Cambridge Assessment International Education

# Cambridge International AS & A Level

**BIOLOGY** **9700/11**

Paper 1 Multiple Choice **May/June 2022**

**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.

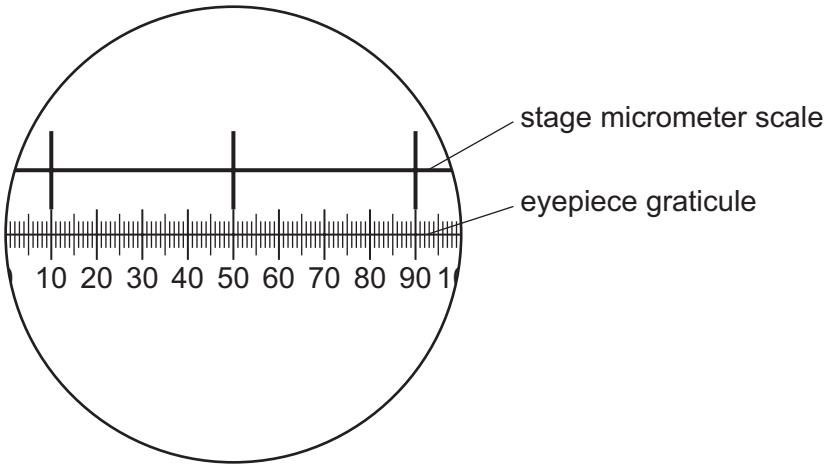
**INFORMATION**

- 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.

**1** A student used a stage micrometer scale to calibrate an eyepiece graticule.

The diagram shows the view of both the stage micrometer scale and the eyepiece graticule seen by the student. The divisions on the stage micrometer scale are 0.1 mm apart.




The student removed the stage micrometer scale and viewed a slide with blood cells on it. The same lenses were used so that the magnification remained unchanged.

The student measured the diameter of one of the white blood cells on the slide using the eyepiece graticule and recorded that it was 8 eyepiece units.

What is the correct diameter of this white blood cell in micrometers?

**A** 0.2 **B** 0.8 **C** 20 **D** 800

**2** Four students were asked to match the function with the appearance of some cell structures in an animal cell.

The functions were listed by number.

1 mRNA passes through to the ribosome

2 produces the mitotic spindle during cell division

3 packaging of hydrolytic enzymes that will remain in the cell

The appearances were listed by letter.

V membranes which surround an enclosed inner cavity

W non-membrane-bound, spherical structures

X a double membrane interspersed with pores

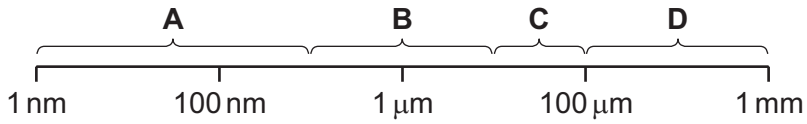
Y non-membrane-bound, cylindrical structures

Z membrane-bound sacs, arranged as a flattened stack

Which student correctly matched the numbered function with the appearance of the cell structure?

| | 1 | 2 | 3 |
|---|---|---|---|
| **A** | V | W | Y |
| **B** | V | Y | Z |
| **C** | X | W | Y |
| **D** | X | Y | Z |

**3** Which size range would include most prokaryotic cells?




**4** What is present in a typical prokaryotic cell **and** a typical eukaryotic cell?

**A** 70S ribosomes

**B** centrioles

**C** circular DNA in the cytoplasm

**D** starch granules

**5** Which statement about viruses is correct?

**A** They all have a capsid made of protein.

**B** They all contain RNA.

**C** They all have an outer envelope made of phospholipids.

**D** They all contain 80S ribosomes.

**6** Samples of glucose, sucrose, and a mixture of glucose and sucrose were divided into two halves **M** and **N**.

**M** was then tested with Benedict's solution.

**N** was boiled with dilute hydrochloric acid, neutralised and then tested with Benedict's solution.

The colour of the solution was compared to colour standards.

Which table identifies the correct colour changes for these samples?

