



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

BIOLOGY

9700/11

Paper 1 Multiple Choice

May/June 2011

1 hour

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



READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, 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.

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.

This document consists of **16** printed pages.



- 1 A cell organelle measures 4×10^{-1} mm in diameter.

What is the diameter in μm ?

- A** $4 \times 10^1 \mu\text{m}$ **B** $4 \times 10^2 \mu\text{m}$ **C** $4 \times 10^3 \mu\text{m}$ **D** $4 \times 10^4 \mu\text{m}$

- 2 In the following table, which is the correct comparison between light and electron microscopes?

| | light microscope | | electron microscope | |
|----------|------------------|---------------|---------------------|---------------|
| | resolution | magnification | resolution | magnification |
| A | high | high | low | low |
| B | high | low | low | high |
| C | low | high | high | low |
| D | low | low | high | high |

- 3 Which structures are present in a typical plant cell?

| | centrioles | cilia | mitochondria | vacuole |
|----------|------------|-------|--------------|---------|
| A | ✓ | ✓ | x | x |
| B | ✓ | x | x | ✓ |
| C | x | ✓ | ✓ | x |
| D | x | x | ✓ | ✓ |

key
 ✓ = present
 x = absent

- 4 Plant cells are stained and then viewed through a light microscope.

Which structures would be clearly visible at a magnification of $\times 400$?

- A** chloroplast grana
B lysosomes
C nucleoli
D ribosomes

- 5 Which type of cell will contain the highest proportion of single membrane-bound structures?

- A** ciliated epithelial cell
B goblet cell
C red blood cell
D smooth muscle cell

- 6 Four different fruit juices, **A**, **B**, **C** and **D**, were tested with Benedict's solution. A second sample of each juice was hydrolysed and tested with Benedict's solution. The table shows the masses of the precipitates formed.

Which juice contains the greatest mass of non-reducing sugar?

| | mass of precipitate before hydrolysis /mg | mass of precipitate after hydrolysis /mg |
|----------|-------------------------------------------------|------------------------------------------------|
| A | 30 | 55 |
| B | 55 | 55 |
| C | 65 | 85 |
| D | 70 | 80 |

- 7 Which molecular bonds will be broken by hydrolysis when a molecule of glycogen is converted to glucose?

| | bonds | | | |
|----------|-------|-----|-----|-----------------------------------|
| | 1,2 | 1,4 | 1,6 | |
| A | ✓ | x | x | key ✓ = broken x = unbroken |
| B | x | ✓ | ✓ | |
| C | ✓ | x | ✓ | |
| D | x | ✓ | x | |

8 Which set of statements correctly describes haemoglobin?

| | | | | |
|----------|--------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| A | four polypeptide chains, each containing a prosthetic group | iron ions can associate with oxygen forming oxyhaemoglobin | in each chain, hydrophobic R groups of amino acids point towards the centre of the molecule | at 50% saturation, two oxygen molecules are transported by the molecule |
| B | polypeptide chains interact to produce a globular chain | each chain contains a prosthetic group of amino acids surrounding an iron ion | two identical alpha chains and two identical beta chains | each chain can transport an oxygen molecule |
| C | polypeptide chains interact to produce an almost spherical molecule | an iron ion is present within each haem group | quaternary structure of two alpha chains and two beta chains | each molecule can transport a total of four oxygen atoms |
| D | polypeptide chains produce a loose helical shape, which curls to form a spherical molecule | iron ions in the molecule can bind reversibly with oxygen | in each chain, hydrophobic R groups of amino acids surround the iron ion | each molecule can transport a total of eight oxygen atoms |

9 Some foods contain 'hydrogenated vegetable oils'. 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 Which rows show the chemical groups present in the biological molecules listed?

| | biological molecule | presence of carboxyl (COOH) groups | presence of two or more hydroxyl (OH) groups |
|---|---------------------|------------------------------------|----------------------------------------------|
| 1 | amino acid | yes | no |
| 2 | β -glucose | no | yes |
| 3 | glycerol | no | no |
| 4 | fatty acid | yes | no |

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

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

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

key ✓ = true ✗ = false

- 12 The breakdown of hydrogen peroxide to water and oxygen is catalysed by the enzyme catalase.

