Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/11**

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.

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1 Which statements about light microscopes are correct?

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

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

3 The divisions on the scale on a stage micrometer are closer together than the divisions on the scale on an eyepiece graticule.

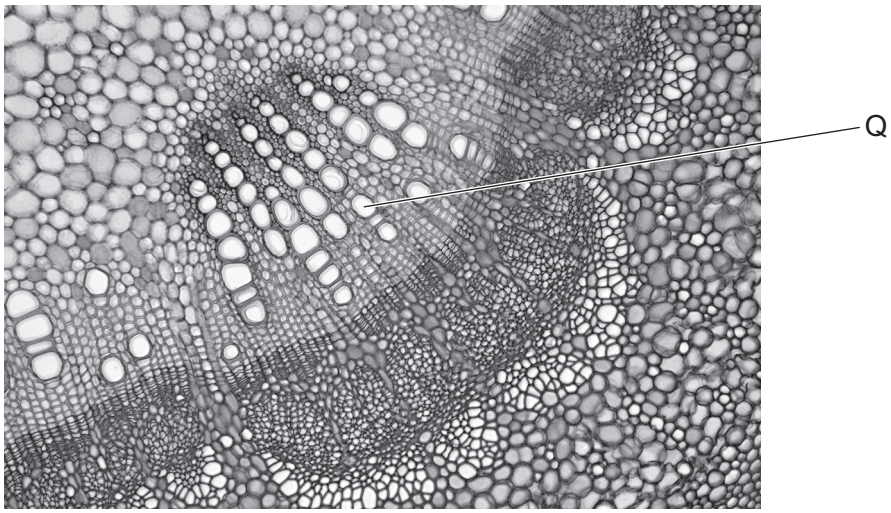
A 1, 2 and 3 **B** 1 and 2 only **C** 2 only **D** 3 only

2 A student measured the width of a mitochondrion in an electron micrograph of an animal cell with a magnification of ×9600. The width was 6 mm.

What was the actual width of the mitochondrion?

A 6 μm **B** 0.6 μm **C** 0.06 μm **D** 0.006 μm

3 The photomicrograph shows a section of the stem of a plant.



Which statements could describe Q?

1 The cell wall contains pits.

2 The cell wall contains cellulose and also lignin.

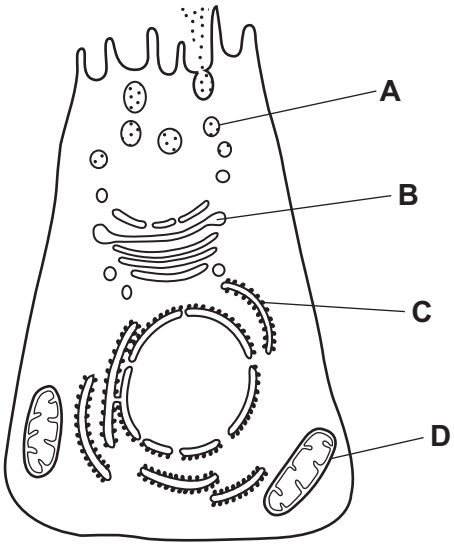
3 It is connected to adjacent cells via plasmodesmata.

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

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4 The diagram is taken from an electron micrograph of a cell that secretes enzymes.

Where are the polypeptides for these enzymes made?



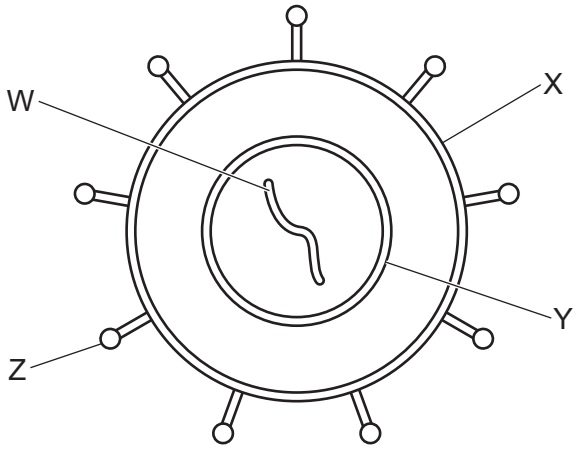
5 Which comparisons between a typical bacterial cell and a typical plant cell are correct?

	bacterial cell	plant cell
1	cytoplasmic DNA	nuclear DNA
2	no smooth ER present	smooth ER present
3	peptidoglycan cell walls found	cellulose cell walls found
4	80S ribosomes	70S ribosomes

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

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6 The diagram shows a virus.



Which row correctly identifies the labelled biological molecules?

	W	X	Y	Z
A	RNA	proteins	phospholipids	carbohydrates
B	DNA	phospholipids	proteins	proteins
C	DNA	proteins	proteins	carbohydrates
D	RNA	phospholipids	phospholipids	proteins

7 The iodine test and the Benedict's test were carried out on samples of a starch solution. Amylase was added to another sample of the starch solution and incubated for 10 minutes. The Benedict's test was then carried out on this sample.

What were the results of the tests?

	iodine test before adding amylase	Benedict's test before adding amylase	Benedict's test after adding amylase
A	✗	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✗	✗

key

✓ = positive result

✗ = negative result

8 Which row about α-glucose and β-glucose molecules is correct?

	carbon atom on which the OH position is different	cellulose contains both molecules
A	1	no
B	1	yes
C	4	no
D	4	yes

9 Which molecules are monosaccharides?

1 ribose

2 glucose

3 deoxyribose

4 sucrose

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

10 Many animals use triglycerides for long-term energy storage.

Which statements are correct additional functions of triglycerides?

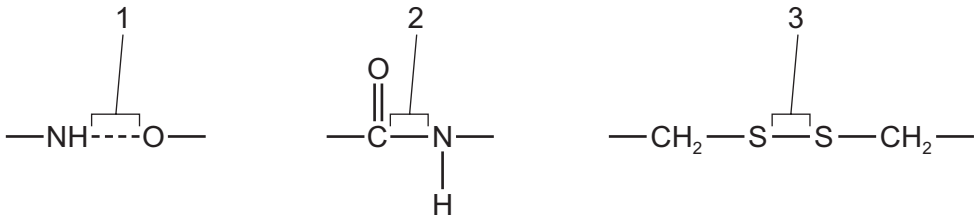
1 They provide buoyancy in some marine animals.

2 They are the main components of cell membranes.

3 They are used as thermal insulation.

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

11 The diagrams show three different bonds.



Which bonds are found in proteins?

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

12 What describes the quaternary structure of a collagen molecule?

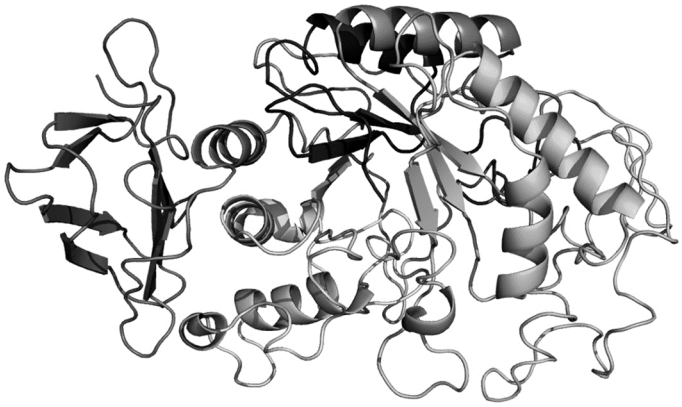
A polypeptides that form an α-helix, which are held together by covalent bonds

B polypeptides that form a double helix, which are held together by hydrogen bonds

C four polypeptides that are held together by covalent bonds, which form a helix

D three polypeptides that form helix structures, which are held together by hydrogen and covalent bonds

13 The diagram shows the structure of the enzyme amylase.



Which level of protein structure results in the folding of amylase into its globular shape?

A primary

B secondary

C tertiary

D quaternary

14 Which statement explains why large volumes of water maintain a constant temperature when the air temperature increases?

A The latent heat of vaporisation of water is high.

B The specific heat capacity of water is high.

C Each water molecule can form a hydrogen bond with a maximum of three water molecules.

D Water is able to evaporate rapidly from a surface with little loss of heat.

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15 Which statements about the mode of action of an enzyme are correct?

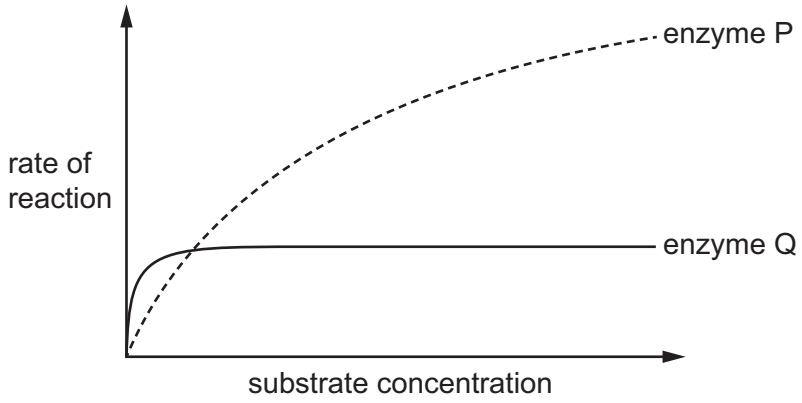
1 Some enzymes have a region on their surface to which the substrate has a complementary shape.

2 Some enzymes and their substrates can change shape slightly as the substrate enters the active site.

3 Enzymes permanently change shape when they react with their substrates to form an enzyme–substrate complex.

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

16 The graph shows the effect of increasing substrate concentration on the rate of reaction of two enzymes that catalyse reactions with the same substrate.



Which statement is correct?

A Enzyme Q has a higher K_m and a higher affinity for the substrate than enzyme P.

B Enzyme Q has a higher K_m and a lower affinity for the substrate than enzyme P.

C Enzyme Q has a lower K_m and a higher affinity for the substrate than enzyme P.

D Enzyme Q has a lower K_m and a lower affinity for the substrate than enzyme P.

17 The cell surface membrane structure is described as a ‘fluid mosaic’.

What correctly describes the ‘mosaic’ part of the cell surface membrane?

A the different patterns that are obtained by the moving phospholipid molecules

B the random distribution of cholesterol molecules within the phospholipid bilayer

C the regular pattern produced by the phospholipid heads and membrane proteins

D the scattering of the different proteins within the phospholipid bilayer

18 A student immersed a plant tissue in solution S.

For the next 30 minutes, the student used a microscope to observe the cells in the plant tissue.

During this time, the cytoplasm of the cells shrunk and no longer pushed up against the cell wall. In many cells, a space appeared between the cytoplasm and the cell wall.

Which statements are correct conclusions from these observations?

1 The water potential in solution S was more negative than the water potential in the cytoplasm of the cells at the start of the experiment.

2 Without a cell wall to provide support, it is likely that many of the cells would have burst.

3 The clear space between the cell wall and the cytoplasm of many of the cells was filled with air.

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

19 A sample of 500 cells dividing by mitosis was examined to identify the stage of mitosis for each cell.

The table shows the results.

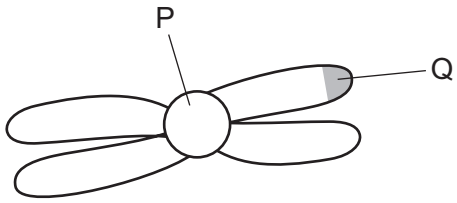
stage of mitosis	percentage of cells in the stage
late prophase	23
end of metaphase	45
between the start of anaphase and the end of telophase	24

Which row is correct?

	number of cells with chromosomes at the equator of the cell	number of cells with separated chromatids
A	225	120
B	225	345
C	380	120
D	380	345

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20 The diagram shows a chromosome.



What are structures P and Q?

	P	Q
A	centriole	chromatid
B	centromere	telomere
C	centromere	centriole
D	centriole	telomere

21 Which processes are used by stem cells during tissue repair?

1 cytokinesis

2 DNA replication

3 transcription

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

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

Which cells transcribe a high concentration of telomerase?

1 neutrophils

2 mature red blood cells

3 activated memory T-lymphocytes

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

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23 Which statements are correct?