**A**

| sample | **M** | **N** |
|---|---|---|
| glucose | blue | blue |
| sucrose | blue | yellow |
| mixture | blue | yellow |

**B**

| sample | **M** | **N** |
|---|---|---|
| glucose | yellow | yellow |
| sucrose | blue | yellow |
| mixture | blue | yellow |

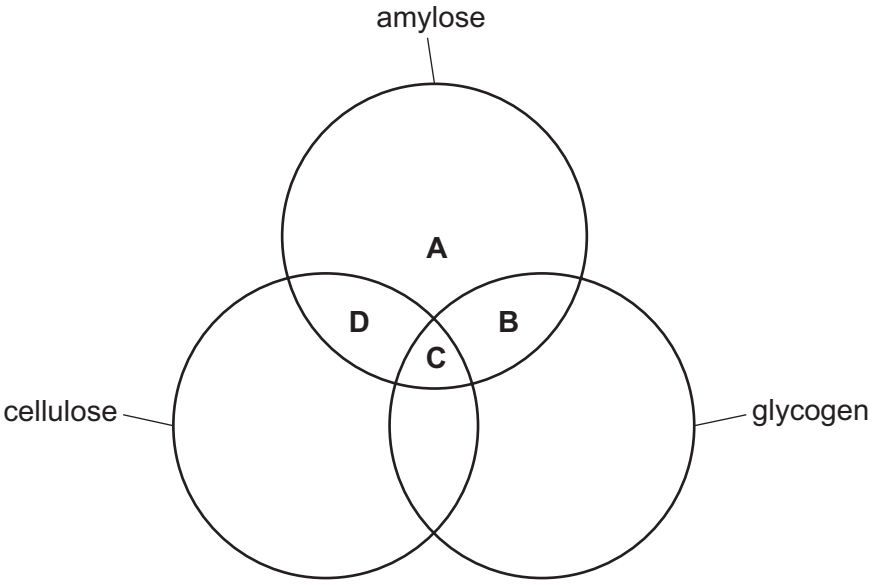
**C**

| sample | **M** | **N** |
|---|---|---|
| glucose | yellow | yellow |
| sucrose | blue | yellow |
| mixture | yellow | red |

