Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/12**

Paper 1 Multiple Choice **October/November 2019**

1 hour

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

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READ THESE INSTRUCTIONS FIRST

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

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

Read the instructions on the Answer Sheet very carefully.

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

This document consists of **18** printed pages and **2** blank pages.

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1 A student calibrated the scale on an eyepiece graticule in the eyepiece lens of a light microscope. The student was given a stage micrometer scale to use.

The divisions on the stage micrometer scale were 0.1 mm apart.

Which data must the student collect in order to calibrate the eyepiece graticule?

1 magnification of the eyepiece lens of the microscope

2 number of divisions of the stage micrometer scale seen in one field of view of the microscope

3 number of divisions of the eyepiece graticule scale equivalent to each division of the stage micrometer scale

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

2 The diameter of living cells varies considerably.

The diameter of a typical eukaryotic cell is 1.5×10^1 μm.
The diameter of a typical prokaryotic cell is 7.5×10^2 nm.

Using these measurements, what is 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	6.7×10^4	1.3×10^2
B	6.7×10^3	1.3×10^5
C	6.7×10^2	1.3×10^4
D	6.7×10^1	1.3×10^3

3 Which structures are found in animal cells and in plant cells?

1 centriole

2 lysosome

3 nucleolus

4 vacuole

A 1 and 3 only

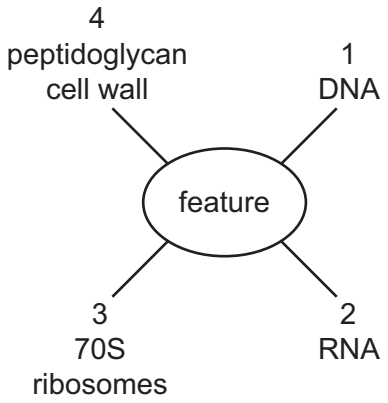
B 2 and 4 only

C 2, 3 and 4 only

D 1, 2, 3 and 4

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4 Which features shown in the diagram can be present in eukaryotes?



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

5 Four students were asked to match the function with the appearance of some cell structures in an animal cell.

The functions were listed by a number.

1 organises microtubules to produce the spindle during cell division

2 synthesis of polypeptides

3 synthesis of lipids

The appearances were listed by a letter.

V membranes which surround an enclosed inner cavity

W non-membrane bound, spherical structures

X a double membrane interspersed with pores

Y non-membrane bound, cylindrical structures

Z membrane-bound sacs, arranged as a flattened stack

Which student correctly matched the numbered functions with the appearance of the cell structure?

	1	2	3
A	W	X	Z
B	W	Z	V
C	Y	W	V
D	Y	Z	W

6 Which types of RNA are present in prokaryotic cells and in eukaryotic cells?

	mRNA	rRNA	tRNA
A	✓	✓	✓
B	✓	✓	✗
C	✗	✓	✓
D	✗	✓	✗

key

✓ = present

✗ = not present

7 A student carried out four tests for biological molecules on a solution. The results are shown in the table.

test for biological molecules	observation
iodine	orange-brown
biuret	purple
Benedict's	orange
emulsion	clear

Which three molecules may be present in this solution?

A glucose, starch, globin

B globin, glucose, collagen

C starch, sucrose, collagen

D sucrose, globin, collagen

8 A student was asked to estimate the concentration of reducing sugar in an unknown solution using the Benedict's test. Five reducing sugar solutions with different concentrations were provided in order to produce a calibration curve.

The student added 2 cm^3 of Benedict's solution to each of the reducing sugar solutions, heated them in a water-bath and recorded the time taken for the first appearance of a colour change.

Which variables should the student standardise, when carrying out the Benedict's test on each reducing sugar solution, to ensure the results are comparable?

