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

BIOLOGY **9700/12**

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)

6265122950

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

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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.

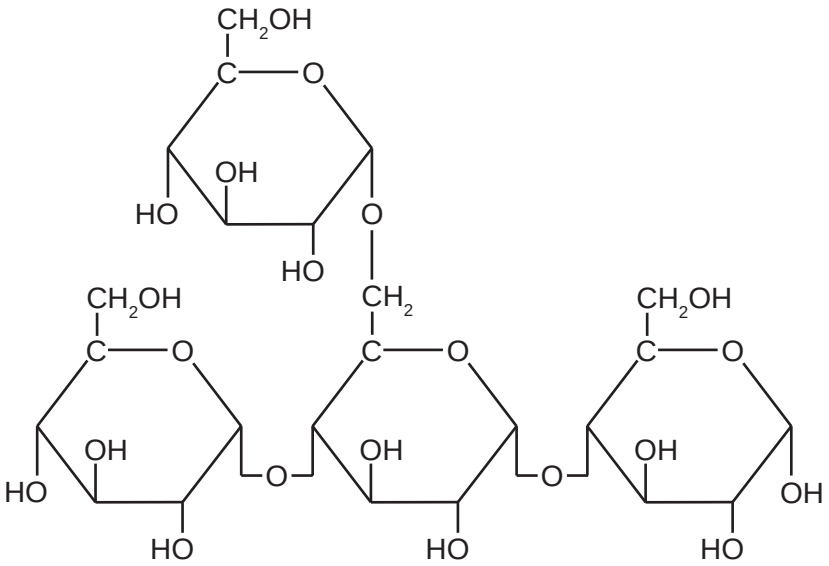
	number of white blood cells	number of *Streptococcus cells*
A	6.7×10^3	1.3×10^5
B	6.7×10^2	1.3×10^4
C	6.7×10^1	1.3×10^3
D	6.7×10^0	1.3×10^2

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

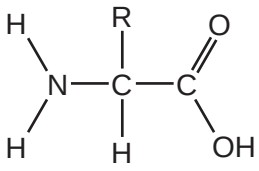
A 1, 2, 3 and 4

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

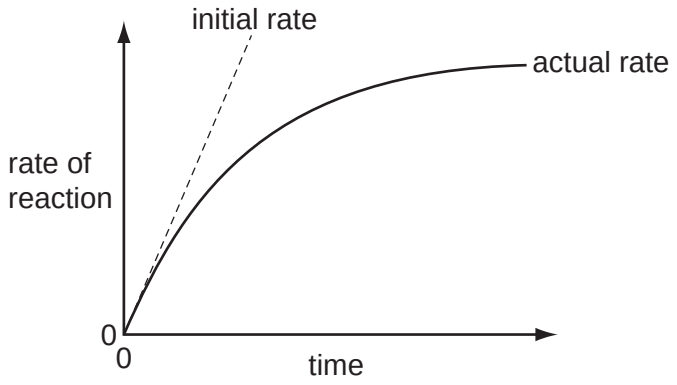
D $HOCH_2CH(OH)CH_2OH$

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.

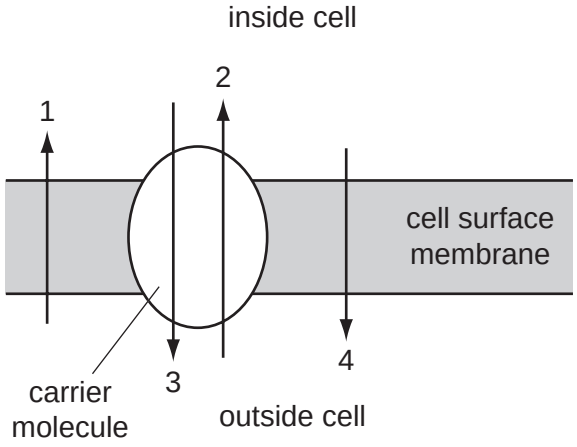
12 Which levels of protein structure are always involved when competitive and non-competitive inhibitors bind to enzymes?

	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

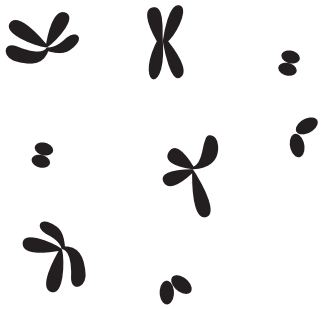
B growth of cells

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.



