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

BIOLOGY **9700/11**

Paper 1 Multiple Choice **October/November 2013**

1 hour

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

* 9 6 0 4 4 0 5 4 8 3 9 *

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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.
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There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
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Electronic calculators may be used.

This document consists of **15** printed pages and **1** blank page.

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1 Which cell structure can be seen **only** with an electron microscope?

A cell wall

B chromosome

C nucleolus

D ribosome

2 Which statement is **not** correct in its description of a light microscope or an electron microscope?

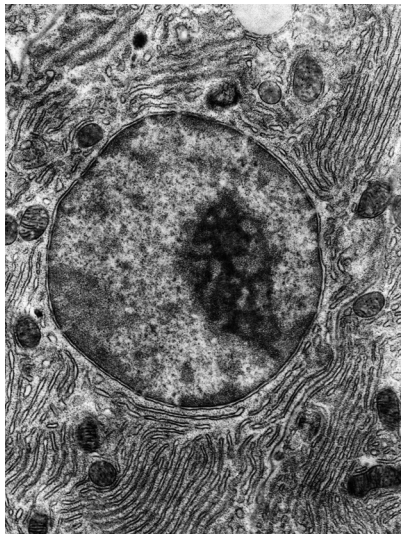
A A light microscope has a maximum resolution of 0.2 μm.

B An electron microscope has a maximum resolution of 0.05 nm.

C A light microscope can resolve specimens as small as 200 nm in diameter.

D An electron microscope can resolve specimens as small as 0.5 nm in diameter.

3 The electronmicrograph shows part of an animal cell.



What will be synthesised in large quantities in this cell?

1 ATP

2 glucose

3 RNA

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

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4 Which statements about a typical eukaryotic cell are correct?

1 It is smaller than 2 μm.

2 It has a nucleolus.

3 It has linear DNA.

4 It only has small (70S) ribosomes.

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

5 Which animal cells would have the most Golgi apparatus?

A ciliated epithelial cells

B goblet cells

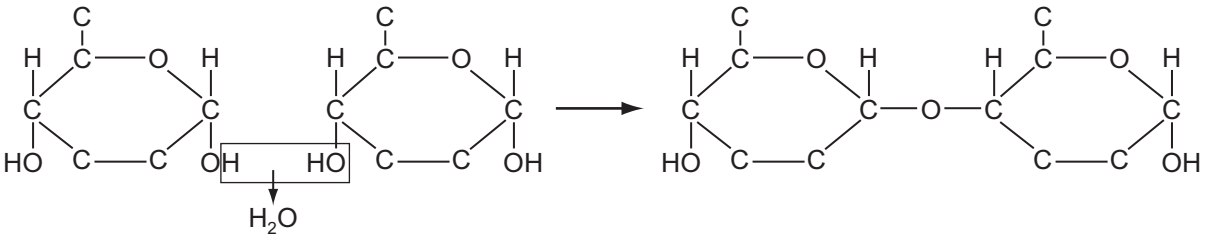
C red blood cells

D smooth muscle cells

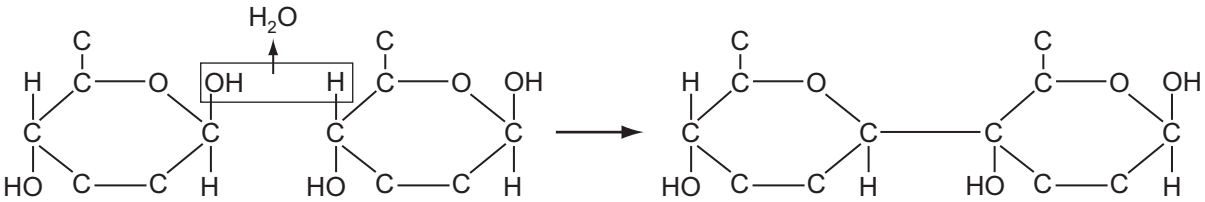
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6 Which diagram shows the reaction that occurs to link two monomers that form cellulose?

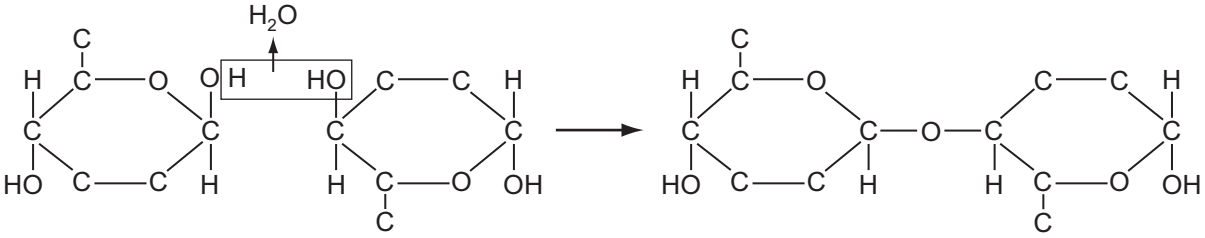
A



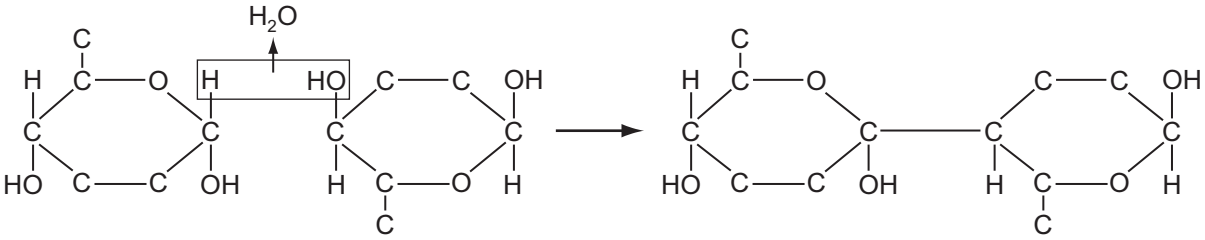
B



C



D



7 Which bonds will be broken when a molecule of glycogen is hydrolysed?

1 α-1, 4

2 β-1, 4

3 α-1, 6

4 β-1, 6

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

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8 Collagen is a macromolecule with three polypeptides lying closely side by side in the form of a triple helix.

Every third amino acid in each polypeptide has the shortest possible R-group or side chain (– H) to allow close packing of the polypeptides.

Which is the amino acid?

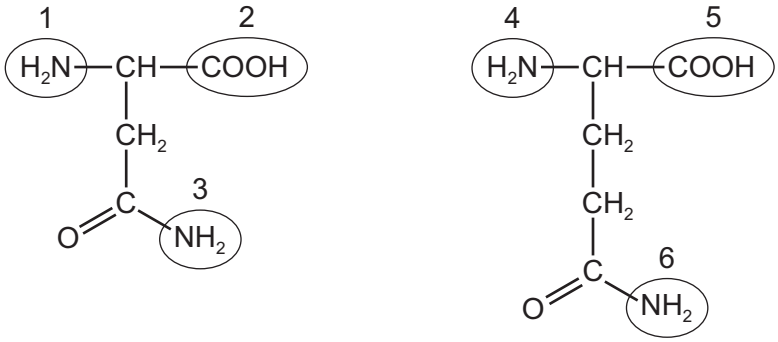
A glucose

B glycerol

C glycine

D guanine

9 The diagrams show the structures of two amino acids, each of which has two amine ($–NH_2$) groups.



A peptide bond is formed between the two amino acids.

Which groups form the peptide bond?

A 1 and 4 **B** 1 and 5 **C** 2 and 6 **D** 3 and 5

10 Each list, 1, 2 and 3, shows some substances found in animal tissues.

1 glucose, cholesterol, triglycerides, water.

2 glycogen, antibodies, adenine, phospholipids.

3 haemoglobin, carbon dioxide, mRNA, monosaccharides.

Which shows one or more substances that contain nitrogen atoms?

A 1, 2 and 3

B 1 and 2 only

C 1 and 3 only

D 2 and 3 only

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11 Which statements about competitive inhibitors of enzyme action are correct?

