



# Cambridge IGCSE™

---

## COMBINED SCIENCE

0653/22

Paper 2 Multiple Choice (Extended)

May/June 2020

45 minutes

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet  
Soft clean eraser  
Soft pencil (type B or HB is recommended)

---

### INSTRUCTIONS

- There are **forty** questions on this paper. Answer **all** questions.
- For each question there are four possible answers **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in soft pencil on the multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.

### INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
- Any rough working should be done on this question paper.
- The Periodic Table is printed in the question paper.

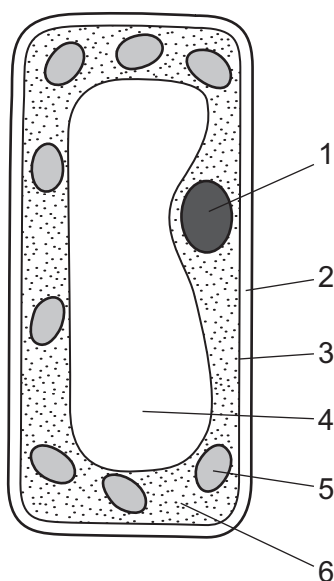
---

This document has **16** pages. Blank pages are indicated.



- 1 The diagram shows a palisade mesophyll cell from a leaf.

The features of the cell are numbered.



Which features are found only in plant cells?

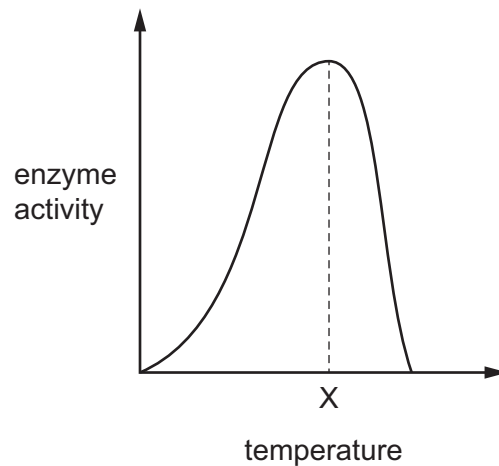
- A** 1, 2 and 3      **B** 1, 5 and 6      **C** 2, 4 and 5      **D** 3, 4 and 6
- 2 Which row about osmosis is correct?

|          | molecules that move | details of movement                               | permeability of membrane |
|----------|---------------------|---------------------------------------------------|--------------------------|
| <b>A</b> | solute              | from a concentrated solution to a dilute solution | fully                    |
| <b>B</b> | solute              | from a dilute solution to a concentrated solution | partially                |
| <b>C</b> | water               | from a concentrated solution to a dilute solution | fully                    |
| <b>D</b> | water               | from a dilute solution to a concentrated solution | partially                |

- 3 Which row matches the adaptation of a root hair cell to its function?

|          | adaptation         | function                    |
|----------|--------------------|-----------------------------|
| <b>A</b> | large surface area | uptake of water and glucose |
| <b>B</b> | large surface area | uptake of water and ions    |
| <b>C</b> | small surface area | uptake of water and glucose |
| <b>D</b> | small surface area | uptake of water and ions    |

- 4 The graph shows the activity of an enzyme as temperature increases.



What happens to the enzyme as the temperature increases above X?

- A The enzyme becomes too hot and dies.
- B The enzyme denatures.
- C The enzyme is used up.
- D The enzyme activity increases.

