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

BIOLOGY **9700/11**

Paper 1 Multiple Choice **October/November 2010**

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

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

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

Read the instructions on the Answer Sheet very carefully.

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

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

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1 Which of the cell organelles, when appropriately stained, will be clearly visible under the high power (×400) of the light microscope?

	lysosomes	endoplasmic reticulum	mitochondria	chloroplasts
A	✓	✓	✗	✗
B	✓	✗	✓	✗
C	✗	✓	✓	✓
D	✗	✗	✗	✓

key
✓ = visible
✗ = not visible

2 Which is correct about the organelles listed in the table?

		carries out transcription	contains enzymes	contains ribosomes
1	lysosomes	no	yes	no
2	mitochondria	yes	no	yes
3	rough endoplasmic reticulum	yes	yes	yes
4	vacuoles	no	yes	no

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

3 The graticule and stage micrometer are used to measure cells.

Which is the correct reason why the graticule calibrated?

A The graticule can be used to make measurements.

B The graticule is magnified by the objective lens.

C The graticule magnifies the specimen.

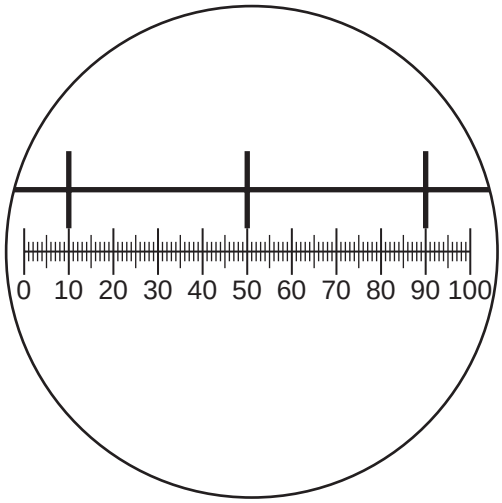
D The graticule makes comparisons.

4 What are the characteristics of a prokaryotic cell?

	DNA structure	endoplasmic reticulum	plasmids	ribosomal size
A	circular	absent	present	small
B	circular	present	absent	large
C	linear	absent	present	small
D	linear	present	absent	large

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



The same eyepiece is now used to examine a blood smear.

How many graticule divisions will cover the diameter of a white cell of 10 μm?

A 1 **B** 4 **C** 10 **D** 20

6 The equation shows a reversible reaction.

$$\text{sucrose} + \text{water} \underset{\textbf{2}}{\overset{\text{sucrase}\ \textbf{1}}{\rightleftharpoons}} \text{glucose} + \text{fructose}$$

In this reaction, on which molecule does an active site occur and what types of reaction occur at **1** and **2**?

	active site present on	reaction at **1**	reaction at **2**
A	sucrase	condensation	hydrolysis
B	sucrase	hydrolysis	condensation
C	sucrose	condensation	hydrolysis
D	sucrose	hydrolysis	condensation

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7 What are the features of triglycerides?

	polar	less dense than water	higher energy value than carbohydrates	lower proportion of hydrogen than in carbohydrates
A	✓	✓	✗	✗
B	✓	✗	✓	✓
C	✗	✓	✓	✗
D	✗	✗	✗	✓

key
✓ = yes
✗ = no

8 Tests on a liquid give these results.

test	observation
Benedict's	red
biuret	lilac
iodine in potassium iodide solution	orange

What are present in the liquid?

A reducing sugar and protein

B reducing sugar and starch

C starch and protein

D starch only

9 Which linkages are found between the glucose units in cellulose?

A α 1–4 only

B α 1–4 and α 1–6

C β 1–4 and α 1–6

D β 1–4 only

10 Water is important to living organisms because it

A acts as an excellent solvent for transport of dissolved glucose and urea.

B becomes more dense in its solid form, ice, than its liquid state.

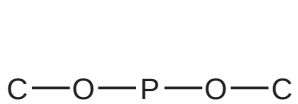
C is used in condensation reactions to synthesise macromolecules.

D requires a small increase in heat energy to raise its temperature.

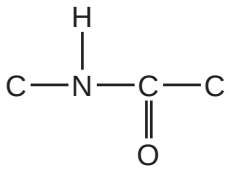
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11 Which diagram shows the bond linking the individual units of both cellulose and amylose?

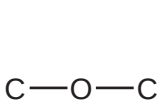
A



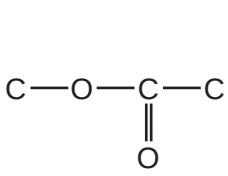
B



C



D



12 Which statements about amylopectin and glycogen are correct?

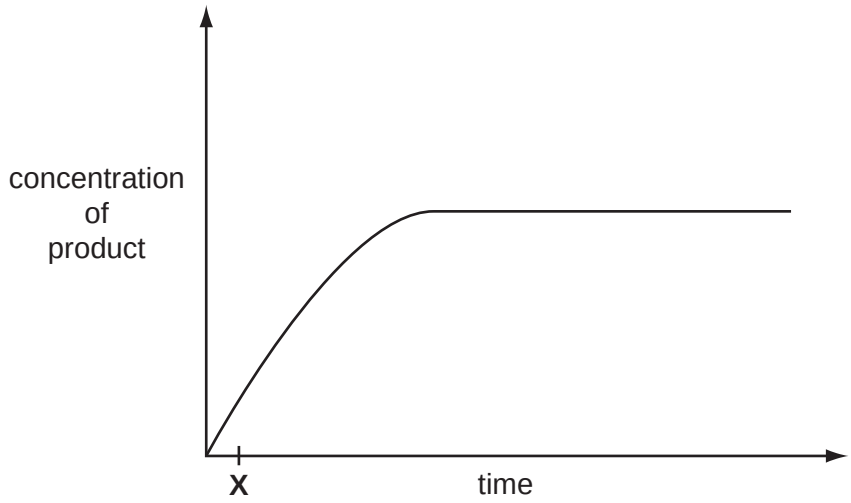
1 both contain 1-4 glycosidic bonds

2 amylopectin contains β-glucose

3 glycogen contains more 1-6 branches than amylopectin

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

13 The graph shows the course of an enzyme-catalysed reaction at 30 °C.



What is true at time **X**?

A Most enzyme molecules will have free active sites.

B The number of available substrate molecules is high.

C The number of enzyme-substrate complexes is low.

D The rate remains the same if more enzyme is added.

14 The rate of enzyme-catalysed reactions in human cells is regulated.

Which may be involved in such regulation?

1 a change in enzyme concentration

2 a change in substrate concentration

3 inhibition by the final product of the reaction

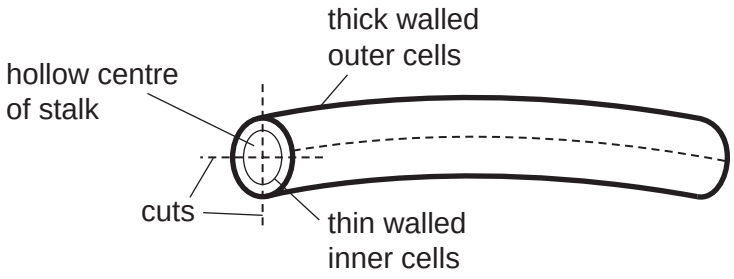
A 1 and 2 only **B** 1 and 3 only **C** 2 and 3 only **D** 1, 2 and 3

15 Which molecules, found in the cell surface membrane, have the properties listed?

	act as receptor sites for hormones	form hydrogen bonds with water	recognise antibodies
A	cholesterol and proteins	phospholipids and cholesterol	proteins and glycolipids
B	glycolipids and glycoproteins	glycolipids and glycoproteins	glycolipids and glycoproteins
C	phospholipids and cholesterol	proteins and glycolipids	cholesterol and proteins
D	proteins and glycolipids	cholesterol and proteins	phospholipids and cholesterol

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16 The stalk of a dandelion is a hollow tube. Pieces of the stalk are cut as shown and placed in sucrose solutions of different water potentials.



Which diagram shows the piece that is placed in the sucrose solution with the highest water potential?

A



B



C



D



17 In an investigation, four sucrose solutions were separated from each other by partially permeable membranes.

1 $1.1\,mol\,dm^{-3}$

2 $0.8\,mol\,dm^{-3}$

3 $0.5\,mol\,dm^{-3}$

4 $0.1\,mol\,dm^{-3}$

Which shows the direction in which water will move between the solutions?

A from 1 and 2 to 3 and 4

B from 2 and 3 to 1

C from 1 to 3

D from 2 to 4

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18 Male bees are haploid. They develop from unfertilised eggs. Female bees are diploid.

Which statements are correct?

1 All male bees are genetically identical.

2 Male bee sperm cells are produced by mitosis.

3 New combinations of genes only occur in female bees.

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

19 What describes the behaviour of the nuclear envelope and the cell membrane during mitosis?

	nuclear envelope	cell membrane
A	breaks down	breaks down
B	breaks down	remains intact
C	remains intact	breaks down
D	remains intact	remains intact

20 DNA was extracted from the salivary glands of a fruit fly and a human cheek cell.

In which way did the DNA molecules differ?

A in the ratio of adenine to thymine

B in the sequence of the nucleotides

C in the type of pentose sugar

D in the types of nucleotide

21 Which statement describes the semi-conservative replication of DNA?

A Parental DNA is broken down into nucleotides and reassembled with new nucleotides.

B Parental DNA is split into triplets and new triplets are added.

C Parental DNA is split into two strands, each of which is replicated.

D Parental DNA remains intact and a new daughter DNA copy is built from new nucleotides.

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22 The table shows the percentages of nitrogenous bases in four samples of nucleic acids.

