

**Thursday 26 January 2012 – Morning**

**GCSE GATEWAY SCIENCE  
CHEMISTRY B**

**B641/01** Unit 1 Modules C1 C2 C3 (Foundation Tier)

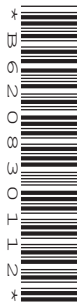
Candidates answer on the Question Paper.  
A calculator may be used for this paper.

**OCR supplied materials:**  
None

**Other materials required:**

- Pencil
- Ruler (cm/mm)

**Duration:** 1 hour



|                       |  |  |  |  |  |                      |  |  |  |  |  |
|-----------------------|--|--|--|--|--|----------------------|--|--|--|--|--|
| Candidate<br>forename |  |  |  |  |  | Candidate<br>surname |  |  |  |  |  |
| Centre number         |  |  |  |  |  | Candidate number     |  |  |  |  |  |

**INSTRUCTIONS TO CANDIDATES**

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

**INFORMATION FOR CANDIDATES**

- The number of marks is given in brackets [ ] at the end of each question or part question.
- The Periodic Table is printed on the back page.
- The total number of marks for this paper is **60**.
- This document consists of **24** pages. Any blank pages are indicated.

Answer **all** the questions.

**Section A – Module C1**

- 1** This question is about polymers.

Polymers are made by polymerisation.

Small molecules join together to make a polymer.

- (a)** What are these small molecules called?

..... [1]

- (b)** Look at the table. It shows some information about polymers.

| polymer  | density<br>in g/cm <sup>3</sup> | melting point<br>in °C | solubility<br>in oil                       |
|----------|---------------------------------|------------------------|--------------------------------------------|
| <b>A</b> | 0.92                            | 85                     | insoluble below 80 °C, soluble above 80 °C |
| <b>B</b> | 0.96                            | 120                    | insoluble below 80 °C, soluble above 80 °C |
| <b>C</b> | 1.05                            | 65                     | soluble                                    |
| <b>D</b> | 1.39                            | 60                     | soluble                                    |
| <b>E</b> | 0.90                            | 150                    | insoluble                                  |

- (i)** Which polymer has the **lowest** density?

Choose **A, B, C, D** or **E**.

..... [1]

- (ii)** Which polymer would be best for making a pipe to carry oil at 100 °C?

Choose **A, B, C, D** or **E**.

.....

Explain your answer.

.....

.....

..... [3]

3

(c) Polystyrene is a polymer.

Write down **one** use of polystyrene.

..... [1]

(d) Polystyrene is **non-biodegradable**.

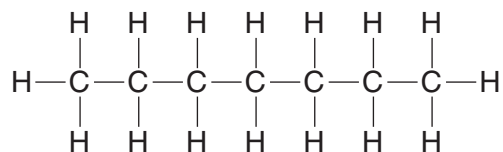
What is meant by non-biodegradable?

.....  
..... [1]

[Total: 7]

**2** Heptane is a fuel.

Look at the displayed formula for heptane.



**(a)** Complete the table to show the number of carbon and hydrogen atoms in heptane.

| element  | number of atoms |
|----------|-----------------|
| carbon   |                 |
| hydrogen |                 |

[1]

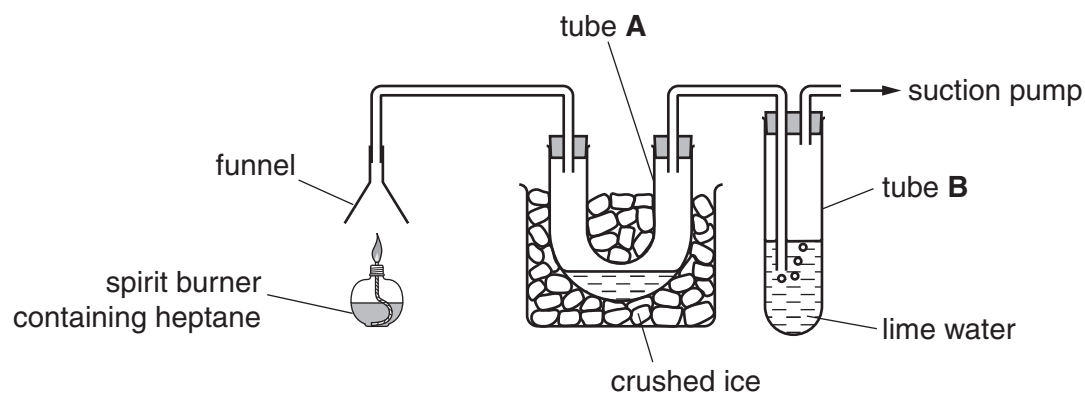
**(b)** When heptane burns, it reacts with a gas in the air.

Write down the name of this gas.

..... [1]

**(c)** Tim investigates the burning of heptane.

The diagram shows the apparatus he uses.



**(i)** Write down the name of the liquid which condenses in tube **A**.

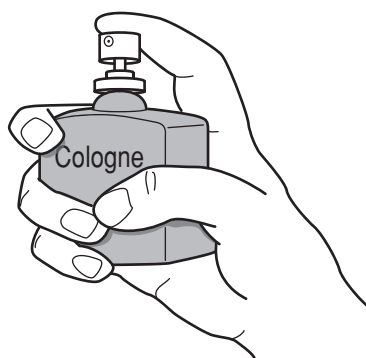
..... [1]

**(ii)** What happens to the lime water in tube **B**? Explain your answer.

.....  
 .....  
 ..... [2]

[Total: 5]

3 This question is about perfumes.



(a) Look at the following list. It shows some properties of perfumes.

