Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/12**

Paper 1 Multiple Choice **October/November 2024**

1 hour 15 minutes

You must answer on the multiple choice answer sheet.

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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.

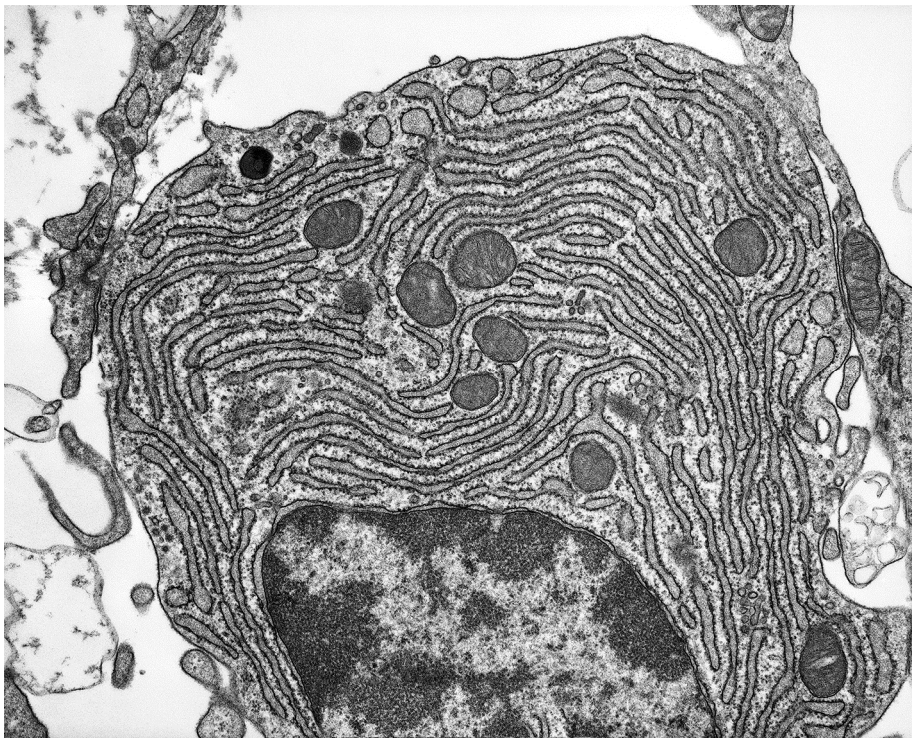
This document has **20** pages. Any blank pages are indicated.

1 A light microscope is used to observe two structures that are 200 nm apart on the slide.

What is the actual distance between the two structures when the magnification is changed from ×40 to ×400?

A 2 μm **B** 20 μm **C** 200 nm **D** 2000 nm

2 A cell is shown in the micrograph.



Which statement explains how it is possible to identify the type of microscope used to produce the micrograph?

A The nucleus is visible, so an electron microscope was used.

B The endoplasmic reticulum is **not** visible, so a light microscope was used.

C Chloroplasts are visible, so a light microscope was used.

D Ribosomes are visible, so an electron microscope was used.

3 Which statement supports the fact that mature plant cells contain organelles that carry out the same role as lysosomes?

A A range of hydrolytic enzymes can be found within mature plant vacuoles.

B Glycogen, found within vesicles, can be hydrolysed to glucose molecules.

C Double membrane-bound vesicles are formed from plant Golgi bodies.

D Vesicles, formed from the cell surface membrane, contain enzymes.

4 Which cell structures may contain cisternae?

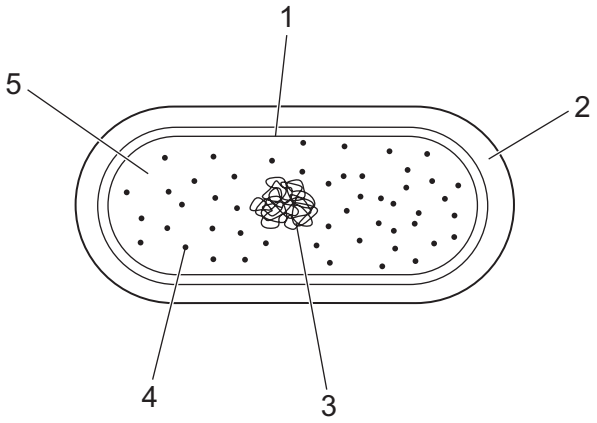
	chloroplast	endoplasmic reticulum	Golgi body	mitochondrion
A	✓	✓	✓	✗
B	✓	✗	✗	✓
C	✗	✓	✓	✗
D	✗	✓	✗	✓

key

✓ = may contain cisternae

✗ = does **not** contain cisternae

5 The diagram shows some cell structures of one type of cell.



Which labelled cell structures are present in typical eukaryotic cells **and** typical bacterial cells?