Which base is adenine?

sample	percentage of nitrogenous bases				
	A	**B**	**C**	**D**	uracil
1	19	31	30	19	nil
2	27	23	24	26	nil
3	25	25	nil	25	25
4	17	32	33	18	nil

23 The table shows the role of four different proteins involved in DNA replication.

protein	helicase	topoisomerase	single-strand binding protein	DNA polymerase
role	unwinds the parental DNA double helix	breaks and rejoins the DNA strands	binds to separated DNA strands to stabilise them	synthesises strand of DNA

Which shows the function of these proteins?

	helicase	topoisomerase	single-strand binding protein	DNA polymerase
A	adds DNA nucleotides to the 3' end of a growing polynucleotide strand	prevents original strands reforming complementary base pairs	enables tension caused by unwinding to be released	makes strands available as templates
B	enables tension caused by unwinding to be released	prevents original strands reforming complementary base pairs	makes strands available as templates	adds DNA nucleotides to the 3' end of a growing polynucleotide strand
C	enables tension caused by unwinding to be released	makes strands available as templates	adds DNA nucleotides to the 3' end of a growing polynucleotide strand	prevents original strands reforming complementary base pairs
D	makes strands available as templates	enables tension caused by unwinding to be released	prevents original strands reforming complementary base pairs	adds DNA nucleotides to the 3' end of a growing polynucleotide strand

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24 Which shows the correct structure of mature xylem vessel elements and phloem sieve tube elements?

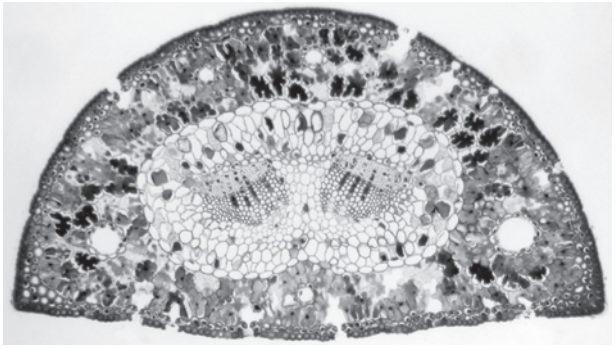
		cytoplasm	nucleus	end wall
A	phloem	✓	✓	✓
	xylem	✓	✗	✗
B	phloem	✓	✗	✓
	xylem	✗	✓	✓
C	phloem	✓	✗	✓
	xylem	✗	✗	✗
D	phloem	✗	✓	✓
	xylem	✗	✗	✓

key

✓ = present

✗ = absent

25 The photomicrograph shows a transverse section through a leaf.



×50

1 sunken stomata

2 two layers of epithelium

3 thick cuticle

4 small surface area to volume

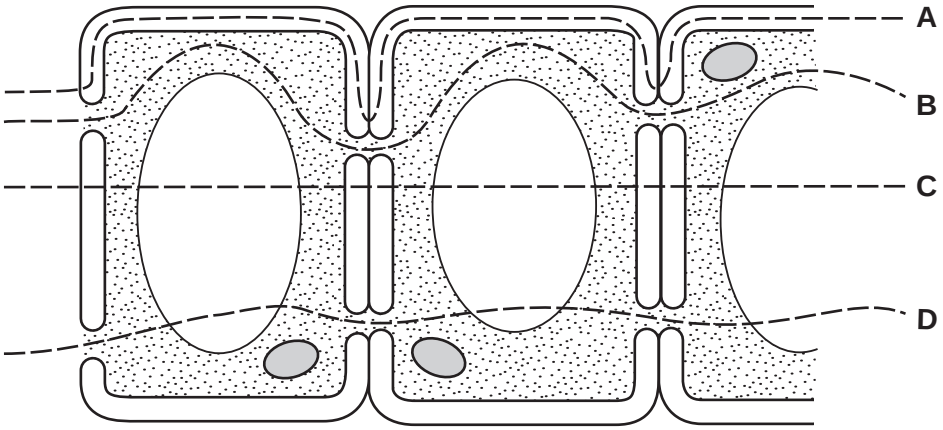
Which features of a xerophytic leaf are visible in this section?

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

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26 The diagram shows some adjacent cells from the root of a plant.

Which is the apoplastic pathway of water movement?



27 What determines the rate of water movement from the roots to the leaves?

A absorption of water through the root hair cells

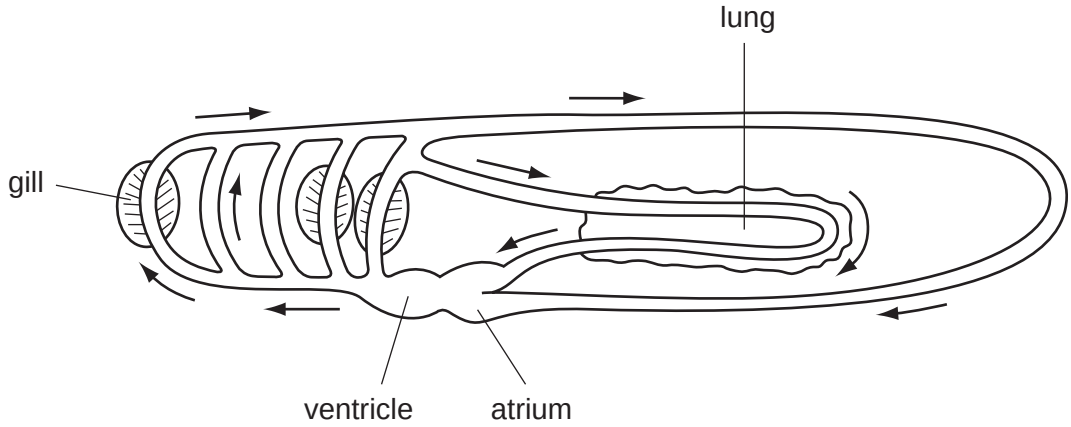
B development of a less negative water potential in the leaves

C diffusion of water through the stomata

D evaporation of water from the mesophyll cell walls

28 The mammalian circulatory system is described as a closed double circulation.

The diagram shows the circulatory system in a different organism. The arrows show the direction of blood flow in the vessels.



How is the circulatory system in this organism described?

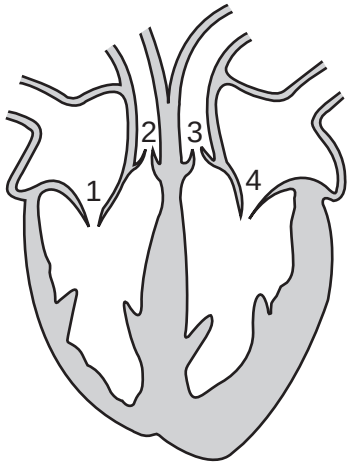
A closed double

B closed single

C open double

D open single

29 The diagram shows the valves inside the heart.



Which valves are open or closed when the atria are relaxed and the ventricles contracted?

	valves open	valves closed
A	3 and 4	1 and 2
B	2 and 4	1 and 3
C	2 and 3	1 and 4
D	1 and 4	2 and 3

30 Which tissues are present in the walls of a trachea and an alveolus?

		tissue		
		cartilage	epithelium with goblet cells	smooth muscle
A	trachea	✓	✓	✓
	alveolus	✓	✓	✗
B	trachea	✓	✓	✓
	alveolus	✗	✗	✗
C	trachea	✓	✓	✗
	alveolus	✗	✓	✓
D	trachea	✓	✓	✓
	alveolus	✗	✗	✓

key
✓ = present
✗ = absent

31 How does nicotine in cigarette smoke increase the risk of cardiac disease?

A by binding with haemoglobin

B by constricting blood vessels

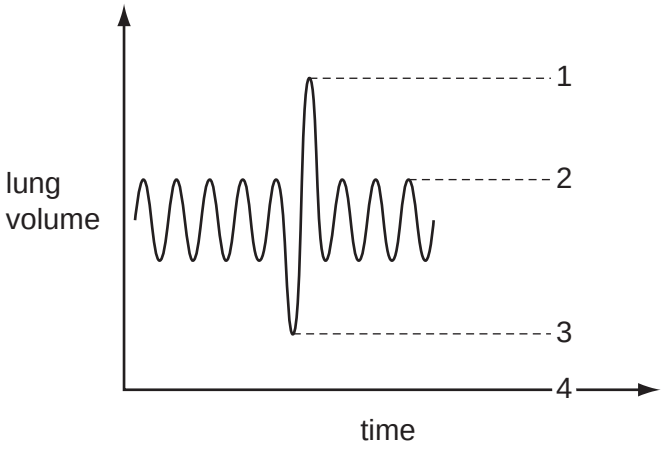
C by inhibiting nerve transmission

D by stimulating the pacemaker

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32 The diagram shows the volume of air breathed in and out while a person is breathing normally when at rest.

They breathe out the deepest breath they can and then breathe in as much as they can before breathing normally again.



Which points would you use to calculate the vital capacity?

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

33 Which diseases can be cured by the use of antibiotics?

A cholera and tuberculosis

B measles and smallpox

C measles and tuberculosis

D smallpox and cholera

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

1 mosquitoes became resistant to insecticides

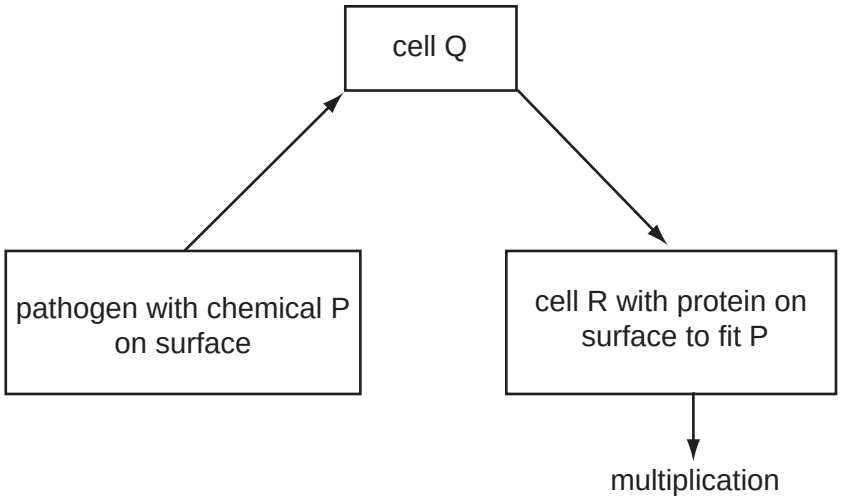
2 migration of population due to war

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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35 The diagram shows part of the immune response.



