

**EDEXCEL · GCSE COMBINED SCIENCE 1SC0**

# Chemistry — Higher Tier, Paper 2

June 2024 exam series

**QUESTION PAPER**

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Please check the examination details below before entering your candidate information

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|-------------------|--|--|--|--|------------------|--|--|--|--|
| Candidate surname |  |  |  |  | Other names      |  |  |  |  |
| Centre Number     |  |  |  |  | Candidate Number |  |  |  |  |
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**Pearson Edexcel Level 1/Level 2 GCSE (9–1)**

**Tuesday 11 June 2024**

Morning (Time: 1 hour 10 minutes) **Paper reference** **1SC0/2CH**

**Combined Science**

**PAPER 5**

**Higher Tier**

**You must have:**  
Calculator, ruler, Periodic table (enclosed)

Total Marks

## Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided  
– *there may be more space than you need.*
- Calculators may be used.
- Any diagrams may NOT be accurately drawn, unless otherwise indicated.
- You must **show all your working out** with **your answer clearly identified** at the **end of your solution**.

## Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets  
– *use this as a guide as to how much time to spend on each question.*
- In questions marked with an **asterisk** (\*), marks will be awarded for your ability to structure your answer logically, showing how the points that you make are related or follow on from each other where appropriate.

## Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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**Answer ALL questions. Write your answers in the spaces provided.**

**Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.**

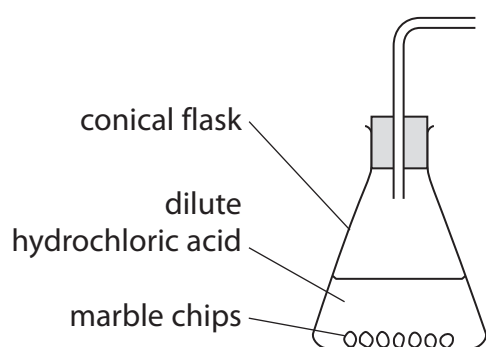
- 1** A student investigates the reaction between marble chips and dilute hydrochloric acid.

The student measures the total volume of carbon dioxide gas produced each minute, for 10 minutes.

- (a) Figure 1 shows part of the apparatus used in the experiment.

Complete Figure 1 by drawing and labelling apparatus that could be used to collect and measure the volume of the carbon dioxide gas.

(2)



**Figure 1**



(b) Figure 2 shows a graph of the results of the experiment.

A tangent has been drawn on the curve at a time of 3.5 minutes.

