



# Cambridge International AS & A Level

**BIOLOGY**

**9700/01**

Paper 1 Multiple Choice

**For examination from 2022**

SPECIMEN PAPER

**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

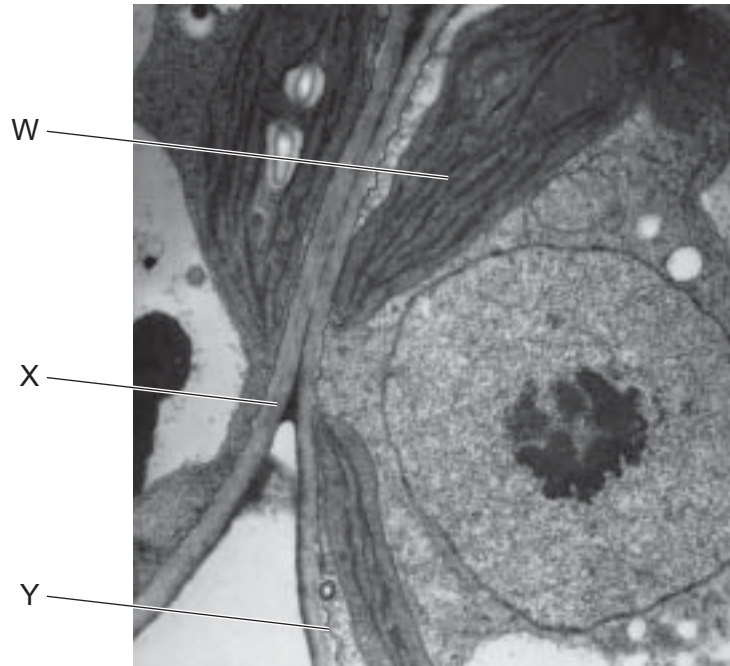
- There are **forty** questions on this paper. Answer **all** questions.
- For each question there are four possible answers **A, B, C** and **D**. Choose the **one** you consider correct and record your choice in soft pencil on the multiple choice answer sheet.
- Follow the instructions on the multiple 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 **18** pages. Blank pages are indicated.

- 1 Which definition of the magnification of a drawing of a leaf is correct?
- A the actual size of the leaf multiplied by the magnification of the microscope
  - B the measured difference in size between the leaf and a drawing of the leaf
  - C the increase in size of the leaf when observed using a microscope
  - D the size of the drawing of the leaf divided by the actual size of the leaf
- 2 The electron micrograph shows part of two cells.



Which labelled features identify these cells as eukaryotic?

- A W, X and Y
  - B W and X only
  - C W only
  - D X only
- 3 Plant cells are stained and viewed using a student microscope. The light source is natural light.
- What could be clearly visible at  $\times 400$  magnification?
- A cristae of mitochondria
  - B grana of chloroplasts
  - C nucleoli
  - D ribosomes

4 Which lengths are equivalent to  $1\ \mu\text{m}$ ?

- 1 1000mm
- 2 0.001 nm
- 3 0.001 mm
- 4 1 000 000 nm
- 5 0.01 mm
- 6 1000 nm

**A** 1 and 4      **B** 2 and 5      **C** 3 and 4      **D** 3 and 6

5 Some secretory cells synthesise and release glycoproteins.

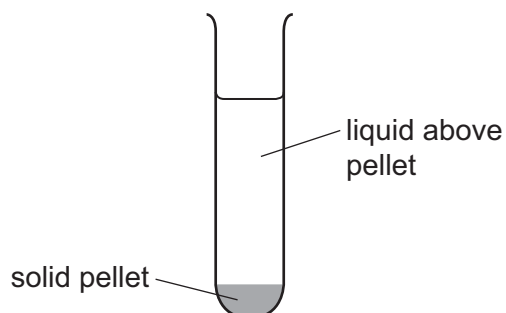
What is the correct sequence of some of the events that occur in a secretory cell?

- 1 exocytosis
- 2 products accumulate in secretory vesicles
- 3 mRNA binds to ribosomes
- 4 synthesis of glycoproteins

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

- 6 A scientist used a blender to break open a sample of animal cells and release the organelles.

The extracted mixture was spun in a centrifuge at a low speed. The heaviest type of organelle sank to the bottom of the centrifuge tube to form a solid pellet, pellet 1.



The liquid above pellet 1 was poured into a clean centrifuge tube and spun at a higher speed. The next heaviest organelle sank to the bottom to form a solid pellet, pellet 2.

The scientist repeated this procedure twice more to obtain pellet 3 and pellet 4, each containing a single type of organelle.