What are P, Q and R?

	P	Q	R
A	antibody	B-lymphocyte	T helper cell
B	antibody	T helper cell	B-lymphocyte
C	antigen	B-lymphocyte	T helper cell
D	antigen	T helper cell	B-lymphocyte

36 When a body cell is infected by a pathogen, which describes a correct immune response?

A Killer T cells punch holes in infected cells, releasing antibodies.

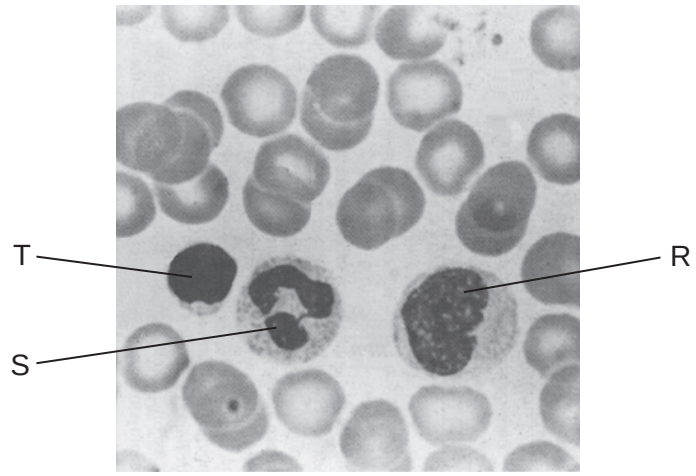
B Killer T cells release cytokines, infected body cells release antibodies.

C Memory cells release antibodies, killer T cells secrete cytokines.

D T helper cells release cytokines, plasma cells release antibodies.

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37 The photomicrograph shows human blood, with three types of white cell labelled.



Which row correctly identifies these white cells?

	cell R	cell S	cell T
A	lymphocyte	lymphocyte	phagocyte
B	lymphocyte	phagocyte	lymphocyte
C	phagocyte	lymphocyte	phagocyte
D	phagocyte	phagocyte	lymphocyte

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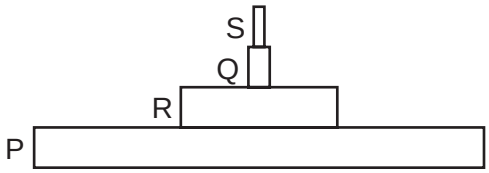
[Turn over

38 The table shows the results of a field study of four species in a food chain in an area of woodland.

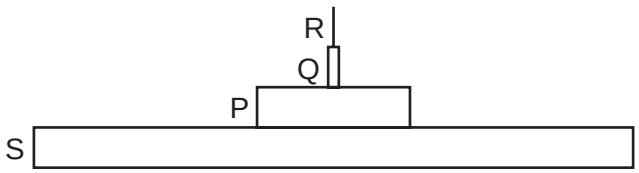
species	number of individuals	biomass of one individual / arbitrary units	energy value per unit mass / arbitrary units
P	10 000	0.100	1.0
Q	5	10.000	2.0
R	500	0.002	1.8
S	3	300 000.000	0.5

Which is the correct pyramid of energy from these data?

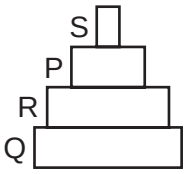
A



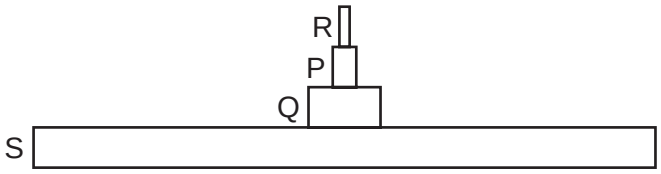
B



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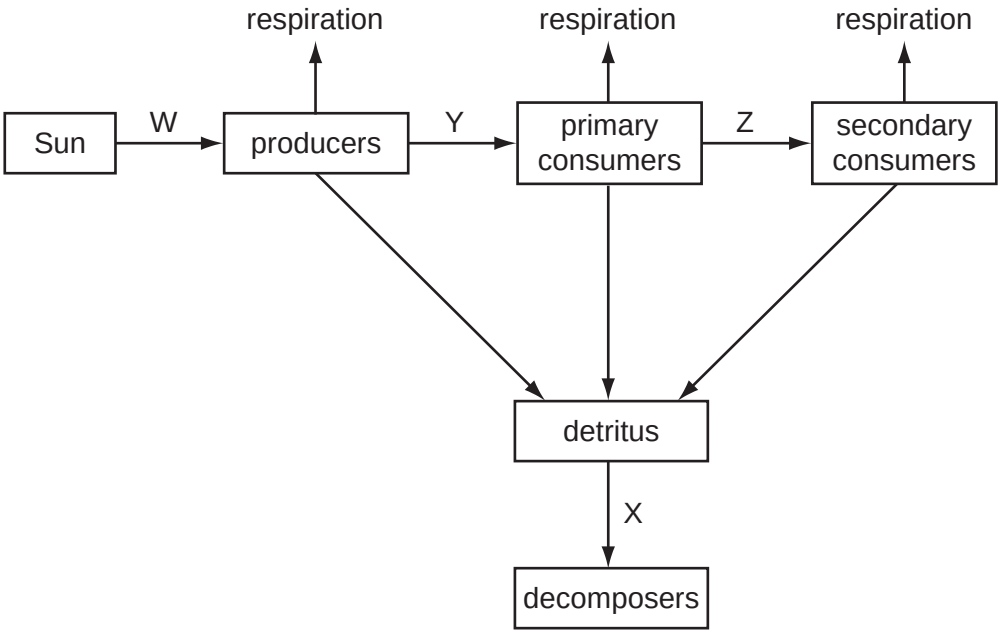


D



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39 The diagram represents the flow of energy through a tropical rainforest ecosystem.



Which set of figures identifies the percentage transfer of energy between the Sun, producers, consumers and decomposers?

	W	X	Y	Z
A	1	10	20	80
B	1	20	10	80
C	10	20	1	10
D	10	10	1	20

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

BIOLOGY **9700/12**

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1 hour

Additional Materials: Multiple Choice Answer Sheet
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1 Which steps are needed to find the actual width of a xylem vessel viewed in transverse section using a ×40 objective lens?

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

2 Calibrate the eyepiece graticule using a stage micrometer on ×10 objective lens.

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

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

A 1, 2, 3 and 4

B 2, 3 and 4 only

C 1 and 2 only

D 3 and 4 only

2 A specimen is viewed under a microscope using green light with a wavelength of 510 nm.

If the same specimen is viewed under the same conditions, but using red light with a wavelength of 650 nm instead, what effect will this have on the magnification and on the resolution of the microscope?

	magnification	resolution
A	decreased	decreased
B	increased	increased
C	remains the same	decreased
D	remains the same	increased

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3 Which cell organelle does **not** contain nucleic acid?

A chloroplast

B Golgi apparatus

C lysosome

D ribosome

4 The diameter of living cells varies considerably.

The typical diameters are

a eukaryote, such as a white blood cell $1.5 \times 10^1\,\mu m$

a prokaryote, such as *Streptococcus* $7.5 \times 10^2\,nm$

Use these measurements to find the maximum number of each cell type which could fit along a line 1 cm long.

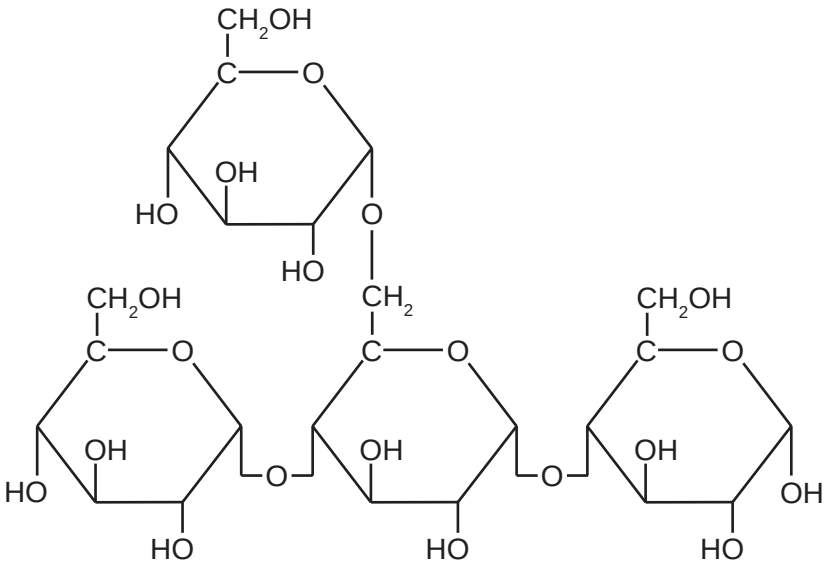
	number of white blood cells	number of *Streptococcus cells*
A	6.7×10^3	1.3×10^5
B	6.7×10^2	1.3×10^4
C	6.7×10^1	1.3×10^3
D	6.7×10^0	1.3×10^2

5 Cells consist of a number of different components.

Which row shows the components present (✓) in both a prokaryotic and eukaryotic cell?

	lysosomes	Golgi apparatus	ribosomes	cell surface membrane
A		✓		✓
B	✓	✓		
C			✓	✓
D	✓		✓	

6 The diagram shows part of a carbohydrate molecule.



If all the 1, 4 glycosidic bonds in this molecule are hydrolysed, how many water molecules will be used and how many separate glucose molecules will be produced?

	number of water molecules used	number of glucose molecules produced
A	1	1
B	2	2
C	3	3
D	4	4

7 A peptide bond is formed between atoms of which two elements?

A carbon and carbon

B carbon and hydrogen

C carbon and nitrogen

D hydrogen and nitrogen

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8 Which features affect the tensile strength of collagen?

