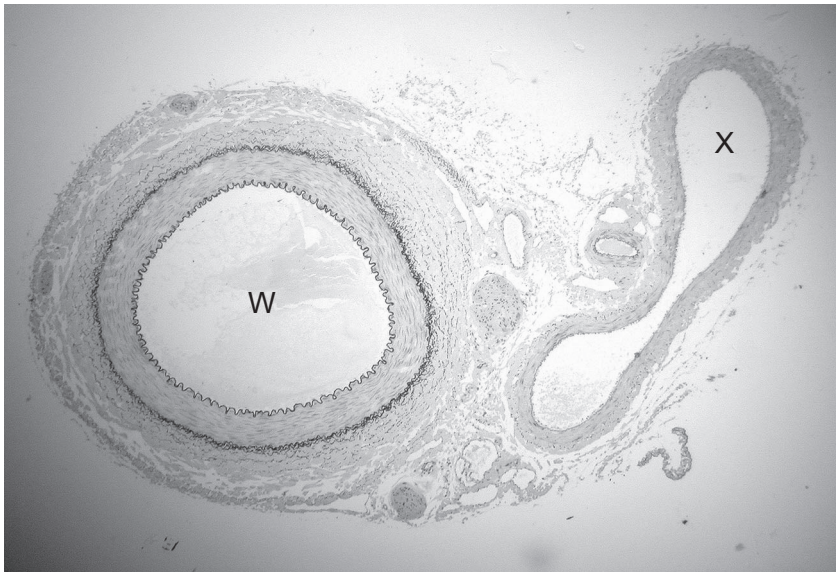
2 $H_2O + CO_2 \rightarrow H_2CO_3$

3 $HHb + 4O_2 \rightarrow HbO_8 + H^+$

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

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31 The photomicrograph shows a section through two structures found in mammals viewed using a light microscope.



×40

Which row is correct?

	W	X	feature
A	artery	vein	X contains cells with haemoglobinic acid
B	bronchiole	vein	X contains cells with oxyhaemoglobin
C	trachea	artery	the lumen of W allows air to pass through
D	vein	atrium	W contains deoxygenated blood

32 Which cells or tissues are **not correctly** paired with their function?

	cells / tissues	function
A	cartilage	supports the trachea
B	ciliated epithelial cells	move mucus over the surface of the trachea
C	goblet cells	produce enzymes to destroy bacteria
D	smooth muscle	constriction of some of the bronchioles

33 Which could lead to chronic bronchitis?

A deposition of allergens in airways causing smooth muscles to contract

B excessive secretion and accumulation of mucus and destruction of many cilia in the airways

C infection of airways leading to phagocytes destroying the elastin in the alveoli

D mutation in epithelial cells in airways caused by inhaled chemicals

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34 What is the minimum number of cell membranes a molecule of carbon dioxide and a molecule of oxygen pass through during gas exchange between alveoli and the capillaries?

	carbon dioxide	oxygen
A	2	4
B	3	5
C	4	5
D	4	4

35 The statements refer to the disease tuberculosis (TB).

1 The pathogen lives inside human cells so is not accessible to the immune system.

2 The bacterial pathogen reproduces slowly.

3 The pathogen is not very sensitive to antibiotics.

Which explains why antibiotic treatment for TB takes a long time?

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

36 The first column in the table contains statements about disease. Columns headed 1-4 represent four different named diseases.

	disease			
statement about disease	1	2	3	4
infectious disease		✓	✓	✓
can be treated with antibiotics			✓	
caused by a bacterium			✓	
degeneration of lung tissue	✓			

key

✓ = true

Which is the correct set of column headings for the diseases in the table?

	disease			
	1	2	3	4
A	bronchitis	measles	malaria	smallpox
B	emphysema	malaria	HIV / AIDS	cholera
C	emphysema	smallpox	cholera	HIV/AIDS
D	lung cancer	smallpox	HIV / AIDS	cholera

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37 The following events occur when a phagocyte responds to the presence of a pathogen.

1 endocytosis

2 enzymic digestion

3 exocytosis

4 phagocytosis

5 vacuole formation

Which is the correct sequence of events?

	first →			last
A	1	5	2	3
B	3	2	5	1
C	4	2	5	3
D	4	5	2	1

38 Which type of immunity occurs as a result of the ingestion of antibodies by an infant through its mother's milk?

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

39 An insect lives in and feeds on the tissue of oak tree leaves and is eaten by birds.

Which ecological terms are described in this information about the insect?

	habitat	niche	trophic level
A	✓	✓	✓
B	✓	✓	✗
C	✗	✓	✓
D	✗	✗	✓

key

✓ = can be described

✗ = cannot be described

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[Turn over

40 A farmer grows a different crop in a field each year for three years.

In the fourth year the farmer plants a leguminous crop and then ploughs this into the soil. The next year the rotation starts again.

Which microorganisms will increase by the time the rotation starts again?

1 denitrifying bacteria

2 nitrifying bacteria

3 nitrogen-fixing bacteria

4 decomposing bacteria

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

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Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/12**

Paper 1 Multiple Choice **May/June 2014**

1 hour

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

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READ THESE INSTRUCTIONS FIRST

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Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.
DO **NOT** WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
Electronic calculators may be used.

This document consists of **16** printed pages.

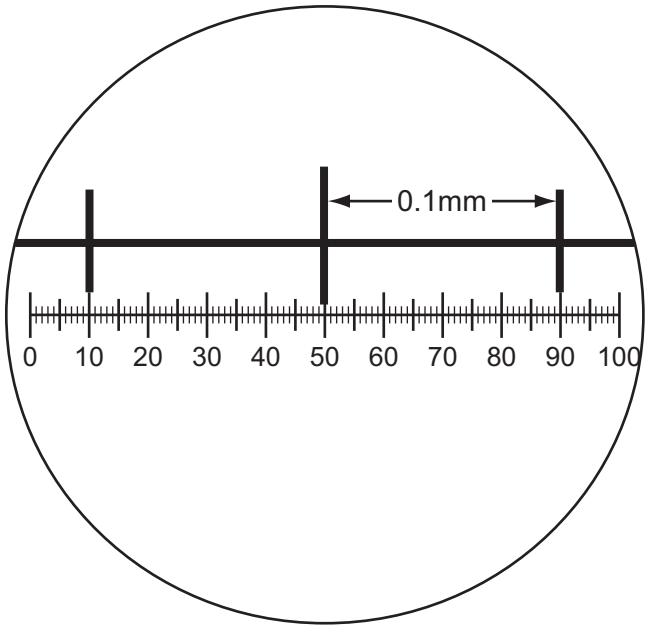
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CAMBRIDGE International Examinations

1 At approximately which magnification is light microscopy not suitable because the resolution becomes too low?

A ×100 **B** ×200 **C** ×400 **D** ×1500

2 The diagram shows a stage micrometer viewed with an eyepiece graticule scale, using a magnification of ×400.



Using the same magnification, a chloroplast is measured and found to be 4 eyepiece graticule divisions long.

How long is the chloroplast?