What is the function of the type of organelle extracted in pellet 3?

- A digestion of old cell organelles
  - B production of ATP by respiration
  - C synthesis of mRNA
  - D synthesis of protein
- 7 What is the general formula for amylose?
- A  $(C_5H_{10}O_5)_n$
  - B  $(C_5H_{10}O_6)_n$
  - C  $(C_6H_{12}O_6)_n$
  - D  $(C_6H_{10}O_5)_n$
- 8 Which statement describes how the molecular structure of starch is suited to its function?
- A Amylose has a branched structure and amylopectin is coiled to give a compact molecule for transport.
  - B In the breakdown of amylose and amylopectin, many condensation reactions release stored energy.
  - C In the formation of amylose and amylopectin, many hydrolysis reactions allow the release of stored energy.
  - D Amylose and amylopectin form a complex that is insoluble and so does not affect the water potential of the cell.

- 9 Cows and whales are mammals that produce milk to feed their babies. Newborn whales grow faster than newborn cows. Milk contains fatty acids with a range of chain lengths.

The table shows the percentage of fatty acids of different chain lengths in cow milk and whale milk.

| chain length of fatty acids/number of carbon atoms | percentage of fatty acids in milk |       |
|--|-----------------------------------|-------|
|  | cow                               | whale |
| 4–12   | 22.2                              | 0.0   |
| 14   | 10.6                              | 13.8  |
| 16   | 25.5                              | 27.9  |
| 18   | 40.1                              | 29.4  |
| > 18   | 1.6                               | 28.9  |

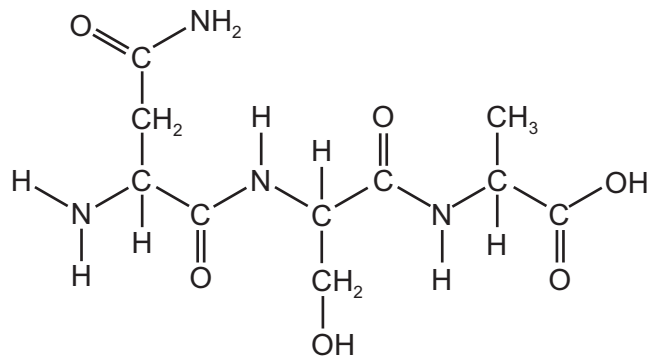
Which statement about the ratio of short fatty acids (4–16 carbon atoms) to long fatty acids (18 or more carbon atoms) in the milk of cows and whales is correct?

- A** The ratio in cow milk is higher because newborn cows need more energy than newborn whales.
- B** The ratio in cow milk is lower because newborn cows need less energy than newborn whales.
- C** The ratio in whale milk is higher because newborn whales need less energy than newborn cows.
- D** The ratio in whale milk is lower because newborn whales need more energy than newborn cows.
- 10 The structure of phospholipids includes:
- 1 polar phosphate heads
  - 2 hydrophobic fatty acid chains
  - 3 saturated fatty acid chains.