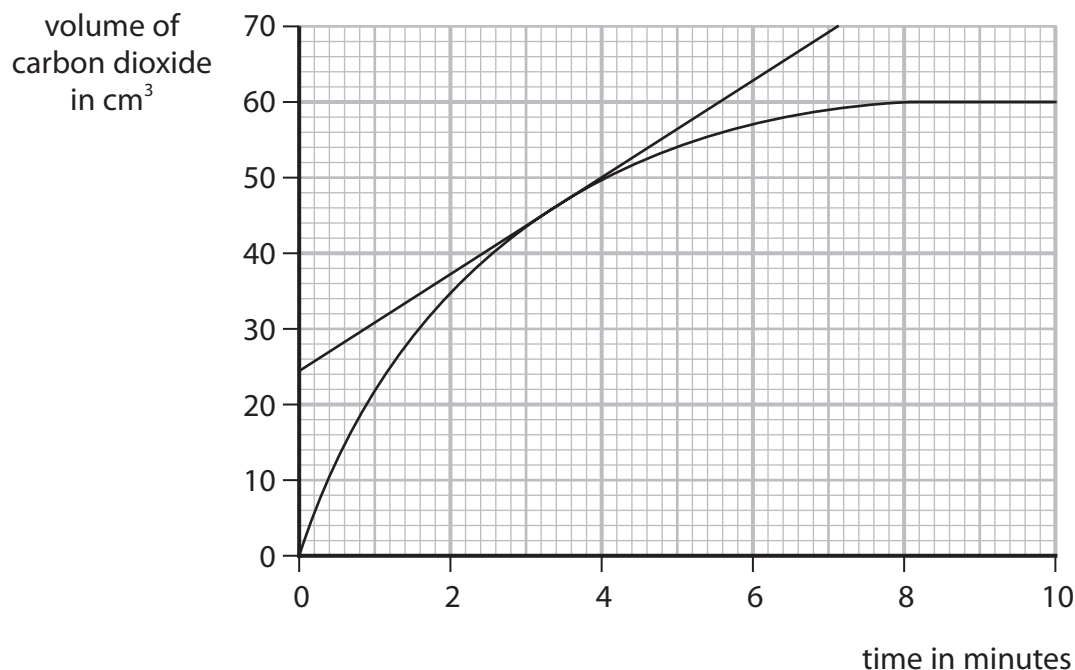


Figure 2

(i) State the total volume of carbon dioxide produced in the first 3.5 minutes.

(1)

volume = ..... cm<sup>3</sup>

(ii) Using the tangent, calculate the rate of reaction at 3.5 minutes in cm<sup>3</sup> per minute.

$$\text{rate of reaction} = \frac{\text{change in gas volume}}{\text{change in time}}$$

(3)

rate = ..... cm<sup>3</sup> per minute

(c) The student repeats the experiment using the same mass of smaller marble chips.

All other conditions remain the same.

Explain the effect on the rate of reaction of using smaller marble chips.

(2)

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(d) Which change would make the rate of reaction slower?

(1)

- ☐ **A** using the same acid at a higher temperature
- ☐ **B** using acid of a lower concentration
- ☐ **C** using a larger flask
- ☐ **D** adding a catalyst

(Total for Question 1 = 9 marks)



2 This question is about the atmosphere.

(a) Describe the test to show that a gas is oxygen.

(2)

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(b) Copper reacts with oxygen to form copper oxide.

2.100 g of copper will react completely with 0.529 g of oxygen.

In an experiment, 4.200 g of copper is heated with 50.000 g of oxygen until the reaction is complete.

Calculate the mass of oxygen remaining at the end of the experiment.

(2)

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mass of oxygen = ..... g

(c) Helium, neon and argon are all inert.

(i) Explain, in terms of electrons, why these gases are inert.

(2)

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(ii) Two pieces of steel can be joined by heating the metal pieces with a very hot flame.

This process is often carried out in an argon atmosphere rather than in air.

Which property makes argon gas suitable for this use?

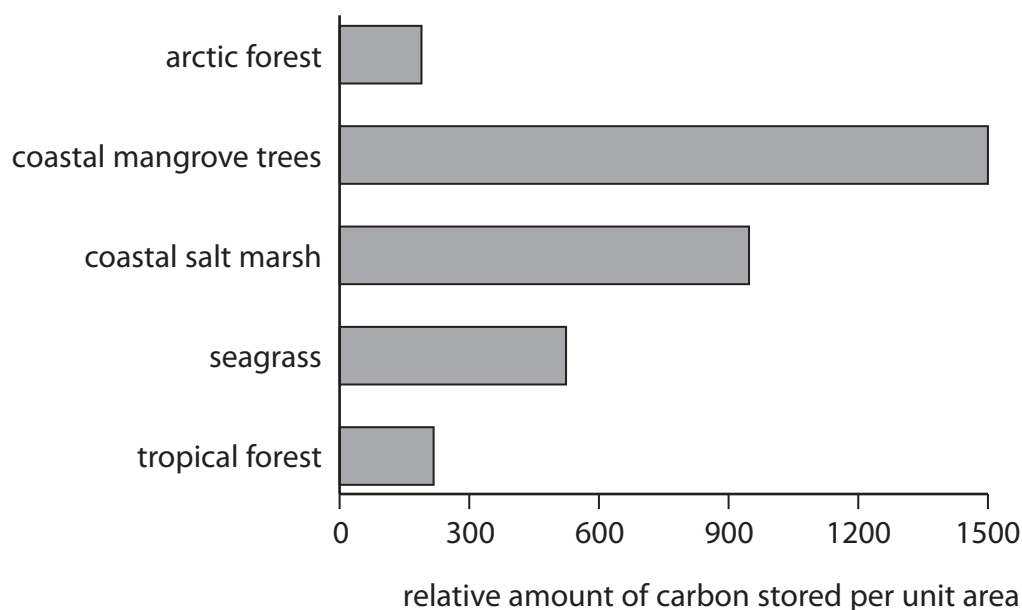
(1)

- ☐ A argon has a low density
- ☐ B argon has a low melting point
- ☐ C argon is colourless
- ☐ D argon is unreactive



- (d) Carbon dioxide is removed from the atmosphere by plants and stored in plants and soil as carbon compounds.

