



**Cambridge International Examinations**  
Cambridge International General Certificate of Secondary Education

**COMBINED SCIENCE**

Paper 2 Multiple Choice (Extended)

**0653/21**

**October/November 2017**

**45 minutes**

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, 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.

A copy of the Periodic Table is printed on page 16.

Electronic calculators may be used.

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

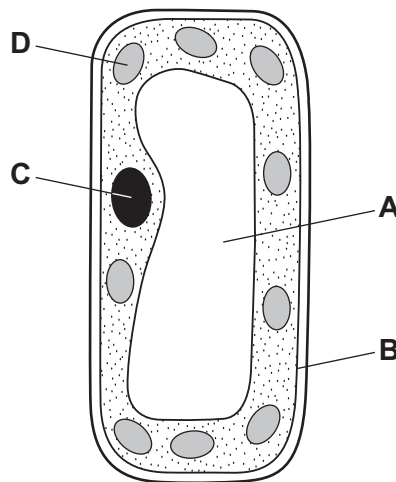


1 Which characteristics help to define a living organism?

- A diffusion, movement, respiration
- B excretion, nutrition, sensitivity
- C excretion, reproduction, transpiration
- D growth, inspiration, nutrition

2 The diagram shows a palisade cell.

Which structure converts energy from light into chemical energy?



3 Why does the rate of enzyme activity change when the temperature rises above the optimum temperature?

- A The enzyme has been denatured.
- B The enzyme has been used up.
- C The enzyme molecules are moving too slowly.
- D The enzyme speeds up the rate of the reaction.

4 Which chemical is used to test for a food substance that contains the elements carbon, hydrogen, nitrogen and oxygen?

- A Benedict's solution
- B biuret solution
- C ethanol
- D iodine solution

5 Which letters from the list represent the balanced equation for photosynthesis?

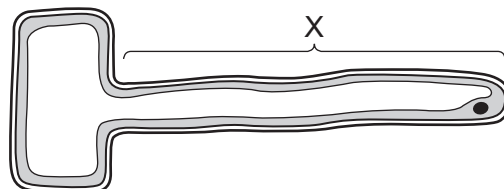
|   |                                      |   |                       |
|---|--------------------------------------|---|-----------------------|
| P | $\text{C}_6\text{H}_{12}\text{O}_6$  | T | $\text{H}_2\text{O}$  |
| Q | $6\text{C}_6\text{H}_{12}\text{O}_6$ | U | $6\text{H}_2\text{O}$ |
| R | $\text{CO}_2$                        | V | $\text{O}_2$          |
| S | $6\text{CO}_2$                       | W | $6\text{O}_2$         |

- A  $\text{P} + \text{U} \rightarrow \text{R} + \text{V}$
- B  $\text{Q} + \text{T} \rightarrow \text{S} + \text{U}$
- C  $\text{R} + \text{T} \rightarrow \text{W} + \text{P}$
- D  $\text{U} + \text{S} \rightarrow \text{P} + \text{W}$

6 In which order does food pass through parts of the alimentary canal?

- A oesophagus  $\rightarrow$  colon  $\rightarrow$  small intestine
- B small intestine  $\rightarrow$  oesophagus  $\rightarrow$  rectum
- C small intestine  $\rightarrow$  rectum  $\rightarrow$  anus
- D stomach  $\rightarrow$  colon  $\rightarrow$  small intestine

7 The diagram shows a plant cell.

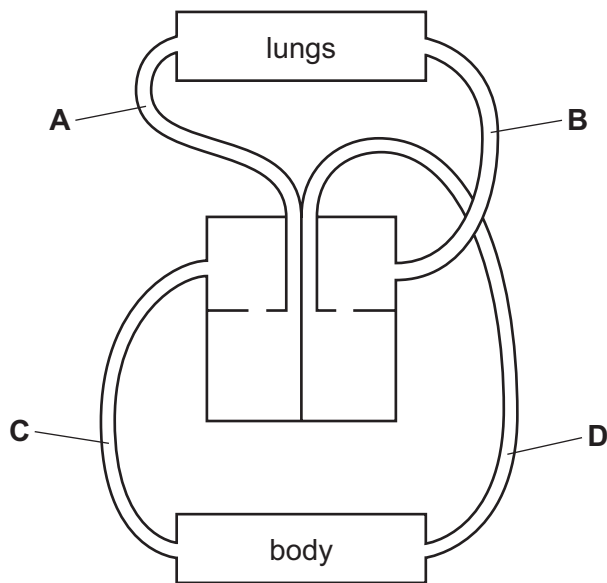


What does structure X do?

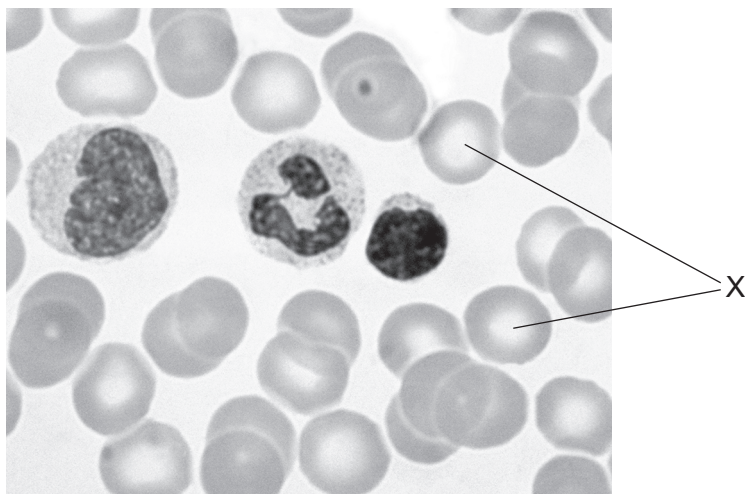
- A decreases the surface area of the cell for water and ion absorption
- B decreases the surface area of the cell for water and sugar absorption
- C increases the surface area of the cell for water and ion absorption
- D increases the surface area of the cell for water and sugar absorption

- 8 The diagram shows the double circulation of blood around the human body.

Which blood vessel contains blood at the highest pressure?



- 9 The photomicrograph shows a sample of human blood.



What is the function of the cells marked X?

- A antibody formation
- B clotting of blood
- C phagocytosis
- D transport of oxygen

10 Which component of tobacco smoke reduces the ability of haemoglobin to carry oxygen?

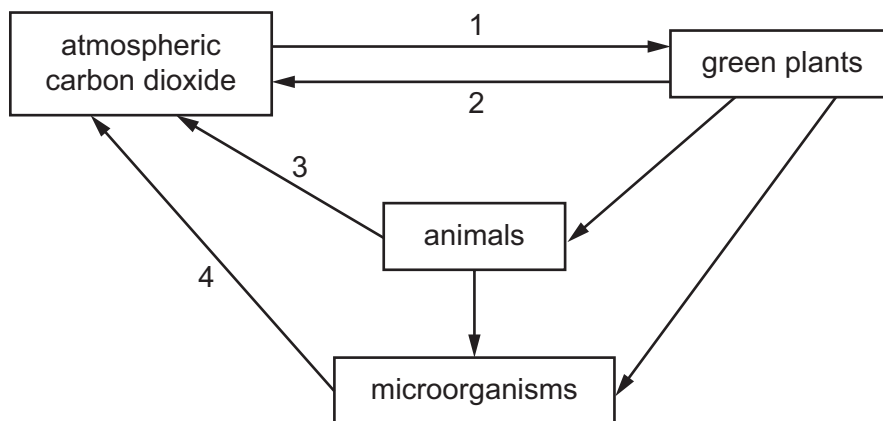
- A carbon monoxide
- B nicotine
- C smoke particles
- D tar

11 During pregnancy, the fetus is contained within the amniotic sac. The amniotic sac contains amniotic fluid.

What is the function of the amniotic fluid?

- A It protects the fetus against knocks and bumps.
- B It provides the fetus with oxygen and nutrients.
- C It removes the fetal waste products.
- D It supplies the fetus with blood.

12 The diagram represents part of the carbon cycle.



Which arrows show where respiration takes place?

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

13 Which gas dissolves in water vapour to produce acid rain?

- A methane
- B nitrogen
- C oxygen
- D sulfur dioxide

14 The formulae of three substances are shown.

| substance | formula          |
|-----------|------------------|
| methane   | CH <sub>4</sub>  |
| water     | H <sub>2</sub> O |
| oxygen    | O <sub>2</sub>   |

Which statement is correct?

- A Methane is made from five different types of atom.
- B Methane, water and oxygen are molecules.
- C Only methane and water are molecules.
- D Oxygen is made from two different types of atom.

15 Which process is used to separate petroleum?

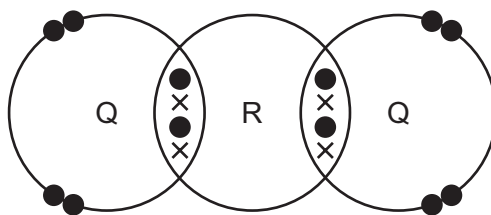
- A crystallisation
- B distillation
- C filtration
- D fractional distillation

16 What is the electronic structure of a chlorine atom, Cl, and of a chloride ion, Cl<sup>-</sup>?

|   | chlorine atom | chloride ion |
|---|---------------|--------------|
| A | 2,8,6         | 2,8,8        |
| B | 2,8,7         | 2,8,6        |
| C | 2,8,7         | 2,8,8        |
| D | 2,8,8         | 2,8,7        |

- 17 Element Q and element R combine to form a covalent compound,  $Q_2R$ .

The arrangement of the outer-shell electrons in the compound is shown.



Which compound has the same arrangement of outer shell electrons as  $Q_2R$ ?

- A** carbon dioxide  
**B** hydrogen chloride  
**C** methane  
**D** water
- 18 Aluminium sulfate contains aluminium ions,  $Al^{3+}$ , and sulfate ions,  $SO_4^{2-}$ .

Iron(II) nitride contains iron(II) ions,  $Fe^{2+}$ , and nitride ions,  $N^{3-}$ .

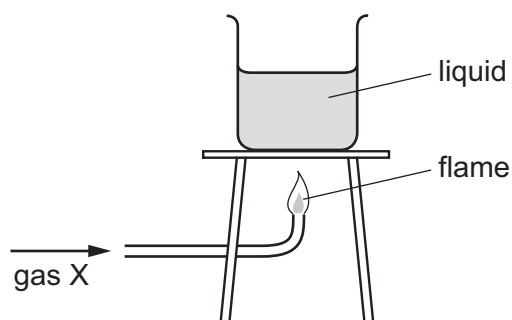
What are the formulae of aluminium sulfate and of iron(II) nitride?

|          | aluminium sulfate | iron(II) nitride |
|----------|-------------------|------------------|
| <b>A</b> | $Al_2(SO_4)_3$    | $Fe_2N_3$        |
| <b>B</b> | $Al_2(SO_4)_3$    | $Fe_3N_2$        |
| <b>C</b> | $Al_3(SO_4)_2$    | $Fe_2N_3$        |
| <b>D</b> | $Al_3(SO_4)_2$    | $Fe_3N_2$        |

- 19 What is produced at the anode during the electrolysis of molten lead(II) bromide?

- A** bromide ions  
**B** bromine  
**C** lead  
**D** lead(II) ions

- 20 The diagram shows gas X burning and heating a liquid.

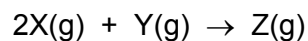


Which row is correct?

|          | gas X    | the burning of gas X is exothermic |
|----------|----------|------------------------------------|
| <b>A</b> | hydrogen | ✓                                  |
| <b>B</b> | hydrogen | x                                  |
| <b>C</b> | oxygen   | ✓                                  |
| <b>D</b> | oxygen   | x                                  |

- 21 Gases X and Y react together to form gas Z.

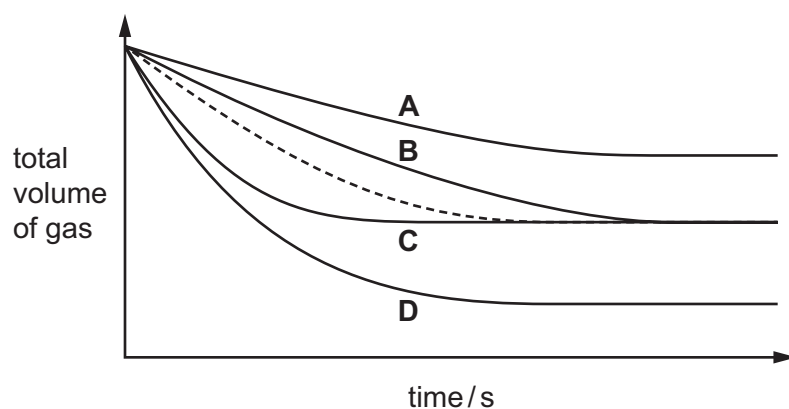
The equation for the reaction is shown.



The total volume of gas is measured as the reaction occurs. The dotted line in the graph shows the results.

The reaction is repeated using the same volumes of X and Y under the same conditions but with the addition of a catalyst.

Which line shows the results for the second experiment?



- 22** Carbon reacts with carbon dioxide at high temperatures.



Which statement about the reaction is correct?

- A** Both carbon and carbon dioxide are oxidised.
  - B** Both carbon and carbon dioxide are reduced.
  - C** The carbon is oxidised and the carbon dioxide is reduced.
  - D** The carbon is reduced and the carbon dioxide is oxidised.
- 23** Excess aqueous barium nitrate is added to dilute sulfuric acid to produce barium sulfate.
- How is barium sulfate obtained from the reaction mixture?
- A** electrolysis
  - B** evaporation
  - C** filtration
  - D** fractional distillation
- 24** Which statement about elements in the Periodic Table is correct?
- A** Barium is a non-metal in Group II and its atoms have two electrons in their outer shells.
  - B** Chlorine is a non-metal in Group VII and its atoms have seven electrons in their outer shells.
  - C** Fluorine is a non-metal in Group VII and its atoms have one electron in their outer shells.
  - D** Sodium is a metal in Group II and its atoms have one electron in their outer shells.
- 25** Which substance is added to the blast furnace to remove acidic impurities during the extraction of iron?
- A** calcium silicate
  - B** carbon monoxide
  - C** coke
  - D** limestone

**26** P, Q, R and S are four gases found in clean air.

P is very unreactive.