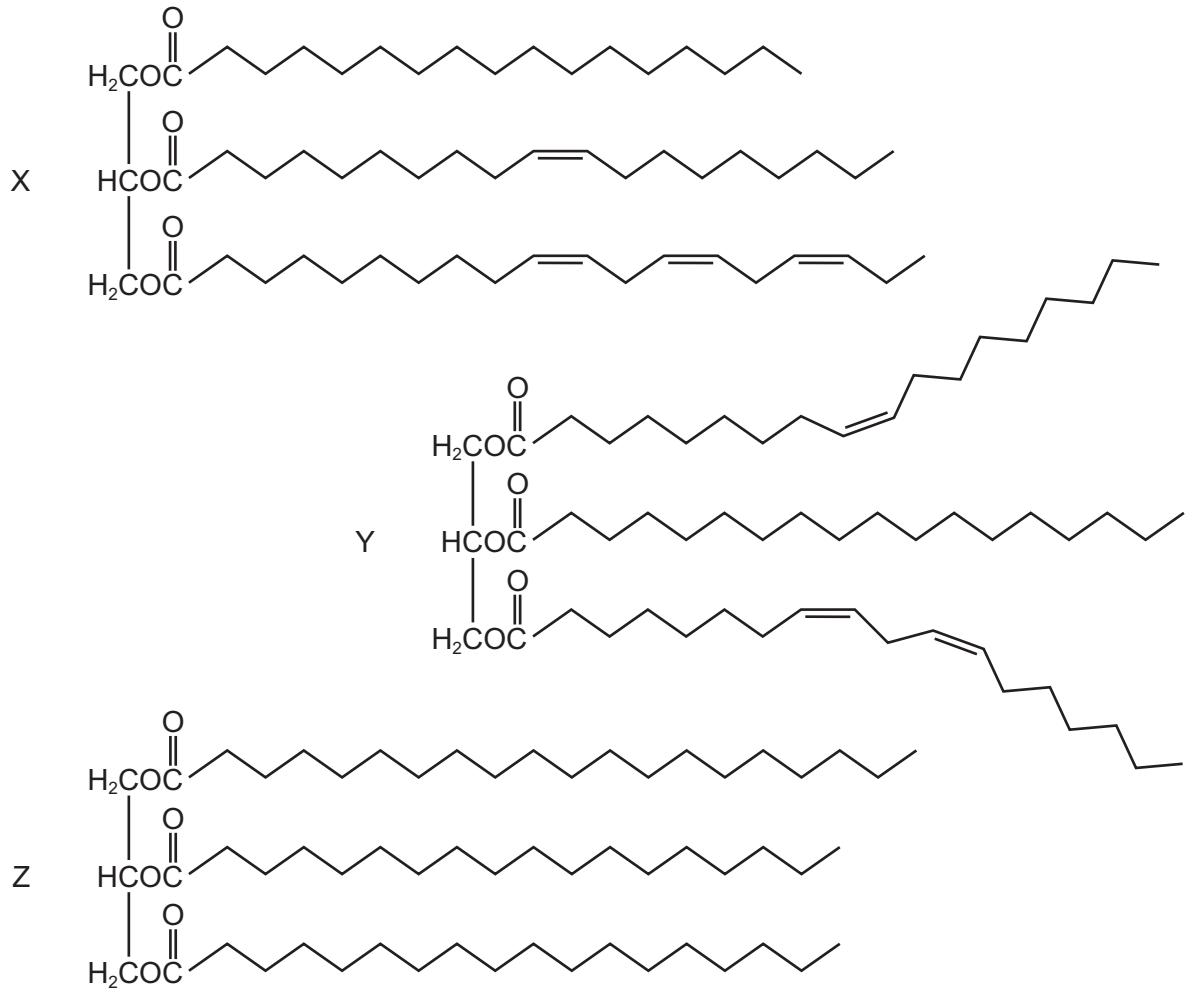
**D**

| sample | **M** | **N** |
|---|---|---|
| glucose | yellow | red |
| sucrose | blue | red |
| mixture | yellow | red |

**7** Which molecules contain 1,4-glycosidic bonds?



**8** The diagram shows three triglycerides, X, Y and Z.




Which row is correct for these triglycerides?

| | contains saturated fatty acids | contains unsaturated fatty acids | contains more than two different fatty acids |
|---|---|---|---|
| **A** | X, Y and Z | X and Y | X and Y |
| **B** | X, Y and Z | Z | X and Y |
| **C** | X and Y | X, Y and Z | X, Y and Z |
| **D** | Z | X and Y | X, Y and Z |

**9** Some foods contain hydrogenated vegetable fats. These are unsaturated fats that have been converted to saturated fats.

Which property of the fats will have changed?

**A** Their hydrocarbon chains will fit together more closely.

**B** Their solubility in water will increase.

**C** They will have more double bonds in their molecules.

**D** They will remain liquid at room temperature.

**10** A polypeptide contains a specific number of amino acids, n.

How many peptide bonds are present in this polypeptide?

**A** n – 1 **B** n **C** n + 1 **D** n + 2

**11** Which statement is correct?

**A** Amylase, ribose and phospholipid are all macromolecules.

**B** Cellulose, glucose and catalase are all polymers.

**C** Deoxyribose, fructose and ribose are all monosaccharides.

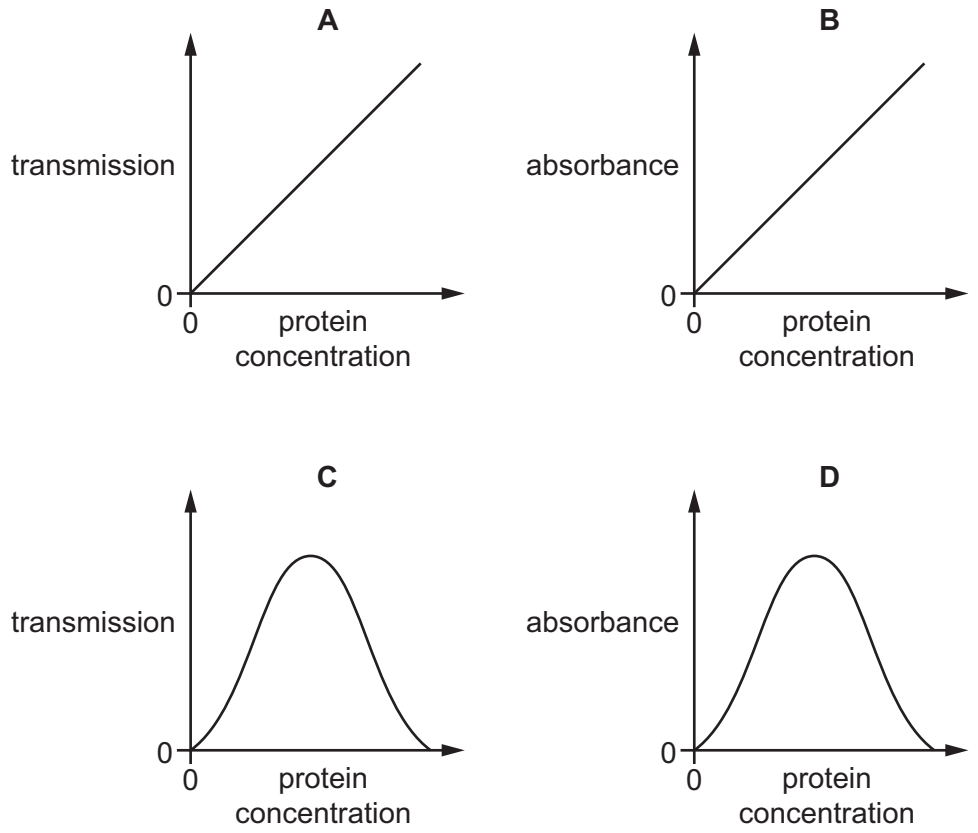
**D** Sucrose, deoxyribose and amylopectin are all polysaccharides.