Figure 3 shows the relative amounts of carbon stored in plants and soils in different environments.



**Figure 3**

It has been suggested that preserving coastal ecosystems is more effective than reforestation in the mitigation of climate change.

Describe how the data in Figure 3 supports this suggestion.

(2)

**(Total for Question 2 = 9 marks)**

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- 3 (a) (i) Most hydrocarbons found in fossil fuels are members of the alkane homologous series.

State **two** features of an homologous series.

(2)

1 .....

2 .....

- (ii) Which molecule is in the same homologous series as  $\text{CH}_4$ ?

(1)

☐ **A**  $\text{C}_5\text{H}_{20}$

☐ **B**  $\text{C}_6\text{H}_{12}$

☐ **C**  $\text{C}_8\text{H}_{18}$

☐ **D**  $\text{C}_9\text{H}_{16}$

- (b) A fossil fuel contains carbon and sulfur.

Explain how the products of the complete combustion of this fossil fuel would affect the environment.

(4)

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(c) Incomplete combustion of fuels may produce carbon monoxide.

Write the balanced equation for the incomplete combustion of heptane,  $C_7H_{16}$ , where all of the carbon atoms form carbon monoxide.

(2)

(Total for Question 3 = 9 marks)



- 4 (a) Damp iron wool reacts with oxygen in the air.  
A student uses the apparatus in Figure 4 to investigate the percentage of oxygen in the atmosphere.

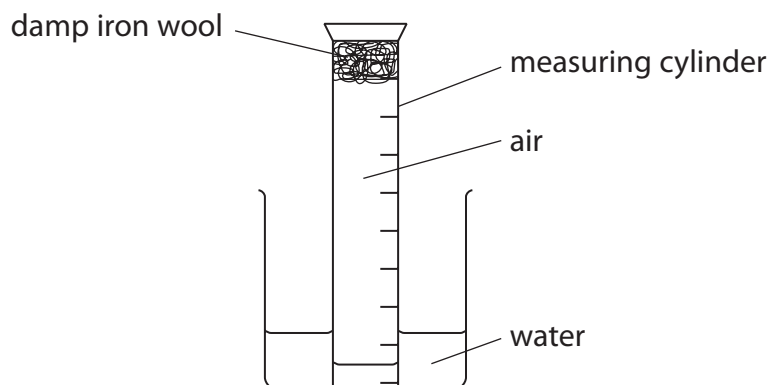


Figure 4

- (i) The initial volume of air in the measuring cylinder was  $18.0 \text{ cm}^3$ .

The student left the apparatus overnight.

The volume of gas in the measuring cylinder the next day was  $14.5 \text{ cm}^3$ .

To the nearest whole number, what percentage of the air has reacted with the iron wool?

(1)

- ☐ A 19%
- ☐ B 21%
- ☐ C 24%
- ☐ D 81%

- (ii) Describe **one** improvement the student could make to this method to ensure that all of the oxygen in the measuring cylinder has reacted.

(2)

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- (b) (i) When hydrocarbon fuels are burned, the products are water and carbon dioxide.

Describe what needs to be done to the apparatus in Figure 5 to collect the water and show that carbon dioxide has been produced.