1 Increasing the concentration of the enzyme's substrate will reduce their effect.

2 They bind to an enzyme at its active site.

3 They reduce the activation energy required for a reaction to take place.

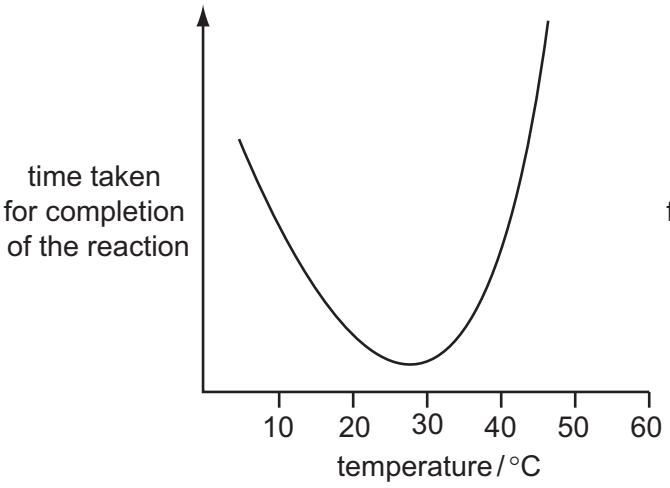
4 They reduce the maximum rate of reaction.

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

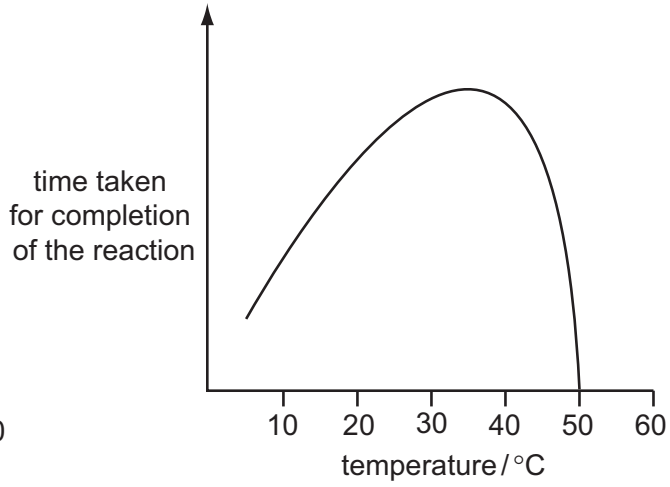
12 An enzyme is completely denatured at 50 °C. A fixed concentration of this enzyme is added to a fixed concentration of its substrate. The time taken for completion of the reaction is measured at different temperatures.

Which graph shows the results?

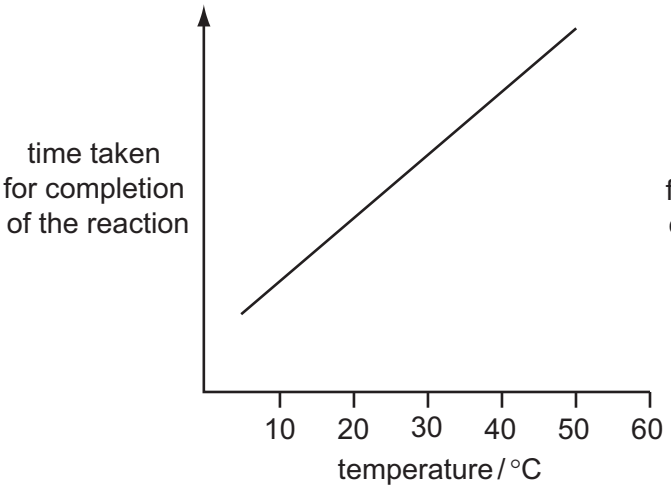
A



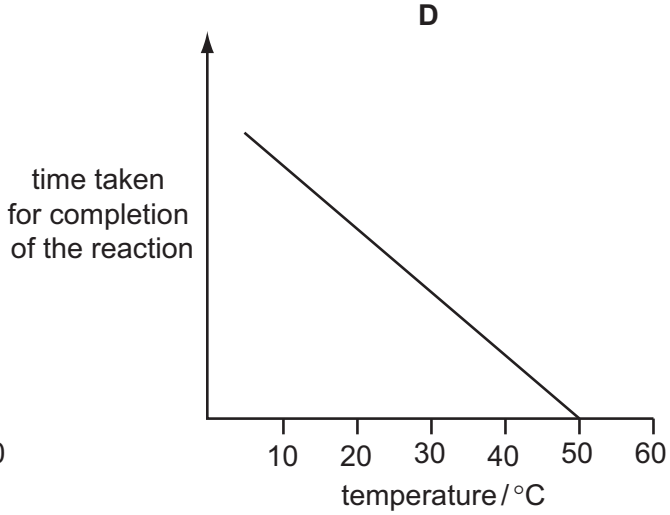
B



C



D



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13 Molecules 1, 2 and 3 are found in cell surface membranes.

1 glycolipids

2 glycoproteins

3 phospholipids

Which contribute to cell recognition?

A 2 only

B 1 and 2 only

C 1 and 3 only

D 2 and 3 only

14 What are the features of facilitated diffusion?

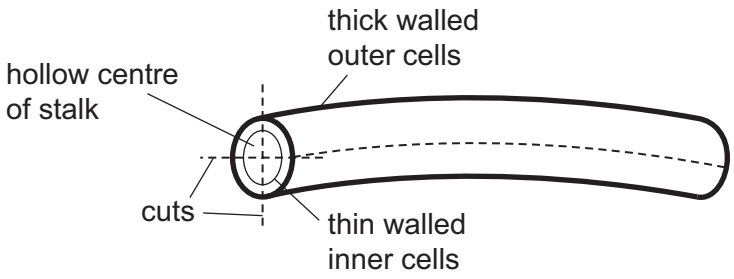
	uses proteins in membrane	uses ATP	molecules move down a concentration gradient
A	✓	✓	✓
B	✗	✓	✓
C	✓	✗	✓
D	✓	✓	✗

key:

✓ correct

✗ incorrect

15 The stalk of a dandelion flower 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



16 What happens to an animal cell when it is placed in a solution with a more negative water potential?

A It loses solutes to the solution and swells.

B It loses water by osmosis and shrinks.

C It takes in solutes and swells.

D It takes in water by osmosis and bursts.

17 Exposure to which of the following increases the risk of developing a cancerous growth?

	ultraviolet light	viruses	carbon monoxide	X-rays
A	✓	✓	✗	✓
B	✓	✗	✓	✓
C	✗	✓	✓	✗
D	✓	✗	✓	✗

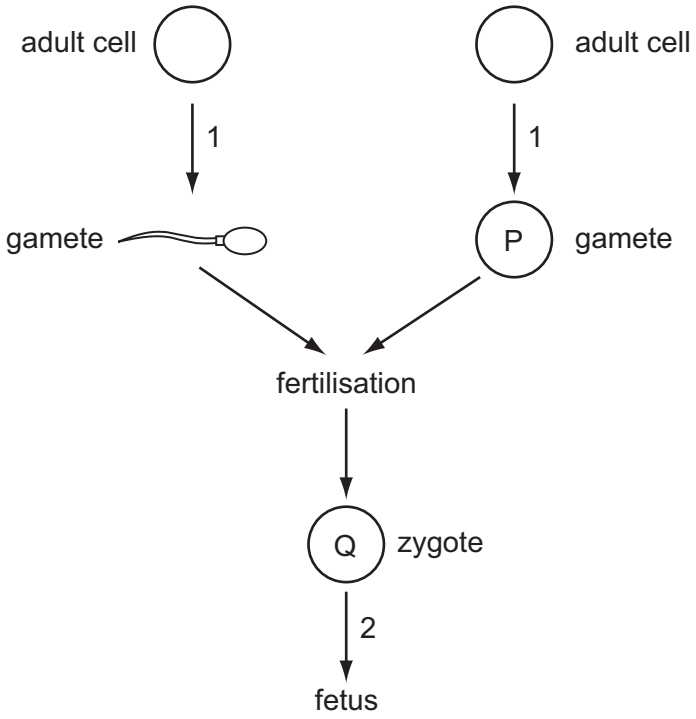
key

✓ increases risk

✗ does not increase risk

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18 The diagram shows an outline of the process of sexual reproduction.



Which row identifies the type of cell division occurring during stages 1 and 2 and the number of chromosomes in cells P and Q?

	1	2	P	Q
A	meiosis	meiosis	diploid	haploid
B	meiosis	mitosis	haploid	diploid
C	mitosis	meiosis	haploid	diploid
D	mitosis	mitosis	diploid	haploid

19 A short piece of DNA 19 base pairs long was analysed to find the number of nucleotide bases in each of the polynucleotide strands. Some of the results are shown below.

	number of nucleotide bases			
	A	C	G	T
strand 1				4
strand 2		7		5

How many nucleotides containing C were present in strand 1?

A 2 **B** 3 **C** 5 **D** 7

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20 Which statements about complementary base pairing are correct?

