Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/13**

Paper 1 Multiple Choice **May/June 2025**

1 hour 15 minutes

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

INSTRUCTIONS

- 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 multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.

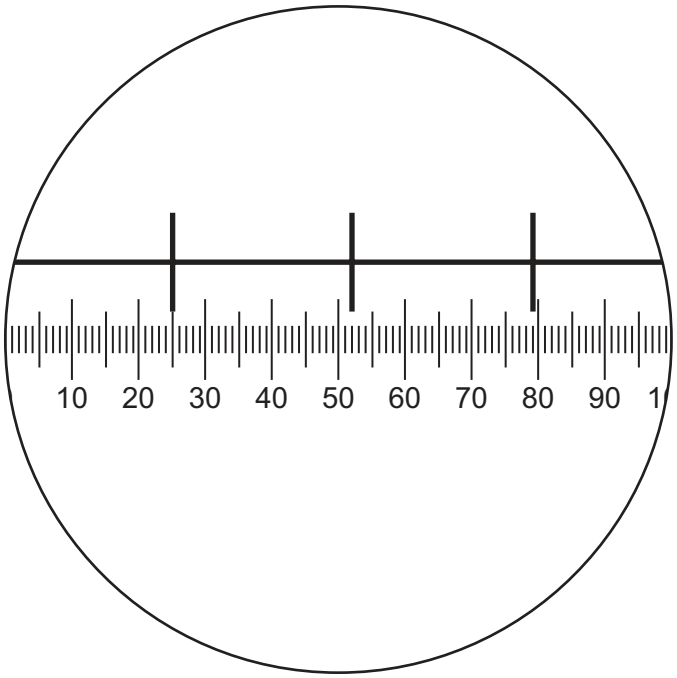
INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark.
- Any rough working should be done on this question paper.

This document has **20** pages. Any blank pages are indicated.

[Turn over

1 The diagram shows a view of an eyepiece graticule being calibrated using a stage micrometer.

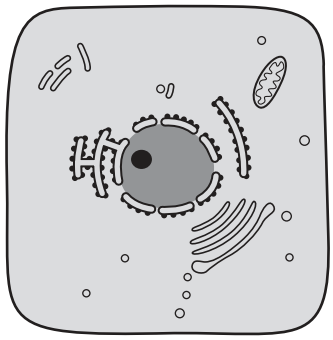


Each division on the stage micrometer scale is 0.1 mm.

Which row shows a correct calculation to calibrate each eyepiece graticule unit and shows the appropriate units?

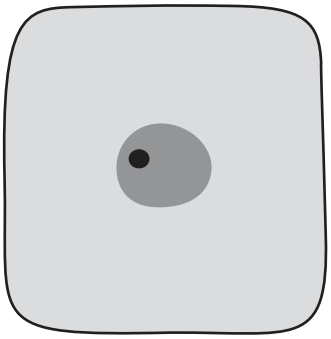
	calculation	units
A	$\frac{0.1}{27} \div 1000$	mm
B	$\frac{0.1}{52} \times 1000$	μm
C	$\frac{0.2}{54} \times 1000$	μm
D	$\frac{0.2}{79} \times 1\,000\,000$	nm

2 The diagram was drawn from an electron micrograph of an animal cell.

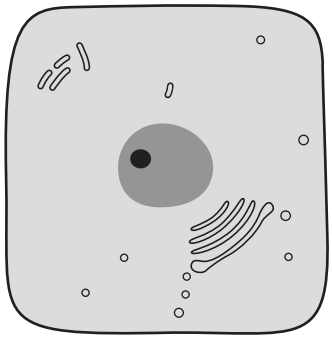


Which diagram would represent the same cell viewed with a simple light microscope, using daylight as the only light source?

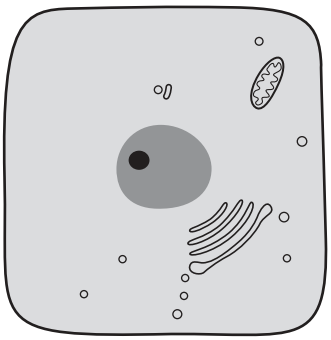
A



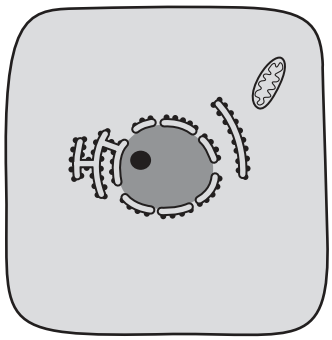
B



C



D



3 *Norovirus* has a diameter of 30 nm.