**12** A student used colorimetry to monitor the hydrolysis of a protein by a protease enzyme.

The student used biuret solution to determine the concentration of protein in the hydrolysis reaction.

The student produced a calibration curve using known concentrations of protein.

Which diagram shows the calibration curve?



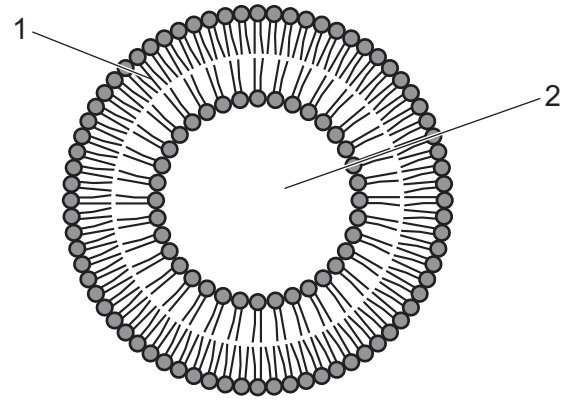

**13** A student completed an experiment to measure how increasing concentrations of substrate affects the rate of an enzyme-controlled reaction.

The student then repeated the experiment after adding a fixed quantity of a reversible competitive inhibitor.

Which row describes the effect of a reversible competitive inhibitor on enzyme activity?

| | attachment of inhibitor at active site | effect of increasing substrate concentration on rate of enzyme-controlled reaction |
|---|---|---|
| **A** | no | little effect on the rate |
| **B** | yes | rate increases |
| **C** | no | rate increases |
| **D** | yes | little effect on the rate |

**14** The diagram shows a liposome.




Liposomes can be used to move therapeutic drugs into cells of the body to treat conditions such as cancer.

Which row shows the property of a drug that could be transported in the sections of the liposome labelled 1 and 2?

| | property of drug transported in location 1 | property of drug transported in location 2 |
|---|---|---|
| **A** | hydrophilic | hydrophilic |
| **B** | hydrophilic | hydrophobic |
| **C** | hydrophobic | hydrophilic |
| **D** | hydrophobic | hydrophobic |

**15** Some processes occurring in cells are listed.

1 endocytosis of water into cells

2 exocytosis of enzymes from cells

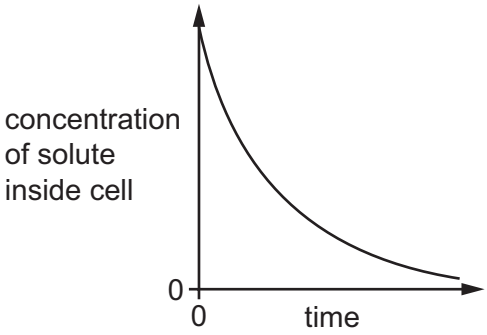
3 facilitated diffusion of glucose into red blood cells

4 phagocytosis of dead cells by macrophages

Which processes use ATP?

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

**16** The graph shows changes in the concentration of a solute inside a cell.




What explains this change in concentration?

1 diffusion

2 endocytosis

3 exocytosis

4 osmosis

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

**17** The indicator cresol red, changes from red to yellow when put into acid.

Four blocks of agar containing cresol red were cut to different sizes measured in millimetres. The blocks were submerged in acid. All other variables were kept constant. The time taken for each of the blocks to completely turn yellow was recorded.

Which of the four blocks became completely yellow most quickly?

