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

BIOLOGY **9700/12**

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)

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

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

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

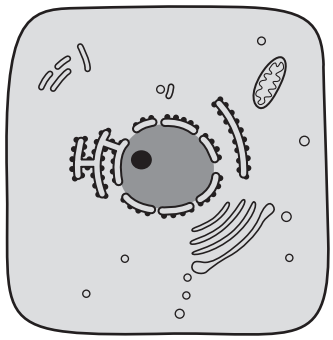
2 The electronmicrograph is of a chloroplast.

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** $\times 8 \times 10^6$

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



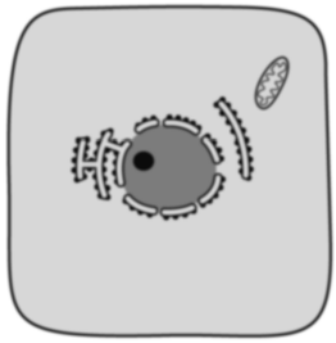
Which represents the same cell, seen under a light microscope at ×400 magnification?

A

B

C

D



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

1 cell wall

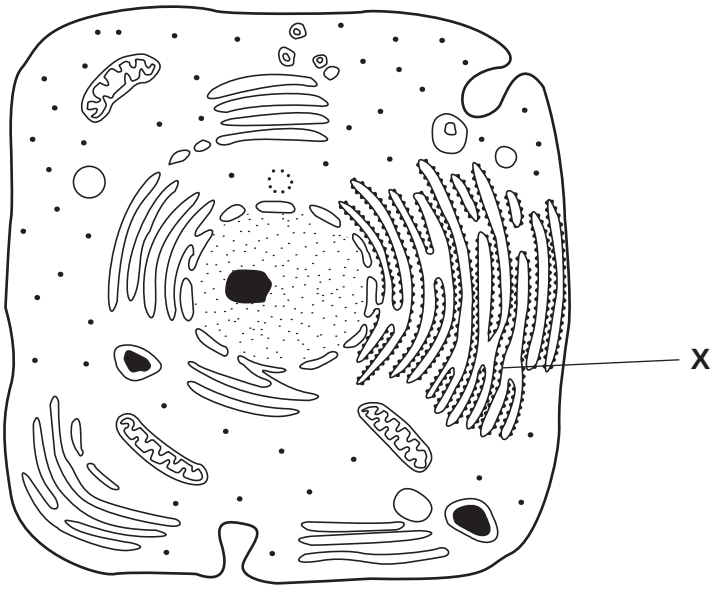
2 circular DNA

3 nucleus

4 ribosomes

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

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?

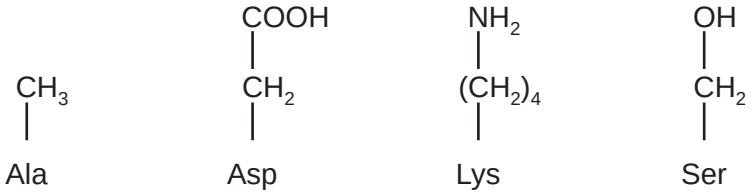
A Animal cells have no cell wall.

B Animal cells have no vacuole.

C Plant cell surface membranes are partially permeable.

D Plant cell walls are freely permeable.

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?

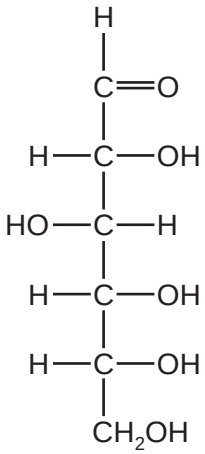
A Add ethanol and shake.

B Add ethanol, pour into water and shake.

C Add water and shake.

D Add water, pour into ethanol and shake.

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



Which of the molecules could be represented by this formula?

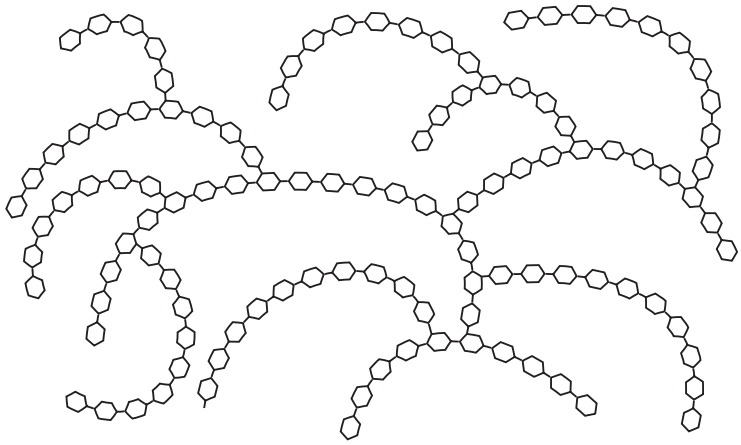
1 ribose

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.

