Cambridge Assessment International Education

# Cambridge International AS & A Level

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

Paper 1 Multiple Choice **May/June 2024**

**1 hour 15 minutes**

You must answer on the multiple choice answer sheet.

*8862199181*

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.

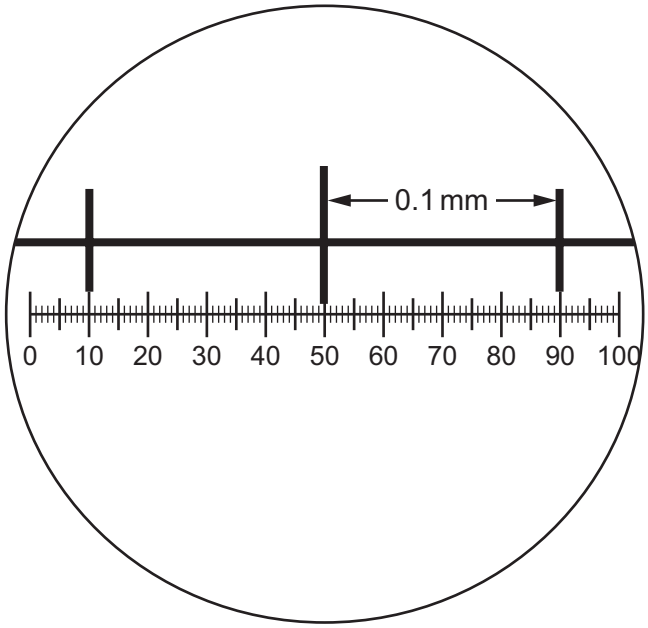
**INFORMATION**

- 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 stage micrometer scale viewed with an eyepiece graticule, using a magnification of ×200.




Using the same magnification, a chloroplast is measured as 4 eyepiece graticule divisions long.

How long is the chloroplast?

**A** $1.0 \times 10^{1}\,\mu m$

**B** $4.0 \times 10^{2}\,\mu m$

**C** $2.5 \times 10^{-1}\,\mu m$

**D** $2.5 \times 10^{-2}\,\mu m$

**2** Which range of cell diameters is typical for prokaryotic cells?

**A** 1 nm to $5 \times 10^{2}$ nm

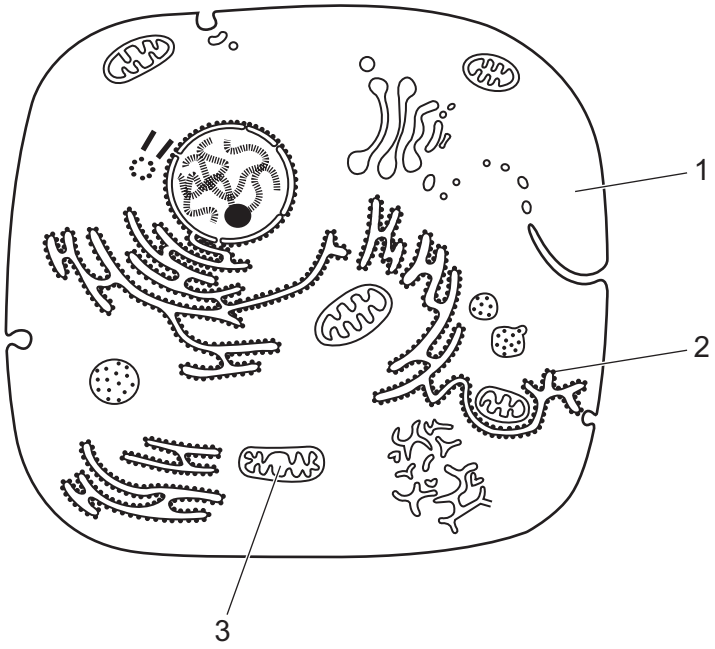
**B** $1 \times 10^{3}$ nm to 5 μm

**C** $1 \times 10^{1}\,\mu m$ to $5 \times 10^{2}\,\mu m$

**D** $1 \times 10^{2}\,\mu m$ to $5 \times 10^{3}\,\mu m$

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**3** The diagram shows a typical animal cell.




