Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/13**

Paper 1 Multiple Choice **May/June 2023**

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)

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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 Which feature is visible with a light microscope using a natural light source?

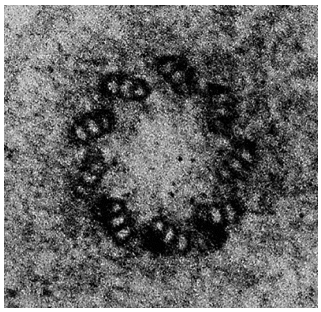
A DNA molecule of diameter 2 nm

B *Paramecium* cell of diameter 200 μm

C phospholipid bilayer of width 8 nm

D ribosome of diameter 20 nm

2 The electron micrograph shows a structure found in the cytoplasm of an animal cell.



Which biological molecules are found in this structure?

1 nucleic acids

2 proteins

3 phospholipids

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

3 Which cell structures contain nucleic acid?

1 cytoplasm

2 lysosomes

3 mitochondria

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

4 Mitochondria are thought to have evolved from prokaryotic cells that were ingested by an ancestral cell.

Which feature have prokaryotes lost during their evolution into mitochondria?

A cell wall

B circular chromosome

C endoplasmic reticulum

D ribosomes

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5 Which polymers are present in all viruses, all prokaryotes **and** all eukaryotes?

1 polynucleotides

2 polypeptides

3 polysaccharides

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

6 How many of the listed structures typically contain genetic material that has telomeres?

- bacterial cell
- chloroplast
- mitochondrion
- nucleus

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

7 Steps 1, 2, 3 and 4 are used to test for a non-reducing sugar.

1 Put 5 cm^3 of solution into a test-tube.

2 Add a few drops of acid.

3 Neutralise with alkali.

4 Add 6 cm^3 of Benedict's solution.

When is the solution heated or boiled?

A between steps 1 and 2

B between steps 2 and 3, and after step 4

C between steps 2 and 3 only

D after step 4 only

8 Which features contribute to the function of a cellulose molecule?

1 Long chains of glucose molecules coil into a helix.

2 Many hydrogen bonds form between adjacent chains.

3 It is insoluble in water.

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

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9 What correctly describes triglycerides?

A non-polar molecules that are soluble in ethanol

B non-polar molecules that are soluble in water

C polar molecules that are soluble in ethanol

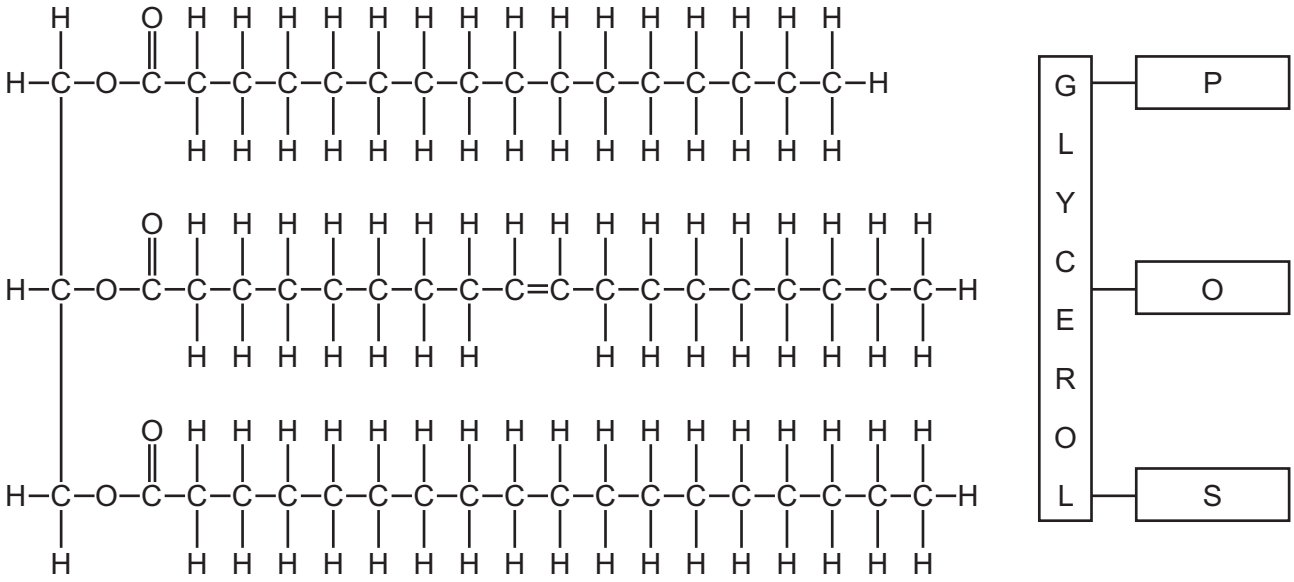
D polar molecules that are soluble in water