In an investigation into the effect of pH on the rate of reaction of catalase, potato cubes were added to hydrogen peroxide.

Which dependent variable should be recorded?

- A** the change in mass of the potato after a given time
 - B** the pH of the solution at regular time intervals
 - C** the number of potato cubes added at the start
 - D** the volume of oxygen given off at regular time intervals
- 13 Which levels of protein structure can determine the specificity of an enzyme?
- 1 primary
 - 2 secondary
 - 3 tertiary
 - 4 quaternary
- A** 1, 2, 3 and 4
 - B** 1, 2 and 3 only
 - C** 1, 2 and 4 only
 - D** 3 and 4 only

14 Some inhibitors of enzyme reactions bind to the enzyme/substrate complex.

Which statements about this type of inhibition are correct?

- 1 The active site changes shape.
- 2 The inhibitor is non-competitive.
- 3 The initial rate of reaction is reduced.
- 4 The maximum rate of reaction (V_{\max}) is increased.

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

15 What is correct for the cell surface membrane and membranes within cells?

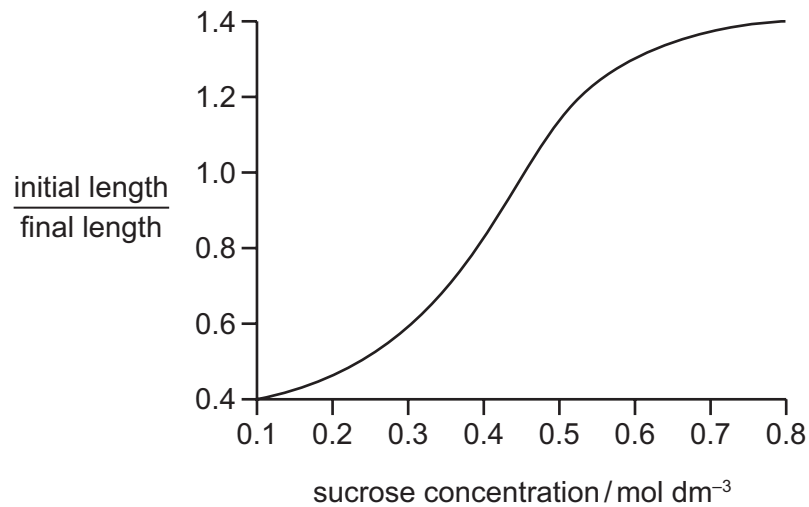
- A** Both allow intracellular transport.
- B** Both are stabilised by glycoproteins.
- C** Both have sites for enzyme attachment.
- D** Both protect cells from the contents of lysosomes.

16 What supports the view that a membrane protein is involved in active transport?

- A** It allows movement of molecules across a membrane if concentration differences exist.
- B** It can only function if mitochondria are supplied with sufficient oxygen.
- C** It has a tertiary structure with a binding site with a specific shape.
- D** It is found in the cell surface membranes and the mitochondrial membranes.

- 17 Strips of plant tissue were immersed in a range of sucrose solutions of different concentrations. Their lengths were measured before immersion and after 30 minutes.

The graph shows the ratio of initial length to final length.



What is a correct description of the change in the cells and in their water potential as the sucrose concentration increases?

| | change in the cells | change in the water potential |
|----------|---------------------|-------------------------------|
| A | less turgid | more negative |
| B | less turgid | less negative |
| C | more turgid | less negative |
| D | more turgid | more negative |

- 18 Which is always true of cytokinesis?