Where would nucleic acids be found?

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

**4** Which structure is found in a typical bacterial cell?

**A** intron

**B** telomere

**C** template strand

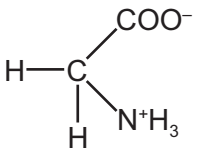
**D** capsid

**5** What is the maximum number of hydrogen bonds that can form between a single water molecule and other water molecules?

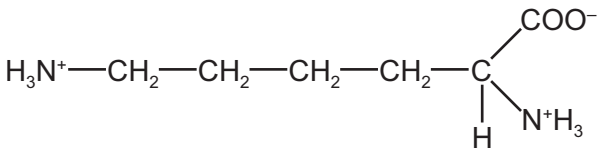
**A** 1 **B** 2 **C** 3 **D** 4

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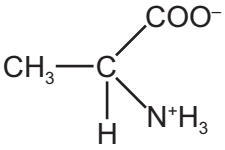
**6** The diagrams show the structure of four amino acids in aqueous solution.



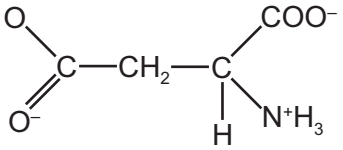

glycine




lysine




alanine




aspartate

Which two structures have an overall charge?

**A** alanine and aspartate

**B** alanine and glycine

**C** aspartate and lysine

**D** glycine and lysine

**7** The table shows the number of carbon atoms and the number of carbon–carbon double bonds in molecules of three triglycerides and the fatty acids they contain.

The information is shown in the format 'number of carbon atoms : number of carbon–carbon double bonds'.

| triglyceride | fatty acid 1 | fatty acid 2 | fatty acid 3 |
|---|---|---|---|
| 54 : 1 | 15 : 0 | 18 : 0 | 18 : 1 |
| 56 : 4 | 17 : 0 | X | 18 : 2 |
| 57 : 3 | 18 : 0 | 18 : 1 | 18 : 2 |

Which description matches fatty acid 2 of the 56 : 4 triglyceride, identified in the table as X?

**A** saturated with 17 carbon atoms

**B** saturated with 18 carbon atoms

**C** unsaturated with 17 carbon atoms

**D** unsaturated with 18 carbon atoms

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**8** Collagen molecules are made up of three polypeptide chains interacting together. The individual polypeptide chains consist of a regular pattern of amino acids. Almost every third amino acid is glycine.

Which protein structures of collagen are described?

**A** primary and secondary

**B** primary and quaternary

**C** secondary and tertiary

**D** tertiary and quaternary

**9** The masses of the parts of haemoglobin are shown in the table.

| component | mass / Da |
|---|---|
| α-globin chain | 15 126 |
| β-globin chain | 15 868 |
| haem group | 617 |

There are 1000 Da in 1 kDa.

What is the mass of a haemoglobin molecule in kDa?

**A** 31.6 **B** 33.5 **C** 62.6 **D** 64.5

**10** What is the correct order of locations in the cell for the production of an extracellular enzyme?

**A** nucleus → ribosome → rough endoplasmic reticulum → Golgi body

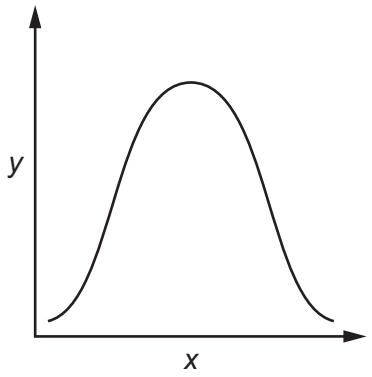
**B** ribosome → nucleus → Golgi body → rough endoplasmic reticulum

**C** ribosome → rough endoplasmic reticulum → nucleus → Golgi body

**D** rough endoplasmic reticulum → nucleus → Golgi body → ribosome

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**11** The graph shows the trend from an enzyme-catalysed reaction.