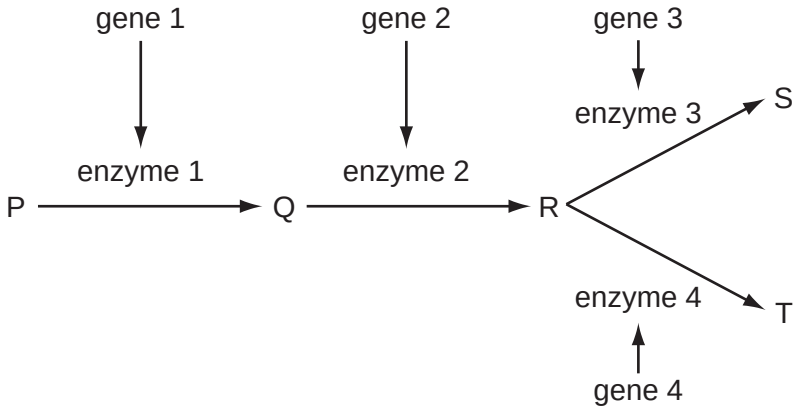
The culture was then allowed to reproduce using nucleotides containing the normal isotope of nitrogen (^{14}N). Samples were taken and spun in a centrifuge after one generation and again after two generations.

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

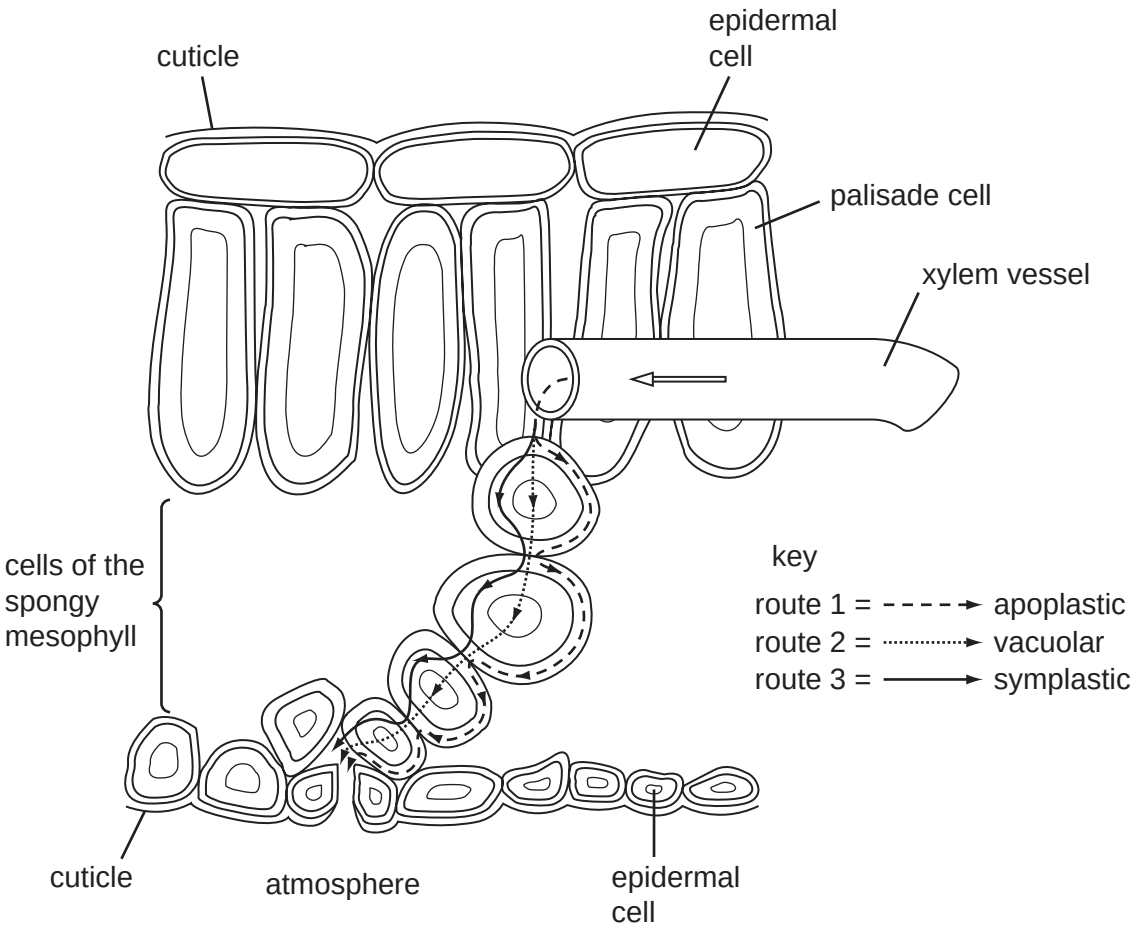
D providing the source of assimilates for storage

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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.