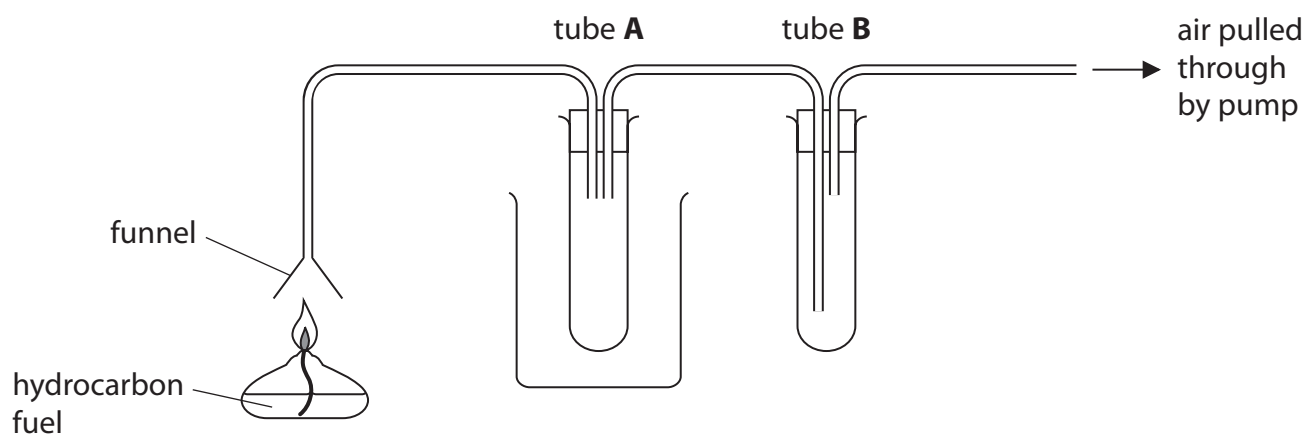


Figure 5

(2)

- (ii) A hydrocarbon,  $C_xH_y$ , is burned in excess oxygen, forming 26.4 g of carbon dioxide and 5.4 g of water.

The relative formula mass of  $C_xH_y$  is 78.

Calculate the molecular formula of the hydrocarbon  $C_xH_y$ .

(relative atomic masses:  $H = 1.0$ ,  $C = 12$ ;  
relative formula masses:  $H_2O = 18$ ,  $CO_2 = 44$ )

(4)

molecular formula = .....

(Total for Question 4 = 9 marks)

- 5 (a) The relative atomic mass of argon is 40 and the relative atomic mass of potassium is 39 but potassium appears after argon in the periodic table.

State why potassium appears after argon in the periodic table.

(1)

- (b) Potassium reacts with water to form two products.

- (i) Give the formulae of both products.

(1)

..... **and** .....

- (ii) The reaction of potassium with water is exothermic.

On Figure 6, draw and label the reaction profile diagram for this reaction, labelling the activation energy.

(2)

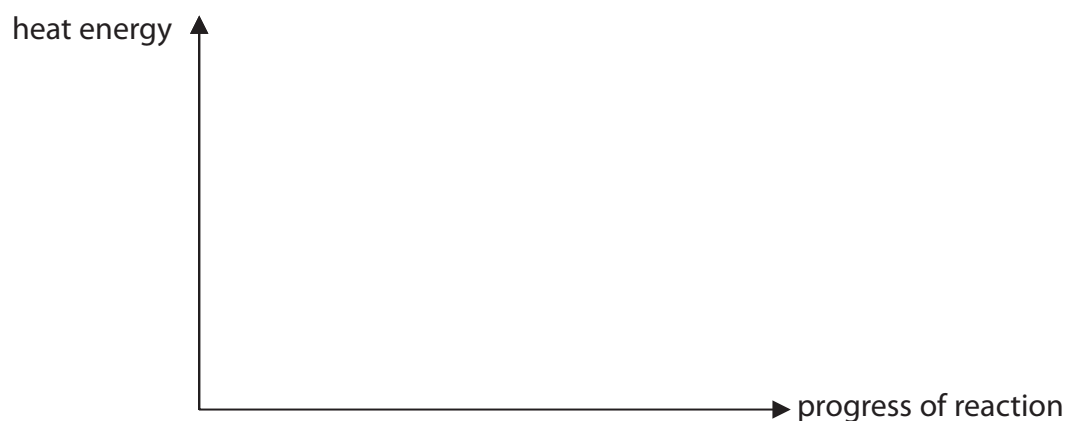


Figure 6



(c) Some reactions are endothermic.

Explain, in terms of bond breaking and bond forming, why some reactions are endothermic.

(3)

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(d) Ethene reacts with hydrogen chloride.