1 volume of reducing sugar used

2 the temperature of the water-bath

3 the time the solutions are heated

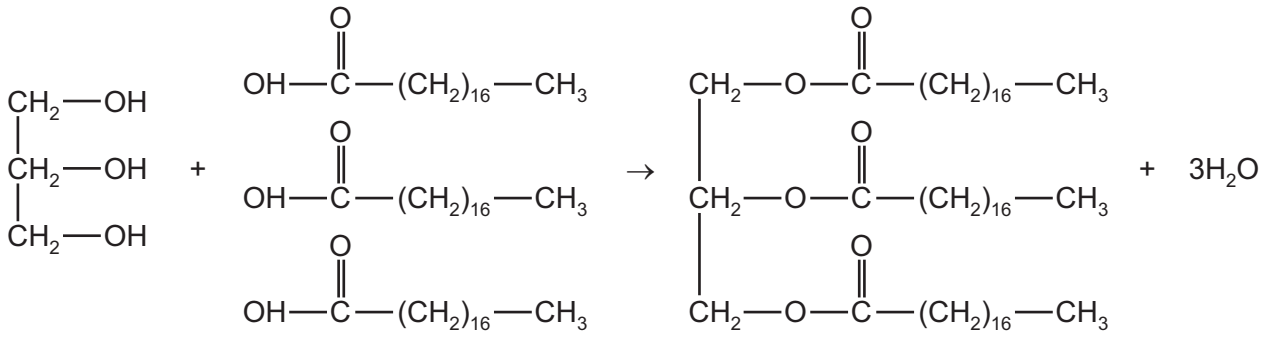
A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 3 only

9 Which rows show the chemical groups present in the biological molecules listed?

	biological molecule	presence of carboxyl (COOH) groups	presence of two or more hydroxyl (OH) groups
1	amino acid	yes	no
2	β-glucose	no	yes
3	glycerol	no	no
4	fatty acid	yes	no

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

10 The diagram shows the formation of a biological macromolecule.



Which type of bonds are formed in the macromolecule product?

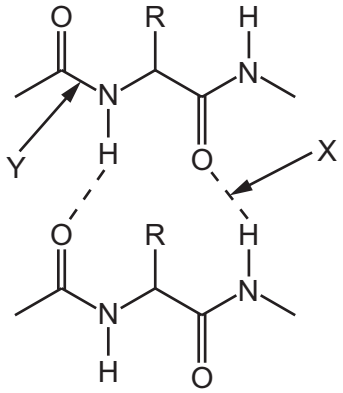
A ester bonds

B glycosidic bonds

C hydrogen bonds

D peptide bonds

11 Fibrous proteins are composed of chains of amino acids held together by bonds. An example of part of a fibrous protein is shown.



Which type of bond is at X and Y?

	X	Y
A	disulfide	hydrophobic interaction
B	hydrogen	peptide
C	hydrophobic interaction	ionic
D	ionic	peptide

12 Which row about the structure of proteins is correct?

	primary structure	secondary structure	quaternary structure
A	is the number of amino acids present in a protein	is the left-handed spiral formed by the primary structure	is the sub-unit polypeptides that link together to form a protein
B	is the order of amino acids present in a protein encoded by DNA	is the coiling of a chain of amino acids to form a β-pleated sheet or α-helix	contains two types of polypeptide that interact forming the shape of a protein
C	is the result of translation of an mRNA molecule by a ribosome into a chain of amino acids	occurs because of attraction between hydrogen and oxygen atoms in the peptide bonds	is formed by four polypeptides and an additional reactive group attached to the protein
D	is the sequence of amino acids in a protein coded by an mRNA molecule	is formed by hydrogen bonding between amino acids forming the primary structure	is formed by the linking together of more than one polypeptide to form a protein

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13 A student wrote four statements about water.

1 Water has a high specific heat capacity which maintains the temperature of water within cells.

2 Mammals rely on water having a relatively low latent heat of vapourisation to keep them cool.

3 When a negatively charged ion is added to water, the δ^+ charge on the hydrogen atom is attracted to the ion.

4 When surrounded by water, non-polar molecules tend to be pushed apart from one another.

Which statements are correct?

	1	2	3	4
A	✓	✗	✓	✓
B	✓	✗	✓	✗
C	✗	✓	✗	✓
D	✗	✓	✗	✗

key

✓ = correct

✗ = not correct

14 Which statement about the active site of an enzyme is correct?

A It always has a specific fixed shape.