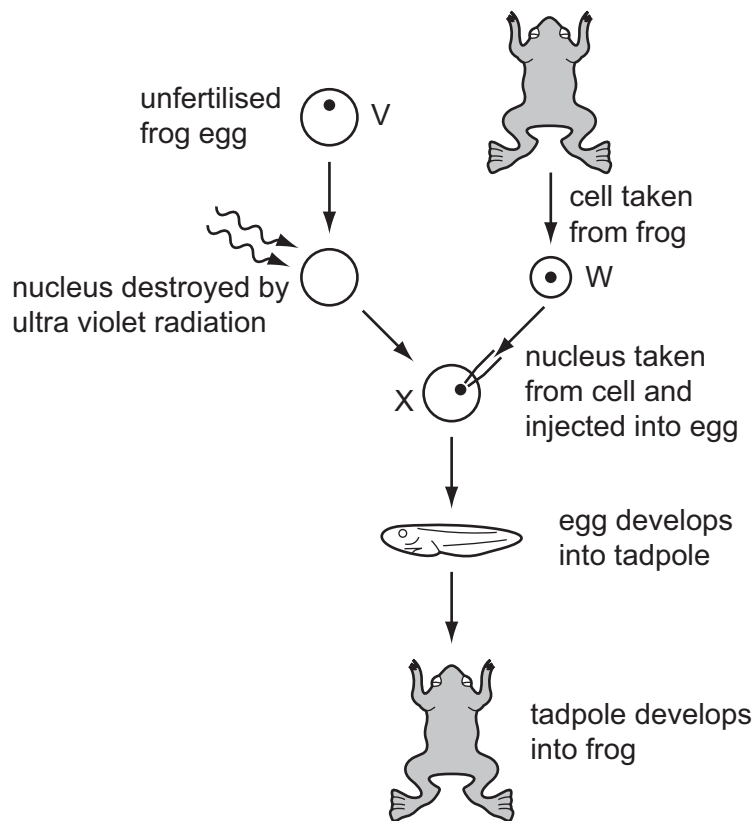
- 1 Cell organelles replicate.
- 2 Cell organelles are divided between two cells.
- 3 Nuclear envelope reforms.

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

- 19 Which process occurs during prophase of the mitotic cell cycle in an animal cell?

- A** division of centromeres
- B** formation of chromosomes
- C** replication of DNA
- D** separation of centrioles

- 20 The diagram shows how genetically identical frogs can be developed from unfertilised frog eggs. The diploid number ($2n$) for frogs is 26.



Which combination of numbers correctly identifies the number of chromosomes in each of the types of cell in the diagram?

| | V | W | X |
|----------|----|----|----|
| A | 13 | 13 | 26 |
| B | 13 | 26 | 13 |
| C | 13 | 26 | 26 |
| D | 26 | 26 | 13 |

21 The mechanism of action of four drugs that inhibit DNA replication is stated below.

- Aphidicholine inhibits DNA polymerase.
- Cytarabine is converted into a molecule that can substitute for a DNA nucleotide and also inhibits DNA repair mechanisms.
- Epirubicin inhibits an enzyme involved in the unwinding of DNA and separation of strands.
- Hydroxycarbamide inhibits an enzyme involved in the production of deoxyribonucleotides.

Which row correctly matches a drug to an explanation of the mechanism of action?

| | explanation of mechanism of action | | | |
|----------|-------------------------------------------------------------------|----------------------------------------------------------|------------------------------------------------------|--------------------------------------------------|
| | decreased pool of available nucleotides inhibits chain elongation | DNA strands not available as templates for transcription | DNA damaged during replication and cell death occurs | exposed DNA template strands unable to be copied |
| A | aphidicholine | epirubicin | cytarabine | hydroxycarbamide |
| B | epirubicin | cytarabine | hydroxycarbamide | aphidicholine |
| C | hydroxycarbamide | aphidicholine | epirubicin | cytarabine |
| D | hydroxycarbamide | epirubicin | cytarabine | aphidicholine |

22 The following events occur during transcription.

- 1 Bonds break between complementary bases.
- 2 Bonds form between complementary bases.
- 3 Sugar-phosphate bonds form.
- 4 Free nucleotides pair with complementary nucleotides.

Before the mRNA leaves the nucleus, which events will have occurred twice?