Mimivirus has a diameter of 400 nm.

Which viruses can be detected using a light microscope with a maximum resolution of 0.25 μm?

	Norovirus	*Mimivirus*
A	✓	✓
B	✗	✗
C	✗	✓
D	✓	✗

key

✓ = can be detected

✗ = **cannot** be detected

4 Which cell structures contain ribosomal RNA?

1 chloroplasts

2 mitochondria

3 nuclei

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

5 Immature red blood cells contain all the usual organelles and cell structures associated with animal cells. Mature red blood cells are specialised cells that have lost their organelles and cell structures.

Which statement correctly compares red blood cells with typical plant cells?

A There are **no** mitochondria in mature red blood cells or plant cells.

B The only ribosomes found in immature red blood cells and plant cells are 80S ribosomes.

C There are **no** centrioles in mature red blood cells or plant cells.

D Immature red blood cells and plant cells contain large permanent vacuoles.

6 A culture of human cells had its cell surface membranes removed, releasing the cell contents.

This material became contaminated by bacteria.

The material was then centrifuged, separating out the various cell structures according to size and mass.

Which cell structure would be separated out along with the bacteria?

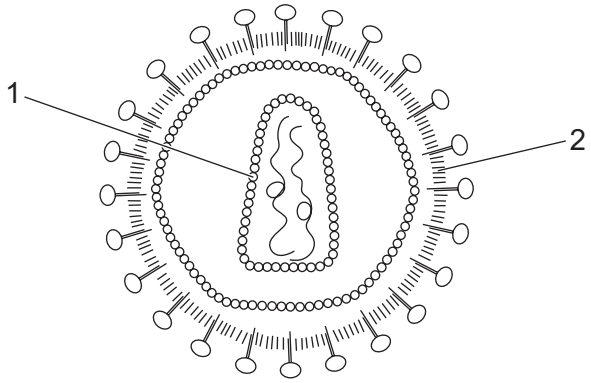
A endoplasmic reticulum

B mitochondria

C nuclei

D ribosomes

7 The diagram shows the structure of a virus.



Which row identifies the correct description of the structures labelled 1 and 2?

	1	2
A	protein coat called the capsid	virus envelope made from phospholipids
B	virus envelope made from phospholipids	protein coat called the capsid
C	virus envelope made from protein	phospholipid coat called the capsid
D	phospholipid coat called the capsid	virus envelope made from protein

8 Which statement about a macromolecule is correct?

A Amylose is a branched polymer made of α-glucose and β-glucose monomers.

B DNA is an association of two polymers made of nucleotide monomers.

C Haemoglobin is an association of four polymers made up of monomers of haem groups and amino acids.

D Triglycerides are polymers made of fatty acids and glycerol.

9 What happens to molecules of sucrose when they are heated with acid?

A Glycosidic bonds are broken by condensation using water, releasing only glucose.

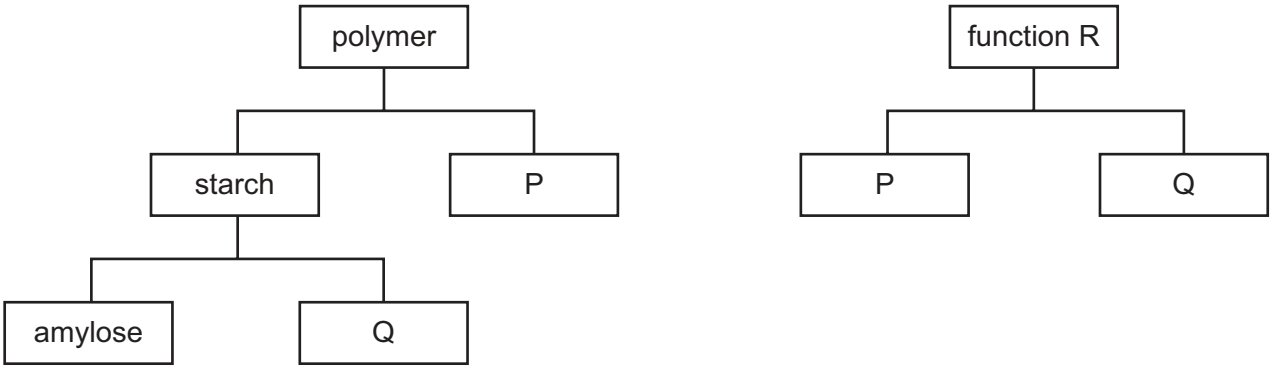
B Glycosidic bonds are broken by condensation, releasing fructose, glucose and water.