B It reduces the total energy of the product.

C It does not form chemical bonds with its substrate.

D It is determined by the primary structure of the enzyme.

15 When investigating the rate of reaction of the enzyme lipase on the hydrolysis of triglycerides, the pH must be maintained at an optimum to prevent the lipase denaturing.

What is the reason for this?

A The addition of water molecules produced by hydrolysis increases the pH.

B The products of hydrolysis decrease the pH.

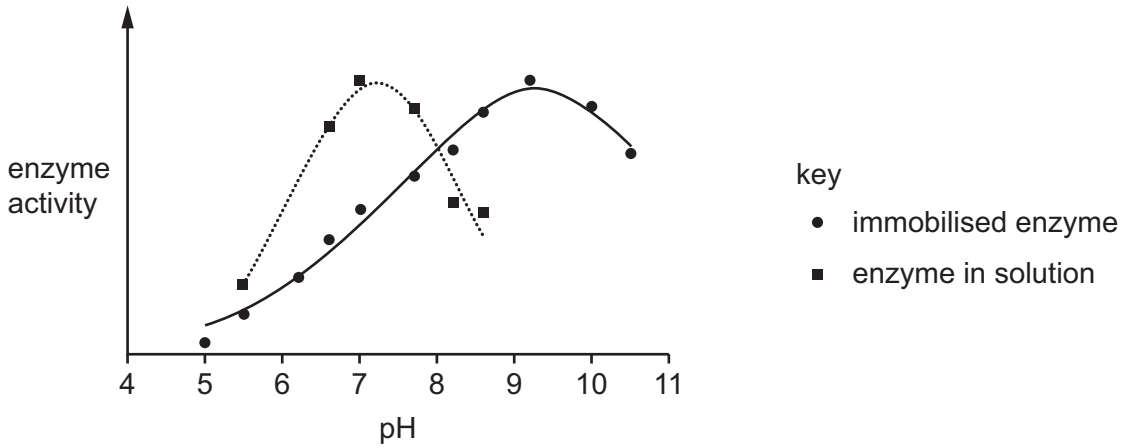
C The products of hydrolysis increase the pH.

D The removal of water molecules used in hydrolysis decreases the pH.

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16 An experiment was carried out to compare the effect of pH on the activity of an enzyme that was in solution and the same enzyme that had been immobilised on a gel. All other variables were kept the same.

The results are shown in the graph.



Which statement explains these results when the enzyme is immobilised?

A The primary structure has changed.

B The secondary structure has changed.

C The tertiary structure has changed.

D The quaternary structure has changed.

17 High concentrations of ethanol can disrupt cell membrane structure and make the cell surface membrane leaky.

Yeast cells release ethanol as a waste product of metabolism.

Yeast cells can alter the composition of the cell surface membrane to reduce the effect of ethanol.

- A saturated fatty acid, X, is replaced by an unsaturated fatty acid, Y.
- Y has a shorter hydrocarbon chain than X.
- There is an increase in the phospholipid to protein ratio.

Which statement would explain why the effect of ethanol is reduced?

A A greater proportion of phospholipid may increase the entry of ethanol via channel proteins.

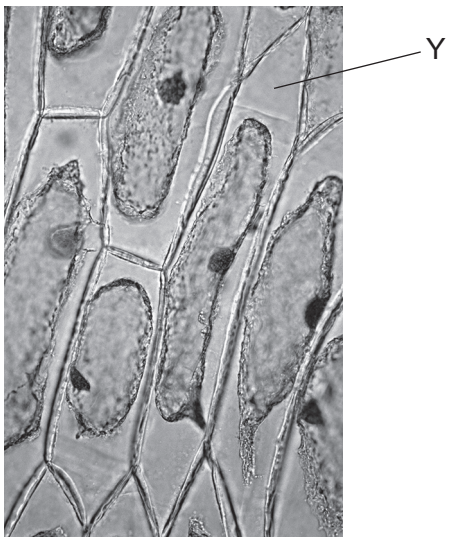
B An increase in hydrophobic interaction by phospholipid tails improves membrane stability.