Which labels are correct for the *x*-axis and *y*-axis?

| | *x*-axis | *y*-axis |
|---|---|---|
| **A** | rate of reaction | substrate concentration |
| **B** | enzyme concentration | temperature |
| **C** | pH | rate of reaction |
| **D** | substrate concentration | pH |

**12** Which statements about the Michaelis–Menten constant ($K_m$) are correct?

1 The higher the $K_m$, the higher the enzyme affinity for the substrate.

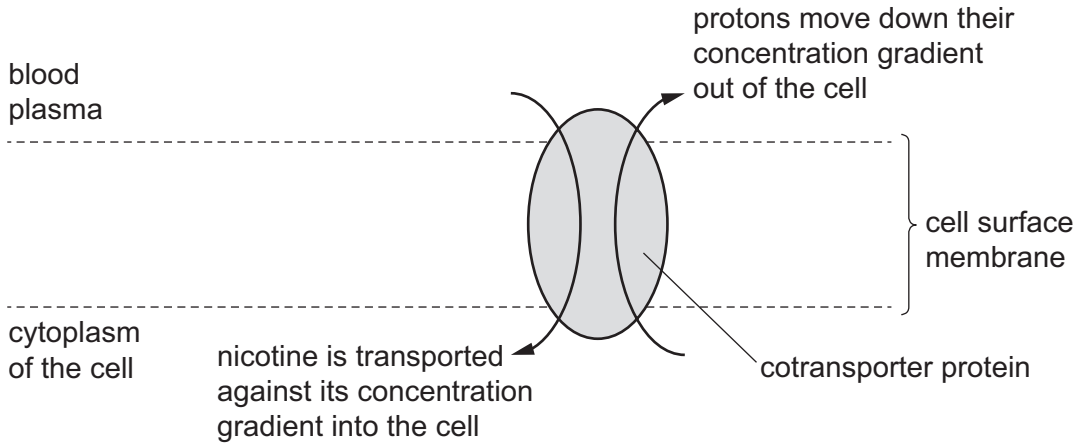
2 $K_m$ is a measure of the degree of enzyme affinity for the substrate.

3 $K_m$ is defined as the substrate concentration at which the enzyme functions at half its maximum rate.

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

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**13** The diagram shows how nicotine is transported from the blood plasma into a cell using a type of cotransporter mechanism.




In the phloem tissue, there is a cotransporter mechanism that moves sucrose into the cytoplasm of a companion cell.

Which statement correctly describes a similarity between the cotransport of nicotine and the cotransport of sucrose?

**A** The cotransporter proteins generate a proton gradient by moving protons out of the cell by active transport.

**B** The protons are transported through the cotransporter proteins by facilitated diffusion.

**C** The protons move through the cotransporter proteins in the opposite direction to the movement of nicotine and sucrose.

**D** The cotransporter proteins use energy from ATP to transport protons with nicotine and sucrose.

**14** The diagram shows a simple metabolic pathway.

$$W \rightarrow X \rightarrow Y \rightarrow Z$$

The letters W, X, Y and Z represent four different substances. At each step in the diagram the substrate undergoes a chemical reaction catalysed by an enzyme. The reaction produces the next substance in the pathway.

Which statements correctly describe the enzymes taking part in this metabolic pathway?

1 They are all globular proteins.

2 They all have the same tertiary structure.

3 They all contain hydrogen atoms in their structure.

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

**15** A student observed the effect of two different concentrations of salt solution on blood cells.

The student added each concentration of salt solution to one of two microscope slides, and then a small drop of fresh blood was added.

Each slide was viewed using the high power lens of a microscope and the student's observations were recorded.

slide 1 No red blood cells were visible.

slide 2 The red blood cells were visible but looked slightly crinkled.