**A** $3 \times 30 \times 30$ **B** $6 \times 6 \times 6$ **C** $6 \times 12 \times 12$ **D** $12 \times 12 \times 12$

**18** Which processes require mitosis?

1 the cloning of T-lymphocytes

2 the repair of cell structures by protein synthesis

3 the growth of multicellular organisms from a single cell

4 the reproduction of a unicellular eukaryote

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

**19** Which events listed are part of the cell cycle?

1 interphase

2 prophase

3 cytokinesis

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

**20** Telomerase is an enzyme that adds nucleotides to telomeres.

Which statement about telomerase is correct?

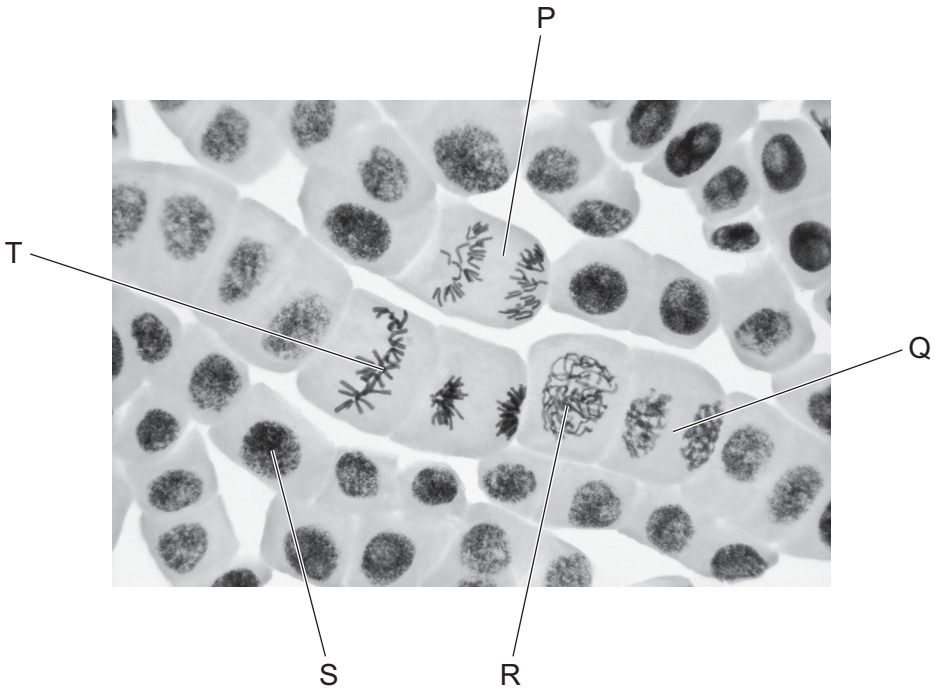
**A** A high concentration of telomerase in a cell damages genes during DNA replication.

**B** A high concentration of telomerase in cancerous cells limits the rate of tumour growth.

**C** The low concentration of telomerase in stem cells means that these cells can divide an unlimited number of times.

**D** The low concentration of telomerase in body cells means that these cells can divide a limited number of times.

**21** The photomicrograph shows cells at different stages of mitosis.




A student wrote four statements about the photomicrograph.

1 Cell P shows anaphase.

2 Spindle formation is occurring in cell Q.

3 The amount of DNA in cell R is the same as in cell T.

4 The correct order for the stages is S → R → T → P → Q.

Which statements are correct?

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

**22** Bacterial cells with DNA containing only the 'heavy' isotope of nitrogen ($^{15}N$) are allowed to reproduce for three generations in a culture medium containing the normal isotope of nitrogen ($^{14}N$).

Which percentage of the DNA molecules produced contain strands with the heavy isotope of nitrogen?

| | first generation % | second generation % | third generation % |
|---|---|---|---|
| **A** | 50 | 25 | 12.5 |
| **B** | 75 | 50 | 25 |
| **C** | 100 | 50 | 25 |
| **D** | 100 | 75 | 50 |

**23** A bacterial circular DNA molecule is 2 600 150 base pairs long. 26% of the bases are adenine.

How many cytosine bases would be in the DNA molecule?