C An increase in the proportion of fatty acids with double bonds decreases membrane fluidity.

D The shorter hydrocarbon chain of Y decreases membrane fluidity.

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18 The photomicrograph shows the appearance of onion epidermal cells after they have been soaked in solution X for one hour.



What fills the space labelled Y?

A air

B cytoplasm

C solution X

D water

19 Equal sized potato pieces were placed into a test-tube and covered with a sucrose solution. The test tube was left for 30 minutes. All other variables were controlled.

After 30 minutes, the potato piece had not changed in size.

What can be concluded from this result?

A The concentration of sucrose is the same in the potato and in the solution and there is no more movement of water into or out of the potato.

B The concentration of sucrose is the same in the potato and in the solution and there is no net movement of water into the potato.

C The water potential is the same in the potato and in the sucrose solution and there is no more movement of water into or out of the potato.

D The water potential is the same in the potato and in the sucrose solution and there is no net movement of water into or out of the potato.

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20 Which row shows the correct number of each component of a single chromosome during prophase of mitosis?

	centromeres	chromatids	polynucleotide strands	telomeres
A	1	0	2	2
B	1	2	4	4
C	2	0	4	2
D	2	2	2	4

21 The cell cycle includes mitosis.

Which are features of nuclear division?

1 forms cells of equal size to the parent cell

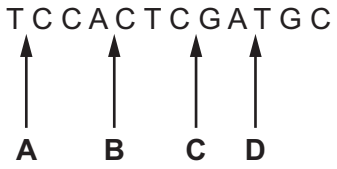
2 forms genetically identical nuclei

3 semi-conservative replication of DNA

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

22 The RNA triplet UAG acts as a stop codon terminating the synthesis of a polypeptide. The diagram shows a strand of DNA which codes for four amino acids.

Where would an insertion mutation of a thymine nucleotide result in the termination of translation?



23 What is correct for uracil?

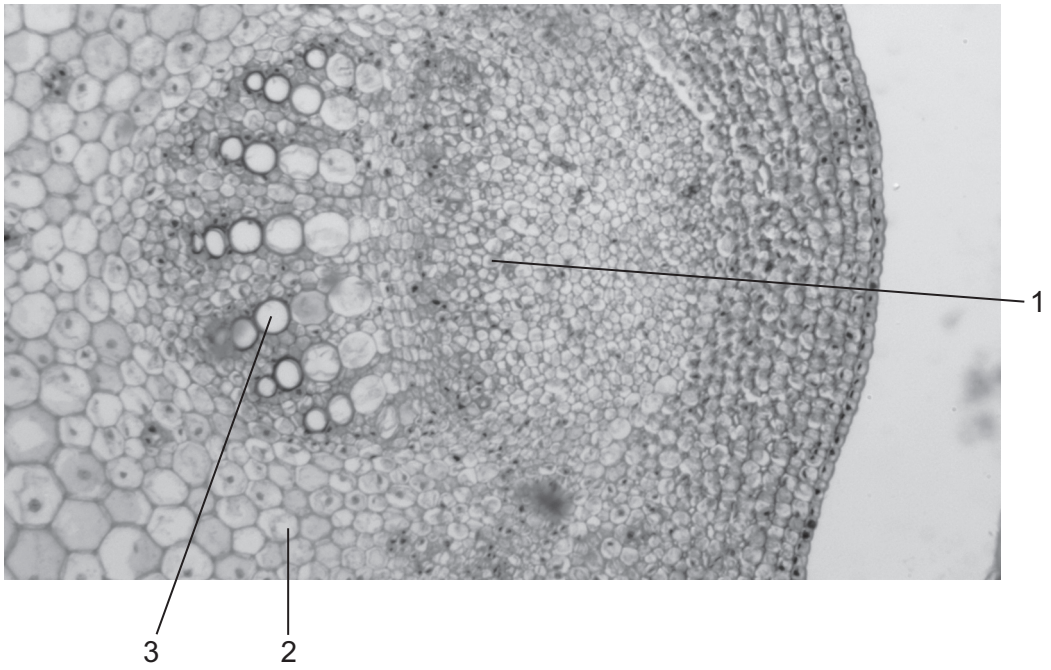
	It has a single ring structure	It is a purine	It joins its complementary base with 2 hydrogen bonds
A	✓	✓	✓
B	✓	✗	✓
C	✗	✓	✗
D	✗	✗	✓

key

✓ = correct

✗ = not correct

24 The photomicrograph shows a vascular bundle.



Which describes the relationship of water potential in the labelled cells?