- 5 What are the correct substrate and products for lipase?

|   | substrate | products                 |
|---|-----------|--------------------------|
| A | fat       | amino acids              |
| B | fat       | fatty acids and glycerol |
| C | protein   | amino acids              |
| D | protein   | fatty acids and glycerol |

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

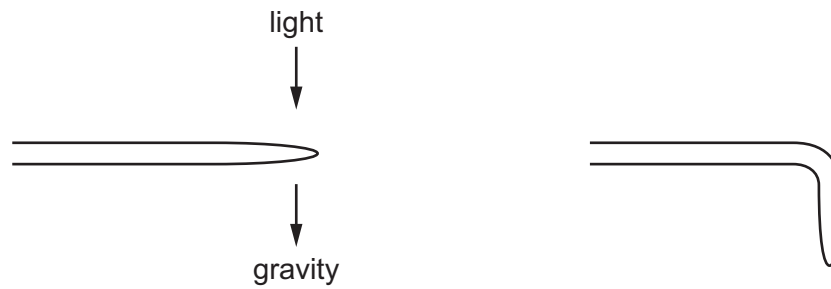
- A Cells elongate more on the left side of the shoot than on the right side.
- B Cells elongate more on the right side of the shoot than on the left side.
- C Cells shrink on the left side of the shoot.
- D Cells shrink on the right side of the shoot.

- 7 Which component of tobacco smoke reduces the ability of haemoglobin to carry oxygen?
- A carbon monoxide
  - B nicotine
  - C smoke particles
  - D tar
- 8 Which substances are the products of photosynthesis?
- A carbon dioxide and glucose
  - B glucose and oxygen
  - C oxygen and water
  - D water and carbon dioxide
- 9 Four people have the same resting pulse rate and the same blood glucose concentration. The table shows their pulse rates and blood glucose concentrations later on the same day.

Which person has the highest concentration of adrenaline in their blood?

|   | pulse rate / beats<br>per minute | blood glucose<br>concentration<br>/mg per dm <sup>3</sup> |
|---|----------------------------------|-----------------------------------------------------------|
| A | 70                               | 65                                                        |
| B | 70                               | 100                                                       |
| C | 120                              | 65                                                        |
| D | 120                              | 100                                                       |

- 10 The diagram shows the root of a plant exposed to light and gravity, and the same root a day later.

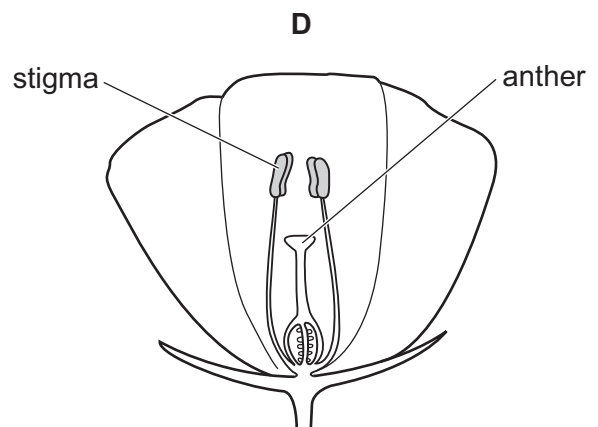
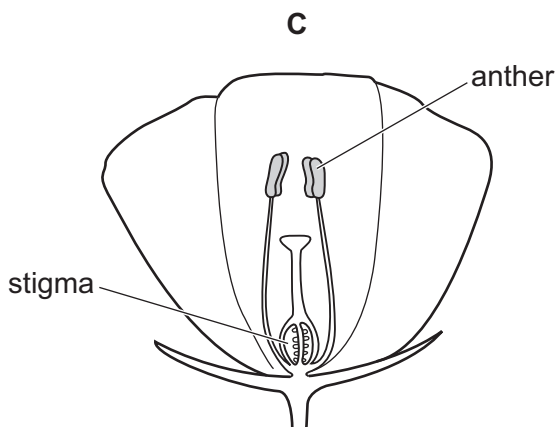
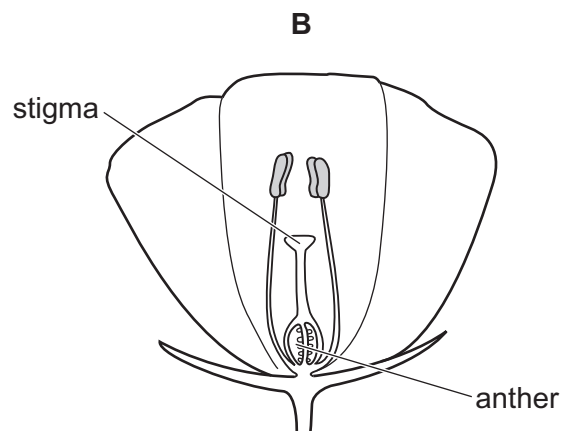
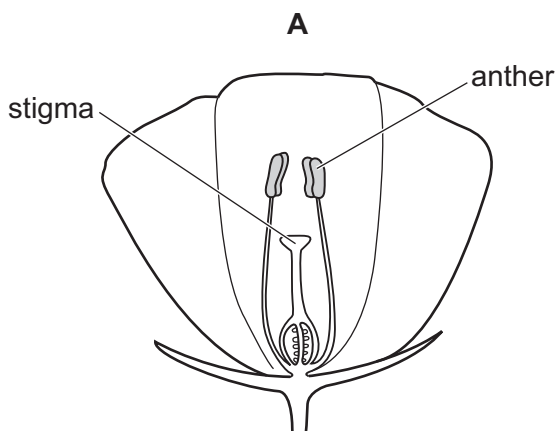