Which row correctly explains the results obtained?

| | slide 1 | slide 2 |
|---|---|---|
| **A** | Swelling of the cells caused them all to burst. | The Ψ of the cell was more negative than the Ψ of the external solution. |
| **B** | The Ψ of the cell was more negative than the Ψ of the external solution. | The Ψ of the external solution was more negative than the Ψ of the cell. |
| **C** | The Ψ of the cell was less negative than the Ψ of the external solution. | There is a net movement of water out of the cell by osmosis. |
| **D** | The Ψ of the external solution was less negative than the Ψ of the cell. | The Ψ of the cell was very similar to, but slightly more negative than, the Ψ of the external solution. |

key
Ψ = water potential

**16** Which statement correctly describes facilitated diffusion?

**A** The process only occurs using channel proteins that change shape and that use energy provided by the cell.

**B** The process occurs using channel proteins or carrier proteins that may or may not change shape.

**C** The process occurs using channel proteins or carrier proteins that use energy provided by the cell.

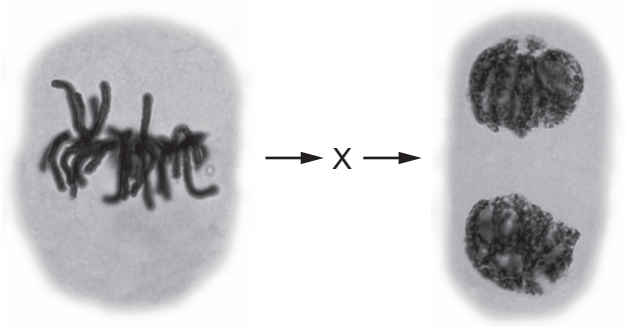
**D** The process only occurs using carrier proteins that create a gradient to move ions in opposite directions.

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**17** Which row is correct for stem cells?

| | can repair cells | can be involved in the formation of phagocytes |
|---|---|---|
| **A** | yes | no |
| **B** | yes | yes |
| **C** | no | no |
| **D** | no | yes |

**18** Eukaryotic organisms grow and increase in size as a result of cell division. The diagram shows some stages of mitosis with one stage missing, labelled X.




What happens in stage X?

**A** Spindle fibres attach to the centromeres and the chromosomes line up along the equator.

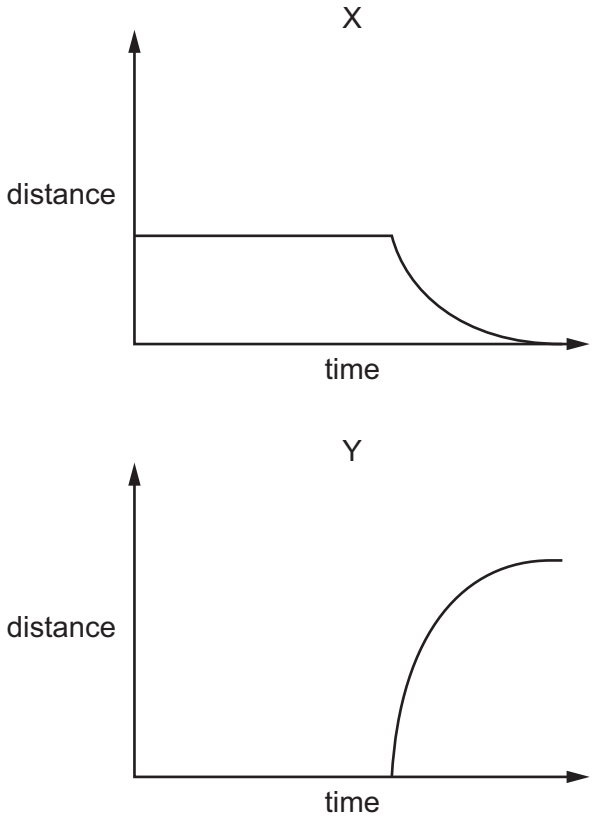
**B** The chromatin coils and condenses and the nuclear membrane disintegrates.