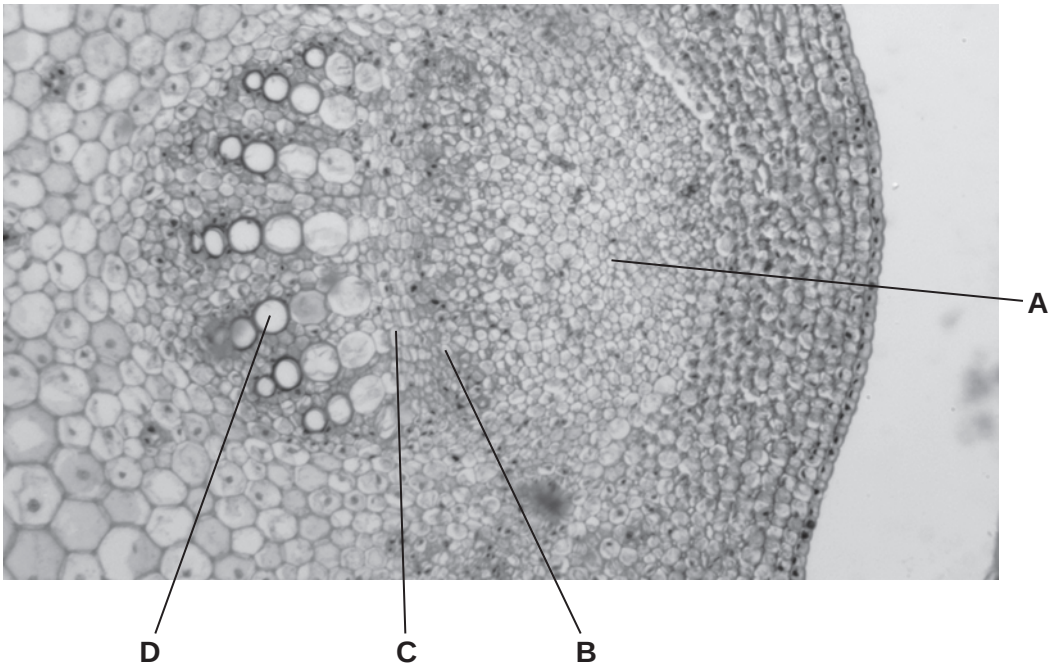
Which row correctly identifies why water passes across leaf tissues by the different routes?

	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

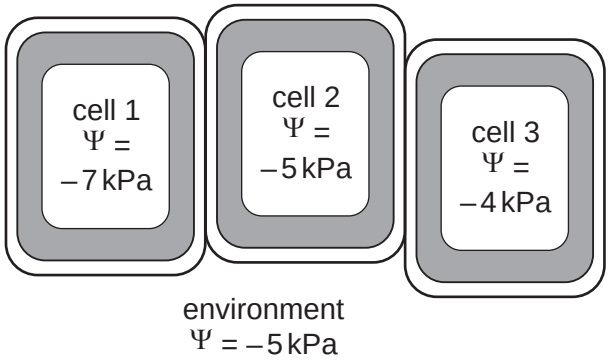
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26 The diagram shows a transverse section of a stem.