1 All polypeptides are coded for by genes.

2 All genes are made up of a sequence of nucleotides.

3 All gene mutations result in a change to the nucleotide sequence.

4 All gene mutations will result in an altered polypeptide.

A 1, 2, 3 and 4

B 1, 2 and 3 only

C 1 and 4 only

D 2 and 3 only

24 A double-stranded DNA molecule was analysed and 29% of its nucleotide bases were found to be adenine.

Which percentage of its nucleotide bases will be cytosine?

A 21% **B** 29% **C** 42% **D** 58%

25 In some cells, non-coding sequences of RNA are removed after transcription.

Which row correctly states the name of these non-coding sequences of RNA and the type of cell in which the non-coding sequences are removed?

	name of non-coding sequences	type of cell in which non-coding sequences are removed
A	exons	eukaryotic
B	exons	prokaryotic
C	introns	eukaryotic
D	introns	prokaryotic

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26 Water potentials were measured inside a leaf cell, in the air spaces of the leaf and in the atmosphere.

Which values of water potential (Ψ) would allow water to move from the leaf to the atmosphere?

	Ψ inside the leaf cell / MPa	Ψ of air spaces / MPa	Ψ of atmosphere / MPa
A	–1	–7	–100
B	–100	–7	–1
C	1	7	100
D	100	7	1

27 Three samples of liquid were taken from different locations in a plant and tested to measure the concentration of four solutes. The results are shown.

sample	concentration of solute / mol m^{-3}			
	sucrose	nitrate ions	amino acids	magnesium ions
1	652	0.14	41	3.4
2	0.12	7.1	7.2	1.1
3	433	0.6	68	3.7

Which samples have been taken from phloem sieve tube elements?

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

28 A heated band was wrapped around the stem of a plant at a height of 1 m above the ground and left for 10 minutes.

How will heating a small section of the stem to 60 °C affect the transport of phloem sap and xylem sap between the roots and leaves?

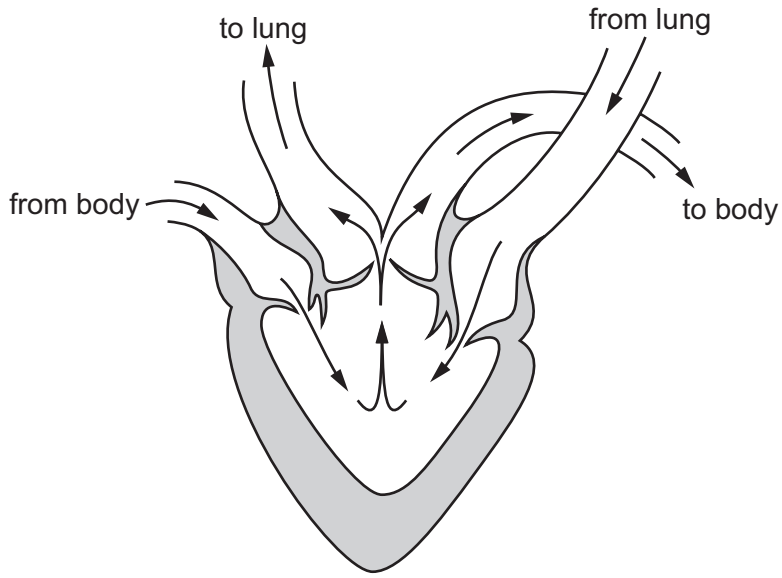
	transport of phloem sap	transport of xylem sap
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

key

✓ = transport continues

✗ = transport stops

29 The diagram shows the structure of an amphibian heart and the movement of blood through it.



Which statements about differences between the amphibian heart and a human heart are correct?

1 The hearts have a different number of ventricles.

2 The hearts have a different number of atrioventricular valves.

3 A septum is absent in the amphibian heart and a septum is present in the human heart.

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

30 A mutation in one of the genes that codes for haemoglobin changes the affinity of haemoglobin for oxygen.

This mutation lowers the partial pressure of oxygen at which haemoglobin is 50% saturated with oxygen.

Which row shows the effect of the mutation on the affinity of haemoglobin for oxygen and the change in the position of the oxygen dissociation curve for haemoglobin?

	the effect of the mutation on the affinity of haemoglobin for oxygen	change in the position of the oxygen dissociation curve for haemoglobin
A	higher	shift to the left
B	higher	shift to the right
C	lower	shift to the left
D	lower	shift to the right

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31 Which processes are responsible for the Bohr shift?

1 Carbon dioxide reacts with haemoglobin to form carbaminohaemoglobin.

2 Carbon dioxide reacts with water to form carbonic acid.

3 Haemoglobinic acid is formed from the dissociation of carbonic acid.

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

32 A student viewed a drop of human blood with a microscope and described a cell as having a very large diameter and a U-shaped nucleus that occupies half the volume of the cell.

Which type of cell was the student viewing?

A monocyte

B neutrophil

C red blood cell

D lymphocyte

33 How many times must an oxygen molecule pass through a cell surface membrane to get from the air in the alveolus to the haemoglobin in a red blood cell?

(Assume there are no pores between the cells the oxygen molecule must pass through.)

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

34 Asthma can affect children and adults. The air passages become narrower, severely restricting the flow of air into the lungs.

Salbutamol is a drug that widens the air passages to relieve the symptoms of asthma.

How does salbutamol relieve the symptoms of asthma?

A It decreases mucus secretions in the terminal bronchioles.

B It decreases the surface area of the alveoli.

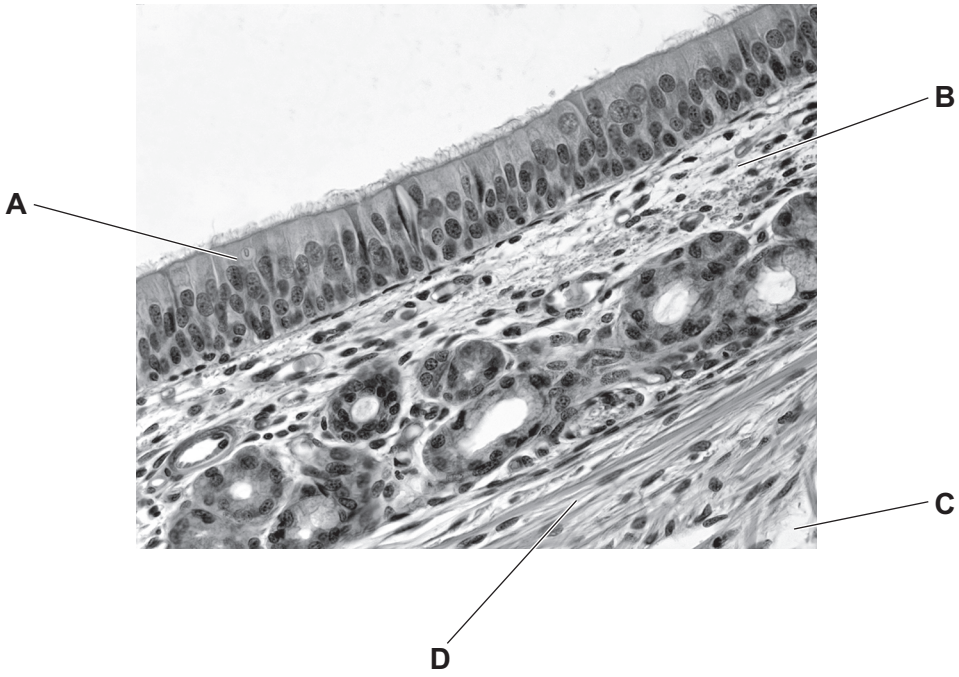
C It causes recoil of elastic tissue in the bronchioles.

D It relaxes smooth muscle in the bronchi and bronchioles.

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35 The photomicrograph shows the transverse section of part of the trachea.

Which letter represents a tissue that can contract and relax to adjust the diameter of the airways?



36 Which statements about an infectious disease may be correct?

1 It can be caused by a protoctist.

2 It can be transmitted by an insect vector.

3 It can be transmitted from mother to child.

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

37 Which statements explain why cholera has **not** been eradicated by vaccination?

1 There is limited availability of an affordable vaccine.

2 Protection takes several weeks to develop after vaccination.

3 The under-reporting of cholera in the community.

4 Immunity to cholera decreases after two years.

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

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38 Antibiotic resistance is a serious threat to global health.

Which statement describes a step that can be taken to reduce the impact of antibiotic resistance?

A Antibiotics prescribed by a doctor should be shared with family members to protect them.

B Antibiotics should only be used to treat infectious diseases caused by viruses.

C Farmers should give antibiotics to healthy animals to prevent infections occurring.

D Vaccination programmes should be used to reduce the spread of bacterial diseases.

39 Tetanus is an infectious disease caused by a type of bacterium. This bacterium produces a protein that is a toxin which causes illness.

Scientists have produced a vaccine for tetanus which contains a harmless form of the toxin called a toxoid.

The toxoid is produced by mixing the toxin with the chemical formaldehyde. This chemical binds to the toxin making it harmless.

Which statement about the tetanus vaccine is correct?

A After vaccination, the toxoid in the vaccine will be ingested by neutrophils and displayed in their cell surface membranes.

B The tetanus vaccine containing the toxoid does **not** contain antigens because it does **not** contain any cells of the pathogen.

C The toxoid protein in the vaccine stimulates the production of antibodies which remain in the blood to provide long-term immunity.

D When formaldehyde binds to the toxin, it causes the toxin to completely change shape.

40 What is an effect on the immune system of a reduced number of T-helper cells?

A a decrease in the destruction of infected body cells by T-helper cells

B a decrease in the activation of B-lymphocytes

C an increase in the activation of T-killer cells

D an increase in the production of plasma cells

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BIOLOGY **9700/12**

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INFORMATION

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

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1 Which row shows possible uses of an eyepiece graticule?

	comparing the diameter of two cells viewed with a ×40 objective lens	calibrating a stage micrometer viewed with a ×10 objective lens
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

key

✓ = possible

✗ = **not** possible

2 Which statement about a light microscope is correct?

A As the distance to see two points as separate points decreases, the resolution also decreases.

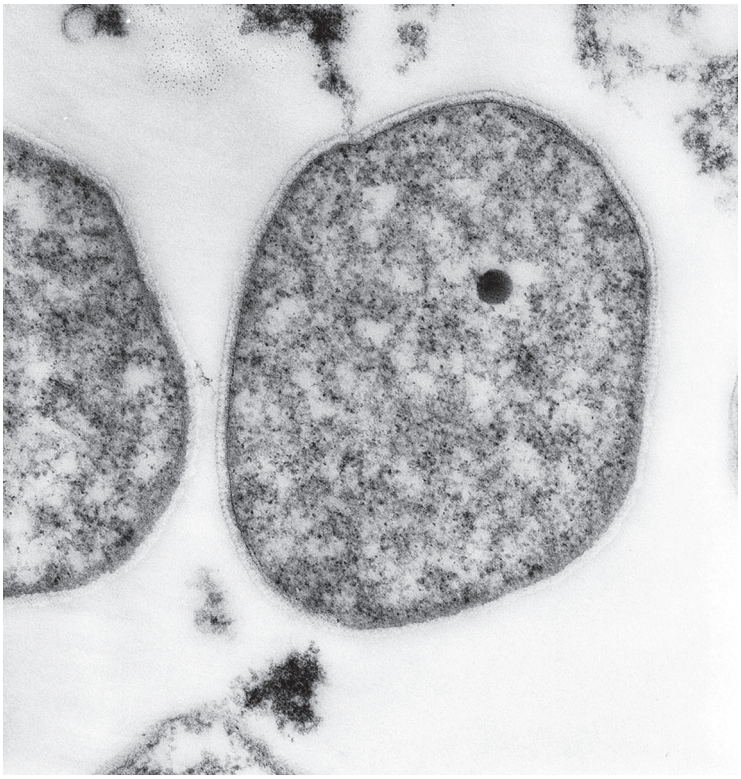
B A bacterium 0.2 μm in diameter will **not** be visible if the resolution is 220 nm.

C Two membranes that are less than 300 nm apart will be visible as two separate membranes if the wavelength of light is 600 nm.

D The resolution will improve with visible light of a longer wavelength, such as red light.