10 Cocoa butter contains three different triglycerides. These triglycerides are made from the fatty acids:

- oleic acid (O)
- palmitic acid (P)
- stearic acid (S).

The three triglycerides found in cocoa butter are POS, SOS and POP.

The chemical structure of the triglyceride POS is shown next to a diagrammatic representation of POS.



Which statement is correct?

A Triglyceride POP contains two unsaturated fatty acids joined by ester bonds to glycerol.

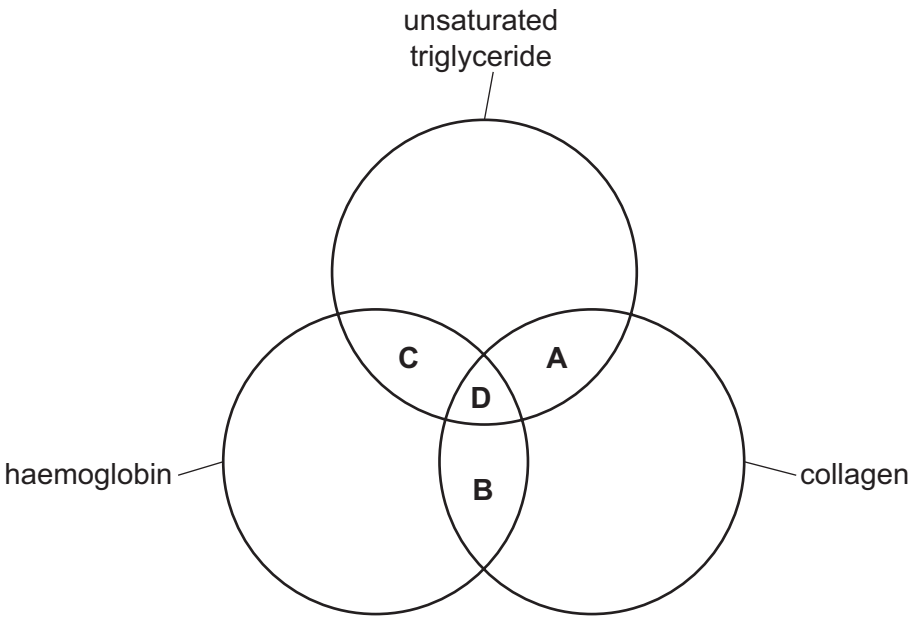
B Triglyceride POS contains two less carbon atoms than triglyceride POP.

C Triglyceride SOS contains four more carbon atoms than triglyceride POP.

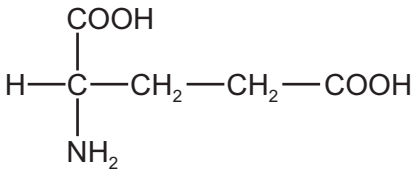
D Triglyceride SOS contains two saturated fatty acids joined by hydrolysis to glycerol.

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11 Which molecules contain at least four double bonds?



12 The diagram shows the amino acid glutamic acid.



What is the R group for glutamic acid?