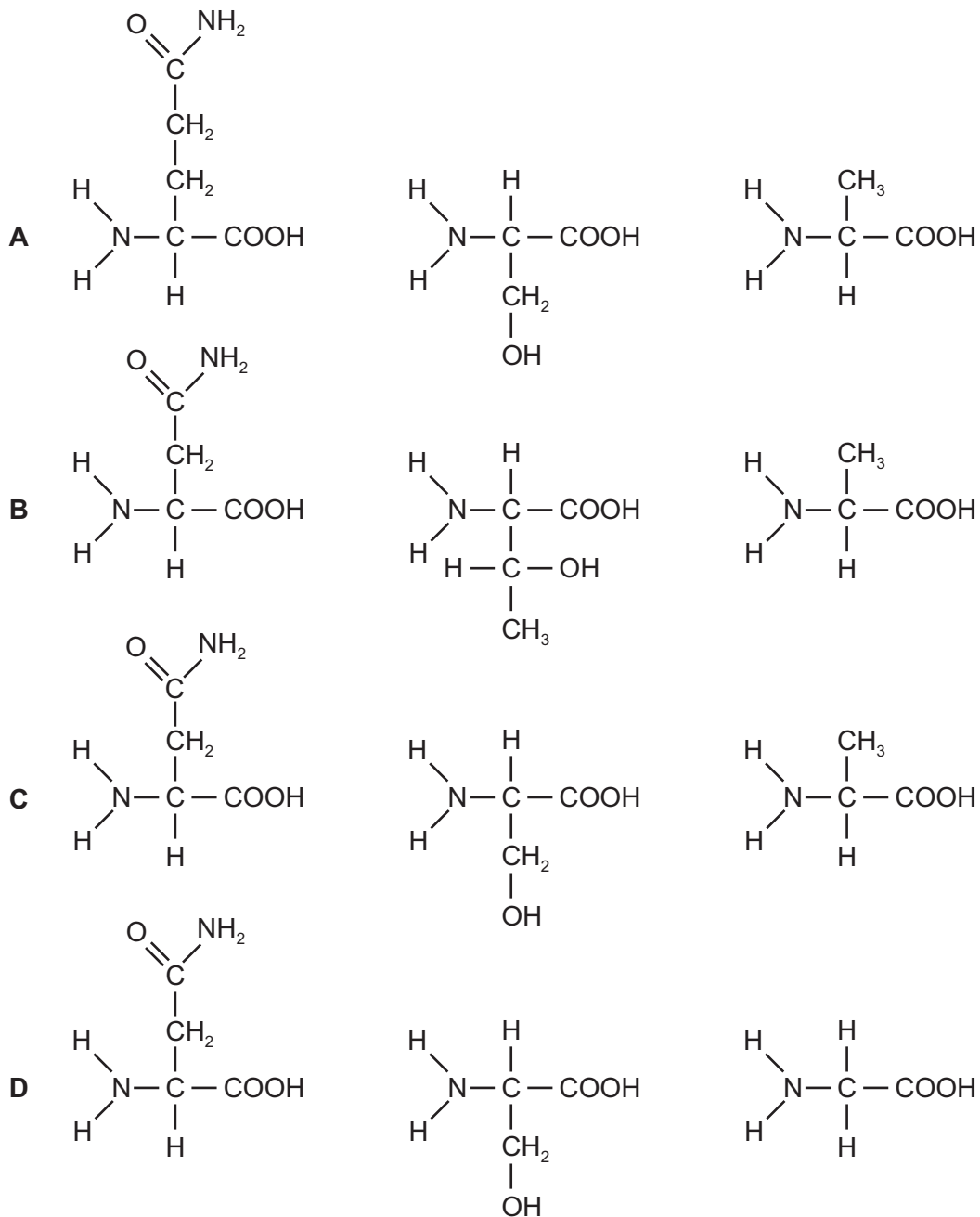
What are essential for the formation of a phospholipid bilayer in a cell surface membrane?

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

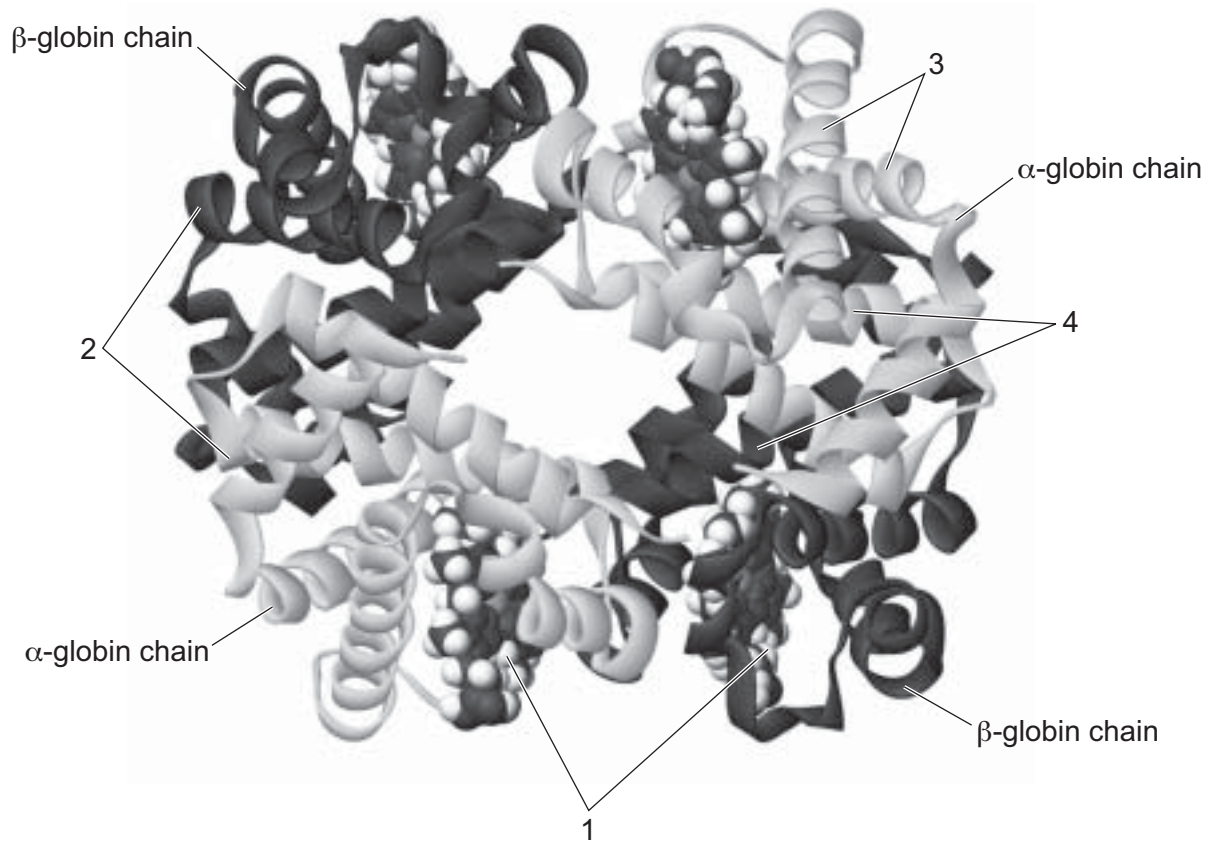
11 The diagram shows the molecular structure of a peptide.