1 Cytosine forms two hydrogen bonds with guanine.

2 Purines and pyrimidines are different sizes.

3 Adenine forms the same number of hydrogen bonds with thymine and uracil.

4 The base pairs are of equal length.

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

21 What does the enzyme DNA polymerase synthesise in a cell?

A a polypeptide using DNA as a template

B a strand of DNA using a polypeptide as a template

C a strand of DNA using DNA as a template

D a strand of mRNA using DNA as a template

22 The statements describe some of the properties of water.

1 requires a lot of heat energy to evaporate

2 retains a lot of heat energy

3 is able to form hydrogen bonds with other water molecules

4 is able to form hydrogen bonds with other polar and non-polar molecules

Which properties are important for transport in xylem?

A 1, 2 and 3 only

B 1, 2 and 4 only

C 1 and 3 only

D 3 and 4 only

23 Which row is correct?

	needs energy from ATP	transfers heat energy	carries assimilates
A	translocation	mass flow	xylem vessel element
B	translocation	transpiration	phloem sieve tube element
C	transpiration	mass flow	xylem vessel element
D	transpiration	translocation	phloem sieve tube element

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24 Which feature of xylem vessel elements allows them to have reduced resistance to water movement?

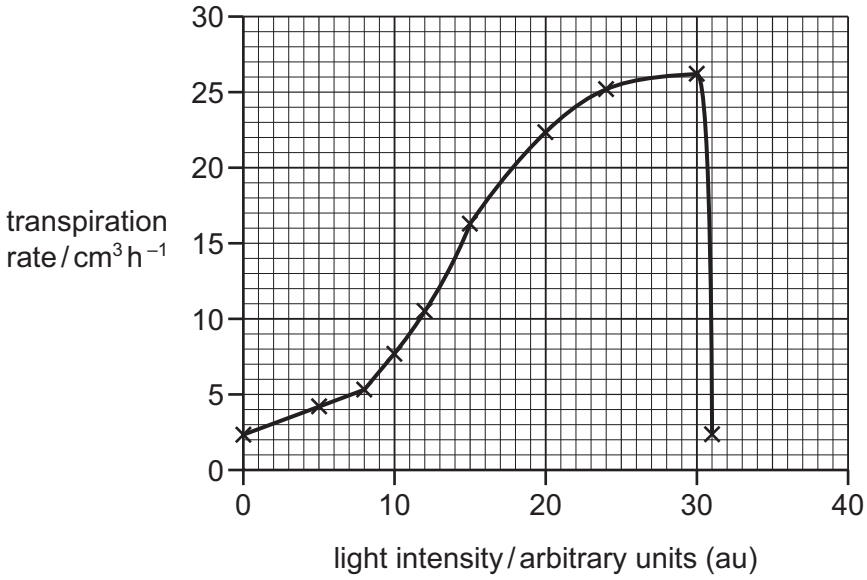
A lignin forms an incomplete secondary wall

B new vessels carry extra water as a plant grows

C there are no cross walls between vessel elements

D vessel elements join to form narrow tubes

25 An investigation was carried out into the effect of light intensity on the rate of transpiration. All other variables were standardised. A student was asked to explain the results shown in the graph below.



Which explanation is correct?

A At light intensities above 30 au the stomata close rapidly.

B The rate of transpiration increases as the light intensity increases.

C The rate of transpiration never falls to 0 cm^3 because some stomata are always open.

D Water uptake by the plant increases as the light intensity increases from 0 to 30 au.

26 Different substances, such as sucrose and amino acids, can move in different directions in the phloem sieve tubes.

Which statement explains this?

A Active transport occurs in some phloem sieve tubes and mass flow occurs in other phloem sieve tubes.

B Both active transport and mass flow occur in each individual phloem sieve tube.

C Mass flow occurs in both directions at the same time in each individual phloem sieve tube.

D Mass flow occurs in different directions in different phloem sieve tubes at the same time.

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27 Which reactions will be taking place in blood that is passing through active tissues?

1 $HbO_8 \rightarrow Hb + 4O_2$

2 $HbO_8 + H^+ \rightarrow HHb + 4O_2$

3 $HCO_3^- + H^+ \rightarrow H_2CO_3$

4 $H_2O + CO_2 \rightarrow H_2CO_3$

A 1, 2, 3, and 4

B 1, 2 and 4 only

C 1, 3 and 4 only

D 2 and 3 only

28 During a cardiac cycle, the pressure in the right ventricle is lower than that in the right atrium and lower than that in the pulmonary artery.

Which row is correct?

	atrioventricular valve	semilunar valve
A	closed	closed
B	closed	open
C	open	closed
D	open	open

29 What correctly describes an event in the cardiac cycle that follows atrial systole?

A A wave of excitation passes through the sinoatrial node (SAN), before spreading down to the base of the septum.

B Electrical impulses pass from the muscles of the atria to the muscles of the ventricles to cause ventricular systole.

C Electrical impulses pass through conducting fibres, which cause a delay before spreading to Purkyne tissue.

D The opening and closing of the semilunar valves occurs later than the opening and closing of the atrioventricular valves.

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30 'Heart block' is a disease which can result in a lower than normal heart rate. A doctor treating a patient suffering from heart block found that electrical impulses were initiated as normal but were not correctly conducted to the ventricles, so the rate of ventricular contraction was slowed.

Which may be functioning incorrectly in the patient?

1 atrioventricular node (AVN)

2 Purkyne tissue

3 sinoatrial node (SAN)

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

31 What correctly describes the effect of carcinogens on lung tissue?

A Cells of the alveoli walls divide more rapidly than normal by reduction division causing a tumour to develop.

B Cilia are paralysed and mucus accumulates in the lungs, causing DNA to change and a tumour to develop.

C DNA changes, causing bronchial epithelial cells to divide by mitosis in an uncontrolled way, causing a tumour to develop.

D Haemoglobin carries less oxygen, causing bronchial cells to divide by mitosis in an uncontrolled way, causing a tumour to develop.

32 A disease damages alveoli walls.

What effect does this have on the gas exchange surface area and on the volume of the lungs?

	surface area	volume
A	decreased	decreased
B	decreased	increased
C	decreased	no change
D	no change	no change

33 Which is a correct description of part of the gas exchange system?

	part of gas exchange system	cartilage	ciliated epithelium	goblet cells	smooth muscle
A	alveolus	✗	✓	✗	✗
B	bronchus	✓	✓	✓	✓
C	bronchiole	✗	✓	✓	✗
D	trachea	✓	✓	✓	✗

key

✓ present

✗ absent

34 Which is correct for TB, measles and malaria?

	TB		measles		malaria	
	causative agent	transmission	causative agent	transmission	causative agent	transmission
A	bacteria	air-borne	virus	air-borne	protoctist	insect vector
B	bacteria	water-borne	protoctist	air-borne	virus	insect vector
C	virus	air-borne	bacteria	water-borne	protoctist	insect vector
D	virus	insect vector	protoctist	insect vector	bacteria	water-borne

35 What do the causative agents of HIV / AIDS, malaria and TB have in common?

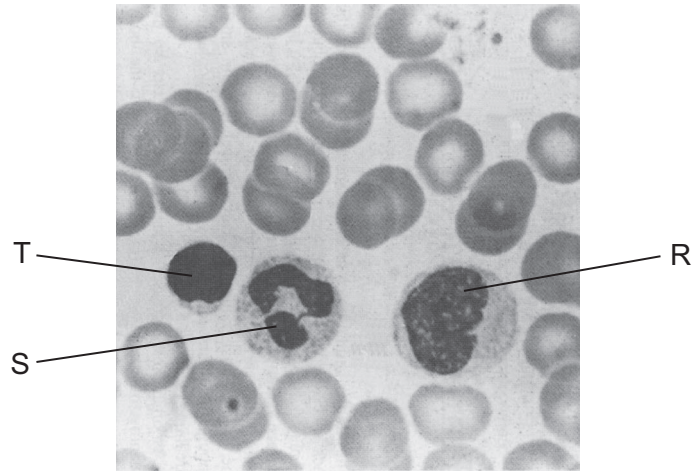
	they have a cell surface membrane	they have genes	they have ribosomes	they respire
A	✓	✓	✓	✓
B	✓	✗	✗	✓
C	✗	✓	✗	✓
D	✗	✓	✗	✗

key

✓ present in each causative agent

✗ not present in each causative agent

36 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	lymphocyte
B	lymphocyte	phagocyte	phagocyte
C	phagocyte	lymphocyte	phagocyte
D	phagocyte	phagocyte	lymphocyte

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37 What are the function(s) of T-lymphocytes during an immune response?