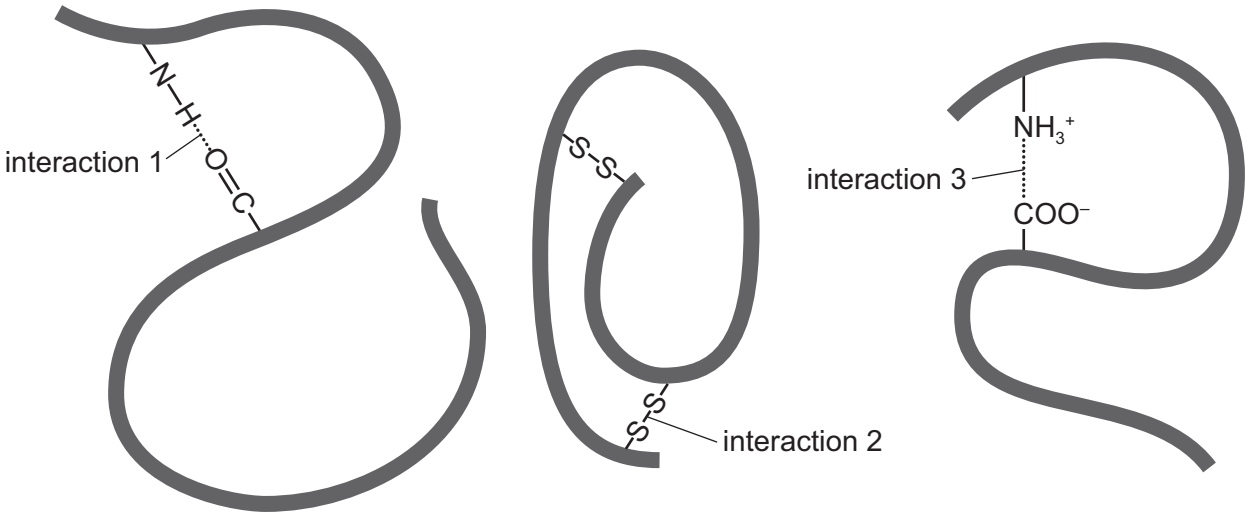
A NH_2

B H

C COOH

D CH_2—CH_2—COOH

13 The diagram shows three interactions that hold protein molecules in shape.



Which row identifies these interactions?

	interaction 1	interaction 2	interaction 3
A	hydrogen bond	disulfide bond	hydrophobic interaction
B	hydrogen bond	covalent bond	ionic bond
C	hydrophobic interaction	ionic bond	hydrogen bond
D	ionic bond	disulfide bond	peptide bond

14 Some animals produce antimicrobial proteins which protect them from pathogens. These proteins could be used to kill human pathogens, however when used as a medicine they are broken down by protein-digesting enzymes.

Replacing one of the amino acids found in the protein with an amino acid that had been synthesised in the laboratory resulted in a modified protein that was **not** broken down.

What could explain why this modified protein was not broken down by the protein-digesting enzymes?