Light does **not** influence the growth of roots in this plant.

Which row shows how the root has responded?

|          | gravitropism                 | phototropism                 |
|----------|------------------------------|------------------------------|
| <b>A</b> | grows away from the stimulus | no response                  |
| <b>B</b> | grows towards the stimulus   | no response                  |
| <b>C</b> | no response                  | grows away from the stimulus |
| <b>D</b> | no response                  | grows towards the stimulus   |

- 11 Which diagram of a flower is correctly labelled?



12 Which row contains correct adaptive features for both sperm and egg cells?

|          | sperm               | egg                 |
|----------|---------------------|---------------------|
| <b>A</b> | energy store        | presence of enzymes |
| <b>B</b> | flagellum           | jelly coat          |
| <b>C</b> | jelly coat          | energy store        |
| <b>D</b> | presence of enzymes | flagellum           |

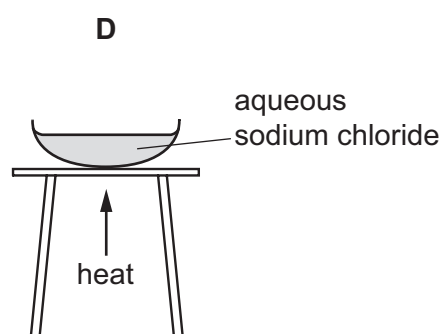
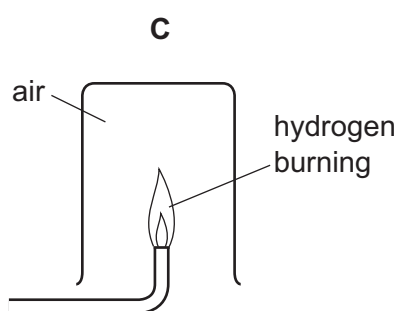
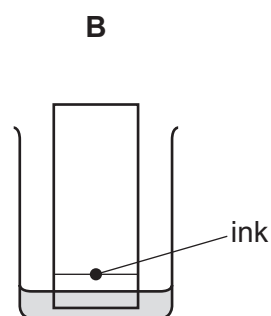
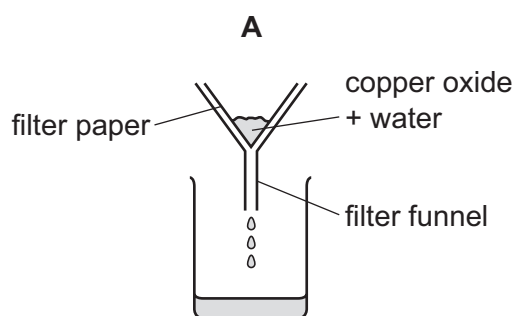
13 Which stage of eutrophication must be reached to cause fish to die?