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

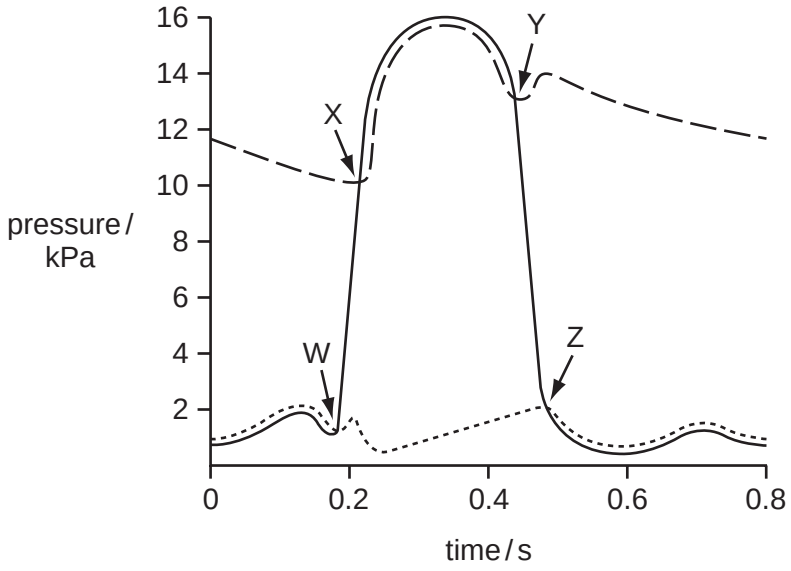
B carbonic acid

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.

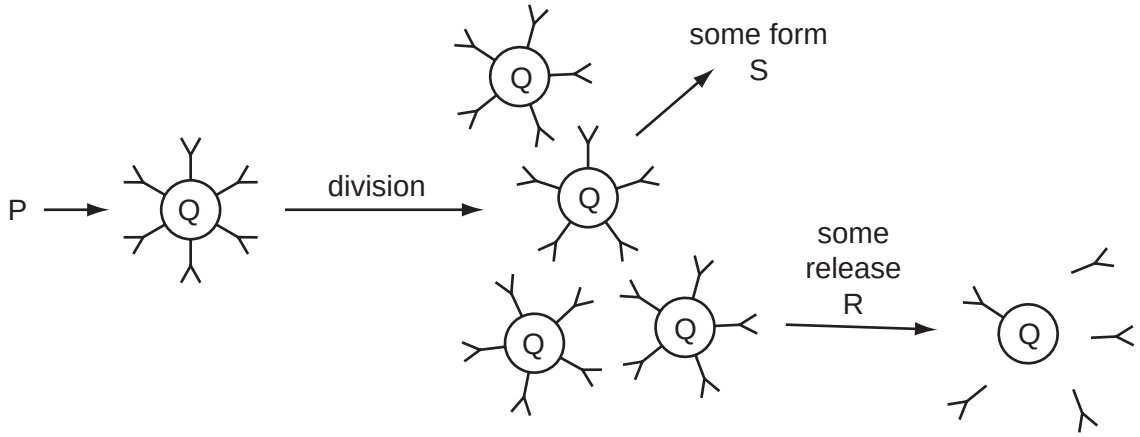
37 An enzyme hydrolyses the two heavy polypeptide chains of an antibody molecule. The hydrolysis occurs at the hinge region and breaks the antibody into three fragments.

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.

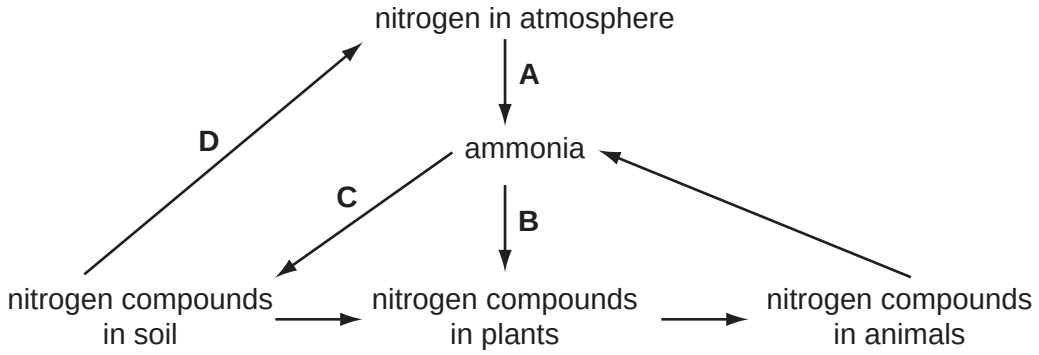


Which row correctly identifies P, Q, R and S?

	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

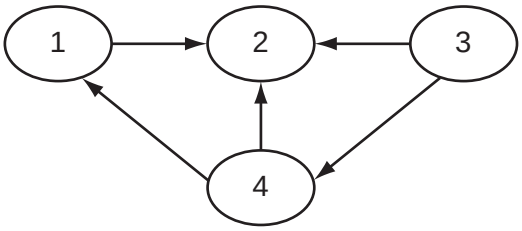
39 The diagram represents part of the nitrogen cycle.

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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