1 The modified protein has a different tertiary structure to the original protein.

2 The modified protein is **not** complementary in shape to the enzyme's active site.

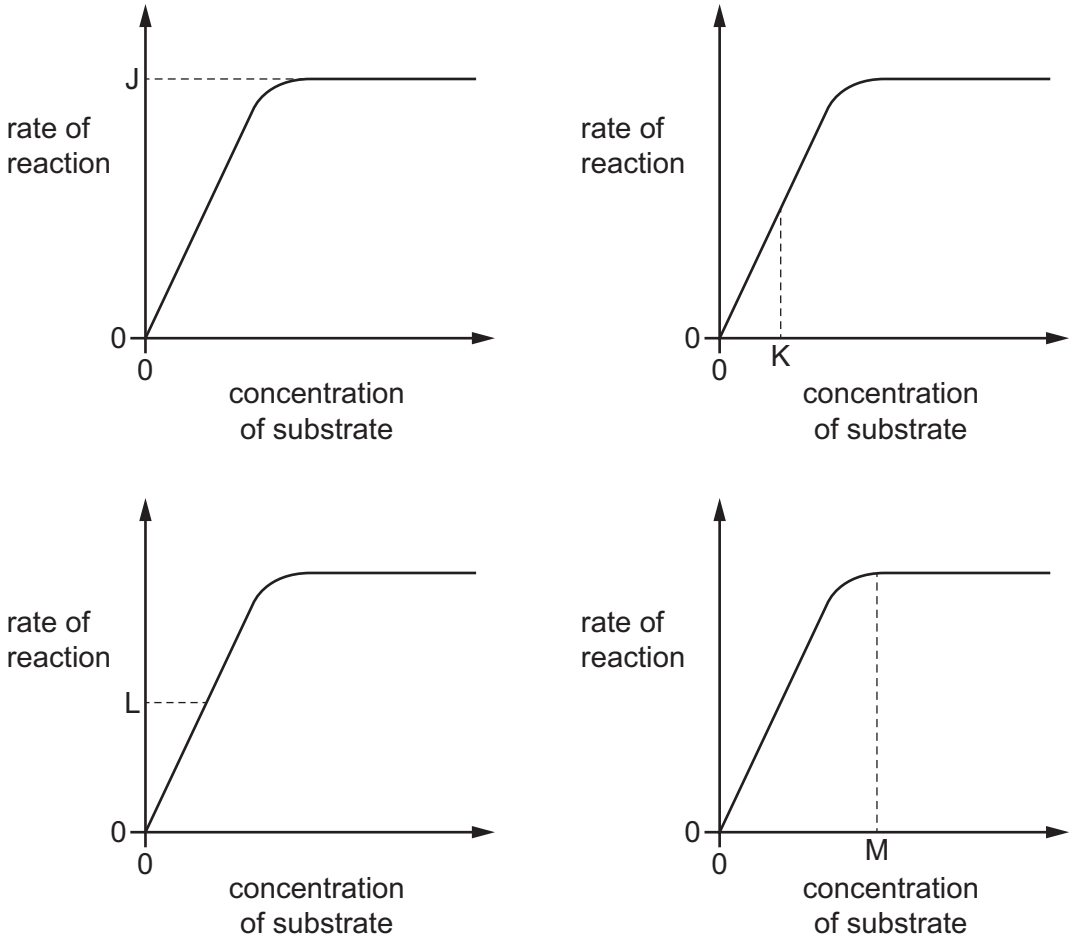
3 The modified protein is unable to induce a fit with the protein-digesting enzyme.

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

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15 A student investigated the effect of substrate concentration on the rate of an enzyme-catalysed reaction. A graph was plotted to show the relationship between these two variables. The student was asked to take readings from the graph that could be used to determine the Michaelis–Menten constant, K_m, for this enzyme.

J, K, L and M show points read from the graphs which the student could use to determine the value of K_m.

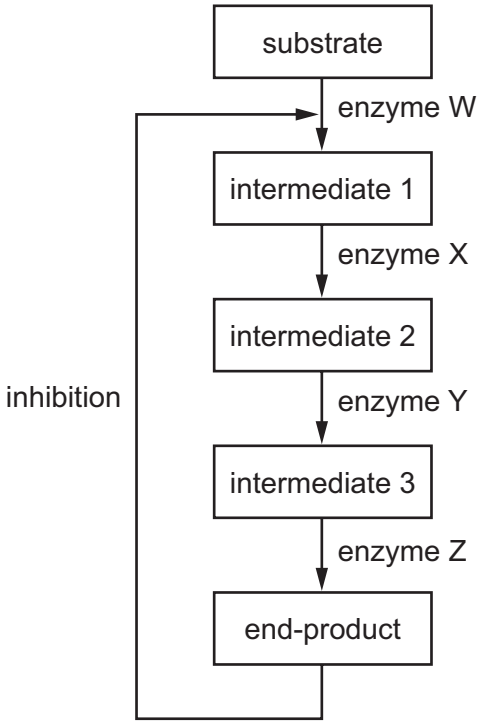


Which two readings must the student use to determine the value of K_m?