1 the helical structure of collagen chains

2 the small R group of the amino acids in collagen

3 the insoluble nature of collagen

4 the covalent bonds between collagen molecules

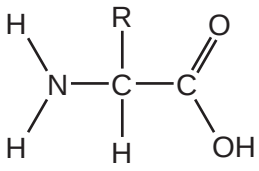
A 1, 2, 3 and 4

B 1 and 3 only

C 1, 2 and 4 only

D 2, 3 and 4 only

9 An amino acid can be represented as



where 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

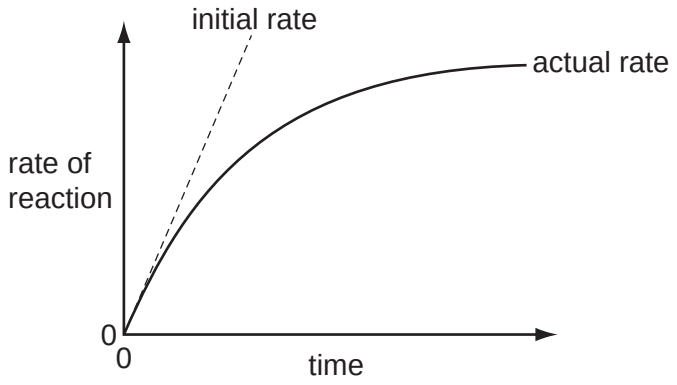
D $HOCH_2CH(OH)CH_2OH$

10 When red cells leave the lungs, haemoglobin is 98 % saturated.

How many molecules of oxygen will be carried by the majority of haemoglobin molecules?

A 2 **B** 4 **C** 6 **D** 8

11 A fixed volume of the enzyme catalase was added to a fixed volume of hydrogen peroxide solution. The diagram shows how the rate of the reaction changed over the course of the reaction.



Why did the actual rate of reaction decrease over time?

A The enzyme active sites become saturated.

B The enzymes were denatured.

C The product inhibited the reaction.

D The substrate molecules were used up.

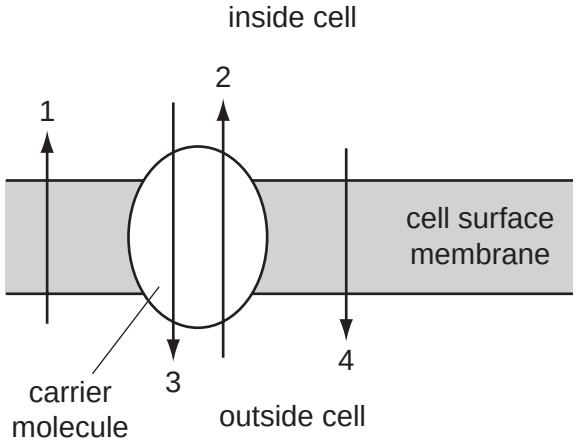
12 Which levels of protein structure are always involved when competitive and non-competitive inhibitors bind to enzymes?

	competitive	non-competitive
A	primary, secondary and tertiary	secondary
B	quaternary and tertiary	quaternary and tertiary
C	secondary	primary and tertiary
D	tertiary	tertiary

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13 The diagram shows the transport of ions across the cell surface membrane. Inside the cell there is a low concentration of sodium ions (Na^+) and a high concentration of potassium ions (K^+). Outside the cell there is a low concentration of K^+ and a high concentration of Na^+.

The carrier molecule is a pump which exchanges Na^+ for K^+ ions.



Which ionic movements are represented by the arrows?

	active transport of K^+	active transport of Na^+	diffusion of Na^+	diffusion of K^+
A	2	3	1	4
B	2	3	4	1
C	3	2	1	4
D	3	2	4	1

14 Plant cells were immersed in solutions of different water potential and left for one hour.

Which row shows the effect of the different solutions on the plant cells?

	water potential of solution compared to plant cells		
	less negative	equal	more negative
A	flaccid	turgid	unchanged
B	flaccid	unchanged	turgid
C	turgid	unchanged	flaccid
D	unchanged	flaccid	turgid

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

1 glycolipids

2 glycoproteins

3 phospholipids

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

16 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 2 only **B** 1 and 2 only **C** 2 and 3 only **D** 1, 2 and 3

17 In which process does mitosis **not** have an important role in living things?

A asexual reproduction

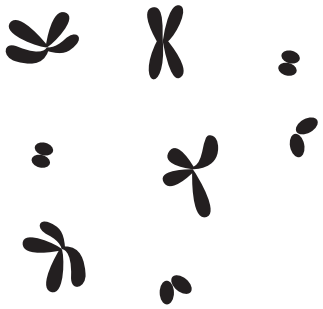
B growth of cells

C increase in size

D repair to damaged tissues

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18 The diagram shows the chromosomes of a typical plant cell at the metaphase stage of mitosis.



Which row describes this cell during metaphase?

	diploid number (2n) for the plant	structures present at metaphase		
		cell wall	centriole	spindle
A	4	✓	✗	✓
B	8	✗	✓	✓
C	8	✓	✗	✓
D	16	✓	✓	✗

19 The table shows the percentages of bases in DNA from various types of cell.

source of DNA	percentage of bases in DNA			
	adenine	guanine	thymine	cytosine
calf thymus	28.2	21.5	27.8	22.5
bull spleen	27.9	22.7	27.3	22.1
bull sperm	28.6	22.2	27.2	22.0
rat bone marrow	28.7	21.4	28.4	21.5
yeast	31.3	18.7	32.9	17.1

What is a valid deduction from these data?

A All cells from the same species have approximately the same content of DNA.

B Small differences in DNA from different cells have large effects.

C The four bases show complementary base pairing.

D The structure of DNA is different in yeast and animal cells.

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20 Which row shows the correct combination?

	triplet code	codon	anticodon
A	DNA	mRNA	tRNA
B	DNA	tRNA	mRNA
C	mRNA	DNA	tRNA
D	tRNA	mRNA	DNA

21 A culture of bacteria had all its DNA labelled with the heavy isotope of nitrogen (^{15}N). A sample was taken and spun in a centrifuge.

The diagram shows the position of the DNA band at Z in the centrifuge tube.



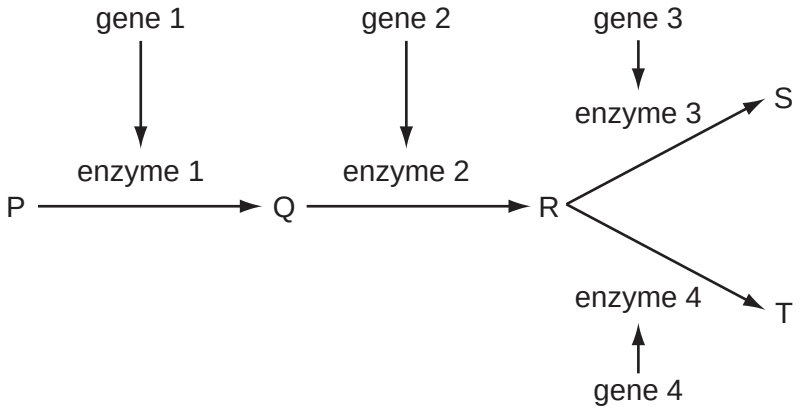
The culture was then allowed to reproduce using nucleotides containing the normal isotope of nitrogen (^{14}N). Samples were taken and spun in a centrifuge after one generation and again after two generations.

In which pattern would the DNA be found after the first and after the second generations?

	after first generation	after second generation
A	half at X and half at Y	quarter at X, quarter at Z and half at Y
B	half at X and half at Z	quarter at X, quarter at Z and half at Y
C	all at Y	half at X and half at Y
D	all at Z	half at Y and half at Z

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22 S and T are products of a biochemical pathway. A different enzyme, coded for by different specific genes, catalyses each step in the pathway.



What is the possible outcome to the pathway if a mutation in gene 3 leads to an inactive enzyme?

A There is a decrease in the activity of gene 1 and gene 2.

B There is an accumulation of product S.

C There is an increase in the rate of reaction of enzyme 4.

D There is an increase in the production of T.

23 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 spongy mesophyll cells

4 the evaporation of water vapour from exposed leaves

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

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

A providing cytoplasmic contact with the sieve tube element for loading

B providing structural support for the sieve tube element

C providing the nucleus for cell division in the phloem

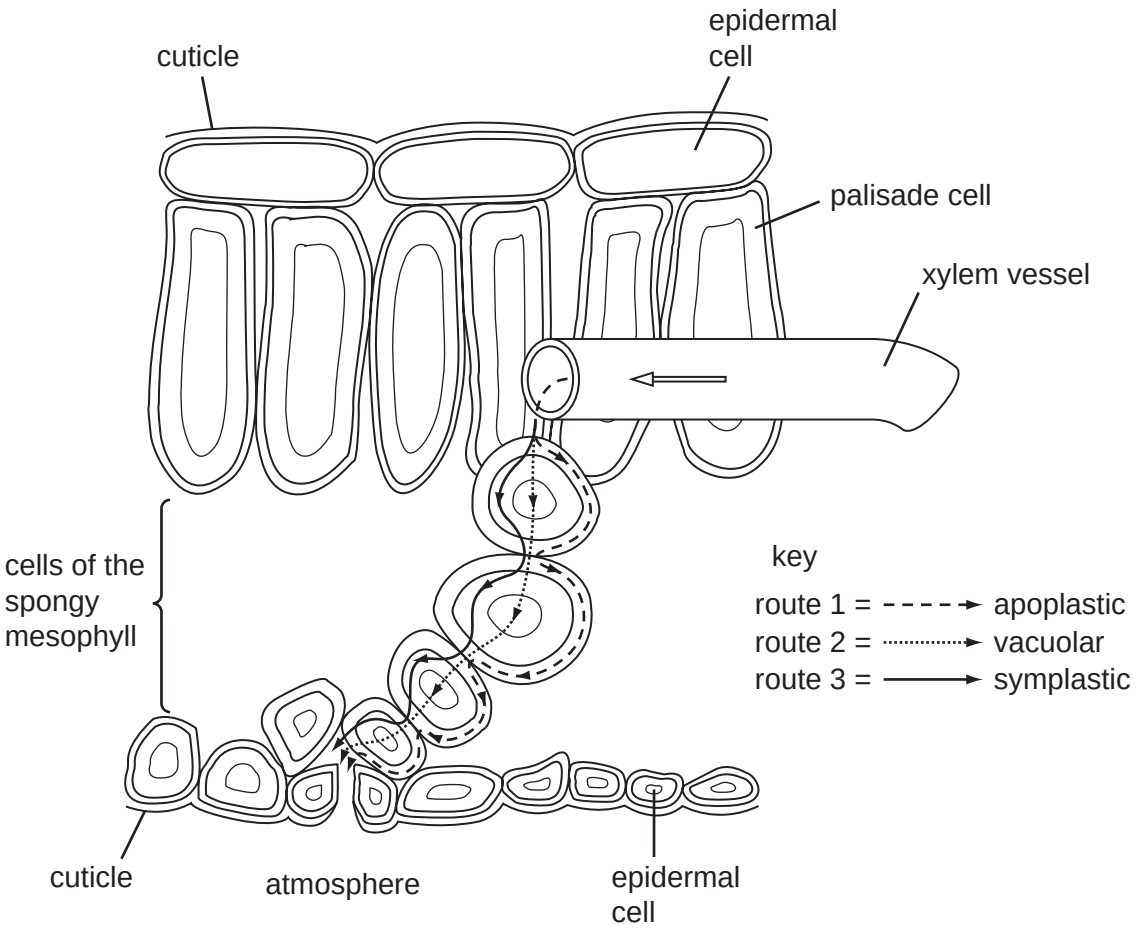
D providing the source of assimilates for storage