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3 The electron micrograph shows a cell.



×108 000

What is the actual maximum length of the cell?

A 0.509 μm **B** 0.676 μm **C** 1.48 μm **D** 6.76 μm

4 The table compares some biochemical molecules of P, Q, R and S.

	chlorophyll	DNA	RNA	peptidoglycan
P	✓	✓	✓	✗
Q	✗	✓	✓	✗
R	✗	✓	✓	✓
S	✗	✗	✓	✗

key
✓ = present
✗ = **not** present

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

	P	Q	R	S
A	chloroplast	virus	mitochondrion	bacterium
B	chloroplast	mitochondrion	bacterium	virus
C	mitochondrion	virus	bacterium	chloroplast
D	virus	bacterium	mitochondrion	chloroplast

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5 Which cell structures contain enzymes **and** are enclosed by a double membrane?

1 nucleus

2 mitochondrion

3 chloroplast

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

6 What is the order of size of cell structures?

	largest →			smallest
A	centrioles	ribosomes	lysosomes	nucleoli
B	centrioles	nucleoli	lysosomes	ribosomes
C	nucleoli	lysosomes	centrioles	ribosomes
D	nucleoli	centrioles	ribosomes	lysosomes

7 A sample of a solution of sucrose tested for reducing sugars remains blue, but when another sample of the same solution is tested for non-reducing sugars the solution turns red.

What explains these results?

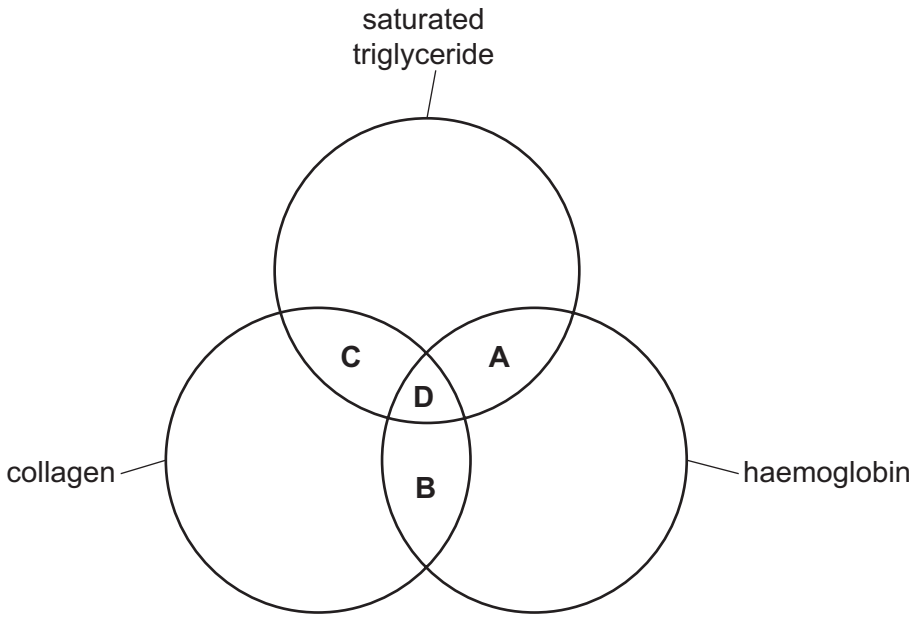
A During the non-reducing sugar test, an acid hydrolyses sucrose to glucose and fructose.

B During the non-reducing sugar test, sucrose molecules condense into polysaccharides.

C The reducing sugar test converts sucrose into glucose and fructose.

D The reducing sugar test hydrolyses monosaccharides to disaccharides.

8 Which molecules contain at least two double bonds?



9 Amylose, amylopectin and glycogen are all polysaccharides.

Enzyme X removes one maltose molecule at a time from the ends of a polysaccharide molecule by hydrolysis of α-1,4-glycosidic bonds.

Which row shows how completely each of these molecules will be hydrolysed by enzyme X?

(Assume that each polysaccharide is composed of the same number of monomers before hydrolysis begins.)

	least completely hydrolysed ⟶		most completely hydrolysed
A	amylose	amylopectin	glycogen
B	amylose	glycogen	amylopectin
C	glycogen	amylose	amylopectin
D	glycogen	amylopectin	amylose

10 Which property of water enables sweating to be an efficient means of losing heat from the body?

A The latent heat of vaporisation of water is high.

B The specific heat capacity of water is high.

C Each water molecule can form a hydrogen bond with four water molecules.

D The forces of cohesion and adhesion on water molecules are very high.

11 Which bonds are found in the levels of structure of a protein molecule?

	primary structure	secondary structure	quaternary structure
A	covalent bond	hydrogen bond	peptide bond
B	covalent bond	ionic bond	disulfide bond
C	peptide bond	hydrogen bond	ionic bond
D	peptide bond	ionic bond	disulfide bond

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12 Prokaryotes and eukaryotes use extracellular enzymes.

Extracellular digestive enzymes are found in the external environments of some prokaryotes.

Some prokaryotes are digested by hydrolytic enzymes during phagocytosis by eukaryotic cells.

Which row shows the locations where extracellular enzymes are produced?

	site of production of digestive enzymes used by prokaryotes	site of production of hydrolytic enzymes used by eukaryotic phagocytes
A	inside cells	inside cells
B	inside cells	outside cells
C	outside cells	inside cells
D	outside cells	outside cells

13 Amylase breaks down starch molecules.

Which substance will have the same number of molecules for the duration of this reaction?

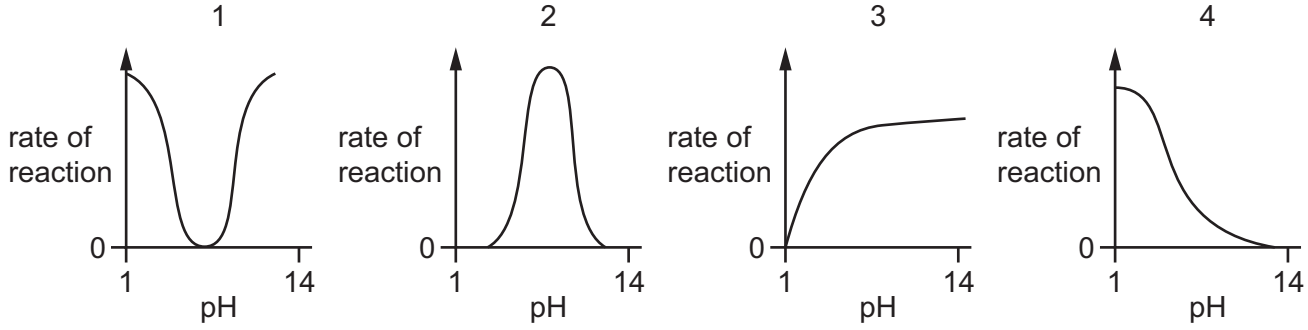
A amylase

B water

C maltose

D amylose

14 Which graphs could show the effect of pH on the rate of enzyme-catalysed reactions?



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

15 After a heart attack, the enzyme lactate dehydrogenase leaks into the blood plasma from damaged heart muscle.

What is required to measure the activity of lactate dehydrogenase activity in a sample of blood plasma?

	sterilisation of blood plasma by heating	incubation of sample with substrate for lactate dehydrogenase	incubation of sample with lactate dehydrogenase inhibitor
A	✓	✓	✓
B	✗	✓	✓
C	✗	✓	✗
D	✗	✗	✓

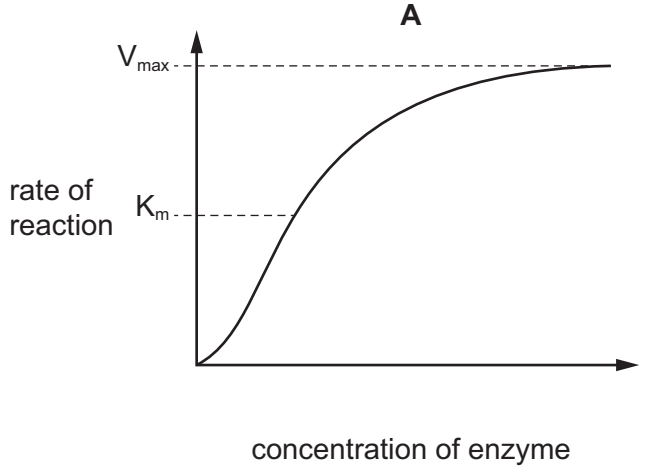
key

✓ = required

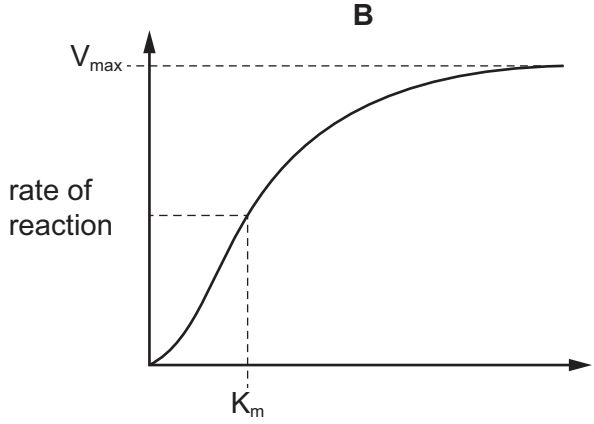
✗ = **not** required

16 Which graph correctly shows K_m and V_{max}?

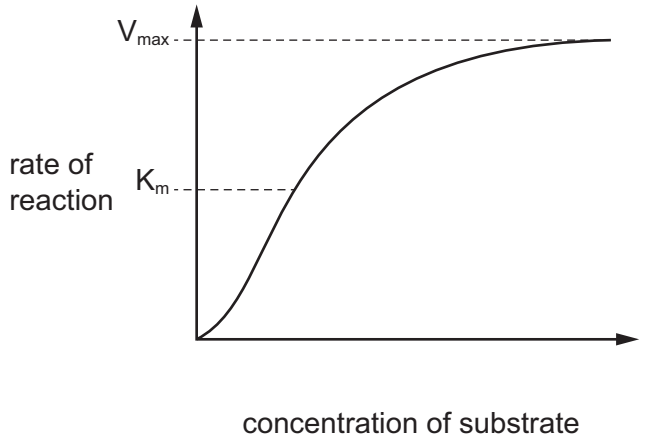
A



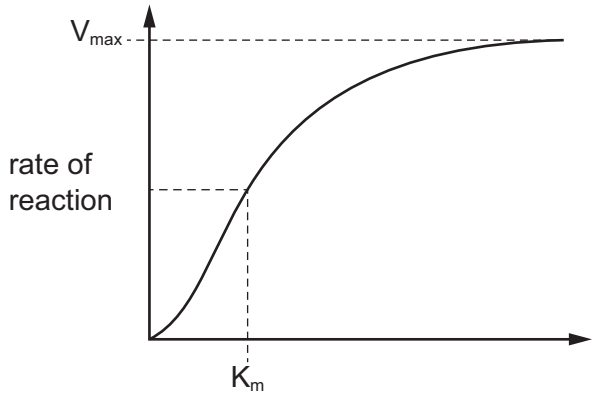
B



C



D



17 Cell membranes become less fluid as the temperature decreases.

Bacteria and yeast cannot regulate their cell temperatures.

How do bacteria and yeast maintain the fluidity of their cell membranes when the temperature decreases?

1 They increase the numbers of unsaturated fatty acids in their phospholipid molecules.

2 They increase the numbers of saturated fatty acids in their phospholipid molecules.

3 They increase the numbers of cholesterol molecules in their cell membranes.

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

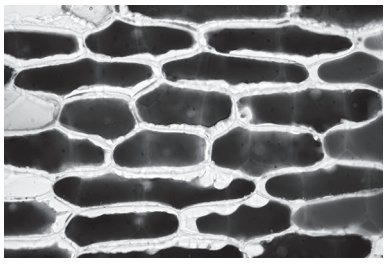
18 Samples X, Y and Z are epidermal tissues cut from an onion. Each epidermal tissue was immersed in one of three different concentrations of a salt solution for 30 minutes.

A student observed each tissue sample with a light microscope. Then the student estimated the concentration of each salt solution using a scale.

