Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/13**

Paper 1 Multiple Choice **May/June 2015**

1 hour

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

2027041770

READ THESE INSTRUCTIONS FIRST

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

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

Read the instructions on the Answer Sheet very carefully.

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

1 What are found in both mitochondria and typical prokaryotic cells?

A 70S ribosomes and circular DNA

B 70S ribosomes only

C 80S ribosomes and circular DNA

D circular DNA only

2 Which statements about light microscopes are correct?

1 To calculate the magnification of a light microscope the eyepiece lens and objective lens magnifications are added together.

2 As the magnification increases the resolution decreases.

3 The resolution of a light microscope is limited by the wavelength of light.

4 The scale on a stage micrometer is resolved more clearly than an eyepiece graticule.

A 1, 2, 3 and 4

B 1, 3 and 4 only

C 2 and 3 only

D 2 and 4 only

3 Which comparison of a phloem companion cell with a B-lymphocyte is correct?

A Both cell types have proteins embedded in their cell surface membranes.

B B-lymphocytes have a spherical nucleus but companion cells do not have a nucleus.

C Companion cells always contain chloroplasts, which are not present in B-lymphocytes.

D Neither B-lymphocytes nor companion cells possess plasmodesmata.

4 Ribosomes exist as separate subunits that bind together during protein synthesis.

What do these subunits consist of?

A mRNA and protein

B mRNA and tRNA

C rRNA and protein

D rRNA and tRNA

5 Which structures in plant cells have a double membrane?

A chloroplasts and vacuoles

B lysosomes and nuclei

C mitochondria and vacuoles

D nuclei and mitochondria

6 What is the diameter of a typical prokaryote, such as *Streptococcus*?

A 7.5×10^{1} nm

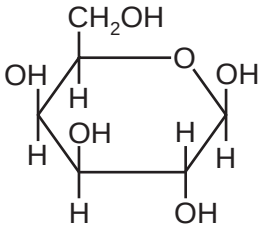
B 7.5×10^{2} nm

C 7.5×10^{0} μm

D 7.5×10^{1} μm

7 Which molecule is α-glucose?

A



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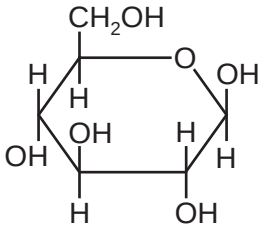

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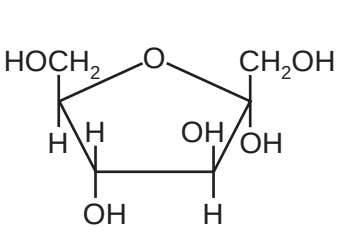

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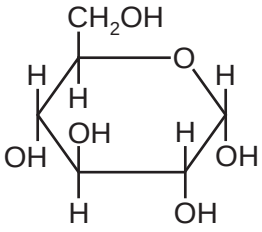
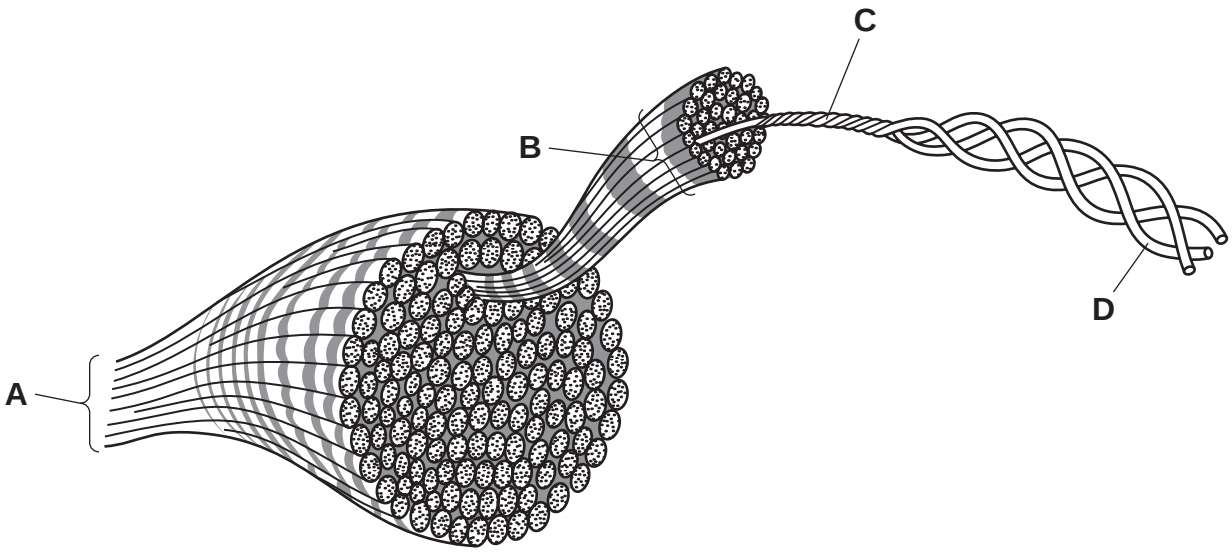