A J and K **B** J and M **C** K and L **D** L and M

16 The end-product of a metabolic pathway can act as a competitive inhibitor. This is called end-product inhibition and allows a cell to control a metabolic pathway.

The diagram shows a metabolic pathway where the end-product could act as an inhibitor of enzyme W.



What would be the effect if enzyme Z was inhibited by the end-product instead of enzyme W?

	quantity of intermediate 1	quantity of end-product
A	increase	decrease
B	increase	unchanged
C	decrease	decrease
D	decrease	unchanged

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17 Which row shows the distribution of cholesterol and the carbohydrate chains of glycolipids and glycoproteins in a cell surface membrane?

	cholesterol	carbohydrate chains of glycolipids	carbohydrate chains of glycoproteins
A	between phospholipid heads only	mainly on the outer surface	mainly on the inner surface
B	between phospholipid heads only	mainly on the inner surface	mainly on the outer surface
C	between phospholipids	mainly on the inner surface	mainly on the inner surface
D	between phospholipids	mainly on the outer surface	mainly on the outer surface

18 Which row correctly describes **all** the possible relative concentrations of a substance when the substance is moved by endocytosis or exocytosis?

	endocytosis	exocytosis
A	concentrations equal	concentrations equal
B	concentrations equal, greater inside or greater outside	concentrations equal, greater inside or greater outside
C	concentrations equal or greater outside	concentrations equal or lower outside
D	concentrations equal or lower outside	concentrations equal or greater outside

19 Which statement about simple diffusion is correct?

A It requires specific molecules in the cell surface membrane.

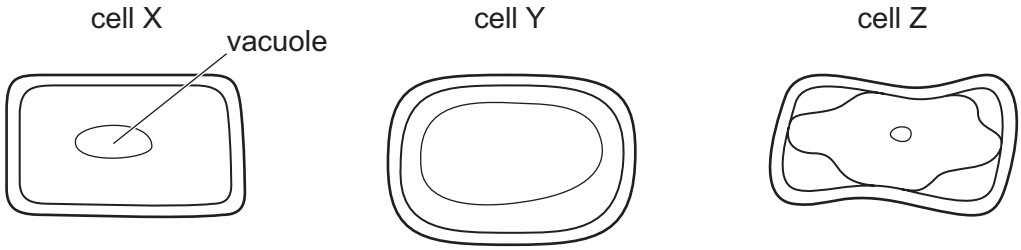
B It is a passive mode of transporting substances.

C It always requires a membrane for transport of substances.

D It only happens in the cells of prokaryotes and eukaryotes.

20 Plant cells with the same water potential in their cytoplasm were each put into one of three different concentrations of sugar solution, 10%, 5% and 2.5%.

The cells were left for 50 minutes and then observed using a light microscope.



Which statements are correct?

1 Cell Y had a lower water potential than the sugar solution it was put into.

2 Cell Z was put into the 10% sugar solution.

3 Cell Z had a less negative water potential than the sugar solution it was put into.

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

21 Which row describes some properties of stem cells?

	able to divide by mitosis to produce more stem cells	able to differentiate into specialised cells	able to repair damaged cells
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✗
D	✗	✗	✓

