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

BIOLOGY **9700/11**

Paper 1 Multiple Choice **May/June 2013**

1 hour

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

9322841128

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.
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**.
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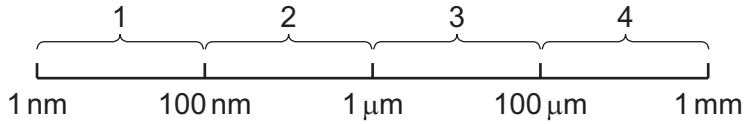
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This document consists of **14** printed pages and **2** blank pages.

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1 Which size ranges can be viewed using a light microscope?



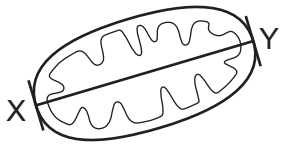
A 4 only

B 1 and 2 only

C 2 and 3 only

D 3 and 4 only

2 The diagram shows a mitochondrion drawn from an electronmicrograph.



The length of the mitochondrion from X to Y is 3000 nm.

What is the magnification of the drawing of the mitochondrion?

A ×100 **B** ×1000 **C** ×10 000 **D** ×100 000

3 What is the function of nucleoli?

A formation and breakdown of the nuclear envelope

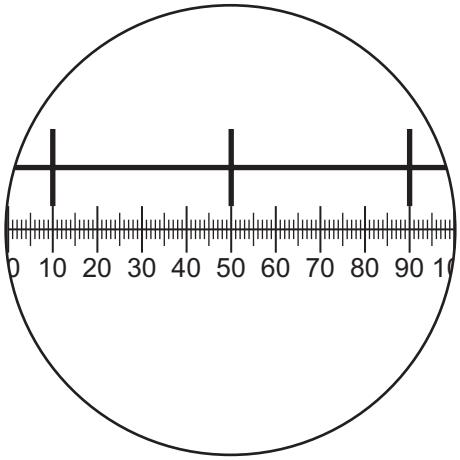
B formation of centromeres

C formation of ribosomes

D formation of the spindle during nuclear division

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



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

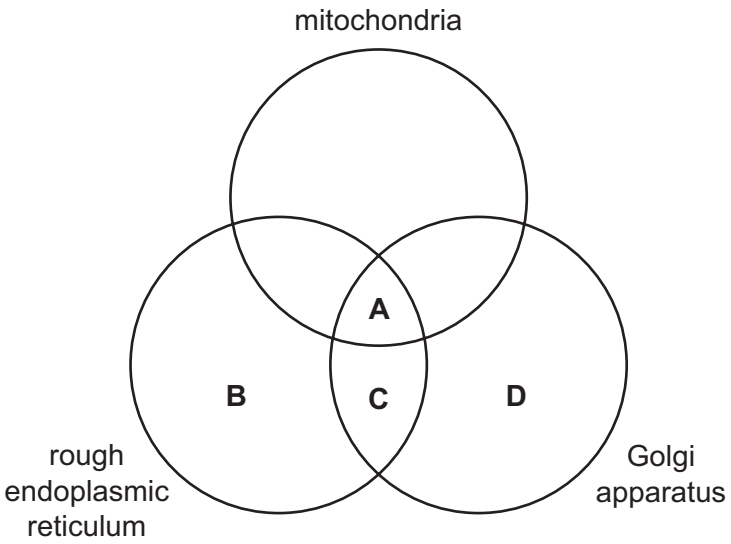
A $\pi \times 12.5 \times 12.5 = 4.9 \times 10^2\ \mu m^2$

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

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

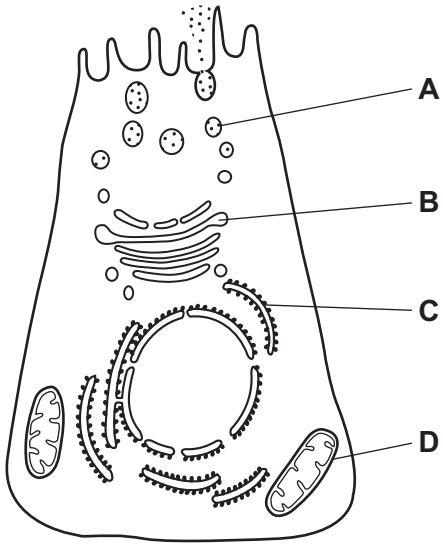
D $\pi \times 250 \times 250 = 2.0 \times 10^5\ \mu m^2$

5 Which organelles are required for the formation of the hydrolytic enzymes found in lysosomes?

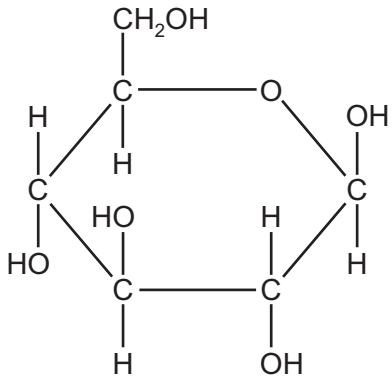


6 The diagram is taken from an electronmicrograph of a cell which secretes enzymes.

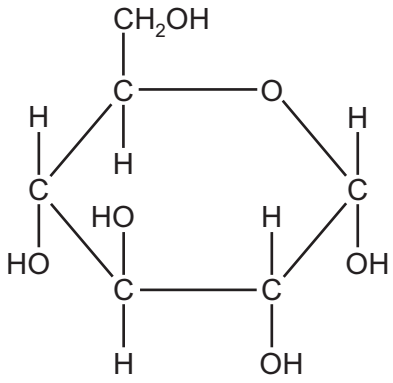
Where are these enzymes made?



7 X and Y show the structures of two hexose sugars.



X



Y

Which statement is correct?

A X is found in amylopectin.

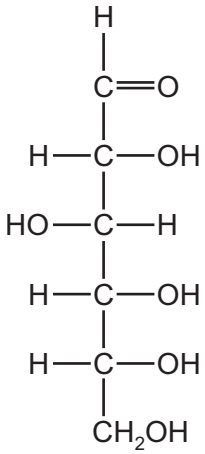
B X is found in amylose.

C Y is found in cellulose.

D Y is found in glycogen.

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8 The structural formula of a carbohydrate molecule can be shown as:



Which of the molecules could be represented by this formula?

1 α glucose

2 deoxyribose

3 ribose

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

9 What occurs when sucrose is broken down to monosaccharides?

A condensation of reducing sugars releasing water

B condensation of reducing sugars using water

C hydrolysis, releasing reducing sugars and releasing water

D hydrolysis, releasing reducing sugars and using water

10 One naturally occurring polysaccharide is an unbranched chain of the molecule acetylglucosamine linked by β-1, 4 glycosidic bonds. There are $-CH_2OH$ groups that alternate on each side of the polysaccharide chain.

Many hydrogen bonds form between these unbranched chains.

Which polysaccharide has a structure similar to that described?

A amylose

B amylopectin

C cellulose

D glycogen

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11 Which molecules have properties that are dependent on hydrogen bonds?

1 cellulose

2 glycogen

3 haemoglobin

4 water

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

12 Features of four proteins, W, X, Y and Z, are described below.

W consists of two polypeptides held together by disulfide bonds

X consists of three polypeptides tightly coiled together

Y consists of four polypeptides each with a prosthetic group

Z consists of four polypeptides held together by disulfide bonds

Which row correctly identifies the named proteins?

	antibody	collagen	haemoglobin
A	W	X	Y
B	W	Y	X
C	Z	X	Y
D	Z	Y	X

13 Why may fish living in ponds survive temperatures below 0 °C in winter?

A Fish body tissues produce an enzyme which prevents blood from freezing.

B The ice on the pond surface insulates the water in the pond.

C The plants in the pond help to keep the water temperature above 0 °C.

D The rocks in the pond warm up during the day and heat the water.

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14 Four students, 1, 2, 3 and 4, counted the number of bubbles of oxygen given off in a minute when investigating the effect of catalase from plant tissue on hydrogen peroxide.

Each student repeated the experiment five times and calculated the mean number of bubbles per minute.

Which have correctly calculated the mean?

student	raw data / number of bubbles minute^{-1}					mean / number of bubbles minute^{-1}
1	12	10	11	13	9	10.5
2	8	19	16	18	19	18
3	8	10	11	9	8	9
4	21	18	17	6	18	18.5

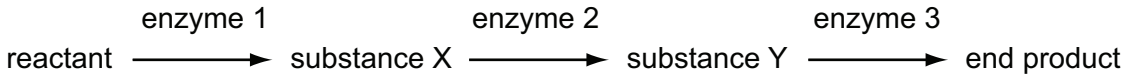
A 1 and 4 only

B 2 and 3 only

C 1, 2, 3 and 4

D 3 only

15 The diagram shows a metabolic pathway.



What would be the effect of adding a small amount of a non-competitive inhibitor of enzyme 2?