**A** 624 036 **B** 676 039 **C** 1 248 072 **D** 1 352 078

**24** Which statement relating to the structure of DNA is correct?

**A** Two DNA strands are joined to each other by phosphodiester bonds.

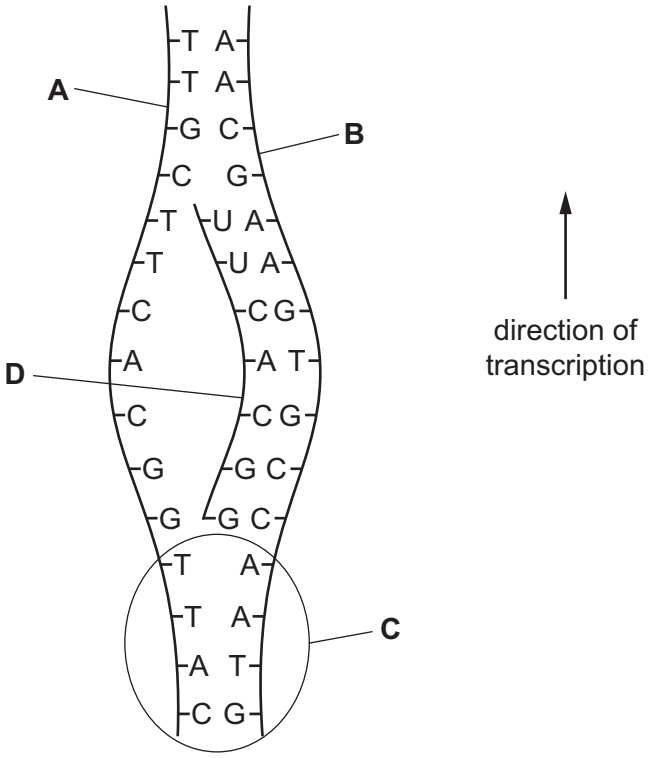
**B** The alignment of bases to form a double helix is only achieved between antiparallel strands.

**C** Three hydrogen bonds are formed between all base pairs containing purines.

**D** The number of cytosine bases always equals the number of thymine bases.

**25** A student sketched a diagram to represent the process of transcription.

Which part of their diagram shows the non-transcribed strand?




**26** Which row is correct for the movement of water in a root?

| | pathway | molecule present in Casparian strip |
|---|---|---|
| **A** | apoplast pathway through intercellular spaces | suberin |
| **B** | apoplast pathway through plasmodesmata | lignin |
| **C** | symplast pathway through plasmodesmata | lignin |
| **D** | symplast pathway through intercellular spaces | suberin |

**27** The table contains some information about uptake and movement of water and of mineral ions in plants.

| | water | mineral ions |
|---|---|---|
| mechanism for uptake | osmosis | diffusion, active transport |
| site of uptake | root hair cells | root hair cells |
| mechanism of release | evaporation, diffusion | diffusion, active transport |
| site of release | stomata | plant cells |

Using the information provided, which factors will affect the uptake and movement of water or of mineral ions in plants?

1 humidity

2 surface area of root hair cell

3 oxygen concentration

4 temperature

**A** 1, 2, 3 and 4

**B** 1, 3 and 4 only

**C** 1 and 3 only

**D** 4 only

**28** Which changes to the water potential and the volume of solution in the phloem sieve tube occur when sucrose is moved from a photosynthesising leaf into the phloem sieve tube?

| | water potential in the phloem sieve tube becomes | volume of solution in the phloem sieve tube |
|---|---|---|
| **A** | higher | decreases |
| **B** | higher | increases |
| **C** | lower | decreases |
| **D** | lower | increases |

**29** A student wrote the following statements about a possible mechanism for loading sucrose from a source.

1 When energy is released from ATP, the released energy is used to move sucrose through a co-transporter protein in the companion cell membrane.

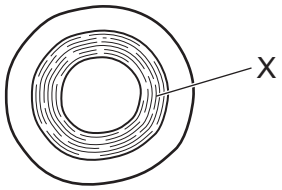
2 As sucrose is moved into a companion cell the pH in the cell wall of the companion cell decreases.

3 Proton pumps in the cell membrane of a companion cell move sucrose into the phloem sieve tube element.

Which statements are correct?

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

**30** The diagram shows a transverse section through an artery.




Which tissues are present in layer X?