Which molecules would result from the complete hydrolysis of the peptide?



12 The diagram shows a haemoglobin molecule.



Which row identifies the different parts of the molecule?

|          | 1                       | 2                       | 3                   | 4                       |
|----------|-------------------------|-------------------------|---------------------|-------------------------|
| <b>A</b> | $\alpha$ -helix         | $\beta$ -pleated sheet  | oxygen binding site | hydrophobic amino acids |
| <b>B</b> | oxygen binding site     | hydrophilic amino acids | $\alpha$ -helix     | hydrophobic amino acids |
| <b>C</b> | haem group              | hydrophobic amino acids | $\alpha$ -helix     | hydrophilic amino acids |
| <b>D</b> | hydrophobic amino acids | $\beta$ -pleated sheet  | haem atom           | oxygen binding site     |

- 13** A student investigated the effect of enzyme concentration on the rate of hydrolysis of protein in milk.

When the enzyme and milk were mixed, the protein was hydrolysed and the mixture changed from cloudy to clear.

The student investigated five different enzyme concentrations and recorded the time taken for the mixture to become clear.

What is an appropriate control for this investigation?

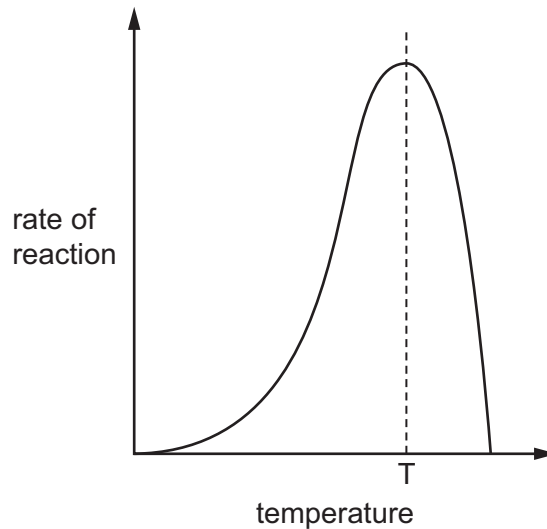
- A** Carrying out an experiment where the enzyme solution is replaced with water.
  - B** Carrying out each experiment in a thermostatically controlled water-bath at 35 °C.
  - C** Repeating each experiment three times for each of the five enzyme concentrations.
  - D** Using the same volume of enzyme solution for each of the five experiments.
- 14** What determines the specificity of an enzyme?

- 1 the covalent and other bonding between R groups of the polypeptide
- 2 the optimum pH of the enzyme
- 3 the covalent peptide bonds between amino acids of the polypeptide
- 4 the shape of the substrate molecule

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



- 15 The graph shows the effect of temperature on the rate at which the enzyme in a biological washing powder digests and removes fruit juice stains.



Which statements explain the shape of the graph at temperatures higher than T?

- 1 Bonds are broken between the R groups of the amino acids in the polypeptide chains of the enzyme.
- 2 There are more collisions between the enzyme and its substrate.
- 3 The tertiary structure of the enzyme is altered.
- 4 The shapes of the active site and the substrate are no longer complementary.

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

- 16 Which statement describes carrier proteins in cell surface membranes?

- A** Carrier proteins are found on the outer surface of the membranes allowing cell recognition.
- B** Carrier proteins are involved in moving substances through the membranes by either active transport or passive transport.
- C** Carrier proteins allow the binding of ligand molecules, which causes changes within cells.
- D** Carrier proteins are involved in moving substances through the membranes by passive transport through water-filled pores.