A Enzyme 2 would be partially denatured.

B Substance X would increase in concentration.

C Substance Y would no longer be formed.

D The initial reactant would no longer be metabolised.

16 Which of the following can increase the fluidity of the cell surface membrane at low temperatures?

1 double bonds between carbon atoms in the fatty acid chains

2 cholesterol

3 fatty acids having shorter chains

A 1, 2 and 3

B 1 and 3 only

C 2 and 3 only

D 1 only

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17 Which process allows the movement of molecules that are too large to **enter** through a cell surface membrane?

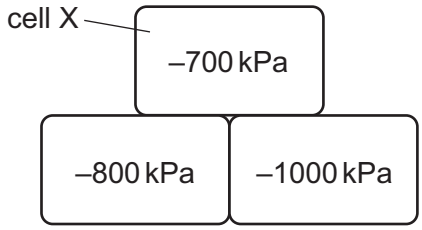
A active transport

B endocytosis

C exocytosis

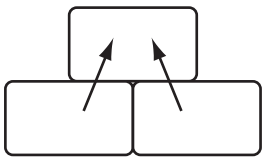
D facilitated diffusion

18 The diagram shows the water potential of three cells.

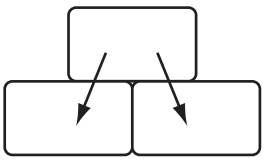


In which directions will there be net movement of water by osmosis to or from cell X?

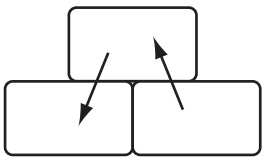
A



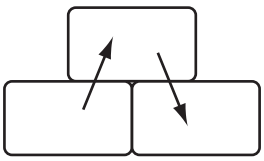
B



C



D



19 Which statement describes a cell belonging to a haploid organism that is capable of reproduction?

A It has chromosomes that contain one polynucleotide chain.

B It is capable of carrying out a reduction division to form gametes.

C It possesses two copies of each gene as a result of fertilisation.

D It will undergo cell division by mitosis during asexual reproduction.

20 Some chemicals, used to stop tumour growth, work by preventing the DNA double helix from uncoiling and separating.

During which stage of the cell cycle would they act?

A anaphase

B interphase

C metaphase

D prophase

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21 Nocodazole is a chemical used in the study of mitosis. It causes all mitotic cells to stop dividing at metaphase.

Which statements correctly identify how this chemical might work?

1 inhibits chromatin condensing in the nucleus

2 prevents replication of the centrioles

3 stops sister chromatids migrating to opposite poles

A 1, 2 and 3

B 1 and 2 only

C 1 and 3 only

D 3 only

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

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

23 Which type of molecule is always the end product of transcription?

A amino acid

B functional protein

C mRNA

D polypeptide

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24 The table gives tRNA anticodons for four amino acids.

amino acid	tRNA anticodon
asparagine	UUA
glutamic acid	CUU
proline	GGA
threonine	UGG

A cell makes a polypeptide with the amino acid sequence:

glutamic acid – asparagine – threonine – proline

What was the sequence of bases on the strand of the DNA which was complementary to the mRNA from which this polypeptide was formed?

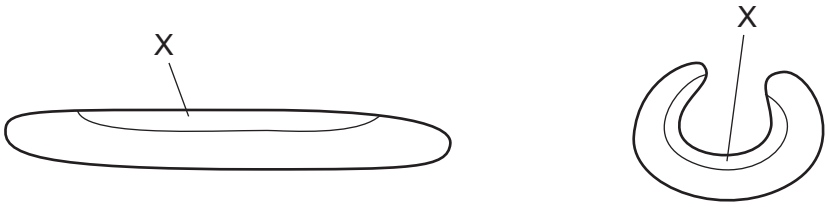
A CTTTTATGGGGA

B CUUUUAUGGGGA

C GAAAATACCCCT

D GAAAAUACCCCU

25 The diagram shows a xerophytic leaf in different conditions, P and Q.



Which statements about the cells in layer X of the leaf in each of the conditions P and Q are correct?

1 less negative water potential in P than Q

2 cells may be turgid in P and plasmolysed in Q

3 cells less turgid in P than Q

4 no net diffusion of water into X in either P or Q

A 1, 2, 3 and 4

B 1, 2 and 4 only

C 1 and 4 only

D 2 and 3 only

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26 The loading of sucrose into companion cells involves a number of processes listed below.

Which is an active process?

A the movement of H^+ ions from companion cells

B the movement of H^+ ions into companion cells

C the movement of sucrose from companion cells

D the movement of sucrose into companion cells

27 Which statement concerning transpiration is correct?

A On a humid day, the water potential gradient between the intercellular air space and the external atmosphere increases to stimulate water loss by evaporation.

B Water arriving at the spongy mesophyll cells via the symplast pathway must move by osmosis through the cell surface membrane before evaporation from the surface of the cells.

C Water diffuses down the water potential gradient from the saturated air space through the guard cells before evaporating from the surface of the cells into the atmosphere.

D Water moves up the xylem in the apoplast pathway and can continue on this pathway by osmosis to reach the spongy mesophyll cells before evaporating into the intercellular air space.

28 Halophytes are plants that can survive in regions where they are regularly exposed to sea water. Sea water has a water potential of approximately –2500 kPa.

What adaptations would you expect halophytes to show?

1 root hair cells that maintain a more negative water potential than sea water

2 root hair cells that accumulate salts and other solutes

3 stomata that are open most of the time

A 1 and 2 only

B 1 and 3 only

C 2 and 3 only

D 1, 2 and 3

29 Which features enable the aorta to withstand ventricular systole?

A collagen fibres and elastin fibres

B collagen fibres and smooth muscle

C elastin fibres and endothelium

D endothelium and smooth muscle

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30 Haemoglobin can bind to carbon dioxide, carbon monoxide and oxygen.

Which statement about the binding sites of haemoglobin is correct?

A Carbon dioxide and carbon monoxide bind to one site, oxygen binds to a different site.

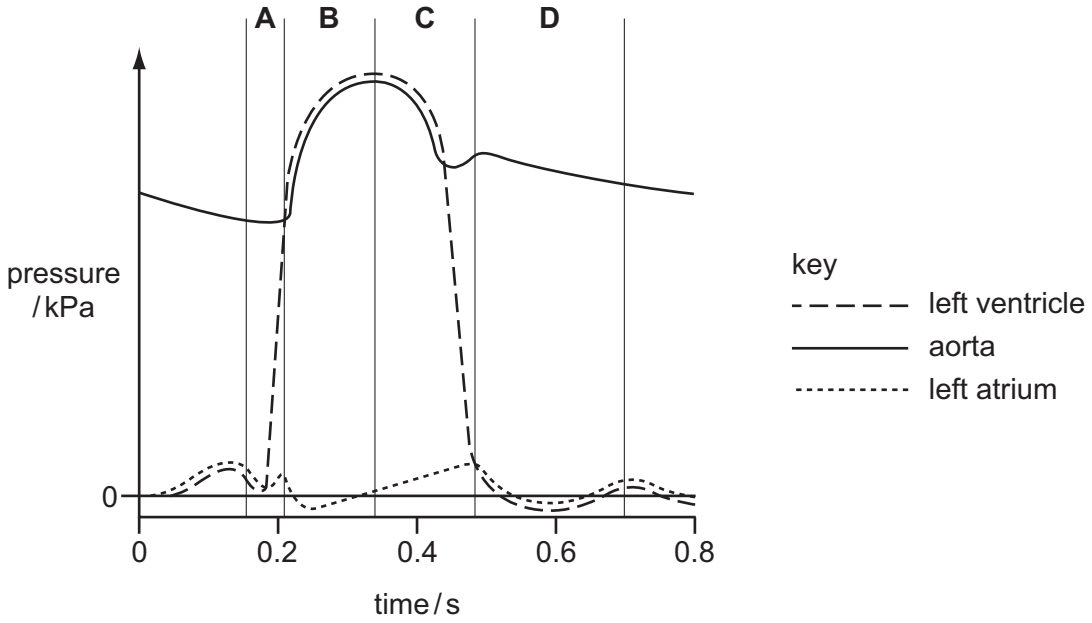
B Carbon dioxide and oxygen bind to one site, carbon monoxide binds to a different site.