- A** increased growth of decomposers
- B** increased levels of nitrates
- C** increased growth of plants
- D** reduction of dissolved oxygen

14 Which process uses  $R_f$  values to identify the components of a mixture?

- A** chromatography
- B** crystallisation
- C** distillation
- D** filtration

15 In which experiment is a compound formed?

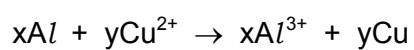


- 16** A magnesium ion,  $\text{Mg}^{2+}$ , is formed from a magnesium atom, Mg.

Which row about the numbers of protons and neutrons in the magnesium ion and in the magnesium atom is correct?

|          | number of protons                      | number of neutrons                     |
|----------|----------------------------------------|----------------------------------------|
| <b>A</b> | larger in $\text{Mg}^{2+}$ than in Mg  | same in Mg and $\text{Mg}^{2+}$        |
| <b>B</b> | same in Mg and $\text{Mg}^{2+}$        | same in Mg and $\text{Mg}^{2+}$        |
| <b>C</b> | same in Mg and $\text{Mg}^{2+}$        | smaller in $\text{Mg}^{2+}$ than in Mg |
| <b>D</b> | smaller in $\text{Mg}^{2+}$ than in Mg | larger in $\text{Mg}^{2+}$ than in Mg  |

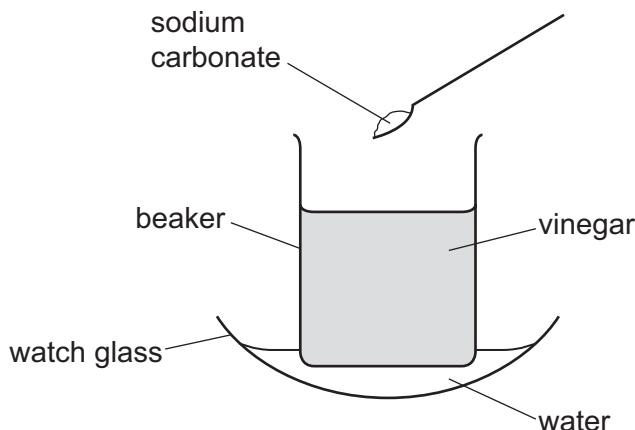
- 17** Aluminium displaces copper from an aqueous solution of its ions.



Which values of x and y balance the equation?

|          | x | y |
|----------|---|---|
| <b>A</b> | 1 | 2 |
| <b>B</b> | 2 | 1 |
| <b>C</b> | 2 | 3 |
| <b>D</b> | 3 | 2 |

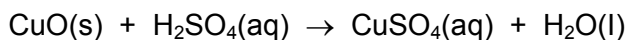
- 18 Solid sodium carbonate is added to vinegar in a beaker and stirred.



The water in the watch glass freezes.

Which statement about the reaction explains why the water freezes?

- A It is a redox reaction.
  - B It is an endothermic reaction.
  - C It is catalysed by sodium carbonate.
  - D It is thermal decomposition.
- 19 Which statements about redox reactions are correct?
- 1 The oxidising agent oxidises another substance.
  - 2 The reducing agent is oxidised.
  - 3 The substance that loses oxygen has been oxidised.
- A 1 and 2 only    B 1 and 3 only    C 2 and 3 only    D 1, 2 and 3
- 20 Copper(II) sulfate is prepared by reacting copper(II) oxide with dilute sulfuric acid.



Which statement is correct?

- A Excess copper(II) oxide is used because it can be easily removed by filtration.
- B Excess copper(II) oxide is used because it can be easily removed by reacting with more sulfuric acid.
- C Excess sulfuric acid is used because it can be easily removed by evaporation.
- D Excess sulfuric acid is used because unreacted copper(II) oxide would contaminate the product.

**21** Solution X is mixed with nitric acid and aqueous barium nitrate.

A white precipitate is formed.

Which ion is present in solution X?