A 1.0×10^{1} μm

B 4.0×10^{2} μm

C 2.5×10^{-1} μm

D 2.5×10^{-2} μm

3 Which organelle does **not** contain a partially permeable membrane?

A Golgi apparatus

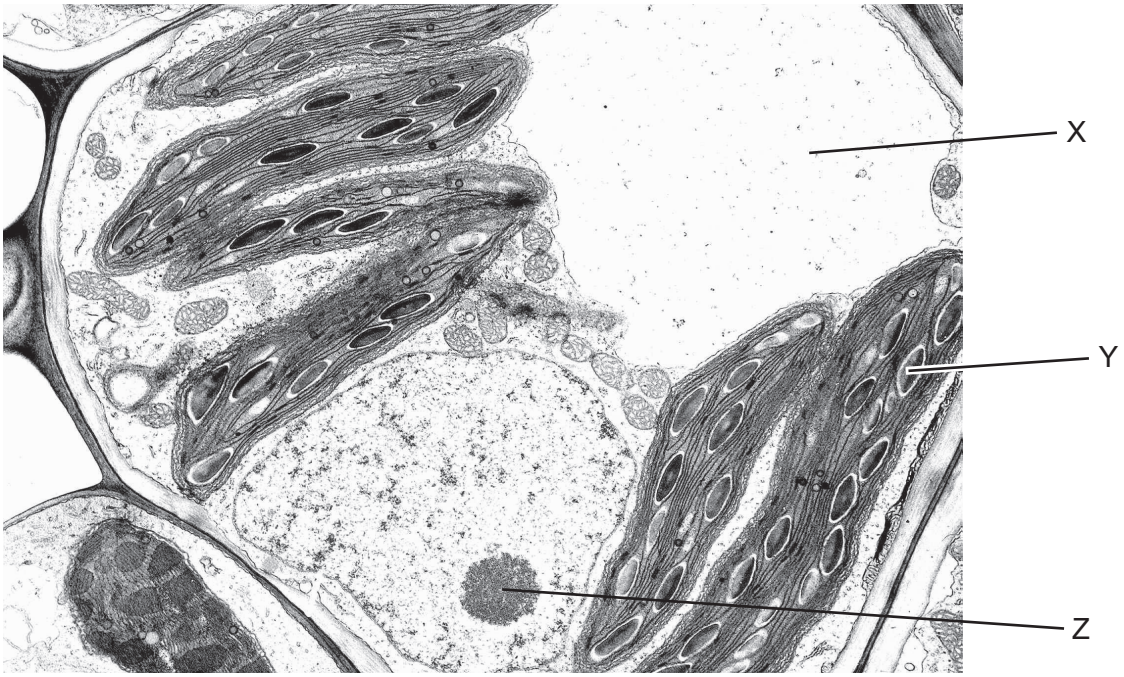
B lysosome

C mitochondrion

D ribosome

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4 The diagram shows an electron micrograph of a plant cell.



What do structures X, Y and Z contain?

	X	Y	Z
A	air	starch	DNA and RNA
B	cell sap	chlorophyll	protein
C	mineral ions	starch	DNA and RNA
D	water	mineral ions	starch

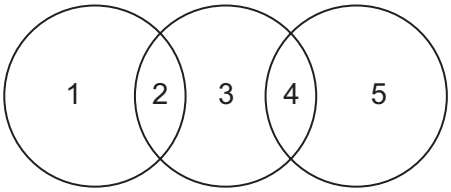
5 An amino acid enters a cell and is then used to synthesise an enzyme secreted by the cell.

What is the sequence of cell structures involved in the synthesis of the enzyme?

	first →			last
A	endoplasmic reticulum	Golgi apparatus	ribosome	exocytotic vesicle
B	endoplasmic reticulum	ribosome	Golgi apparatus	cell surface membrane
C	ribosome	endoplasmic reticulum	Golgi apparatus	exocytotic vesicle
D	ribosome	Golgi apparatus	endoplasmic reticulum	cell surface membrane

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

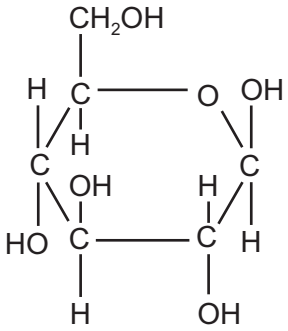


Which row is correct?

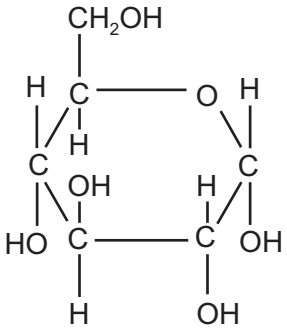
	1	2	3	4	5
A	chloroplasts	70S ribosomes	prokaryotes	70S ribosomes	mitochondria
B	chloroplasts	70S ribosomes	prokaryotes	80S ribosomes	mitochondria
C	mitochondria	70S ribosomes	chloroplasts	80S ribosomes	prokaryotes
D	mitochondria	80S ribosomes	chloroplasts	80S ribosomes	prokaryotes

7 Which shows the basic unit of glycogen?

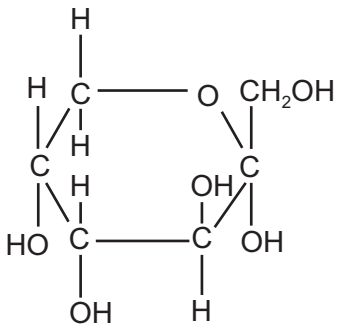
A



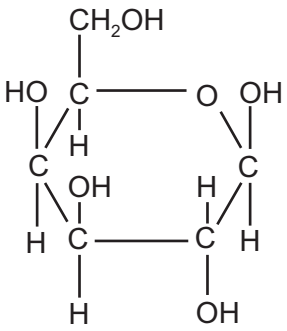
B



C



D



8 Four sugar solutions were tested with Benedict's solution. The table shows the colour of the solutions after testing.

solution	colour
1	green
2	blue
3	brick red
4	yellow

What is the best interpretation of the results?

	solution 1	solution 2	solution 3	solution 4
A	0.05% reducing sugar	0.5% non-reducing sugar	1.0% reducing sugar	0.1% reducing sugar
B	0.5% reducing sugar	0.0% reducing sugar	1.0% reducing sugar	0.1% reducing sugar
C	1.0% reducing sugar	1.0% non-reducing sugar	1.5% reducing sugar	0.5% reducing sugar
D	0.05% non-reducing sugar	0.5% reducing sugar	1.0% non-reducing sugar	0.1% non-reducing sugar

9 Which features adapt a cellulose molecule for its function?

1 Long chains of glucose molecules coil into a helix.

2 Many hydrogen bonds form between adjacent chains.

3 It is insoluble in water.

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

10 The structure of phospholipids and triglycerides include the following.

1 glycerol linked to fatty acids

2 hydrophobic fatty acid chains

3 saturated fatty acid chains

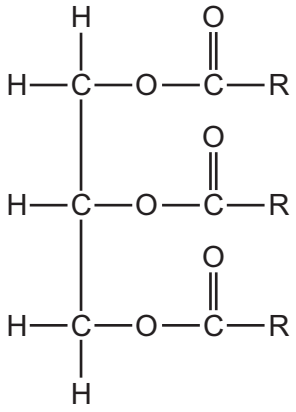
Which structures enable the formation of a lipid bilayer in cell surface membranes?

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

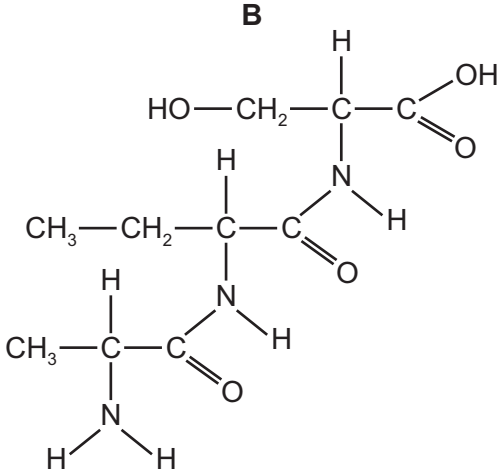
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11 Which molecule contains a glycosidic bond?