1 destroy infected body cells

2 differentiate into memory cells

3 secrete antibodies

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

38 A student wrote down three statements about antibodies.

1 Their structure depends on peptide, hydrogen and disulfide bonds.

2 They are protein molecules with both tertiary and quaternary structure.

3 Four polypeptides provide four antigen binding sites.

Which statements are true?

A 1, 2 and 3

B 1 and 2 only

C 1 and 3 only

D 2 and 3 only

39 An insect consumes 180 J of plant material. Of this, 95 J of energy is passed out in the insect's faeces and 58 J is used for respiration.

Which percentage of the energy, in the original plant material taken in by the insect, is converted into biomass?

A 10 % **B** 15 % **C** 32 % **D** 47 %

40 Decomposition of organic matter can cause the concentration of ammonia to rise in a fish tank. High concentrations of ammonia in the tank are toxic to fish. Bacteria may be added to remove the ammonia.

Which type of bacteria should be added?

A ammonifying

B denitrifying

C nitrifying

D nitrogen-fixing

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1 Which structure is measured in the units shown using a light microscope?

	structure	unit
A	cell surface membrane	nm
B	cell wall	nm
C	chloroplast	μm
D	ribosome	μm

2 A student studied two photographs, at the same magnification, of a palisade mesophyll cell, one using a light microscope and the other using an electron microscope.

The student observed:

1 the cisternae of the Golgi apparatus

2 the grana in the chloroplasts

3 the two membranes of the nuclear envelope

4 the vacuole enclosed by a tonoplast.

Which features can only be seen because of the higher resolution of the electron microscope?

A 1, 2 and 3 only

B 1, 2 and 4 only

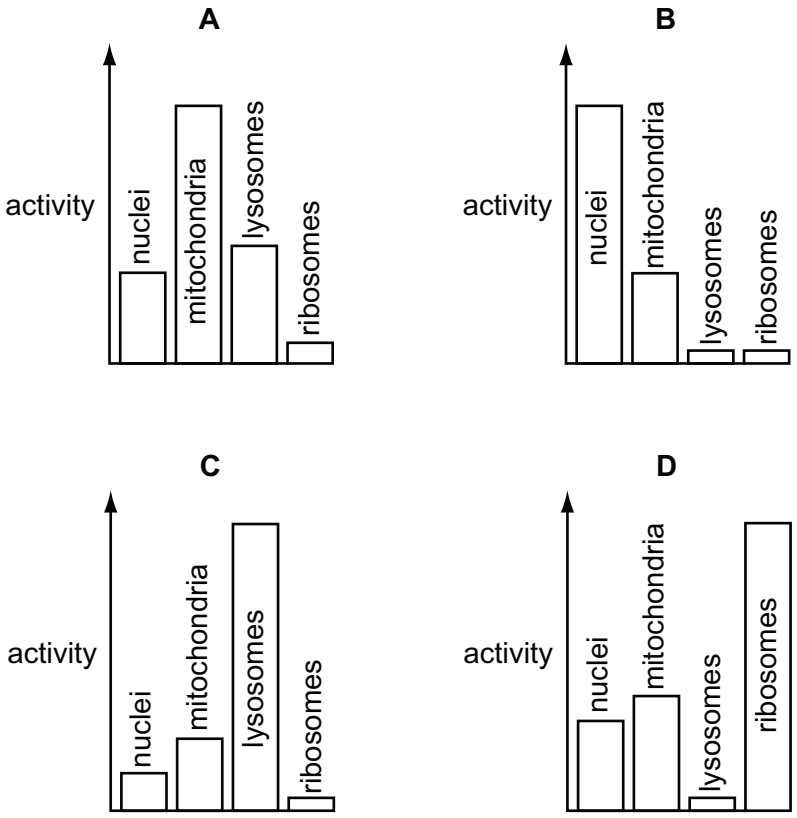
C 1, 3 and 4 only

D 2, 3 and 4 only

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3 A piece of mammalian tissue was homogenised and centrifuged. The biochemical activity of four subcellular fractions was investigated.

Which diagram indicates the fraction with maximum synthesis of messenger RNA?



4 Which row shows features of a typical eukaryotic cell?

	cell size	nucleus	DNA	ribosome size
A	< 2μm	absent	linear	large 80S
B	< 2μm	present	circular	small 70S
C	> 2μm	present	circular	small 70S
D	> 2μm	present	linear	large 80S

5 Many single-celled animals, living in fresh water, possess vacuoles which contract regularly, expelling excess water.

Why do the cells of plants living in fresh water **not** require such vacuoles?

A Plant cells have a higher concentration of dissolved solutes than animal cells.

B Plant cell walls are impermeable to water.

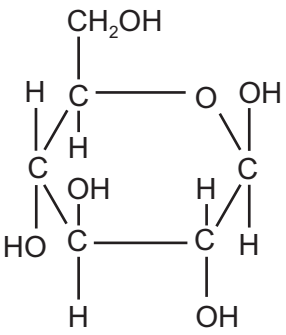
C Plant cell walls limit cell size.

D Water movement into plants is controlled by their roots.

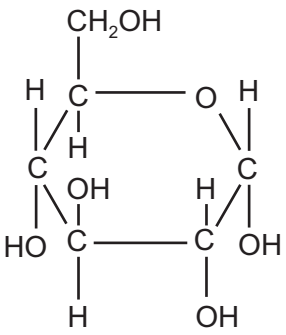
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6 Which shows β-glucose?

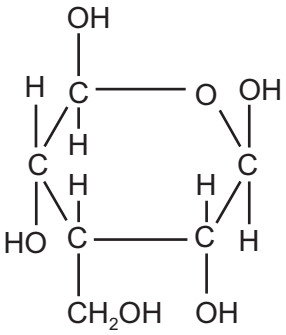
A



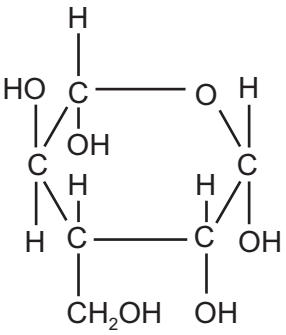
B



C



D



7 Which row is correct when one molecule of sucrose is hydrolysed?

	molecules of reducing sugar	molecules of water
A	1	1
B	1	2
C	2	1
D	2	2

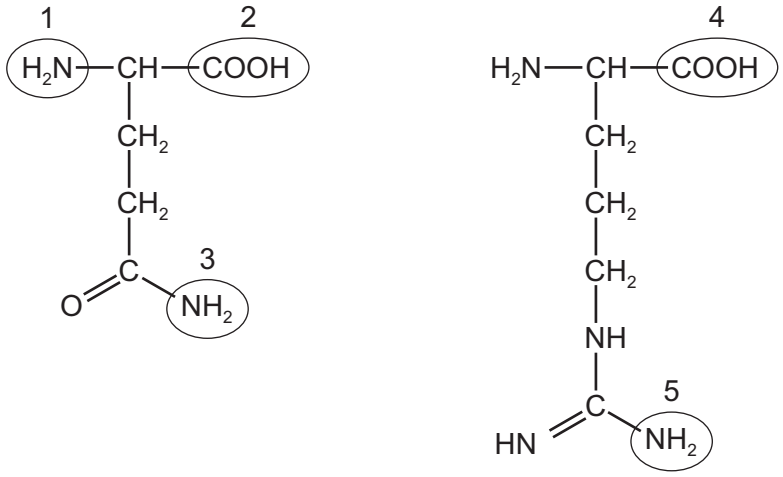
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8 The formation of glycosidic and peptide bonds is responsible for polymerisation in some biological molecules.

Which bonds are found in which molecules?

	glycosidic	peptide
A	glycerol	glycoprotein
B	glycogen	glycerol
C	glycogen	glycoprotein
D	glycoprotein	glycolipid

9 The diagrams show the structures of two amino acids, each of which has more than one amine ($–NH_2$) group.



A peptide bond is formed between the two amino acids.

Which groups form the peptide bond?

A 1 and 4 **B** 2 and 4 **C** 2 and 5 **D** 3 and 4

10 Which explains why haemoglobin is able to carry oxygen?

A It consists of four polypeptides.

B It contains iron.

C It has a quaternary structure.

D It is a globular protein.

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11 Which is correct for a non-competitive inhibitor of enzyme action?

1 Increasing the concentration of the enzyme's substrate will reduce its effect.

2 It reduces the activation energy required for a reaction to take place.

3 It reduces the maximum rate of reaction.

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

12 The enzyme lysozyme secreted from tear glands forms deposits on contact lenses.

Which ingredient would be effective in a contact lens cleaner for removing these deposits?