8 The diagram shows the three dimensional structure of collagen.

Which labelled part represents a molecule of collagen?



9 Which type of bond does **not** hold together the tertiary structure of a protein?

A disulfide

B hydrogen

C hydrophobic interactions

D peptide

10 Which properties of water are a result of only cohesion?

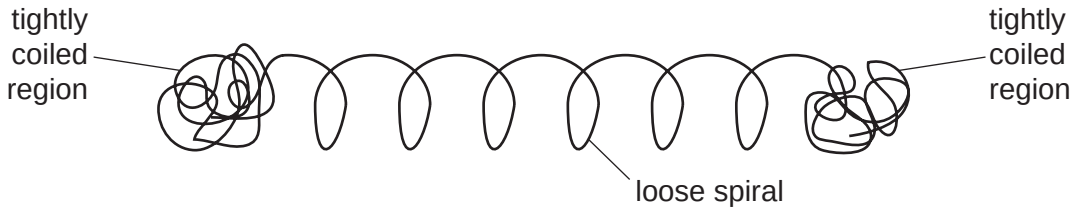
1 The water has a high surface tension.

2 Water moves up xylem vessels.

3 Water is an excellent solvent.

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

11 The protein glutenin gives bread dough its elasticity. The diagram represents a polypeptide of glutenin.



What describes the structure of glutenin?

A quaternary structure because there are both globular and fibrous regions

B quaternary structure because there are both spiral and tightly coiled regions

C secondary structure because the loose spiral is an α-helix

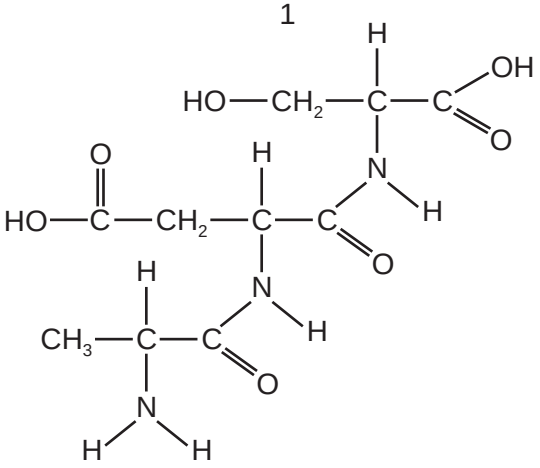
D tertiary structure because the different regions form a 3D shape

12 A student carried out four tests for biological molecules. The observations are shown in the table.

test	observations
iodine	orange
biuret	purple
Benedict's	orange
emulsion	clear

Which molecules are present in the solution?