C Glycosidic bonds are broken by hydrolysis using water, releasing fructose and glucose.

D Glycosidic bonds are broken by hydrolysis, releasing fructose, glucose and water.

[Turn over

10 The diagrams show how some polymers of glucose can be classified.



Which row correctly identifies P, Q and R?

	polymer P	polymer Q	function R
A	cellulose	amylopectin	structural support
B	glycogen	amylopectin	energy storage
C	cellulose	glycogen	energy storage
D	glycogen	cellulose	structural support

11 Which molecules have products containing a carboxyl group when they are hydrolysed?

1 phospholipids

2 polysaccharides

3 proteins

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

12 Which bonds are involved in maintaining the secondary and tertiary levels of protein structure?

1 disulfide

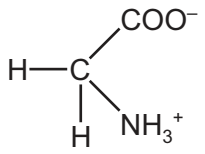
2 hydrogen

3 ionic

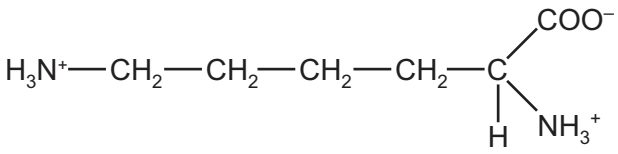
	secondary	tertiary
A	2 only	1, 2 and 3
B	2 and 3 only	2 and 3 only
C	1 and 3 only	1 and 3 only
D	1, 2 and 3	1 only

13 The diagrams show the structure of four amino acids in solution.

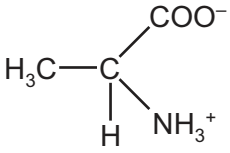
glycine



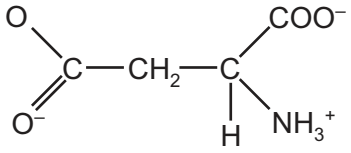
lysine



alanine



aspartate



Which amino acids have **no** overall charge?

A alanine and aspartate

B alanine and glycine

C aspartate and lysine

D glycine and lysine

14 Which property of water means that there are relatively small changes in the temperature of the oceans and of the cytoplasm within cells?

A the high latent heat of vaporisation of water

B the high specific heat capacity of water

C the low specific heat capacity of water

D the low latent heat of vaporisation of water

15 Histidine and proline are two amino acids commonly found in enzymes.

Histidine has a polar R-group and proline has a non-polar R-group.

Where would most histidines and prolines be positioned?

	histidine	proline
A	inside an enzyme	on the surface of an enzyme
B	on the surface of an enzyme	on the surface of an enzyme
C	inside an enzyme	inside an enzyme
D	on the surface of an enzyme	inside an enzyme

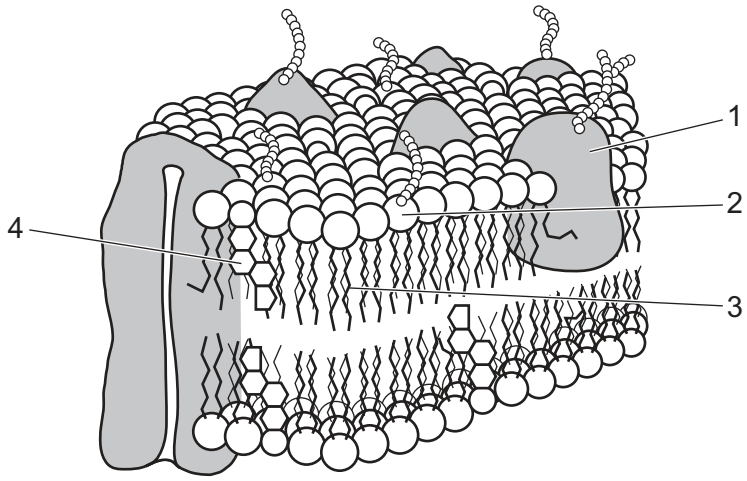
[Turn over

16 The activity of an enzyme can be affected by a competitive inhibitor.

Which row is correct for the effect of a competitive inhibitor on the value of K_m and the reason for this?