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25 Water passes across leaf tissues by different routes as a result of

- differences in water potential
- the pull transmitted by cohesive forces between water molecules.

The diagram shows three routes by which water can travel.



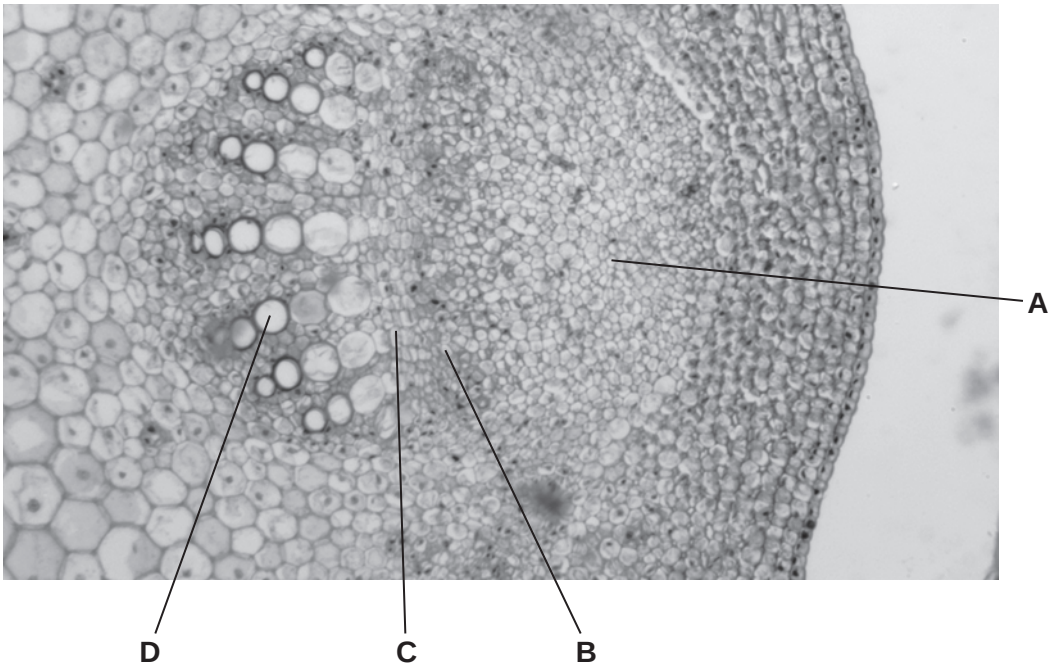
Which row correctly identifies why water passes across leaf tissues by the different routes?

	differences in water potential	pull transmitted by cohesive forces
A	route 1	routes 2 and 3
B	routes 1 and 3	route 2
C	route 2	routes 1 and 3
D	routes 2 and 3	route 1

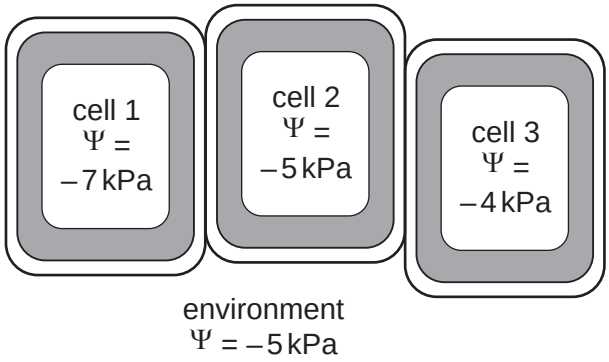
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26 The diagram shows a transverse section of a stem.

Which area is the phloem?



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



Which statements are correct for this situation?

1 Water moves into and out of all three cells.

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

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

4 Water moves out of cell 3 so it becomes plasmolysed.

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

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28 Which of the tissue types below are present in the walls of **all** blood vessels?

1 collagen

2 elastic

3 endothelial

4 smooth muscle

A 1, 2, 3 and 4

B 1, 2 and 4 only

C 2 and 3 only

D 3 only

29 In mammals, some carbon dioxide is transported by red blood cells in combination with haemoglobin.

What is the product of this combination?

A carbamino-haemoglobin

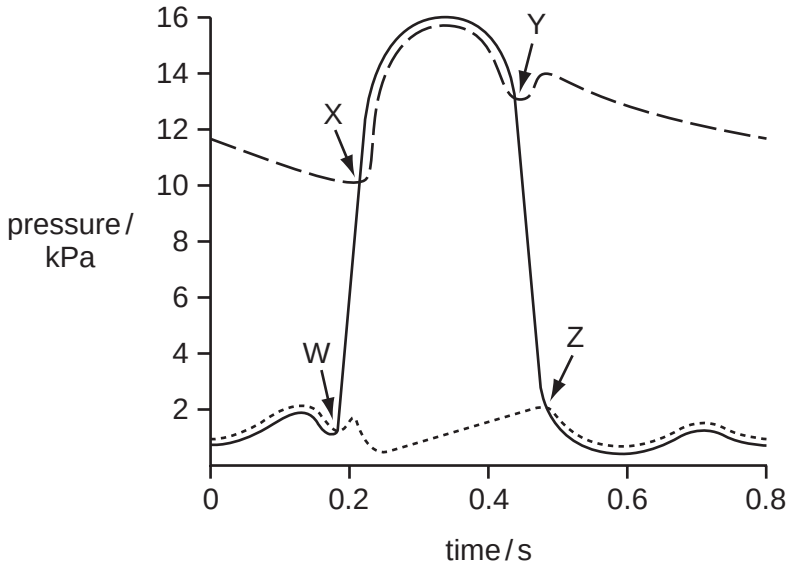
B carbonic acid

C carboxyhaemoglobin

D haemoglobinic acid

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30 The graph shows pressure changes during a cardiac cycle.



Which row correctly identifies W, X, Y, and Z?

	W	X	Y	Z
A	atrio-ventricular valves close	semi-lunar valves close	semi-lunar valves open	atrio-ventricular valves open
B	atrio-ventricular valves close	semi-lunar valves open	semi-lunar valves close	atrio-ventricular valves open
C	semi-lunar valves close	atrio-ventricular valves open	atrio-ventricular valves close	semi-lunar valves open
D	semi-lunar valves open	atrio-ventricular valves close	atrio-ventricular valves open	semi-lunar valves close

31 Some babies are born with a hole between the right and left atria. These newly born 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 Newly born babies' haemoglobin has a higher affinity for oxygen.

C Newly born babies' haemoglobin molecules only have one haem group.

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

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32 Which row correctly shows the areas of the respiratory tract that contain cartilage, cilia (ciliated epithelium), goblet cells and smooth muscle?

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

33 In some cases where a person has lung disease, the partial pressure of oxygen in the pulmonary veins is less than the partial pressure of oxygen in the alveoli.

Which would contribute to the description above?

1 A high proportion of alveoli are collapsed and do not have enough alveolar capillaries.

2 The degree of alveolar ventilation is too low for the cardiac output supplying most of the alveoli.

3 The partial pressure of oxygen in the pulmonary arteries is lower than in the alveolar air.

4 The rate of diffusion of oxygen from the alveolar air to the surrounding alveolar capillaries is too slow.

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

34 Which of the effects listed occur as a result of inhaling both carbon monoxide and nicotine from cigarette smoke?

1 increased heart rate

2 increased risk of cardiovascular disease

3 increased risk of emphysema

4 increased risk of lung cancer

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

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35 During an investigation on gas exchange, three measurements were made on four people. The efficiency of gas exchange was the same in all four people.

Which person, **A**, **B**, **C** or **D**, absorbed most oxygen during normal breathing?

	breathing rate / breaths per minute	tidal volume / dm^3	total lung volume / dm^3
A	14	0.6	6.4
B	15	0.6	6.0
C	16	0.5	6.4
D	17	0.5	5.8

36 The data shows how the number of human deaths caused by the bacterium *Staphylococcus aureus* has changed from 1997 to 2005.

Methicillin is an antibiotic used to treat a disease caused by *S. aureus*.
MRSA is methicillin-resistant *S. aureus*.

year	total number of death certificates with *S. aureus*	total number of death certificates with MRSA
1997	369	355
1999	452	431
2001	456	681
2003	420	890
2005	428	1512

Which statement is **not** supported by this data?

A More people have MRSA so the disease spreads.

B MRSA is more likely to lead to death as there is no treatment.

C Resistant strains of MRSA are becoming more common.

D *S. aureus* will always cause humans to die.