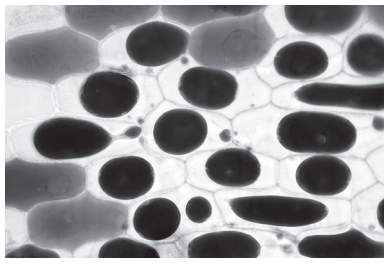
The diagram shows the scale. P, Q and R represent the estimated concentration of the three salt solutions.



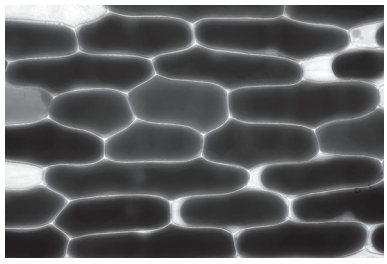
The photomicrographs show the appearance of the tissues in samples X, Y and Z.



sample X



sample Y



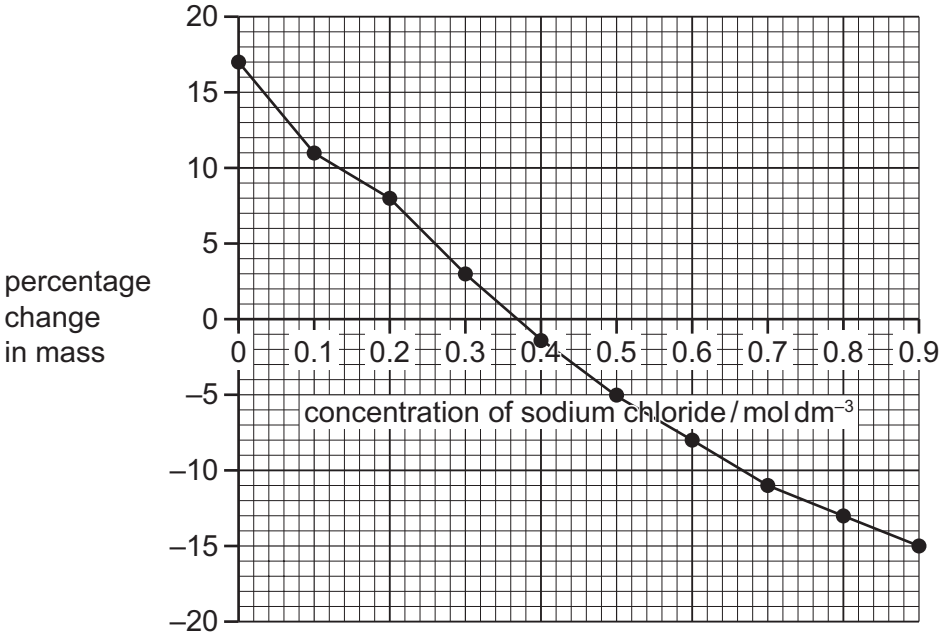
sample Z

Which row shows the estimated concentrations of the salt solutions in which samples Y and Z were immersed?

	sample Y	sample Z
A	P	Q
B	P	R
C	Q	R
D	R	P

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19 The graph shows the results of an osmosis investigation using potato tissue.



What is the concentration of sodium chloride solution that has the equivalent water potential to this potato tissue and what is correct about the movement of water at that point?

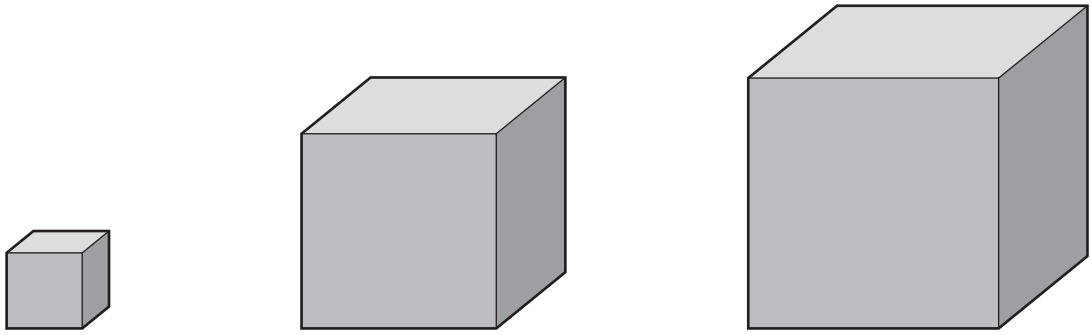
A 0.37 mol dm^{-3} and no net movement of water

B 17 mol dm^{-3} and net movement of water out of the potato tissue

C 0 mol dm^{-3} and no net movement of water

D 0.9 mol dm^{-3} and net movement of water into the potato tissue

20 Some agar was coloured pink using a pH indicator. The pink agar was then used to make three agar cubes with different dimensions.



2 cm × 2 cm × 2 cm 4 cm × 4 cm × 4 cm 5 cm × 5 cm × 5 cm

The cubes were placed in a beaker and covered with 0.1 mol dm^{-3} hydrochloric acid. The temperature of the experiment was standardised at 20 °C.

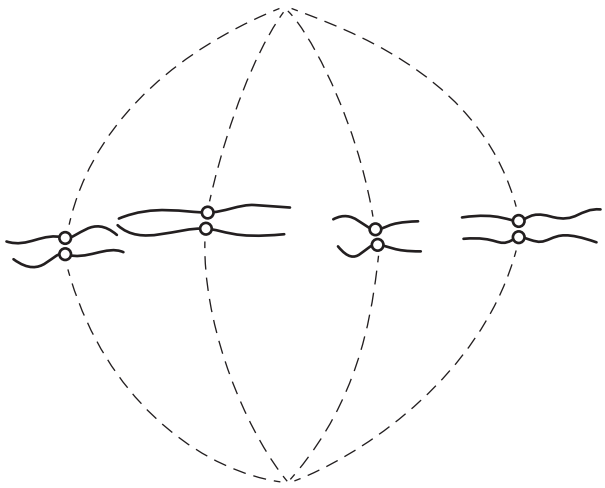
Hydrochloric acid diffused into the agar cubes causing the cubes to become colourless.

What is the surface area to volume ratio of the agar cube that became colourless in the **least** amount of time?

A 0.33 : 1 **B** 0.83 : 1 **C** 1.2 : 1 **D** 3.0 : 1

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21 The diagram shows the arrangement of chromosomes with attached spindle fibres during a stage of mitosis.



Which row correctly identifies the stage of mitosis and describes what is happening?

	stage of mitosis	description
A	anaphase	chromosomes are being pulled towards the centromeres
B	metaphase	sister chromatids are replicating prior to separation
C	metaphase	chromosomes are being positioned along the equator of the cell
D	anaphase	sister chromatids are being pulled towards the poles of the cell

22 During which phase of the cell cycle does DNA replication take place?

A G_1 **B** G_2 **C** M **D** S

23 Human body cells in interphase have 46 chromosomes.

What is correct about the number of telomeres present in prophase of a human body cell?

A 46 as there is one telomere at the end of 46 chromosomes

B 92 as there is one telomere at each end of 46 chromosomes

C 92 as there is one telomere at the end of 92 chromatids

D 184 as there is one telomere at each end of 92 chromatids

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24 Sometimes hydrogen bonds form temporarily between the bases of two strands of RNA.

How many hydrogen bonds form when guanine and uracil each bind to their complementary base?

	guanine	uracil
A	3	3
B	3	2
C	2	3
D	2	2

25 The table shows all the possible DNA triplet codes for some amino acids.

amino acid	DNA triplet code
cysteine	ACA
cysteine	ACG
tryptophan	ACC
isoleucine	TAA
isoleucine	TAG
isoleucine	TAT
methionine	TAC

The amino acid sequence is shown.

methionine – isoleucine – cysteine – tryptophan

What is the maximum number of different DNA sequences that could produce this amino acid sequence?

A 1 **B** 4 **C** 6 **D** 7

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26 Which row is correct for transpiration?

	definition of transpiration	comparison of water potential
A	evaporation of water from leaf surfaces	higher inside air spaces in the leaf than the air outside
B	evaporation of water from leaf surfaces	lower inside air spaces in the leaf than the air outside
C	loss of water vapour from leaves	lower inside air spaces in the leaf than the air outside
D	loss of water vapour from leaves	higher inside air spaces in the leaf than the air outside

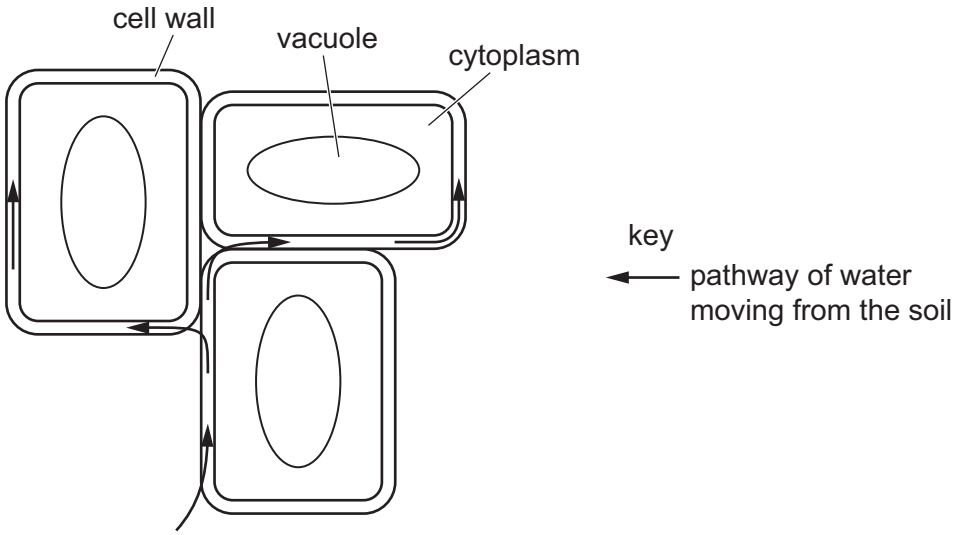
27 Which features of companion cells and xylem vessel elements make them suitable for their function?

	companion cells	xylem vessel elements
A	transport contents of cell in one direction only	lignified walls provide support
B	cellulose walls provide support	nuclei allow cell division
C	nuclei allow cell division	gaps between cells allow rapid transport
D	numerous mitochondria supply energy	absence of cytoplasm allows mass flow

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[Turn over

28 The diagram shows some root cells.



Which statement is correct for the pathway shown by the arrows?

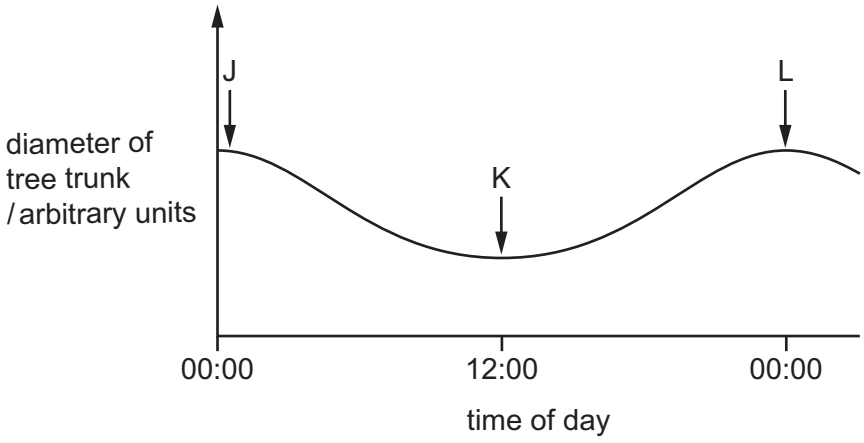
A Water will be blocked by a band of suberin.

B Water will move through the Casparian strip.

C Water will pass easily through the root endodermis.

D Water will pass through plasmodesmata.

29 The graph shows the diameter of a tree trunk at different times.



Which statement is correct?

A J shows the expansion of the trunk as water fills the xylem during transpiration.

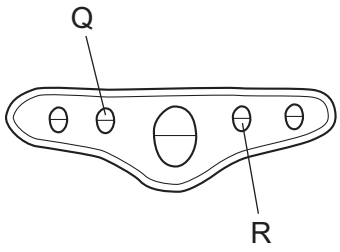
B K shows a reduction in diameter of the trunk as water is lost from the phloem due to translocation.