**C** The chromosomes line up in pairs along the equator of the cell.

**D** Microtubules shorten so that spindle fibres contract and the centromeres divide.

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**19** The graphs show various distance measurements taken from the start of metaphase of mitosis. The graphs are to scale when compared to one another.




Which row correctly identifies the distance measurement for each graph?

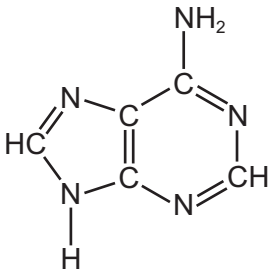
| | X | Y |
|---|---|---|
| **A** | distance between poles of spindle | distance of centromeres from poles of spindle |
| **B** | distance between poles of spindle | distance between sister chromatids |
| **C** | distance of centromeres from poles of spindle | distance between sister chromatids |
| **D** | distance of centromeres from poles of spindle | distance between poles of spindle |

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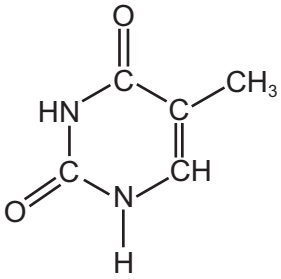
**20** Which row is correct for the start of anaphase of mitosis?

| | form of DNA | DNA is associated with histone proteins | state of the cell surface membrane |
|---|---|---|---|
| **A** | chromosomes | always | broken apart |
| **B** | chromosomes | sometimes | intact |
| **C** | separated sister chromatids | always | intact |
| **D** | separated sister chromatids | sometimes | broken apart |

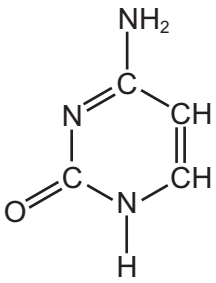
**21** The diagrams show the chemical structure of four bases.



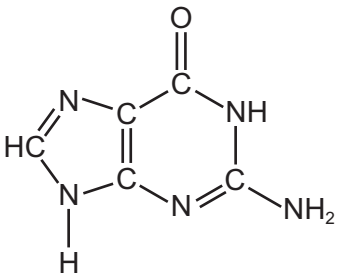

1




2




3




4

Which diagrams show thymine and cytosine?

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

**22** The diagram shows the nucleotide sequence of a small section of the transcribed strand of a gene.

CGG GCC CCG CGG

The table shows the amino acids coded for by 10 mRNA codons.

| mRNA codon | amino acid |
|---|---|
| AAG | Lys |
| ACG | Thr |
| CGG CGC CGU | Arg |
| CCG | Pro |
| GCC GCG | Ala |
| GGC | Gly |
| UGC | Cys |

What is the sequence of the four amino acids in the polypeptide translated from this small section of a gene?

**A** Ala-Ala-Cys-Ala

**B** Ala-Arg-Gly-Ala

**C** Arg-Ala-Pro-Arg

**D** Arg-Arg-Thr-Arg

**23** What does the process of translation require?

**A** DNA, free nucleotide bases and mRNA

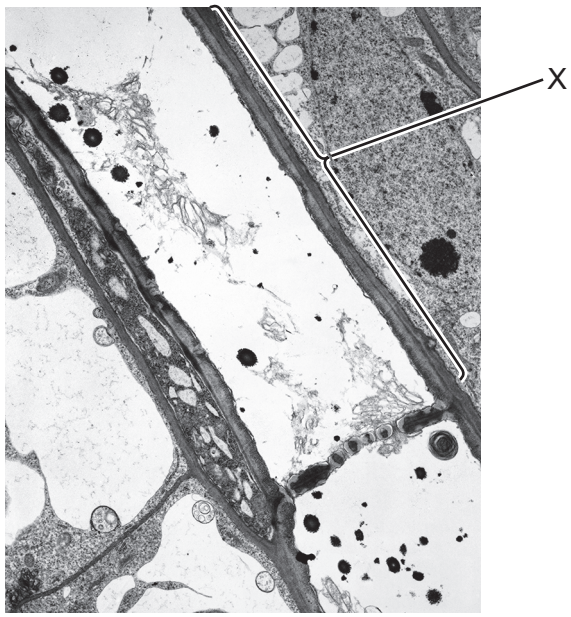
**B** DNA, mRNA, amino acids and RNA polymerase

**C** mRNA, ribosomes and RNA polymerase

**D** mRNA, ribosomes, amino acids and tRNA

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**24** The electron micrograph shows a longitudinal section of part of the stem of a plant.