A ethanol

B lysosomes

C pH buffers

D proteases

13 Which is correct for components of a cell surface membrane?

	increases membrane fluidity	allows recognition of cell
A	cholesterol	glycoproteins
B	glycolipids	phospholipids
C	glycoproteins	glycolipids
D	phospholipids	cholesterol

14 A method called freeze-fracture can be used to study the structure of cell membranes. The membrane is frozen and then split down the middle, separating the two layers of phospholipids from each other. Any proteins contained within one layer remain in that layer. Proteins which span the membrane can be found in either layer after freeze-fracture, depending on the protein's properties.

Which statement(s) about the results of freeze-fracture studies are correct?

1 It provides evidence for the bilayer nature of membranes.

2 It provides evidence for the arrangement of proteins.

3 It shows that the proteins in the membrane do not contribute to its strength.

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

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15 Which statements are descriptions of **both** facilitated diffusion and active transport?

1 moves substances against a concentration gradient

2 requires ATP

3 transports charged ions across the cell surface membrane

4 uses proteins

A 1, 2, 3 and 4

B 1, 2 and 4 only

C 2 and 3 only

D 3 and 4 only

16 Which statement about the fluid mosaic model of membrane structure is correct?

A The less unsaturated the fatty acid chains of the phospholipids, the more fluid the membrane.

B The more unsaturated the fatty acid chains of the phospholipids, the more fluid the membrane.

C The higher the temperature, the less fluid the membrane.

D The lower the temperature, the more fluid the membrane.

17 Which statements about cancer are correct?

1 Exposure to UV light from the sun always causes skin cancer.

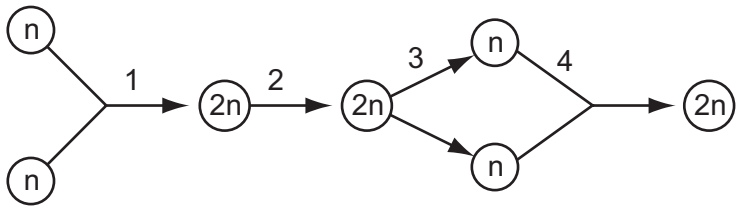
2 Some viruses can cause cancer.

3 The mutation of genes controlling the cell cycle may cause cancer.

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

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18 The diagram represents the life cycle of a sexually reproducing animal.



Which row correctly identifies meiosis and mitosis?

	meiosis	mitosis
A	1	4
B	2	1
C	3	2
D	4	3

19 The following statements describe events that take place during DNA replication and transcription.

Which row is **not** correct?

		DNA replication	transcription
A	adenine pairs with thymine	yes	no
B	both DNA polynucleotide chains act as templates	yes	no
C	the original DNA molecule is changed after the process	no	yes
D	uracil pairs with adenine	no	yes

20 Which statements about complementary base pairing are correct?

1 Purines and pyrimidines are different sizes.

2 It occurs during translation.

3 The base pairs are of different length.

4 Uracil forms two hydrogen bonds with adenine.

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

21 What is the minimum number of base substitutions required to change the nucleotide sequence of the HbA (normal) allele to the HbS (sickle cell) allele?

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

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22 Which feature of a plant cell is an adaptation for water uptake from the soil solution?

A waxy cuticle

B large numbers of mitochondria

C long, thin extension to the cell

D thick cellulose cell wall

23 A student used a potometer to measure the rate of water loss from a plant by transpiration.

The internal diameter of the capillary tube and the distance moved by the bubble in 30 seconds were recorded.

The results are shown in the table.

internal diameter of capillary tube / mm	distance bubble moved in 30 s / mm
1.8	40.0

The volume of water moved = πr^2 x distance moved by the bubble.

Which calculation correctly shows how to determine the rate of transpiration in $mm^3 s^{-1}$?

A $\frac{\pi(1.8^2 \times 40.0)}{30}$

B $\pi(1.8^2 \times 40.0) \times 30$

C $\frac{30}{\pi(0.9^2 \times 40.0)}$

D $\frac{\pi(0.9^2 \times 40.0)}{30}$

24 Which feature of xylem vessel elements helps the cohesion of water?

A lignin forms an incomplete secondary wall

B new vessels carry extra water as a plant grows

C there are no cross walls between the vessel elements

D the vessel elements form narrow tubes

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

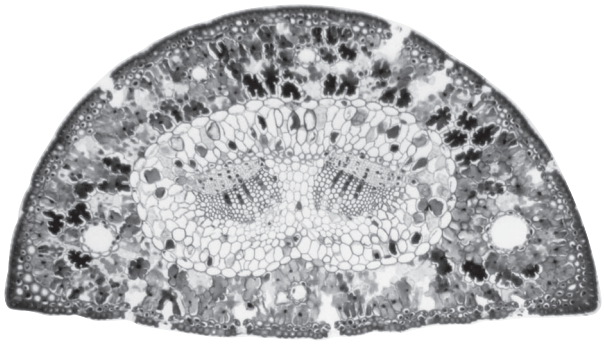
A absorption of water through the root hair cells

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

26 The photomicrograph shows a transverse section through a leaf.



×50

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

1 sunken stomata

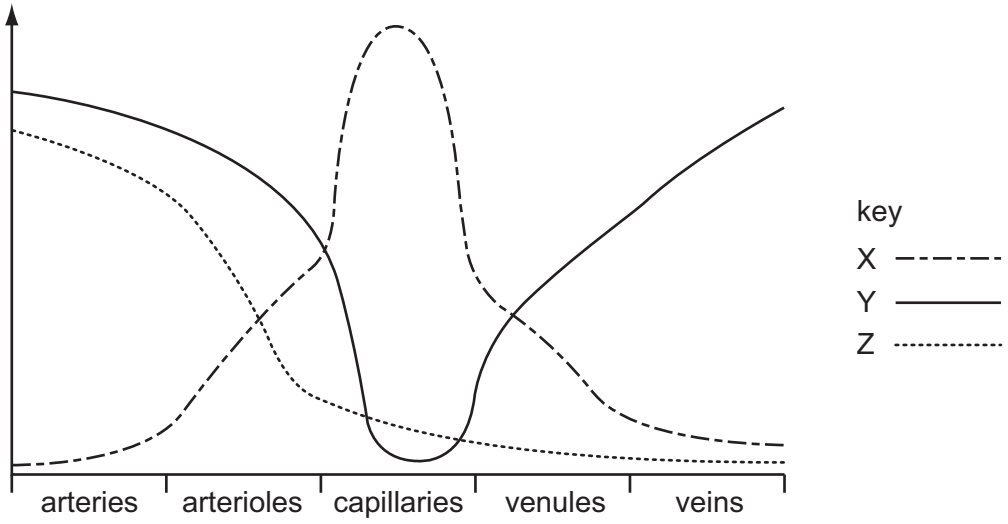
2 two layers of epithelium

3 thick cuticle

4 small surface area to volume

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

27 The graph represents data on blood vessels and blood flow.



Which row correctly identifies the curves?

	velocity of blood flow	pressure of blood	total cross-sectional area
A	X	Y	Z
B	X	Z	Y
C	Y	Z	X
D	Z	X	Y

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28 What occurs during ventricular systole in a mammalian heart?

1 aortic pressure increases

2 atrial pressure does not change

3 ventricular pressure increases

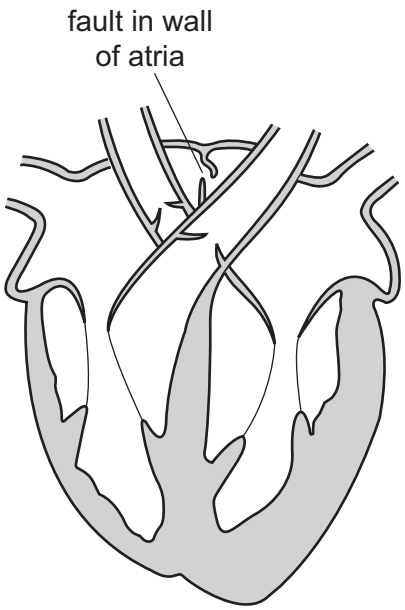
A 1 and 2

B 1 and 3

C 2 and 3

D 3 only

29 The diagram shows a defect in the walls between the atria.



What effect would this defect have on the blood circulatory system?