key

✓ = is a property

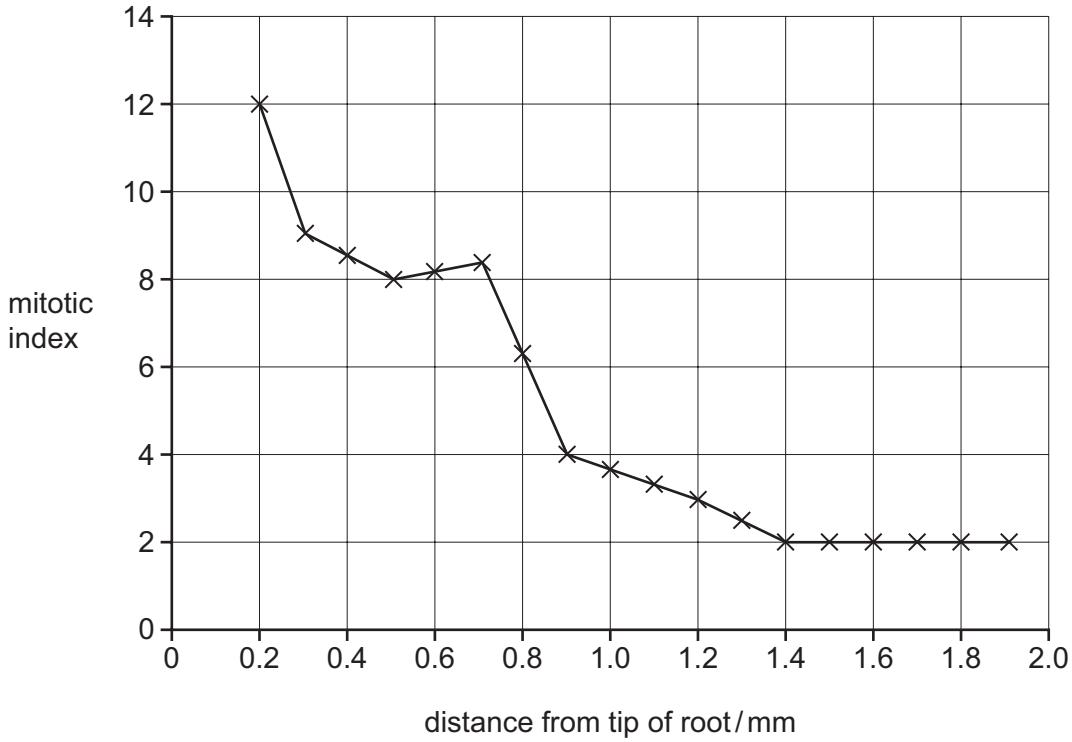
✗ = is not a property

22 The mitotic index is a measure of the proportion of cells that are undergoing mitosis in an area of tissue. It is calculated using the formula shown.

mitotic index = (number of cells undergoing mitosis ÷ total number of cells) × 100

A scientist calculated the mitotic index of areas of onion root at different distances from the tip of the root.

The results are shown.



Which statement is correct?

A No cell division occurs further than 1.4 mm from the tip of the root.

B The rate of cell division decreases as the distance from the root tip decreases.

C Most of the cells undergoing cell division are closer to the tip of the root.

D For a sample of 200 cells 0.2 mm from the tip of the root, 6 would be undergoing mitosis.

23 Which molecules make up the structure of ATP?

1 adenine

2 thymine

3 deoxyribose

4 phosphate

5 ribose

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

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

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

How many cytosines were in strand 1?

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

25 Which statement about the role of DNA polymerase in the process of semi-conservative replication of DNA is correct?

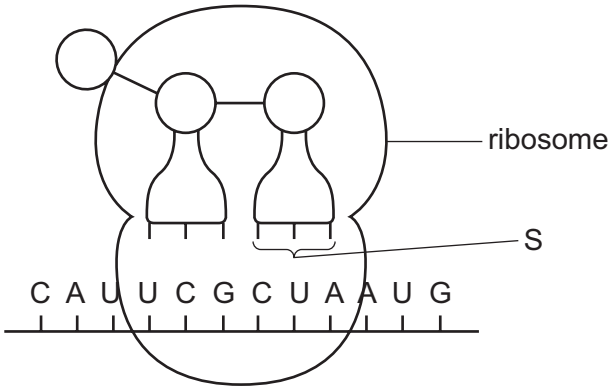
A DNA polymerase forms the hydrogen bonds between complementary base pairs.

B DNA polymerase moves along the lagging strand in the 3′ to 5′ direction.

C DNA polymerase joins new bases to the leading strand only.

D DNA polymerase moves along leading and lagging strands in the 5′ to 3′ direction.