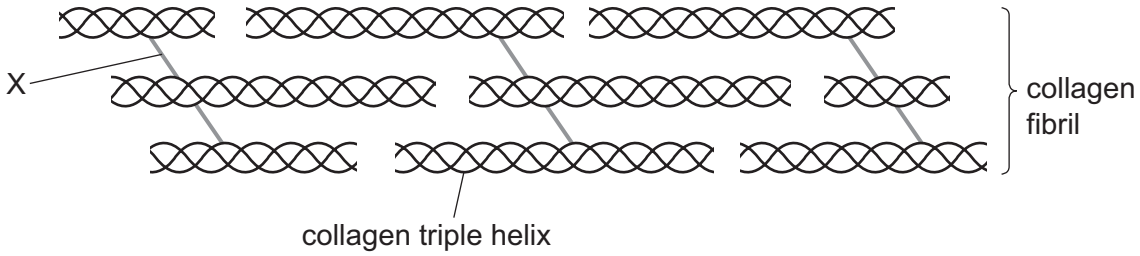
A 1, 2, 3 and 4

B 1, 3, 4 and 5

C 1, 2 and 3 only

D 3, 4 and 5 only

6 The diagram shows part of a collagen fibril made of collagen triple helices. The collagen triple helices are linked to each other by one type of bond. This bond is labelled as X in the diagram.



What is bond X?

A covalent bond

B disulfide bond

C hydrogen bond

D peptide bond

7 The table shows some information about the polypeptides that make up haemoglobin.

	α-globin	β-globin
total number of amino acid residues in polypeptide chain	141	146
position of amino acid cysteine in polypeptide chain	104	93 and 112

Scientists studied the region of the β-globin polypeptide chain containing the amino acid cysteine at position 93. They found that:

- this region faces outwards when **no** oxygen is attached to the haem group
- this region faces inwards when oxygen is attached to the haem group
- replacing cysteine with a different amino acid reduces the Bohr shift.

What can be concluded from the information about cysteine in haemoglobin?

A More than 1% of the amino acids in one haemoglobin protein are cysteine.

B In α-globin, there is a cysteine closer to the end of the polypeptide chain with an unreacted carboxyl group than in β-globin.

C The replacement of the cysteine at position 93 in β-globin decreases the affinity of haemoglobin for oxygen at low pH.

D The binding of oxygen to the haem group causes the region of β-globin containing cysteine at position 93 to become more hydrophilic.

8 Which feature of glycogen distinguishes it from starch?

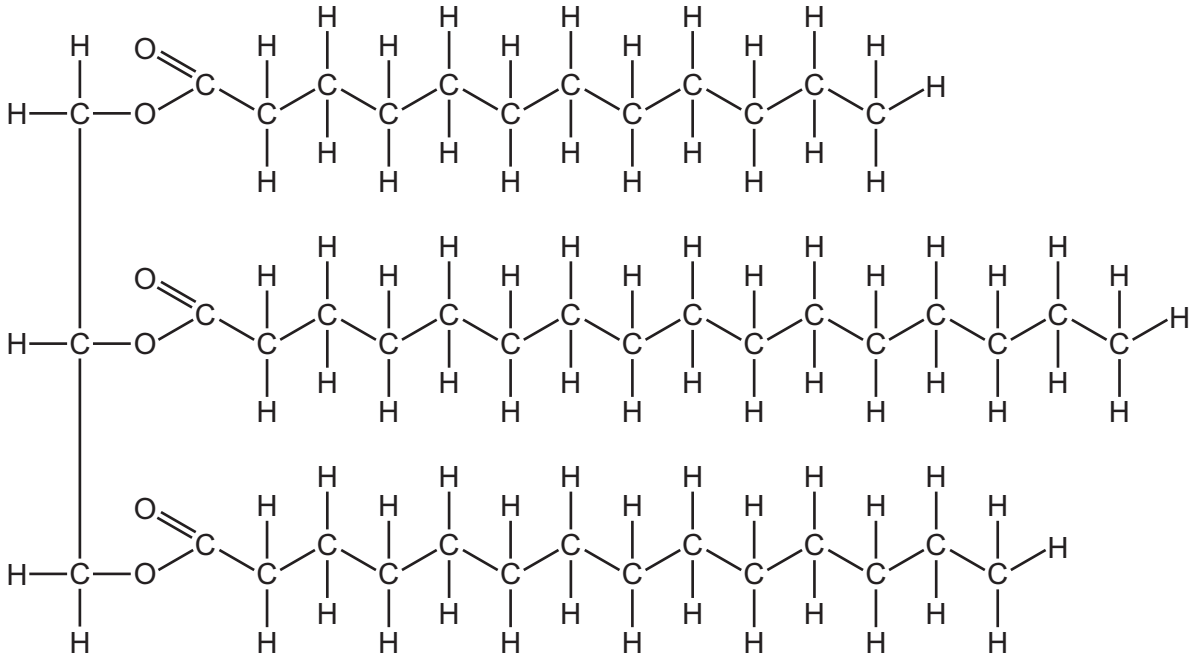
A All glycogen molecules are highly branched.