A increased pressure in the pulmonary artery

B irregular heart beat

C reduced oxygen saturation of haemoglobin

D ventricular systole is delayed

30 Which will **not** be formed in the plasma in capillaries surrounding active tissue?

A carbaminohaemoglobin

B carbonic acid

C hydrogen carbonate

D hydrogen ions

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[Turn over

31 Goblet cells are found in the trachea.

Which organelles would be found in large numbers in a goblet cell?

1 lysosomes

2 mitochondria

3 rough endoplasmic reticulum

4 secretory vesicles

A 1, 2 and 3 only

B 2, 3 and 4 only

C 1 and 3 only

D 2 and 4 only

32 Which tissues are present in a bronchus?

	cartilage	ciliated epithelium	smooth muscle
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✓	✓

key

✓ present

✗ absent

33 Which statements are correct effects of tar in tobacco smoke on the human gas exchange system?

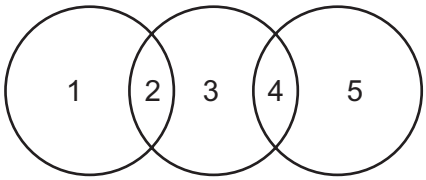
	goblet cells are stimulated to secrete more mucus	mucus glands in the trachea are enlarged	mutations may occur in epithelial cells forming tumours	the activity of cilia in the airways is inhibited
A	✓	✓	✗	✗
B	✗	✓	✓	✓
C	✓	✓	✓	✓
D	✓	✗	✓	✓

key

✓ correct

✗ not correct

34 The diagram shows the relationship between cholera, measles and TB.



Which is correct?

	1	2	3	4	5
A	cholera	bacteria	TB	airborne	measles
B	cholera	virus	measles	waterborne	TB
C	measles	airborne	cholera	bacteria	TB
D	measles	waterborne	TB	virus	cholera

35 New-born babies have natural passive immunity.

What is the correct explanation for this?

	immunity is not inherited	antibodies are broken down
A	✗	✓
B	✗	✗
C	✓	✓
D	✓	✗

key

✓ = correct

✗ = not correct

36 Which is a correct description of different types of immunity?

	natural active	natural passive	artificial active	artificial passive
A	antibodies cross the placenta	injection of antigens	injection of antibodies	no memory cells form
B	memory cells form	antibodies cross the placenta	injection of antigens	injection of antibodies
C	injection of antibodies	memory cells form	antibodies cross the placenta	injection of antigens
D	injection of antigens	injection of antibodies	no memory cells form	antibodies cross the placenta

37 The World Health Organization (WHO) set a target to eradicate polio, using vaccination, by the year 2000. However, cases are still being reported in some parts of the world after this date.

What explains these new cases of polio?

1 Some parts of countries are difficult to reach because of poor transport or wars.

2 There is not enough research to develop more effective vaccines.

3 Records of vaccinated and unvaccinated people are incomplete.

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

38 The graph shows the annual changes of the following factors in a lake.

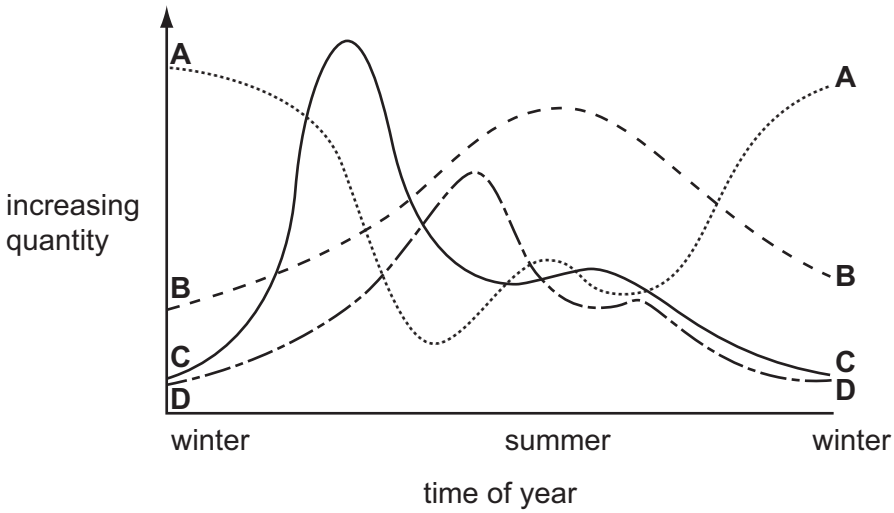
intensity of light per day

numbers of producers

numbers of primary consumers

quantity of nutrients

Which curve represents the numbers of producers?



39 Which events can occur in the nitrogen cycle?

1 Inorganic nitrogen in the atmosphere undergoes denitrification by specific prokaryotes.

2 Nitrate concentrations in the soil are increased by nitrifying bacteria in waterlogged soil.

3 Organic nitrogen in legumes passes into the soil where deamination and ammonification occurs.

4 Saprotrophic fungi living in the soil decompose organic nitrogen in faeces.

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

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40 Two different ecosystems of the same size, X and Y, were compared. Both ecosystems have the same climate.
The results of the comparison are shown.

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

Using the information in the table, which statement is **not** a valid suggestion concerning X and Y?

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

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

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

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

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

BIOLOGY **9700/13**

Paper 1 Multiple Choice **October/November 2013**

1 hour

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

4295094601

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.

This document consists of **14** printed pages and **2** blank pages.

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1 For which process is the large surface area of the cristae in the mitochondria important?

A energy radiation

B enzyme reaction

C gaseous exchange

D protein synthesis

2 What is **not** a limitation of an electron microscope?

A Electrons do not travel far in air so the whole system must be in a vacuum.

B The electron beam cannot penetrate far into biological material.

C The typical specimen viewed in a vacuum must be dehydrated.

D There is an increase in resolution and magnification compared with the light microscope.

3 What explains why cells with no nucleoli die?

A They do not have centrioles and cannot divide.

B They do not have mitochondria and cannot release energy.

C They do not have mRNA and cannot transcribe DNA.

D They do not have ribosomes and cannot synthesise protein.

4 Which statements about a typical prokaryotic cell are correct?

1 It is smaller than 2 μm.

2 It has a nucleus.

3 Its has circular DNA.

4 It has small (70S) ribosomes.

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

5 When mitochondria are extracted from cells for biochemical study, they are usually kept in a $0.25\,mol\,dm^{-3}$ sucrose solution.

Why is the sucrose solution used?

A to act as a solvent

B to enable the rate of reaction of the mitochondria to be determined

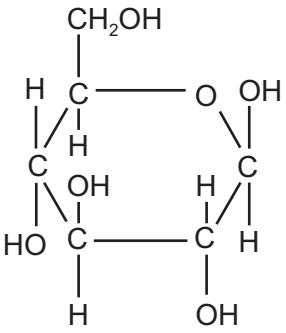
C to prevent the mitochondria from changing in structure

D to provide a source of energy

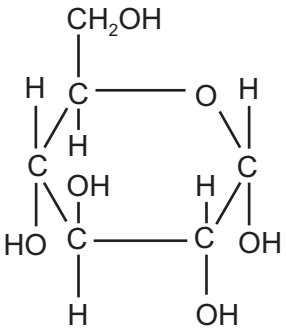
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6 Which shows the basic unit of cellulose?

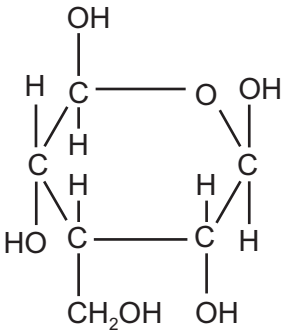
A



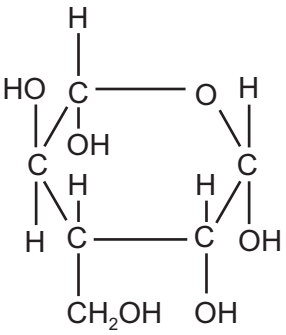
B



C



D



7 Which explains why haemoglobin is suitable as an oxygen carrier?

1 The haem group combines with oxygen.

2 The iron combines with oxygen reversibly.

3 Haemoglobin changes shape as oxygen loads.

A 1 only

B 1 and 2 only

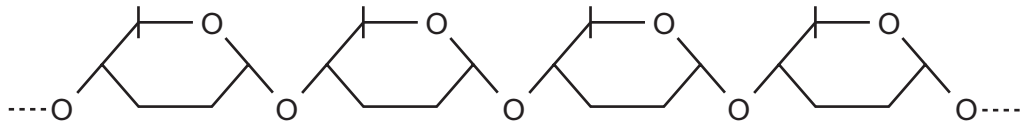
C 2 and 3 only

D 1, 2 and 3

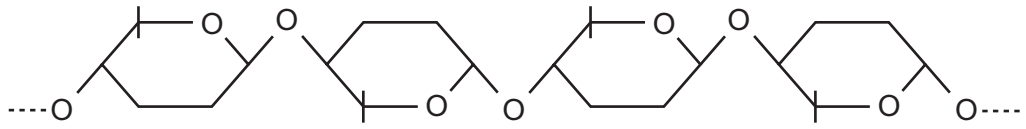
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8 Which diagram shows part of a structural polysaccharide?