	effect of a competitive inhibitor on the value of K_m	reason
A	increased	Few substrate molecules will bind to the active site when the substrate concentration is low because the active site is blocked by the inhibitor.
B	increased	V_{max} will increase because the substrate will only bind to the active site when the concentration of the substrate is high.
C	no effect	At high substrate concentrations, substrate molecules are still able to bind to the enzymes in the presence of a competitive inhibitor.
D	no effect	The inhibitor molecule does **not** bind to the active site; it binds to a site on another part of the enzyme.

17 The diagram shows part of a eukaryotic cell surface membrane.



Which components act as antigens in cell surface membranes?

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

18 Descriptions of three biological molecules found in cell surface membranes are given.

- X is a molecule comprised of carbon, hydrogen and oxygen, with a non-polar region and one region that extends out of the membrane capable of forming hydrogen bonds.
- Y is a molecule with a hydrophilic end that forms hydrogen bonds with the water outside the membrane, and a hydrophilic region that is located within the cell membrane.
- Z is a molecule that can position itself within the membrane due to a hydrophilic region at one end and two hydrophobic extensions that are positioned within the membrane.

Which row correctly identifies a carrier protein and a glycolipid?

	carrier protein	glycolipid
A	X	Z
B	X	Y
C	Z	Y
D	Y	X

19 Antimycin is a chemical that inhibits the function of mitochondria.

Which methods of transport across the cell surface membrane could be directly affected by antimycin?

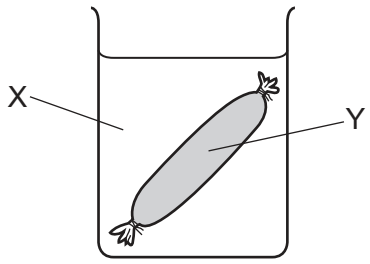
1 active transport

2 facilitated diffusion

3 endocytosis

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

20 A student half filled a beaker with solution X. They placed a sealed Visking tubing bag containing solution Y into the beaker.



At 30 minutes, the solution in the beaker was orange and the solution inside the Visking tubing was blue-black.

What did solutions X and Y contain at the start to give these results?

	solution X	solution Y
A	starch	amylase and iodine
B	iodine	amylase
C	starch and amylase	iodine
D	iodine	starch

21 A cell is in mitosis. Each of the chromosomes in the cell consists of two chromatids. The chromosomes are **not** lined up at the equator.

Which stage of mitosis is described?

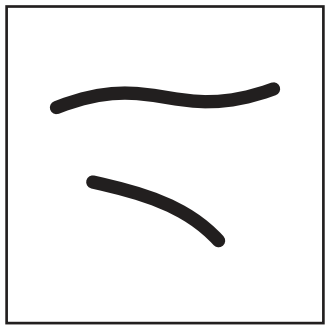
A prophase

B metaphase

C anaphase

D telophase

22 The diagrams show two stages of the cell cycle in different organisms.



The number of specific structures in each diagram is counted.

Which row shows the correct **combined** total for the different structures?

	chromosomes	centromeres	telomeres
A	5	3	8
B	5	5	16
C	8	3	16
D	8	5	8

23 Which statements about tRNA are correct?

1 Hydrogen bonds between bases temporarily bond tRNA to mRNA.

2 The base sequences in the tRNA molecules are the same as the base sequences in the mRNA that is being translated.

3 Some codons in mRNA do **not** have corresponding tRNA anticodons.

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

24 Why is the genetic code described as universal?

A Each codon is made up of a sequence of three bases.

B More than one codon can represent one amino acid.

C Mutations can change the genetic code in all organisms.

D The genetic code is the same in all organisms.