**A** collagen and smooth muscle only

**B** elastic fibres and collagen only

**C** elastic fibres and smooth muscle only

**D** elastic fibres, collagen and smooth muscle

**31** What is systolic blood pressure?

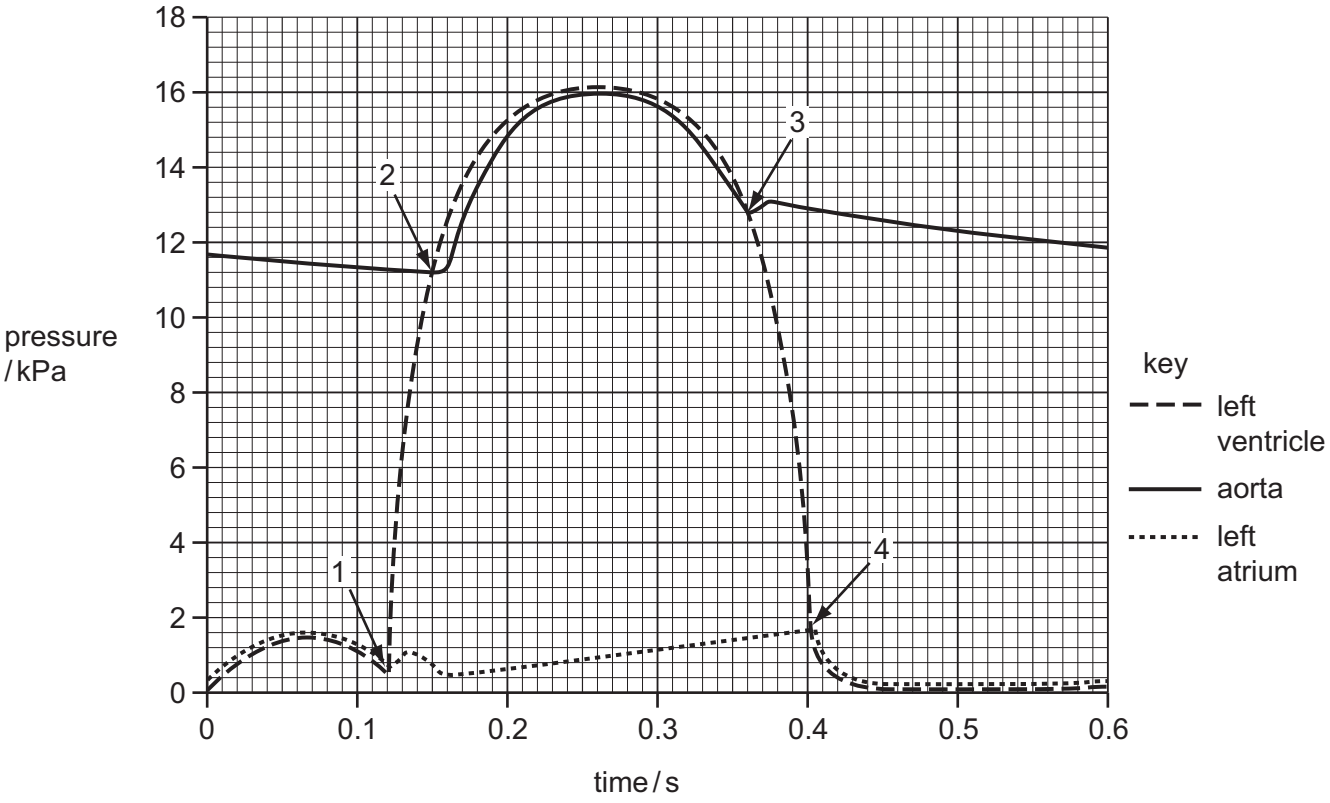
**A** the blood pressure in the arteries when the heart is relaxing

**B** the blood pressure in the left ventricle at the start of a contraction

**C** the maximum blood pressure in the arteries

**D** the maximum blood pressure in the right ventricle

**32** The diagram shows pressure changes in the left side of the heart and aorta over time. The length of this cardiac cycle is 0.6 s. Points 1, 2, 3 and 4 indicate when atrioventricular valves and semilunar valves either open or close.




What is the total time during one cardiac cycle that the atrioventricular valves and the semilunar valves are both closed at the same time?

**A** 0.03 s **B** 0.04 s **C** 0.07 s **D** 0.21 s

**33** Which reactions take place in the capillaries surrounding an alveolus?

1 carbon dioxide + water → carbonic acid

2 carbon dioxide + haemoglobin → carbaminohaemoglobin

3 haemoglobinic acid → haemoglobin + hydrogen ions

4 hydrogencarbonate ions + hydrogen ions → carbonic acid → carbon dioxide + water