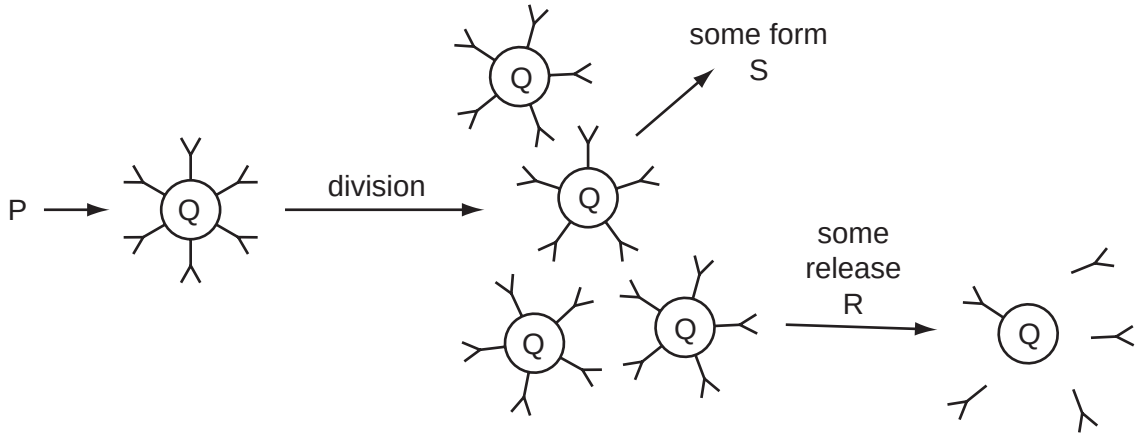
37 An enzyme hydrolyses the two heavy polypeptide chains of an antibody molecule. The hydrolysis occurs at the hinge region and breaks the antibody into three fragments.

How many of these fragments are able to bind to antigens?

A 0 **B** 1 **C** 2 **D** 3

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38 The diagram shows the response to a pathogen by the immune system.

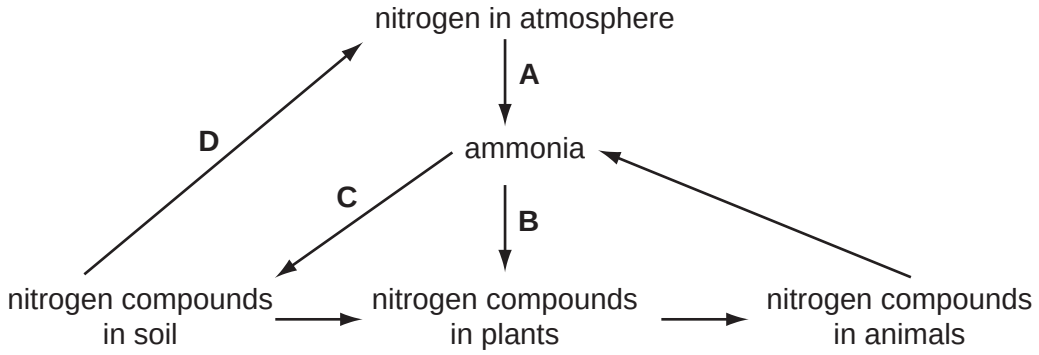


Which row correctly identifies P, Q, R and S?

	P	Q	R	S
A	antibody	T-lymphocyte	antigen	plasma cell
B	antigen	B-lymphocyte	antibody	memory cell
C	antigen	T-lymphocyte	antitoxin	B-lymphocyte
D	bacteria	B-lymphocyte	antibody	T-lymphocyte

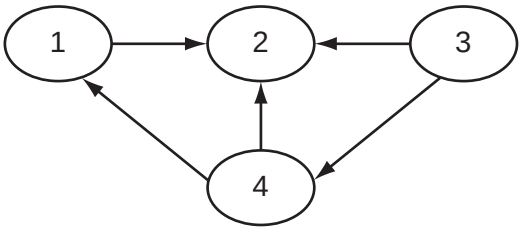
39 The diagram represents part of the nitrogen cycle.

Which process is carried out by nitrifying bacteria?



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



Which correctly identifies each organism in the ecosystem?

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

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General Certificate of Education
Advanced Subsidiary Level and Advanced Level

BIOLOGY **9700/13**

Paper 1 Multiple Choice **October/November 2010**

1 hour

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

3821339057

READ THESE INSTRUCTIONS FIRST

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

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

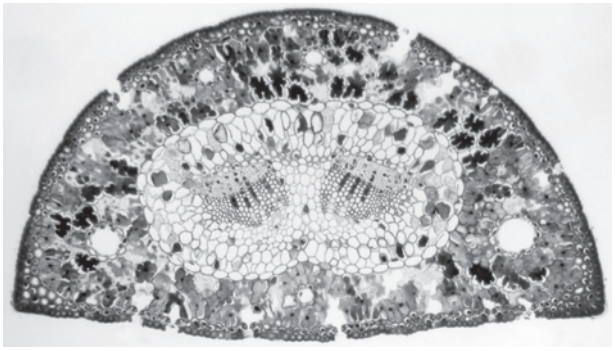
Read the instructions on the Answer Sheet very carefully.

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

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

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1 The photomicrograph shows a transverse section through a leaf.



×50

1 sunken stomata

2 two layers of epithelium

3 thick cuticle

4 small surface area to volume

Which features of a xerophytic leaf are visible in this section?

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

2 What determines the rate of water movement from the roots to the leaves?

A absorption of water through the root hair cells

B development of a less negative water potential in the leaves

C diffusion of water through the stomata

D evaporation of water from the mesophyll cell walls

3 Which shows the correct structure of mature xylem vessel elements and phloem sieve tube elements?

		cytoplasm	nucleus	end wall
A	phloem	✓	✓	✓
	xylem	✓	✗	✗
B	phloem	✓	✗	✓
	xylem	✗	✓	✓
C	phloem	✓	✗	✓
	xylem	✗	✗	✗
D	phloem	✗	✓	✓
	xylem	✗	✗	✓

key

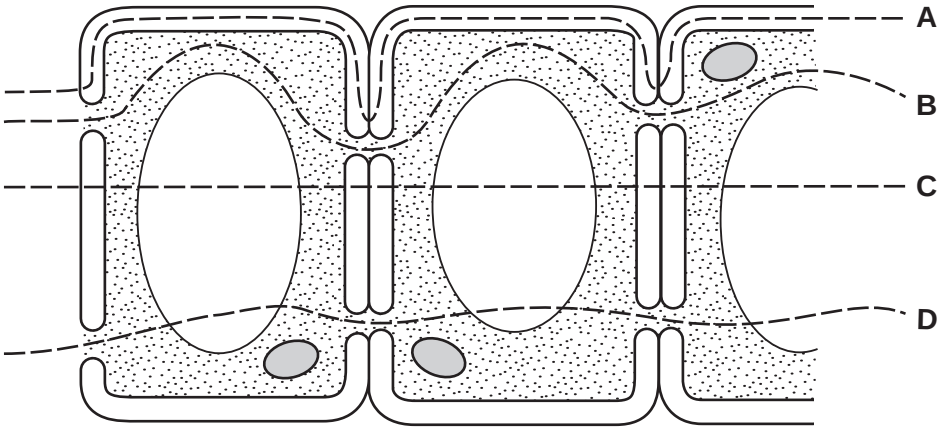
✓ = present

✗ = absent

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4 The diagram shows some adjacent cells from the root of a plant.

Which is the apoplastic pathway of water movement?



5 Water is important to living organisms because it

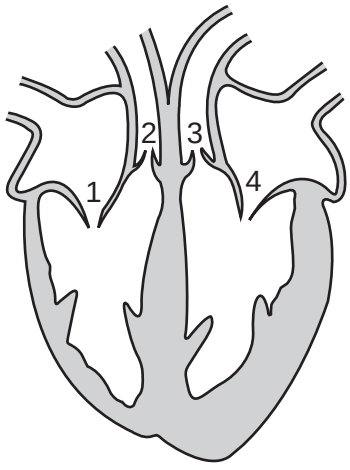
A acts as an excellent solvent for transport of dissolved glucose and urea.

B becomes more dense in its solid form, ice, than its liquid state.

C is used in condensation reactions to synthesise macromolecules.

D requires a small increase in heat energy to raise its temperature.

6 The diagram shows the valves inside the heart.



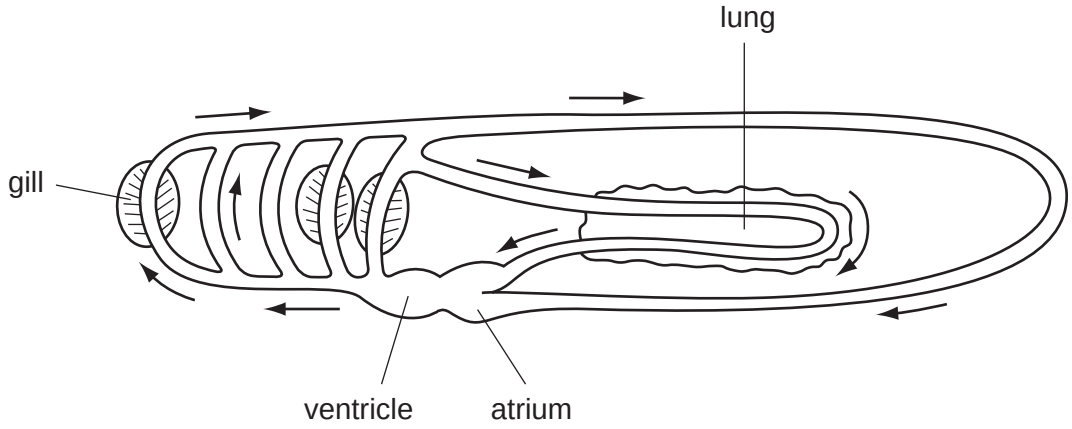
Which valves are open or closed when the atria are relaxed and the ventricles contracted?

	valves open	valves closed
A	3 and 4	1 and 2
B	2 and 4	1 and 3
C	2 and 3	1 and 4
D	1 and 4	2 and 3

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7 The mammalian circulatory system is described as a closed double circulation.

