Cambridge International AS & A Level

**Cambridge International Examinations**
Cambridge International Advanced Subsidiary and Advanced Level

**BIOLOGY** **9700/12**

Paper 1 Multiple Choice **October/November 2017**

**1 hour**

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

*5635932162*

**READ THESE INSTRUCTIONS FIRST**

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.
DO **NOT** WRITE IN ANY BARCODES.

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 separate Answer Sheet.

**Read the instructions on the Answer Sheet very carefully.**

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
Electronic calculators may be used.

This document consists of **17** printed pages and **3** blank pages.


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**1** Which equation for calculating the actual size of a specimen, A, or image size, I, or magnification, M, is correct?

**A** $A = M \div I$ **B** $A = I \times M$ **C** $I = M \div A$ **D** $M = I \div A$

**2** One of the smallest viruses is the polio virus, which has a diameter of approximately 30 nm.

In 2003, the *Mimivirus* was discovered which has a diameter of approximately 680 nm.

In 2013, the *Pandoravirus* was discovered which has a diameter of approximately 1000 nm.

Which row correctly matches a cell structure with a virus that has a similar approximate size?

| | polio virus | *Mimivirus* | *Pandoravirus* |
|---|---|---|---|
| **A** | lysosome | nucleolus | nucleus |
| **B** | nucleolus | lysosome | mitochondrion |
| **C** | nucleolus | mitochondrion | lysosome |
| **D** | ribosome | lysosome | mitochondrion |

**3** Which cell components are present in **all** prokaryotic cells?

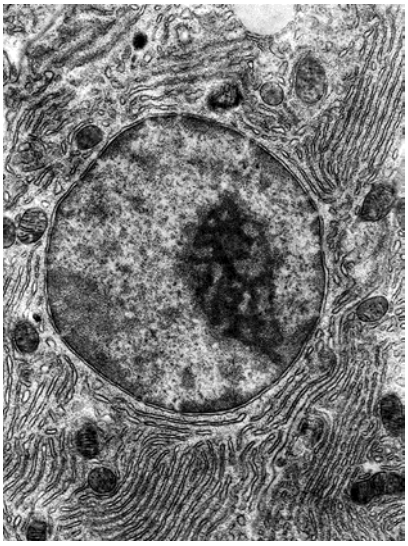
| | cell surface membrane | cell wall | endoplasmic reticulum | flagellum |
|---|---|---|---|---|
| **A** | ✓ | ✓ | ✗ | ✓ |
| **B** | ✓ | ✓ | ✗ | ✗ |
| **C** | ✓ | ✗ | ✓ | ✗ |
| **D** | ✗ | ✓ | ✓ | ✓ |

key

✓ = present

✗ = not present

**4** The electron micrograph shows part of an animal cell.



What will be synthesised in large quantities in this cell?

1 ATP

2 glucose

3 RNA

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

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

Which feature have the prokaryotes lost during their evolution into mitochondria?

**A** cell wall

**B** circular chromosome

**C** endoplasmic reticulum

**D** ribosomes

**6** Which statement is correct?

**A** A virus is composed of a protein coat which may surround RNA or DNA.

**B** Eukaryotic plant cell walls contain peptidoglycans in addition to cellulose.

**C** Plasmodesmata and centrioles are found in all plant cells.

**D** Prokaryotic cells contain 80S ribosomes which they use to manufacture proteins.

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**7** A student carried out four tests for biological molecules on a sample of milk.

The tests and their results were as follows.

- Heating to 80 °C with Benedict's solution gave a brick red colour.
- Adding Biuret solution gave a purple colour.
- Adding iodine solution gave an orange colour.
- Boiling with acid, followed by neutralisation, then heating to 80 °C with Benedict's solution gave a brick red colour.

Which biological molecules **must** be present in the milk?