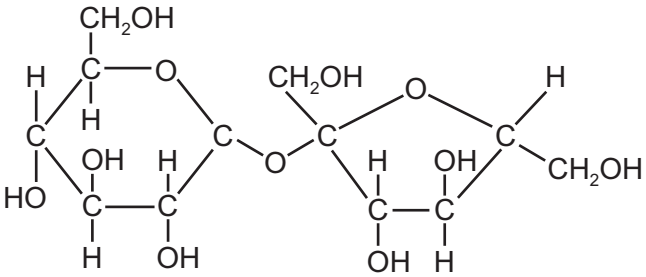
A



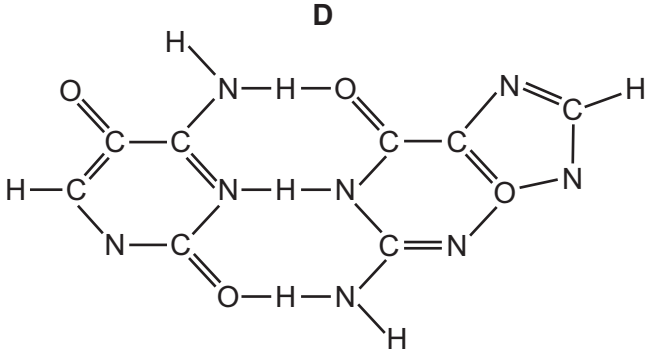
B



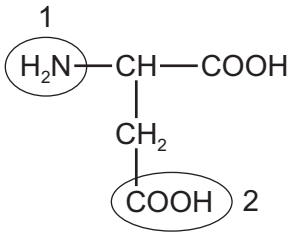
C

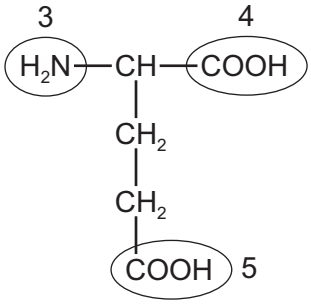


D



12 The diagrams show the structures of two amino acids, each of which has two carboxylic acid (–COOH) groups.





A peptide bond is formed between the two amino acids.

Which groups form the peptide bond?

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

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13 The drug ritonavir is sometimes used in the treatment of HIV / AIDS.

Ritonavir consists of three amino acids and is a competitive inhibitor of HIV protease. HIV causes this protease to be made inside human cells.

Ritonavir produces many side effects as it interferes with many metabolic processes in human cells.

Which statements about ritonavir are correct?

1 Ritonavir has a shape complementary to the active site of HIV protease.

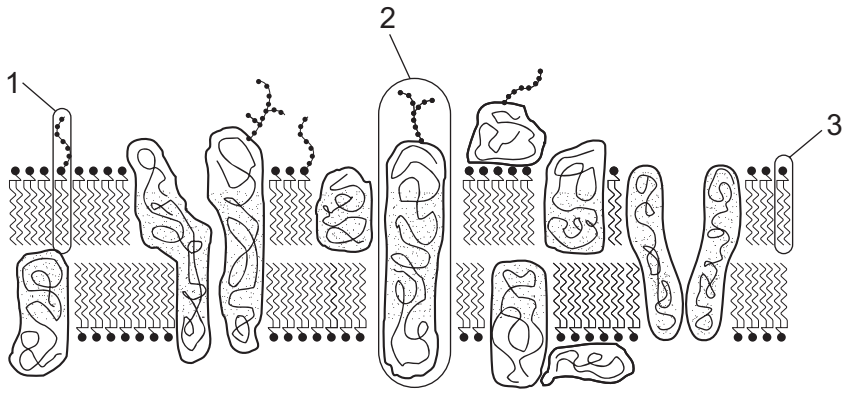
2 Ritonavir will enter human cells directly through the lipid bilayer and not require any transport proteins.

3 Ritonavir is likely to inhibit many of the enzymes of human cells.

4 Complete hydrolysis of ritonavir would require the addition of three water molecules.

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

14 The diagram shows the fluid mosaic model of a section of a cell surface membrane.



What is the role of each of the components labelled 1 to 3?

	1	2	3
A	antigen	chemical receptor	allow lipid soluble molecules to pass through
B	barrier to polar molecules	stabilise the membrane	antigen
C	chemical receptor	allow lipid soluble molecules to pass through	regulate the fluidity of the membrane
D	stabilise the membrane	control the fluidity of the membrane	barrier to polar molecules

15 Proteins in the cell surface membranes of human cells and mouse cells were labelled with red and green fluorescent dyes respectively.

When a human cell and a mouse cell were fused together the red and green fluorescent labels were at first found in different regions of the cell surface membrane of the hybrid cell, but after 40 minutes they were evenly distributed in the entire cell surface membrane.

What explains this observation?

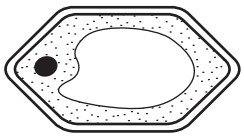
A All protein molecules in the cell surface membrane are fixed to structures within the cell, but phospholipid molecules move freely between them.

B Groups of protein and phospholipid molecules in the cell surface membrane are attached to each another and move together.

C Only protein molecules in the outer layer of the cell surface membrane can move freely between phospholipid molecules.

D Protein molecules in the outer layer of the cell surface membrane and those which span the bilayer can move freely between phospholipid molecules.

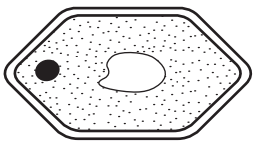
16 The diagram shows a plant cell.



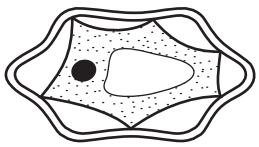
The plant cell is put into a solution with a water potential less negative than the cell contents.

What will happen to the appearance of the cell?

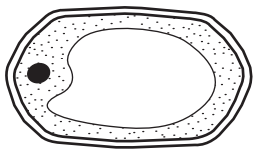
A



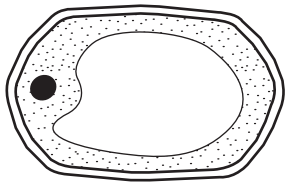
B



C



D



17 The cell cycle includes mitosis.

Which are features of **nuclear** division?

1 forms cells of equal size to the parent cell

2 forms genetically identical cells

3 semi-conservative replication of DNA

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

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18 Which is the correct statement concerning cell and nuclear division?

A Haploid eukaryotes can reproduce by mitosis whereas diploid eukaryotes can reproduce by mitosis or meiosis.

B Just before prophase, the mass of DNA is double the normal mass. Following anaphase, this mass is reduced by half and following cytokinesis this mass halves again.

C Mutagens can cause mutations whereas carcinogens can cause cancer. This means that all mutagens are carcinogenic.

D Some of the roles of mitosis are growth, asexual reproduction, cell repair following tissue damage and cell replacement.

19 Diploid (2n) organisms that reproduce sexually produce haploid (n) gametes.

Some plants, such as wheat, can produce diploid or haploid gametes. These gametes can fertilise other diploid or haploid gametes.

Which statements are correct for plants like these?

1 Diploid gametes may be produced by a fault in the reduction division (meiosis).

2 The offspring will always show an increased chromosome number.

3 The offspring could be either 2n, 3n or 4n.

4 The chromosome number could, in theory, increase with each generation.

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

20 Which nucleic acid bases are pyrimidines?

A adenine and guanine

B adenine, cytosine and thymine

C cytosine, thymine and uracil

D guanine, cytosine and uracil

21 What is the correct sequence for the processes involved in the formation of an enzyme in a cell?

A transcription → condensation → translation → ionic bonding

B translation → hydrogen bonding → transcription → condensation

C transcription → translation → condensation → ionic bonding

D translation → transcription → ionic bonding → hydrogen bonding

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22 A short piece of DNA fifteen 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 adenine (A) were present in strand 2?