C Carbon monoxide and oxygen bind to one site, carbon dioxide binds to a different site.

D Carbon monoxide, oxygen and carbon dioxide all bind to different sites.

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

At the end of which period, **A**, **B**, **C** or **D**, is the ventricle full of blood?



32 Which substances will displace oxygen from oxyhaemoglobin?

1 carbon dioxide

2 carbon monoxide

3 hydrogen carbonate ions

4 hydrogen ions

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

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33 Which statement about chronic obstructive pulmonary disease is **not** correct?

A The disease can often be reversed by treatment.

B The patient coughs a lot, bringing up mucus.

C The patients are normally over 30 years old.

D The patient's symptoms normally do not change.

34 Which statement about coronary by-pass surgery is correct?

A It is carried out to reduce the effects of atherosclerosis, improving the delivery of oxygen and dissolved glucose to the cardiac muscle of the heart.

B It is the surgical removal of one or more coronary arteries to reduce the strain on the heart of a person with coronary heart disease.

C Surgeons are able to divert blood around the diseased sections of the coronary arteries so that more oxygenated blood can be pumped round the systemic circulation.

D The diseased parts of the aorta are replaced by using a section of a main artery from elsewhere in the body of the same person, to avoid rejection.

35 How does smoking increase the risk of developing atherosclerosis?

A by damaging artery walls

B by decreasing blood pressure

C by increasing the risk of blood clotting

D by reducing the oxygen supply to cardiac muscle

36 Which development in vaccine production would be most important in the fight to eradicate measles in **developing** countries?

A a combined vaccine to combat it and other diseases

B a single vaccine, without the need for boosters

C a vaccine containing only live measles viruses

D a vaccine produced by genetic engineering techniques

37 What could cause an outbreak of malaria in a country where it had been eliminated?

1 mosquitoes became resistant to insecticides

2 migration of population due to war

3 malarial parasites became resistant to quinine

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

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38 Termites are insects that build large nests that contain millions of termites of the same species.

These nests are common in tropical savanna, which typically consists of grasses with widely spaced trees. Here, the termites feed on wood and other dead plant material.

Which statement is correct?

A The termites in the nest form a community, the savanna is the ecosystem and they feed as decomposers.

B The termites in the nest form a community, the savanna is the ecosystem and they feed as primary consumers.

C The termites in the nest form a population, the savanna is both the ecosystem and the habitat and they feed as primary consumers.

D The termites in the nest form a population, the savanna is their habitat and they feed as decomposers.

39 During the nitrogen cycle, microorganisms are involved in nitrogen fixation, nitrification and denitrification.

What are the correct soil conditions for each process?

	nitrogen fixation	nitrification	denitrification
A	aerobic	aerobic	anaerobic
B	aerobic	anaerobic	aerobic
C	anaerobic	anaerobic	aerobic
D	anaerobic	aerobic	anaerobic

40 Which processes are essential in making nitrogen in dead plant material available to growing plants?

1 ammonification

2 deamination

3 nitrification

4 nitrogen fixation

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

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
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BIOLOGY **9700/12**

Paper 1 Multiple Choice **May/June 2013**

1 hour

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* 2 4 2 0 4 7 2 8 0 6 *

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1 A light microscope is used to observe two membranes that are 200 nm apart.

How far apart are the membranes when the objective lens is changed from low power (×40) to high power (×400)?

A 2 μm **B** 20 μm **C** 200 nm **D** 2000 nm

2 The electronmicrograph is of a chloroplast.



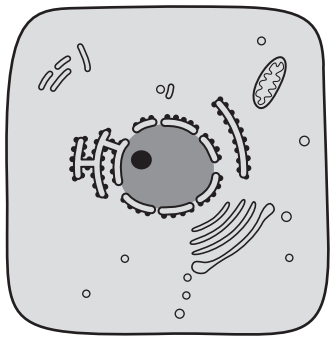
The length of the chloroplast along the line shown is 80 mm. The actual length of the chloroplast is 10 μm.

What is the magnification of the chloroplast?

A $\times 8 \times 10^2$ **B** $\times 8 \times 10^3$ **C** $\times 8 \times 10^4$ **D** $\times 8 \times 10^6$

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3 The diagram below is drawn from an electronmicrograph of an animal cell.



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

A



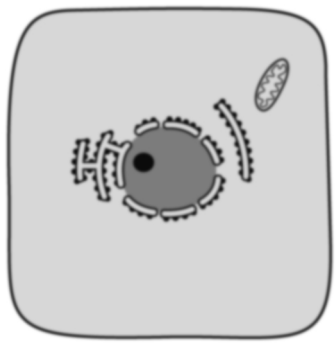
B



C



D



4 Which features enable an organism to be identified as a prokaryote?

1 cell wall

2 circular DNA

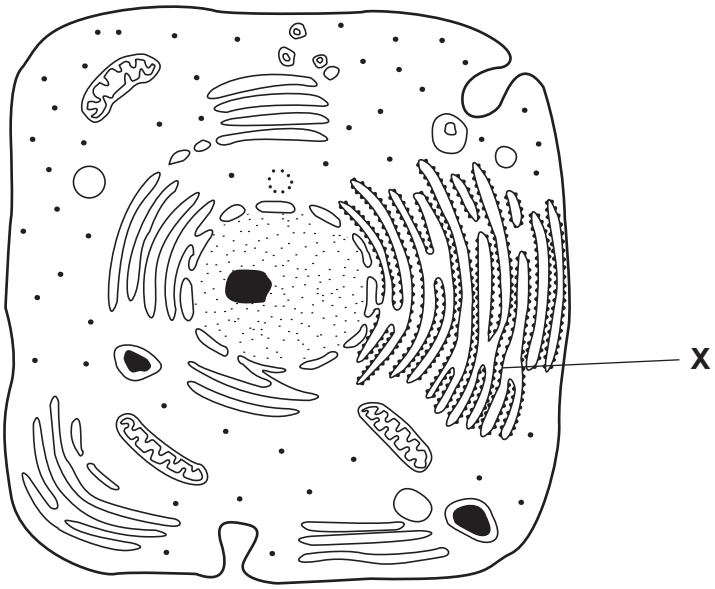
3 nucleus

4 ribosomes

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

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5 The diagram shows an electronmicrograph of a typical animal cell.



What is the function of the membrane system labelled **X**?

A lipid synthesis

B lipid synthesis and transport

C protein synthesis

D protein synthesis and transport

6 An animal cell and a plant cell are placed in distilled water. The animal cell swells and bursts, while the plant cell swells but does **not** burst.

What accounts for this difference?

A Animal cells have no cell wall.

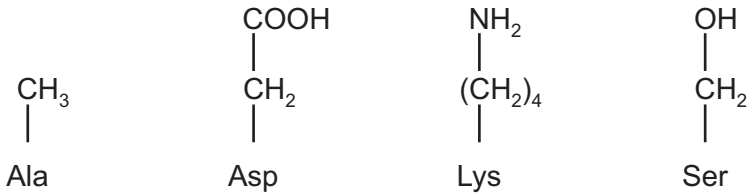
B Animal cells have no vacuole.

C Plant cell surface membranes are partially permeable.

D Plant cell walls are freely permeable.

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7 The R groups (side chains) of amino acids can be hydrophobic, hydrophilic, acidic or basic. The diagram shows four different amino acid R groups.



Which row is correct for these amino acid R groups?

	hydrophobic	hydrophilic	acidic	basic
A	Ala	Ser	Asp	Lys
B	Ala	Ser	Lys	Asp
C	Asp	Lys	Ser	Ala
D	Asp	Ser	Lys	Ala

8 Which describes the emulsion test for the presence of lipids?

A Add ethanol and shake.

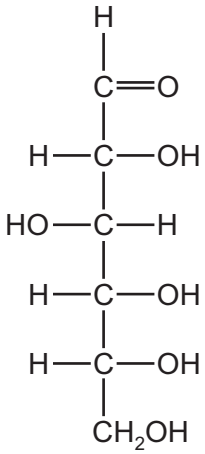
B Add ethanol, pour into water and shake.

C Add water and shake.

D Add water, pour into ethanol and shake.

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9 The structural formula of a carbohydrate molecule can be shown as:



Which of the molecules could be represented by this formula?