What is the name of the structure labelled X?

**A** companion cell

**B** Casparian strip

**C** phloem sieve tube element

**D** xylem vessel element

**25** Which substance makes xylem vessel walls impermeable to water?

**A** cellulose

**B** lignin

**C** suberin

**D** collagen

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**[Turn over**

**26** The following tissues carry an electrical impulse during the cardiac cycle.

1 atrioventricular node

2 muscle wall of atria

3 Purkyne tissue

4 sinoatrial node

In which order does the electrical impulse travel during the cardiac cycle?

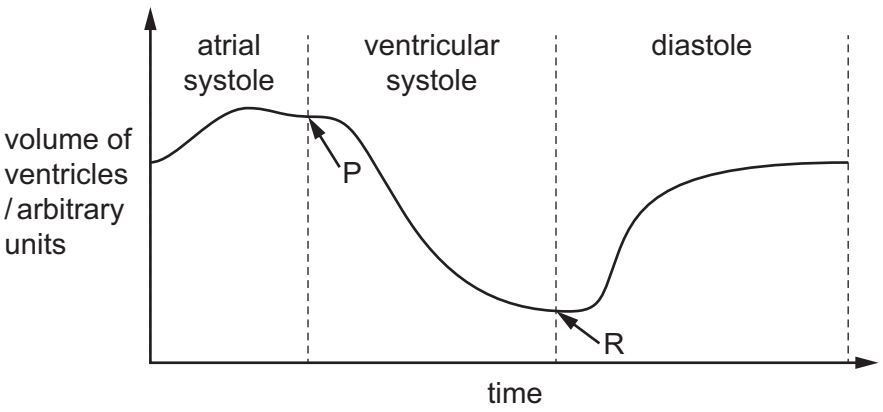
**A** $1 \rightarrow 2 \rightarrow 3 \rightarrow 4$

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

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

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

**27** The graph shows changes in the volume of the ventricles during a single cardiac cycle.

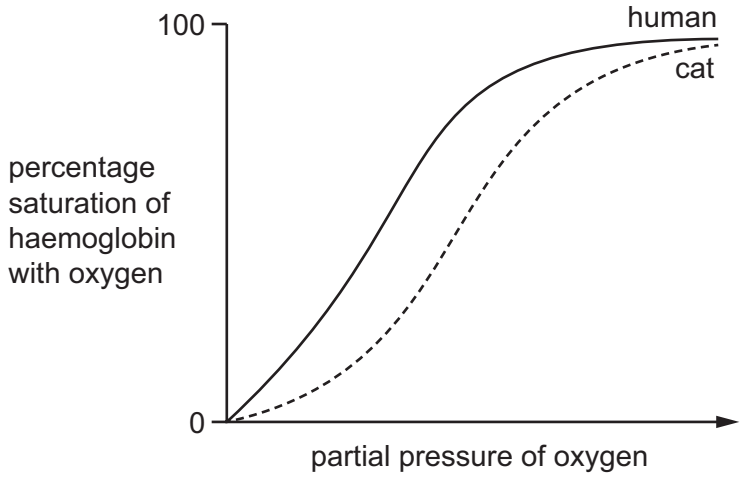



Which row is correct for the atrioventricular valve at P and for the semilunar valve at R?

| | atrioventricular valve at P | semilunar valve at R |
|---|---|---|
| **A** | closes | closes |
| **B** | closes | opens |
| **C** | opens | closes |
| **D** | opens | opens |

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**28** The graph shows how changes in oxygen concentration affect the percentage oxygen saturation of human haemoglobin and cat haemoglobin under normal physiological conditions. The partial pressure of carbon dioxide was kept constant at 5.0 kPa and the temperature was kept constant at 37 °C.