Q makes up 21% of the air.

R makes up 78% of the air.

S is formed when fossil fuels are burned.

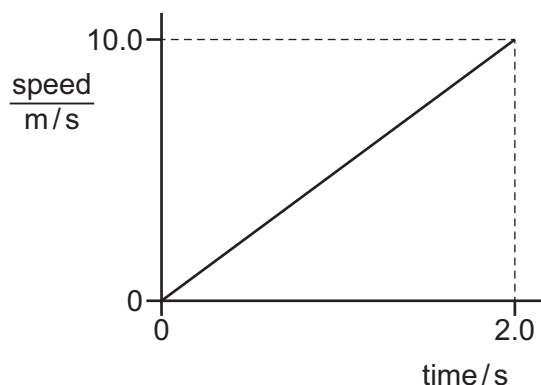
Which row is correct?

|          | P              | Q        | R        | S              |
|----------|----------------|----------|----------|----------------|
| <b>A</b> | argon          | nitrogen | oxygen   | carbon dioxide |
| <b>B</b> | argon          | oxygen   | nitrogen | carbon dioxide |
| <b>C</b> | carbon dioxide | oxygen   | nitrogen | argon          |
| <b>D</b> | carbon dioxide | nitrogen | oxygen   | argon          |

**27** Which process is an example of thermal decomposition?

- A** cracking an alkane
- B** electrolysis of molten lead(II) bromide
- C** extraction of iron in a blast furnace
- D** fractional distillation of petroleum

- 28 The diagram is a speed-time graph for a moving object.



What is the acceleration of the object and what distance does it travel in 2.0 s?

|          | <u>acceleration</u><br>$\text{m/s}^2$ | distance<br>travelled / m |
|----------|---------------------------------------|---------------------------|
| <b>A</b> | 5.0                                   | 10                        |
| <b>B</b> | 5.0                                   | 20                        |
| <b>C</b> | 20                                    | 10                        |
| <b>D</b> | 20                                    | 20                        |

- 29 A piece of scientific equipment is taken on a space ship from Earth to a distant planet.

Which property or properties of the equipment **must** remain the same on the distant planet?

|          | mass | weight |
|----------|------|--------|
| <b>A</b> | ✓    | ✓      |
| <b>B</b> | ✓    | ✗      |
| <b>C</b> | ✗    | ✓      |
| <b>D</b> | ✗    | ✗      |

key

✓ = must be the same

✗ = does not have to be the same

- 30 A student stretches a steel spring by hanging a load on it. The measurements for the extension of the spring are shown in the table.

| load / N       | 1.0 | 2.0 | 3.0 | 4.0 | 5.0 | 6.0 |
|----------------|-----|-----|-----|-----|-----|-----|
| extension / cm | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 |

What is the value for the spring constant  $k$  of the spring?

- A** 0.50 N/cm      **B** 1.0 N/cm      **C** 2.0 N/cm      **D** 18 N/cm

- 31** A panel of solar cells is 15% efficient. The power supplied by the Sun to the panel is 40 kW.

What is the output power of the panel?

- A** 2.7 kW      **B** 6.0 kW      **C** 25 kW      **D** 34 kW

- 32** When a liquid evaporates, which molecules escape and what happens, if anything, to the temperature of the remaining liquid?

|          | molecules escaping       | temperature of remaining liquid |
|----------|--------------------------|---------------------------------|
| <b>A</b> | less energetic molecules | decreases                       |
| <b>B</b> | less energetic molecules | stays the same                  |
| <b>C</b> | more energetic molecules | decreases                       |
| <b>D</b> | more energetic molecules | stays the same                  |

- 33** A teacher explains about transfer of thermal energy.

When air is .....X....., it becomes less dense and rises.

This helps to explain transfer of thermal energy by .....Y..... .

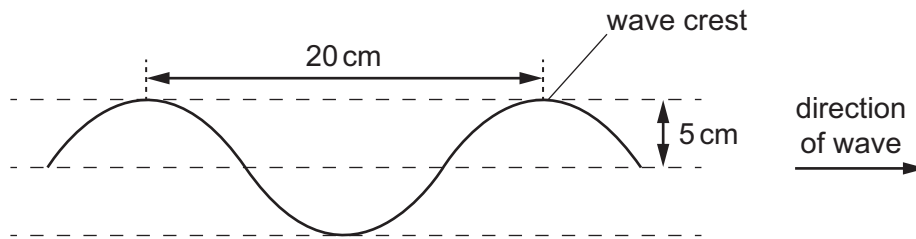
Which words complete gaps X and Y?

|          | X      | Y          |
|----------|--------|------------|
| <b>A</b> | cooled | conduction |
| <b>B</b> | cooled | convection |
| <b>C</b> | heated | conduction |
| <b>D</b> | heated | convection |

- 34 The diagram shows a section of a rope.

Four wave crests pass a point on the rope every second.

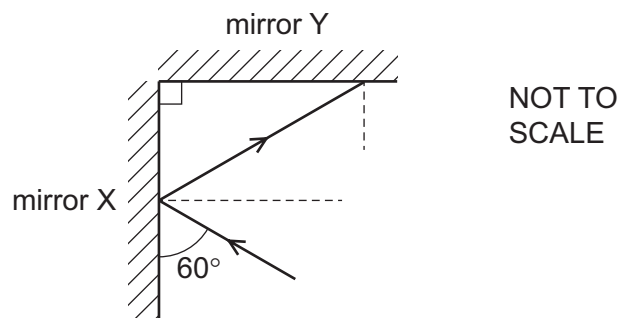
Each wave crest travels 80 cm in one second.



What is the speed of the wave?

- A** 4.0 cm/s      **B** 5.0 cm/s      **C** 20 cm/s      **D** 80 cm/s
- 35 The diagram shows a ray of light striking a plane mirror X.

Plane mirror Y is at  $90^\circ$  to mirror X.



What is the angle of reflection at mirror Y?

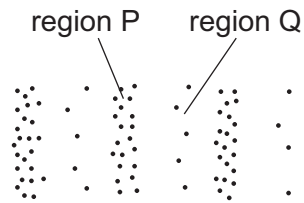
- A**  $30^\circ$       **B**  $60^\circ$       **C**  $90^\circ$       **D**  $120^\circ$
- 36 Electromagnetic waves are used to scan passengers' luggage before they board an aeroplane.

Electromagnetic waves are also used in a television remote controller.

Which type of electromagnetic wave is used for each of these purposes?

|          | scanning luggage | television remote controller |
|----------|------------------|------------------------------|
| <b>A</b> | radio waves      | infra-red waves              |
| <b>B</b> | radio waves      | ultraviolet waves            |
| <b>C</b> | X-rays           | infra-red waves              |
| <b>D</b> | X-rays           | ultraviolet waves            |

- 37 The diagram represents a wave in air. Molecules are closer together in region P than they are in region Q.



What are the names of regions P and Q, and which type of wave is represented?

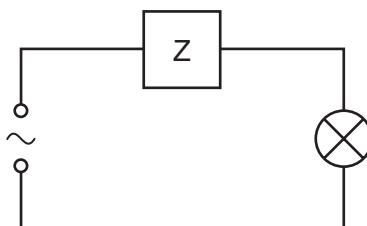
|          | region P    | region Q    | type of wave |
|----------|-------------|-------------|--------------|
| <b>A</b> | compression | rarefaction | longitudinal |
| <b>B</b> | compression | rarefaction | transverse   |
| <b>C</b> | rarefaction | compression | longitudinal |
| <b>D</b> | rarefaction | compression | transverse   |

- 38 The resistance of a wire depends on its length and on its diameter.

Which row shows two changes that **both** increase the resistance of the wire?

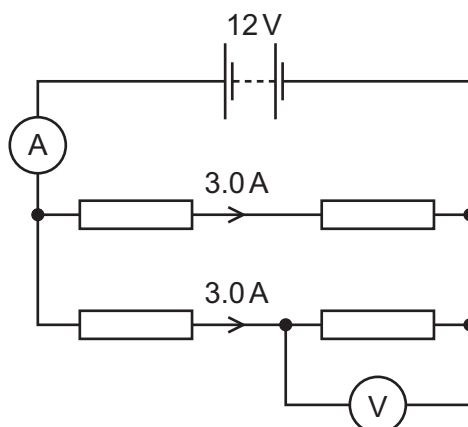
|          | change 1            | change 2              |
|----------|---------------------|-----------------------|
| <b>A</b> | decrease the length | decrease the diameter |
| <b>B</b> | decrease the length | increase the diameter |
| <b>C</b> | increase the length | decrease the diameter |
| <b>D</b> | increase the length | increase the diameter |

- 39 The device Z in this circuit is designed to cut off the electricity supply **automatically** if too much current flows.



What is device Z?

- A** a fuse  
**B** a resistor  
**C** a switch  
**D** an ammeter
- 40 The diagram shows a circuit containing a 12 V battery, four identical resistors, an ammeter and a voltmeter. Two values of current are shown.



What is the reading on the ammeter and what is the reading on the voltmeter?

|          | reading on<br>ammeter / A | reading on<br>voltmeter / V |
|----------|---------------------------|-----------------------------|
| <b>A</b> | 3.0                       | 6.0                         |
| <b>B</b> | 3.0                       | 12                          |
| <b>C</b> | 6.0                       | 6.0                         |
| <b>D</b> | 6.0                       | 12                          |

The Periodic Table of Elements

| Group                      |                             |                                                                                             |                                 |                             |                              |                              |                              |                              |                                |                               |                               |                             |                               |                             |                              |                           |                           |
|----------------------------|-----------------------------|---------------------------------------------------------------------------------------------|---------------------------------|-----------------------------|------------------------------|------------------------------|------------------------------|------------------------------|--------------------------------|-------------------------------|-------------------------------|-----------------------------|-------------------------------|-----------------------------|------------------------------|---------------------------|---------------------------|
| I                          | II                          | 1<br>H<br>hydrogen<br>1                                                                     |                                 |                             |                              |                              |                              |                              |                                |                               |                               | III                         | IV                            | V                           | VI                           | VII                       | VIII                      |
|                            |                             | <div>Key</div> <div>atomic number<br/>atomic symbol<br/>name<br/>relative atomic mass</div> |                                 |                             |                              |                              |                              |                              |                                |                               |                               |                             |                               |                             |                              |                           |                           |
| 3<br>Li<br>lithium<br>7    | 4<br>Be<br>beryllium<br>9   |                                                                                             |                                 |                             |                              |                              |                              |                              |                                |                               |                               |                             |                               |                             |                              |                           |                           |
| 11<br>Na<br>sodium<br>23   | 12<br>Mg<br>magnesium<br>24 | 13<br>Al<br>aluminium<br>27                                                                 | 14<br>Si<br>silicon<br>28       | 15<br>P<br>phosphorus<br>31 | 16<br>S<br>sulfur<br>32      | 17<br>Cl<br>chlorine<br>35.5 | 18<br>Ar<br>argon<br>40      |                              |                                |                               |                               |                             |                               |                             |                              |                           |                           |
| 19<br>K<br>potassium<br>39 | 20<br>Ca<br>calcium<br>40   | 21<br>Sc<br>scandium<br>45                                                                  | 22<br>Ti<br>titanium<br>48      | 23<br>V<br>vanadium<br>51   | 24<br>Cr<br>chromium<br>52   | 25<br>Mn<br>manganese<br>55  | 26<br>Fe<br>iron<br>56       | 27<br>Co<br>cobalt<br>59     | 28<br>Ni<br>nickel<br>59       | 29<br>Cu<br>copper<br>64      | 30<br>Zn<br>zinc<br>65        | 31<br>Ga<br>gallium<br>70   | 32<br>Ge<br>germanium<br>73   | 33<br>As<br>arsenic<br>75   | 34<br>Se<br>selenium<br>79   | 35<br>Br<br>bromine<br>80 | 36<br>Kr<br>krypton<br>84 |
| 37<br>Rb<br>rubidium<br>85 | 38<br>Sr<br>strontium<br>88 | 39<br>Y<br>yttrium<br>89                                                                    | 40<br>Zr<br>zirconium<br>91     | 41<br>Nb<br>niobium<br>93   | 42<br>Mo<br>molybdenum<br>96 | 43<br>Tc<br>technetium<br>—  | 44<br>Ru<br>ruthenium<br>101 | 45<br>Rh<br>rhodium<br>103   | 46<br>Pd<br>palladium<br>106   | 47<br>Ag<br>silver<br>108     | 48<br>Cd<br>cadmium<br>112    | 49<br>In<br>indium<br>115   | 50<br>Sn<br>tin<br>119        | 51<br>Sb<br>antimony<br>122 | 52<br>Te<br>tellurium<br>128 | 53<br>I<br>iodine<br>127  | 54<br>Xe<br>xenon<br>131  |
| 55<br>Cs<br>caesium<br>133 | 56<br>Ba<br>barium<br>137   | 57–71<br>lanthanoids                                                                        | 72<br>Hf<br>hafnium<br>178      | 73<br>Ta<br>tantalum<br>181 | 74<br>W<br>tungsten<br>184   | 75<br>Re<br>rhenium<br>186   | 76<br>Os<br>osmium<br>190    | 77<br>Ir<br>iridium<br>192   | 78<br>Pt<br>platinum<br>195    | 79<br>Au<br>gold<br>197       | 80<br>Hg<br>mercury<br>201    | 81<br>Tl<br>thallium<br>204 | 82<br>Pb<br>lead<br>207       | 83<br>Bi<br>bismuth<br>209  | 84<br>Po<br>polonium<br>—    | 85<br>At<br>astatine<br>— | 86<br>Rn<br>radon<br>—    |
| 87<br>Fr<br>francium<br>—  | 88<br>Ra<br>radium<br>—     | 89–103<br>actinoids                                                                         | 104<br>Rf<br>rutherfordium<br>— | 105<br>Db<br>dubnium<br>—   | 106<br>Sg<br>seaborgium<br>— | 107<br>Bh<br>bohrium<br>—    | 108<br>Hs<br>hassium<br>—    | 109<br>Mt<br>meitnerium<br>— | 110<br>Ds<br>darmstadtium<br>— | 111<br>Rg<br>roentgenium<br>— | 112<br>Cn<br>copernicium<br>— | 114<br>Fl<br>flerovium<br>— | 116<br>Lv<br>livermorium<br>— | —                           | —                            | —                         | —                         |