1



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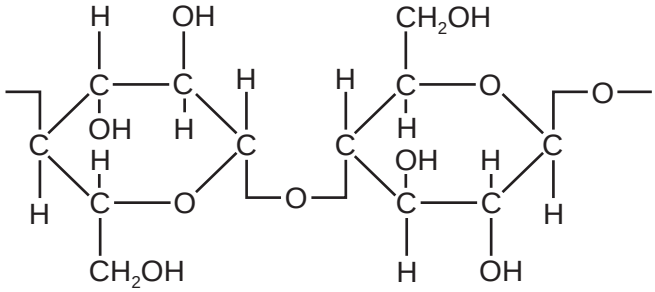

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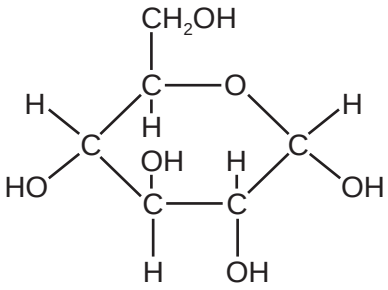

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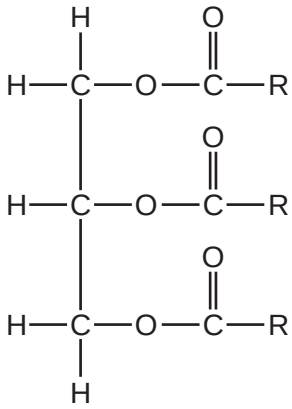


A 1 and 2 **B** 1 and 3 **C** 2 and 3 **D** 3 and 4

13 Some inhibitors of enzyme reactions bind to the enzyme-substrate complex.

Which statements about this type of inhibition are correct?

1 The active site changes shape.

2 The inhibitor is non-competitive.

3 The initial rate of reaction is reduced.

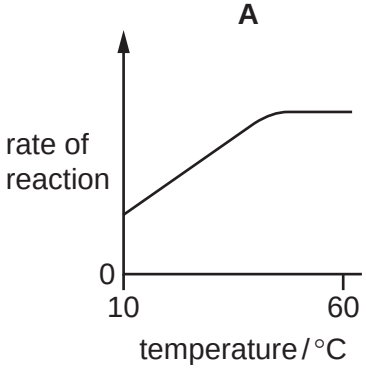
4 The maximum rate of reaction (V_{max}) stays the same.

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

14 The enzyme DNA polymerase is used in DNA replication. This enzyme was extracted from bacteria living in natural hot water springs where the water temperature is between 85 °C and 95 °C.

Which graph would represent the relationship between temperature and the rate of DNA replication when catalysed by the enzyme from these bacteria?

A



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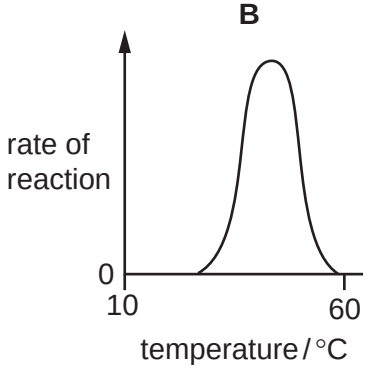

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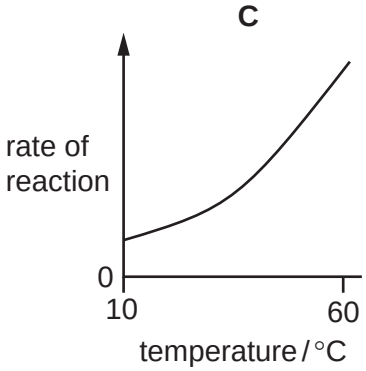

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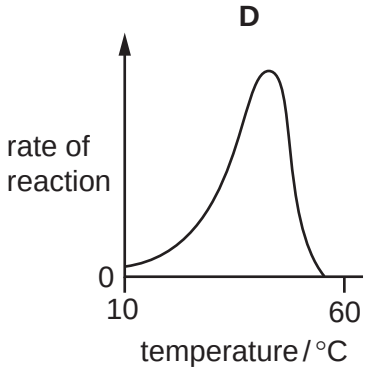