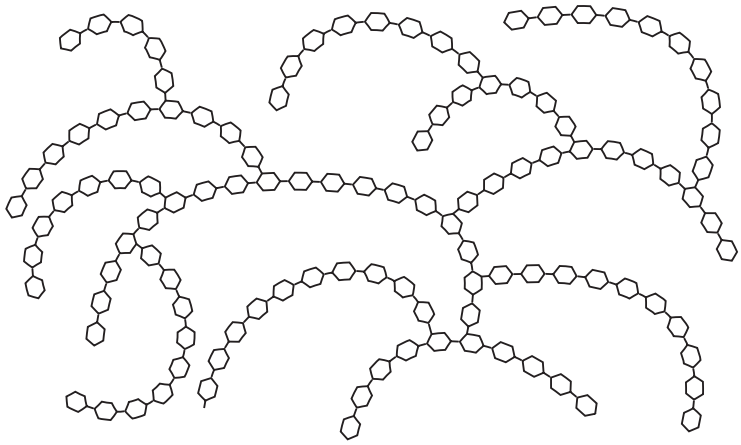
1 ribose

2 β-glucose

3 sucrose

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

10 The diagram shows part of a molecule of glycogen.



How does the molecule differ from a molecule of amylose?

A Amylose has only α-1,4 glycosidic bonds.

B Amylose has only β-1,4 glycosidic bonds.

C Amylose has α-1,6 glycosidic bonds with 1,4 linkages forming branches.

D Amylose has β-1,4 glycosidic bonds with 1,6 linkages forming branches.

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11 Which molecules contain a carboxyl group?

1 amino acid

2 glycerol

3 saturated fatty acid

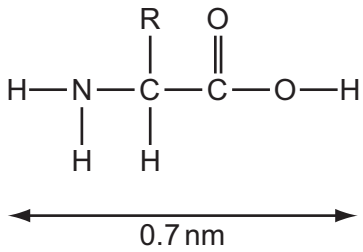
4 unsaturated fatty acid

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

12 The diameter of some atoms when they form bonds are given in the table.

atom	single bond / nm	double bond / nm
H	0.060	–
O	0.132	0.110
N	0.140	0.120
C	0.154	0.134

The approximate length of the amino acid shown below was estimated using the figures in the table.



What would be the approximate length of a dipeptide formed using this amino acid?

A 0.9 nm **B** 1.2 nm **C** 1.4 nm **D** 1.7 nm

13 Which feature of water is **leas**t likely to affect the life of an animal in a tropical rain forest?

A adhesion with other molecules

B cohesion between water molecules

C low viscosity

D maximum density at 4 °C

14 Two pairs of students each counted the number of bubbles of oxygen given off in a minute when investigating the effect of catalase from plant tissue on hydrogen peroxide.

Each pair repeated the experiment five times and calculated the mean number of bubbles per minute.

Which have correctly calculated the mean?

student	raw data / number of bubbles minute^{-1}					mean / number of bubbles minute^{-1}
1	8	10	11	9	8	9.2
2	8	10	11	9	8	9
3	21	18	6	17	19	16.2
4	21	18	6	17	19	18.8

A 1, 3 and 4 only

B 1 and 4 only

C 2 only

D 3 only

15 When investigating the rate of reaction of the enzyme lipase on the hydrolysis of triglycerides, the pH must be maintained at an optimum to prevent the lipase denaturing.

What is the reason for this?

A The addition of water molecules produced by hydrolysis increases pH.

B The products of hydrolysis decrease the pH.

C The products of hydrolysis increase the pH.

D The removal of water molecules used in hydrolysis decreases pH.

16 Which of the following can increase the fluidity of the cell surface membrane?

1 single bonds between carbon atoms in the fatty acid chains

2 cholesterol

3 fatty acids having longer chains

A 1, 2 and 3

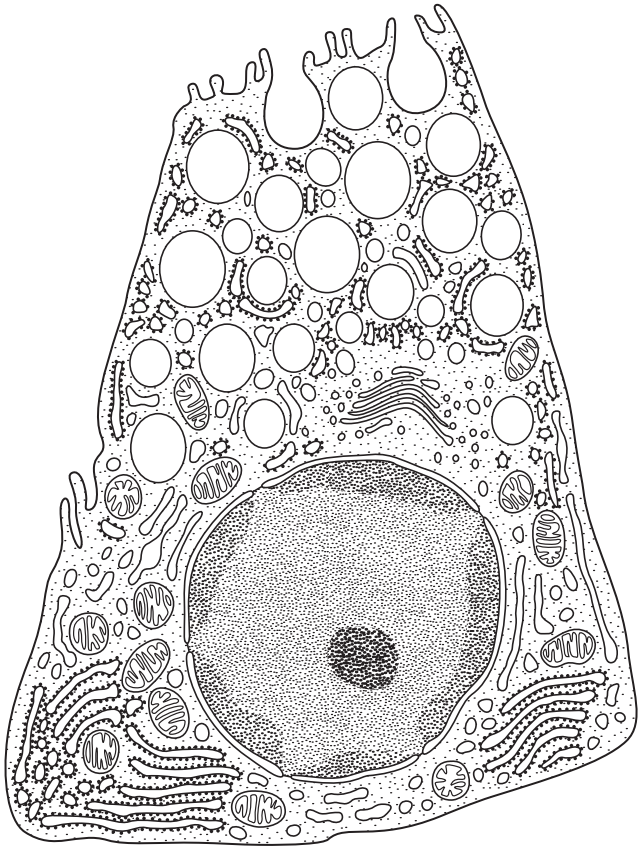
B 1 and 3 only

C 2 and 3 only

D 2 only

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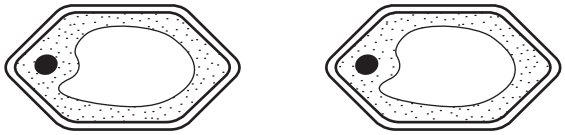
17 The diagram shows a cell that produces protease enzymes.



Which row is correct?

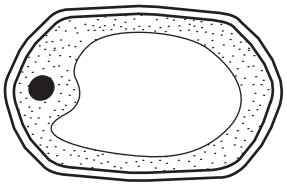
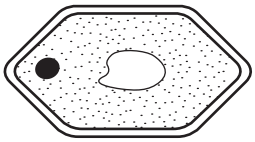
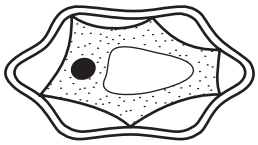
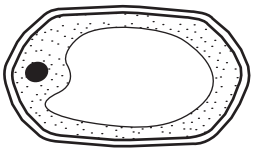
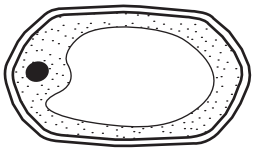
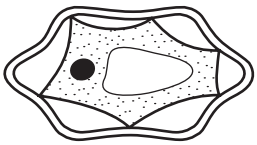
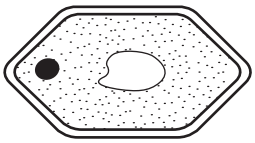
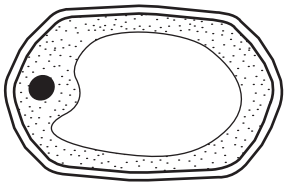
	enzymes released by	ATP needed
A	endocytosis	no
B	endocytosis	yes
C	exocytosis	no
D	exocytosis	yes

18 The diagram shows two identical plant cells.



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

What will happen to the appearance of each cell?

	water potential of solution surrounding cell less negative than cell contents	water potential of solution surrounding cell more negative than cell contents
A		
B		
C		
D		

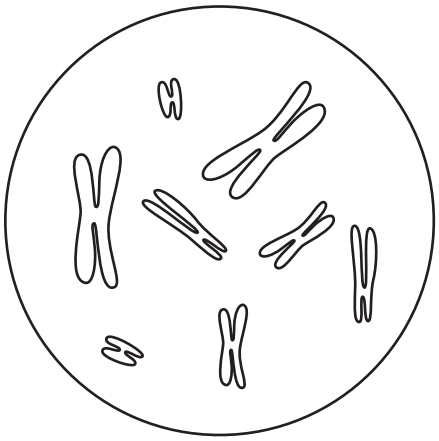
19 Chromosome telomeres are essential for DNA replication and are **not** completely replaced during mitosis.

A substance **X** is known that completely replaces telomeres during mitosis.