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

23 Which type of sugar and types of bonds are found in a DNA molecule?

| | type of sugar | types of bonds |
|----------|---------------|-----------------------|
| A | non-reducing | hydrogen and ionic |
| B | non-reducing | hydrogen and peptide |
| C | reducing | covalent and hydrogen |
| D | reducing | hydrogen and peptide |

24 In an animal cell, which process is dependent upon cell surface area and which process is dependent upon cell volume?

| | cell surface area | cell volume |
|----------|-------------------------|-------------------------|
| A | carbon dioxide produced | oxygen used |
| B | glucose absorbed | hormones detected |
| C | hormones detected | carbon dioxide produced |
| D | oxygen used | glucose absorbed |

25 Which xerophytic adaptations reduce the water potential gradient?

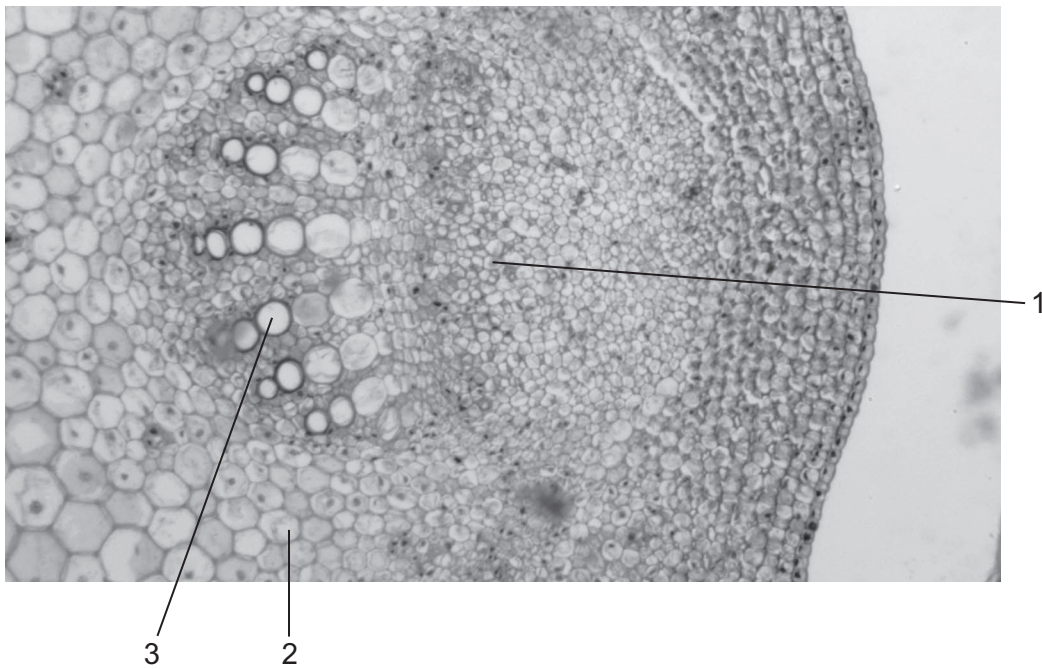
- 1 rolled leaves
- 2 hairy leaves
- 3 sunken stomata
- 4 fewer stomata
- 5 fleshy leaves

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

26 During transpiration, what is the site of evaporation of water in the leaves?

- A** air spaces
B guard cell walls
C mesophyll cell walls
D stomata

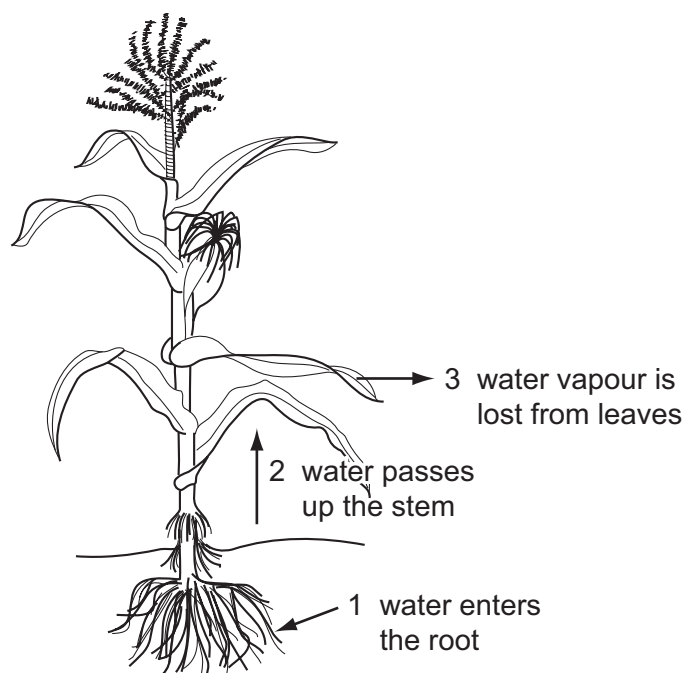
27 The photomicrograph shows a vascular bundle.