15 What supports the view that a membrane protein is involved in active transport?

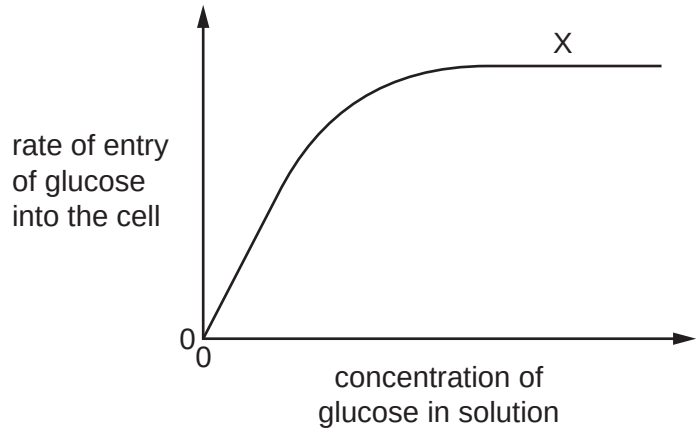
A It allows movement of molecules across a membrane if concentration differences exist.

B It can only function if mitochondria are supplied with sufficient oxygen.

C It has a tertiary structure with a binding site with a specific shape.

D It is found in the cell surface membranes and the mitochondrial membranes.

16 The graph shows the effect of increasing the concentration of glucose in a solution on the rate of entry of glucose into a cell.



What are **not** causes of the plateau at X?

1 All the carrier proteins are saturated with glucose.

2 The carrier proteins are denatured and no longer able to function.

3 The cell has used up its supply of ATP.

4 The concentrations of glucose inside and outside the cell are equal.

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

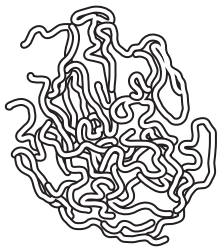
17 Which set of factors will produce the **least** fluid cell surface membrane?

	an increase in
A	• proportion of short fatty acid chains • distance between phospholipid molecules
B	• proportion of long fatty acid chains • proportion of phospholipids with saturated fatty acid chains
C	• proportion of short fatty acid chains • proportion of phospholipids with unsaturated fatty acid chains
D	• proportion of phospholipids with unsaturated fatty acid chains • temperature

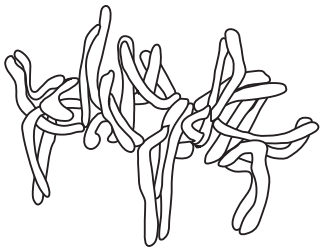
18 The diagrams show chromosomes at different stages of mitosis.

W

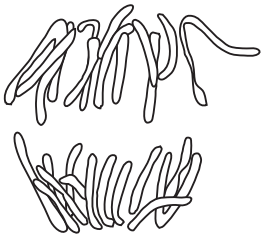
X



Y



Z



Which shows the correct order of the cell cycle?

A W → X → Y → Z

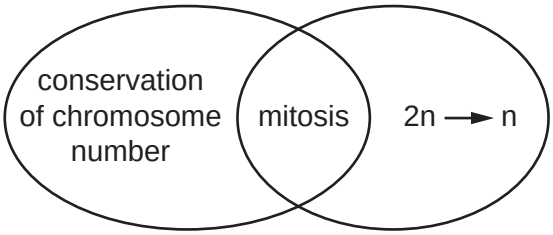
B X → Y → Z → W

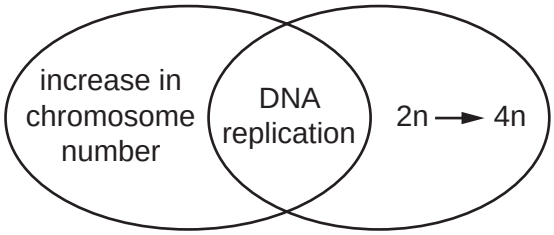
C Y → Z → W → X

D Z → W → X → Y

19 Which diagrams show the correct relationships?

A





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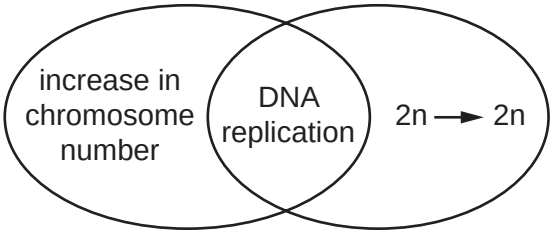