What will be the effect of growing cells with and without substance **X**?

	with substance **X**	without substance **X**
A	cells divide continually	cell division eventually slows and stops
B	cells divide more rapidly	cells divide continually
C	cell division eventually slows and stops	cell division stops immediately
D	cell division stops immediately	cells divide continually

20 The diagram shows a cell nucleus in prophase of mitosis.



Which statement describes the chromosomes found in each daughter nucleus immediately following division of this cell by mitosis?

A 8 chromosomes, each consisting of 4 chromatids

B 8 chromosomes, each containing 1 molecule of DNA

C 4 chromosomes, each consisting of 4 chromatids

D 16 chromosomes, each containing 1 molecule of DNA

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21 Which features of mitosis ensure that the genetic constitution of the cell is maintained?

1 the position of the chromosomes on the equator of the spindle

2 the longitudinal division of the centromeres

3 the DNA of the parent cells replicates before mitosis begins

4 the pulling apart of the chromatids to opposite poles

A 1, 2 and 3 only

B 1, 2 and 4 only

C 2, 3 and 4 only

D 1, 2, 3 and 4

22 What is the **maximum** number of hydrogen bonds in a length of DNA containing 700 nucleotides?

A 350 **B** 700 **C** 1050 **D** 2100

23 Which type of molecule is the end product of translation?

A amino acid

B mRNA

C polypeptide

D tRNA

24 A polypeptide molecule contains the amino acid sequence:

glycine – leucine – lysine – valine.

The table shows DNA codes for these amino acids.

glycine	leucine	lysine	valine
CCC	GAA	TTT	CAA

Which tRNA anticodons are needed for the synthesis of this polypeptide?

A CCC GAA TTT CAA

B CCC GAA UUU CAA

C GGG CUU AAA GUU

D GGG CUU UUU GUU

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25 Which plant cells do **not** contain a nucleus?

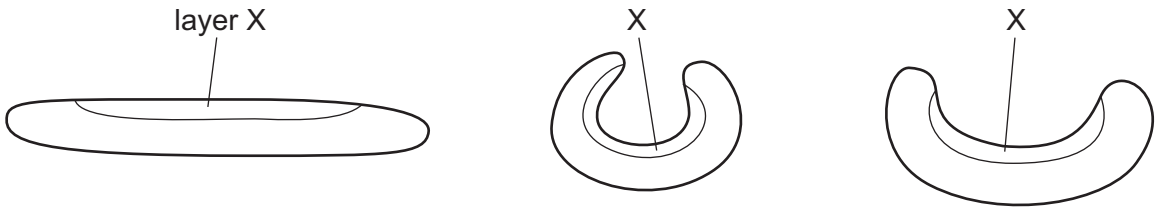
1 companion cells

2 sieve tube elements

3 xylem vessel elements

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

26 The diagram shows three xerophytic leaves of the same type in three different conditions, P, R and S.

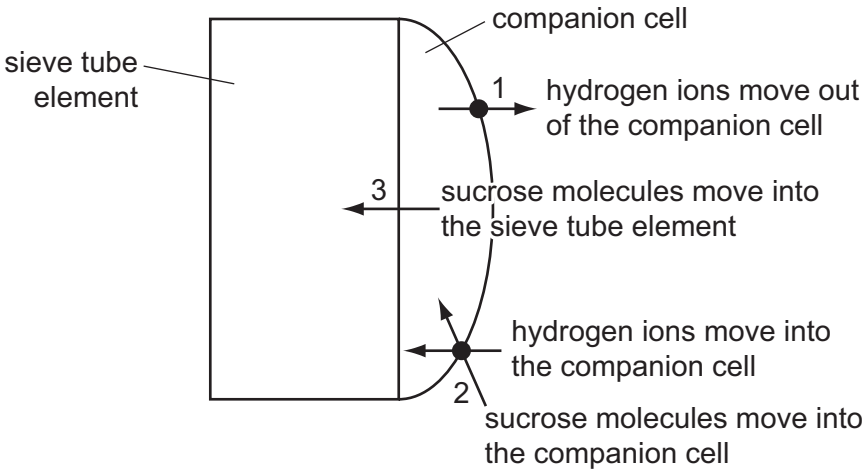


Which description of the water potential of the cells in layer X is correct?

	water potential of cells in layer X		
	P	R	S
A	less negative than R and S	more negative than P and S	more negative than P
B	less negative than S	more negative than P	less negative than P
C	more negative than R	less negative than S	less negative than R
D	more negative than R and S	less negative than P	more negative than P

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27 The diagram shows how sucrose is loaded into a sieve tube element.



What type of transport is used to move the substances in steps 1, 2 and 3?

	1	2	3
A	active transport	active transport	diffusion
B	active transport	facilitated diffusion	diffusion
C	facilitated diffusion	active transport	active transport
D	facilitated diffusion	facilitated diffusion	active transport

28 Halophytes are plants that can survive in regions where they are regularly exposed to sea water. Sea water has a water potential of approximately –2500 kPa.

Which adaptation would you expect halophytes to show?

A root hair cells with a very high water potential

B root hair cells which accumulate salts and other solutes

C a high density of stomata that are open most of the time

D leaves that have a large surface area and a thick cuticle

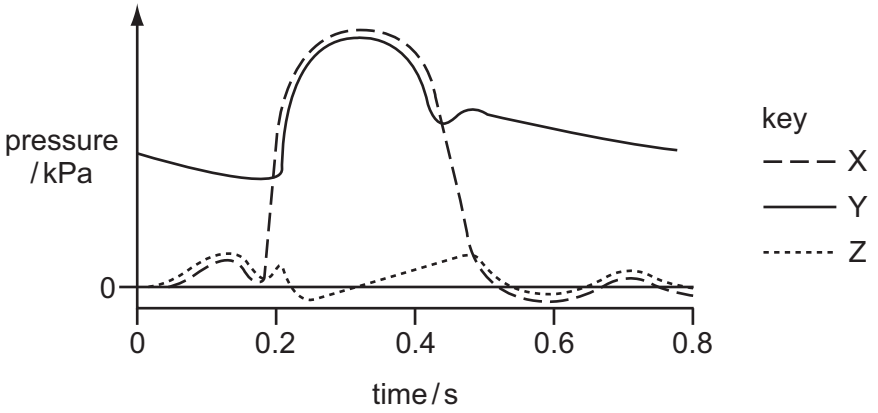
29 A number of different tissues occur in the walls of major blood vessels.

Which row correctly identifies the main tissues found in the three layers of the wall of an artery?

	outer layer (tunica externa)	middle layer (tunica media)	inner layer (tunica intima)
A	collagen	elastic	endothelium
B	collagen	muscle	elastic
C	elastic	collagen	endothelium
D	elastic	collagen	muscle

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30 The diagram shows the pressure changes in various structures of the **right side** of the heart during the cardiac cycle.



Which structures are represented by the letters X, Y and Z?

	X	Y	Z
A	pulmonary artery	right atrium	right ventricle
B	right atrium	pulmonary artery	right ventricle
C	right ventricle	pulmonary artery	right atrium
D	right ventricle	right atrium	pulmonary artery

31 Which statement is true for the Bohr effect?

A As the partial pressure of carbon dioxide increases the dissociation curve becomes S- shaped (sigmoid).

B At higher partial pressures of carbon dioxide and equal partial pressures of oxygen, the percentage saturation of haemoglobin with oxygen will be higher.

C The carbon dioxide in the air prevents haemoglobin becoming fully saturated with oxygen during gas exchange in the lungs.

D The release of oxygen from haemoglobin is more likely at higher partial pressures of carbon dioxide.

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

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

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

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

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

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

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33 What can be observed about some of the tissues in a transverse section of a mammalian trachea?

	epithelium	goblet cells	cartilage
A	ciliated	present	in blocks
B	ciliated	present	in C-shaped rings
C	non-ciliated	absent	in blocks
D	non-ciliated	absent	in C-shaped rings

34 There is a lot of epidemiological evidence linking smoking to disease and early death.

Which is the best description of 'epidemiological'?

A Disease and deaths are not randomly distributed in small populations.

B Disease and deaths are not randomly distributed in the whole population.

C Disease and deaths are only randomly distributed in large populations.

D Disease and deaths are randomly distributed in the whole population.

35 Which row shows the effects of chronic bronchitis?

	lymph glands	alveoli	bronchi	infection
A	destroyed	damaged	inflamed	absent
B	destroyed	inflamed	scarred	absent
C	swollen	damaged	scarred	present
D	swollen	inflamed	inflamed	present

36 A country had fewer than 2.5 deaths per 100 000 people from TB in one year and the next year this rose to 25 deaths per 100 000.