- A** carbonate
- B** chloride
- C** nitrate
- D** sulfate

**22** Which row shows the relationship between the group number of an element, its number of outer shell electrons and its metallic/ non-metallic character?

|          | group number | number of outer shell electrons | metallic/ non-metallic character |
|----------|--------------|---------------------------------|----------------------------------|
| <b>A</b> | I            | 1                               | non-metal                        |
| <b>B</b> | III          | 5                               | metal                            |
| <b>C</b> | V            | 5                               | non-metal                        |
| <b>D</b> | VII          | 1                               | metal                            |

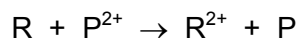
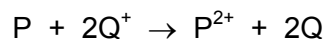
**23** Astatine is an element found at the bottom of Group VII in the Periodic Table.

Which row shows the properties of astatine?

|          | melting point / °C | reacts with iodide ions |
|----------|--------------------|-------------------------|
| <b>A</b> | -7                 | no                      |
| <b>B</b> | 302                | no                      |
| <b>C</b> | -7                 | yes                     |
| <b>D</b> | 302                | yes                     |

**24** Atoms and ions of metals P, Q and R take part in two reactions.

The equations for these reactions are shown.



Which statements are correct?

- 1 P is more reactive than R.
- 2 P is less reactive than Q.
- 3 R is more reactive than Q.
- 4 R loses electrons most readily.

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

**25** Copper can be made from copper oxide by reacting it with carbon at a high temperature.

Why is carbon used?

- A** It does not react with copper.
- B** It is a conductor of electricity.
- C** It is a high melting point solid.
- D** It is more reactive than copper.

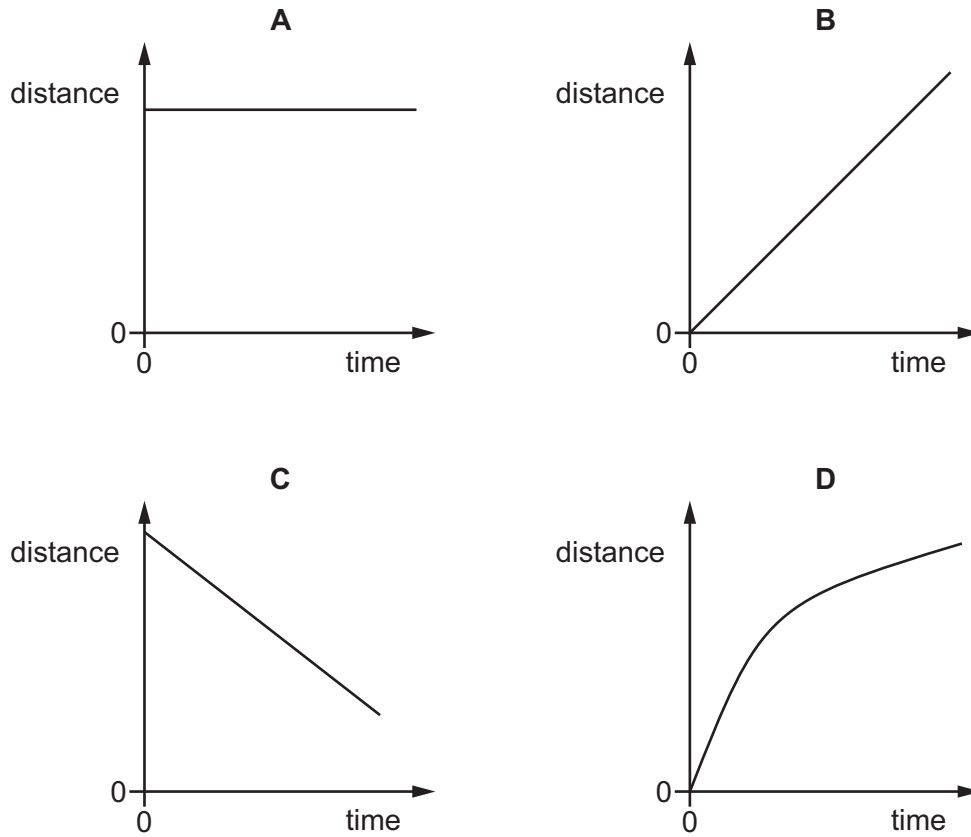
**26** Which row about a gas in clean air is correct?