B All glycogen molecules are polysaccharides.

C All glycogen molecules contain α-glucose.

D All glycogen molecules contain 1,4-glycosidic bonds.

9 The diagram shows a biological molecule.



Which molecules would be produced if this biological molecule was hydrolysed?

A amino acids and glycerol only

B amino acids, glycerol and water

C fatty acids and glycerol only

D fatty acids, glycerol and water

10 A mixture of glucose and starch solutions was placed in a length of dialysis (Visking) tubing and the tubing sealed. The tubing was then placed in a boiling tube containing distilled water. Two samples were immediately removed from this water (time 0 minutes) and tested with either iodine solution or Benedict's solution. This was repeated at 10 minute intervals for 30 minutes.

The iodine solution gave an orange-brown colour each time.

The table shows the results of the Benedict's test.

	time / minutes			
	0	10	20	30
colour produced by Benedict's test	blue	green	yellow	red

What may be concluded from these results?

1 The pores in the Visking tubing are too small for a starch molecule to pass through.

2 Glucose diffuses through the Visking tubing down a diffusion gradient.

3 Water diffuses into the Visking tubing.

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

11 Which molecules are globular proteins?

1 amylase

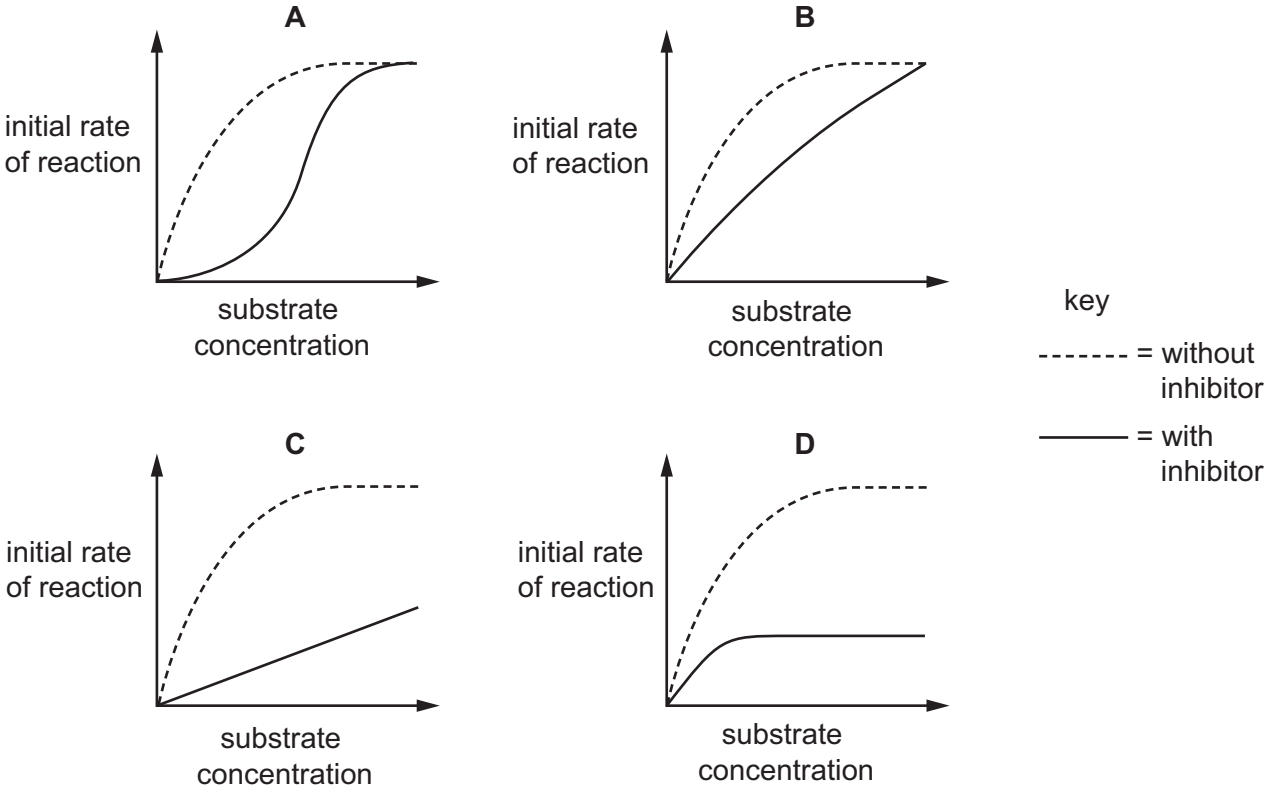
2 haemoglobin

3 DNA polymerase

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

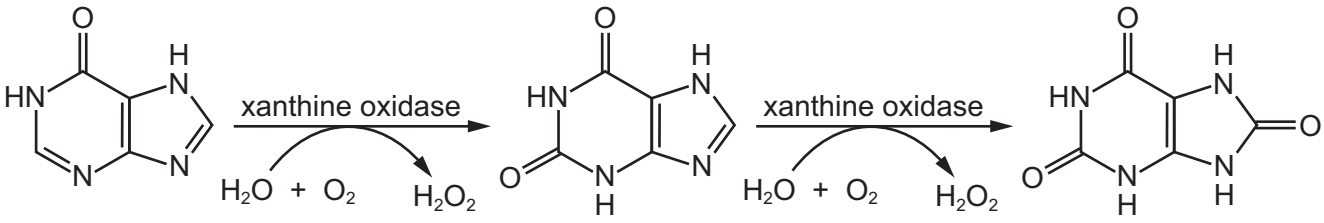
12 The initial rate of a reaction catalysed by an enzyme was measured at various substrate concentrations.