1 non-reducing sugars

2 protein

3 reducing sugars

4 starch

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

**8** Which features adapt a cellulose molecule for its function?

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

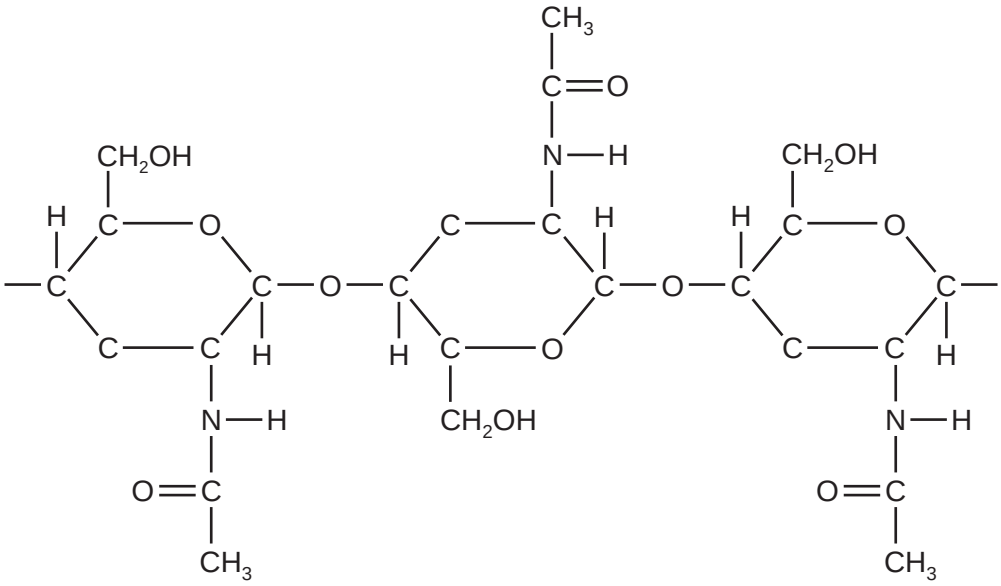
**9** Two disaccharides are maltose and sucrose. Maltose is formed from two molecules of glucose, whilst sucrose is formed from fructose and glucose.

Which row shows the molecular formulae of the two disaccharides?

| | maltose | sucrose |
|---|---|---|
| **A** | $C_{12}H_{22}O_{11}$ | $C_{12}H_{22}O_{11}$ |
| **B** | $C_{12}H_{22}O_{11}$ | $C_{12}H_{24}O_{12}$ |
| **C** | $C_{12}H_{24}O_{12}$ | $C_{12}H_{22}O_{11}$ |
| **D** | $C_{12}H_{24}O_{12}$ | $C_{12}H_{24}O_{12}$ |

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**10** The diagram shows the structure of the polysaccharide chitin which is found in the cell wall of fungi.



Which statements are correct for chitin **and** for cellulose?

1 The monomers are joined by 1,4 glycosidic bonds.

2 Every second monosaccharide in the polysaccharide chain is rotated by 180°.

3 The polysaccharide contains the elements carbon, hydrogen, oxygen and nitrogen.

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

**11** Which row correctly matches the functional and structural features of cellulose, collagen, glycogen or triglyceride?

| | molecule | function | structure | | |
|---|---|---|---|---|---|
| | | | fibrous | molecules held together by hydrogen bonds | branched chains |
| **A** | cellulose<br>triglyceride | support<br>energy source | ✓<br>✗ | ✓<br>✗ | ✗<br>✗ |
| **B** | collagen<br>cellulose | strengthening<br>support | ✓<br>✓ | ✓<br>✗ | ✗<br>✓ |
| **C** | collagen<br>glycogen | strengthening<br>storage | ✓<br>✗ | ✓<br>✗ | ✓<br>✓ |
| **D** | glycogen<br>triglyceride | storage<br>energy source | ✗<br>✗ | ✓<br>✓ | ✓<br>✗ |

key ✓ = true ✗ = false

**12** A polypeptide has a number of amino acids (*n*).

How many peptide bonds and R groups (side chains) does this polypeptide have?

**A** *n* – 1 peptide bonds and *n* – 1 R groups

**B** *n* – 1 peptide bonds and *n* R groups

**C** *n* peptide bonds and *n* – 1 R groups

**D** *n* peptide bonds and *n* R groups

**13** What are the features of triglycerides?

| | polar | less dense than water | lower proportion of hydrogen than in carbohydrates |
|---|---|---|---|
| **A** | ✓ | ✓ | ✗ |
| **B** | ✓ | ✗ | ✓ |
| **C** | ✗ | ✓ | ✗ |
| **D** | ✗ | ✗ | ✓ |

key

✓ = yes

✗ = no

**14** Which of these statements describe the action of an extracellular enzyme?

1 synthesis of a polynucleotide in the nucleus during DNA replication

2 digestion of macromolecules in the lumen of the small intestine

3 synthesis of ATP molecules in the mitochondria

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

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**15** An experiment was carried out in which the enzyme lipase was used to hydrolyse a triglyceride.