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

**34** Which statement explains the importance of the chloride shift in red blood cells (RBC)?

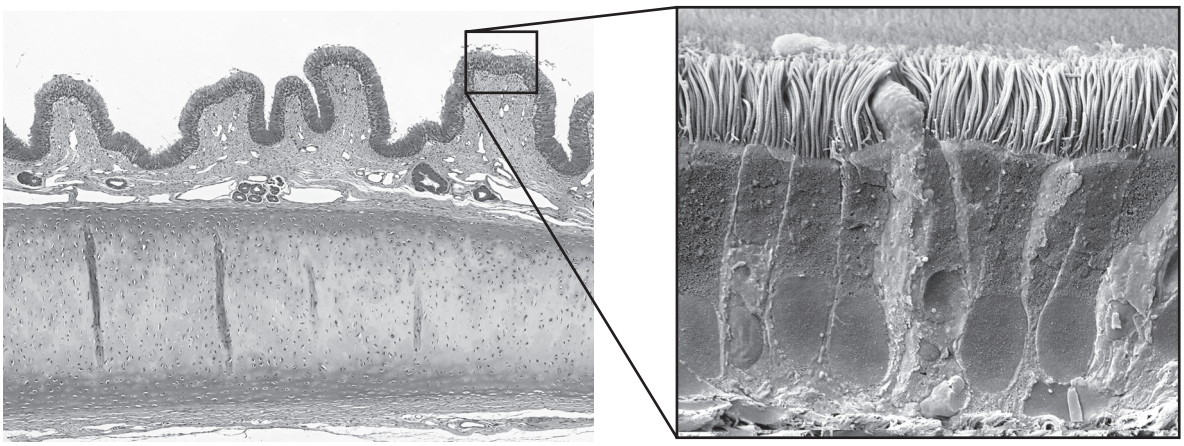
**A** Carbon dioxide diffuses from blood plasma into RBC and chloride ions diffuse out of RBC to maintain a balance of positive and negative ions.

**B** Hydrogencarbonate ions diffuse into plasma from RBC and chloride ions diffuse into RBC to maintain a balance of positive and negative ions.

**C** Carbon dioxide in RBC together with chloride ions stimulate the release of oxygen from haemoglobin to allow increased levels of respiration.

**D** Hydrogencarbonate ions diffuse into RBC from plasma and chloride ions diffuse into plasma to maintain a balance of positive and negative ions.

**35** The photomicrographs show a cross-section through the lining of part of the respiratory system.



Which statements about the photomicrographs are correct?

1 Goblet cells are visible between squamous epithelium cells.

2 Smooth muscle is visible.

3 The section cannot be from a bronchiole as cartilage is visible.

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

**36** The surface tension of the layer of liquid lining the alveoli tends to pull the walls inwards so alveoli could collapse.

Which statements could explain how this is prevented?

1 Alveolar fluid is moved around by cilia.

2 Elastic fibres keep the alveoli open.

3 Epithelial cells secrete a chemical that reduces the cohesion in water.

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

**37** What will reduce the rate at which bacteria become resistant to antibiotics?

1 prescribing two antibiotics with different modes of action

2 prescribing different antibiotics for the same bacterium

3 finishing a prescribed course of antibiotics

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

**38** T-lymphocytes have a protein, PD-1, on their surface. Some cancer cells have a receptor molecule on their surface which binds with PD-1, inactivating the T-lymphocyte.

A monoclonal antibody, lambrolizumab, has been produced against this receptor.

Trials showed that in 54 of 135 people with advanced skin cancer who were given lambrolizumab the tumours more than halved in volume. In six of the 57 people who were given the highest dose the tumours disappeared.

What may be correctly concluded from this information?

1 Lambrolizumab binds with a receptor on the surface of skin cancer cells.

2 Cancer cells to which lambrolizumab is bound cannot inactivate T-lymphocytes.

3 Lambrolizumab targets and kills skin cancer cells.

4 Lambrolizumab allows a patient's own immune system to kill cancer cells.

**A** 1, 2, 3 and 4

**B** 1, 2 and 4 only

**C** 1 and 3 only

**D** 2, 3 and 4 only

**39** A person's blood group is determined by antigens present on the red blood cells.

The table shows the antigens and antibodies in the blood of people with different blood groups.

| blood group | presence of A or B antigens on red blood cells | presence of antibodies to A or B in plasma |
|---|---|---|
| A | A only | anti-B only |
| B | B only | anti-A only |
| AB | A and B | neither |
| O | neither | anti-A and anti-B |

During a blood transfusion, it is essential that the person receiving the blood does not have antibodies to the donor's blood.

Which blood groups can be given to a person with blood group AB?

**A** AB only

**B** O only

**C** A and B only

**D** A, B, AB and O

**40** Which types of cell are stimulated to divide by the cytokines produced by T-helper cells?

**A** macrophages

**B** B-lymphocytes only

**C** T-killer cells only

**D** B-lymphocytes and T-killer cells

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