26 The diagram shows the process of translation occurring at a ribosome.



What is the base sequence at S?

A CUA **B** CAT **C** GAU **D** GAT

27 Which row correctly explains how the structures of phloem sieve tube elements and xylem vessel elements are related to their functions as transport systems?

	phloem sieve tube elements	xylem vessel elements
A	contain mitochondria to make ATP for the active loading of sucrose into the phloem	cell walls are thickened and contain lignin which makes xylem vessels waterproof
B	contain no nucleus so that dissolved solutes can move easily through cells	end walls between cells are perforated so that water can move easily through xylem vessels
C	end walls between cells are perforated so that dissolved solutes can move between cells	lignin in cell walls gives strength so that xylem vessels do not collapse due to transpiration pull
D	no end walls between cells so that sucrose solution can move up and down the phloem	contain no cytoplasm so that a continuous column of water can move up the xylem vessels

28 Which component of plants is used by the apoplast pathway as water is moved from the soil to the xylem?

A Casparian strip

B cellulose

C endodermis

D suberin

29 Which statements correctly describe transport pathways in dicotyledonous plants?

1 In the symplast pathway, water may move through intercellular spaces.

2 The symplast pathway may be blocked by the tonoplast.

3 In the apoplast pathway, water does **not** move through plasmodesmata.

4 The apoplast pathway may be blocked by the Casparian strip.

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

30 Plants, such as the tobacco plant, retain very little of the water they take in and the volume of water lost during transpiration is very high. This is because these plants can only absorb carbon dioxide through open stomata.

Plants use carbon dioxide to synthesise glucose molecules. It is estimated that 400 molecules of water are lost for each carbon dioxide molecule gained.

How many water molecules are lost for a plant to synthesise one molecule of glucose?

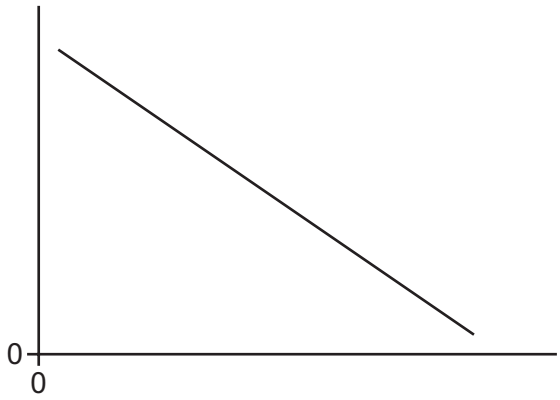
A 800 **B** 1200 **C** 2000 **D** 2400

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31 Which changes occur as sucrose is transferred from leaves into phloem sieve tubes to be transported to a sink?

	water potential in phloem sieve tubes becomes	volume of liquid in phloem sieve tubes
A	less negative	decreases
B	less negative	increases
C	more negative	decreases
D	more negative	increases

32 The graph shown does not have any axis labels.



Which row shows appropriate labels for the axes that would explain mass flow in phloem?

	x-axis	*y*-axis
A	distance from sink / m	hydrostatic pressure / kPa
B	hydrostatic pressure / kPa	distance from sink / m
C	distance from source / m	hydrostatic pressure / kPa
D	hydrostatic pressure / kPa	distance from source / m

33 What is present in the blood in human veins?

1 chloride ions

2 carbonic anhydrase

3 oxyhaemoglobin

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

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34 The photomicrograph shows two blood vessels P and Q.

Both these blood vessels are part of a network which transports blood around the body.