11 Which molecules contain a carboxyl group?

1 amino acid

2 glycerol

3 saturated fatty acid

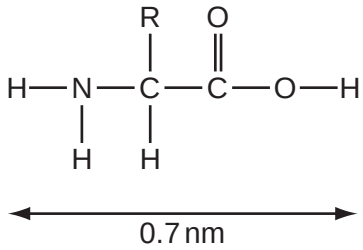
4 unsaturated fatty acid

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

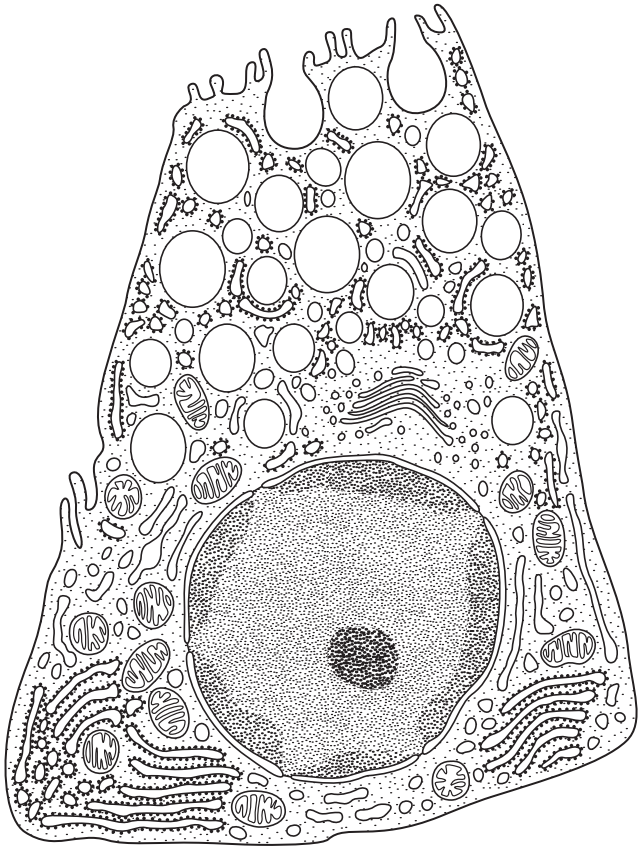
A 1, 2 and 3

B 1 and 3 only

C 2 and 3 only

D 2 only

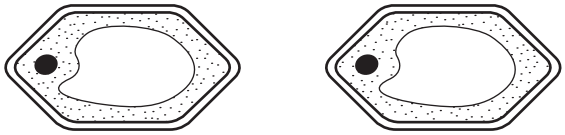
17 The diagram shows a cell that produces protease enzymes.



Which row is correct?

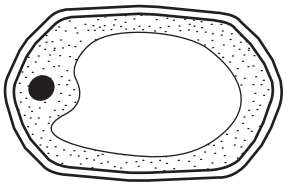
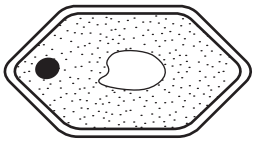
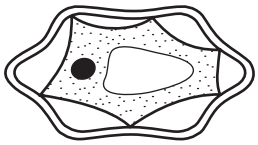
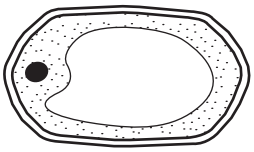
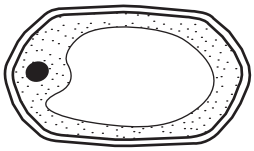
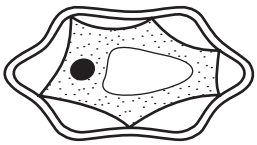
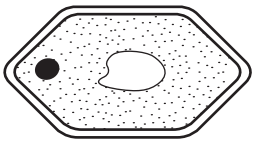
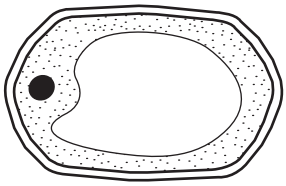
	enzymes released by	ATP needed
A	endocytosis	no
B	endocytosis	yes
C	exocytosis	no
D	exocytosis	yes

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		

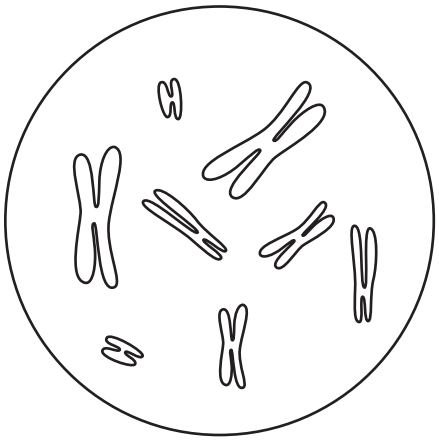
19 Chromosome telomeres are essential for DNA replication and are **not** completely replaced during mitosis.