25 What correctly identifies the number and type of bonds between cytosine and guanine in a DNA molecule?

A 2 hydrogen bonds

B 2 phosphodiester bonds

C 3 hydrogen bonds

D 3 phosphodiester bonds

26 Three proteins that have a quaternary structure are listed.

- Type IX collagen is formed from three different polymers.
- The main form of haemoglobin contains two alpha globins and two beta globins.
- HIV protease consists of two identical polymers.

Which row shows the correct number of genes needed to code for each protein?

	number of genes		
	type IX collagen	haemoglobin	HIV protease
A	1	2	2
B	1	4	1
C	3	2	1
D	3	4	2

27 The photomicrograph shows a section of vascular tissue from the stem of a plant.

×80

Which description of this photomicrograph is correct?

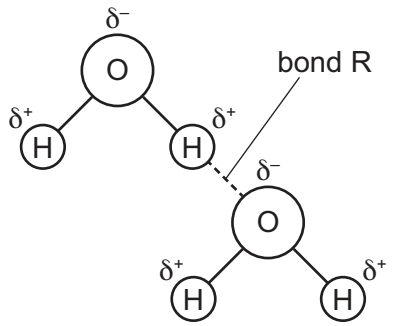
A a transverse section showing xylem tissue

B a longitudinal section showing xylem tissue

C a transverse section showing phloem tissue

D a longitudinal section showing phloem tissue

28 The diagram shows a bond between two molecules transported in a xylem vessel.



Which row correctly names bond R and states the role of the bond between these molecules for their transport in a xylem vessel?

	name of bond R	role of the bond between these molecules for their transport in a xylem vessel
A	hydrogen	adhesion of the molecules to the wall of the xylem vessel
B	hydrogen	cohesion of the molecules in the lumen of the xylem vessel
C	ionic	adhesion of the molecules to the wall of the xylem vessel
D	ionic	cohesion of the molecules in the lumen of the xylem vessel

29 How can water and solutes move through a leaf?

A through the lignified endodermis using the apoplast pathway

B through the cytoplasm of cells using the symplast pathway

C through the cell walls containing cellulose by osmosis

D through the cell walls containing suberin by diffusion

30 Atrial septal defect (ASD) is a heart defect found in some newborn babies. ASD is an opening between the right and left atria.

What are possible effects for babies born with ASD compared with babies born with **no** ASD?

	blood in pulmonary artery	blood in aorta
A	less oxygen	same level of oxygen
B	less oxygen	more oxygen
C	more oxygen	same level of oxygen
D	more oxygen	more oxygen

31 Which statement is correct?

A The contraction of heart muscle causes blood to enter arteries that pump the blood to organs, causing the formation of tissue fluid between cells before returning to the heart in veins.

B The heart connects two types of blood vessels so that oxygen from the lungs can be distributed by red blood cells and wastes can be collected from tissues directly into blood plasma for removal.

C The heart muscle contracts and relaxes which causes molecules such as carbon dioxide and antibodies to be transported in blood plasma through blood vessels that connect different parts of the body.

D The heart provides enough pressure to push blood through arteries to capillaries between cells, causing filtration of blood and the formation of tissue fluid which diffuses back into veins.

32 What describes the function of the atrioventricular node of the heart?

A It causes the muscles of the atria to contract.

B It delays the transmission of a wave of electrical activity from the sinoatrial node.

C It initiates a new wave of electrical activity in the ventricles.

D It provides a non-conducting barrier between the atria and the ventricles.