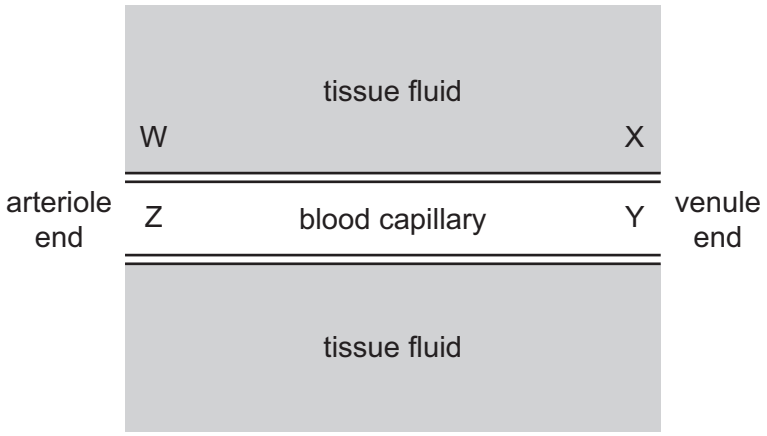
Which row is correct for blood vessel P and blood vessel Q?

	blood vessel P	blood vessel Q
A	carries blood into arterioles	carries blood into arterioles
B	carries blood into arterioles	carries blood from venules
C	carries blood from venules	carries blood into arterioles
D	carries blood from venules	carries blood from venules

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[Turn over

35 The diagram shows a blood capillary and the tissue fluid which surrounds it.



Tissue fluid is formed when fluid and solutes from blood plasma pass through tiny gaps in the capillary wall. Most tissue fluid is then returned to the blood in the capillary.

Which pressures will be needed at points W, X, Y and Z so that this system can function?

	pressure at W / mm Hg	pressure at X / mm Hg	pressure at Y / mm Hg	pressure at Z / mm Hg
A	18	26	36	26
B	26	26	18	36
C	26	36	26	18
D	36	18	26	26

36 What happens during ventricular systole in a mammalian heart?

A Aortic pressure increases.

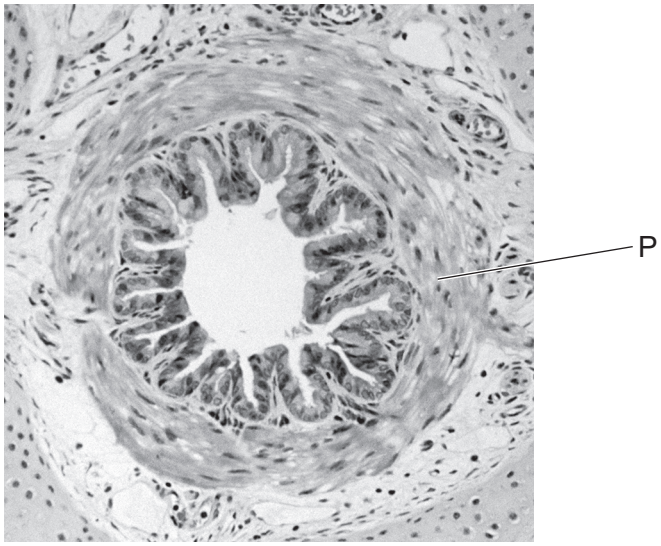
B Atrioventricular valves open.

C Semilunar valves close.

D Ventricular pressure decreases.

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37 The photomicrograph shows a part of the human gas exchange system with one tissue labelled P.



Which row is correct?

	part of gas exchange system	function of tissue P
A	bronchus	regulates the amount of air reaching the lungs
B	bronchus	provides support and prevents collapse
C	bronchiole	regulates the amount of air reaching the lungs
D	bronchiole	provides support and prevents collapse

38 How many times must a molecule of oxygen pass through a cell surface membrane as it diffuses from the airspace inside an alveolus, through a cell in the capillary wall, to bind to a molecule of haemoglobin?

A 3 **B** 4 **C** 5 **D** 10

39 A student wrote four statements about cholera.

Which statement is **not** correct?

A It can be controlled by vaccination.

B It is caused by bacteria spread by ingestion.

C HIV/AIDS increases the risk of infection.

D It may be transmitted by animal vectors.

40 Monoclonal antibodies are produced using the hybridoma method.

What are removed from the spleen of a mouse to produce monoclonal antibodies?

A antigens

B clones

C lymphocytes

D myeloma cells

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