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

23 Which feature of xylem vessel elements helps adhesion during transpiration?

A lignin forms an incomplete secondary wall

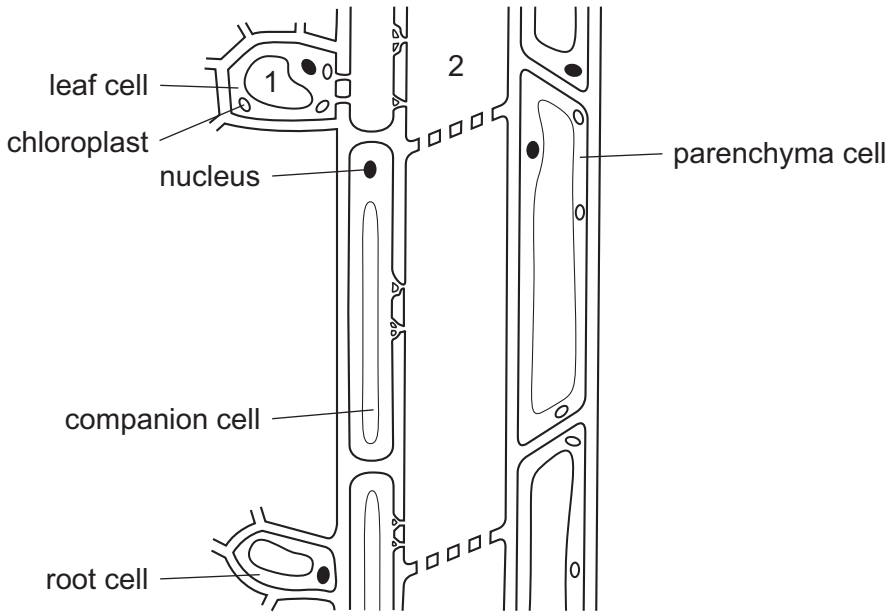
B new vessels carry extra water as the plants grow

C there are no cross walls between vessel elements

D the vessel elements form a narrow tube

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24 The diagram represents part of the phloem pathway, with adjacent cells, from leaf to root in a plant.



Which process is occurring between 1 to 2 and what is the effect on the water potential at 2?

	process from 1 to 2	water potential at 2
A	active transport of sucrose	becomes less negative
B	active transport of sucrose	becomes more negative
C	diffusion of sucrose	becomes less negative
D	diffusion of sucrose	becomes more negative

25 Which xerophytic adaptations reduce the water potential gradient?

1 rolled leaves

2 hairy leaves

3 sunken stomata

4 fewer stomata

5 fleshy leaves

A 1, 2, 3, 4 and 5

B 1, 2 and 3 only

C 1, 3 and 4 only

D 2 and 5 only

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26 What is **not** a factor influencing blood pressure?

A the diameter of the blood vessels

B the number of red blood cells in circulation

C the systolic pressure of the heart ventricles

D the volume of blood returning to the heart each heart beat

27 Which of the following are found in blood and lymph and tissue fluid?

1 carbon dioxide

2 fatty acids

3 white blood cells

4 proteins

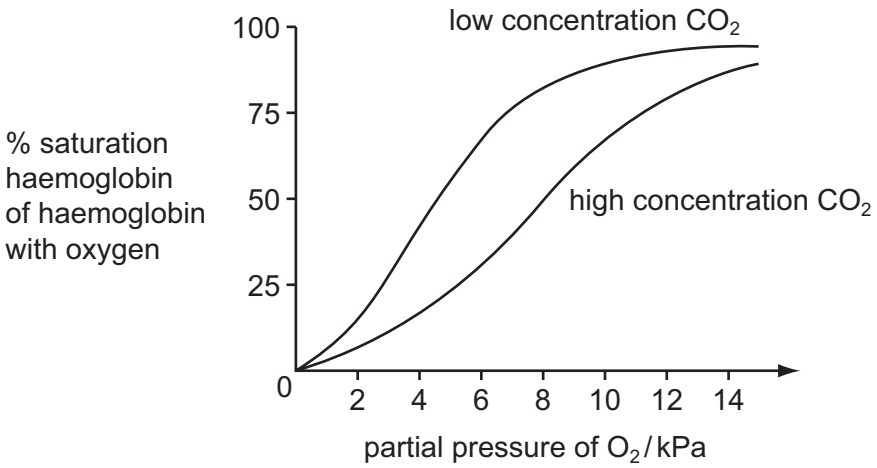
A 1, 2, 3 and 4

B 1, 2 and 3 only

C 1, 2 and 4 only

D 3 and 4 only

28 The graph shows the percentage saturation of haemoglobin with oxygen at different partial pressures of oxygen and two different concentrations of carbon dioxide.



What is the effect of increasing the concentration of carbon dioxide?

A It increases the affinity of haemoglobin for oxygen at respiring tissues.

B It increases the dissociation of haemoglobinic acid inside red blood cells.

C It increases the dissociation of oxygen from haemoglobin at respiring tissues.

D It increases the inhibition of carbonic anhydrase enzyme in red blood cells.

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29 Some babies are born with a hole between the right and left atria. These babies are found to have an increased number of red blood cells.

What is the reason for this increase?

A More blood is needed because it is pumped faster.

B More blood is needed because the pressure is lower.

C Their haemoglobin has a higher affinity for oxygen.

D There is less oxygen available to the newly born baby.

30 In the lungs, oxygen and carbon dioxide pass through cell membranes by diffusion.

Which row is correct?

	number of cell membranes diffused through by	
	oxygen from air	carbon dioxide to air
A	3	2
B	3	2 or 3
C	5	4
D	5	4 or 5

31 Which describes how substances in cigarette smoke increase the risk of developing atherosclerosis?

1 Carbon monoxide damages the endothelium of the arteries.

2 Nicotine makes platelets sticky.

3 Nicotine stimulates the release of adrenaline.

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

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

A carcinogens come into contact with DNA → mutation occurs → uncontrolled cell division

B goblet cells secrete more mucus → mucus accumulates causing infection → phagocytes attracted by inflammation

C mucus accumulates causing infection → phagocytes attracted by inflammation → elastase destroys the alveolar walls

D mutation occurs → phagocytes attracted by inflammation → causes irritation and coughing

33 Which could **directly** reduce the surface area available for gas exchange in human lungs?

1 emphysema

2 lung cancer

3 smoking

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

34 The malarial parasite, *Plasmodium,* infects red blood cells and breaks down haemoglobin. Free haem groups are toxic to *Plasmodium* and the parasite converts them into non-toxic, crystalline haematozoin, using an enzyme, HDP, which is found in all species of *Plasmodium.*

What will be the long term result of giving patients with malaria a drug which inhibits HDP?

A a decreased concentration of free haem groups in infected red blood cells

B a decreased concentration of haemoglobin in infected red blood cells

C more rapid reproduction of some species of *Plasmodium* in infected red blood cells

D slower reproduction of all species of *Plasmodium* in infected red blood cells

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35 During a primary immune response, the following events occur.

1 Some B-lymphocytes form plasma cells.

2 B-lymphocytes with the specific cell surface receptors divide repeatedly by mitosis.

3 Specific antibody is produced.

4 T-helper cells secrete cytokines.

5 T-helper cells identify a specific antigen.

In which order will the events occur?