What may have contributed to this change?

1 decrease in contact tracing

2 increase in refugee camps

3 water supply contaminated by sewage

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

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37 A graft of tissue, such as skin, from a different person is usually rejected by the body.

Which statement about graft rejection is correct?

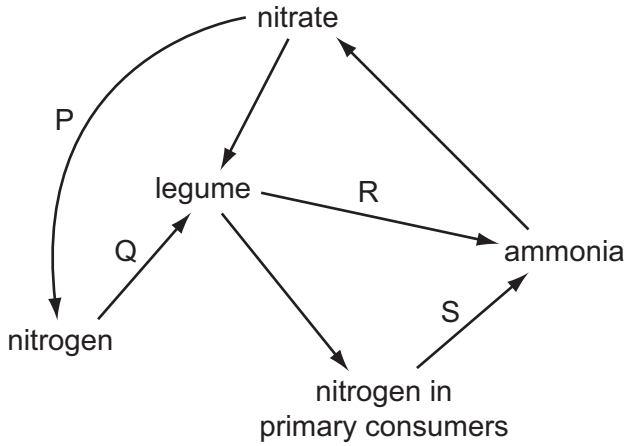
A The graft is rejected by B-lymphocytes because they make and release antibodies which react with the surface antigens on the graft cells.

B The graft is rejected by B-lymphocytes because T-lymphocytes are not stimulated to produce antibodies.

C The graft is rejected by T-lymphocytes because the graft tissue causes T-lymphocytes to release antibodies.

D The graft is rejected by T-lymphocytes because they circulate in the blood and can gather at the graft site.

38 The diagram shows a simplified nitrogen cycle.



Which row shows the correct labels for P, Q, R and S?

	P	Q	R	S
A	denitrification by anaerobic bacteria	nitrogen fixation by nitrifying bacteria	decay of leaf tissue by saprotrophic bacteria	ammonification by saprotrophic fungi
B	lightning action on soil nitrates	nitrogen fixation by nitrogen fixing bacteria	decomposition using nitrogenase enzyme	decomposition by root nodule bacteria
C	nitrification by anaerobic bacteria	nitrification using nitrogenase enzyme	decay of leaf tissue by saprotrophic fungi	assimilation of organic nitrogen
D	reduction by anaerobic bacteria	nitrogen fixation by root nodule bacteria	decomposition of organic nitrogen	decay of urea by saprotrophic bacteria

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[Turn over

39 Which statements about energy flow in ecosystems are correct?

1 All energy eventually leaves ecosystems in the form of heat.

2 The average energy transfer between trophic levels is 10 %.

3 The energy stored and lost from an ecosystem is equal to the energy input from the Sun.

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

40 In many freshwater ecosystems, the availability of inorganic nitrogen compounds is a limiting factor for growth. This means that producers cannot grow as quickly as they could even though no other factor is limiting.

Which statements about these ecosystems are correct?

1 Transfer of energy to higher trophic levels is also limited by availability of these nitrogen compounds.

2 Addition of excess nitrate compounds will benefit all organisms in the ecosystem.

3 The percentage of energy lost between trophic levels will be the same whether nitrogen compounds are limiting or not.

4 Addition of ammonium compounds will cause an increase in the numbers of nitrifying bacteria.

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

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

BIOLOGY **9700/13**

Paper 1 Multiple Choice **May/June 2013**

1 hour

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

9832585139

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.
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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1 An electron microscope has a higher resolution than a light microscope.

Which is a result of the higher resolution?

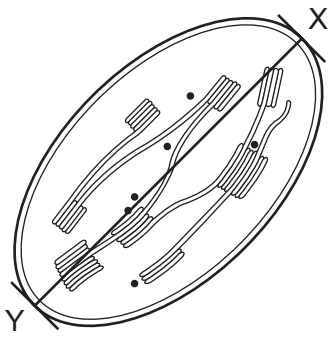
A the ability to produce larger images of cells

B the ability to see cristae in mitochondria

C the ability to see mRNA in all cells

D the ability to see the nucleus in eukaryotes

2 The diagram shows a chloroplast drawn from an electronmicrograph.



The length of the chloroplast from X to Y is 5000 nm.

What is the magnification of the drawing of the chloroplast?

A ×100 **B** ×1000 **C** ×10 000 **D** ×100 000

3 Eyepiece graticules and stage micrometers are used to measure cells.

Which is the correct reason why an eyepiece graticule is calibrated?

A An eyepiece graticule can be used to make measurements.

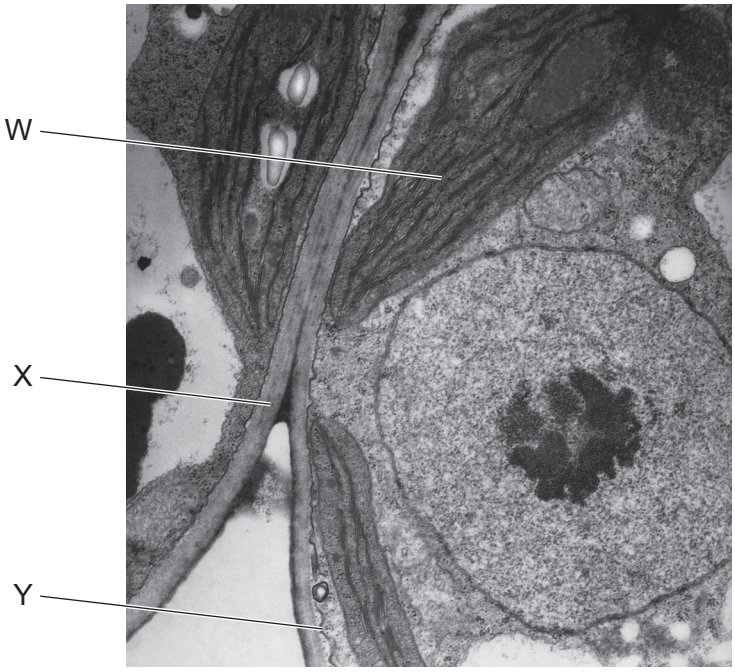
B An eyepiece graticule is magnified by the objective lens.

C An eyepiece graticule magnifies the specimen.

D An eyepiece graticule makes comparisons.

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4 The electronmicrograph shows part of two cells.



Which of the labelled features enable these cells to be identified as eukaryotic?

A W only **B** X only **C** W and X only **D** W, X and Y

5 When mucus is secreted from a goblet cell in the trachea, these events take place.

1 addition of carbohydrate to protein

2 fusion of the vesicle with the plasma membrane

3 secretion of a glycoprotein

4 separation of a vesicle from the Golgi apparatus

What is the sequence in which these events take place?

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

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

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

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

6 What is a function of the smooth endoplasmic reticulum?

A antibody synthesis

B enzyme synthesis

C protein synthesis

D steroid synthesis

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7 Two solutions, 1 and 2, one containing starch and sucrose, and the other containing glucose and protein, were tested with a variety of reagents to confirm their identity.

The table shows the conclusions from the results recorded for the various tests.

Which row identifies the two solutions?

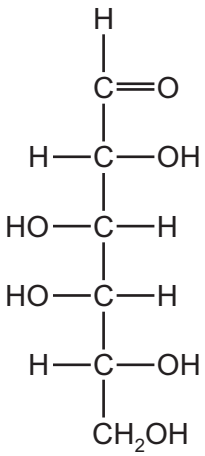
	add iodine solution		boil with Benedict's solution		boil with Benedict's solution after acid hydrolysis		add biuret solution	
	1	2	1	2	1	2	1	2
A	+	–	+	–	–	+	–	+
B	–	+	+	–	+	–	–	+
C	+	–	–	+	+	–	–	+
D	–	+	+	–	+	+	+	–

key

+ = biological molecule present

– = biological molecule absent

8 The structural formula of a carbohydrate molecule can be shown as:



Which of the molecules could be represented by this formula?