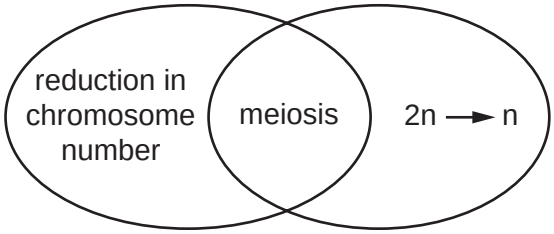

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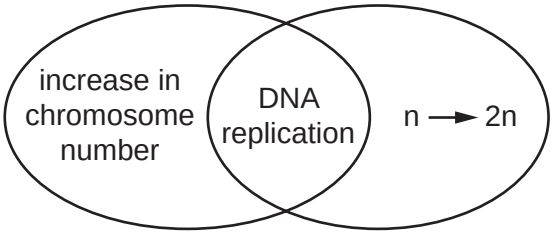

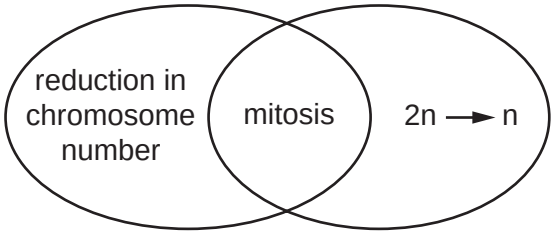

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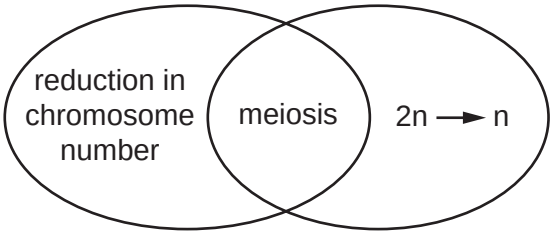
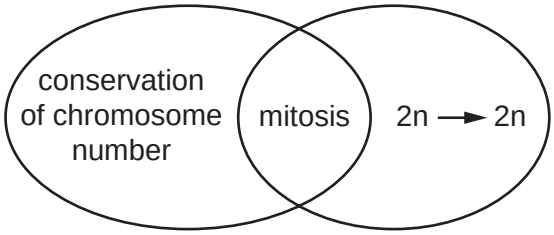




20 Which row correctly describes adenine?

	complementary base	component on nucleotide strand it is attached to	ring structure
A	thymine	deoxyribose	double
B	thymine	phosphate	single
C	uracil	phosphate	double
D	uracil	ribose	single

21 Which row shows two pairs of nucleotides formed when mRNA is translated?

	first base pair translated		second base pair translated	
	bases present	number of hydrogen bonds	bases present	number of hydrogen bonds
A	AT	2	TU	2
B	AU	2	AT	2
C	AU	2	GC	3
D	AU	3	GC	3

22 Sickle cell anaemia is caused by a mutation in an allele of the gene that codes for the β-globin polypeptide of haemoglobin.

The diagram shows the sequence of bases in a small section of the coding strand of DNA for both the HbA (normal) and HbS (sickle cell) β-globin alleles.

HbA CTGACTCCTGAGGAGAAGTCT

HbS CTGACTCCTGTGGAGAAGTCT

How will the mutation in the HbS allele result in the production of an altered version of the β-globin polypeptide?

A A tRNA molecule with the anticodon GUG will hydrogen bond to the altered codon on mRNA.

B All the amino acids coded for after the mutation will differ from those in the HbA protein.

C mRNA transcribed from the HbS allele will contain the codon CAC instead of the codon CTC.

D The ribosome will be unable to continue translation of the HbS mRNA after the altered codon.

23 Which force holds water molecules on the surface of cell walls?

A adhesion

B capillarity

C cohesion

D surface tension

24 The statements are about the properties of water.

1 requires a lot of heat to evaporate

2 holds a lot of heat

3 is able to form hydrogen bonds with other water molecules

4 is able to form hydrogen bonds with other polar molecules

Which properties are important for translocation in phloem?