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

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

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

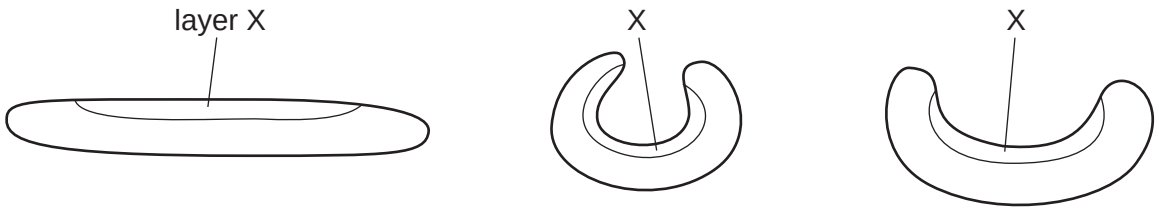
1 companion cells

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

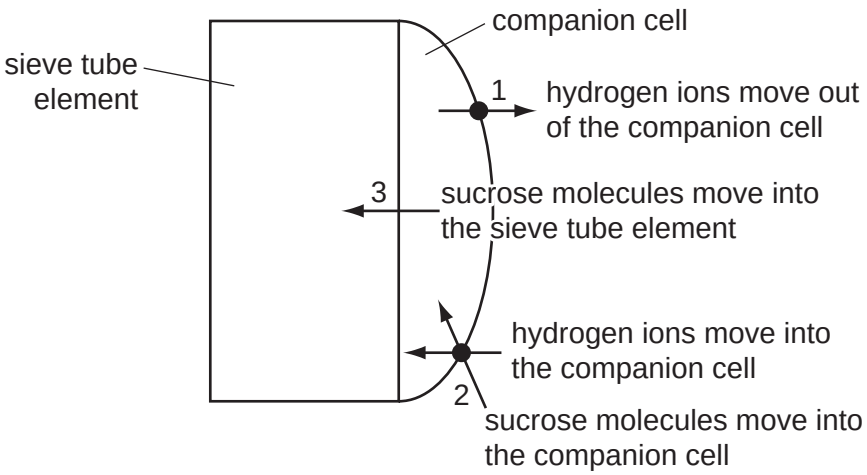
26 The diagram shows three xerophytic leaves of the same type in three different conditions, P, R and S.



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

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

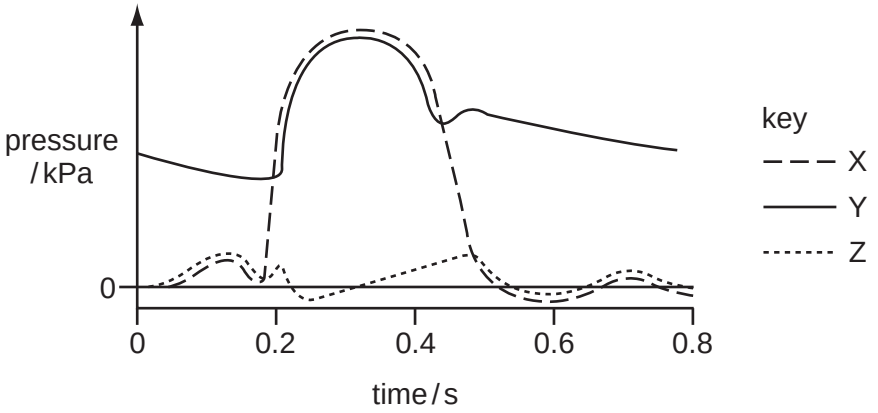
D leaves that have a large surface area and a thick cuticle

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

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.

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

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?

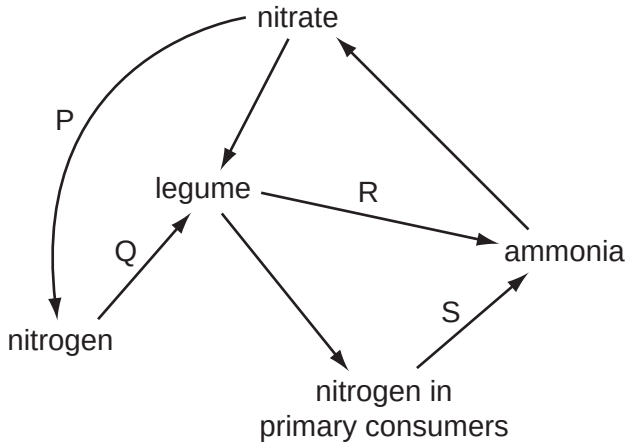
A The graft is rejected by B-lymphocytes because they make and release antibodies which react with the surface antigens on the graft cells.

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

[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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