Which graph shows the effect of a low concentration of non-competitive inhibitor on the reaction?



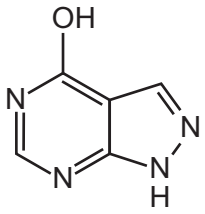
13 Gout is a type of arthritis in which small uric acid crystals form inside and around the joints. It causes sudden attacks of severe pain and swelling.

The diagram shows how uric acid is formed from hypoxanthine catalysed by the enzyme xanthine oxidase.



hypoxanthine xanthine uric acid

Gout can be treated using a drug called allopurinol which has a similar shape to hypoxanthine.



allopurinol

What can be concluded from this information about how allopurinol prevents the formation of uric acid?

A It binds to the active site of xanthine oxidase instead of hypoxanthine, resulting in reduced production of uric acid.

B It binds to another part of xanthine oxidase and this changes the shape of the active site.

C It disrupts the hydrogen bonds within xanthine oxidase so it denatures and the active site is no longer complementary to hypoxanthine and xanthine.

D It hydrolyses the peptide bonds within xanthine oxidase to change the shape of the active site.

14 Phospholipids are formed in a similar way to triglycerides.

A sample contained six phospholipid molecules.

- The molecular weight of a phosphate ion is 95 g mol^{-1}.
- The molecular weight of each individual fatty acid in this sample was found to be 282 g mol^{-1}.
- The molecular weight of glycerol is 92 g mol^{-1}.
- The molecular weight of water is 18 g mol^{-1}.

What is the molecular weight of the sample in g mol^{-1}?