A Cell 3 is less negative than cell 1.

B Cell 2 is less negative than cell 3.

C Cell 3 is more negative than cells 1 and 2.

D Cells 1, 2 and 3 have the same water potential.

25 Which features have a role in the transport of water in xylem vessel elements?

1 capillary action

2 cohesion

3 hydrogen bonding

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

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26 What is a definition of transpiration?

A the evaporation of water vapour from a leaf due to the diffusion of water from an area of low water potential to high water potential

B the loss of water vapour from a plant to its environment by diffusion down a water potential gradient

C the movement of water from root to leaf due to the adhesion of water molecules to one another

D the uptake of water by plant roots by movement of water down a continuous water potential gradient from air to soil

27 Which are present in the walls of arteries?

	endothelium	smooth muscle	elastic tissue	collagen fibres
A	✓	✓	✓	✓
B	✓	✓	✓	✗
C	✓	✗	✓	✓
D	✗	✓	✗	✓

key
✓ = present
✗ = not present

28 The statements list some of the events in the cardiac cycle. They are not in the correct order.

Which statement describes the fifth of these events to occur in the cardiac cycle?

1 The impulse travels through Purkyne tissue.

2 A wave of excitation sweeps across the atria.

3 The atrioventricular node delays the impulse for a fraction of a second.

4 The sinoatrial node contracts.

5 The wave of excitation sweeps upwards from the base of the ventricles.

6 The ventricles contract.

7 The atria contract.

A 1 **B** 3 **C** 4 **D** 7

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29 Which row correctly identifies the molecules or cells that are present in the different locations?

	type of molecule or cell	blood	lymph	tissue fluid
A	antibodies	✗	✓	✓
B	large plasma proteins	✓	✗	✓
C	lymphocytes	✓	✓	✗
D	phagocytes	✓	✓	✓

key

✓ = present

✗ = not present

30 When active tissues have high carbon dioxide concentrations, oxyhaemoglobin releases oxygen to these tissues.

What encourages this release in the presence of high concentrations of carbon dioxide?