A $2 \rightarrow 1 \rightarrow 4 \rightarrow 3 \rightarrow 5$

B $2 \rightarrow 4 \rightarrow 3 \rightarrow 1 \rightarrow 5$

C $5 \rightarrow 4 \rightarrow 2 \rightarrow 1 \rightarrow 3$

D $5 \rightarrow 4 \rightarrow 3 \rightarrow 1 \rightarrow 2$

36 Which statement concerning the defence in the body against infectious disease is **not** correct?

A Antibodies against specific antigens are produced by plasma cells in passive immunity, but the protection is short-lived as no memory cells are produced.

B A specific immune response involves activation of B-lymphocytes and T-lymphocytes following recognition of, and binding to, a specific antigen.

C Following invasion by microorganisms, natural active immunity can be gained by initiating an immune response.

D Lysosomes fuse with vacuoles that have been formed by phagocytes and which contain invading microorganisms.

37 An antiserum to a snake toxin can be obtained by injecting the toxin into a horse. The antiserum is made from blood plasma taken from the horse a few weeks later. The antiserum is injected into a person who has been bitten by the same species of snake.

Which type of immunity occurs as a result of using this antiserum?

A artificial active

B artificial passive

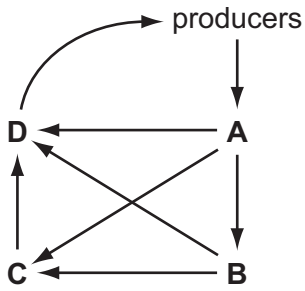
C natural active

D natural passive

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38 The flow of nutrients in an ecosystem is shown in the diagram.

Which letter represents decomposers?



39 An insect eats only the leaves of grass. This insect is eaten by carnivorous beetles.

Which ecological terms are described in this information about the insect?

1 habitat

2 niche

3 trophic level

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

40 A gardener has a waterlogged garden showing poor growth. He decides to drain it in an attempt to reduce the numbers of some harmful bacteria.

Which type of bacteria would he be attempting to reduce in number?

A decomposing

B denitrifying

C nitrifying

D nitrogen fixing

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BIOLOGY **9700/13**

Paper 1 Multiple Choice **May/June 2014**

1 hour

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

1418915042

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
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Electronic calculators may be used.

IB14 06_9700_13/4RP
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1 The eyepiece lens of a microscope is fitted with an eyepiece graticule.

Which statements about the graticule are correct?

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

2 It allows you to draw cells with correct proportions.

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

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

2 The diameter of living cells varies considerably.

The diameter of a typical eukaryotic cell is 1.5×10^1 μm.
The diameter of a typical prokaryotic cell is 7.5×10^2 nm.

Using these measurements, what is the maximum number of each cell type which could fit along a line 1 cm long?

	number of white blood cells	number of *Streptococcus cells*
A	6.7×10^4	1.3×10^2
B	6.7×10^3	1.3×10^5
C	6.7×10^2	1.3×10^4
D	6.7×10^1	1.3×10^3

3 In order to complete the sentence below, what is the correct process and cell structure?

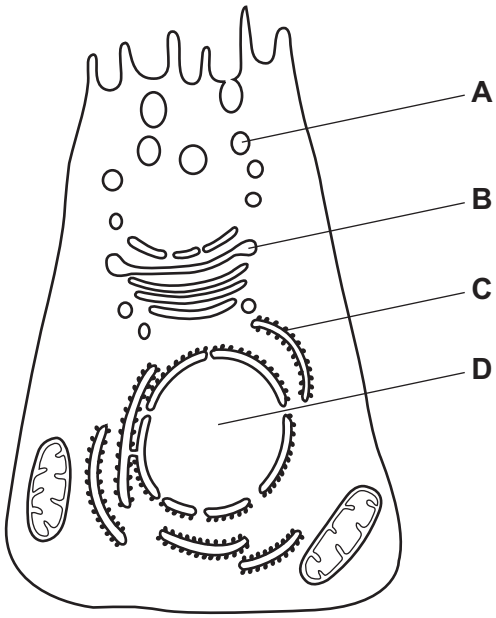
Cells which have a high rate of ……1…… will have many ……2…… .

	1	2
A	DNA replication	lysosomes
B	exocytosis	Golgi vesicles
C	facilitated diffusion	mitochondria
D	phospholipid production	ribosomes

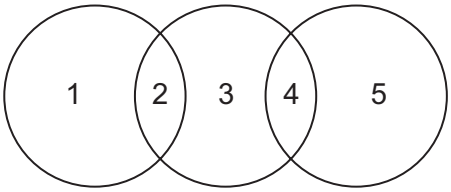
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4 A cell secreting glycoproteins is supplied with radioactively-labelled glucose which is detected in the cytoplasm first.

In which organelle would radioactively-labelled glucose be detected next?



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



Which row is correct?

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

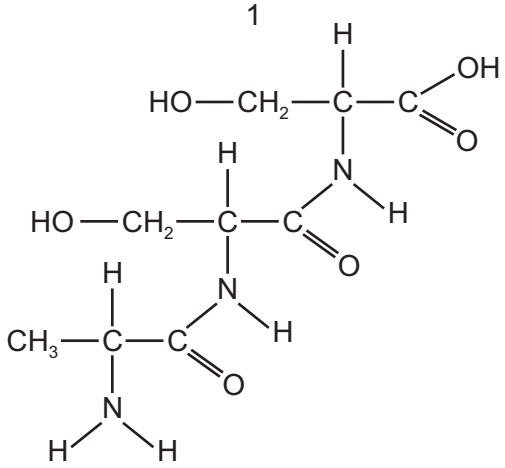
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6 A student carried out four tests for biological molecules on a solution. The results are shown in the table.

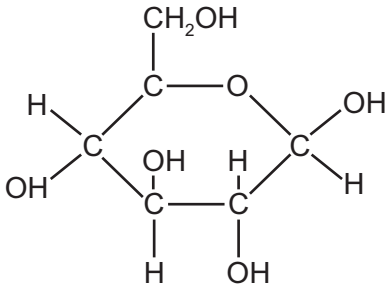
test for biological molecule	observation
iodine solution	orange
biuret	blue
Benedict's	orange
emulsion	clear

Which molecules are present in this solution?

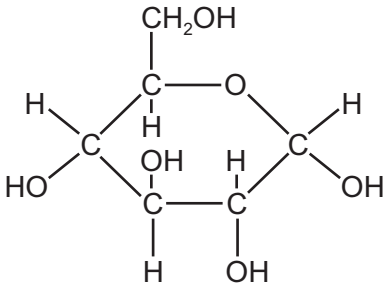
1



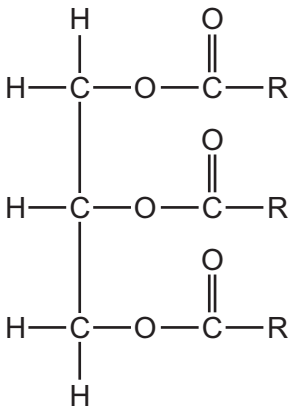
2



3



4



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

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7 Which bonds will be broken when a molecule of amylose is hydrolysed?

1 α1,4

2 β1,4

3 α1,6

4 β1,6

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

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 condensation reactions release stored energy.

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

D The amylose-amylopectin complex is insoluble and does not affect the water potential of the cell.

9 Which comparative statements concerning biological molecules are correct?

1 A collagen molecule is a fibrous protein that contains many amino acids with hydrophobic R-groups whereas a haemoglobin molecule is a globular protein with no amino acids with hydrophobic R-groups.