A 2598 **B** 4182 **C** 4506 **D** 4830

15 Which statements about phospholipids in cell surface membranes are correct?

1 Fatty acid tails allow most ions to pass through the membrane.

2 Hydrophobic tails point inwards facing each other.

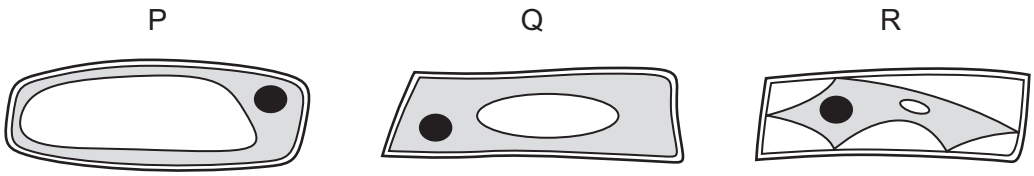
3 All polar heads face the cytoplasm.

4 The phospholipids help with the flexibility of the membrane.

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

16 In an experiment, pieces of onion epidermis are put into three different concentrations of sucrose solutions, P, Q and R. The pieces of onion are left for an hour and then examined using the low power of a light microscope.

Each diagram shows one cell from the epidermis that was placed in each of the sucrose concentrations.



What explains the appearance of cells in solution Q?

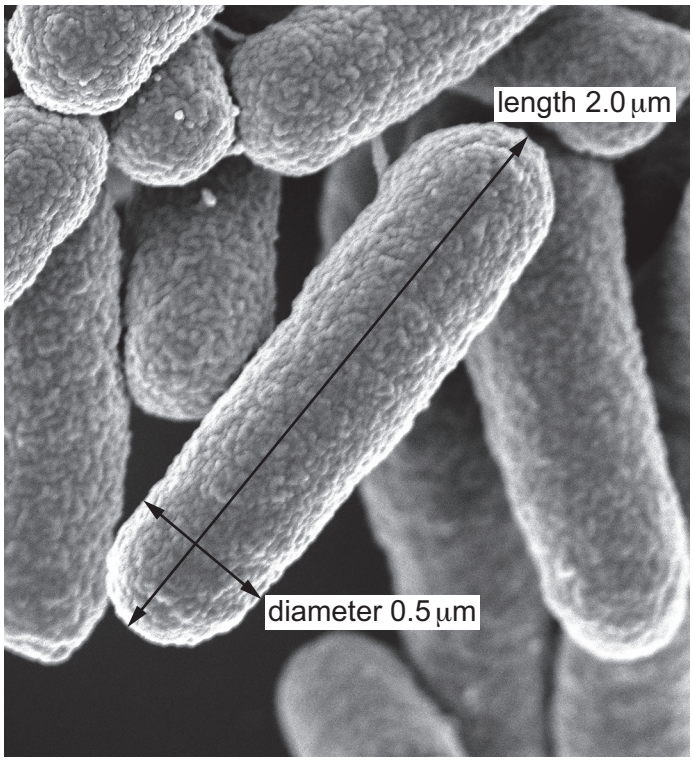
A The concentration of solution Q is equal to the concentration of the solutes in the cell sap.

B The cytoplasm has the same concentration of sucrose as solution Q.

C The water potential of the cytoplasm is equal to the water potential of the vacuole.

D The water potential of the cell sap is equal to the water potential of solution Q.

17 The electron micrograph shows rod-shaped bacteria.



The actual length of the bacterium is 2.0 μm and the diameter is 0.5 μm. Assume that the bacterium is cylinder-shaped.

What is the surface area to volume ratio of the bacterium?

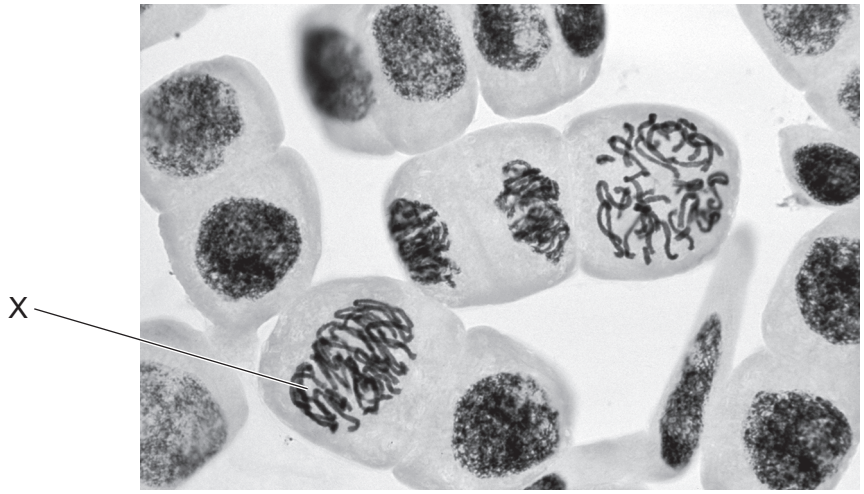
A 3.0 : 1.0 **B** 5.0 : 1.0 **C** 8.0 : 1.0 **D** 9.0 : 1.0