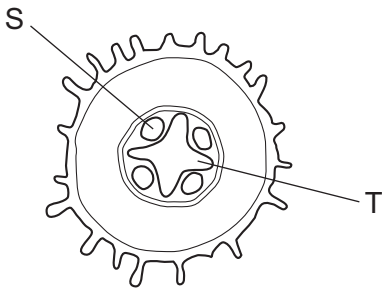
C K shows a reduction in diameter of the trunk due to water held in tension in the xylem.

D L shows the expansion of the trunk as the phloem tissue acts as a sink at night.

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30 The plan diagrams of transverse sections of two plant organs are shown. These are **not** drawn to scale.

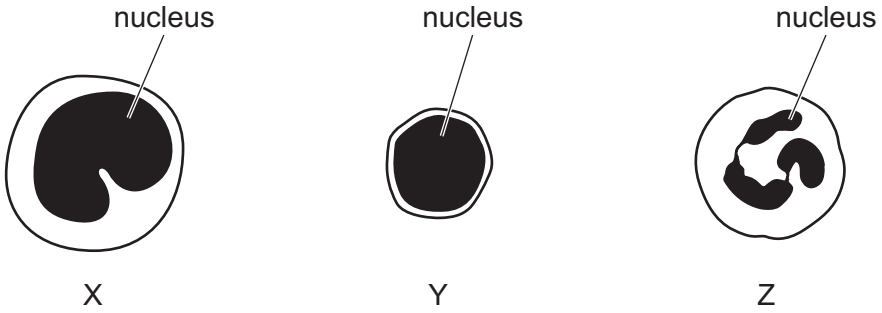




Which tissues contain proton pumps?

A Q and S **B** Q and T **C** R and S **D** R and T

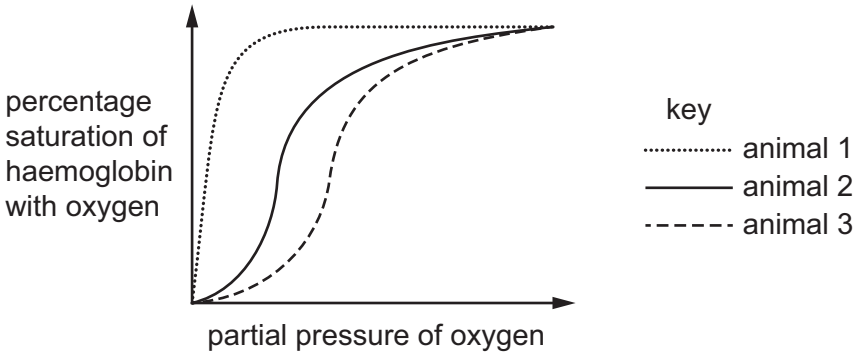
31 The diagrams show three types of blood cells, which are all drawn to the same scale.



Which row shows the characteristics of the cells?

	name of blood cell X	engulfs pathogens by endocytosis	each responds to one antigen
A	monocyte	Y	Z
B	monocyte	Z	Y
C	lymphocyte	Y	Z
D	lymphocyte	Z	Y

32 The graph shows oxygen dissociation curves for three animals. The shape of each curve is influenced by respiration rate and the affinity of haemoglobin for oxygen.



What can be concluded from the graph?

A Animal 1 has haemoglobin adapted to have a higher affinity for oxygen than animal 2.

B Animal 3 has haemoglobin adapted to have a higher affinity for oxygen than animal 2.

C Animal 3 has haemoglobin adapted to maintain a lower respiration rate than animal 2.

D Animal 1 has haemoglobin adapted to maintain a higher respiration rate than animal 2.

33 Which statements about a mammalian heart are correct?

1 The right atrium and right ventricle contain deoxygenated blood going to the lungs.

2 The left atrium and left ventricle contain oxygenated blood going to the pulmonary circulation.

3 The left ventricle has a thicker wall than the right ventricle and delivers blood at higher pressure.

4 The pressure of blood in the aorta is less than that in the pulmonary artery.

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

34 How is **most** carbon dioxide transported in the blood?

A as carbaminohaemoglobin

B as carbonic acid

C as hydrogencarbonate ions

D in solution in cytoplasm

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35 Which row shows the tissues that are present in the wall of the trachea **and** the wall of the bronchus?

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

key

✓ = present

✗ = **not** present

36 Which factors maintain the diffusion gradient for carbon dioxide at the surface of the alveoli?

1 blood flow around the alveoli

2 breathing movement exchanging air in the lungs

3 thin epithelial lining of the alveoli

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

37 A student made notes about two diseases: hand, foot and mouth disease (HFMD) and Lyme disease.

HFMD is caused by a viral pathogen and is transmitted in a variety of ways including:

- ingestion of water contaminated with faeces
- inhalation of droplets containing the pathogen.

Lyme disease is caused by a bacterial pathogen and is transmitted by the bite of an infected insect.

Which statement makes a correct comparison between the diseases the student wrote about and cholera, malaria or tuberculosis (TB)?

A Antibiotics can be used to kill the vector of the pathogen that causes malaria and the vector of the pathogen that causes Lyme disease.

B HFMD can be transmitted in a similiar way to either cholera or TB.

C The cells of the pathogen that causes HFMD and the cells of the pathogen that causes TB are prokaryotic.

D Transmission of TB and HFMD could be reduced by chlorinating drinking water.

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38 Which statements explain why antibiotics may **not** treat cholera successfully?

1 The infectious organism has developed resistance to the antibiotic.

2 Antibiotics **cannot** harm viruses.

3 Antibiotics do **not** affect pathogens that are eukaryotic.

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

39 The statements describe the phagocytosis of a bacterium by a macrophage.

1 Digestive enzymes break down the bacterium.

2 Lysosome fuses with the vacuole.

3 Macrophage displays the bacterial antigens on its cell surface membrane.

4 Macrophage engulfs the bacterium and encloses it in a vacuole.

5 Receptors on the cell surface membrane of macrophage bind to the bacterium.

Which order is correct for phagocytosis?

A $3 \rightarrow 5 \rightarrow 4 \rightarrow 1 \rightarrow 2$

B $4 \rightarrow 2 \rightarrow 1 \rightarrow 5 \rightarrow 3$

C $5 \rightarrow 4 \rightarrow 2 \rightarrow 1 \rightarrow 3$

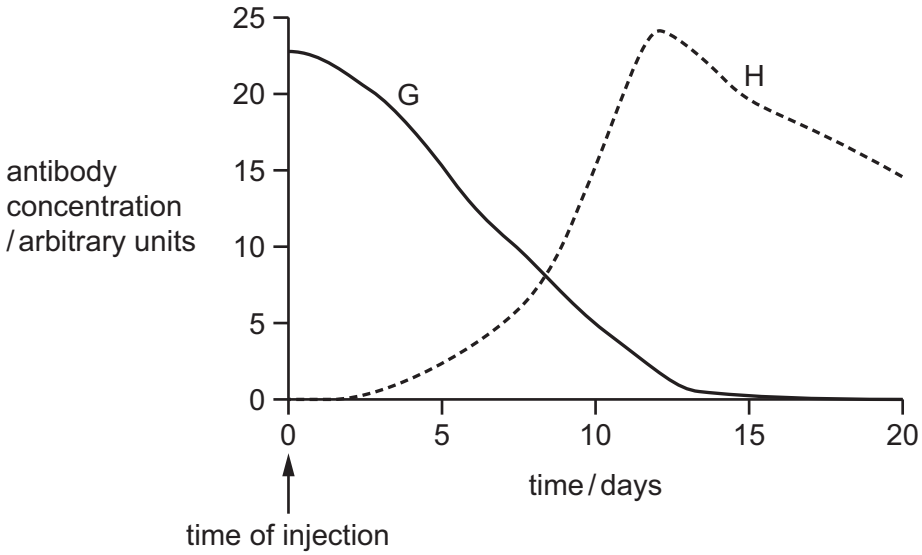
D $5 \rightarrow 4 \rightarrow 3 \rightarrow 1 \rightarrow 2$

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40 Two people, G and H, were each given an injection to protect them against a particular pathogen.

One person was injected with antibodies. The other person was injected with a vaccine.

The graph shows the concentrations of the antibody against this pathogen in the blood of the two people, G and H, during a period of 20 days after their injections.



Which row correctly describes the type of immunity shown by G and H?

	G	H
A	artificial active immunity	artificial passive immunity
B	artificial passive immunity	artificial active immunity
C	natural active immunity	natural passive immunity
D	natural passive immunity	natural active immunity

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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.

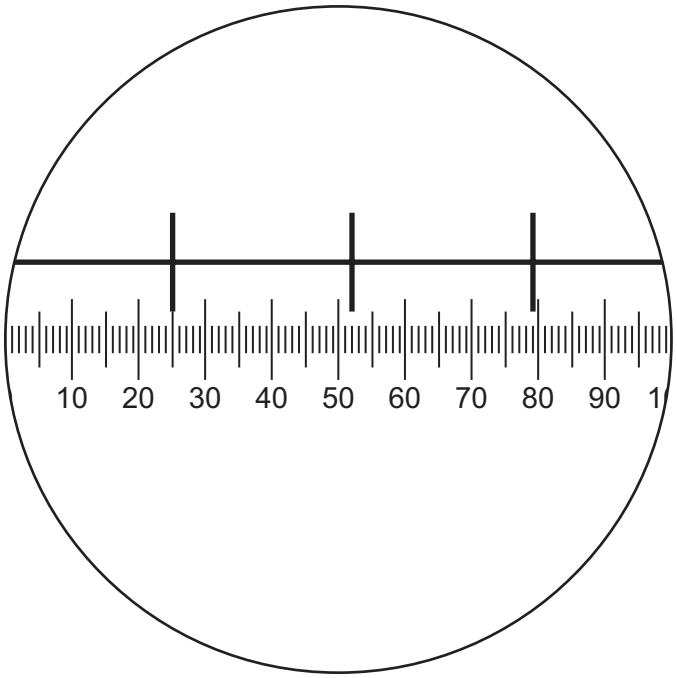
INFORMATION

- 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.

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

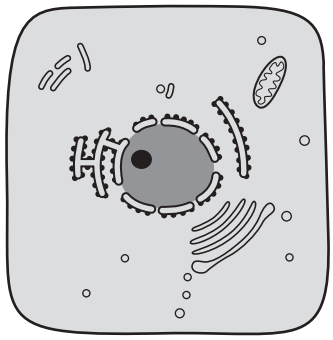


Each division on the stage micrometer scale is 0.1 mm.

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

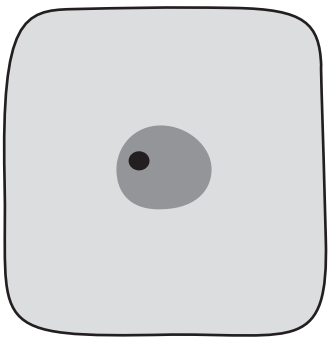
	calculation	units
A	$\frac{0.1}{27} \div 1000$	mm
B	$\frac{0.1}{52} \times 1000$	μm
C	$\frac{0.2}{54} \times 1000$	μm
D	$\frac{0.2}{79} \times 1\,000\,000$	nm

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

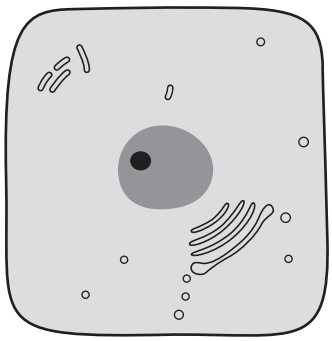


Which diagram would represent the same cell viewed with a simple light microscope, using daylight as the only light source?