lanthanoids

|                                     |                                   |                                        |                                     |                                    |                                    |                                    |                                      |                                   |                                      |                                     |                                  |                                      |                                     |                                     |
|-------------------------------------|-----------------------------------|----------------------------------------|-------------------------------------|------------------------------------|------------------------------------|------------------------------------|--------------------------------------|-----------------------------------|--------------------------------------|-------------------------------------|----------------------------------|--------------------------------------|-------------------------------------|-------------------------------------|
| 57<br><b>La</b><br>lanthanum<br>139 | 58<br><b>Ce</b><br>cerium<br>140  | 59<br><b>Pr</b><br>praseodymium<br>141 | 60<br><b>Nd</b><br>neodymium<br>144 | 61<br><b>Pm</b><br>promethium<br>— | 62<br><b>Sm</b><br>samarium<br>150 | 63<br><b>Eu</b><br>europium<br>152 | 64<br><b>Gd</b><br>gadolinium<br>157 | 65<br><b>Tb</b><br>terbium<br>159 | 66<br><b>Dy</b><br>dysprosium<br>163 | 67<br><b>Ho</b><br>holmium<br>165   | 68<br><b>Er</b><br>erbium<br>167 | 69<br><b>Tm</b><br>thulium<br>169    | 70<br><b>Yb</b><br>ytterbium<br>173 | 71<br><b>Lu</b><br>lutetium<br>175  |
| 89<br><b>Ac</b><br>actinium<br>—    | 90<br><b>Th</b><br>thorium<br>232 | 91<br><b>Pa</b><br>protactinium<br>231 | 92<br><b>U</b><br>uranium<br>238    | 93<br><b>Np</b><br>neptunium<br>—  | 94<br><b>Pu</b><br>plutonium<br>—  | 95<br><b>Am</b><br>americium<br>—  | 96<br><b>Cm</b><br>curium<br>—       | 97<br><b>Bk</b><br>berkelium<br>— | 98<br><b>Cf</b><br>californium<br>—  | 99<br><b>Es</b><br>einsteinium<br>— | 100<br><b>Fm</b><br>fermium<br>— | 101<br><b>Md</b><br>mendelevium<br>— | 102<br><b>No</b><br>nobelium<br>—   | 103<br><b>Lr</b><br>lawrencium<br>— |

actinoids

The volume of one mole of any gas is 24 dm<sup>3</sup> at room temperature and pressure (r.t.p.).



**Cambridge International Examinations**  
Cambridge International General Certificate of Secondary Education

**COMBINED SCIENCE**

Paper 2 Multiple Choice (Extended)

**0653/22**

**October/November 2017**

**45 minutes**

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, 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.

A copy of the Periodic Table is printed on page 20.

Electronic calculators may be used.

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

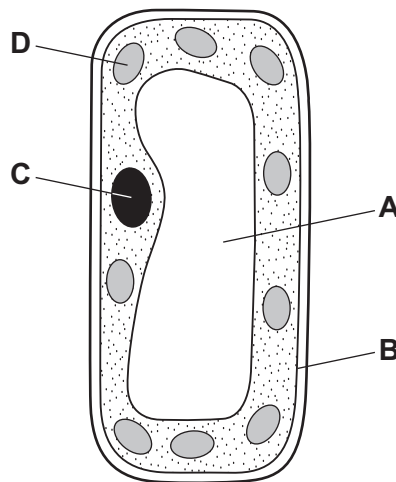


1 Which characteristics help to define a living organism?

- A diffusion, movement, respiration
- B excretion, nutrition, sensitivity
- C excretion, reproduction, transpiration
- D growth, inspiration, nutrition

2 The diagram shows a palisade cell.

Which structure converts energy from light into chemical energy?



3 What is the role of microorganisms in the manufacture of yoghurt?

- A to turn lactic acid into lactose sugar and lower the pH
- B to turn lactic acid into lactose sugar and raise the pH
- C to turn lactose sugar into lactic acid and lower the pH
- D to turn lactose sugar into lactic acid and raise the pH

4 In which order does food pass through parts of the alimentary canal?

- A oesophagus → colon → small intestine
- B small intestine → oesophagus → rectum
- C small intestine → rectum → anus
- D stomach → colon → small intestine

5 These four conditions may be a result of malnutrition.

- 1 constipation
- 2 coronary heart disease
- 3 obesity
- 4 starvation

Which conditions are a direct result of an imbalance between energy intake and energy output?

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

6 What are the functions of root hairs?

|          | uptake of ions | uptake of sugar | uptake of water |
|----------|----------------|-----------------|-----------------|
| <b>A</b> | ✓              | x               | x               |
| <b>B</b> | ✓              | x               | ✓               |
| <b>C</b> | x              | ✓               | x               |
| <b>D</b> | x              | ✓               | ✓               |

7 When we cut ourselves, blood comes out of the wound.

Which constituent of blood is most important in the formation of a blood clot?

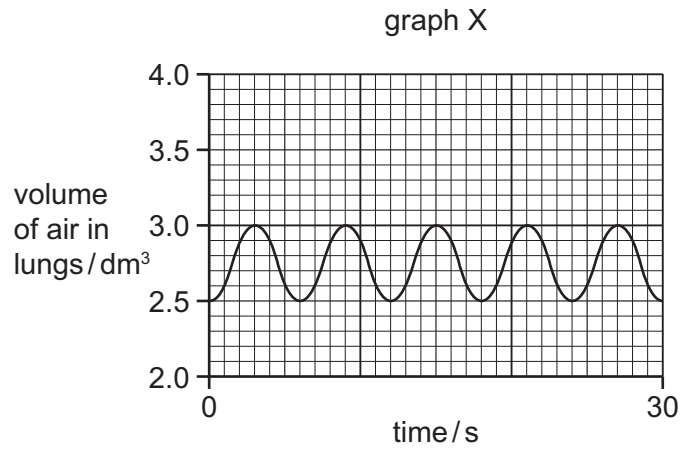
- A** plasma
- B** platelets
- C** red blood cells
- D** white blood cells

8 What is the equation for aerobic respiration?

- A**  $6\text{CO}_2 + 6\text{O}_2 \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{H}_2\text{O}$
- B**  $6\text{H}_2\text{O} + 6\text{CO}_2 \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$
- C**  $\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{H}_2\text{O} \rightarrow 6\text{CO}_2 + 6\text{O}_2$
- D**  $\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O}$

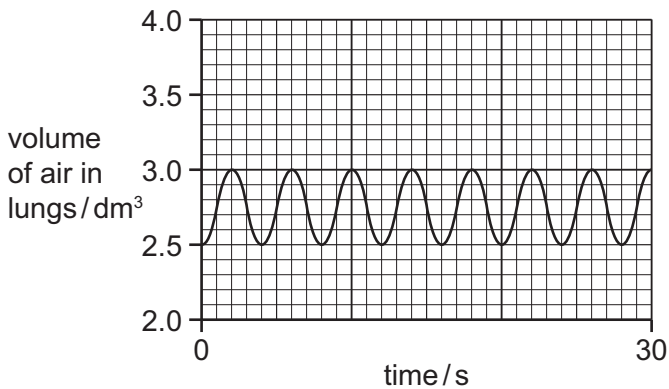
- 9 The depth and rate of breathing can be measured by a spirometer, and recorded in the form of a graph.

Graph X shows the depth and rate of breathing of a person at rest.

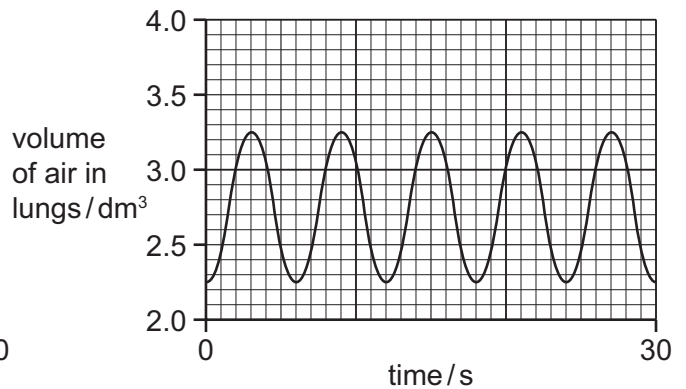


Which graph shows the depth and rate of breathing when the same person is running?

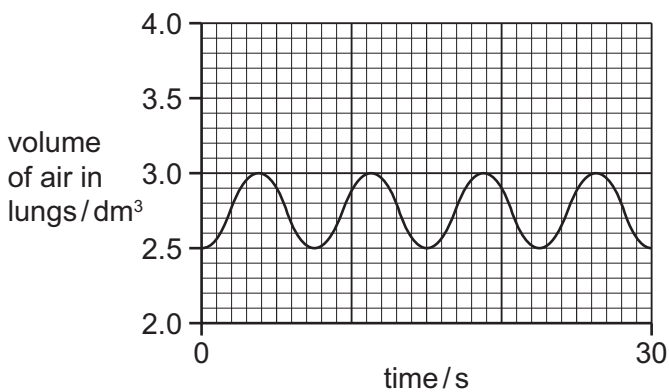
**A**



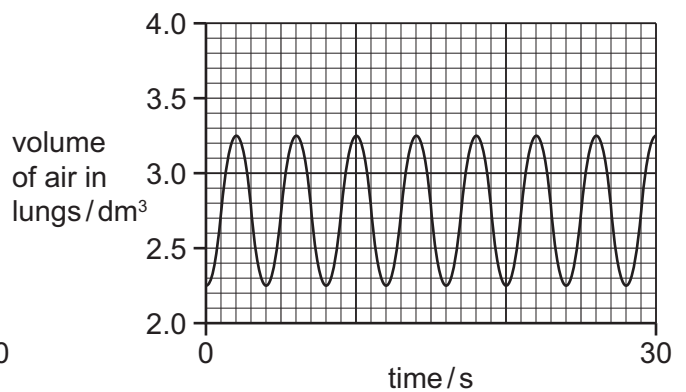
**B**



**C**

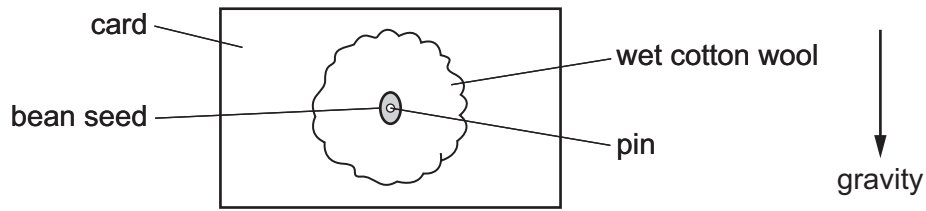


**D**



- 10** A student carried out an experiment to test geotropism.

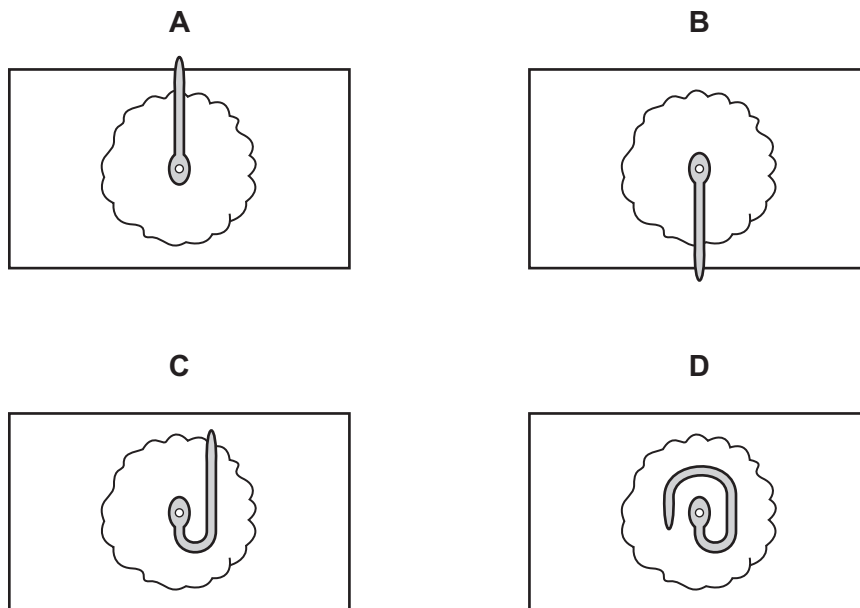
A bean seed was pinned to a card with wet cotton wool, as shown.



Every day the card was turned 90° clockwise.

After a few days the student drew the results of the root growth.

Which diagram shows the student's result?