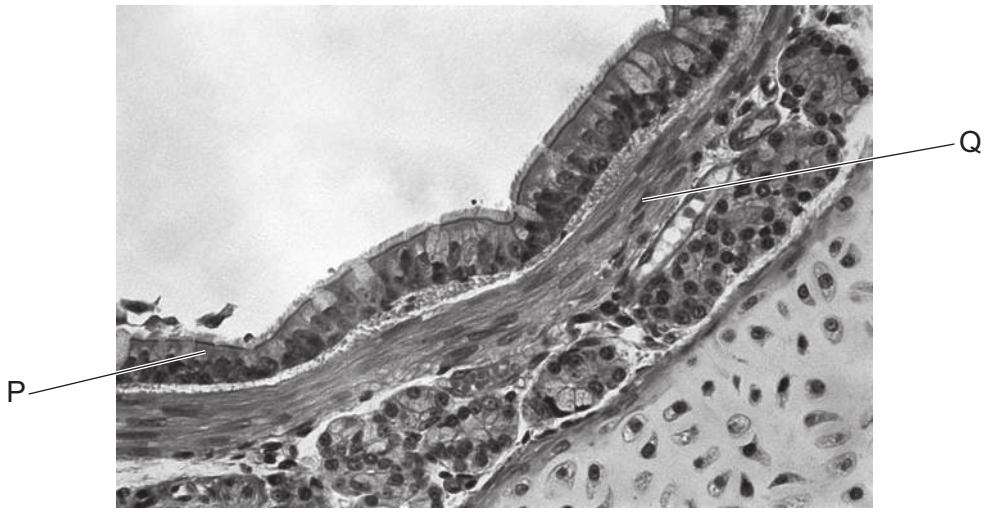
[Turn over

33 A sample of adult haemoglobin was tested to determine its saturation with oxygen. All other variables were standardised. At a partial pressure of 0 kPa, the saturation was 0%. The saturation reached 97% at a partial pressure of 14 kPa.

Which row shows the possible percentage saturation of haemoglobin at some intermediate partial pressures?

	2 kPa	4 kPa	7 kPa	12 kPa
A	5	10	15	40
B	10	25	40	65
C	15	56	80	93
D	60	80	90	95

34 The photomicrograph shows a transverse section of part of the human gas exchange system.



Which row shows the label and function of smooth muscle?

	label	function
A	P	regulates air flow towards the gas exchange surfaces
B	Q	pumps air towards the gas exchange surfaces
C	P	pumps air towards the gas exchange surfaces
D	Q	regulates air flow towards the gas exchange surfaces

35 Which feature of the human gas exchange system helps to maintain a steep diffusion gradient?

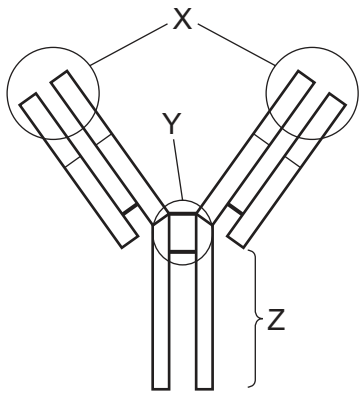
A A large number of alveoli are present in each lung.

B Alveoli walls contain elastic fibres allowing expansion.

C The air brought into the alveoli has a high concentration of oxygen.

D The endothelium of the capillary wall is made of flattened cells.

36 The diagram shows the structure of an antibody.



Which statements about the antibody are correct?

1 X has a similar shape to the antigen.

2 Y is the hinge region held by disulfide bonds.

3 Z is a constant region which binds to receptors on B-lymphocytes.

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

37 Which statement is a possible description of how resistance to penicillin may develop in bacteria?

A A mutation of a bacterial gene prevents penicillin from binding to DNA in bacterial cells, which allows DNA replication to continue.

B A mutation of a bacterial gene causes penicillin to bind less readily to certain proteins, which allows bacteria to continue producing cell walls.

C A mutation of a bacterial gene allows the production of an enzyme that breaks down penicillin, which allows the ribosomes to continue functioning.

D A mutation of a bacterial gene changes the tertiary structure of an enzyme that penicillin inhibits, which allows bacteria to continue producing cell membranes.

38 Some events that happen during phagocytosis are listed.

1 Molecules on the surface of a pathogen bind to the cell surface membrane of a phagocyte.

2 Endocytosis takes place forming a specialised vesicle.

3 Enzymes catalyse hydrolysis reactions.

4 Lysosomes migrate through the cytoplasm and fuse with an organelle.

What is the correct order of these events during phagocytosis?

A $1 \rightarrow 2 \rightarrow 4 \rightarrow 3$

B $1 \rightarrow 4 \rightarrow 2 \rightarrow 3$

C $3 \rightarrow 2 \rightarrow 4 \rightarrow 1$

D $3 \rightarrow 4 \rightarrow 2 \rightarrow 1$

39 What are the functions of plasma cells during an immune response?

1 to destroy cancer cells

2 to differentiate into memory cells

3 to secrete antibodies

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

40 Which disease is caused by a eukaryotic pathogen?

A cholera

B HIV/AIDS

C malaria

D tuberculosis

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