2 Sucrose hydrolysis results in glycosidic bond breakage and the production of equal proportions of fructose and α-glucose molecules, whereas cellulose hydrolysis results in only β-glucose molecules.

3 The glycosidic bonds of glycogen have been formed between two α-glucose molecules, whereas with amylopectin, the bonds have been formed between an α-glucose molecule and a β-glucose molecule.

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

10 In triglyceride molecules, where are double bonds located?

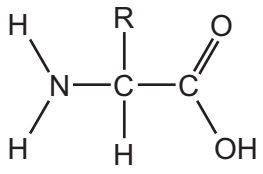
A between fatty acids and glycerol

B within fatty acids and within glycerol

C within fatty acids only

D within glycerol only

11 The diagram represents an amino acid.



R represents a variable side chain.

Which is **not** a possible side chain?

A CH_3

B $CH_2CH_2SCH_3$

C CH_2CONH_2

D $HOCH_2CH(OH)CH_2OH$

12 Which of the statements describe some roles of enzymes?

1 catalyse the breakdown of larger molecules into smaller ones

2 lower the activation energy required to start a reaction

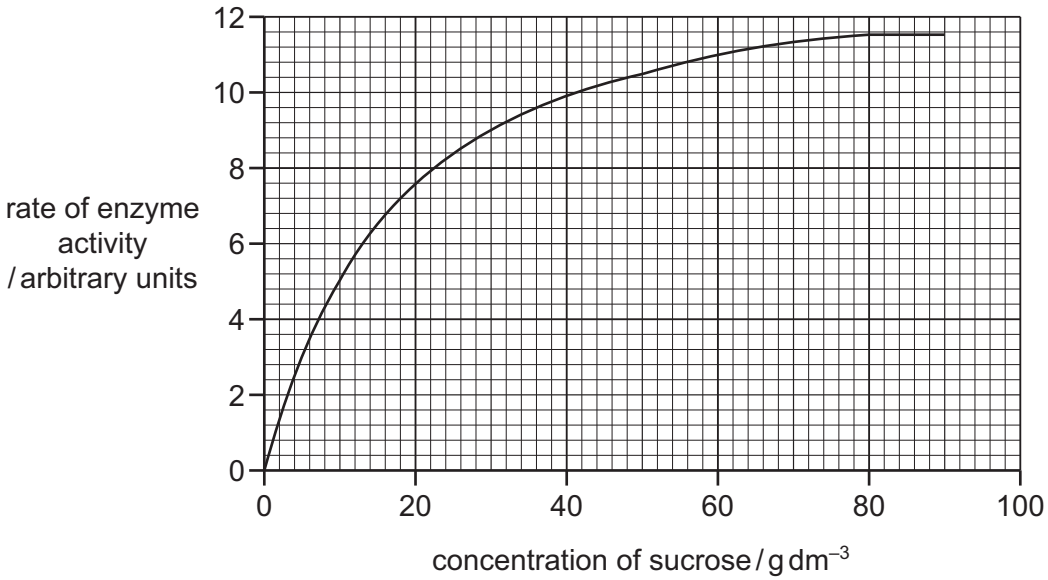
3 increase the number of collisions between molecules

4 supply the activation energy required to start a reaction

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

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13 The graph shows the rate of activity of the enzyme sucrase plotted against the concentration of sucrose.



Why does the rate of enzyme activity remain constant from 80 – 90 g dm^{-3}.

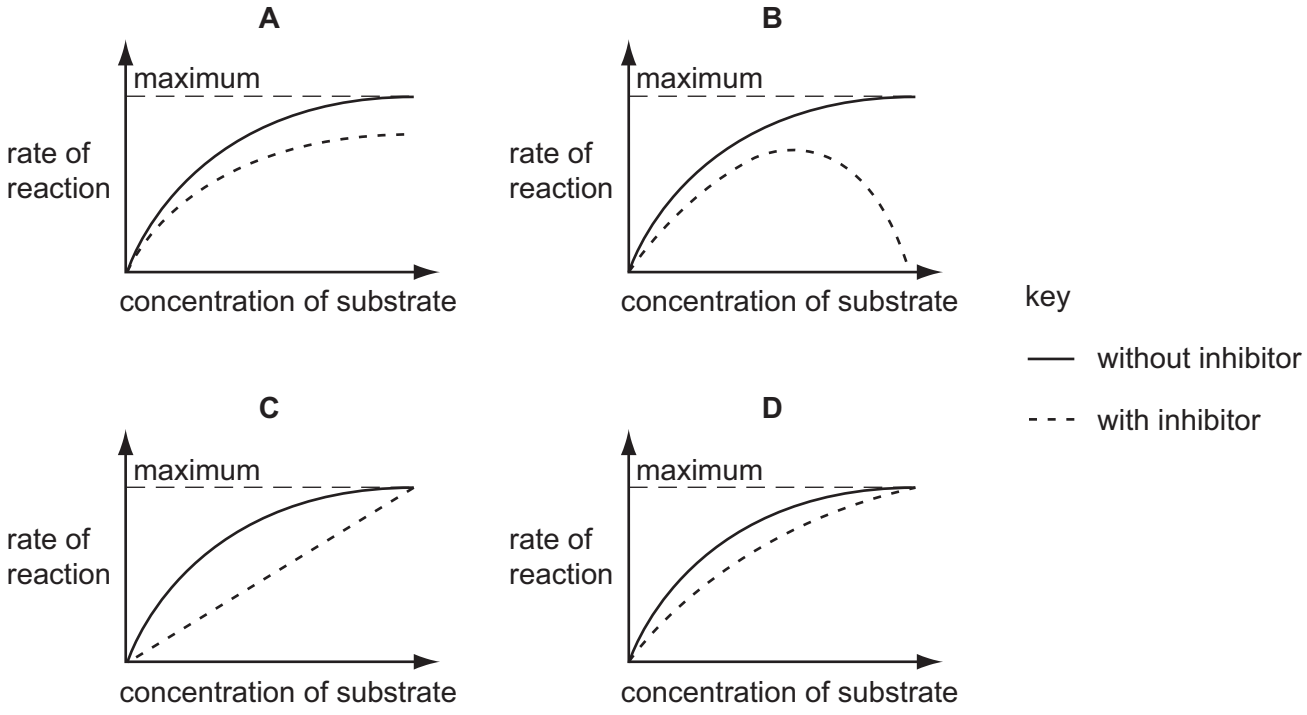
A All the enzyme has been inhibited.

B All the substrate has been used up.

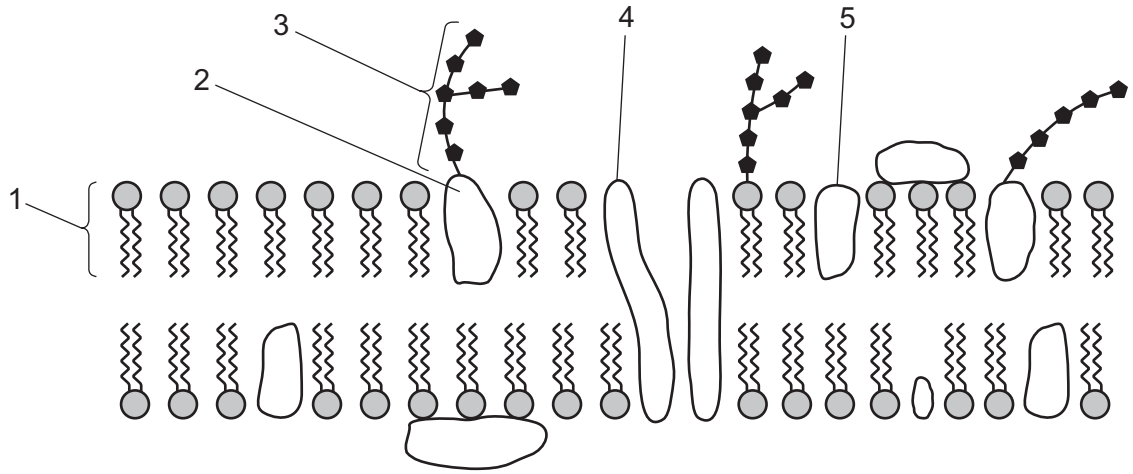
C The concentration of the enzyme is limiting the rate.