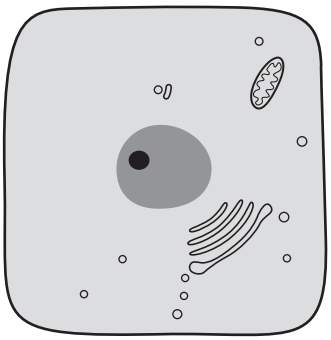
A



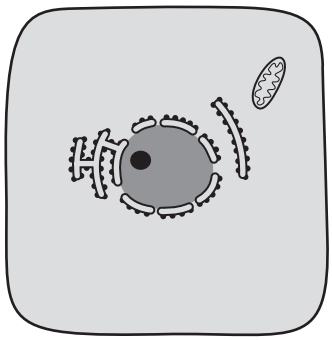
B



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

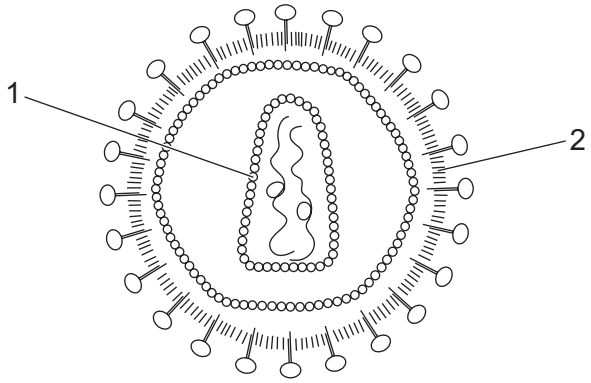
B mitochondria

C nuclei

D ribosomes

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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.

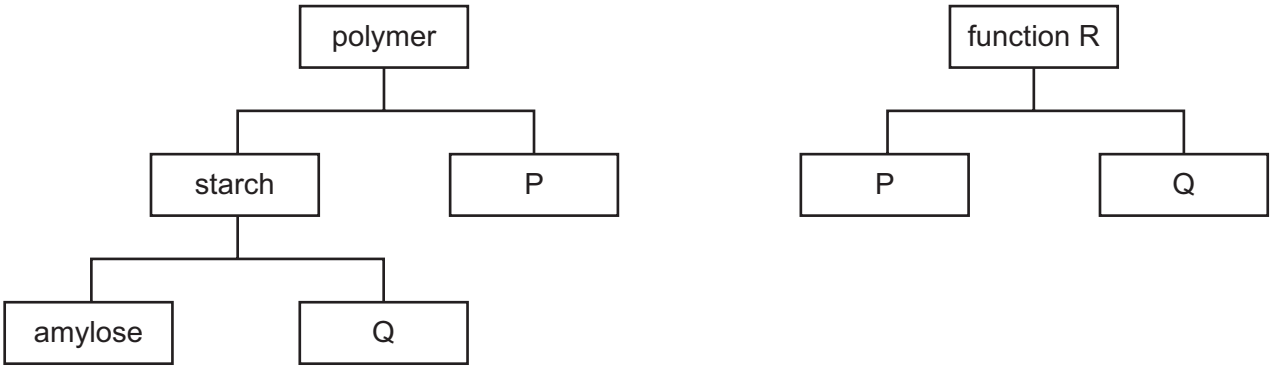
B Glycosidic bonds are broken by condensation, releasing fructose, glucose and water.

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.

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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

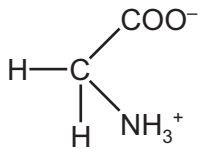
3 ionic

	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

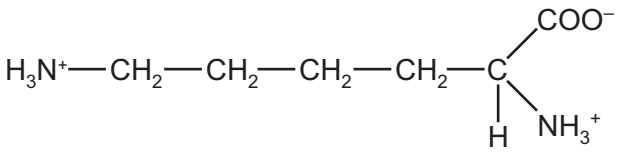
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13 The diagrams show the structure of four amino acids in solution.

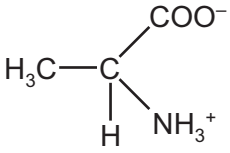
glycine



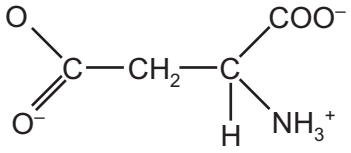
lysine



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?

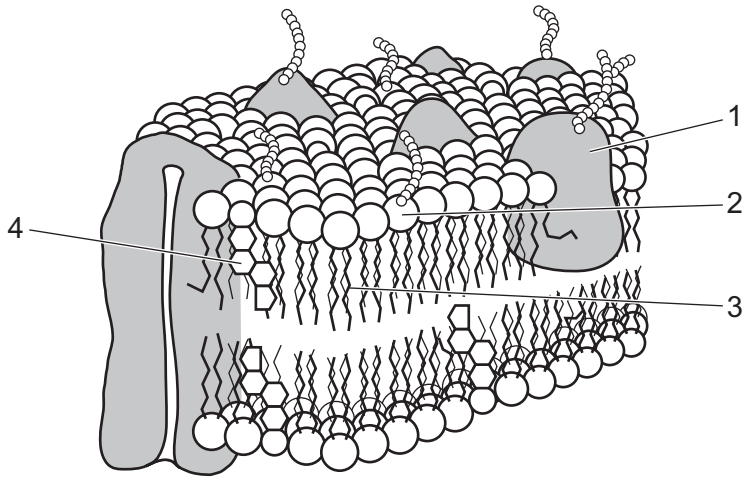
	histidine	proline
A	inside an enzyme	on the surface of an enzyme
B	on the surface of an enzyme	on the surface of an enzyme
C	inside an enzyme	inside an enzyme
D	on the surface of an enzyme	inside an enzyme

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?

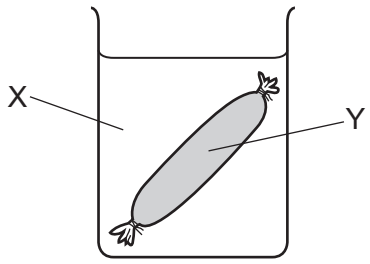
1 active transport

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

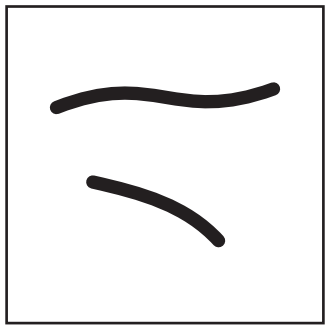
C anaphase

D telophase

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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.

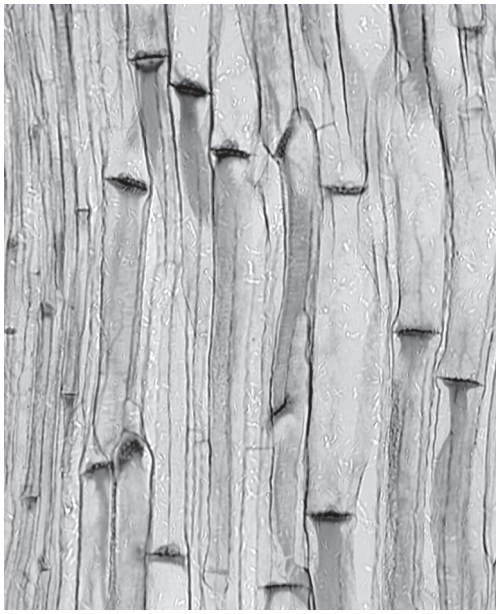
- Type IX collagen is formed from three different polymers.
- The main form of haemoglobin contains two alpha globins and two beta globins.
- HIV protease consists of two identical polymers.

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

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



×80

Which description of this photomicrograph is correct?

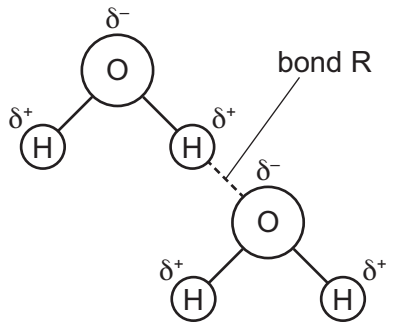
A a transverse section showing xylem tissue

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

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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.

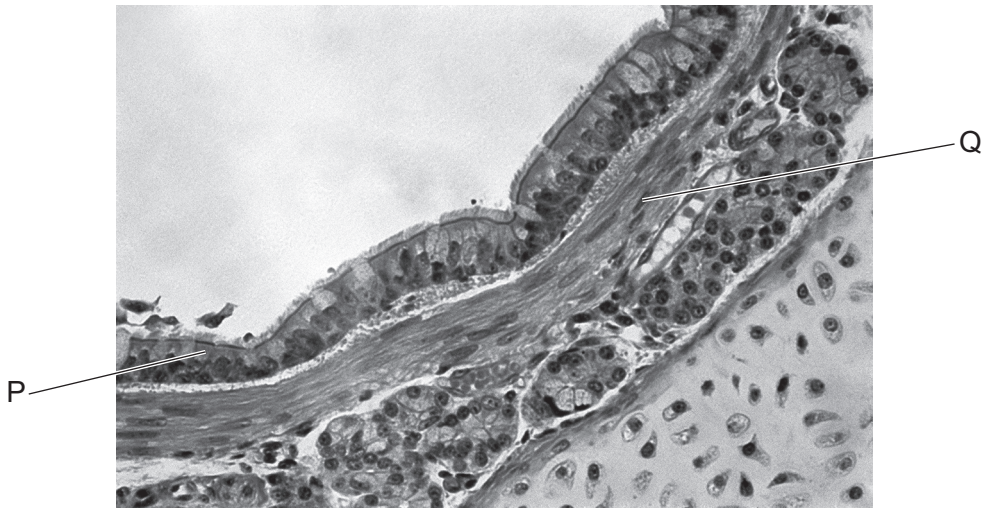
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33 A sample of adult haemoglobin was tested to determine its saturation with oxygen. All other variables were standardised. At a partial pressure of 0 kPa, the saturation was 0%. The saturation reached 97% at a partial pressure of 14 kPa.

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

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

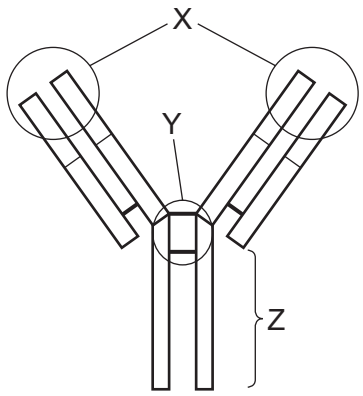
A A large number of alveoli are present in each lung.

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.

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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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BIOLOGY **9700/14**

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

1 hour 15 minutes

You must answer on the multiple choice answer sheet.

6051780241

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.

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1 Plant cells are stained and then viewed with a simple light microscope, using daylight as the only light source.

Which cell structures are clearly visible at a magnification of ×400?

A chloroplast grana

B lysosomes

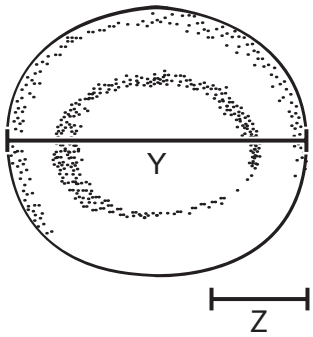
C nucleoli

D ribosomes

2 The diagram shows an image of a cell with a scale bar.

The scale bar (Z) represents an actual size of 15 μm.

Distance Y represents the diameter of the cell image.



Which calculation to find the actual diameter of the cell is correct?