- 17 What happens to a typical bacterium when it is placed in surroundings that have a higher water potential than the water potential inside the cell?

- A** The bacterium bursts because the cell wall has no structural function.
- B** The bacterium dies because water leaves the cell by osmosis.
- C** There is no change because the cell wall is impermeable to water.
- D** There is a net movement of water into the bacterium.

18 By which process do hydrogencarbonate ions leave red blood cells?

- A active transport
- B endocytosis
- C facilitated diffusion
- D phagocytosis

19 In an experiment, fluorescent dyes were attached to proteins on the outer surface of cell surface membranes. Fluorescent dyes of one colour were attached to proteins of a living human cell and fluorescent dyes of a different colour were attached to proteins of a living mouse cell.

The human cell and the mouse cell were then fused to form a hybrid cell.

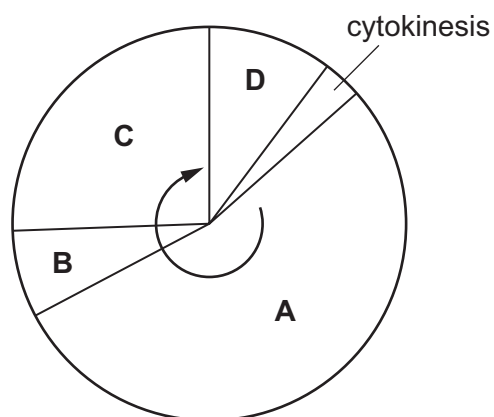
At first, the proteins attached to different fluorescent dyes remained separate, but after 40 minutes the proteins were distributed randomly across the hybrid cell surface membrane.

What does this experiment show?

- A Proteins are found only on the outer surface of cell surface membranes.
- B Proteins in the outer layer of a bilayer do not penetrate into the inner layer.
- C Proteins move freely in the phospholipids of a bilayer.
- D The cell surface membranes of the two cells are bilayers.

20 The diagram shows the mitotic cell cycle.

During which phase is DNA replicated?



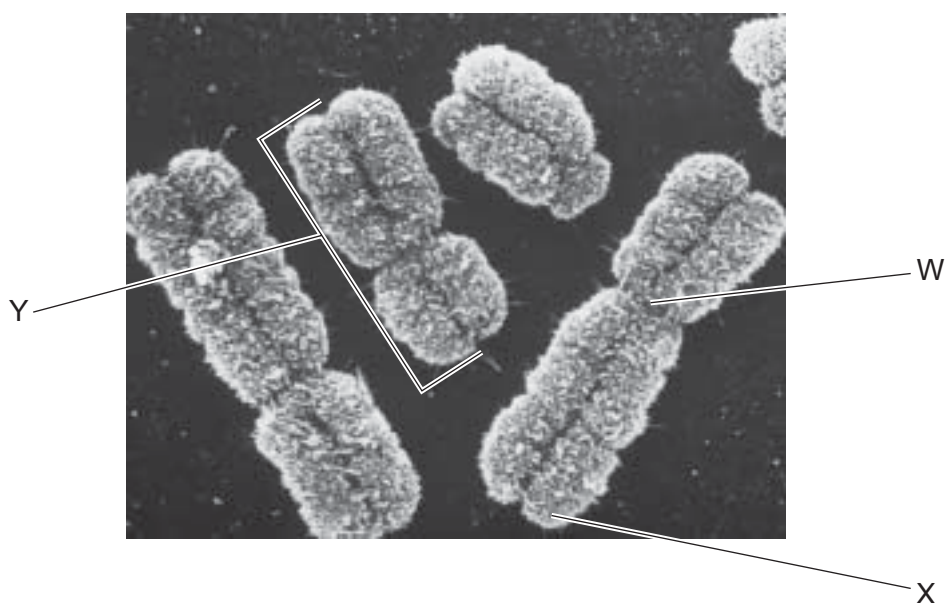
21 Bacterial cells divide by a process called binary fission.

Which macromolecules must be synthesised for binary fission?

- 1 cell membrane proteins and RNA
- 2 DNA and peptidoglycan
- 3 enzymes and cellulose

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

22 The electron micrograph shows a group of human chromosomes.



Which label is correct for each of the structures labelled W, X and Y?

|          | W          | X          | Y           |
|----------|------------|------------|-------------|
| <b>A</b> | centriole  | centromere | chromatid   |
| <b>B</b> | centriole  | centromere | microtubule |
| <b>C</b> | centromere | telomere   | chromatid   |
| <b>D</b> | centromere | telomere   | microtubule |

23 Which statement about the behaviour of chromosomes during mitosis is correct?

- A** They attach to the spindle fibres to contain them within the nucleus.
- B** They condense to prevent further translation of genes.
- C** They reach the poles of the cell and begin to uncoil.
- D** They replicate to produce sufficient DNA to form two new nuclei.