D The concentration of the substrate is limiting the rate.

14 Which graph represents the action of a non-competitive inhibitor?



15 The diagram shows part of a cell surface membrane.



Which molecules have both hydrophobic and hydrophilic regions?

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

16 One type of antigen is formed by a reaction between two different molecules.

Apart from oxygen, which other elements are found in this antigen?

A carbon and hydrogen only

B hydrogen and nitrogen only

C carbon, nitrogen and phosphorus

D carbon, hydrogen, nitrogen and sulfur

17 What are the features of facilitated diffusion?

1 It uses protein channels in the membrane and is driven by the energy from ATP.

2 It moves molecules from regions of higher concentration to lower concentration and is driven by the kinetic energy of the molecules which are diffusing.

3 It uses protein channels in the membrane, and the maximum rate of diffusion depends on the number of these channels.

A 1 and 2 only

B 1 and 3 only

C 2 and 3 only

D 1, 2 and 3

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18 Single-celled animals that live in fresh water have a vacuole that contracts regularly to remove excess water. Single-celled plants that live in fresh water do not have a similar vacuole.

Which statement explains why these animals need this vacuole but plants do not?

A Plant cell cytoplasm and animal cell cytoplasm both have a lower water potential than fresh water.

B Plant cell sap has the same water potential as fresh water, animal cytoplasm has a lower water potential than fresh water.

C Plant cell walls are impermeable to water, animal cell surface membranes are permeable to water.

D Plant cell walls restrict the entry of water, animal cell membranes allow the entry of water.

19 During which process does **only** mitosis occur?

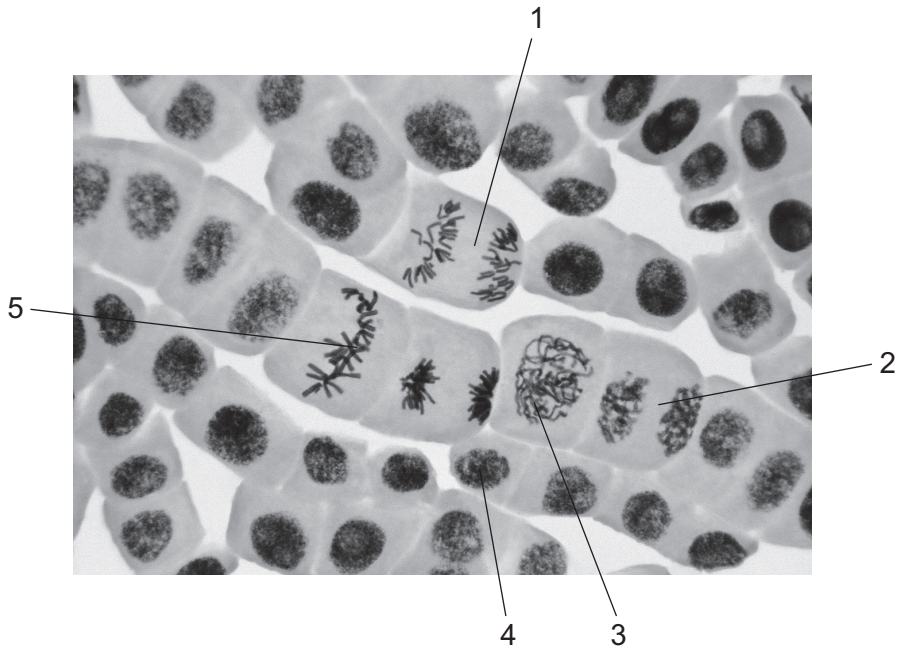
A the production of antibodies from B-lymphocyte memory cells

B the production of cancerous tissue in alveoli

C the production of gametes

D the production of root hairs

20 The photomicrograph shows cells in different stages of mitosis.



In which order do these stages occur?

A 3 → 5 → 2 → 1 → 4

B 3 → 5 → 1 → 2 → 4

C 4 → 3 → 5 → 1 → 2

D 4 → 5 → 1 → 2 → 3

21 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 *RAD51* gene is required for the repair of damaged DNA.

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

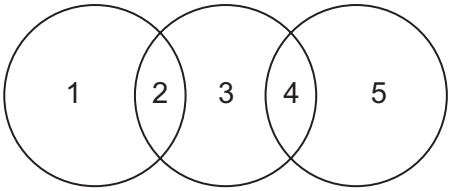
	gene	
	BRAC1	*RAD51*
A	✓	✓
B	✗	✓
C	✓	✗
D	✗	✗

key

✓ = normal active gene

✗ = mutated gene

22 The diagram shows some relationships between different nucleic acid bases.

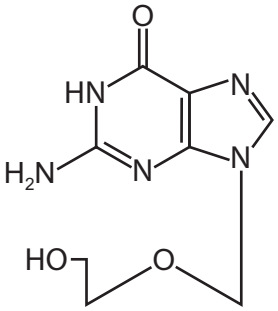


Which row is correct?

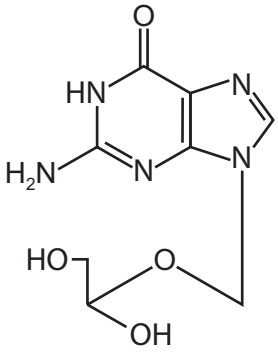
	1	2	3	4	5
A	adenine	purine	cytosine	pairs with	guanine
B	cytosine	purine	guanine	pairs with	uracil
C	guanine	pairs with	cytosine	pyrimidine	thymine
D	thymine	pairs with	uracil	pyrimidine	adenine

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23 The diagram shows the structures of some drugs that have a similar structure to nucleotides. The presence of these drugs reduces nucleic acid synthesis.



acyclovir



gancyclovir

Which statement explains how these drugs reduce nucleic acid synthesis?

A Increasing the concentration of these drugs results in the increased length of the nucleic acid.

B They are non-competitive inhibitors of the enzymes that catalyse the synthesis of DNA or RNA.

C They bind to pyrimidine nucleotides and the base pair is the wrong size.

D They replace purine nucleotides causing the synthesis of incomplete nucleic acids.