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

25 Which changes to the water potential and the volume of liquid in the phloem occur when amino acids are moved into a phloem sieve tube at a source?

	water potential in phloem sieve tubes	volume of liquid in phloem sieve tubes
A	higher	decreased
B	higher	increased
C	lower	decreased
D	lower	increased

26 Which feature of transport in xylem depends on the use of energy?

A mass flow of water to the leaves

B osmosis of water into xylem

C uptake of ions into the root

D transpiration of water from the leaves

27 What is correct about the transport of carbon dioxide by blood?

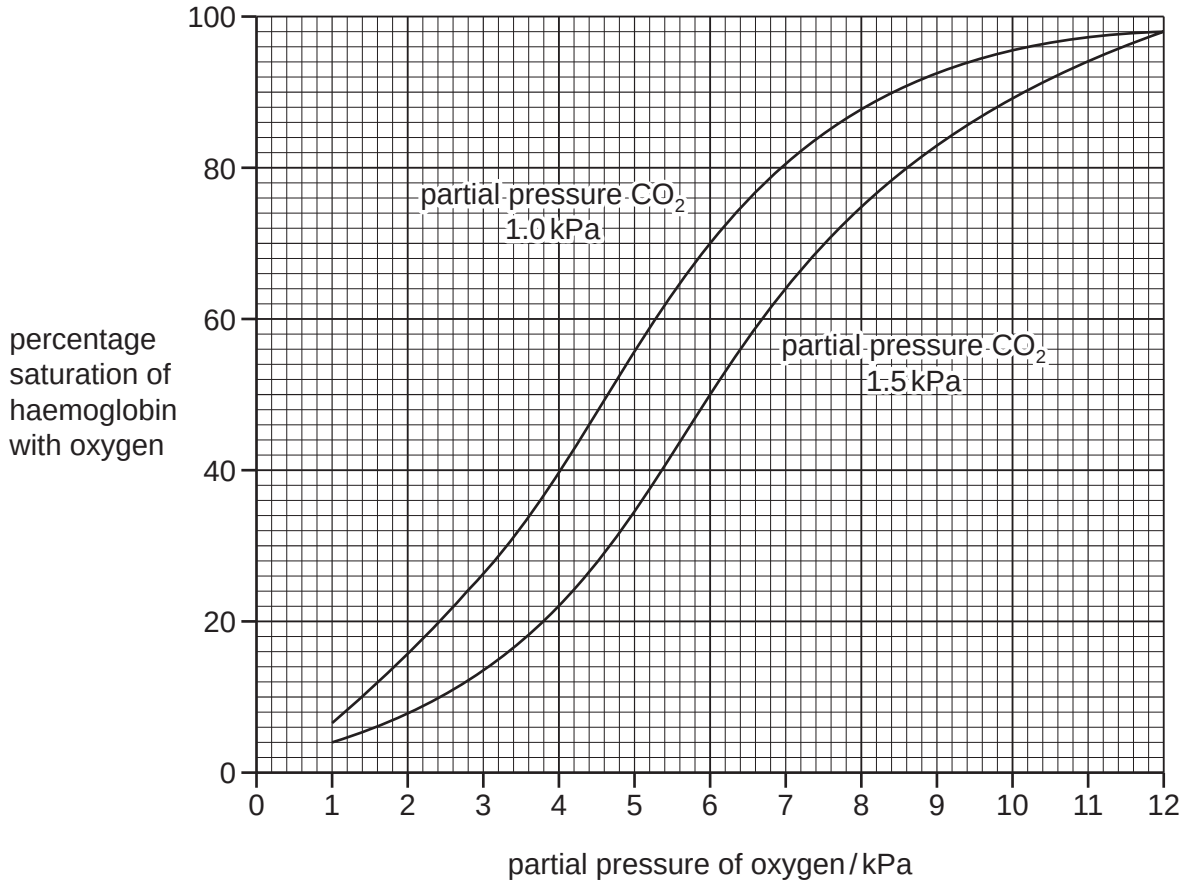
1 The enzyme carbonic anhydrase catalyses the formation of carbonic acid in red blood cells.