The diagram shows the circulatory system in a different organism. The arrows show the direction of blood flow in the vessels.



How is the circulatory system in this organism described?

A closed double

B closed single

C open double

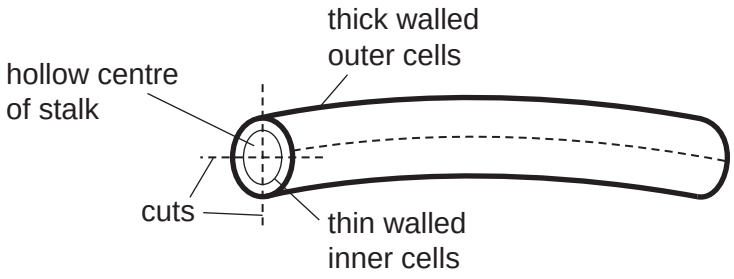
D open single

8 Which molecules, found in the cell surface membrane, have the properties listed?

	act as receptor sites for hormones	form hydrogen bonds with water	recognise antibodies
A	cholesterol and proteins	phospholipids and cholesterol	proteins and glycolipids
B	glycolipids and glycoproteins	glycolipids and glycoproteins	glycolipids and glycoproteins
C	phospholipids and cholesterol	proteins and glycolipids	cholesterol and proteins
D	proteins and glycolipids	cholesterol and proteins	phospholipids and cholesterol

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9 The stalk of a dandelion is a hollow tube. Pieces of the stalk are cut as shown and placed in sucrose solutions of different water potentials.



Which diagram shows the piece that is placed in the sucrose solution with the highest water potential?

A



B



C



D



10 In an investigation, four sucrose solutions were separated from each other by partially permeable membranes.

1 $1.1\,mol\,dm^{-3}$

2 $0.8\,mol\,dm^{-3}$

3 $0.5\,mol\,dm^{-3}$

4 $0.1\,mol\,dm^{-3}$

Which shows the direction in which water will move between the solutions?

A from 1 and 2 to 3 and 4

B from 2 and 3 to 1

C from 1 to 3

D from 2 to 4

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11 The equation shows a reversible reaction.

$$\text{sucrose} + \text{water} \underset{\textbf{2}}{\overset{\text{sucrase}\ \textbf{1}}{\rightleftharpoons}} \text{glucose} + \text{fructose}$$

In this reaction, on which molecule does an active site occur and what types of reaction occur at **1** and **2**?

	active site present on	reaction at **1**	reaction at **2**
A	sucrase	condensation	hydrolysis
B	sucrase	hydrolysis	condensation
C	sucrose	condensation	hydrolysis
D	sucrose	hydrolysis	condensation

12 Tests on a liquid give these results.

test	observation
Benedict's	red
biuret	lilac
iodine in potassium iodide solution	orange

What are present in the liquid?

A reducing sugar and protein

B reducing sugar and starch

C starch and protein

D starch only

13 Which linkages are found between the glucose units in cellulose?

A α 1–4 only

B α 1–4 and α 1–6

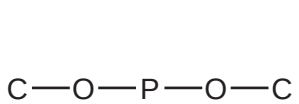
C β 1–4 and α 1–6

D β 1–4 only

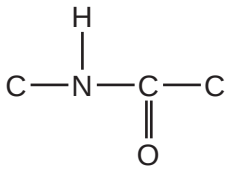
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14 Which diagram shows the bond linking the individual units of both cellulose and amylose?

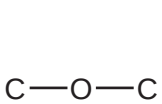
A



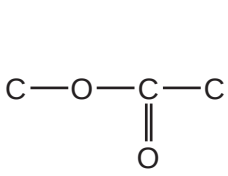
B



C



D



15 Which statements about amylopectin and glycogen are correct?

1 both contain 1-4 glycosidic bonds

2 amylopectin contains β-glucose

3 glycogen contains more 1-6 branches than amylopectin

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

16 What are the features of triglycerides?

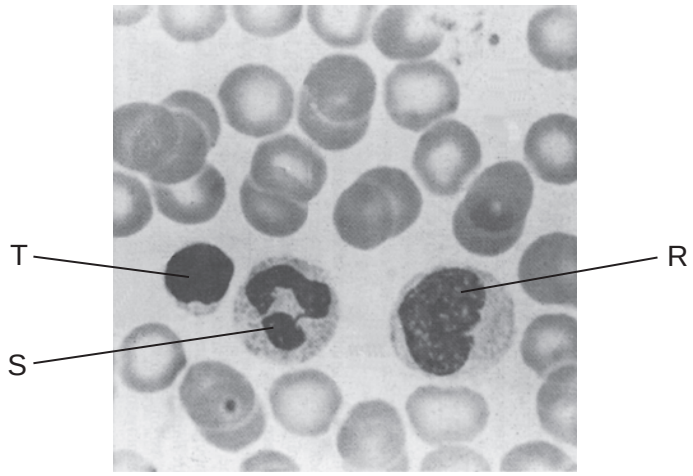
	polar	less dense than water	higher energy value than carbohydrates	lower proportion of hydrogen than in carbohydrates
A	✓	✓	✗	✗
B	✓	✗	✓	✓
C	✗	✓	✓	✗
D	✗	✗	✗	✓

key

✓ = yes

✗ = no

17 The photomicrograph shows human blood, with three types of white cell labelled.

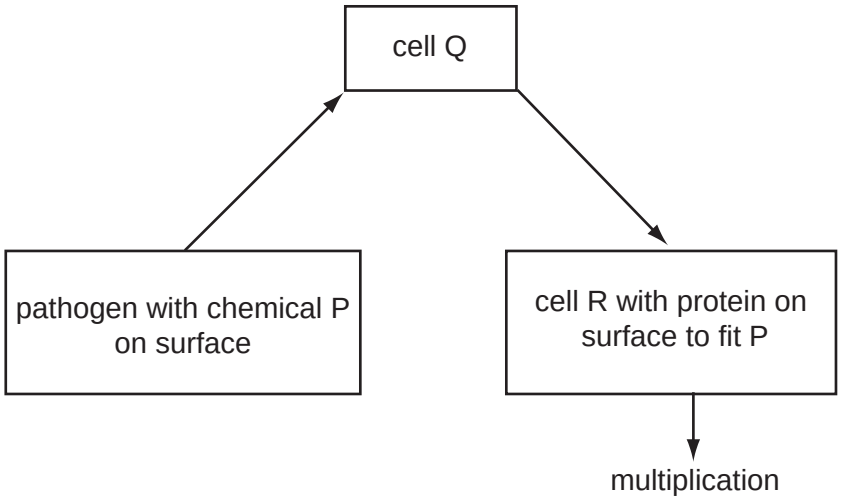


Which row correctly identifies these white cells?

	cell R	cell S	cell T
A	lymphocyte	lymphocyte	phagocyte
B	lymphocyte	phagocyte	lymphocyte
C	phagocyte	lymphocyte	phagocyte
D	phagocyte	phagocyte	lymphocyte

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18 The diagram shows part of the immune response.



What are P, Q and R?

	P	Q	R
A	antibody	B-lymphocyte	T helper cell
B	antibody	T helper cell	B-lymphocyte
C	antigen	B-lymphocyte	T helper cell
D	antigen	T helper cell	B-lymphocyte

19 Which diseases can be cured by the use of antibiotics?

A cholera and tuberculosis

B measles and smallpox

C measles and tuberculosis

D smallpox and cholera

20 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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21 When a body cell is infected by a pathogen, which describes a correct immune response?

A Killer T cells punch holes in infected cells, releasing antibodies.

B Killer T cells release cytokines, infected body cells release antibodies.

C Memory cells release antibodies, killer T cells secrete cytokines.

D T helper cells release cytokines, plasma cells release antibodies.

22 Which of the cell organelles, when appropriately stained, will be clearly visible under the high power (×400) of the light microscope?

	lysosomes	endoplasmic reticulum	mitochondria	chloroplasts
A	✓	✓	✗	✗
B	✓	✗	✓	✗
C	✗	✓	✓	✓
D	✗	✗	✗	✓

key

✓ = visible

✗ = not visible

23 The graticule and stage micrometer are used to measure cells.

Which is the correct reason why the graticule calibrated?

A The graticule can be used to make measurements.

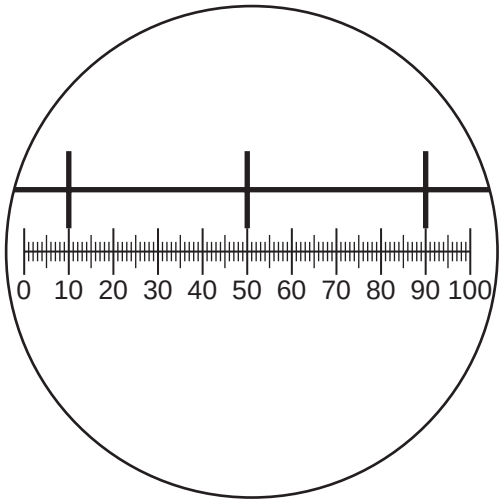
B The graticule is magnified by the objective lens.

C The graticule magnifies the specimen.

D The graticule makes comparisons.

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



The same eyepiece is now used to examine a blood smear.

How many graticule divisions will cover the diameter of a white cell of 10 μm?