Which conclusion is supported by the graph?

**A** The affinity of cat haemoglobin for oxygen is greater than the affinity of human haemoglobin for oxygen.

**B** At high partial pressures of oxygen, cat haemoglobin picks up oxygen more easily than human haemoglobin picks up oxygen.

**C** At low partial pressures of oxygen, oxygen is released more easily from cat haemoglobin than from human haemoglobin.

**D** The shift in the oxygen dissociation curve caused by the Bohr effect is larger for cat haemoglobin than for human haemoglobin.

**29** Which statement is correct about how oxygen combines with haemoglobin?

**A** Combining all four oxygen molecules with haemoglobin does **not** affect the shape of haemoglobin.

**B** One oxygen molecule can combine with each haem group of the haemoglobin molecule.

**C** The first oxygen molecule to combine with haemoglobin does **not** affect the shape of haemoglobin.

**D** The third oxygen molecule to combine with haemoglobin makes it more difficult for the fourth oxygen molecule to combine with haemoglobin.

**30** How are alveoli adapted to their function?

**A** They contain squamous epithelium for a short diffusion distance.

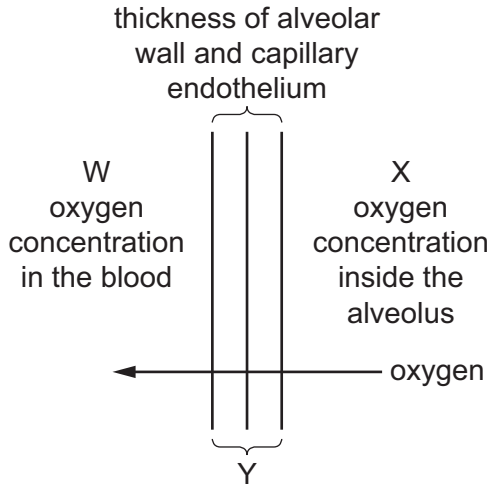
**B** They contain goblet cells to produce mucus.

**C** They contain ciliated epithelium to move mucus.

**D** They contain cartilage to prevent alveolar collapse.

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**31** The diagram shows oxygen diffusing from the space inside an alveolus into the blood through the gaseous exchange surface.




What would increase the rate of diffusion of oxygen from the alveolus to the blood?

| | increase | decrease | keep the same |
|---|---|---|---|
| **A** | W | X | Y |
| **B** | W | Y | X |
| **C** | Y | X | W |
| **D** | X | Y | W |

**32** Which tissues are present in a bronchus?

| | cartilage | ciliated epithelium | smooth muscle |
|---|---|---|---|
| **A** | ✓ | ✓ | ✓ |
| **B** | ✓ | ✓ | ✗ |
| **C** | ✓ | ✗ | ✓ |
| **D** | ✗ | ✓ | ✓ |

key

✓ = present

✗ = not present

**33** Steep concentration gradients must be maintained for efficient gaseous exchange to occur in the human lungs.

Which row correctly describes how steep concentration gradients can be maintained?

| | elastic fibres in the walls of the alveoli recoil when breathing out | continual supply of deoxygenated blood by the pulmonary artery |
|---|---|---|
| **A** | ✓ | ✓ |
| **B** | ✗ | ✓ |
| **C** | ✓ | ✗ |
| **D** | ✗ | ✗ |

key

✓ = helps maintain

✗ = does not help maintain

**34** A scientist investigated the effect of an antibiotic on the treatment of cholera.

320 people with cholera were divided into two groups. One group was treated with the antibiotic while the other group was not given the antibiotic. Both groups were given fluids containing sugars and mineral salts (oral rehydration therapy).

The scientist recorded the number of days that each person had diarrhoea.