|          | name of gas | percentage of gas |
|----------|-------------|-------------------|
| <b>A</b> | nitrogen    | 20                |
| <b>B</b> | nitrogen    | 50                |
| <b>C</b> | oxygen      | 20                |
| <b>D</b> | oxygen      | 50                |

**27** In which list are all of the hydrocarbons in the same homologous series?

- A** CH<sub>4</sub>, C<sub>2</sub>H<sub>6</sub>, C<sub>3</sub>H<sub>8</sub>, C<sub>5</sub>H<sub>10</sub>
- B** C<sub>2</sub>H<sub>4</sub>, C<sub>2</sub>H<sub>6</sub>, C<sub>3</sub>H<sub>6</sub>, C<sub>4</sub>H<sub>8</sub>
- C** C<sub>2</sub>H<sub>4</sub>, C<sub>3</sub>H<sub>6</sub>, C<sub>4</sub>H<sub>8</sub>, C<sub>5</sub>H<sub>10</sub>
- D** C<sub>2</sub>H<sub>6</sub>, C<sub>3</sub>H<sub>6</sub>, C<sub>4</sub>H<sub>8</sub>, C<sub>5</sub>H<sub>10</sub>

28 Which distance–time graph represents a body that is moving with changing speed?



29 A car travels at various speeds during a short journey.

The table shows the distances travelled and the times taken during each of four stages P, Q, R and S.

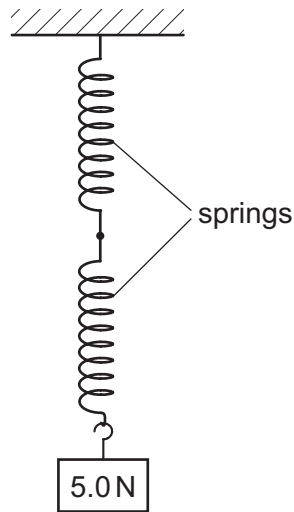
| stage                   | P   | Q   | R   | S   |
|-------------------------|-----|-----|-----|-----|
| distance travelled / km | 1.8 | 3.6 | 2.7 | 2.7 |
| time taken / minutes    | 2.0 | 2.0 | 4.0 | 3.0 |

During which two stages is the car travelling at the same average speed?

- A** P and Q      **B** P and S      **C** Q and R      **D** R and S

- 30** A spring obeys Hooke's law. A load of 10 N hangs from the spring and causes the spring to extend by 12 mm.

Two springs, identical to the first one, are now joined as shown. A load of 5.0 N is hung from the springs.



What is the total extension of the combination of the two springs?

- A** 3.0 mm      **B** 6.0 mm      **C** 12 mm      **D** 24 mm
- 31** A force  $F$  acts on a body of mass  $m$  for a time  $t$ . In this time, the speed of the body increases from speed  $u$  to speed  $v$  and the body travels a distance  $d$ .

Which expression gives the work done by the force on the body?

- A**  $F \times d$       **B**  $F \times t$       **C**  $F \times u$       **D**  $F \times v$
- 32** Four objects P, Q, R and S are moving.

The table shows the mass and speed of each object.

|   | mass/kg | speed<br>m/s |
|---|---------|--------------|
| P | 1.0     | 4.0          |
| Q | 2.0     | 1.0          |
| R | 1.0     | 2.0          |
| S | 4.0     | 1.0          |

Which two objects have equal kinetic energy?