24 What terminates the formation of a polypeptide chain during protein synthesis in cells?

A when a ‘stop’ codon is reached on the mRNA molecule

B when a ‘stop’ codon is reached on the tRNA molecule

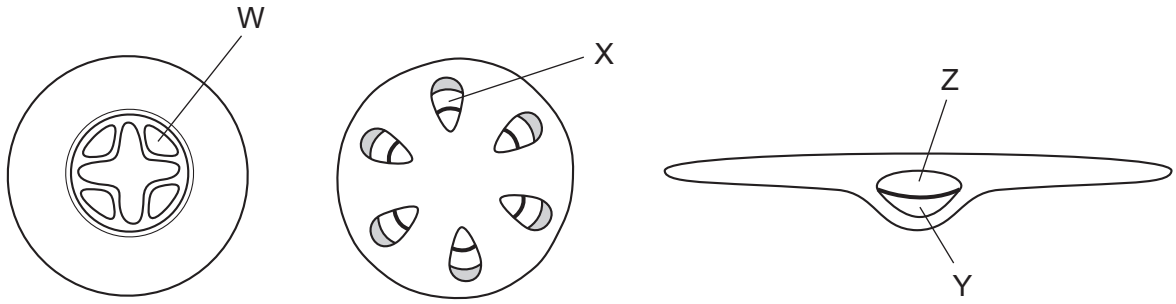
C when the ribosome reaches the end of the mRNA molecule

D when the ribosome reaches the end of the tRNA molecule

25 In which combination of environmental conditions are the stomata of a plant most likely to close?

	atmospheric humidity	soil water potential	wind speed
A	high	low	high
B	high	low	low
C	low	high	high
D	low	low	high

26 The diagrams show some tissue types, in plant organs.



Which row identifies the tissue types?

	W	X	Y	Z
A	phloem	phloem	phloem	xylem
B	phloem	xylem	phloem	xylem
C	xylem	phloem	xylem	phloem
D	xylem	xylem	phloem	xylem

27 Which features apply to **both** sieve tube elements and xylem vessel elements?

1 no cytoplasm

2 no end walls

3 no nucleus

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

28 What changes occur to the water potential and the volume of liquid in the **phloem** when carbohydrate is moved into a sink?

	water potential	volume of liquid
A	lowers	decreases
B	lowers	increases
C	raises	decreases
D	raises	increases

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29 Some plant species can take up heavy metal contaminants that are dissolved in soil water and then transport them within the plant. Within plant cells, the heavy metals accumulate mainly in the vacuole.

Which are valid suggestions about the transport and accumulation of heavy metals?

1 After initial entry into the root, some of the heavy metals can pass through the tonoplast to be stored in the vacuole of cortical cells.

2 The heavy metals take an apoplastic pathway in the xylem but at the endodermis must take a symplastic pathway.

3 The rate of accumulation of the heavy metals in leaf cells will be faster at night, when photosynthesis is not occurring, than during the day.

4 The presence of the heavy metal will inhibit active transport, causing the transpiration stream to slow down and reduce the rate of transpiration.

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

30 Which process can be carried out by a mature red blood cell?

A active transport

B cell division

C phagocytosis

D protein synthesis

31 Which is **not** a correct statement about phagocytes?

A They are white blood cells with a lobed nucleus.

B They have many lysosomes containing hydrolytic enzymes.

C They have many mitochondria to produce ATP for endocytosis.

D They provide specific defence against disease-causing organisms.

32 Which of the following are found in blood and lymph and tissue fluid?

1 carbon dioxide

2 glucose

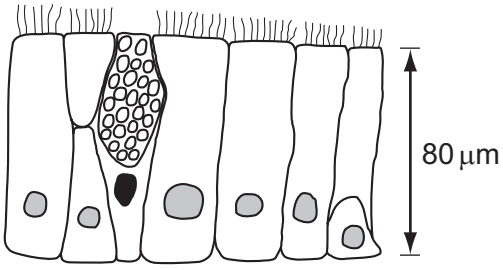
3 white blood cells

4 fatty acids

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

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

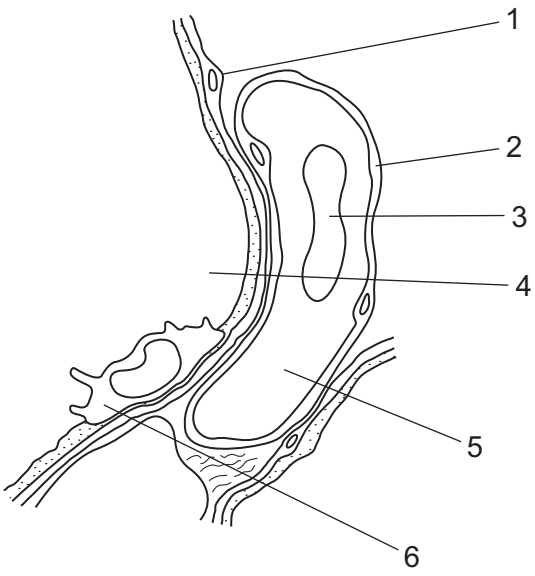


Where is this type of epithelium found in the respiratory system?

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

key
✓ = present
✗ = absent

34 The diagram shows a magnified section of part of the lungs containing specialised tissues.



Where are there a high proportion of carbonic anhydrase, HCO_3^- ions and lysosomes?

	contains high proportion of		
	carbonic anhydrase	HCO_3^- ions	lysosomes
A	1	3	4
B	2	4	5
C	3	5	6
D	4	6	1

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35 Which row correctly identifies the effects of carbon monoxide, nicotine and tar?

	effect		
	raises blood pressure	causes gene mutation	reduces oxygenation of blood
A	carbon monoxide	nicotine	tar
B	nicotine	nicotine	carbon monoxide
C	nicotine	tar	carbon monoxide
D	tar	carbon monoxide	nicotine

36 Which factors may increase the risk of cholera in refugee camps?

1 no refrigeration of food

2 increase in the number of people

3 lack of hand washing facilities

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

37 What are antigens?

A non-self macromolecules found only on bacteria that trigger the formation of antibodies

B non-self macromolecules that trigger an immune response

C proteins that consist of two light and two heavy polypeptide chains

D self macromolecules embedded in B-lymphocyte cell membranes

38 A total of $3 \times 10^6\,kJ\,m^{-2}\,yr^{-1}$ is available from the producers in an ecosystem.

In theory, how much of this energy would be available to tertiary consumers?

A $3 \times 10^4\,kJ\,m^{-2}\,yr^{-1}$

B $3 \times 10^3\,kJ\,m^{-2}\,yr^{-1}$

C $3 \times 10^2\,kJ\,m^{-2}\,yr^{-1}$

D $3 \times 10^1\,kJ\,m^{-2}\,yr^{-1}$

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

A Bull fishes feed on small crustacea.

B Herons feed on bull fishes.

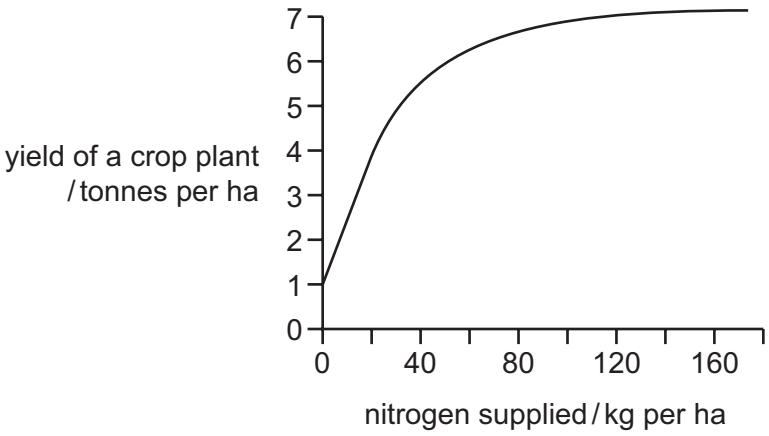
C Mangrove plants trap sunlight during photosynthesis.

D Small crustacea feed on dead mangrove leaves.

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40 The growth of crop plants is often limited by the availability of nitrogen in the soil.

The graph shows the results of an investigation into the yield of a crop plant, with increasing levels of nitrogen supplied.



Which of the following best explains the shape of this curve?

	protein synthesis	DNA synthesis
A	increases	no effect
B	no effect	no effect
C	increases	increases
D	no effect	increases

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