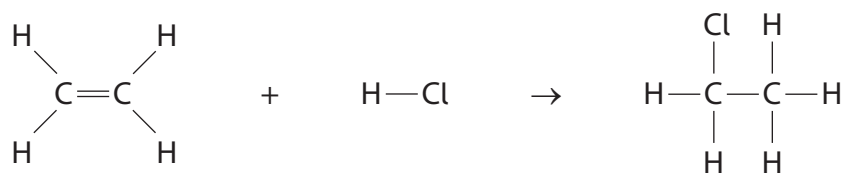


Figure 7 shows the bond energies for the different bonds in the three molecules in the reaction.

| bond                 | bond energy in $\text{kJ mol}^{-1}$ |
|----------------------|-------------------------------------|
| $\text{C}-\text{H}$  | 412                                 |
| $\text{C}=\text{C}$  | 612                                 |
| $\text{C}-\text{C}$  | 348                                 |
| $\text{H}-\text{Cl}$ | 431                                 |
| $\text{C}-\text{Cl}$ | 338                                 |

**Figure 7**

Calculate the energy change for this reaction.

(4)

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energy change = .....  $\text{kJ mol}^{-1}$

**(Total for Question 5 = 11 marks)**



6 The elements in group 7 of the periodic table are the halogens.

(a) Which row shows the colour and physical state of iodine at room temperature?

(1)

|                          |   | colour    | physical state |
|--------------------------|---|-----------|----------------|
| <input type="checkbox"/> | A | dark grey | solid          |
| <input type="checkbox"/> | B | red brown | liquid         |
| <input type="checkbox"/> | C | green     | solid          |
| <input type="checkbox"/> | D | purple    | gas            |

(b) Iron wool is heated with bromine vapour as shown in Figure 8.

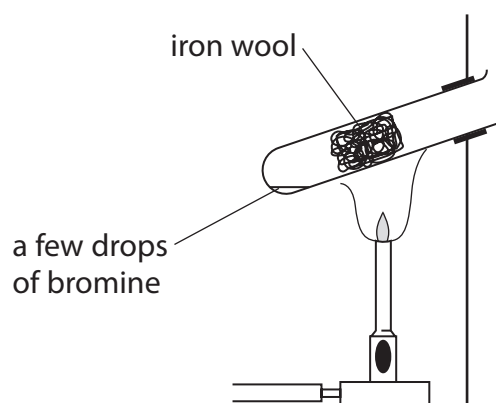


Figure 8

At the end of the reaction, a solid forms at the top of the test tube.

Identify the solid.

(1)

(c) Aluminium reacts with bromine.

Write the balanced equation for the reaction between aluminium and bromine.

(3)

- \* (d) (i) The order of reactivity of the halogens can be found by displacement reactions.

A student was provided with

- solutions of bromine, chlorine and iodine
- solutions of sodium bromide, sodium chloride and sodium iodide.

Describe experiments the student could carry out using these solutions to find the order of reactivity of bromine, chlorine and iodine, explaining how the results would show the order of reactivity.

You should use equations to support your answer.

(6)



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(ii) Explain why the displacement reactions of halogens are redox reactions.

(2)

(Total for Question 6 = 13 marks)

**TOTAL FOR PAPER = 60 MARKS**

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**Pearson Edexcel Level 1/Level 2 GCSE (9–1)**

**Tuesday 11 June 2024**

Paper  
reference

**1SC0/2CH**

**Combined Science**

**PAPER 5**

**Higher Tier**

**Periodic Table Insert**

**Do not return this Insert with the question paper.**

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# The periodic table of the elements