A $15 \times (Y + Z)$

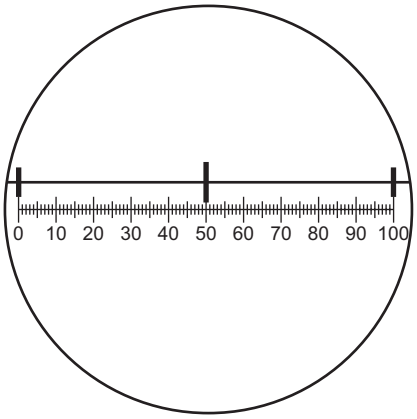
B $Y \times \left(\frac{Z}{15}\right)$

C $\left(\frac{Y}{Z}\right) \times 15$

D $\left(\frac{Y}{15}\right)$

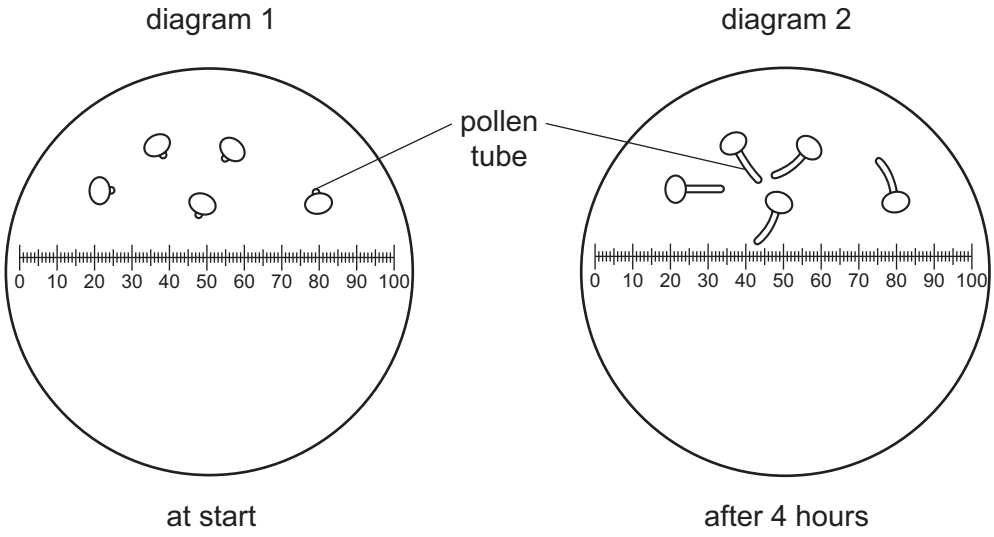
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3 The diagram shows a stage micrometer, with divisions of 0.1 mm, viewed using an eyepiece graticule.



Pollen grains were grown in a sugar solution and viewed using the eyepiece graticule.

Diagram 1 shows the pollen grains at the start. Diagram 2 shows the pollen grains after 4 hours.



What is the growth rate of the pollen tubes?

A $5\,\mu m\,h^{-1}$ **B** $10\,\mu m\,h^{-1}$ **C** $5\,mm\,h^{-1}$ **D** $10\,mm\,h^{-1}$

4 What are found in chloroplasts **and** also in mitochondria?

1 DNA

2 70S ribosomes

3 mRNA

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

5 A long-distance runner has become adapted to run faster for longer after regular training.

Which cell structure in a muscle cell has increased in number to allow this adaptation?

A lysosome

B mitochondrion

C nucleus

D smooth endoplasmic reticulum

6 Some functions carried out within eukaryotic cells are listed.

1 lysosome production

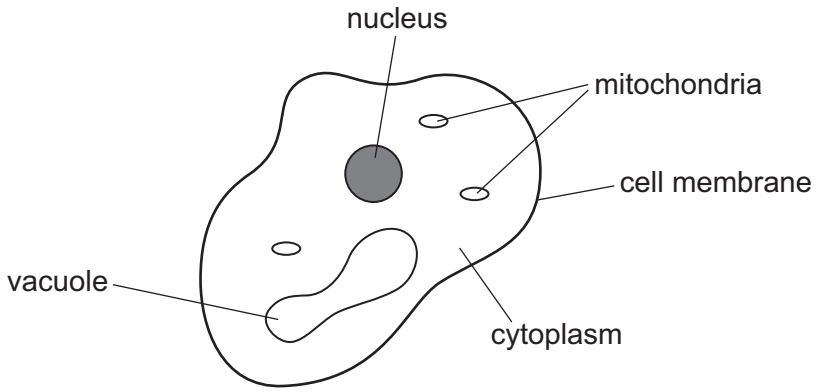
2 polypeptide modification

3 exocytosis

Which functions are carried out by the Golgi body?

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

7 The diagram shows the structure of a unicellular organism.



Which statement is correct for this organism?

A It contains a nucleus so it is **not** prokaryotic.

B It contains mitochondria so it is **not** a plant.

C It does **not** have a cell wall so it must be eukaryotic.

D It is unicellular so it must be a bacterium.

8 Diastase is an enzyme that breaks down starch into maltose.

A sample of starch is treated with boiled diastase and left for 15 minutes.

Samples of the mixture are then tested with iodine solution and with Benedict's solution.

What is the correct result?

	iodine solution	Benedict's solution
A	blue-black	blue
B	blue-black	red
C	brown	blue
D	brown	red

9 Which molecule is required for this reaction to occur?

$$C_{12}H_{22}O_{11} + H_2O \rightarrow C_6H_{12}O_6 + C_6H_{12}O_6$$

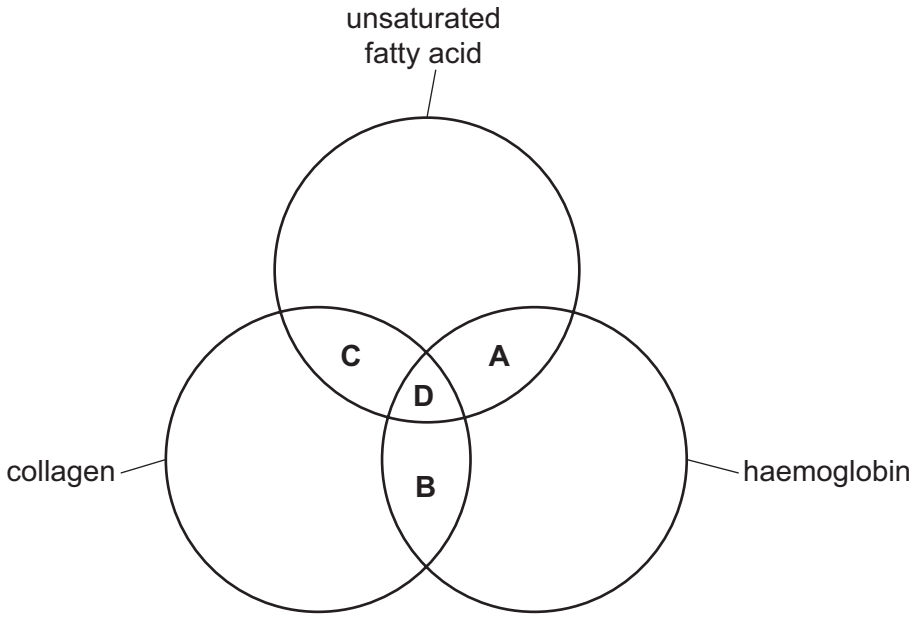
A catalase

B copper sulfate

C hydrochloric acid

D sodium hydroxide

10 Which molecules contain **at least** two double bonds?



11 Which description of globular proteins is correct?

A They are only found in cell surface membranes.

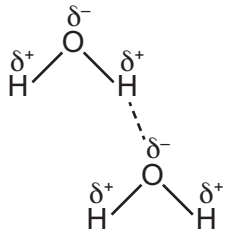
B They only contain amino acids with hydrophilic R groups.

C They can change shape by using energy from ATP.

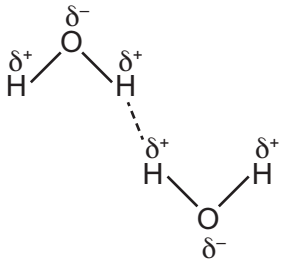
D They always have a quaternary structure of at least three polypeptides.

12 Which diagram shows where a hydrogen bond occurs between two water molecules?

A



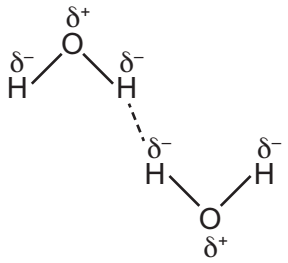
B



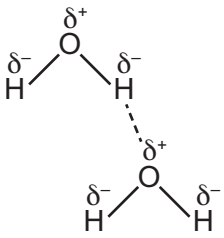
key

---- hydrogen bond

C



D



13 Some detergents disrupt hydrogen bonds between water molecules.

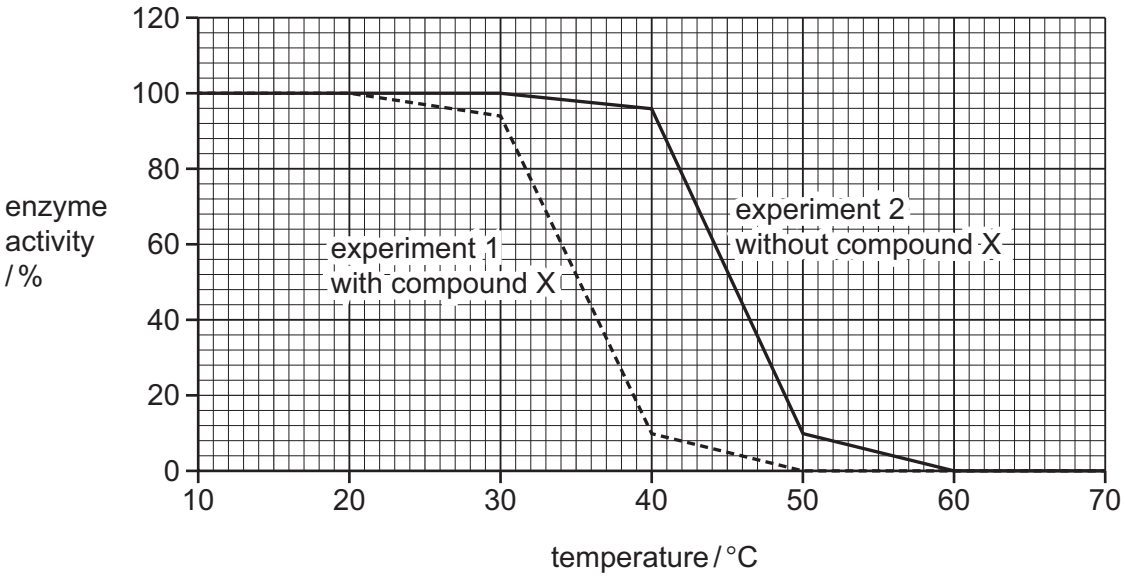
Which row shows the correct effects of detergent on the specific heat capacity and latent heat of vaporisation of water?

	specific heat capacity	latent heat of vaporisation
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

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14 An investigation was carried out to see if compound X could improve the thermostability of an enzyme. Thermostable enzymes will function well at high temperatures.

The results of the investigation are shown.



Which row is correct?

	compound X makes the enzyme more thermostable	at 40 °C in experiment 1 most of the enzyme active sites will **no longer** be complementary to the substrate	at 45 °C in experiment 2 approximately half of the enzymes are forming enzyme–substrate complexes
A	✓	✗	✗
B	✓	✓	✗
C	✗	✓	✓
D	✗	✗	✓

key

✓ = correct

✗ = **not** correct

15 The table shows the results from an investigation into the effect of temperature on an enzyme-catalysed reaction. All other variables were standardised.

temperature / °C	rate of reaction / arbitrary units
10	3
20	7
30	16
40	33
50	32
60	14

What is the correct conclusion?

A 40 °C was the optimum temperature.

B The data for 50 °C was anomalous.

C The optimum temperature was between 30 °C and 50 °C.