18 Chickens have 78 chromosomes in the nucleus of a body cell.

How many DNA molecules are there in a chicken body cell at the start of prophase of mitosis?

A 46 **B** 78 **C** 92 **D** 156

19 The photomicrograph shows cells undergoing mitosis.



Which statement describes what will happen next in cell X?

A Chromatin coils up tightly and the nuclear envelope breaks down.

B Chromosomes line up along the equator of the cell and attach to the spindle.

C Sister chromatids move towards opposite poles, pulled by the spindle fibres.

D Spindle fibres break down and the cell prepares for cytokinesis.

20 Which processes occur in bone marrow cells that are in a mitotic cell cycle?

1 Phosphate groups bind to ADP molecules to form ATP.

2 Bonds form between nucleotides in a DNA strand.

3 Hydrogen bonds form between tRNA anticodons and mRNA codons.

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

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

Which cells need to transcribe telomerase enzyme?

1 stem cells

2 activated memory B-lymphocytes

3 helper T-lymphocytes secreting cytokines

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

22 A polypeptide molecule contains the amino acid sequence:

glycine – leucine – lysine – valine.

The table shows DNA triplets for these amino acids.

glycine	leucine	lysine	valine
CCC	GAA	TTT	CAA

Which tRNA anticodons are needed for the synthesis of this polypeptide?

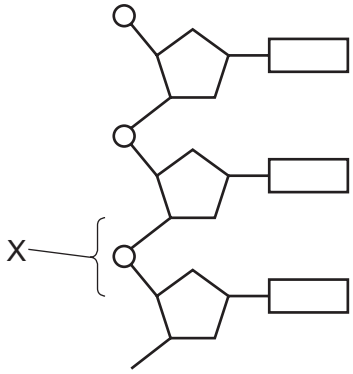
A CCC GAA TTT CAA

B CCC GAA UUU CAA

C GGG CUU AAA GUU

D GGG CUU UUU GUU

23 The diagram shows a section of a strand of DNA.



Which type of bond is labelled X?

A glycosidic

B hydrogen

C peptide

D phosphodiester

24 Which row correctly describes cytosine?

	ring structure	number of hydrogen bonds it forms with its complementary base	type of base
A	double	three	purine
B	double	two	pyrimidine
C	single	three	pyrimidine
D	single	two	purine

25 During the production of protein molecules, only one strand from the DNA double helix is used.

Which name is given to the DNA strand that is used to produce a new protein?

A non-transcribed strand

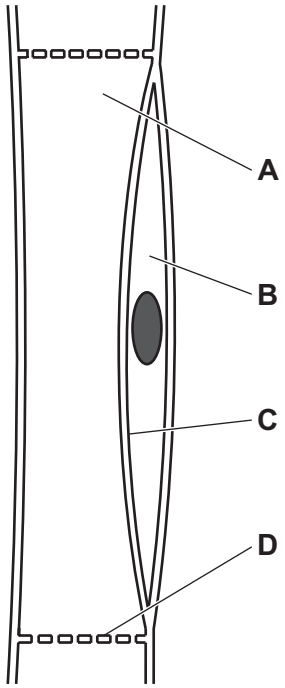
B leading strand

C template strand

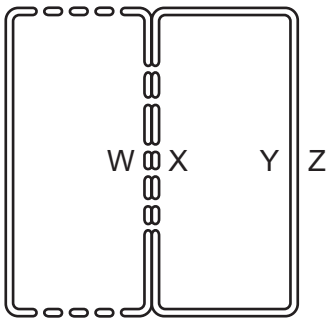
D lagging strand

26 The diagram shows a longitudinal section of a phloem sieve tube with a companion cell.

Where are the mitochondria located for the release of energy for cotransport?