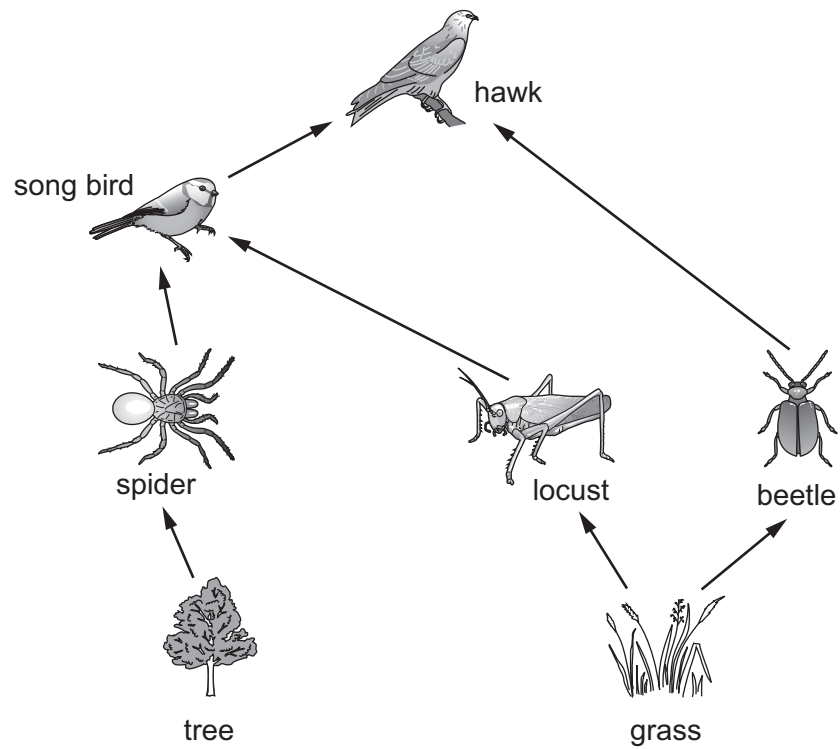


- 11** During pregnancy, the fetus is contained within the amniotic sac. The amniotic sac contains amniotic fluid.

What is the function of the amniotic fluid?

- A** It protects the fetus against knocks and bumps.
- B** It provides the fetus with oxygen and nutrients.
- C** It removes the fetal waste products.
- D** It supplies the fetus with blood.

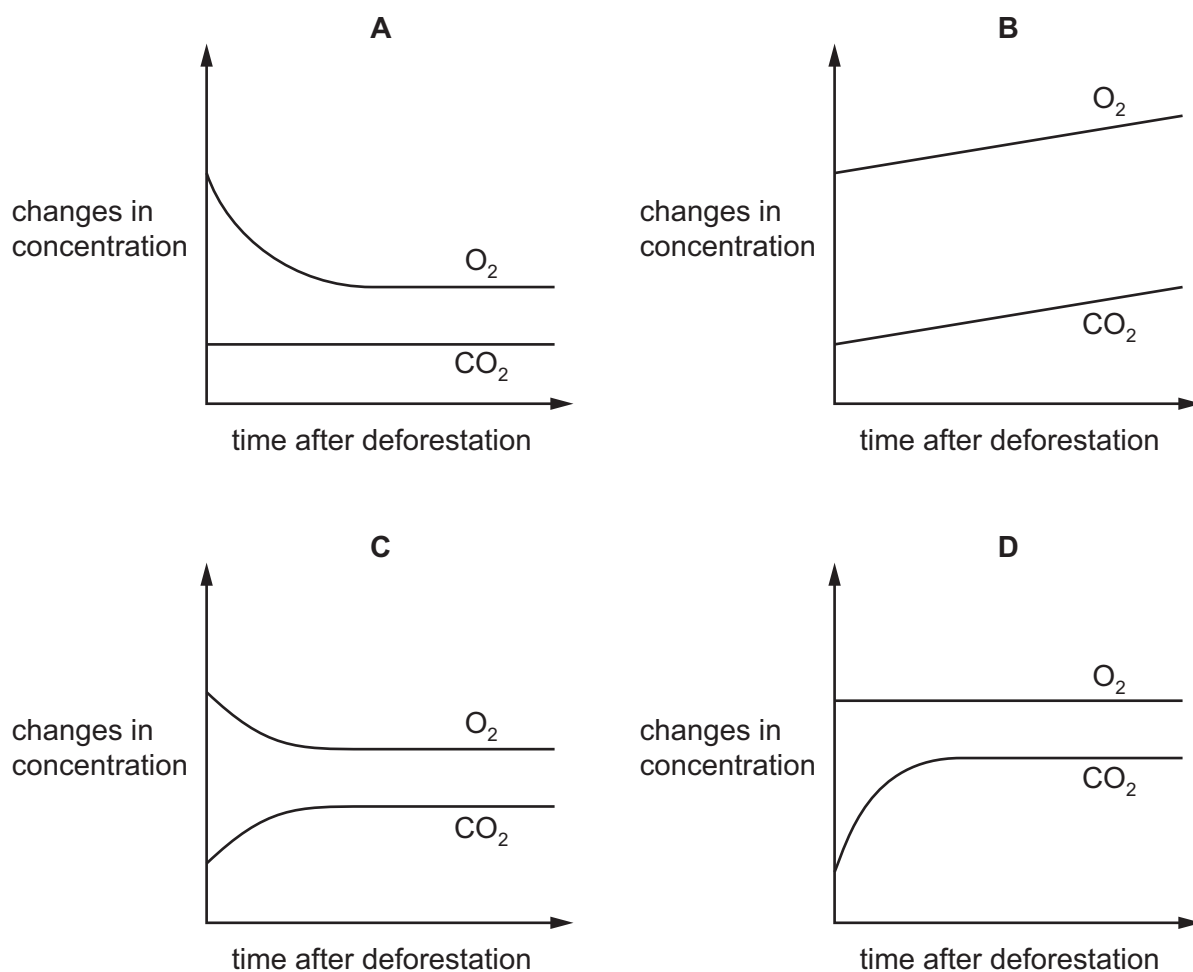
12 The diagram shows a food web.



Which statement about this food web is correct?

- A** Some of the energy from the grass eventually passes to the hawk.
- B** The producers get their energy from the soil.
- C** There are more carnivores shown than herbivores.
- D** There are six consumers shown.

- 13 Which graph shows the effect of large-scale deforestation on the changes in the concentrations of oxygen and carbon dioxide in the air?



- 14 The formulae of three substances are shown.

| substance | formula |
|-----------|---------|
| methane   | $CH_4$  |
| water     | $H_2O$  |
| oxygen    | $O_2$   |

Which statement is correct?

- A** Methane is made from five different types of atom.
- B** Methane, water and oxygen are molecules.
- C** Only methane and water are molecules.
- D** Oxygen is made from two different types of atom.

15 What is the correct sequence that takes place during fractional distillation?

- A evaporate → condense → collect → heat
- B evaporate → condense → heat → collect
- C heat → condense → collect → evaporate
- D heat → evaporate → condense → collect

16 Which substances react to produce a mixture of an element and a compound?

- A copper oxide and carbon
- B hydrochloric acid and sodium carbonate
- C hydrogen and oxygen
- D nitric acid and sodium hydroxide

17 The electronic structure of a sodium atom is 2,8,1.

The electronic structure of a sodium ion is 2,8.

Which statement is **not** correct?

- A Sodium ions form metallic bonds.
- B The electronic structure of a sodium ion is more stable than that of a sodium atom.
- C The sodium atom loses one electron to become an ion.
- D The sodium ion has a noble gas electronic structure.

18 The symbols for some ions are shown.

| name of ion | symbol           |
|-------------|------------------|
| silver      | $\text{Ag}^+$    |
| nitrate     | $\text{NO}_3^-$  |
| magnesium   | $\text{Mg}^{2+}$ |
| chloride    | $\text{Cl}^-$    |

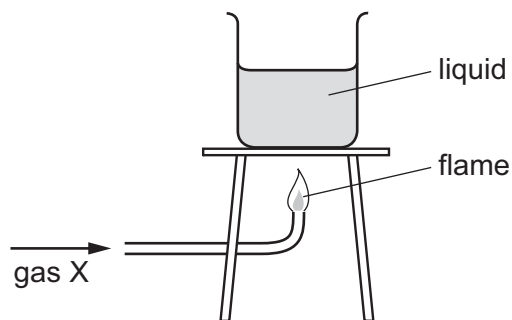
Which symbol equation is correct?

- A  $\text{AgNO}_3 + \text{MgCl} \rightarrow \text{AgCl} + \text{MgNO}_3$
- B  $\text{Ag}_2\text{NO}_3 + \text{MgCl} \rightarrow \text{Ag}_2\text{Cl} + \text{MgNO}_3$
- C  $2\text{AgNO}_3 + \text{MgCl}_2 \rightarrow 2\text{AgCl} + \text{Mg}(\text{NO}_3)_2$
- D  $2\text{AgNO}_3 + \text{Mg}_2\text{Cl} \rightarrow 2\text{AgCl} + 2\text{MgNO}_3$

19 What is formed at the cathode during the electrolysis of aqueous copper chloride?

- A chlorine
- B copper
- C hydrogen
- D oxygen

20 The diagram shows gas X burning and heating a liquid.



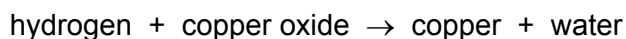
Which row is correct?

|   | gas X    | the burning of gas X is exothermic |
|---|----------|------------------------------------|
| A | hydrogen | ✓                                  |
| B | hydrogen | x                                  |
| C | oxygen   | ✓                                  |
| D | oxygen   | x                                  |

21 What is the effect of increasing the temperature on the collisions between reacting particles during a chemical reaction?

|   | number of collisions per second | energy of collisions |
|---|---------------------------------|----------------------|
| A | decreases                       | decreases            |
| B | decreases                       | increases            |
| C | increases                       | decreases            |
| D | increases                       | increases            |

- 22 The word equation for the reaction between hydrogen and copper oxide is shown.



Which substance, shown in the word equation, is reduced in the reaction?

- A copper
  - B copper oxide
  - C hydrogen
  - D water
- 23 Excess aqueous barium nitrate is added to dilute sulfuric acid to produce barium sulfate.
- How is barium sulfate obtained from the reaction mixture?
- A electrolysis
  - B evaporation
  - C filtration
  - D fractional distillation
- 24 Weather balloons are used to carry scientific instruments into the atmosphere.
- Which gas is used to fill the balloons?
- A argon
  - B helium
  - C krypton
  - D xenon
- 25 Which reaction does **not** take place in the blast furnace?
- A Calcium carbonate decomposes to make calcium oxide.
  - B Carbon dioxide reacts with carbon to make carbon monoxide.
  - C Carbon monoxide reacts with iron oxide to make iron.
  - D Limestone reacts with iron oxide to make slag.

26 P, Q, R and S are four gases found in clean air.

P is very unreactive.

Q makes up 21% of the air.

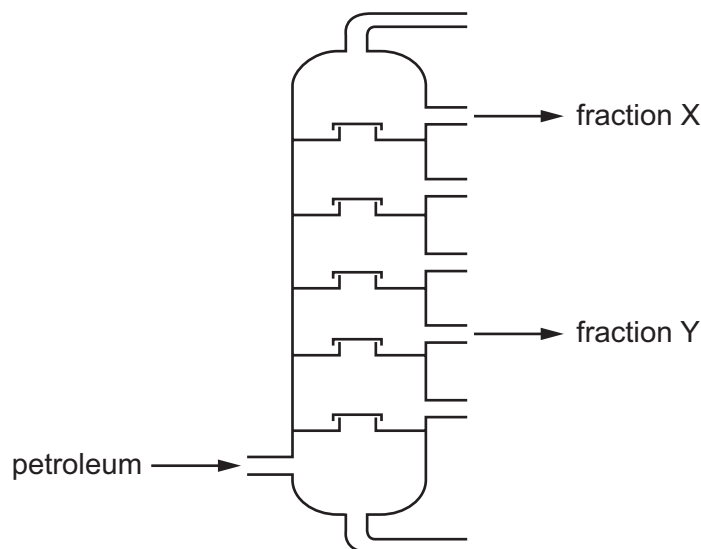
R makes up 78% of the air.

S is formed when fossil fuels are burned.

Which row is correct?

|          | P              | Q        | R        | S              |
|----------|----------------|----------|----------|----------------|
| <b>A</b> | argon          | nitrogen | oxygen   | carbon dioxide |
| <b>B</b> | argon          | oxygen   | nitrogen | carbon dioxide |
| <b>C</b> | carbon dioxide | oxygen   | nitrogen | argon          |
| <b>D</b> | carbon dioxide | nitrogen | oxygen   | argon          |

27 In the fractional distillation of petroleum, fractions X and Y are removed at the positions shown.

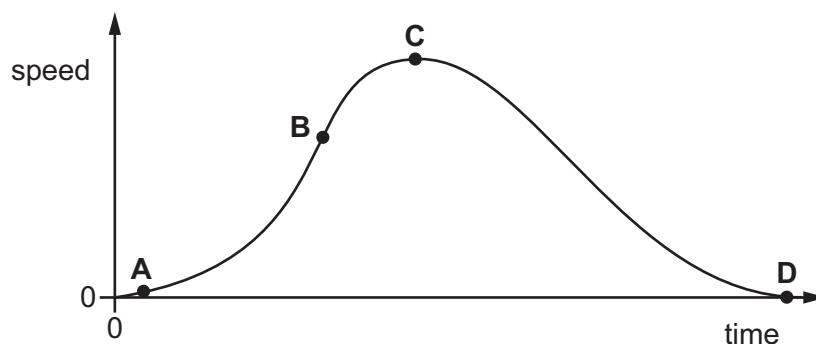


Which row describes the molecular sizes and the intermolecular attractive forces in fractions X and Y?

|          | molecular sizes | intermolecular attractive forces |
|----------|-----------------|----------------------------------|
| <b>A</b> | X larger than Y | X greater than Y                 |
| <b>B</b> | X larger than Y | Y greater than X                 |
| <b>C</b> | Y larger than X | X greater than Y                 |
| <b>D</b> | Y larger than X | Y greater than X                 |

- 28 The speed-time graph shown is for a bus travelling between stops.