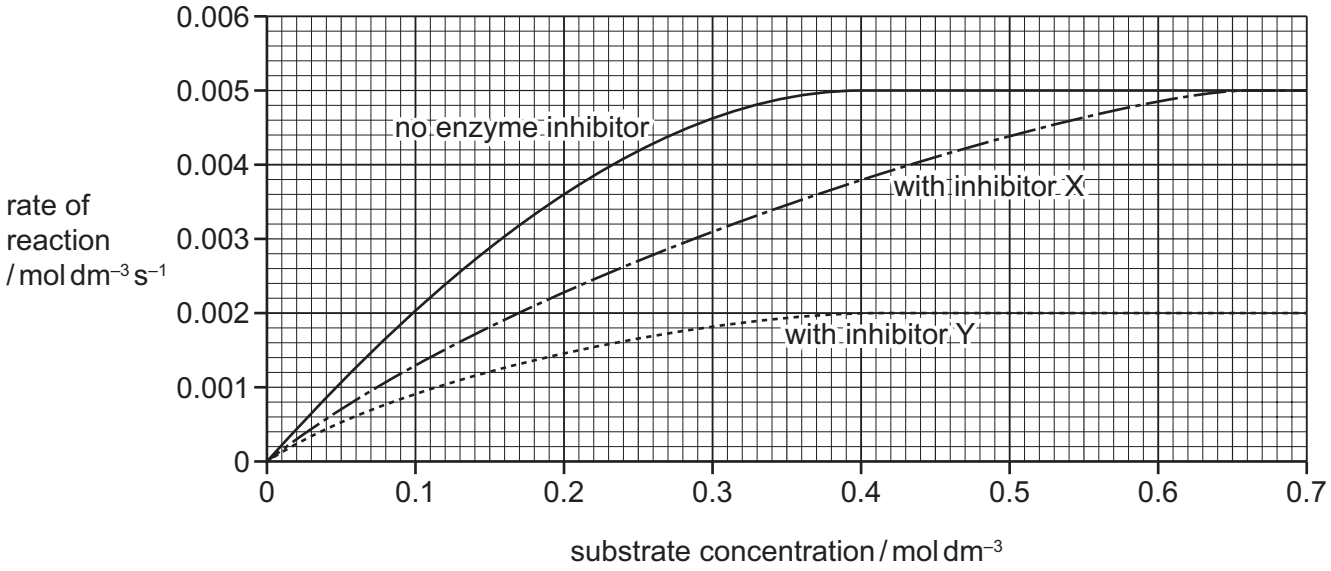
D All the enzymes denatured at 60 °C.

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16 The graph shows how the rate of a reaction changes with substrate concentration in the presence of:

- no inhibitor
- inhibitor X
- inhibitor Y.

One of the inhibitors is competitive and the other inhibitor is non-competitive.



What is the correct estimate of K_m for the reaction shown when a competitive inhibitor is present?

A 0.11 mol dm^{-3}

B 0.23 mol dm^{-3}

C 0.38 mol dm^{-3}

D 0.65 mol dm^{-3}

17 Which of these substances can pass directly through cell surface membranes **without** using a carrier protein or channel protein?

1 K^+ and Cl^-

2 CO_2

3 $C_6H_{12}O_6$

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

18 Which of these statements about facilitated diffusion are correct?

1 It is limited by the number of transport proteins.

2 It transports molecules against their concentration gradient.

3 It requires a source of ATP.

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

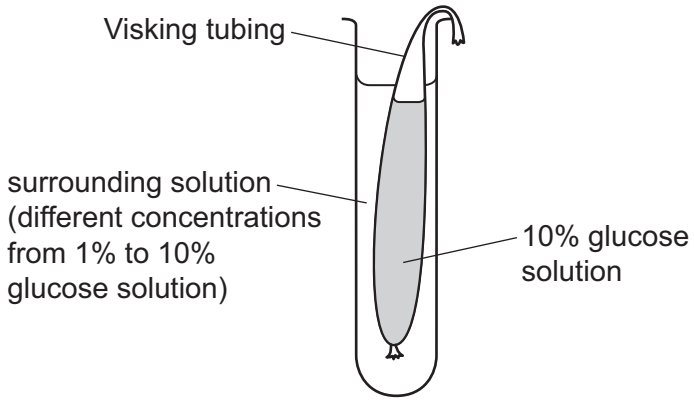
19 A cell absorbs amino acids. This cell then synthesises and exports a digestive enzyme. Different cell structures are involved with different stages of this process.

Which row shows a possible sequence of cell structures that the amino acids pass through?

	cell surface membrane	Golgi body	rough endoplasmic reticulum	secretory vesicle
A	1st	2nd	3rd	4th
B	1st	3rd	4th	2nd
C	4th	2nd	1st	3rd
D	4th	1st	2nd	3rd

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20 The diagram shows apparatus set up to investigate the effect of changing the initial concentration of glucose in the surrounding solution on the movement of molecules through a selectively permeable membrane (Visking tubing) in 15 minutes.



Which statements are correct as the initial concentration of glucose solution in the surrounding solution increases?

1 Net diffusion of water increases.

2 Glucose molecules reach an equilibrium quicker.

3 There is less change in the volume of the surrounding solution.

4 Net diffusion of glucose increases.

A 1, 2, 3 and 4

B 1, 2 and 4 only

C 1 and 3 only

D 2 and 3 only

21 The epithelium that lines the stomach is damaged by acid and is renewed every two days.

Why is mitosis required to repair the damage?

A Mitosis repairs damaged cells.

B Mitosis produces new genetically similar cells.

C Mitosis provides genetically identical replacement cells.

D Mitosis doubles the original cell number.

22 What is the role of telomeres?

A allowing the chromatids to reach the poles during mitosis

B holding sister chromatids together

C making sure that the sister chromatids are of identical length

D preventing loss of genes during DNA replication

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23 Which features of mitosis help to maintain the genetic composition of the cell?

1 the longitudinal division of the centromeres

2 the DNA of the parent cells replicates before mitosis begins

3 the pulling apart of the chromatids to opposite poles

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

24 DNA forms a leading strand and a lagging strand during semi-conservative replication.

Which row correctly matches the strands to their properties?

	the strand that is replicated by joining together short sequences of DNA in a 3′ to 5′ direction	the strand that requires DNA ligase
A	lagging	lagging
B	lagging	leading
C	leading	leading
D	leading	lagging

25 How many genes could code for one collagen molecule?

A 1 gene only

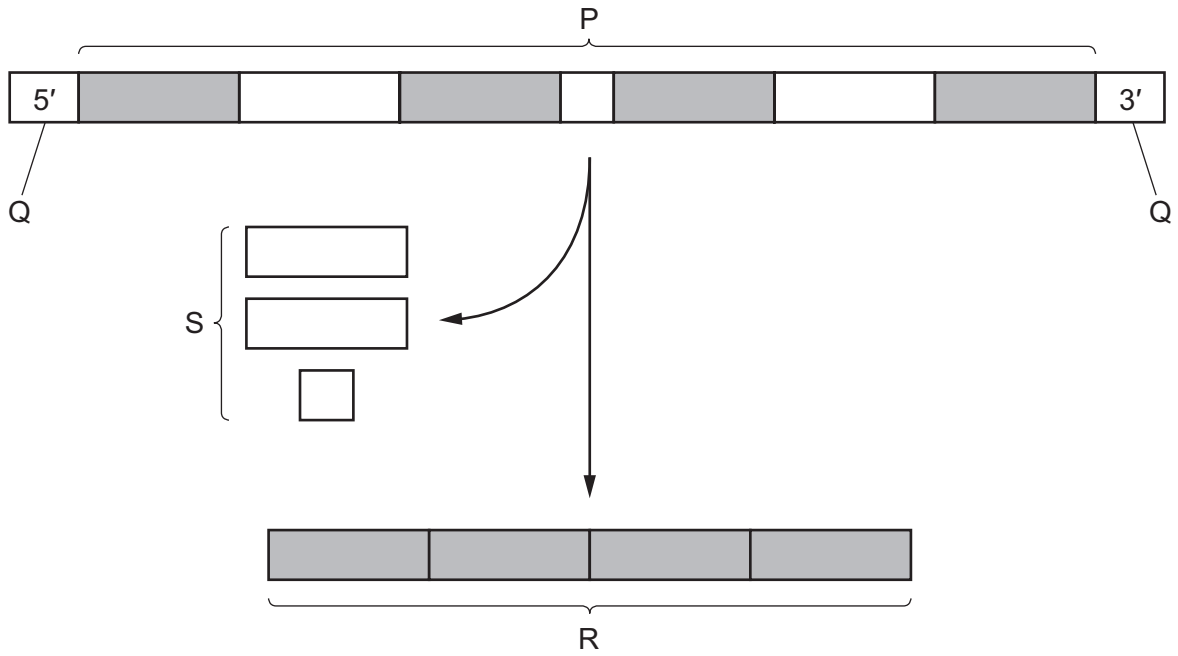
B 2 genes only

C 3 genes only

D 1 gene or 2 genes or 3 genes

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26 The diagram shows some events during the formation of an mRNA molecule at transcription.



What is correctly identified in the diagram?

A P are introns.

B Q are exons.

C R is a primary transcript.

D S are non-coding sequences.

27 Two plants, K and L, are parasites of other plants. Both species grow structures that invade the vascular tissue of plants.

Plant K grows into xylem tissue of other plants.

Plant L grows into phloem tissue of other plants.

Which substances could plants K and L take from the plants that they parasitise?

	plant K	plant L
A	water only	water and sucrose only
B	water and minerals	water, amino acids and sucrose
C	water only	amino acids and sucrose only
D	water and minerals	water and sucrose only

28 Which statements are correct for the apoplast pathway?

1 Water enters the cell wall.

2 Water moves by osmosis.

3 Water moves from cell wall to cell wall.

4 Water moves through plasmodesmata.

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

29 Mass flow is the bulk movement of materials from one place to another.

Which vessels carry fluids by mass flow?

1 artery

2 phloem sieve tube element

3 vein

4 xylem vessel element

A 1, 2, 3 and 4

B 1, 2 and 3 only

C 1 and 3 only

D 2 and 4 only

30 Which features are present in companion cells **and** also in phloem sieve tube elements?

	ribosomes	plasmodesmata
A	✓	✗
B	✓	✓
C	✗	✓
D	✗	✗

key

✓ = present

✗ = **not** present

31 Which two terms describe the mammalian circulatory system?

A open and double circulation

B closed and double circulation

C closed and single circulation

D open and single circulation

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32 One function of an arteriole is to increase or decrease the flow of blood to tissues.

Which of these **must** be present in an arteriole wall to allow this function?

1 collagen

2 endothelium

3 smooth muscle

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

33 The table shows the blood pressures in different parts of the circulatory system of a person sitting at rest.

parts of the circulatory system	blood pressure / kPa
aorta	16.0
arteriole	11.3
arterial end of capillary	4.7
venous end of capillary	1.3
vein	0.6

What is the percentage decrease in blood pressure between the arteriole and the arterial end of a capillary?

A 42% **B** 58% **C** 142% **D** 240%

34 Which reaction is catalysed by carbonic anhydrase?

A the dissociation of carbonic acid

B the formation of carbaminohaemoglobin

C the formation of hydrogencarbonate ions and hydrogen ions

D the association of carbon dioxide and water

35 What **directly** causes the percentage oxygen saturation of haemoglobin to decrease in actively respiring muscles?

A hydrogencarbonate ions

B carbon dioxide

C carbonic acid

D hydrogen ions

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36 Which row shows the tissues that are present in the wall of the trachea **and** also the wall of the bronchus?

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

key

✓ = present in trachea and bronchus

✗ = **not** present in trachea or bronchus

37 Outbreaks of cholera commonly occur in camps that are set up after a major natural disaster.

The list shows some control measures that can be taken to limit the spread of cholera in the camps.

1 treating all drinking water supplies with a high concentration of chlorine

2 setting up an emergency treatment centre to isolate cases of cholera and treat them with antibiotics

3 using concentrated disinfectant to clean sewage disposal areas and infected bedding

4 health workers visiting regularly to detect cases

5 keeping good records of the number of cases and deaths at treatment centres

Which features of these control measures involve an economic factor?

A 1, 2, 3, 4 and 5

B 1, 3 and 5 only

C 2, 3, 4 and 5 only

D 2 and 4 only

38 Antibiotics are used to treat many infections. Each antibiotic has one or more biochemical targets.

Tetracycline inhibits 70S ribosomes.

Rifamycin inhibits prokaryotic RNA polymerase.

Which antibiotics can be used to treat an infection caused by the influenza virus?

	penicillin	tetracycline	rifamycin
A	✓	✓	✓
B	✓	✗	✓
C	✗	✗	✓
D	✗	✗	✗

key

✓ = can be used

✗ = **cannot** be used

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39 Which cells involved in the primary immune response are phagocytes?

A monocytes

B plasma cells

C T-helper cells

D T-killer cells

40 Some ways in which different types of monoclonal antibodies can work are described.

1 binding to proteins on cell surfaces and triggering the immune system

2 blocking molecules on cell surfaces that inhibit T-cells

3 blocking cell signalling receptors that trigger cell division

4 blocking cell signalling receptors that trigger the immune response

Which types of monoclonal antibody could be used to treat cancer?

A 1, 2, 3 and 4

B 1, 2 and 3 only

C 1 and 4 only

D 2, 3 and 4 only

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