27 The diagram shows a phloem sieve tube element and a companion cell that are involved in translocation of sucrose.



Which process correctly describes the translocation of sucrose through these cells?

A Sucrose moves from Y to Z by active transport.

B Protons move from Y to Z by active transport.

C Protons move from Z to Y by diffusion.

D Protons move from X to W by diffusion.

28 Which types of molecules are cotransported into companion cells?

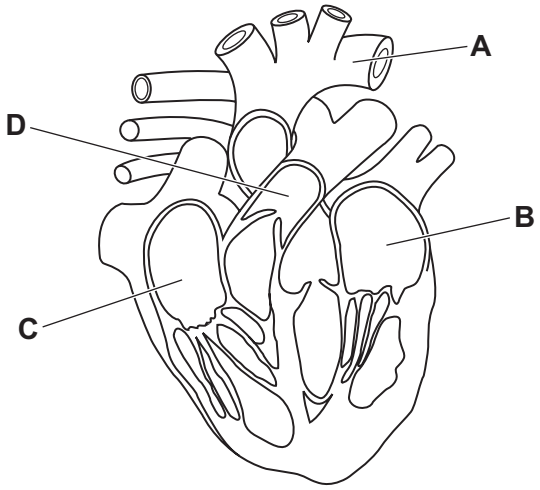
A monomers and disaccharides

B monomers and polysaccharides

C polymers and disaccharides

D polymers and monosaccharides

29 The diagram shows a section through the human heart.



Which label is correct?

A pulmonary artery

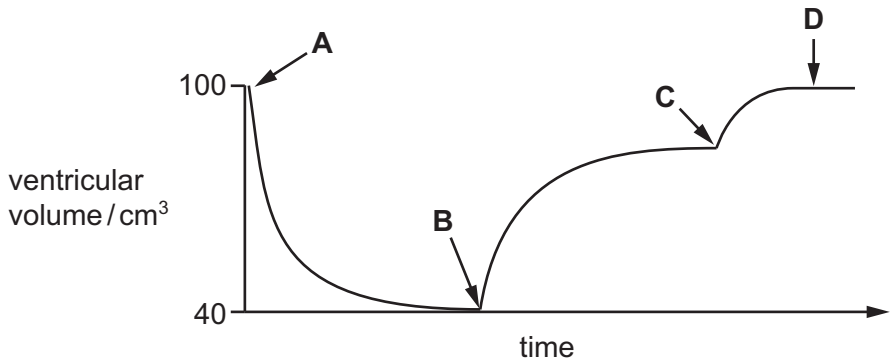
B left ventricle

C right atrium

D aorta

30 The graph shows how the volume of the left ventricle changes during one cardiac cycle.

Which point on the graph represents the start of atrial systole?



31 Which statement is correct?

A In a red blood cell, CO_2 can combine with haemoglobin to form haemoglobinic acid.

B Carbonic anhydrase is an enzyme that catalyses the reaction between CO_2 and H_2O.

C At the lungs, carbon dioxide is released when carbonic acid and water react together.

D The greater the concentration of CO_2 in the blood, the higher the affinity of haemoglobin for oxygen.