The pH was recorded at regular intervals during the reaction.

The results are shown in the table.

| time / minutes | pH |
|---|---|
| 0 | 7.0 |
| 2 | 6.2 |
| 4 | 5.6 |
| 6 | 5.1 |
| 8 | 4.7 |
| 10 | 4.6 |
| 12 | 4.6 |
| 14 | 4.6 |

At 14 minutes unreacted triglyceride was still present.

What explains the results after 10 minutes?

**A** The end-products acted as competitive inhibitors.

**B** The end-products acted as non-competitive inhibitors.

**C** The enzyme reaction had reached $V_{max}$.

**D** The tertiary structure of the enzyme had been lost.

**16** Which statement about the effect of substrate concentration on the activity of an enzyme is correct?

**A** Above a certain concentration of substrate an enzyme reaches its maximum rate of reaction.

**B** At high concentration of competitive inhibitor increasing the substrate concentration has no effect.

**C** At high substrate concentration a non-competitive inhibitor no longer affects the enzyme activity.

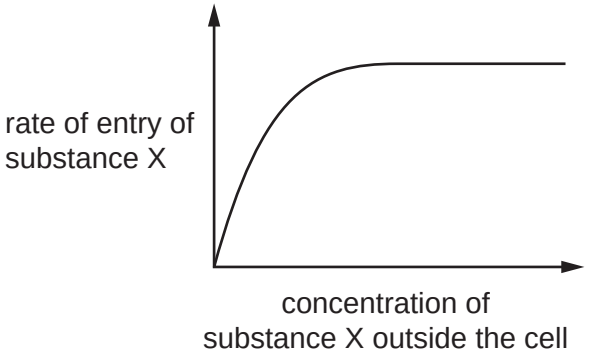
**D** The higher the concentration of substrate the faster an enzyme can catalyse a reaction.

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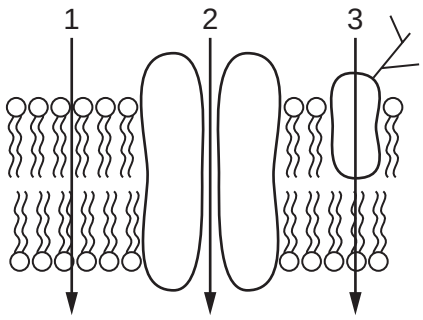
**17** Which row shows a correct function of the components of the cell surface membrane?

| | phospholipids | cholesterol | proteins | glycoproteins |
|---|---|---|---|---|
| **A** | prevent the entry of non-polar molecules | regulates permeability of the membrane | allow exchange of ions between the cell and its environment | allow cell-to-cell communication |
| **B** | prevent the entry of polar molecules | stabilises the membrane by binding to water molecules | allow cell-to-cell communication | provide sites of attachment for hormones |
| **C** | regulate the flexibility of the cell membrane | prevents the entry of protons | allow exchange of gases between the cell and its environment | stabilise the membrane by binding to water molecules |
| **D** | regulate the fluidity of the cell membrane | stabilises the membrane over a range of temperatures | form channels for polar molecules | allow cell-to-cell recognition |

**18** The graph shows how the rate of entry of substance X into a cell changes as the concentration of substance X outside the cell increases.




The diagram shows part of a cell surface membrane.