**24** Gene mutations can occur by substitution, deletion or insertion.

What is the smallest part of a DNA molecule that can be changed by a gene mutation?

- A** base
- B** codon
- C** gene
- D** nucleotide

**25** Which statements about mRNA are correct?

- 1 mRNA can form base pairs.
- 2 mRNA can form hydrogen bonds.
- 3 mRNA is single stranded.

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

26 The table shows the role of four different proteins involved in DNA replication.

| protein | helicase                              | topoisomerase                      | single-strand binding protein                    | DNA polymerase            |
|---------|---------------------------------------|------------------------------------|--|---------------------------|
| role    | unwinds the parental DNA double helix | breaks and rejoins the DNA strands | binds to separated DNA strands to stabilise them | synthesises strand of DNA |

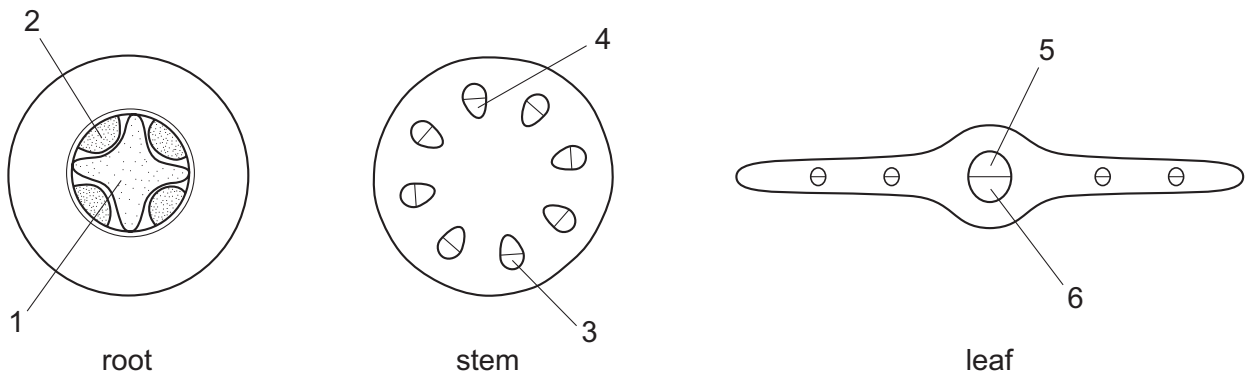
Which row shows the functions of these proteins?

|          | helicase  | topoisomerase   | single-strand binding protein   | DNA polymerase  |
|----------|---|---|---|---|
| <b>A</b> | adds DNA nucleotides to the 3' end of a growing polynucleotide strand | prevents original strands re-forming complementary base pairs | enables tension caused by unwinding to be released                    | makes strands available as templates                                  |
| <b>B</b> | enables tension caused by unwinding to be released                    | prevents original strands re-forming complementary base pairs | makes strands available as templates                                  | adds DNA nucleotides to the 3' end of a growing polynucleotide strand |
| <b>C</b> | enables tension caused by unwinding to be released                    | makes strands available as templates                          | adds DNA nucleotides to the 3' end of a growing polynucleotide strand | prevents original strands re-forming complementary base pairs         |
| <b>D</b> | makes strands available as templates                                  | enables tension caused by unwinding to be released            | prevents original strands re-forming complementary base pairs         | adds DNA nucleotides to the 3' end of a growing polynucleotide strand |

27 Which type of sugar and which type of bond are found in a DNA molecule?

|          | type of sugar  | type of bond   |
|----------|----------------|----------------|
| <b>A</b> | disaccharide   | glycosidic     |
| <b>B</b> | disaccharide   | phosphodiester |
| <b>C</b> | monosaccharide | peptide        |
| <b>D</b> | monosaccharide | hydrogen       |

28 The diagrams represent transverse sections of three plant organs.



Which row is correct for phloem?

|          | root | stem | leaf |
|----------|------|------|------|
| <b>A</b> | 1    | 3    | 5    |
| <b>B</b> | 1    | 4    | 6    |
| <b>C</b> | 2    | 3    | 6    |
| <b>D</b> | 2    | 4    | 5    |

29 Sucrose moves from a phloem sieve tube element into a root cell.

Which changes to the water potential and the volume of liquid in the phloem sieve tube element are correct?