A 1 **B** 4 **C** 10 **D** 20

25 What are the characteristics of a prokaryotic cell?

	DNA structure	endoplasmic reticulum	plasmids	ribosomal size
A	circular	absent	present	small
B	circular	present	absent	large
C	linear	absent	present	small
D	linear	present	absent	large

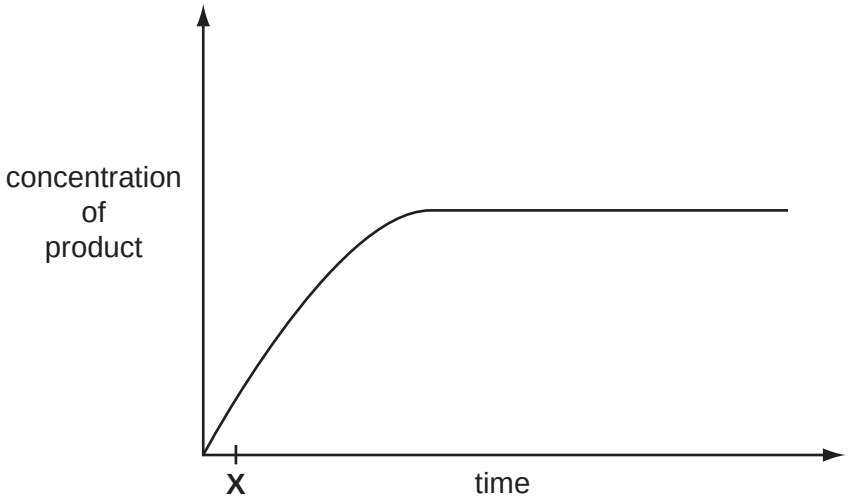
26 Which is correct about the organelles listed in the table?

		carries out transcription	contains enzymes	contains ribosomes
1	lysosomes	no	yes	no
2	mitochondria	yes	no	yes
3	rough endoplasmic reticulum	yes	yes	yes
4	vacuoles	no	yes	no

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

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27 The graph shows the course of an enzyme-catalysed reaction at 30 °C.



What is true at time **X**?

A Most enzyme molecules will have free active sites.

B The number of available substrate molecules is high.

C The number of enzyme-substrate complexes is low.

D The rate remains the same if more enzyme is added.

28 The rate of enzyme-catalysed reactions in human cells is regulated.

Which may be involved in such regulation?

1 a change in enzyme concentration

2 a change in substrate concentration

3 inhibition by the final product of the reaction

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

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29 The table shows the role of four different proteins involved in DNA replication.

protein	helicase	topoisomerase	single-strand binding protein	DNA polymerase
role	unwinds the parental DNA double helix	breaks and rejoins the DNA strands	binds to separated DNA strands to stabilise them	synthesises strand of DNA

Which shows the function of these proteins?

	helicase	topoisomerase	single-strand binding protein	DNA polymerase
A	adds DNA nucleotides to the 3' end of a growing polynucleotide strand	prevents original strands reforming complementary base pairs	enables tension caused by unwinding to be released	makes strands available as templates
B	enables tension caused by unwinding to be released	prevents original strands reforming complementary base pairs	makes strands available as templates	adds DNA nucleotides to the 3' end of a growing polynucleotide strand
C	enables tension caused by unwinding to be released	makes strands available as templates	adds DNA nucleotides to the 3' end of a growing polynucleotide strand	prevents original strands reforming complementary base pairs
D	makes strands available as templates	enables tension caused by unwinding to be released	prevents original strands reforming complementary base pairs	adds DNA nucleotides to the 3' end of a growing polynucleotide strand

30 Male bees are haploid. They develop from unfertilised eggs. Female bees are diploid.

Which statements are correct?

1 All male bees are genetically identical.

2 Male bee sperm cells are produced by mitosis.

3 New combinations of genes only occur in female bees.

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

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31 Which statement describes the semi-conservative replication of DNA?

A Parental DNA is broken down into nucleotides and reassembled with new nucleotides.

B Parental DNA is split into triplets and new triplets are added.

C Parental DNA is split into two strands, each of which is replicated.

D Parental DNA remains intact and a new daughter DNA copy is built from new nucleotides.

32 What describes the behaviour of the nuclear envelope and the cell membrane during mitosis?

	nuclear envelope	cell membrane
A	breaks down	breaks down
B	breaks down	remains intact
C	remains intact	breaks down
D	remains intact	remains intact

33 DNA was extracted from the salivary glands of a fruit fly and a human cheek cell.

In which way did the DNA molecules differ?

A in the ratio of adenine to thymine

B in the sequence of the nucleotides

C in the type of pentose sugar

D in the types of nucleotide

34 The table shows the percentages of nitrogenous bases in four samples of nucleic acids.

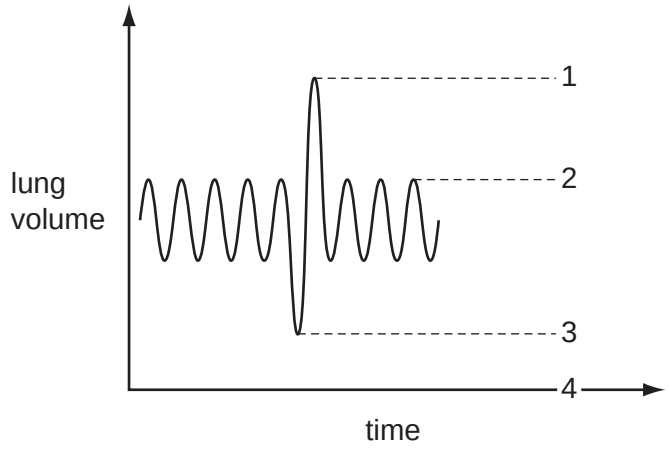
Which base is adenine?

sample	percentage of nitrogenous bases				
	A	**B**	**C**	**D**	uracil
1	19	31	30	19	nil
2	27	23	24	26	nil
3	25	25	nil	25	25
4	17	32	33	18	nil

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35 The diagram shows the volume of air breathed in and out while a person is breathing normally when at rest.

They breathe out the deepest breath they can and then breathe in as much as they can before breathing normally again.



Which points would you use to calculate the vital capacity?

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

36 Which tissues are present in the walls of a trachea and an alveolus?

		tissue		
		cartilage	epithelium with goblet cells	smooth muscle
A	trachea	✓	✓	✓
	alveolus	✓	✓	✗
B	trachea	✓	✓	✓
	alveolus	✗	✗	✗
C	trachea	✓	✓	✗
	alveolus	✗	✓	✓
D	trachea	✓	✓	✓
	alveolus	✗	✗	✓

key
✓ = present
✗ = absent

37 How does nicotine in cigarette smoke increase the risk of cardiac disease?

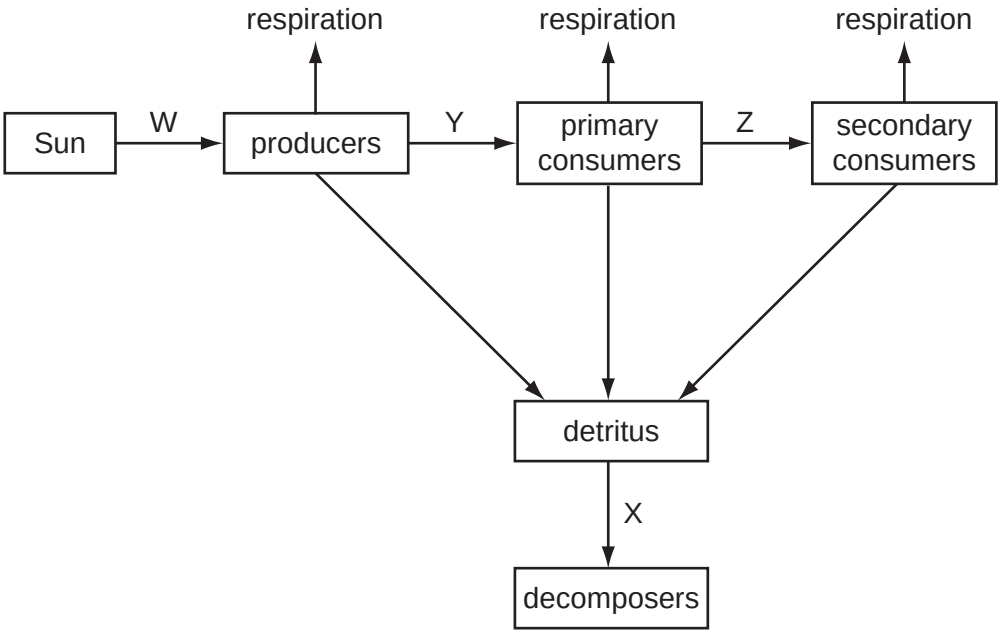
A by binding with haemoglobin

B by constricting blood vessels

C by inhibiting nerve transmission

D by stimulating the pacemaker

38 The diagram represents the flow of energy through a tropical rainforest ecosystem.



Which set of figures identifies the percentage transfer of energy between the Sun, producers, consumers and decomposers?

	W	X	Y	Z
A	1	10	20	80
B	1	20	10	80
C	10	20	1	10
D	10	10	1	20

39 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

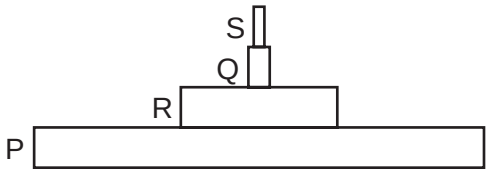
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40 The table shows the results of a field study of four species in a food chain in an area of woodland.

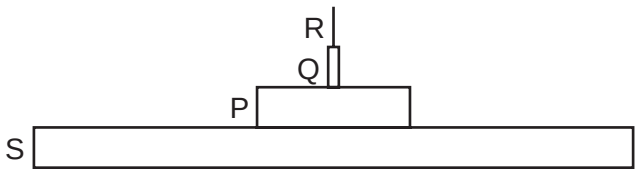
species	number of individuals	biomass of one individual / arbitrary units	energy value per unit mass / arbitrary units
P	10 000	0.100	1.0
Q	5	10.000	2.0
R	500	0.002	1.8
S	3	300 000.000	0.5

Which is the correct pyramid of energy from these data?

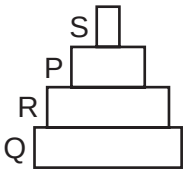
A



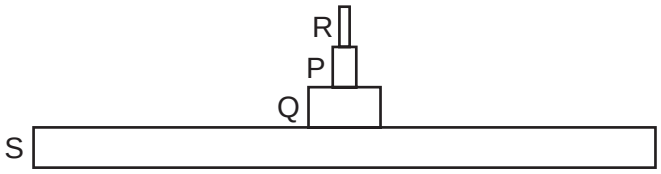
B



C



D



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