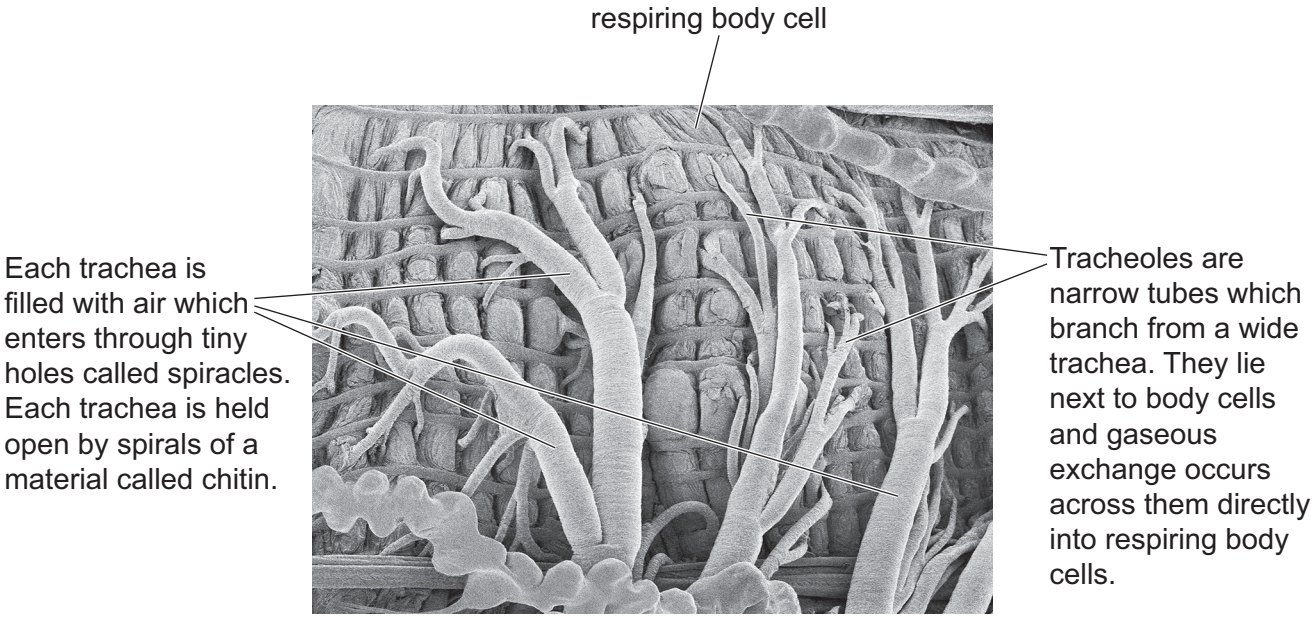
32 Which row is correct for an artery?

	inner layer	middle layer	outer layer
A	smooth layer of endodermis cells	collagen, elastic fibres and smooth muscle	collagen only
B	smooth layer of endodermis cells	elastic fibres and smooth muscle only	collagen and elastic fibres
C	smooth layer of squamous cells	collagen, elastic fibres and smooth muscle	collagen and elastic fibres
D	smooth layer of squamous cells	elastic fibres and smooth muscle only	collagen only

33 Which row shows the features of the gas exchange surface that increase diffusion of carbon dioxide and oxygen?

	concentration gradient	diffusion distance
A	steep	long
B	steep	short
C	shallow	long
D	shallow	short

34 The electron micrograph shows some of the airways in the gaseous exchange system of an insect and the respiring body cells that surround them.



Which statements describe correct differences between the insect gas exchange system shown in the electron micrograph and the human gas exchange system?

1 Gas exchange occurs through the walls of the airways directly into respiring body cells in insects but this does **not** occur in humans.

2 There are spirals of chitin in the walls of a trachea in insects to hold it open but **not** in humans.

3 There is more than one trachea in the gas exchange system of the insect but only one in humans.

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

35 Which row is correct for the wall of the trachea **and** the wall of the bronchus?

	cartilage	smooth muscle	goblet cells
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✓	✗

key

✓ = present

✗ = **not** present

36 A bacterial pathogen produces a protein that acts as a toxin. This toxin is harmful to humans.

Scientists are developing monoclonal antibodies that can be used to detect the presence of the toxin in the body so that early treatment can be given.

Which statements describe steps in the development of these monoclonal antibodies?

1 The toxin protein is injected into a mouse and triggers mitosis of specific B-lymphocytes.

2 Antibodies are collected from the spleen of the mouse and fused with myeloma cells.

3 A hybridoma cell produces many antibodies with a variety of different variable regions.

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

37 Which statements are correct for penicillin?

1 It is harmful to prokaryotic cells.

2 It disrupts cell wall synthesis.

3 It becomes less effective with regular use.

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

38 Why is passive immunity effective for only a short time?

A Antibodies are rapidly broken down.

B Antigens are rapidly broken down.

C Memory cells soon die.

D Phagocytes soon die.

39 Which row is correct for the control or prevention methods for each disease?

	TB	malaria	cholera
A	vaccination	chlorination of water	vaccination
B	chlorination of water	contact tracing	destruction of the vector
C	contact tracing	destruction of the vector	chlorination of water
D	destruction of the vector	vaccination	contact tracing

40 Peptidoglycan is stained purple by the chemical crystal violet.

Which cells would stain purple in the presence of crystal violet?

A palisade mesophyll cells

B *Vibrio cholerae* cells

C *Plasmodium falciparum* cells

D endothelial cells

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