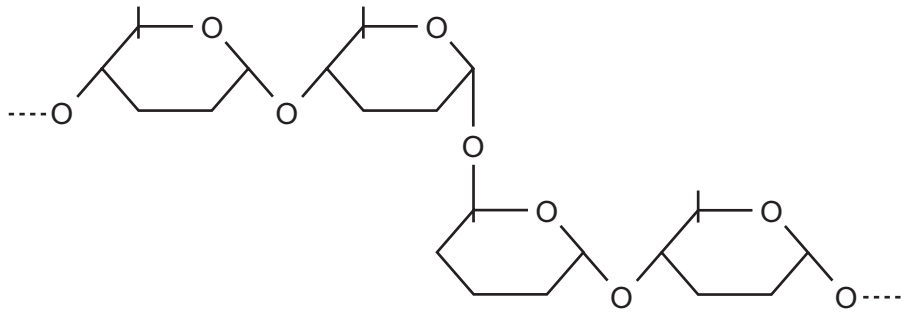
A



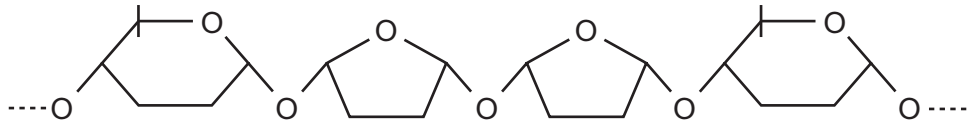
B



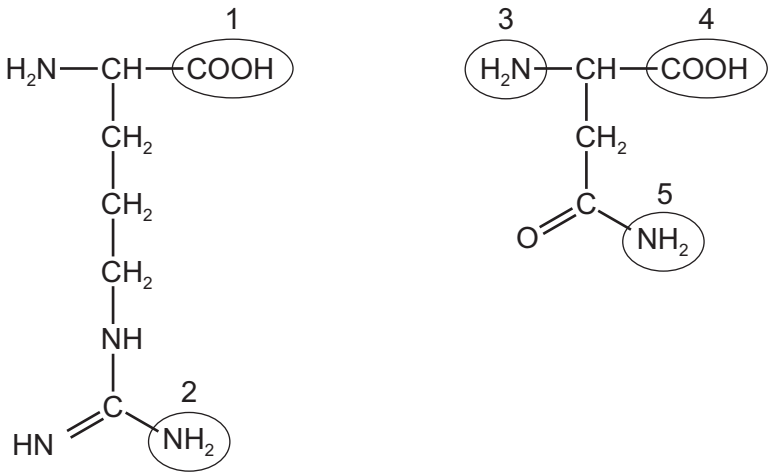
C



D



9 The diagrams show the structures of two amino acids, each of which has more than one amine ($-NH_2$) group.



A peptide bond is formed between the two amino acids.

Which groups form the peptide bond?

A 1 and 3 **B** 1 and 5 **C** 2 and 4 **D** 2 and 5

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10 Which combination of bond types correctly shows the weak and strong bonds that hold a molecule of protein in shape?

	types of bond		
	hydrogen	disulfide	ionic
A	strong	strong	weak
B	strong	weak	strong
C	weak	strong	strong
D	weak	strong	weak

11 Which is correct for competitive inhibitors of enzymes?

1 They occupy the active site of an enzyme.

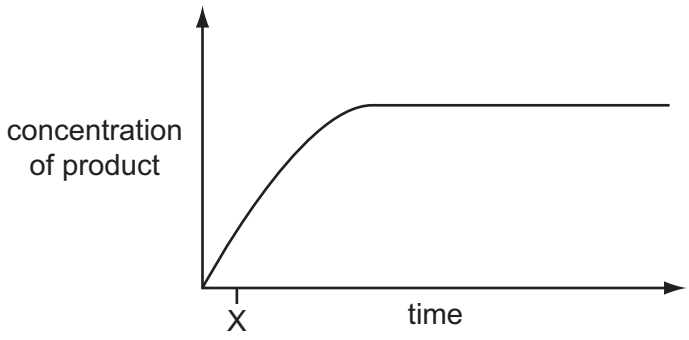
2 They have exactly the same shape as the substrate.

3 They can be used to control the rate of enzyme activity.

4 They can bind to a site on an enzyme other than the active site.

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

12 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.

13 Which statement concerning the role of cholesterol in the cell surface membrane is correct?

A It can act as a barrier to the entry into the cell of non-polar molecules.

B It helps the entry and exit of ions through the fatty acids.

C It maintains the fluidity of the membrane at low temperatures.

D It makes the membrane more permeable to very small water-soluble substances.

14 Which processes that contribute to transport across cell surface membranes are active or passive?

	endocytosis	exocytosis	facilitated diffusion	osmosis
A	✓	✓	✗	✗
B	✓	✗	✓	✗
C	✗	✓	✗	✓
D	✗	✗	✓	✓

key
✓ = active
✗ = passive

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

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

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

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

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

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

A from 1 and 2 to 3 and 4

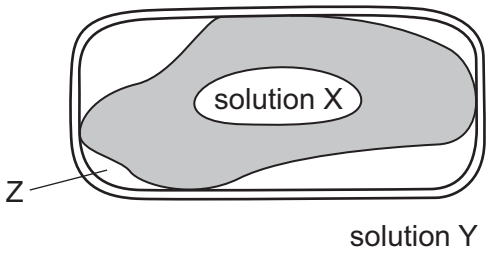
B from 2, 3 and 4 to 1

C from 1 to 3 to 2 and 4

D from 1, 2 and 3 to 4

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16 The diagram shows a partially plasmolysed plant cell.



What is found at Z?

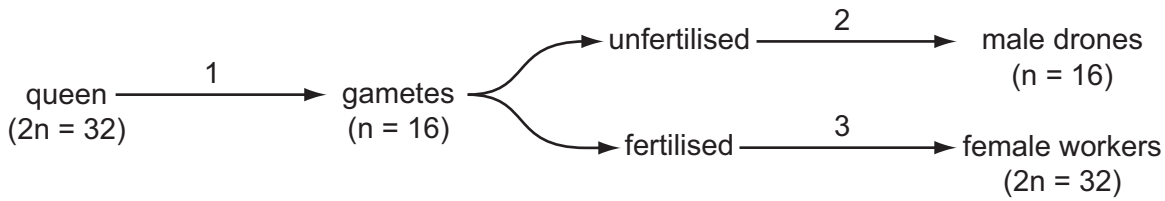
A air

B solution X

C solution Y

D water

17 The diagram shows part of the life cycle of the honey bee, *Apis mellifera*.



Where does mitosis occur?

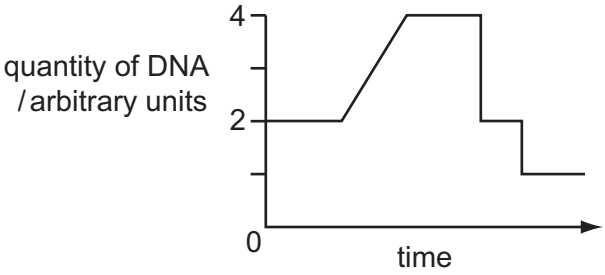
A 1 only

B 1 and 2 only

C 1 and 3 only

D 2 and 3 only

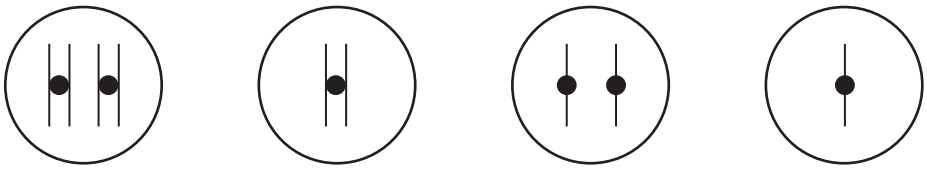
18 The graph shows the change in the quantity of DNA in a cell during a reduction division (meiosis).



A cell with one pair of chromosomes (2n = 2) undergoes meiosis.