1 β-glucose

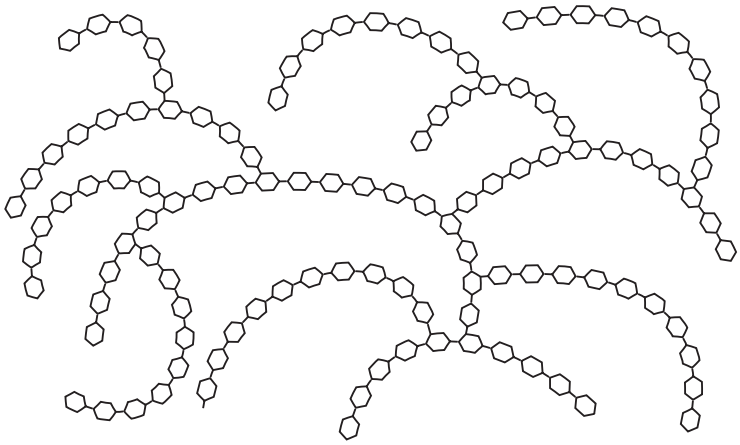
2 deoxyribose

3 ribose

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

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9 The diagram shows part of a molecule of a carbohydrate formed by glucose.



What is the name of the molecule?

A amylose

B cellulose

C glycogen

D starch

10 A naturally occurring polysaccharide is a branched chain of α-glucose.

The straight parts of the molecule are linked by α-1, 6 glycosidic bonds with a small number of branches which are linked by either an α-1, 3 glycosidic bond or an α-1, 4 glycosidic bond.

Which polysaccharide has a structure **most** similar to that described?

A amylopectin

B amylose

C cellulose

D glycogen

11 Which molecule has properties that are **not** dependent on hydrogen bonds?

A cellulose

B glycogen

C haemoglobin

D water

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12 What occurs during protein denaturation by extremes of pH?

1 breakage of peptide bonds leading to loss of shape of active site

2 disruption of existing ionic bonds between amino acid R-groups

3 loss of α-helical regular arrangement of amino acids

4 loss of protein tertiary structure resulting in loss of function

A 1, 2, 3 and 4

B 2, 3 and 4 only

C 1 and 3 only

D 2 and 4 only

13 When the ice on the surface of a pond melts, which changes benefit the ecosystem in the pond?

1 The melted water sinks to the bottom of the pond.

2 The water from the bottom of the pond brings dissolved minerals to the surface.

3 Warmer water dissolves more oxygen for the aerobic organisms.

A 1, 2 and 3

B 1 and 2 only

C 1 and 3 only

D 2 and 3 only

14 How does increasing substrate concentration affect the rate of an enzyme-catalysed reaction in the presence of a competitive inhibitor?

A The rate of the reaction decreases.

B The rate of the reaction decreases initially and then recovers.

C The rate of the reaction increases.

D The rate of the reaction is not affected.

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15 Four students investigated the effect of catalase on hydrogen peroxide.

Each student started a digital clock at the beginning of the experiment and stopped the clock after 25 bubbles had been counted.

The time recorded on the digital clock is shown below.

hours	minutes	seconds	hundredths
00	01	33	54

Which student recorded the results to the best level of precision for the apparatus used?

student	time recorded
A	1.34 minutes
B	1 minute 33.54 seconds
C	94 seconds
D	93.54 seconds

16 Which of the following can decrease the fluidity of the cell surface membrane?

1 double bonds between carbon atoms in the fatty acid chains

2 cholesterol

3 fatty acids having longer chains

A 1, 2 and 3

B 1 and 2 only

C 2 and 3 only

D 3 only

17 Which process would allow the movement of large protein molecules **out** of the cell?

A active transport

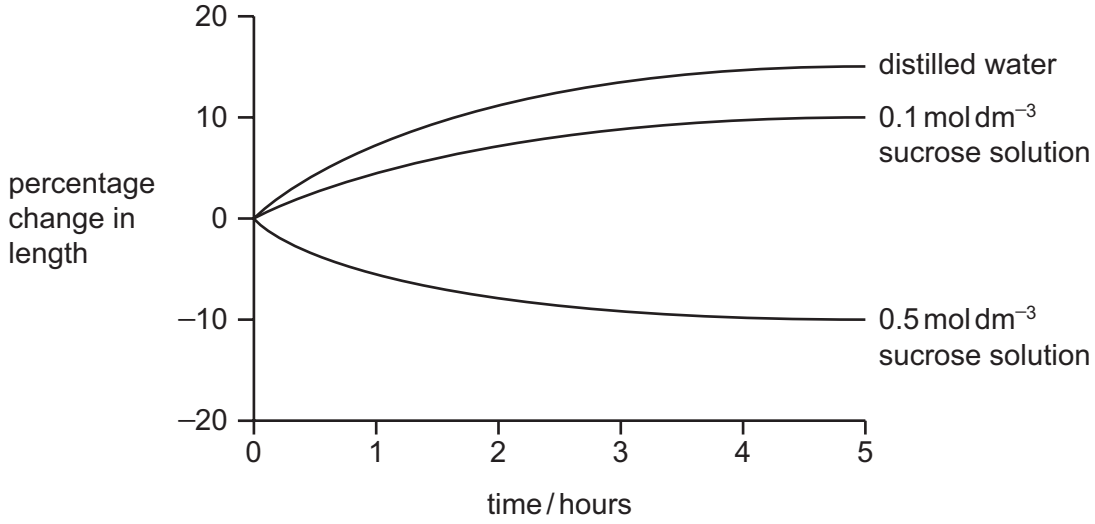
B exocytosis

C facilitated diffusion

D phagocytosis

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18 Strips of potato tissue were immersed in distilled water or in sucrose solutions of different concentrations. The graph shows the percentage change in length of the potato tissue over time.



Which row correctly shows how the water potentials of the distilled water and sucrose solutions differ from the initial water potential of the potato tissue?

	distilled water	0.1 mol dm^{-3} sucrose solution	0.5 mol dm^{-3} sucrose solution
A	less negative	less negative	more negative
B	less negative	more negative	more negative
C	more negative	less negative	less negative
D	more negative	more negative	less negative

19 Uncontrolled cell division of cancer cells forms tumours.

Which statement describes the difference between a cancer cell and a normal cell?

A Cancer cells do not undergo cytokinesis.

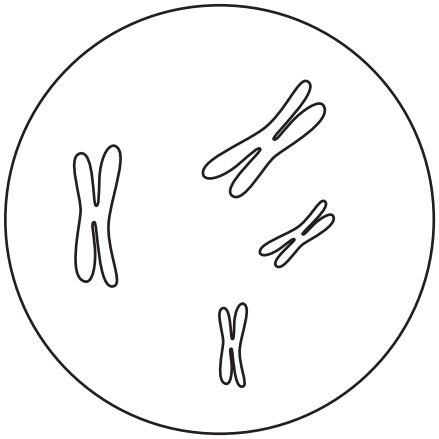
B Cancer cells do not have metaphase.

C Cancer cells have a shorter interphase.

D Only cancer cells have mutated DNA.

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20 The diagram shows a cell nucleus in prophase of mitosis.



Which statement describes the chromosomes found in each daughter nucleus immediately following division of this cell by mitosis?

A 2 chromosomes, each consisting of 2 chromatids

B 4 chromosomes, each consisting of 2 chromatids

C 8 chromosomes, each containing 1 molecule of DNA

D 4 chromosomes, each containing 1 molecule of DNA

21 Gene mutations in either the *BRCA1* or the *BRCA2* genes are responsible for the majority of hereditary breast cancer in humans.

The proteins produced by the two genes migrate to the nucleus where they interact with other proteins, such as those produced by the tumour suppressor gene, *p53* and the DNA repair gene, *RAD51*.

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

	gene		
	BRCA1 or *BRCA2*	*p53*	*RAD51*
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✗	✗

key

✓ = gene produces normal protein

✗ = gene produces abnormal protein or no protein

22 One gene provides the code for the production of which molecule?

A amino acid

B DNA

C nucleotide

D polypeptide

23 A polypeptide has the amino acid sequence glycine – arginine – lysine – serine.

The table gives possible tRNA anticodons for each amino acid.

amino acid	tRNA anticodons
arginine	UCC GCG
glycine	CCA CCU
lysine	UUC UUU
serine	AGG UCG

Which sequence of bases on DNA would code for the polypeptide?