The table shows the results.

| treatment | mean time person had diarrhoea / days |
|---|---|
| antibiotic and oral rehydration therapy | 3.2 |
| oral rehydration therapy | 5.3 |

What is the percentage decrease in the mean time that a person had diarrhoea when they were treated with the antibiotic?

**A** 39.6% **B** 60.4% **C** 165.6% **D** 252.4%

**35** How does the antibiotic penicillin affect the metabolism of a bacterial cell?

**A** Penicillin reduces cell growth by preventing water uptake.

**B** Penicillin inhibits the formation of cross-links in the cell wall between peptidoglycan molecules.

**C** Penicillin inhibits the hydrolysis of peptidoglycan links in the cell wall during cell extension.

**D** Penicillin weakens the cell wall by digesting peptidoglycan molecules.

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**36** Scientists studied the multidrug-resistant bacterial infections in children caused by one type of bacteria between 2007 and 2015. The percentage of multidrug-resistant infections rose from 0.2% to 1.5%.

What was the percentage increase in multidrug-resistant infections between 2007 and 2015?

**A** 1.3% **B** 87% **C** 130% **D** 650%

**37** Whooping cough is a highly infectious disease of the gas exchange system, caused by the bacterium *Bordetella pertussis*.

Which method provides protection to infants against whooping cough and reduces the chance of developing this disease later?

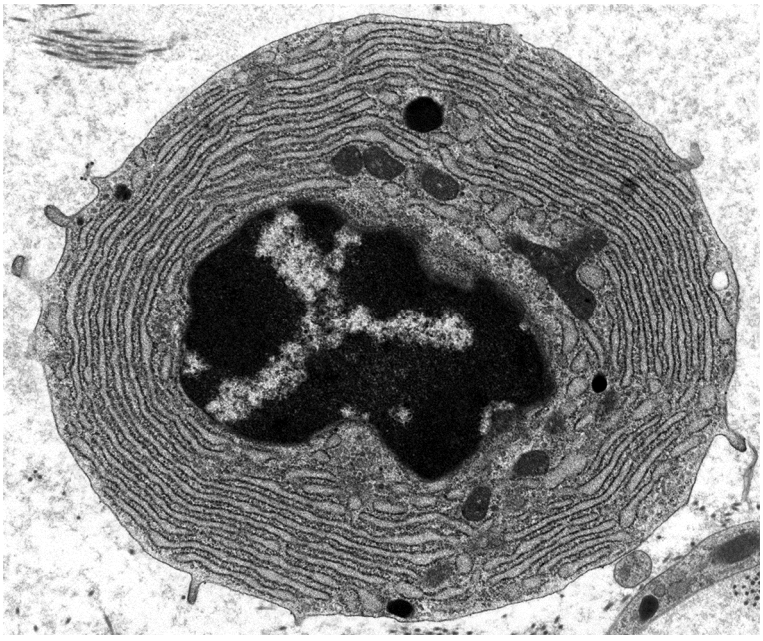
**A** a short course of more than one type of antibiotic

**B** a six-month course of one type of antibiotic

**C** injections of antibodies specific to *Bordetella pertussis*

**D** injections of antigens from *Bordetella pertussis* bacteria

**38** The electron micrograph shows a type of blood cell.



What can be concluded from the electron micrograph?

**A** The cell secretes products that are toxic to pathogens.

**B** The cell synthesises a large quantity of proteins.

**C** The cell synthesises large quantities of antigens.

**D** The cell digests pathogenic bacteria.

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**39** Why is mitosis important in the immune response?

**A** It allows B-lymphocytes to produce plasma cells.

**B** It allows B-lymphocytes to synthesise antibodies.

**C** It allows neutrophils to carry out phagocytosis.

**D** It allows T-lymphocytes to recognise foreign antigens.

**40** What is fused with a B-lymphocyte to form a hybridoma cell in monoclonal antibody production?

**A** antigen

**B** clone

**C** macrophage

**D** myeloma cell

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