1 carboxyhaemoglobin forms more readily

2 oxyhaemoglobin dissociates more readily

3 haemoglobin needs higher concentrations of oxygen to become saturated

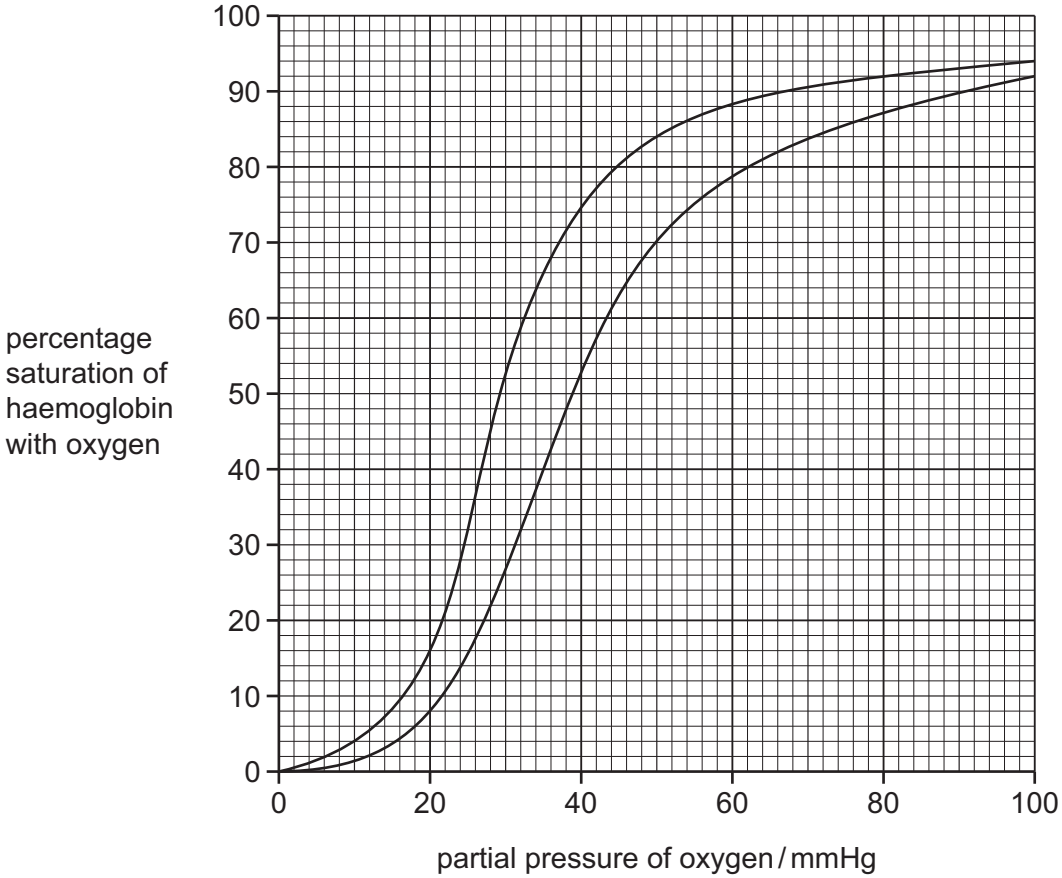
A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

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31 The graph shows oxygen dissociation curves of haemoglobin at two different carbon dioxide concentrations.

The partial pressure of oxygen in the lungs is 100 mmHg.

The partial pressure of oxygen in metabolically active tissues is 35 mmHg.



What is the percentage saturation of haemoglobin with oxygen at the lungs and in metabolically active tissues?

	percentage saturation of haemoglobin with oxygen	
	lungs	metabolically active tissue
A	92	40
B	92	66
C	94	40
D	94	66

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32 Which statement is correct?

A Alveoli have goblet cells to produce mucus to trap pathogens from the air.

B Cartilage in the bronchi keeps the bronchi open and allows air to flow through freely.

C Complete rings of cartilage in the bronchioles make sure that air can reach the alveoli.

D During exercise, muscles in the bronchioles and alveoli relax to allow a greater flow of air.

33 Four types of cell in the gas exchange system are listed.

J alveolus epithelium cell

K ciliated cell

L goblet cell

M smooth muscle cell

The ticks (✓) in the table show specialised features of three of these types of cell.

	many mitochondria	lots of endoplasmic reticulum	many Golgi bodies
1	✓		
2	✓		
3	✓	✓	✓

Which row correctly matches the specialised feature with the correct cell?

	1	2	3
A	J	M	K
B	K	J	M
C	K	M	L
D	M	K	J

34 Some symptoms of chronic obstructive pulmonary disease (COPD) are listed.

1 bursting of alveoli

2 loss of elastic fibres

3 increase in secretion of mucus

4 reduction in surface area for gaseous exchange

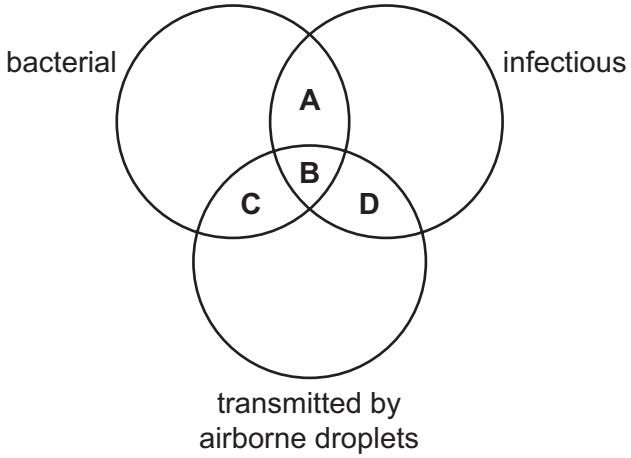
5 narrowing of airways

Which of these are also the symptoms of emphysema?