Which describes the relationship of water potential in the labelled cells?

- A cell 3 less negative than cell 1
- B cell 2 less negative than cell 3
- C cell 3 more negative than cells 1 and 2
- D cells 1, 2 and 3 have the same water potential

28 The diagram represents the movement of water through a plant.



Which row identifies the processes involved during the stages of water movement shown?

| | cohesion and adhesion | transpiration | osmosis |
|----------|-----------------------|---------------|---------|
| A | 1 | 2 | 3 |
| B | 1 | 3 | 2 |
| C | 2 | 1 | 3 |
| D | 2 | 3 | 1 |

29 What is correct for tissue fluid?

| | phagocytes | platelets | protein concentration compared to blood plasma |
|----------|------------|-----------|------------------------------------------------|
| A | ✓ | ✓ | higher |
| B | x | x | higher |
| C | ✓ | x | lower |
| D | x | ✓ | lower |

key

✓ = present

x = absent

30 What happens during ventricular diastole?

- A All semilunar valves open.
- B The atrio-ventricular valves open.
- C The pressure in the atria rises above the pressure in the ventricles.
- D The pressure in the left atrium rises more than the pressure in the right atrium.

31 Which row correctly describes the events during the cardiac cycle?

| | nerve impulses from atrio-ventricular node (AVN) to | nerve impulses from Purkyne tissue (PT) to | nerve impulses from sino-atrial node (SAN) to |
|----------|-----------------------------------------------------|--------------------------------------------|-----------------------------------------------|
| A | SAN | the ventricles | AVN |
| B | PT | the atria | PT |
| C | PT | the ventricles | AVN |
| D | SAN | the atria | PT |

32 Which row correctly identifies the structure of an artery compared with a vein seen in transverse section under a light microscope?

| | outer wall of artery | layer of muscles and elastic fibres | diameter of the lumen (hollow space) |
|----------|----------------------|-------------------------------------|--------------------------------------|
| A | thicker | thicker | narrower |
| B | thicker | thinner | wider |
| C | thinner | thicker | narrower |
| D | thinner | thinner | wider |

33 In the lungs, oxygen and carbon dioxide pass through cell membranes by diffusion.

Which row is correct?

| | number of cell membranes diffused through by | |
|----------|----------------------------------------------|-----------------------|
| | oxygen from air | carbon dioxide to air |
| A | 3 | 2 |
| B | 3 | 2 or 3 |
| C | 5 | 4 |
| D | 5 | 4 or 5 |

34 A student was asked to describe the differences between four microscope slides of sections taken from different parts of the gas exchange system.

slide 1 not present: cartilage, glands

present: few goblet cells, ciliated epithelial cells, smooth muscle

slide 2 present: incomplete cartilage rings, glands, goblet cells, ciliated epithelial cells, smooth muscle

slide 3 not present: cartilage, glands, goblet cells, smooth muscle

present: squamous epithelial cells

slide 4 present: plates of cartilage, glands, goblet cells, ciliated epithelial cells, smooth muscle

Which is the correct identification of the parts of the gas exchange system?

| | slide 1 | slide 2 | slide 3 | slide 4 |
|----------|------------|------------|------------|----------|
| A | alveolus | bronchiole | bronchus | trachea |
| B | bronchiole | bronchus | alveolus | trachea |
| C | bronchiole | trachea | alveolus | bronchus |
| D | bronchus | trachea | bronchiole | alveolus |

35 A person suffering from mild emphysema stopped smoking cigarettes.

Why would this person's health improve?