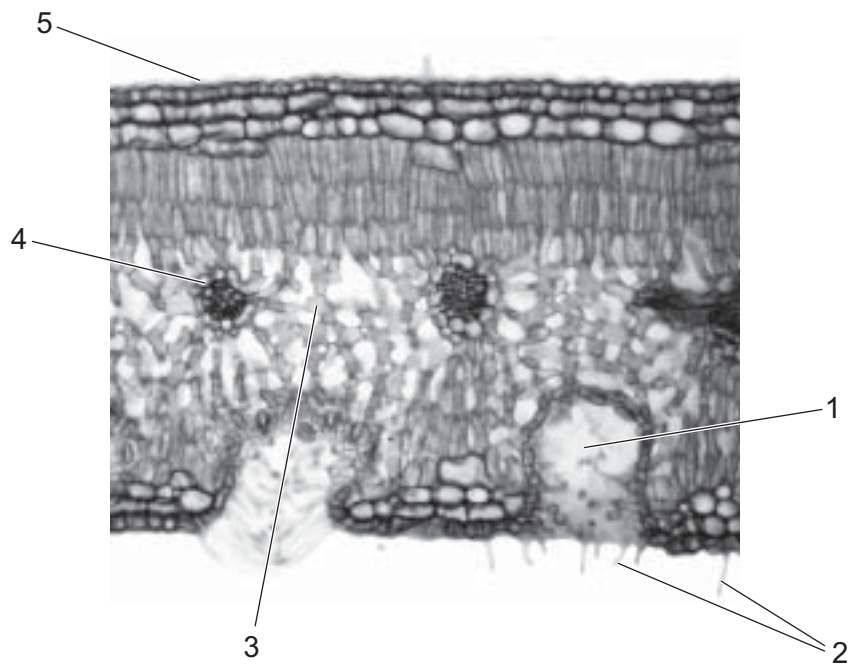
|          | water potential | volume of liquid |
|----------|-----------------|------------------|
| <b>A</b> | becomes higher  | decreases        |
| <b>B</b> | becomes higher  | increases        |
| <b>C</b> | becomes lower   | decreases        |
| <b>D</b> | becomes lower   | increases        |

30 Which statements about water movement in plants are correct?

- 1 Water can pass through cell walls containing layers of cellulose fibres.
- 2 Water can pass through cell walls containing rings or spirals of lignin.
- 3 Water cannot pass through a band of suberin in cell walls.

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

31 The photomicrograph is a transverse section of a leaf.



Which labelled features are characteristic adaptations of many xerophytes?

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

32 A maize crop is growing successfully in a field in which the water potential of the soil is  $-40$  kPa.

What is the most likely water potential of the cell sap in the root hair cell?

- A**  $-60$  kPa    **B**  $-40$  kPa    **C**  $-20$  kPa    **D**  $0$  kPa

33 The contraction of the heart is coordinated through electrical impulses passing through the cardiac muscle.

What is the correct order of part of the sequence of these impulses?

- A** right and left atria  $\rightarrow$  sinoatrial node  $\rightarrow$  atrioventricular node  $\rightarrow$  ventricular walls  
**B** sinoatrial node  $\rightarrow$  right and left atria  $\rightarrow$  atrioventricular node  $\rightarrow$  Purkyne tissue  
**C** sinoatrial node  $\rightarrow$  right and left atria  $\rightarrow$  Purkyne tissue  $\rightarrow$  atrioventricular node  
**D** right and left atria  $\rightarrow$  sinoatrial node  $\rightarrow$  Purkyne tissue  $\rightarrow$  ventricular walls

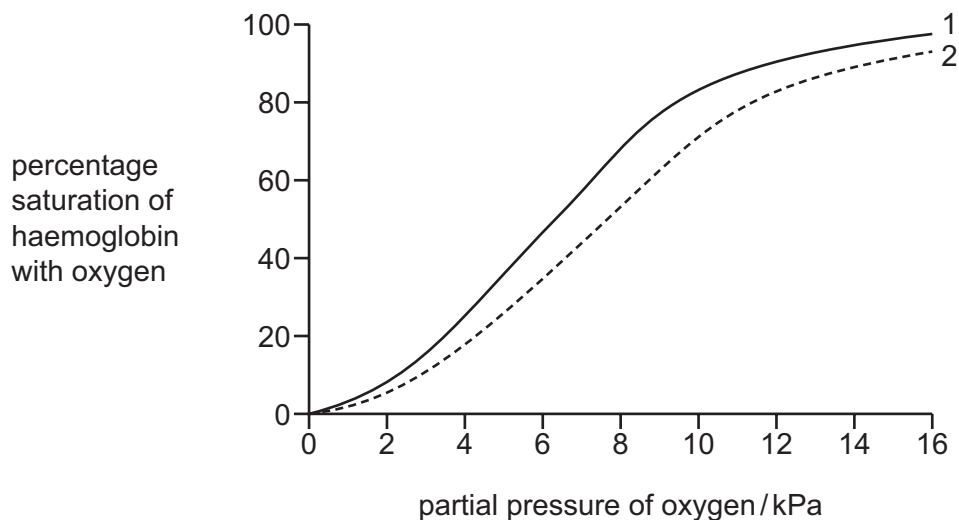
34 Which features allow the aorta to withstand high blood pressures?