Where on the graph is the acceleration of the bus greatest?



- 29 The table gives the volumes and masses of four objects.

Which object has the greatest density?

|          | mass / g | volume / cm <sup>3</sup> |
|----------|----------|--------------------------|
| <b>A</b> | 5.4      | 2.0                      |
| <b>B</b> | 13       | 3.0                      |
| <b>C</b> | 15       | 6.0                      |
| <b>D</b> | 18       | 5.0                      |

- 30 A student stretches a steel spring by hanging a load on it. The measurements for the extension of the spring are shown in the table.

| load / N       | 1.0 | 2.0 | 3.0 | 4.0 | 5.0 | 6.0 |
|----------------|-----|-----|-----|-----|-----|-----|
| extension / cm | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 |

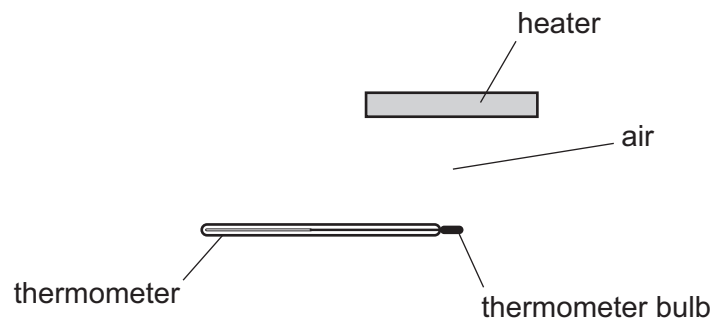
What is the value for the spring constant  $k$  of the spring?

- A** 0.50 N/cm      **B** 1.0 N/cm      **C** 2.0 N/cm      **D** 18 N/cm
- 31 A 600 W motor is 75% efficient. The motor is used to do 3600 J of useful work.
- How long does it take the motor to do this work?
- A** 4.5 s      **B** 6.0 s      **C** 8.0 s      **D** 24 s

32 Which description is correct for the molecules of a gas with a temperature that is rising?

|          | force between molecules | average speed of molecules |
|----------|-------------------------|----------------------------|
| <b>A</b> | negligible              | decreasing                 |
| <b>B</b> | negligible              | increasing                 |
| <b>C</b> | strong                  | decreasing                 |
| <b>D</b> | strong                  | increasing                 |

33 The diagram shows a heater above a thermometer. The thermometer bulb is in the position shown.



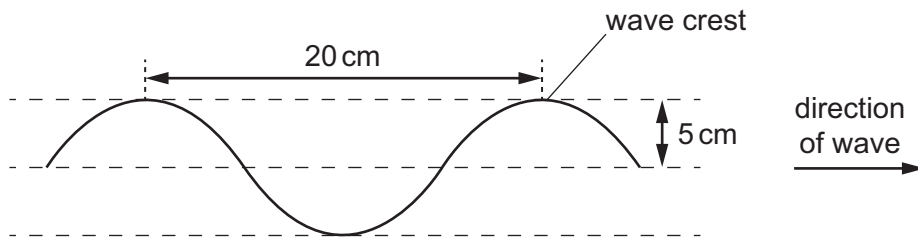
Which row shows how the heat energy from the heater reaches the thermometer bulb?

|          | conduction | convection | radiation |
|----------|------------|------------|-----------|
| <b>A</b> | no         | no         | yes       |
| <b>B</b> | no         | yes        | no        |
| <b>C</b> | no         | yes        | yes       |
| <b>D</b> | yes        | yes        | no        |

34 The diagram shows a section of a rope.

Four wave crests pass a point on the rope every second.

Each wave crest travels 80 cm in one second.

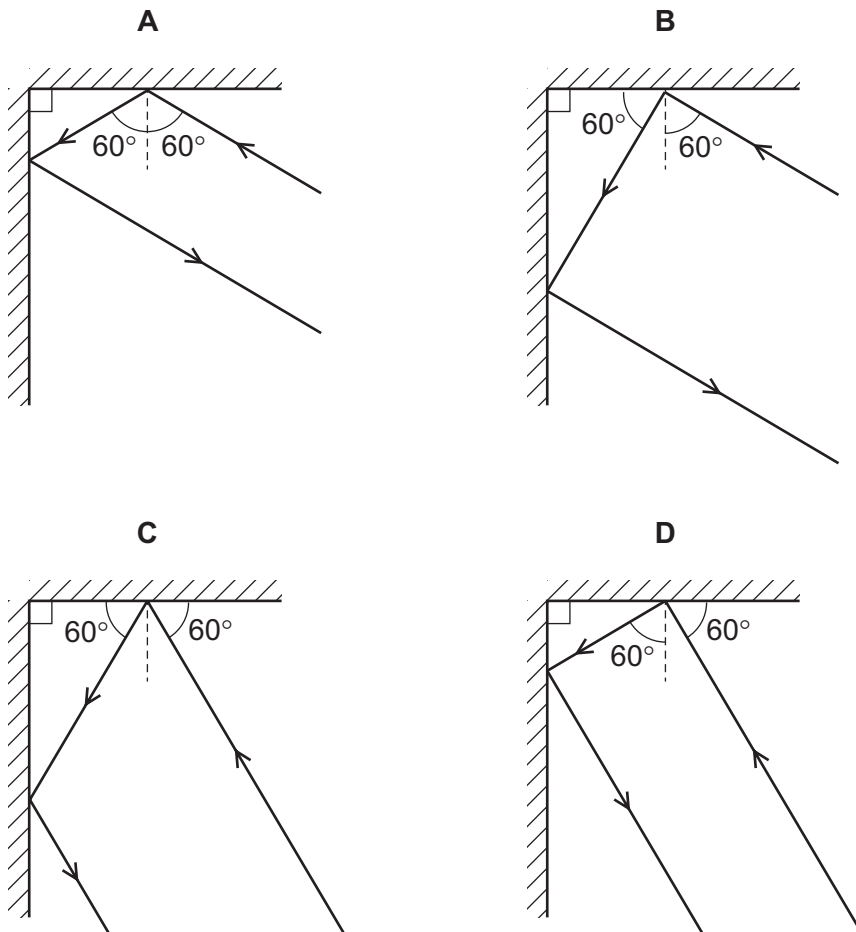


What is the speed of the wave?

- A** 4.0 cm/s      **B** 5.0 cm/s      **C** 20 cm/s      **D** 80 cm/s

35 Two plane mirrors are placed at  $90^\circ$  to each other. A ray of light strikes one mirror at an angle of incidence of  $60^\circ$ .

Which diagram shows this ray and its path after reflection?



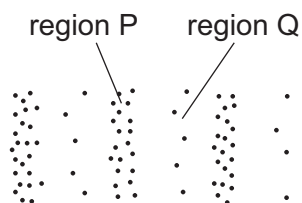
- 36** Electromagnetic waves are used to scan passengers' luggage before they board an aeroplane.

Electromagnetic waves are also used in a television remote controller.

Which type of electromagnetic wave is used for each of these purposes?

|          | scanning luggage | television remote controller |
|----------|------------------|------------------------------|
| <b>A</b> | radio waves      | infra-red waves              |
| <b>B</b> | radio waves      | ultraviolet waves            |
| <b>C</b> | X-rays           | infra-red waves              |
| <b>D</b> | X-rays           | ultraviolet waves            |

- 37** The diagram represents a wave in air. Molecules are closer together in region P than they are in region Q.



What are the names of regions P and Q, and which type of wave is represented?

|          | region P    | region Q    | type of wave |
|----------|-------------|-------------|--------------|
| <b>A</b> | compression | rarefaction | longitudinal |
| <b>B</b> | compression | rarefaction | transverse   |
| <b>C</b> | rarefaction | compression | longitudinal |
| <b>D</b> | rarefaction | compression | transverse   |

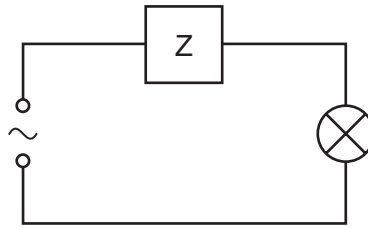
- 38** A piece of wire has electrical resistance.

The wire is stretched so that it becomes longer and thinner.

What, if anything, happens to its resistance?

- A** It could increase or decrease depending on how much it is stretched.
- B** It does not change because its smaller diameter cancels the effect of its greater length.
- C** It must decrease.
- D** It must increase.

- 39 The device Z in this circuit is designed to cut off the electricity supply **automatically** if too much current flows.

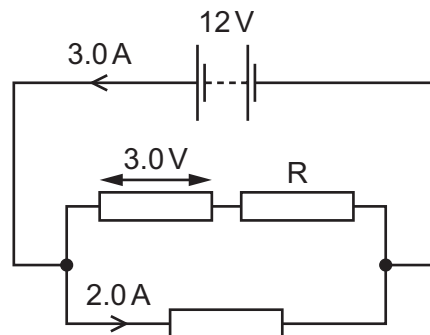


What is device Z?

- A a fuse
  - B a resistor
  - C a switch
  - D an ammeter
- 40 The diagram shows three resistors connected to a 12 V battery.

The current at two points in the circuit and the p.d. across one resistor are shown.

Another resistor is labelled R.



What is the current in resistor R and what is the p.d. across resistor R?

|          | current in<br>resistor R / A | p.d. across<br>resistor R / V |
|----------|------------------------------|-------------------------------|
| <b>A</b> | 1.0                          | 3.0                           |
| <b>B</b> | 1.0                          | 9.0                           |
| <b>C</b> | 2.0                          | 3.0                           |
| <b>D</b> | 2.0                          | 9.0                           |

**BLANK PAGE**

**BLANK PAGE**

**BLANK PAGE**

---

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at [www.cie.org.uk](http://www.cie.org.uk) after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

## The Periodic Table of Elements

| Group                                |                                       |                                                                                            |                                           |                                       |                                        |                                       |                                        |                                        |                                          |                                         |                                         |                                       |                                       |                                       |                                         |                                     |                                     |                                  |
|--------------------------------------|---------------------------------------|--------------------------------------------------------------------------------------------|-------------------------------------------|---------------------------------------|----------------------------------------|---------------------------------------|----------------------------------------|----------------------------------------|------------------------------------------|-----------------------------------------|-----------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|-----------------------------------------|-------------------------------------|-------------------------------------|----------------------------------|
| I                                    | II                                    | <div>1<div>Hhydrogen1</div></div>                                                          |                                           |                                       |                                        |                                       |                                        |                                        |                                          |                                         |                                         | III                                   | IV                                    | V                                     | VI                                      | VII                                 | VIII                                |                                  |
| 3 <div>Li<br/>lithium<br/>7</div>    | 4 <div>Be<br/>beryllium<br/>9</div>   | <div>Key<div>atomic number<br/>atomic symbol<br/>name<br/>relative atomic mass</div></div> |                                           |                                       |                                        |                                       |                                        |                                        |                                          |                                         |                                         |                                       |                                       |                                       |                                         |                                     |                                     | 2 <div>He<br/>helium<br/>4</div> |
|                                      | 11 <div>Na<br/>sodium<br/>23</div>    |                                                                                            |                                           |                                       |                                        |                                       |                                        |                                        |                                          |                                         |                                         |                                       |                                       |                                       |                                         |                                     |                                     |                                  |
| 19 <div>K<br/>potassium<br/>39</div> | 20 <div>Ca<br/>calcium<br/>40</div>   | 21 <div>Sc<br/>scandium<br/>45</div>                                                       | 22 <div>Ti<br/>titanium<br/>48</div>      | 23 <div>V<br/>vanadium<br/>51</div>   | 24 <div>Cr<br/>chromium<br/>52</div>   | 25 <div>Mn<br/>manganese<br/>55</div> | 26 <div>Fe<br/>iron<br/>56</div>       | 27 <div>Co<br/>cobalt<br/>59</div>     | 28 <div>Ni<br/>nickel<br/>59</div>       | 29 <div>Cu<br/>copper<br/>64</div>      | 30 <div>Zn<br/>zinc<br/>65</div>        | 31 <div>Ga<br/>gallium<br/>70</div>   | 32 <div>Ge<br/>germanium<br/>73</div> | 33 <div>As<br/>arsenic<br/>75</div>   | 34 <div>Se<br/>selenium<br/>79</div>    | 35 <div>Br<br/>bromine<br/>80</div> | 36 <div>Kr<br/>krypton<br/>84</div> |                                  |
| 37 <div>Rb<br/>rubidium<br/>85</div> | 38 <div>Sr<br/>strontium<br/>88</div> | 39 <div>Y<br/>yttrium<br/>89</div>                                                         | 40 <div>Zr<br/>zirconium<br/>91</div>     | 41 <div>Nb<br/>niobium<br/>93</div>   | 42 <div>Mo<br/>molybdenum<br/>96</div> | 43 <div>Tc<br/>technetium<br/>—</div> | 44 <div>Ru<br/>ruthenium<br/>101</div> | 45 <div>Rh<br/>rhodium<br/>103</div>   | 46 <div>Pd<br/>palladium<br/>106</div>   | 47 <div>Ag<br/>silver<br/>108</div>     | 48 <div>Cd<br/>cadmium<br/>112</div>    | 49 <div>In<br/>indium<br/>115</div>   | 50 <div>Sn<br/>tin<br/>119</div>      | 51 <div>Sb<br/>antimony<br/>122</div> | 52 <div>Te<br/>tellurium<br/>128</div>  | 53 <div>I<br/>iodine<br/>127</div>  | 54 <div>Xe<br/>xenon<br/>131</div>  |                                  |
| 55 <div>Cs<br/>caesium<br/>133</div> | 56 <div>Ba<br/>barium<br/>137</div>   | 57–71 <div>lanthanoids</div>                                                               | 72 <div>Hf<br/>hafnium<br/>178</div>      | 73 <div>Ta<br/>tantalum<br/>181</div> | 74 <div>W<br/>tungsten<br/>184</div>   | 75 <div>Re<br/>rhenium<br/>186</div>  | 76 <div>Os<br/>osmium<br/>190</div>    | 77 <div>Ir<br/>iridium<br/>192</div>   | 78 <div>Pt<br/>platinum<br/>195</div>    | 79 <div>Au<br/>gold<br/>197</div>       | 80 <div>Hg<br/>mercury<br/>201</div>    | 81 <div>Tl<br/>thallium<br/>204</div> | 82 <div>Pb<br/>lead<br/>207</div>     | 83 <div>Bi<br/>bismuth<br/>209</div>  | 84 <div>Po<br/>polonium<br/>—</div>     | 85 <div>At<br/>astatine<br/>—</div> | 86 <div>Rn<br/>radon<br/>—</div>    |                                  |
| 87 <div>Fr<br/>francium<br/>—</div>  | 88 <div>Ra<br/>radium<br/>—</div>     | 89–103 <div>actinoids</div>                                                                | 104 <div>Rf<br/>rutherfordium<br/>—</div> | 105 <div>Db<br/>dubnium<br/>—</div>   | 106 <div>Sg<br/>seaborgium<br/>—</div> | 107 <div>Bh<br/>bohrium<br/>—</div>   | 108 <div>Hs<br/>hassium<br/>—</div>    | 109 <div>Mt<br/>meitnerium<br/>—</div> | 110 <div>Ds<br/>darmstadtium<br/>—</div> | 111 <div>Rg<br/>roentgenium<br/>—</div> | 112 <div>Cn<br/>copernicium<br/>—</div> |                                       | 114 <div>Fl<br/>flerovium<br/>—</div> |                                       | 116 <div>Lv<br/>livermorium<br/>—</div> |                                     |                                     |                                  |