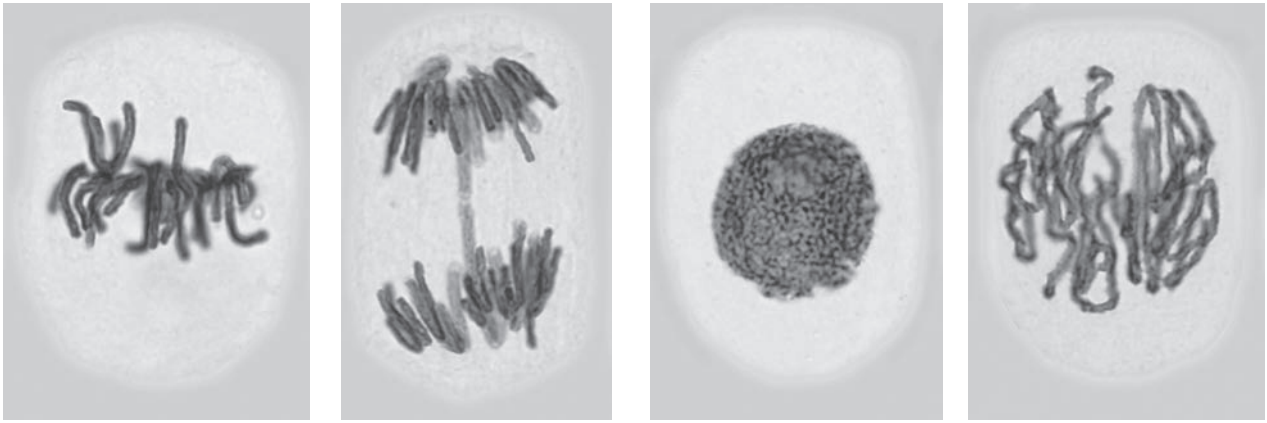

Which pathways could substance X use to enter the cell?

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

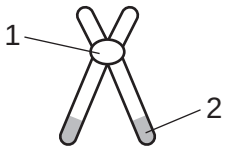
**19** The photomicrographs show cells in various stages of the cell cycle.

In which stage does semi-conservative replication of DNA take place?

**A** **B** **C** **D**



**20** The diagram shows the structure of one chromosome.




Which row is correct?

| | 1 | 2 | number of DNA strands |
|---|---|---|---|
| **A** | centromere | chromatid | 2 |
| **B** | centromere | telomere | 4 |
| **C** | chromatid | telomere | 2 |
| **D** | telomere | chromatid | 4 |

**21** Cancer cells may divide by far more divisions than other cells found in humans.

Which statement about cancer cells is correct?

**A** They are able to synthesise the enzyme telomerase.

**B** They have a mutation in the telomeres so DNA is not hydrolysed.

**C** They have DNA polymerase so can replicate their DNA without telomere loss.

**D** They increase the number of copies of repeated DNA sequences in the telomeres.

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**22** What is the **maximum** number of hydrogen bonds in a length of DNA containing 700 nucleotides?

**A** 350 **B** 700 **C** 1050 **D** 2100

**23** Which statements concerning DNA and RNA are correct?

1 Adenine and guanine are bases that have a double ring structure; cytosine, thymine and uracil are bases with a single ring structure.

2 An adenine nucleotide from DNA is the same as an adenine nucleotide from RNA; DNA adenine pairs with thymine and RNA adenine pairs with uracil.

3 The base pairing that occurs in a double DNA helix and when RNA is synthesised during transcription is always according to the rule that a purine pairs with a pyrimidine.

4 The two polynucleotides on a DNA molecule run in opposite directions so that the double helix formed has two strands that are parallel to each other.

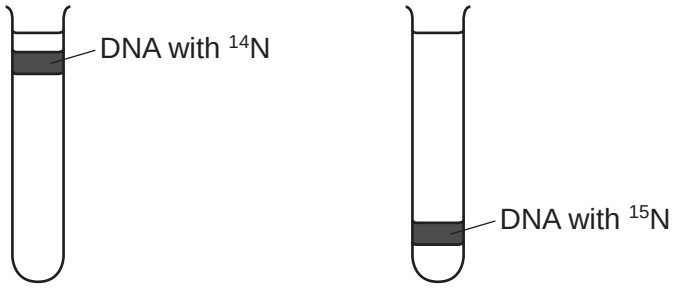
**A** 1, 2 and 3 **B** 1, 2 and 4 **C** 1, 3 and 4 **D** 2, 3 and 4

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**24** Two sets of bacteria were grown using different types of nitrogen-containing growth media.

One set was grown in a medium containing the 'heavy' isotope of nitrogen, $^{15}N$, until all the DNA was labelled. The other set was grown in a medium containing the 'light' isotope of nitrogen, $^{14}N$, until all the DNA was labelled.