2 Carbon dioxide diffuses from respiring cells to red blood cells and reacts with water.

3 Carbonic acid dissociates forming hydrogen ions that combine with haemoglobin to form carbaminoglobin.

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

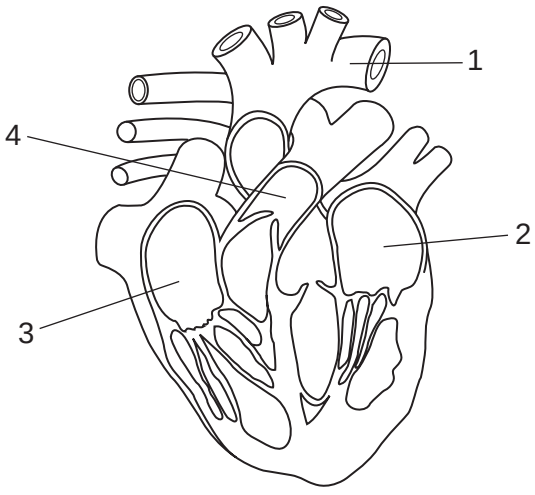
28 The graph shows the effect of different partial pressures of carbon dioxide (CO_2) on the oxygen dissociation curve for haemoglobin.



What is the change in percentage oxygen saturation of haemoglobin at a partial pressure of oxygen of 6 kPa as the partial pressure of carbon dioxide changes from 1.0 kPa to 1.5 kPa?

A –26% **B** –20% **C** 20% **D** 46%

29 Which structures transport deoxygenated blood?



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

30 Which effect could be due to a reduced concentration of carbonic anhydrase?

A carbaminohaemoglobin concentrations will decrease

B less oxygen is released from oxyhaemoglobin in respiring tissues

C the pH of the blood will be lowered

D the rate of dissociation of carbonic acid is increased

31 Which row identifies the effects on the body of nicotine in tobacco smoke?

	reduces the diameter of small arteries (arterioles)	increases the secretion of adrenaline	combines with haemoglobin
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✓	✓

key
✓ = true
✗ = false

32 Lung cancer and chronic obstructive pulmonary disease (COPD) share a number of common symptoms.

Which symptom is typical of lung cancer and not COPD?

A coughing up blood

B mucus production increases

C persistent cough that does not go away

D wheezing (difficulty breathing)

33 A person breathes in small particles from a very dusty environment.

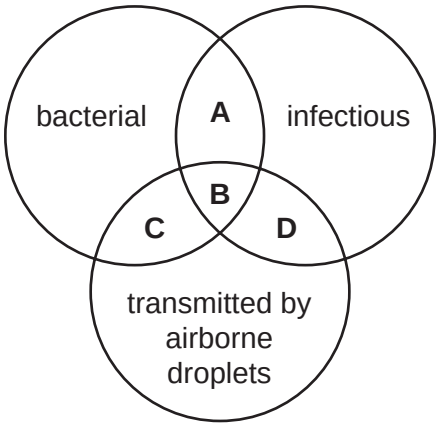
What effect will this have on B-lymphocytes and goblet cells?

	B-lymphocytes	goblet cells
A	less active	more active
B	less active	no change
C	more active	more active
D	no change	less active

[Turn over

34 The diagram shows properties of diseases.

What shows the properties that are common to **both** tuberculosis (TB) and measles?



35 Strains of *Mycobacterium* have been found that are:

- multiple drug-resistant (MDR) – resistant to the drugs most commonly used to control tuberculosis (TB)
- extensively drug-resistant (XDR) – resistant to the drugs most commonly used to control TB and to some of the drugs less commonly used to control TB
- totally drug-resistant (TDR) – resistant to all known drugs used to control TB.

Comparisons of some of these strains of *Mycobacterium* found differences in the thickness of their cell walls, as shown in the table.

Mycobacterium	thickness of cell wall / nm
non-resistant	15
MDR	17
TDR	20

What conclusions may be drawn from this information?

A Bacteria secrete thicker cell walls when in contact with a mixture of drugs.

B The cell walls of TDR bacteria are impermeable to drugs.

C Thicker cell walls may form a physical barrier to drugs.