- A** collagen fibres and elastin fibres  
**B** collagen fibres and smooth muscle  
**C** elastin fibres and endothelium  
**D** endothelium and smooth muscle

35 Which row is correct for the pulmonary artery?

|          | blood carried | thickness of wall | lumen size |
|----------|---------------|-------------------|------------|
| <b>A</b> | oxygenated    | thin              | large      |
| <b>B</b> | oxygenated    | thick             | small      |
| <b>C</b> | deoxygenated  | thin              | large      |
| <b>D</b> | deoxygenated  | thick             | small      |

36 The graph shows oxygen dissociation curves of adult haemoglobin in different carbon dioxide concentrations, 1 and 2.

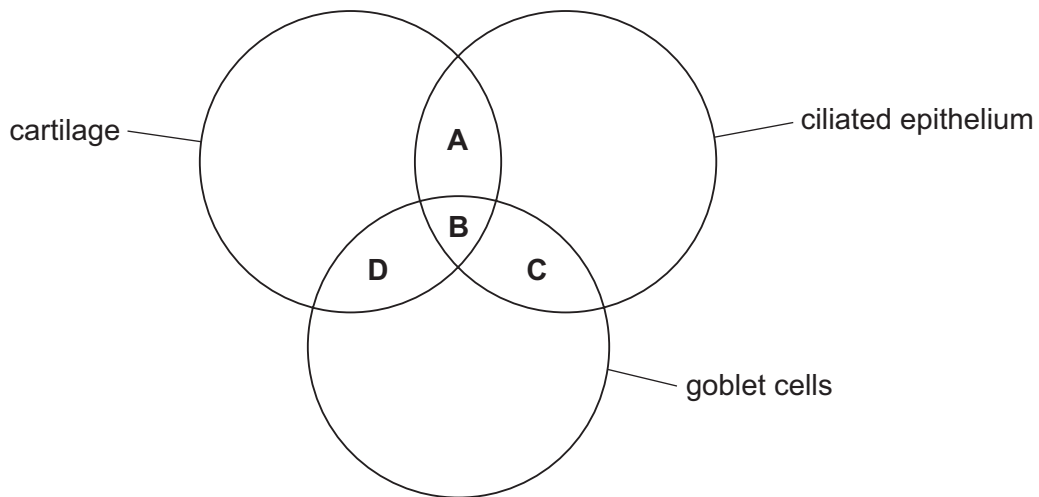


Which conditions could change the shape of curve 1 to the shape of curve 2?

- A** increased carbon dioxide concentration causing a decrease in pH
  - B** increased carbon dioxide concentration causing an increase in pH
  - C** decreased carbon dioxide concentration causing a decrease in pH
  - D** decreased carbon dioxide concentration causing an increase in pH
- 37 What maintains the necessary concentration gradients for carbon dioxide and oxygen in the lungs?
- A** good ventilation of the lungs
  - B** large surface area of the alveoli
  - C** the capillaries are close to the walls of the alveoli
  - D** the walls of the alveoli are thin



38 Which cells and tissues are present in the trachea?



39 The global mortality figures for some diseases in 2013 are shown in the table.

| cause of death | millions of deaths |
|----------------|--------------------|
| HIV/AIDS       | 1.50               |
| TB             | 1.40               |
| malaria        | 1.03               |
| cholera        | 0.02               |

How many millions of people died in 2013 from the bacterial diseases listed in the table?

- A** 0.02      **B** 1.42      **C** 2.45      **D** 2.90

40 Why is it difficult for B-lymphocytes and T-lymphocytes to respond to the antigens on pathogens that are intracellular parasites?

- A** The antigens are constantly mutating.  
**B** The antigens can destroy the lymphocytes.  
**C** The lymphocytes do **not** encounter the antigens.  
**D** The lymphocytes do **not** recognise the antigens.

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