Which nucleus is formed as a result of this division?

A **B** **C** **D**



19 What is the minimum number of hydrogen bonds in a length of DNA containing 700 base pairs?

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

20 Which term best describes the length of DNA that codes for the synthesis of a polypeptide?

A anticodon

B codon

C gene

D nucleotide

21 Which statements about complementary base pairing are correct?

1 It occurs during translation.

2 Purines and pyrimidines are the same size.

3 The base pairs are of equal length.

4 Uracil forms three hydrogen bonds with adenine.

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

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22 What is transpiration and which advantage does it give to a plant?

	transpiration	advantage to a plant
A	evaporation of water from leaf surfaces	maintains the water potential
B	evaporation of water from leaf surfaces	stomata are open for gas exchange
C	loss of water vapour from leaves	maintains the water potential
D	loss of water vapour from leaves	stomata are open for gas exchange

23 Which feature of xylem vessel elements allows them to stay open as transpiration increases?

A new vessel elements carry extra water as a plant grows

B there are no cross walls between vessel elements

C vessel elements form narrow tubes

D walls of vessel elements contain lignin

24 What occurs in the sieve tube elements of a photosynthesising leaf and an actively growing root?

	sieve tube elements in leaf	sieve tube elements in root
A	water potential decreases	sugars are moved in
B	water potential decreases	sugars are moved out
C	water potential increases	sugars are moved in
D	water potential increases	sugars are moved out

25 What occurs in the apoplast and symplast pathways?

	water enters cytoplasm through cell surface membrane	water enters vacuoles	water moves from cell to cell through intercellular spaces
A	apoplast	apoplast	symplast
B	apoplast	symplast	symplast
C	symplast	apoplast	apoplast
D	symplast	symplast	apoplast

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26 Some fungi cause wilting in crop plants by growing within the xylem vessels.

Which process will be directly affected by these fungi?

A cohesion between water molecules

B development of root pressure

C mass flow during translocation

D uptake of water by root hair cells

27 Which statement correctly identifies a similarity between blood plasma and tissue fluid?

A Protein is found in equal concentration in both blood plasma and tissue fluid.

B The blood plasma is under the same pressure as the tissue fluid.

C The water potential of the blood plasma and tissue fluid are equal.

D White blood cells are found in both blood plasma and tissue fluid.

28 Which reactions are **not** likely to occur in blood that is passing through active tissues?

1 $Hb + 4O_2 \rightarrow HbO_8$

2 $HbO_8 + H^+ \rightarrow HHb + 4O_2$

3 $HCO_3^- + H^+ \rightarrow H_2CO_3$

4 $H_2O + CO_2 \rightarrow H_2CO_3$

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

29 The pressure of blood entering capillaries is about seven times higher than that of blood leaving the capillaries.

What correctly explains this observation?

1 Blood pressure decreases with distance from the heart.

2 Tissue fluid formation is due to a net loss of plasma from capillaries.

3 Veins have fewer elastic and muscle fibres in their walls than arteries.

A 1, 2 and 3

B 1 and 2 only

C 1 and 3 only

D 2 and 3 only

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30 The red blood cell count of humans increases when they remain at high altitudes.

Why does this occur?

1 to increase the Bohr effect

2 to increase the diffusion gradient for oxygen in the lungs

3 to maintain transport of oxygen

A 3 only

B 1 and 2 only

C 2 and 3 only

D 1, 2 and 3

31 Goblet cells are found in the trachea.

Which organelles would be found in large numbers in a goblet cell?

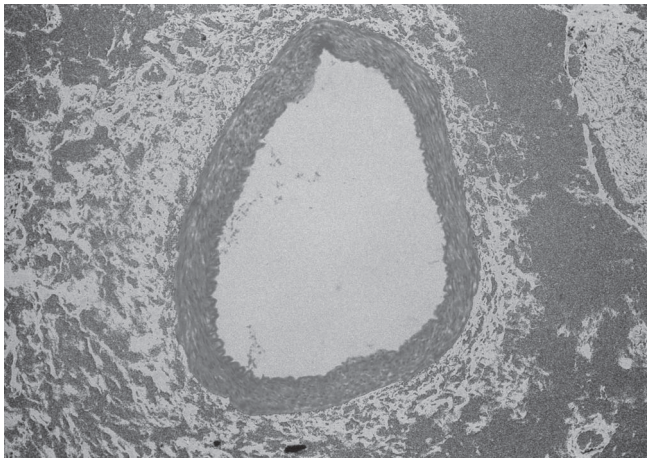
	Golgi apparatus	mitochondria	ribosomes
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✓	✓

key

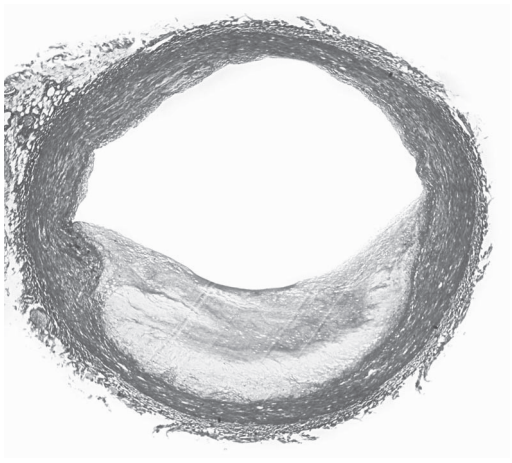
✓ = present in large numbers

✗ = not present in large numbers

32 The photomicrographs show a TS of an artery from a non-smoker and a TS of an artery from a smoker.



non-smoker



smoker

What is the reason for the appearance of smoker's artery?

A A cancerous tumour has formed and is blocking the lumen.

B Nicotine has damaged the artery endothelium causing a plaque.

C Tar has stuck to the artery wall forming a blockage.

D The artery has become constricted due to carbon monoxide.

33 Which row describes emphysema?

	lung tissue	total surface area of the alveoli
A	less elastic	decreased
B	less elastic	increased
C	more elastic	decreased
D	more elastic	increased

34 Which row is correct?

	disease	causative agent	method of transmission	method of control
A	AIDS	HIV	intimate contact	antibiotics
B	cholera	virus	waterborne	oral rehydration therapy (ORT)
C	malaria	bacterium	insect vector	antimalarial drugs
D	tuberculosis (TB)	bacterium	airborne	vaccination

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35 Scientists are concerned that avian (bird) flu caused by the H5N1 virus could infect humans and cause a pandemic.

What could help prevent humans from spreading the disease?

1 killing all poultry

2 reducing the number of air flights

3 taking a course of antibiotics

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

36 What are the function(s) of plasma cells during an immune response?

1 destroy cancer cells

2 differentiate into memory cells

3 secrete antibodies

A 2 only

B 3 only

C 2 and 3 only

D 1, 2 and 3

37 Some of the facts about a pathogen, P, are that:

1 it is transmitted in food and water

2 it lives in human intestines

3 it has many genes coding for surface proteins

4 it changes its surface antigens

5 it may or may not trigger an immune response.

Which explains why it is difficult to develop an effective vaccine for P?

A P can mutate to produce different antigens.

B P is a eukaryotic cell with many genes.

C P is found in contaminated food and water and affects the gut.

D People can be infected with P and may not show symptoms.

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38 Which description is correct for B-lymphocytes?

	processed in the thymus	release antibodies immediately after formation	act in the cell mediated response	can act as antigen presenting cells
A	✓	✓	✓	✗
B	✓	✗	✓	✗
C	✗	✓	✗	✓
D	✗	✗	✗	✓

key
✓ = correct
✗ = incorrect

39 In a mangrove ecosystem, leaves from the grey mangrove plants fall into the water and sink to the mud below. They are then broken down by bacteria and fungi.

Invertebrates such as crabs, prawns, and molluscs live in the mud and feed on the dead leaves. The bullseye fish feeds on the invertebrates. Humans eat prawns, crabs and fish.

Herons and other wading birds live and breed in the mangroves. These birds feed on invertebrates and fish.

What is correct about this ecosystem?

A Bacteria, fungi, crabs, prawns and molluscs form the community in the mud.

B Bullseye fish are at the second trophic level in the food web.

C Fungi in the water are the main producers in the ecosystem.

D Grey mangroves are the ecological niche of herons.

40 Two species of birds feed on different insects living on the same tree and so do not compete for food.

Which statement describes these two species of birds?

A They occupy different habitats in the same ecosystem.

B They occupy the same habitat in the same ecosystem.

C They occupy different niches in the same habitat.

D They occupy the same niche in the same habitat.

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