lanthanoids

actinoids

|                                     |                                   |                                        |                                     |                                    |                                    |                                    |                                      |                                   |                                      |                                     |                                  |                                      |                                     |                                     |
|-------------------------------------|-----------------------------------|----------------------------------------|-------------------------------------|------------------------------------|------------------------------------|------------------------------------|--------------------------------------|-----------------------------------|--------------------------------------|-------------------------------------|----------------------------------|--------------------------------------|-------------------------------------|-------------------------------------|
| 57<br><b>La</b><br>lanthanum<br>139 | 58<br><b>Ce</b><br>cerium<br>140  | 59<br><b>Pr</b><br>praseodymium<br>141 | 60<br><b>Nd</b><br>neodymium<br>144 | 61<br><b>Pm</b><br>promethium<br>— | 62<br><b>Sm</b><br>samarium<br>150 | 63<br><b>Eu</b><br>europium<br>152 | 64<br><b>Gd</b><br>gadolinium<br>157 | 65<br><b>Tb</b><br>terbium<br>159 | 66<br><b>Dy</b><br>dysprosium<br>163 | 67<br><b>Ho</b><br>holmium<br>165   | 68<br><b>Er</b><br>erbium<br>167 | 69<br><b>Tm</b><br>thulium<br>169    | 70<br><b>Yb</b><br>ytterbium<br>173 | 71<br><b>Lu</b><br>lutetium<br>175  |
| 89<br><b>Ac</b><br>actinium<br>—    | 90<br><b>Th</b><br>thorium<br>232 | 91<br><b>Pa</b><br>protactinium<br>231 | 92<br><b>U</b><br>uranium<br>238    | 93<br><b>Np</b><br>neptunium<br>—  | 94<br><b>Pu</b><br>plutonium<br>—  | 95<br><b>Am</b><br>americium<br>—  | 96<br><b>Cm</b><br>curium<br>—       | 97<br><b>Bk</b><br>berkelium<br>— | 98<br><b>Cf</b><br>californium<br>—  | 99<br><b>Es</b><br>einsteinium<br>— | 100<br><b>Fm</b><br>fermium<br>— | 101<br><b>Md</b><br>mendelevium<br>— | 102<br><b>No</b><br>nobelium<br>—   | 103<br><b>Lr</b><br>lawrencium<br>— |

The volume of one mole of any gas is 24 dm<sup>3</sup> at room temperature and pressure (r.t.p.).



**Cambridge International Examinations**  
Cambridge International General Certificate of Secondary Education

**COMBINED SCIENCE**

**0653/23**

Paper 2 Multiple Choice (Extended)

**October/November 2017**

**45 minutes**

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, 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.

A copy of the Periodic Table is printed on page 20.

Electronic calculators may be used.

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

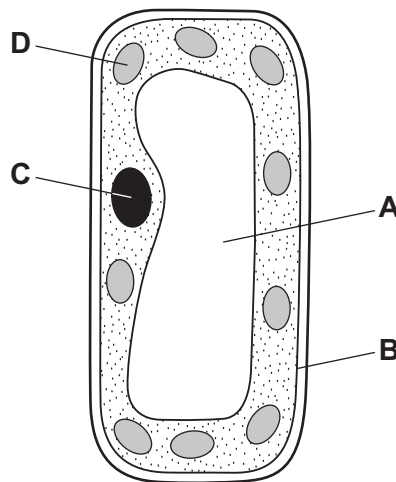


1 Which characteristics help to define a living organism?

- A diffusion, movement, respiration
- B excretion, nutrition, sensitivity
- C excretion, reproduction, transpiration
- D growth, inspiration, nutrition

2 The diagram shows a palisade cell.

Which structure converts energy from light into chemical energy?



3 Which substance is produced by respiration in microorganisms during yoghurt making?

- A amino acids
- B fatty acids
- C hydrochloric acid
- D lactic acid

4 The list shows chemicals that are important to a plant.

- 1 carbon dioxide
- 2 nitrates
- 3 oxygen
- 4 water

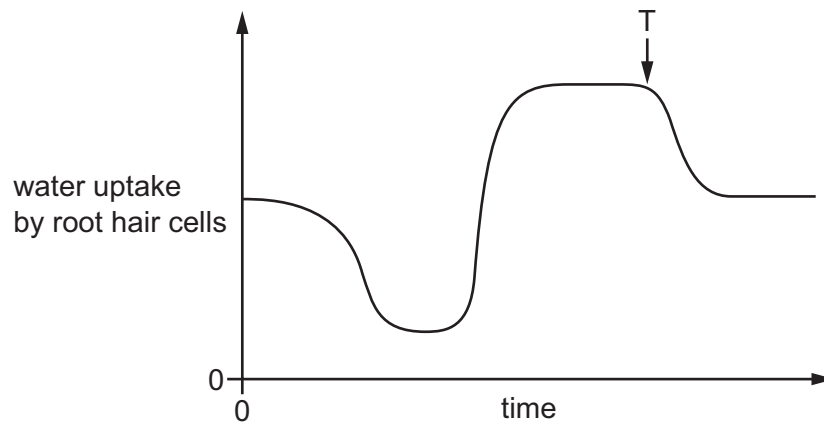
Which chemicals does a plant use in photosynthesis?

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

5 In which order does food pass through parts of the alimentary canal?

- A oesophagus → colon → small intestine
- B small intestine → oesophagus → rectum
- C small intestine → rectum → anus
- D stomach → colon → small intestine

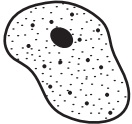
6 The graph shows the uptake of water by root hair cells over many hours during a day.



What could have caused the change in the rate of uptake at T?

- A decrease in temperature
- B decrease in humidity
- C increase in light intensity
- D increase in temperature

7 Which row correctly matches the cell to its function?

|          | cell                                                                              | function         |
|----------|-----------------------------------------------------------------------------------|------------------|
| <b>A</b> |  | blood clotting   |
| <b>B</b> |  | blood clotting   |
| <b>C</b> |  | oxygen transport |
| <b>D</b> |  | oxygen transport |

8 Dust particles and pathogens may be inhaled from the air. These can cause damage to the airways if they are not removed.

Which features work together to remove them from the airways?

- A** cilia and enzymes
- B** mucus and cilia
- C** mucus and saliva
- D** saliva and enzymes

9 How does auxin cause a plant shoot to bend to the right?

- A** Cells elongate more on the left side of the shoot than on the right side.
- B** Cells elongate more on the right side of the shoot than on the left side.
- C** Cells shrink on the left side of the shoot.
- D** Cells shrink on the right side of the shoot.

10 The table shows features of four flowers.

Which row shows features of a typical wind-pollinated flower?

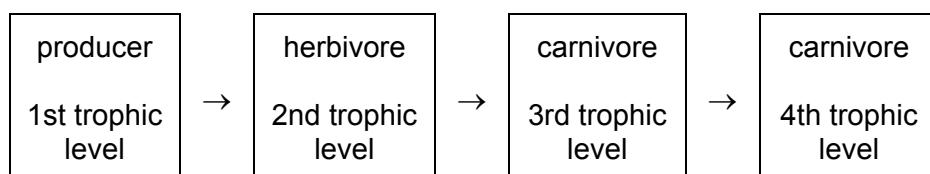
|          | petals                             | pollen grains    | shape of stigma                         |
|----------|------------------------------------|------------------|-----------------------------------------|
| <b>A</b> | large white petals and sweet scent | large and hooked | branched and feathery                   |
| <b>B</b> | large white petals and sweet scent | small and light  | straight and enclosed within the flower |
| <b>C</b> | small green petals and no scent    | large and hooked | straight and enclosed within the flower |
| <b>D</b> | small green petals and no scent    | small and light  | branched and feathery                   |

11 During pregnancy, the fetus is contained within the amniotic sac. The amniotic sac contains amniotic fluid.

What is the function of the amniotic fluid?

- A** It protects the fetus against knocks and bumps.
- B** It provides the fetus with oxygen and nutrients.
- C** It removes the fetal waste products.
- D** It supplies the fetus with blood.

12 The diagram shows the trophic levels of a food chain.

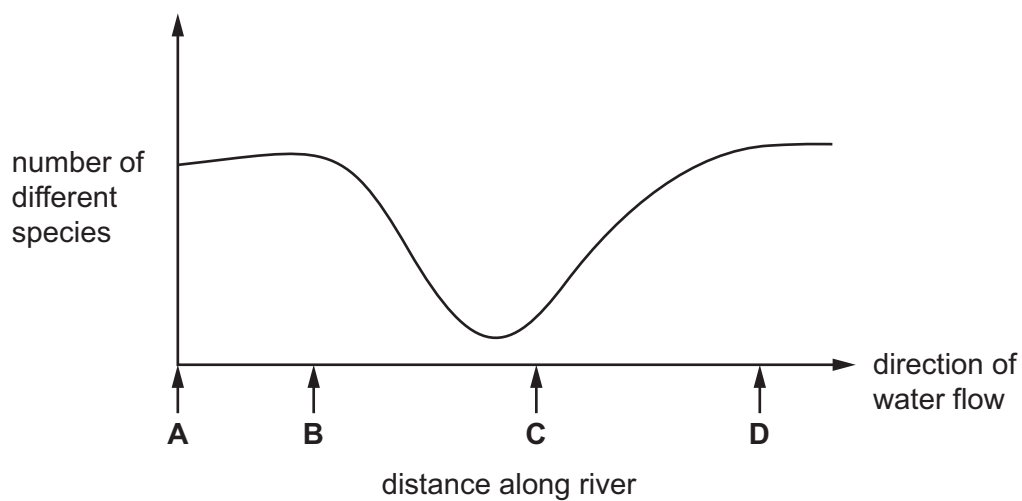


Why do most food chains **not** have more than four trophic levels?

- A** There are too many carnivores in the 3rd trophic level.
- B** There are too many herbivores in the 2nd trophic level.
- C** There is no energy transferred from the 2nd trophic level to the 3rd trophic level.
- D** There is not enough energy available to be transferred to a 5th trophic level.

- 13 The graph shows changes in the number of different species in the water flowing along a river.

At which point is untreated sewage released into the river?



- 14 The formulae of three substances are shown.