- A** P and R      **B** P and S      **C** Q and R      **D** R and S

**33** Which action increases the rate of evaporation of a liquid?

- A** cooling the liquid
- B** covering the liquid
- C** increasing the surface area of the liquid
- D** reducing any draught over the liquid

**34** Conduction of heat in metals involves the movement of atoms and electrons.

Which row describes the movement of the atoms and the electrons?

|          | atoms                         | electrons                     |
|----------|-------------------------------|-------------------------------|
| <b>A</b> | move freely                   | move freely                   |
| <b>B</b> | move freely                   | vibrate about fixed positions |
| <b>C</b> | vibrate about fixed positions | move freely                   |
| <b>D</b> | vibrate about fixed positions | vibrate about fixed positions |

**35** Four students suggest values for the speed of electromagnetic waves in a vacuum.

The students use two different units.

Which value is correct?

- A** 300 m/s
- B** 300 km/s
- C**  $3.0 \times 10^5$  m/s
- D**  $3.0 \times 10^5$  km/s

**36** The sound from a drum is loud and has a low pitch.

Which row describes the amplitude and the frequency of the sound wave?

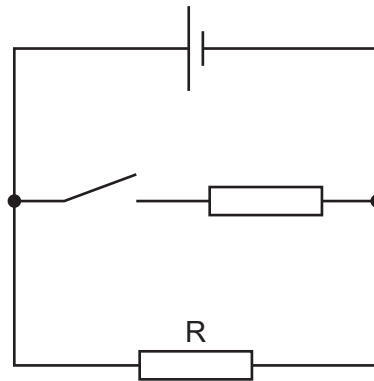
|          | amplitude | frequency |
|----------|-----------|-----------|
| <b>A</b> | large     | high      |
| <b>B</b> | large     | low       |
| <b>C</b> | small     | high      |
| <b>D</b> | small     | low       |

37 What is the unit of charge?

- A ampere
- B coulomb
- C ohm
- D volt

38 An electric circuit contains two resistors connected to a cell.

One resistor is labelled R. The switch is open.



The switch is now closed.

What happens to the potential difference (p.d.) across resistor R and what happens to the current in resistor R?

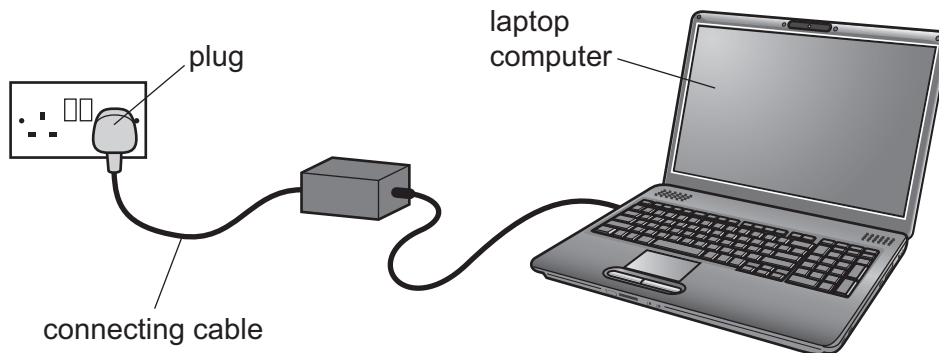
- A The p.d. decreases and the current increases.
- B The p.d. decreases and the current remains the same.
- C The p.d. remains the same and the current increases.
- D The p.d. remains the same and the current remains the same.

39 A 12 V power supply is connected to a  $6.0\ \Omega$  resistor. This causes a current in the resistor.

How much thermal energy is produced in the resistor in 5.0 minutes?

- A 120 J
- B 600 J
- C 7200 J
- D 21 600 J

- 40** The charger for a laptop computer is connected by a cable to the mains supply through a plug. The plug contains a 13 A fuse. The cable is designed to carry a current of 2 A.
- A fault develops and the current in the cable increases to 5 A.



What is a possible danger caused by this larger current?

- A** A large amount of electrical energy is wasted.
- B** Somebody receives an electric shock.
- C** The fuse blows and starts a fire.
- D** The cable overheats and starts a fire.

---

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 Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at [www.cambridgeinternational.org](http://www.cambridgeinternational.org) after the live examination series.

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