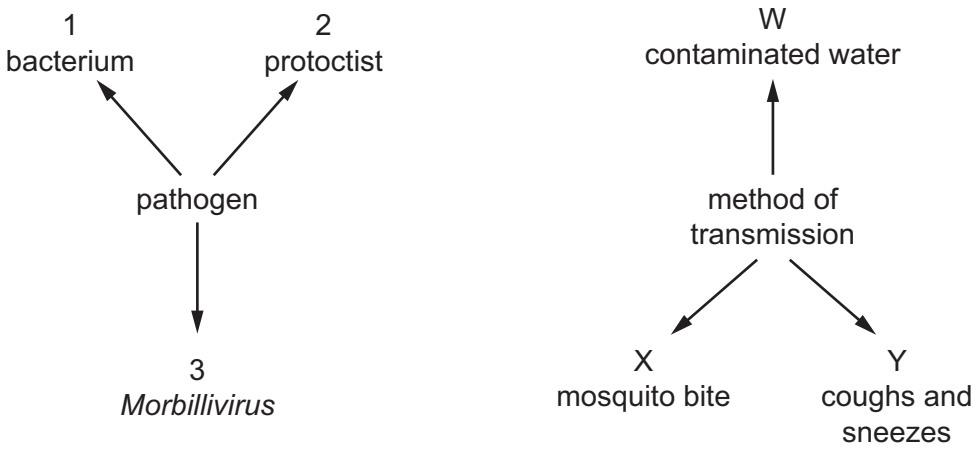
A 1, 2 and 4 **B** 1, 3 and 5 **C** 2, 3 and 5 **D** 3, 4 and 5

35 The diagram shows properties of diseases.

Which shows the properties that are common to tuberculosis (TB) and measles?



36 The diagram shows some of the pathogens that cause disease in humans and some of the ways they are transmitted.



What is the correct pathogen and method of transmission for cholera?

A 1 and W **B** 1 and X **C** 2 and X **D** 3 and Y

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37 Different antibiotics function in different ways. It is important that the antibiotic kills the bacteria, but does not harm the infected human.

The antibiotic tetracycline has been found to affect the way in which human mitochondria function.

Which statements could explain why human mitochondria function is affected by tetracycline?

A The antibiotic prevents the synthesis of peptidoglycan cell walls.

B The antibiotic prevents synthesis of linear DNA.

C The antibiotic prevents translation of circular DNA.

D The antibiotic prevents translation by binding to 70S ribosomes.

38 Immune response to a vaccination against a virus can be assessed by making three measurements:

1 the concentration of anti-virus antibody in the blood

2 the time taken to increase the antibody concentration significantly after a booster vaccination

3 the number of virus-specific lymphocytes per cm^3 blood.

What describes the immunity of an individual when the values of 1, 2 and 3 are all low ten years after vaccination?

A active immunity due to the presence of memory cells

B low immunity due to the absence of antibodies

C low immunity due to the absence of memory cells

D passive immunity due to the presence of antibodies

39 The enzyme telomerase prevents loss of telomeres after many mitotic cell cycles.

Which types of white blood cell involved in an autoimmune condition will contain active telomerase?

	mature B-lymphocyte plasma cells	neutrophils	helper T-lymphocyte memory cells
A	✓	✓	✓
B	✓	✓	✗
C	✗	✗	✓
D	✗	✓	✓

key

✓ = contain active telomerase

✗ = do not contain active telomerase

40 Which features of monoclonal antibodies make them useful in the diagnosis and treatment of disease?

1 A particular monoclonal antibody attaches to a specific antigen.

2 Identical monoclonal antibodies can be produced in large numbers.

3 Binding a monoclonal antibody to its specific antigen may mark that antigen for destruction by white blood cells.

4 Fluorescent or radioactive markers can be attached to a monoclonal antibody to show where the antigen is in the body.

A 1, 2, 3 and 4

B 1, 2 and 3 only

C 2 and 3 only

D 3 and 4 only

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