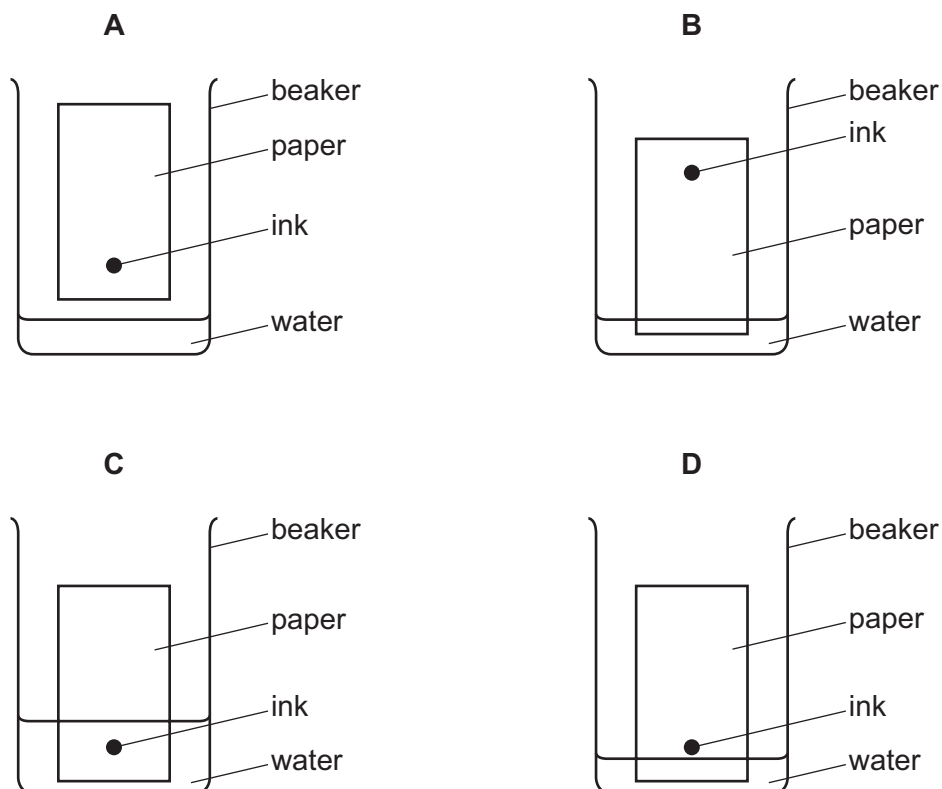
| substance | formula              |
|-----------|----------------------|
| methane   | $\text{CH}_4$        |
| water     | $\text{H}_2\text{O}$ |
| oxygen    | $\text{O}_2$         |

Which statement is correct?

- A Methane is made from five different types of atom.
- B Methane, water and oxygen are molecules.
- C Only methane and water are molecules.
- D Oxygen is made from two different types of atom.

**15** Chromatography separates ink into different colours.

Which diagram shows how the apparatus is set up?



**16** Which statement describes how sodium atoms and oxygen atoms combine to form sodium oxide,  $\text{Na}_2\text{O}$ ?

- A** One sodium atom gains two electrons and two oxygen atoms lose one electron each.
- B** One sodium atom loses two electrons and two oxygen atoms gain one electron each.
- C** Two sodium atoms gain one electron each and one oxygen atom loses two electrons.
- D** Two sodium atoms lose one electron each and one oxygen atom gains two electrons.

17 Which dot-and-cross diagrams show the outer-shell electrons in molecules of water and of carbon dioxide?

|   | water                                                                                                     | carbon dioxide                                                                                                                                      |
|---|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| A | $\text{H} \times \text{O} \times \text{H}$                                                                | $\begin{array}{c} \times \times \times \times \\ \times \text{O} \times \text{C} \times \text{O} \times \\ \times \times \times \times \end{array}$ |
| B | $\text{H} \times \text{O} \times \text{H}$                                                                | $\begin{array}{c} \times \times \times \times \\ \times \text{O} \times \text{C} \times \text{O} \times \\ \times \times \times \times \end{array}$ |
| C | $\begin{array}{c} \times \times \\ \text{H} \times \text{O} \times \text{H} \\ \times \times \end{array}$ | $\begin{array}{c} \times \times \times \times \\ \times \text{O} \times \text{C} \times \text{O} \times \\ \times \times \times \times \end{array}$ |
| D | $\begin{array}{c} \times \times \\ \text{H} \times \text{O} \times \text{H} \\ \times \times \end{array}$ | $\begin{array}{c} \times \times \times \times \\ \times \text{O} \times \text{C} \times \text{O} \times \\ \times \times \times \times \end{array}$ |

18 The formulae of some ions are shown.

- ammonium,  $\text{NH}_4^+$
- calcium,  $\text{Ca}^{2+}$
- nitrate,  $\text{NO}_3^-$
- phosphate,  $\text{PO}_4^{3-}$

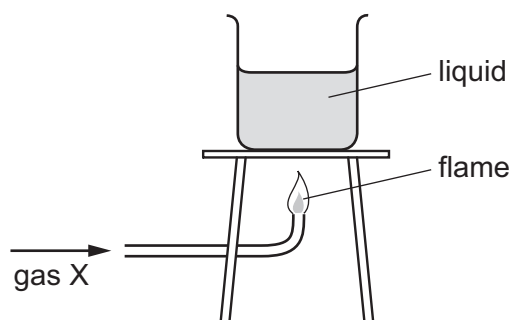
What is the formula of calcium nitrate and of ammonium phosphate?

|   | calcium nitrate            | ammonium phosphate           |
|---|----------------------------|------------------------------|
| A | $\text{Ca}(\text{NO}_3)_2$ | $\text{NH}_4(\text{PO}_4)_3$ |
| B | $\text{Ca}(\text{NO}_3)_2$ | $(\text{NH}_4)_3\text{PO}_4$ |
| C | $\text{Ca}_2\text{NO}_3$   | $\text{NH}_4(\text{PO}_4)_3$ |
| D | $\text{Ca}_2\text{NO}_3$   | $(\text{NH}_4)_3\text{PO}_4$ |

19 Which row describes an ionic compound?

|          | melting point | can be electrolysed |
|----------|---------------|---------------------|
| <b>A</b> | high          | no                  |
| <b>B</b> | high          | yes                 |
| <b>C</b> | low           | no                  |
| <b>D</b> | low           | yes                 |

20 The diagram shows gas X burning and heating a liquid.



Which row is correct?

|          | gas X    | the burning of gas X is exothermic |
|----------|----------|------------------------------------|
| <b>A</b> | hydrogen | ✓                                  |
| <b>B</b> | hydrogen | x                                  |
| <b>C</b> | oxygen   | ✓                                  |
| <b>D</b> | oxygen   | x                                  |

- 21** Dilute hydrochloric acid reacts with marble pieces to produce carbon dioxide.

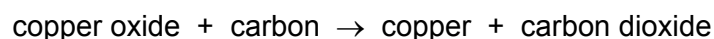
The results of some experiments to investigate the rate of reaction are shown.

| relative concentration of hydrochloric acid | size of marble pieces | time taken to make 50 cm <sup>3</sup> of carbon dioxide / s |
|---------------------------------------------|-----------------------|-------------------------------------------------------------|
| 1                                           | large                 | 100                                                         |
| 2                                           | large                 | 50                                                          |
| 1                                           | small                 | 80                                                          |
| 2                                           | small                 | 40                                                          |

Which conclusion can be made from these results?

- A** When bigger marble pieces are used, the rate of reaction is greater.
  - B** When smaller marble pieces are used, the rate of reaction is doubled.
  - C** When the concentration is doubled, the rate of reaction is doubled.
  - D** When the concentration is doubled, the rate of reaction is halved.
- 22** Copper is produced by heating copper oxide with carbon.

The word equation for this reaction is shown.



Which statement explains why this is a redox reaction?

- A** Carbon dioxide contains oxygen.
  - B** Carbon is a solid and carbon dioxide is a gas.
  - C** Copper oxide is oxidised.
  - D** Copper oxide loses oxygen and carbon gains oxygen.
- 23** Excess aqueous barium nitrate is added to dilute sulfuric acid to produce barium sulfate.

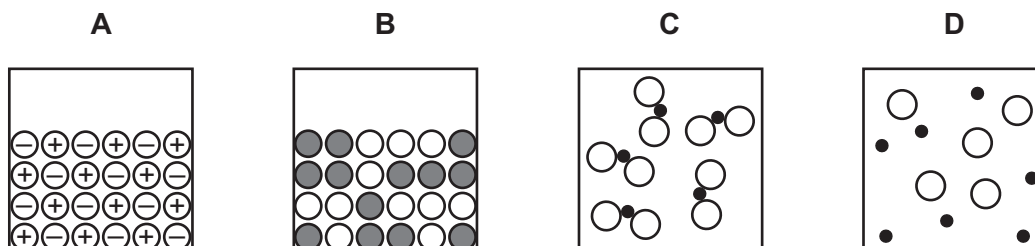
How is barium sulfate obtained from the reaction mixture?

- A** electrolysis
- B** evaporation
- C** filtration
- D** fractional distillation

24 What is a use for argon?

- A as a fuel
- B filling balloons
- C providing an inert atmosphere
- D the extraction of copper

25 Which diagram shows the arrangements of atoms in an alloy?



26 P, Q, R and S are four gases found in clean air.

P is very unreactive.

Q makes up 21% of the air.

R makes up 78% of the air.

S is formed when fossil fuels are burned.

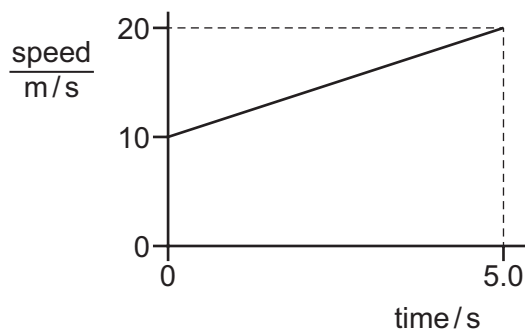
Which row is correct?

|   | P              | Q        | R        | S              |
|---|----------------|----------|----------|----------------|
| A | argon          | nitrogen | oxygen   | carbon dioxide |
| B | argon          | oxygen   | nitrogen | carbon dioxide |
| C | carbon dioxide | oxygen   | nitrogen | argon          |
| D | carbon dioxide | nitrogen | oxygen   | argon          |

27 Which statement about the fractional distillation of petroleum is **not** correct?

- A Fractions obtained from higher up the fractional distillation column have higher boiling point ranges.
- B Fractions obtained from lower down the fractional distillation column contain larger molecules.
- C Refinery gas is used for heating and cooking.
- D Smaller molecules have weaker intermolecular attractive forces.

- 28 The diagram shows the speed-time graph for a car.



What is the acceleration of the car?

- A**  $2.0 \text{ m/s}^2$       **B**  $4.0 \text{ m/s}^2$       **C**  $50 \text{ m/s}^2$       **D**  $75 \text{ m/s}^2$

- 29 Which conditions are necessary for an object to have weight?

|          | must have mass | must be in a gravitational field | must be in an electric field |
|----------|----------------|----------------------------------|------------------------------|
| <b>A</b> | no             | yes                              | no                           |
| <b>B</b> | no             | yes                              | yes                          |
| <b>C</b> | yes            | no                               | yes                          |
| <b>D</b> | yes            | yes                              | no                           |

- 30 A student stretches a steel spring by hanging a load on it. The measurements for the extension of the spring are shown in the table.

|                |     |     |     |     |     |     |
|----------------|-----|-----|-----|-----|-----|-----|
| load / N       | 1.0 | 2.0 | 3.0 | 4.0 | 5.0 | 6.0 |
| extension / cm | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 |

What is the value for the spring constant  $k$  of the spring?

- A**  $0.50 \text{ N/cm}$       **B**  $1.0 \text{ N/cm}$       **C**  $2.0 \text{ N/cm}$       **D**  $18 \text{ N/cm}$

- 31 A motor is used to lift a load of  $3000 \text{ N}$  through a vertical height of  $40 \text{ m}$  in  $2.0$  minutes.

How much useful power does the motor produce?

- A**  $1000 \text{ W}$       **B**  $9000 \text{ W}$       **C**  $60\,000 \text{ W}$       **D**  $240\,000 \text{ W}$

- 32** The molecules of a substance are far apart and moving at high speeds in straight lines. The forces between them are negligible.

Two changes are now made to the substance.

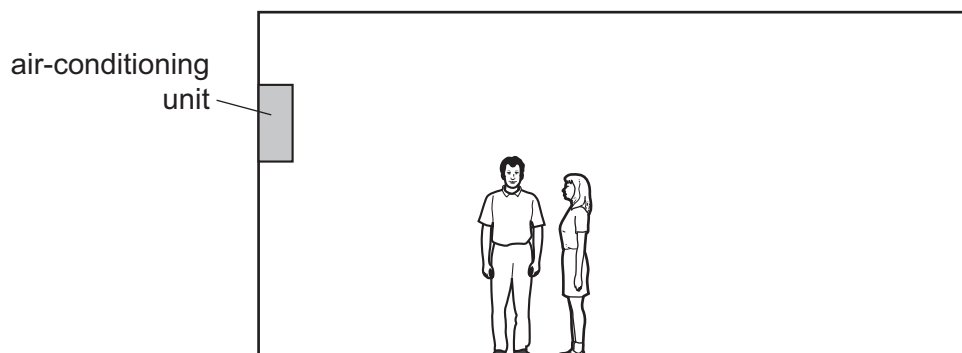
change 1 The average speed of the molecules is reduced but they remain far apart.

change 2 The molecules move much closer together. There are much stronger forces between them, but they can change places with each other.

What is the effect of each change?

|          | change 1              | change 2        |
|----------|-----------------------|-----------------|
| <b>A</b> | temperature decreases | gas to liquid   |
| <b>B</b> | temperature decreases | liquid to solid |
| <b>C</b> | temperature increases | gas to liquid   |
| <b>D</b> | temperature increases | liquid to solid |

- 33** The diagram shows an air-conditioning unit on the wall of a room. The unit draws in warm air from the room and releases cold air into the room.



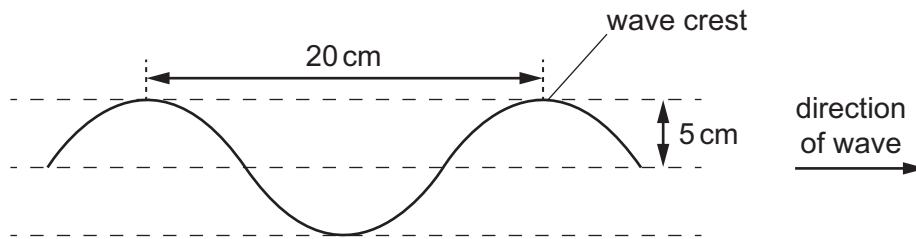
What happens to the cold air and what is the reason?

|          | cold air | reason                         |
|----------|----------|--------------------------------|
| <b>A</b> | falls    | it is less dense than warm air |
| <b>B</b> | falls    | it is more dense than warm air |
| <b>C</b> | rises    | it is less dense than warm air |
| <b>D</b> | rises    | it is more dense than warm air |

- 34 The diagram shows a section of a rope.