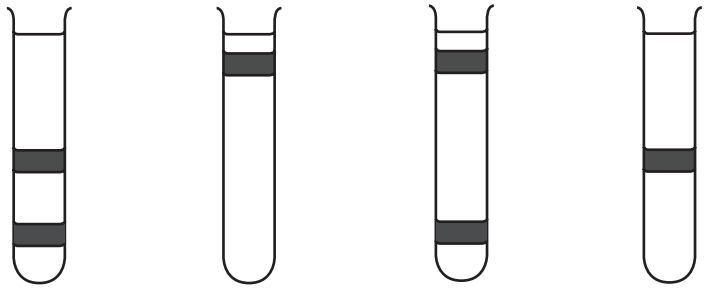
The DNA from each set of bacteria was extracted and centrifuged. The diagram shows the position in the centrifuge tubes of this DNA.




Bacteria with $^{15}N$ labelled DNA were transferred to a medium containing $^{14}N$ and allowed to reproduce once. The DNA of the new generation of bacteria was extracted and centrifuged.

Which tube shows the position of DNA from this new generation of bacteria?

**A** **B** **C** **D**



**25** The diagram shows the nucleotide sequence of a small section of a gene which is transcribed.

GCGCGCGGCGCG

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 order 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

**26** What contributes to the movement of water through the xylem vessel elements?

**A** cohesion of water molecules through hydrogen bonding

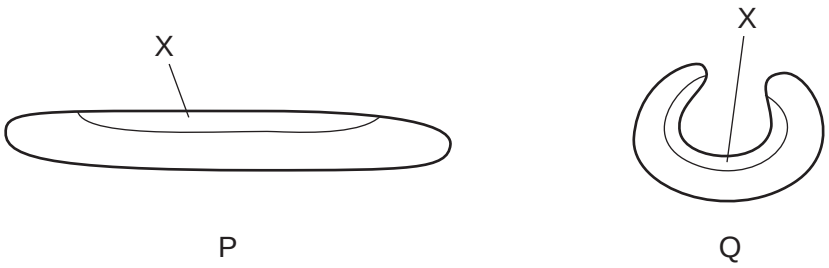
**B** ion movement followed by passive osmosis

**C** negative water potential in the xylem

**D** surface tension at the top of the plant

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**27** The diagram shows a xerophytic leaf in different conditions, P and Q.




Which statements about the cells in layer X of the leaf in each of the conditions P and Q are correct?

1 less negative water potential in P than Q

2 cells may be turgid in P and plasmolysed in Q

3 cells less turgid in P than Q

4 no net diffusion of water into X in either P or Q

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

**B** 1, 2 and 4 only

**C** 1 and 4 only

**D** 2 and 3 only

**28** What are features that adapt root hair cells for efficient uptake of mineral ions?

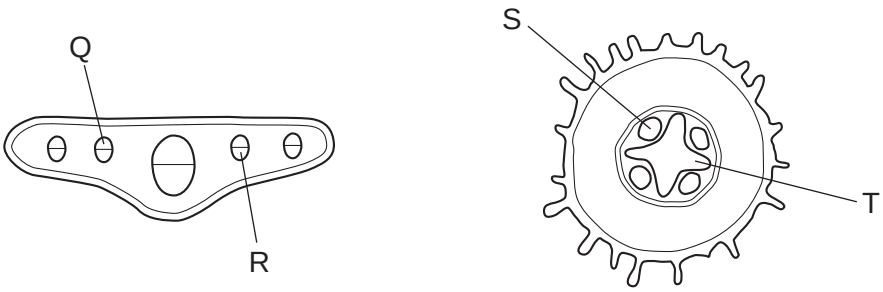
1 a large number of mitochondria

2 a large number of protein carriers in the cell surface membrane

3 a large surface area to volume ratio

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

**29** The transverse sections of two plant organs are shown.




Which pair of tissues contains proton pumps?

**A** Q and S **B** Q and T **C** R and S **D** R and T

**30** Measurements of the stem of a young tree showed that the diameter varied slightly. It decreased during the day and increased during the night.

Which statement explains these observations?

**A** During the day, cohesion between water molecules and lignin in the walls of the xylem vessels pulls the walls of the vessels inwards.