A goblet cells secrete more mucus, allowing a greater number of pathogens to be trapped

B increased numbers of phagocytic macrophages arrive in the lungs

C less atheroma build-up on the inner lining of arteries, increasing lumen diameter

D less carboxyhaemoglobin produced, increasing oxygen transport by haemoglobin

36 Which disease is **not** likely to be passed directly from parents to child?

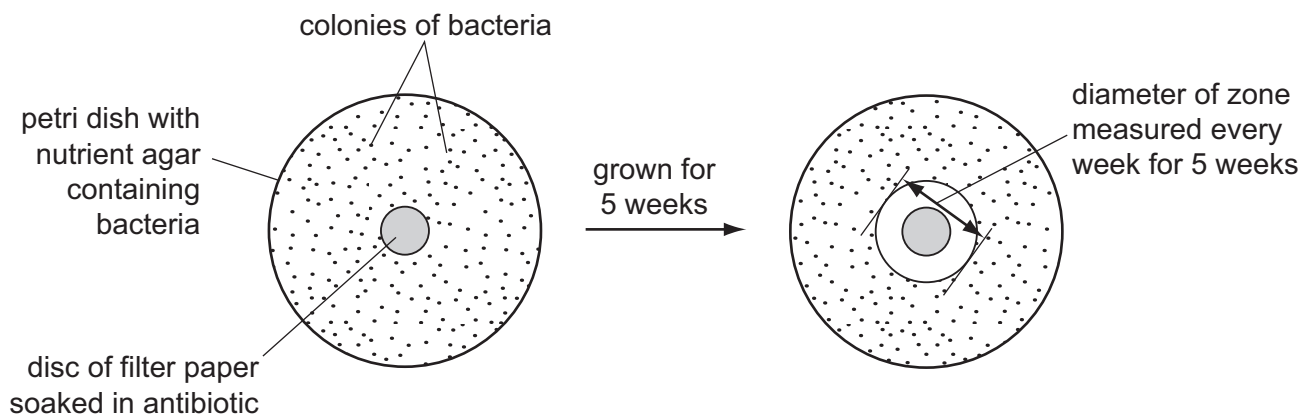
A cholera

B malaria

C sickle cell anaemia

D tuberculosis

37 The diagram shows one way of testing the effect of an antibiotic on bacteria.



The table shows the results of testing five different types of bacteria. Zones of less than 13 mm show the presence of resistant bacteria.

| type of bacteria | diameter of zone / mm | | | | |
|------------------|-----------------------|--------|--------|--------|--------|
| | week 1 | week 2 | week 3 | week 4 | week 5 |
| 1 | 24.10 | 21.90 | 19.00 | 17.60 | 14.30 |
| 2 | 18.60 | 15.40 | 12.20 | 9.00 | 0.00 |
| 3 | 17.90 | 12.80 | 12.40 | 11.10 | 10.90 |
| 4 | 19.40 | 15.30 | 13.20 | 8.10 | 0.00 |
| 5 | 22.00 | 21.00 | 20.50 | 20.40 | 20.40 |

Which statement can be supported by this data?

- A Bacteria become more resistant to antibiotics over time.
- B Only types 2, 3 and 4 of the bacteria show resistance to the antibiotic.
- C The antibiotic can be used to treat all the types of bacteria.
- D Type 5 of the bacteria can never become resistant to the antibiotic.

38 Smallpox has been eradicated, but not malaria or cholera.

Which statements correctly explain this?

- 1 Cholera bacteria in the intestines are not destroyed by antibiotics.
- 2 Plasmodium antigens change during the life cycle.
- 3 Smallpox antigens remain stable.
- 4 Vaccines only work against viruses.

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

39 A square metre of grassland receives about 1 047 000 kJ of solar light energy each year.

The table shows what happens to this energy.

| | kJ |
|-------------------------------|---------|
| used in evaporation of water | 523 500 |
| transmitted to the ground | 335 000 |
| reflected by the leaves | 165 000 |
| used for growth | 21 500 |
| used for other life processes | 1 500 |
| respiratory heat losses | 500 |

How much energy is used by the grass in photosynthesis?

- A** 2000 kJ **B** 19500 kJ **C** 21500 kJ **D** 23500 kJ

40 Which process does **not** involve making nitrogen available to plants?

- A** ammonification
B denitrification
C nitrification
D nitrogen fixation