Four wave crests pass a point on the rope every second.

Each wave crest travels 80 cm in one second.



What is the speed of the wave?

- A** 4.0 cm/s      **B** 5.0 cm/s      **C** 20 cm/s      **D** 80 cm/s
- 35 A man stands a distance  $d$  in front of a plane mirror and views his own image in the mirror.

Is the image real or virtual, and what is the distance between the man and his image?

|          | image   | distance between man and image |
|----------|---------|--------------------------------|
| <b>A</b> | real    | $d$                            |
| <b>B</b> | real    | $2d$                           |
| <b>C</b> | virtual | $d$                            |
| <b>D</b> | virtual | $2d$                           |

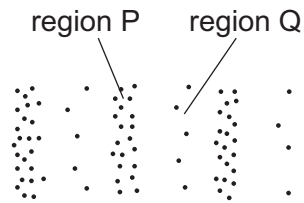
- 36 Electromagnetic waves are used to scan passengers' luggage before they board an aeroplane.

Electromagnetic waves are also used in a television remote controller.

Which type of electromagnetic wave is used for each of these purposes?

|          | scanning luggage | television remote controller |
|----------|------------------|------------------------------|
| <b>A</b> | radio waves      | infra-red waves              |
| <b>B</b> | radio waves      | ultraviolet waves            |
| <b>C</b> | X-rays           | infra-red waves              |
| <b>D</b> | X-rays           | ultraviolet waves            |

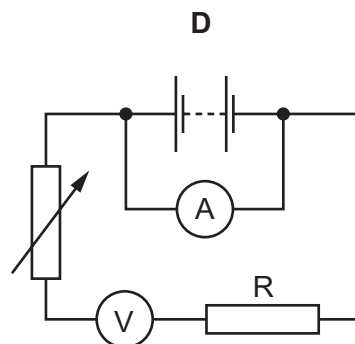
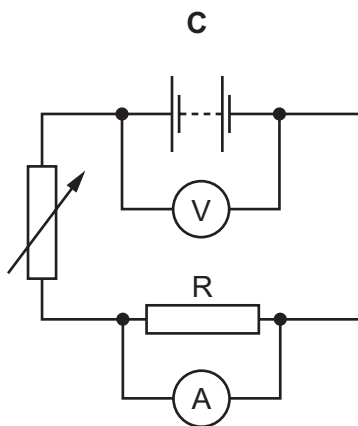
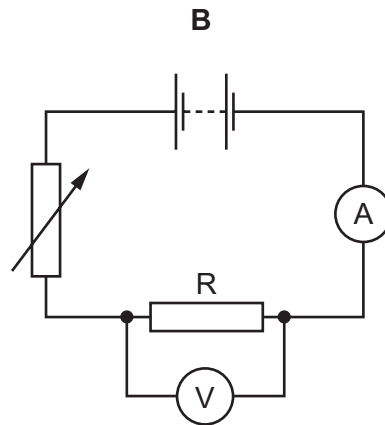
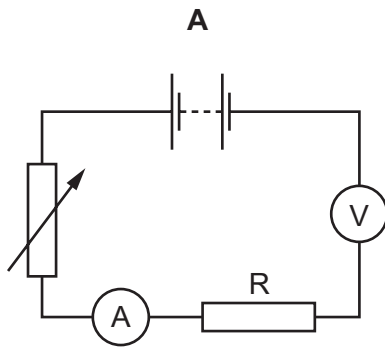
- 37 The diagram represents a wave in air. Molecules are closer together in region P than they are in region Q.



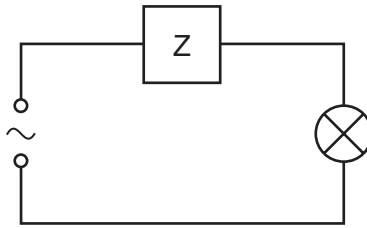
What are the names of regions P and Q, and which type of wave is represented?

|          | region P    | region Q    | type of wave |
|----------|-------------|-------------|--------------|
| <b>A</b> | compression | rarefaction | longitudinal |
| <b>B</b> | compression | rarefaction | transverse   |
| <b>C</b> | rarefaction | compression | longitudinal |
| <b>D</b> | rarefaction | compression | transverse   |

- 38 Which circuit is used to determine the resistance of the resistor R?

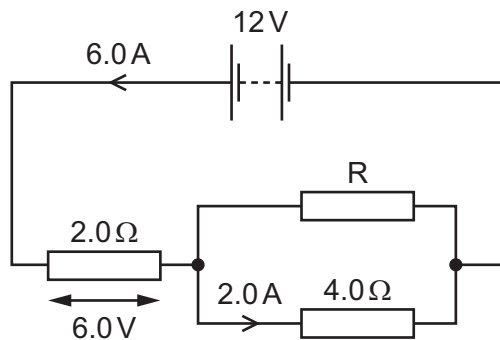


- 39 The device Z in this circuit is designed to cut off the electricity supply **automatically** if too much current flows.



What is device Z?

- A** a fuse  
**B** a resistor  
**C** a switch  
**D** an ammeter
- 40 The diagram shows a 12V battery connected to a  $2.0\Omega$  resistor, a  $4.0\Omega$  resistor and resistor R. The current at two points in the circuit and the p.d. across the  $2.0\Omega$  resistor are shown.



What is the current in resistor R and what is the p.d. across resistor R?

|          | current in resistor R/A | p.d. across resistor R/V |
|----------|-------------------------|--------------------------|
| <b>A</b> | 2.0                     | 3.0                      |
| <b>B</b> | 2.0                     | 6.0                      |
| <b>C</b> | 4.0                     | 3.0                      |
| <b>D</b> | 4.0                     | 6.0                      |

**BLANK PAGE**

**BLANK PAGE**

**BLANK PAGE**

---

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at [www.cie.org.uk](http://www.cie.org.uk) after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

## The Periodic Table of Elements

| Group                      |                             |                                                                                             |                                 |                             |                              |                             |                              |                              |                                |                               |                               |                             |                             |                               |                              |                              |                           |
|----------------------------|-----------------------------|---------------------------------------------------------------------------------------------|---------------------------------|-----------------------------|------------------------------|-----------------------------|------------------------------|------------------------------|--------------------------------|-------------------------------|-------------------------------|-----------------------------|-----------------------------|-------------------------------|------------------------------|------------------------------|---------------------------|
| I                          | II                          | 1<br>H<br>hydrogen<br>1                                                                     |                                 |                             |                              |                             |                              |                              |                                |                               |                               | III                         | IV                          | V                             | VI                           | VII                          | VIII                      |
| 3<br>Li<br>lithium<br>7    | 4<br>Be<br>beryllium<br>9   | <div>Key</div> <div>atomic number<br/>atomic symbol<br/>name<br/>relative atomic mass</div> |                                 |                             |                              |                             |                              |                              |                                |                               |                               | 5<br>B<br>boron<br>11       | 6<br>C<br>carbon<br>12      | 7<br>N<br>nitrogen<br>14      | 8<br>O<br>oxygen<br>16       | 9<br>F<br>fluorine<br>19     | 10<br>Ne<br>neon<br>20    |
|                            | VIII                        |                                                                                             |                                 |                             |                              |                             |                              |                              |                                |                               |                               |                             |                             |                               |                              |                              |                           |
| 11<br>Na<br>sodium<br>23   | 12<br>Mg<br>magnesium<br>24 |                                                                                             |                                 |                             |                              |                             |                              |                              |                                |                               |                               | 13<br>Al<br>aluminium<br>27 | 14<br>Si<br>silicon<br>28   | 15<br>P<br>phosphorus<br>31   | 16<br>S<br>sulfur<br>32      | 17<br>Cl<br>chlorine<br>35.5 | 18<br>Ar<br>argon<br>40   |
| 19<br>K<br>potassium<br>39 | 20<br>Ca<br>calcium<br>40   | 21<br>Sc<br>scandium<br>45                                                                  | 22<br>Ti<br>titanium<br>48      | 23<br>V<br>vanadium<br>51   | 24<br>Cr<br>chromium<br>52   | 25<br>Mn<br>manganese<br>55 | 26<br>Fe<br>iron<br>56       | 27<br>Co<br>cobalt<br>59     | 28<br>Ni<br>nickel<br>59       | 29<br>Cu<br>copper<br>64      | 30<br>Zn<br>zinc<br>65        | 31<br>Ga<br>gallium<br>70   | 32<br>Ge<br>germanium<br>73 | 33<br>As<br>arsenic<br>75     | 34<br>Se<br>selenium<br>79   | 35<br>Br<br>bromine<br>80    | 36<br>Kr<br>krypton<br>84 |
| 37<br>Rb<br>rubidium<br>85 | 38<br>Sr<br>strontium<br>88 | 39<br>Y<br>yttrium<br>89                                                                    | 40<br>Zr<br>zirconium<br>91     | 41<br>Nb<br>niobium<br>93   | 42<br>Mo<br>molybdenum<br>96 | 43<br>Tc<br>technetium<br>— | 44<br>Ru<br>ruthenium<br>101 | 45<br>Rh<br>rhodium<br>103   | 46<br>Pd<br>palladium<br>106   | 47<br>Ag<br>silver<br>108     | 48<br>Cd<br>cadmium<br>112    | 49<br>In<br>indium<br>115   | 50<br>Sn<br>tin<br>119      | 51<br>Sb<br>antimony<br>122   | 52<br>Te<br>tellurium<br>128 | 53<br>I<br>iodine<br>127     | 54<br>Xe<br>xenon<br>131  |
| 55<br>Cs<br>caesium<br>133 | 56<br>Ba<br>barium<br>137   | 57–71<br>lanthanoids                                                                        | 72<br>Hf<br>hafnium<br>178      | 73<br>Ta<br>tantalum<br>181 | 74<br>W<br>tungsten<br>184   | 75<br>Re<br>rhenium<br>186  | 76<br>Os<br>osmium<br>190    | 77<br>Ir<br>iridium<br>192   | 78<br>Pt<br>platinum<br>195    | 79<br>Au<br>gold<br>197       | 80<br>Hg<br>mercury<br>201    | 81<br>Tl<br>thallium<br>204 | 82<br>Pb<br>lead<br>207     | 83<br>Bi<br>bismuth<br>209    | 84<br>Po<br>polonium<br>—    | 85<br>At<br>astatine<br>—    | 86<br>Rn<br>radon<br>—    |
| 87<br>Fr<br>francium<br>—  | 88<br>Ra<br>radium<br>—     | 89–103<br>actinoids                                                                         | 104<br>Rf<br>rutherfordium<br>— | 105<br>Db<br>dubnium<br>—   | 106<br>Sg<br>seaborgium<br>— | 107<br>Bh<br>bohrium<br>—   | 108<br>Hs<br>hassium<br>—    | 109<br>Mt<br>meitnerium<br>— | 110<br>Ds<br>darmstadtium<br>— | 111<br>Rg<br>roentgenium<br>— | 112<br>Cn<br>copernicium<br>— | 114<br>Fl<br>flerovium<br>— |                             | 116<br>Lv<br>livermorium<br>— |                              |                              |                           |

lanthanoids

actinoids

|                                     |                                   |                                        |                                     |                                    |                                    |                                    |                                      |                                   |                                      |                                     |                                  |                                      |                                     |                                     |
|-------------------------------------|-----------------------------------|----------------------------------------|-------------------------------------|------------------------------------|------------------------------------|------------------------------------|--------------------------------------|-----------------------------------|--------------------------------------|-------------------------------------|----------------------------------|--------------------------------------|-------------------------------------|-------------------------------------|
| 57<br><b>La</b><br>lanthanum<br>139 | 58<br><b>Ce</b><br>cerium<br>140  | 59<br><b>Pr</b><br>praseodymium<br>141 | 60<br><b>Nd</b><br>neodymium<br>144 | 61<br><b>Pm</b><br>promethium<br>— | 62<br><b>Sm</b><br>samarium<br>150 | 63<br><b>Eu</b><br>europium<br>152 | 64<br><b>Gd</b><br>gadolinium<br>157 | 65<br><b>Tb</b><br>terbium<br>159 | 66<br><b>Dy</b><br>dysprosium<br>163 | 67<br><b>Ho</b><br>holmium<br>165   | 68<br><b>Er</b><br>erbium<br>167 | 69<br><b>Tm</b><br>thulium<br>169    | 70<br><b>Yb</b><br>ytterbium<br>173 | 71<br><b>Lu</b><br>lutetium<br>175  |
| 89<br><b>Ac</b><br>actinium<br>—    | 90<br><b>Th</b><br>thorium<br>232 | 91<br><b>Pa</b><br>protactinium<br>231 | 92<br><b>U</b><br>uranium<br>238    | 93<br><b>Np</b><br>neptunium<br>—  | 94<br><b>Pu</b><br>plutonium<br>—  | 95<br><b>Am</b><br>americium<br>—  | 96<br><b>Cm</b><br>curium<br>—       | 97<br><b>Bk</b><br>berkelium<br>— | 98<br><b>Cf</b><br>californium<br>—  | 99<br><b>Es</b><br>einsteinium<br>— | 100<br><b>Fm</b><br>fermium<br>— | 101<br><b>Md</b><br>mendelevium<br>— | 102<br><b>No</b><br>nobelium<br>—   | 103<br><b>Lr</b><br>lawrencium<br>— |

The volume of one mole of any gas is 24 dm<sup>3</sup> at room temperature and pressure (r.t.p.).