**B** During the day, the tension developed in a moving column of water molecules reduces the pressure inside the xylem vessels, so that their walls move inwards.

**C** During the night, the adhesion of water molecules to the lignin in the walls of the xylem vessels pushes the walls of the vessels outwards.

**D** During the night, the pressure of the column of water molecules adhering to one another increases and pushes the walls of the xylem vessels outwards.

**31** Which statement about the human circulatory system is correct?

**A** Blood passes twice through the heart in one complete circulation.

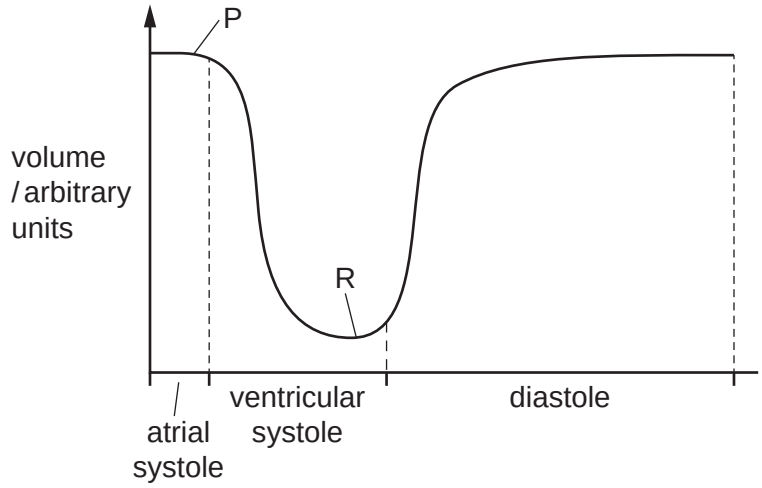
**B** Blood, tissue fluid and lymph are all parts of the circulatory system.

**C** Capillaries have the lowest blood pressure.

**D** Veins in the circulatory system all carry deoxygenated blood.

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**32** The graph shows changes in the volume of the ventricles during the cardiac cycle.




Which valves open and close at P and R?

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

**33** Haemoglobin can bind to carbon dioxide, carbon monoxide and oxygen.

1 carbon dioxide

2 carbon monoxide

3 oxygen

Which gases share a binding site?

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

**34** A good gas exchange system maintains a steep diffusion gradient, has a large total surface area and a short diffusion distance.

Which feature of the human gas exchange system helps to maintain a steep diffusion gradient?

**A** A large number of alveoli are present in each lung.

**B** Alveoli walls contain elastic fibres allowing expansion.

**C** The air brought into the alveoli by ventilation is high in oxygen.

**D** The endothelium of the capillary wall is made of flattened cells.

**35** Which statement about bronchioles is correct?

**A** They have cartilage and ciliated cells.

**B** They have cartilage and elastic tissue.

**C** They have cartilage and muscle tissue.

**D** They have elastic tissue and ciliated cells.

**36** In which regions of the human gas exchange system is the function of some types of cell **directly** affected by tar in cigarette smoke?

**A** bronchioles and alveoli only

**B** trachea, bronchus, bronchioles, alveoli

**C** trachea and bronchus only

**D** trachea, bronchus and bronchioles only

**37** What is the causative agent and method of transmission of smallpox?

| | causative agent | method of transmission |
|---|---|---|
| **A** | *Morbillivirus* | direct contact |
| **B** | *Morbillivirus* | waterborne |
| **C** | *Variola* | direct contact |
| **D** | *Variola* | waterborne |

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

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

The scientist recorded the number of days that each person suffered from 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 suffered from diarrhoea when they were treated with the antibiotic?

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

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**39** Which sequence of events occurs during an immune response?

1 development of plasma cells

2 mitosis of B-lymphocytes

3 recognition of non-self antigens

4 secretion of antibodies

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

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

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

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

**40** An influenza vaccine can be made by growing the viruses in chicken eggs.

The viruses are extracted in liquid from the eggs and inactivated. The purified egg extract containing the viruses is then used as the vaccine.

What is a side-effect of using this vaccine in some people?

**A** An auto-immune condition could occur.

**B** An immune response to egg antigens could occur.

**C** The egg antigens could cause infections.

**D** The influenza viruses could cause infections.

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