|                            |                             |                                                                         |                             |                             |                              |                                |                              |                            |                              |                            |                            |                             |                             |                             |                               |                               |                            |
|----------------------------|-----------------------------|-------------------------------------------------------------------------|-----------------------------|-----------------------------|------------------------------|--------------------------------|------------------------------|----------------------------|------------------------------|----------------------------|----------------------------|-----------------------------|-----------------------------|-----------------------------|-------------------------------|-------------------------------|----------------------------|
| 1                          | 2                           | Key                                                                     |                             |                             |                              |                                |                              |                            |                              |                            |                            | 3                           | 4                           | 5                           | 6                             | 7                             | 0                          |
|                            |                             | relative atomic mass<br>atomic symbol<br>name<br>atomic (proton) number |                             |                             |                              |                                |                              |                            |                              |                            |                            |                             |                             |                             |                               |                               |                            |
| 7<br>Li<br>lithium<br>3    | 9<br>Be<br>beryllium<br>4   |                                                                         |                             |                             |                              |                                |                              |                            |                              |                            |                            | 11<br>B<br>boron<br>5       | 12<br>C<br>carbon<br>6      | 14<br>N<br>nitrogen<br>7    | 16<br>O<br>oxygen<br>8        | 19<br>F<br>fluorine<br>9      | 20<br>Ne<br>neon<br>10     |
| 23<br>Na<br>sodium<br>11   | 24<br>Mg<br>magnesium<br>12 |                                                                         |                             |                             |                              |                                |                              |                            |                              |                            |                            | 27<br>Al<br>aluminium<br>13 | 28<br>Si<br>silicon<br>14   | 31<br>P<br>phosphorus<br>15 | 32<br>S<br>sulfur<br>16       | 35.5<br>Cl<br>chlorine<br>17  | 40<br>Ar<br>argon<br>18    |
| 39<br>K<br>potassium<br>19 | 40<br>Ca<br>calcium<br>20   | 45<br>Sc<br>scandium<br>21                                              | 48<br>Ti<br>titanium<br>22  | 51<br>V<br>vanadium<br>23   | 52<br>Cr<br>chromium<br>24   | 55<br>Mn<br>manganese<br>25    | 56<br>Fe<br>iron<br>26       | 59<br>Co<br>cobalt<br>27   | 59<br>Ni<br>nickel<br>28     | 63.5<br>Cu<br>copper<br>29 | 65<br>Zn<br>zinc<br>30     | 70<br>Ga<br>gallium<br>31   | 73<br>Ge<br>germanium<br>32 | 75<br>As<br>arsenic<br>33   | 79<br>Se<br>selenium<br>34    | 80<br>Br<br>bromine<br>35     | 84<br>Kr<br>krypton<br>36  |
| 85<br>Rb<br>rubidium<br>37 | 88<br>Sr<br>strontium<br>38 | 89<br>Y<br>yttrium<br>39                                                | 91<br>Zr<br>zirconium<br>40 | 93<br>Nb<br>niobium<br>41   | 96<br>Mo<br>molybdenum<br>42 | [98]<br>Tc<br>technetium<br>43 | 101<br>Ru<br>ruthenium<br>44 | 103<br>Rh<br>rhodium<br>45 | 106<br>Pd<br>palladium<br>46 | 108<br>Ag<br>silver<br>47  | 112<br>Cd<br>cadmium<br>48 | 115<br>In<br>indium<br>49   | 119<br>Sn<br>tin<br>50      | 122<br>Sb<br>antimony<br>51 | 128<br>Te<br>tellurium<br>52  | 127<br>I<br>iodine<br>53      | 131<br>Xe<br>xenon<br>54   |
| 133<br>Cs<br>caesium<br>55 | 137<br>Ba<br>barium<br>56   | 139<br>La*<br>lanthanum<br>57                                           | 178<br>Hf<br>hafnium<br>72  | 181<br>Ta<br>tantalum<br>73 | 184<br>W<br>tungsten<br>74   | 186<br>Re<br>rhenium<br>75     | 190<br>Os<br>osmium<br>76    | 192<br>Ir<br>iridium<br>77 | 195<br>Pt<br>platinum<br>78  | 197<br>Au<br>gold<br>79    | 201<br>Hg<br>mercury<br>80 | 204<br>Tl<br>thallium<br>81 | 207<br>Pb<br>lead<br>82     | 209<br>Bi<br>bismuth<br>83  | [209]<br>Po<br>polonium<br>84 | [210]<br>At<br>astatine<br>85 | [222]<br>Rn<br>radon<br>86 |

|   |          |   |
|---|----------|---|
| 1 | <b>H</b> | 1 |
|   | hydrogen |   |

## Key

|                        |
|------------------------|
| relative atomic mass   |
| <b>atomic symbol</b>   |
| name                   |
| atomic (proton) number |

\* The elements with atomic numbers from 58 to 71 are omitted from this part of the periodic table.

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.