D XDR bacteria have cell walls between 17 and 20 nm thick.

36 What describes natural passive immunity?

A protection against a pathogen by an injection of antibodies

B protection against a pathogen by drinking colostrum containing antibodies

C stimulation of lymphocytes by antigens contained in a vaccine

D stimulation of lymphocytes by antigens on the surface of invading pathogens

37 What happens when people are injected with dead bacteria?

A B-lymphocytes produce antibodies.

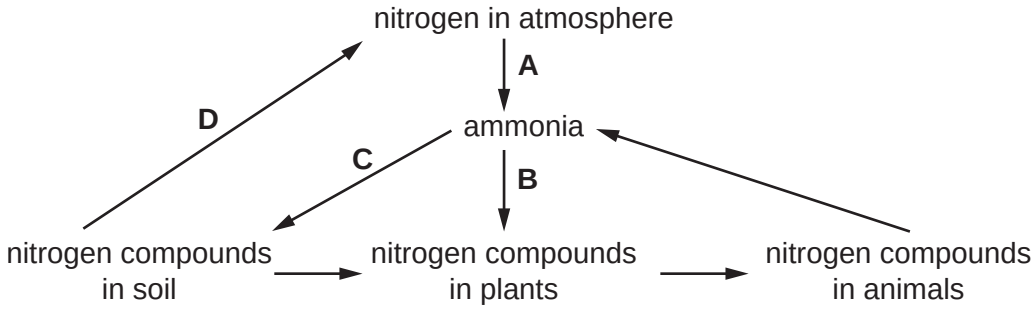
B B-lymphocytes produce antigens.

C T-lymphocytes produce antibodies.

D T-lymphocytes produce antigens.

38 The diagram represents part of the nitrogen cycle.

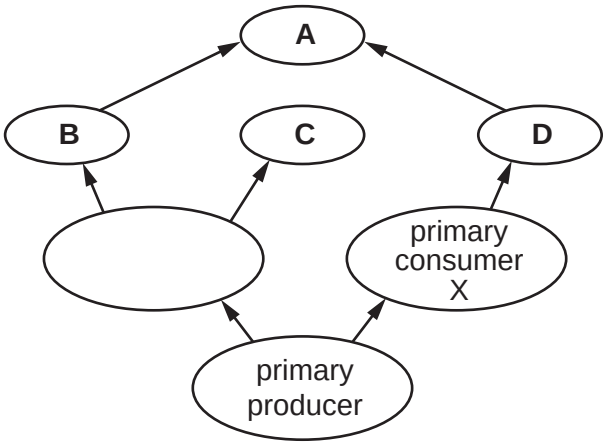
Which process is carried out by nitrifying bacteria?



39 A primary consumer, X, is lost from a community due to a lethal viral infection.

After a time, the size of the populations of some of the organisms shown in the food web changed.

Which population of organisms increased?

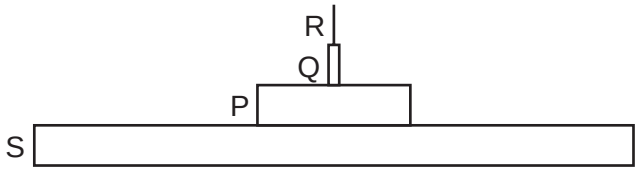


40 The table shows the results of a field study of four species in a food chain in an area of woodland.

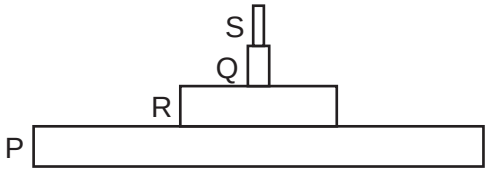
species	number of individuals	biomass of one individual / arbitrary units	energy value per unit mass / arbitrary units
P	10 000	0.100	1.0
Q	5	10.000	2.0
R	500	0.002	1.8
S	3	300 000.000	0.5

Which is the correct pyramid of energy from these data?

A



B



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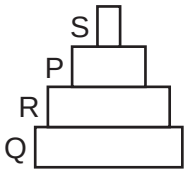

D