A CCACGCAAGAGC

B CCTTCCTTCTCG

C GGAAGGAAAAGC

D GGTTGGTTGTGC

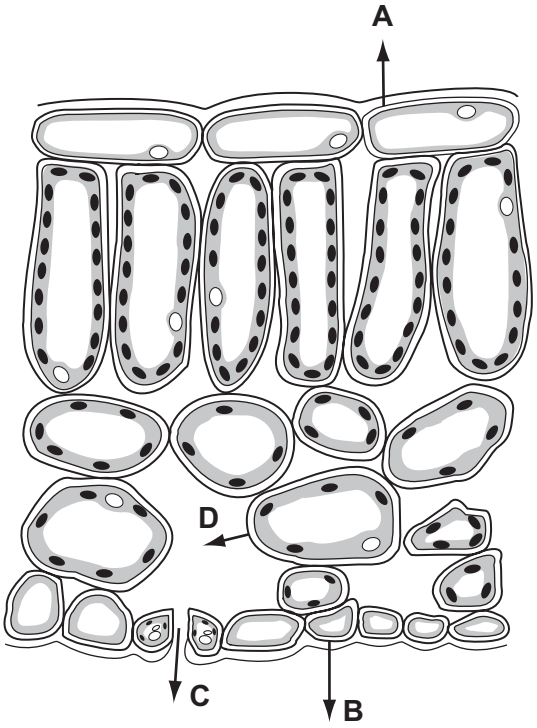
24 What is the **minimum** number of hydrogen bonds in a length of DNA containing 700 nucleotides?

A 350 **B** 700 **C** 1050 **D** 1400

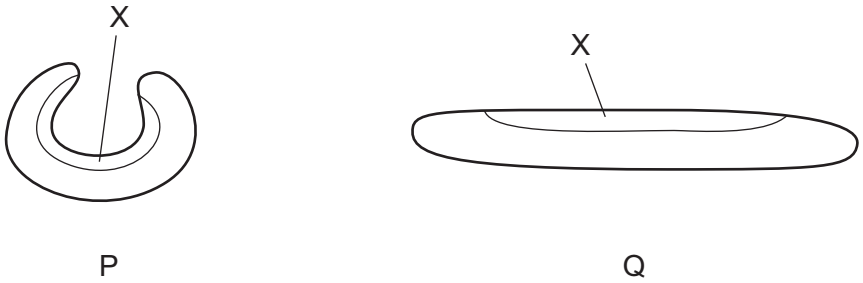
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25 The diagram shows part of a transverse section of a leaf.

Where does evaporation of water occur during transpiration?



26 The diagram shows a xerophytic leaf in different conditions, P and Q.



Which statements describe the difference between the cells in layer X in conditions P and Q?

1 More negative water potential in P than Q.

2 More cells plasmolysed in P.

3 Cells less turgid in Q.

4 Water potential becomes zero in Q.

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

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27 A potometer can be used to measure transpiration rates in a plant.

Why is the plant stem cut under water before attaching to the potometer?

A to maintain the turgidity of the xylem vessels

B to prevent collapse of the xylem vessels

C to stop air entering the xylem vessels

D to stop water loss from the xylem vessels

28 Three solutions, with different water potentials (ψ) are listed.

1 cortex cell solution

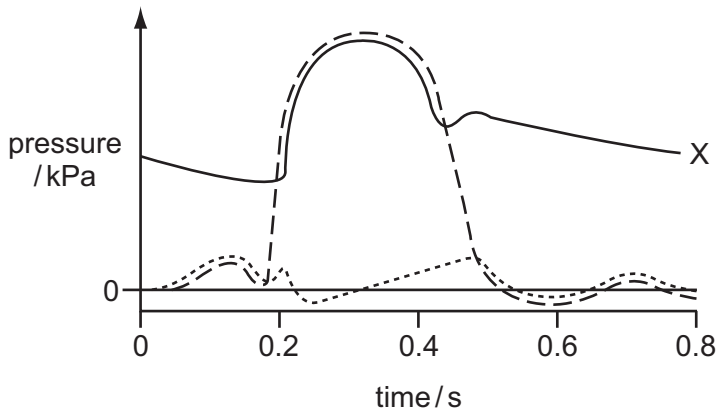
2 endodermal cell solution

3 root hair cell solution

Which row has the solutions in order from the least negative ψ to the most negative ψ?

	highest ψ	⟶	lowest ψ
A	1	2	3
B	2	1	3
C	3	2	1
D	3	1	2

29 The diagram shows the pressure changes in various structures of the **right side** of the heart during the cardiac cycle.



Which structure is represented by letter X?

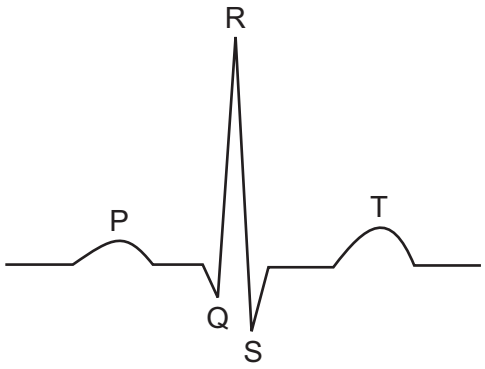
A pulmonary artery

B right atrium

C right ventricle

D vena cava

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



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

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

31 Which row describes the changes in the properties of haemoglobin as a result of the Bohr effect?

	affinity for oxygen by haemoglobin	oxygen dissociates from haemoglobin
A	higher	less readily
B	higher	more readily
C	lower	less readily
D	lower	more readily

32 Humans have a double circulation system.

What does the term ‘double circulation’ mean?

A The blood circulates separately in the two sides of the heart.

B The blood passes twice through the heart during one complete circulation.

C The heart has two of each chamber; atria and ventricles.

D The heart beat has a double sound caused by the two sets of valves closing.

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33 The photomicrograph shows a section through part of a bronchus wall.



What is the function of the tissue labelled X?

A contracts to constrict the airway

B helps to widen the airway after an allergic reaction

C produces mucus to trap dust particles and bacteria

D supports the airway to prevent collapse

34 Why is the inner lining of the bronchiole folded?

A to allow for expansion during breathing

B to facilitate gaseous exchange

C to increase the surface area

D to trap foreign particles

35 What are the effects of carbon monoxide and nicotine on the cardiovascular system?

	carbon monoxide	nicotine
A	combines with haemoglobin	increases blood pressure
B	combines with haemoglobin	reduces heart rate
C	reduces blood pressure	increases heart rate
D	reduces heart rate	combines with haemoglobin

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36 Some antibiotics are used in animal feed to reduce disease.

What explains why these antibiotics should **not** be used in the treatment of human diseases?

A Humans may be allergic to these antibiotics.

B Human cells may stop responding to these antibiotics.

C Pathogenic bacteria may develop resistance to these antibiotics.

D Useful gut bacteria may be killed by these antibiotics.

37 Which statement about both B-lymphocytes and T-lymphocytes is correct?

A They become active only when a specific antibody binds to their surface receptor.

B They divide to form clones when meeting an antitoxin in a cell.

C They produce memory cells to respond to an antigen when exposed in the future.

D They release hormone-like cytokines which stimulate release of antibodies.

38 Which uses energy to produce its own food supply from inorganic compounds?

A autotroph

B consumer

C heterotroph

D saprotroph

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[Turn over

39 Two different ecosystems, X and Y, were compared. Both ecosystems are the same size and both have the same climate. The results of the comparison are shown in the table below.

ecosystem X	ecosystem Y
greater number of trophic levels	fewer number of trophic levels
lower proportion of decomposers	higher proportion of decomposers
dominant producer is smaller and non-woody	dominant producer is larger and woody
has a smaller fluctuation in environmental temperature	has a larger fluctuation in environmental temperature
has less oxygen	has more oxygen

Using the information in the table, which statements are a valid suggestion concerning X and Y?

1 A greater percentage of primary producers are likely to be consumed by primary consumers in X than in Y.

2 X could be a marine aquatic ecosystem and Y could be a terrestrial ecosystem.

3 Energy losses between trophic levels are likely to be lower for X than for Y.

4 There is likely to be a higher rate of photosynthesis and production of organic matter in X than in Y.

A 2 and 4 only

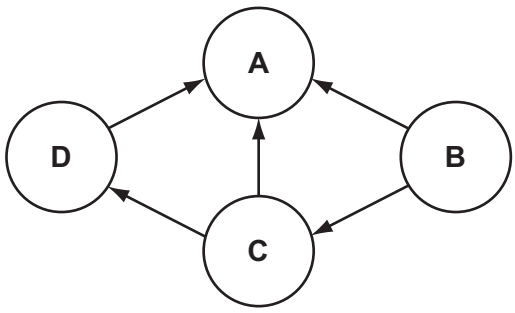
B 1, 2 and 3 only

C 1, 3 and 4 only

D 1, 2, 3 and 4

40 The diagram shows the flow of energy in a food web.

Which represents the decomposers?



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