Put a tick (✓) in the correct box for each property. One has been done for you.

|                           | needed by<br>perfume     | not needed<br>by perfume            |
|---------------------------|--------------------------|-------------------------------------|
| toxic                     | <input type="checkbox"/> | <input type="checkbox"/>            |
| does not react with water | <input type="checkbox"/> | <input type="checkbox"/>            |
| irritates the skin        | <input type="checkbox"/> | <input type="checkbox"/>            |
| soluble in water          | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

[2]

(b) New perfumes must be tested before they can be used.

Explain why.

.....

..... [1]

[Total: 3]

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**PLEASE DO NOT WRITE ON THIS PAGE**

4 This question is about cooking.

(a) Emily is frying an egg.

She notices that the egg changes from a liquid to a solid.

(i) Write down **one other** change that she would see.

..... [1]

(ii) Frying an egg is a chemical change.

Explain why.

Choose from this list.

**A – the process is reversible**

**B – a new substance is made**

**C – there is no energy change**

**D – eggs are mainly protein**

answer ..... [1]

(b) Emily makes a cake.

She adds **baking powder** to the mixture.

When the cake is cooked, the baking powder gives off a gas.

(i) Write down the **name** of this gas.

..... [1]

(ii) Why is baking powder added to the cake mixture?

..... [1]

(c) Baking powder is a food additive.

An **antioxidant** is another type of food additive.

What is the job of an antioxidant?

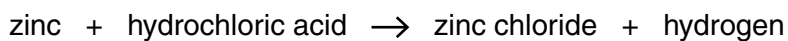
..... [1]

[Total: 5]

## Section B – Module C2

- 5 Luke and Sophie investigate the reaction between zinc and hydrochloric acid.

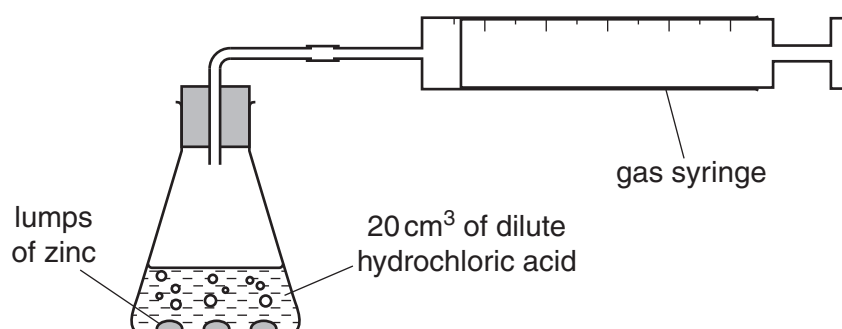
Look at the word equation for this reaction.



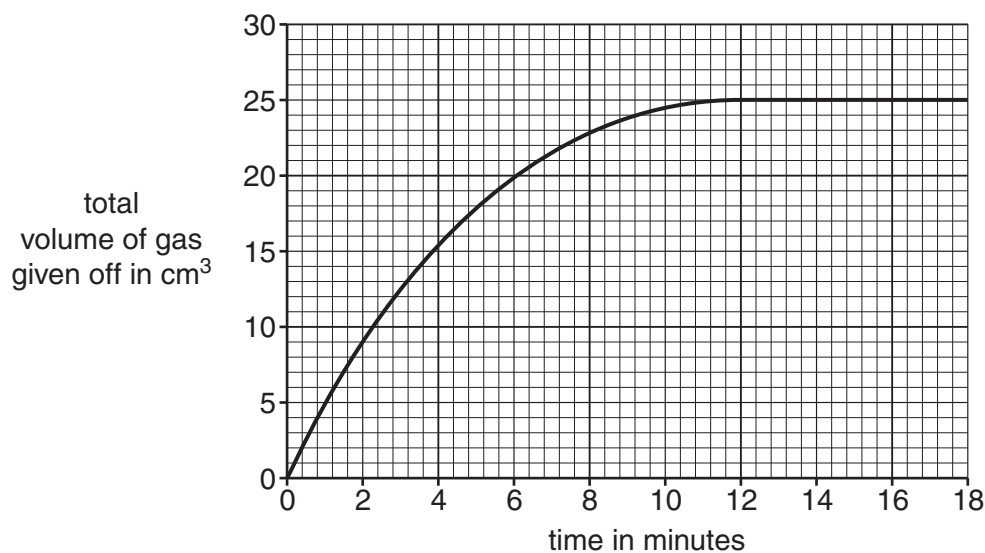
- (a) Write down the name of one **product**.

..... [1]

- (b) The diagram shows the apparatus they use.



Look at the graph of their results.



- (i) How long does it take to make 20 cm³ of gas?

..... minutes

[1]

9

(ii) The reaction stops at 12 minutes.

Why does the reaction stop?

.....  
..... [1]

(c) Luke and Sophie do the experiment again.

This time they use **powdered** zinc.

They keep the volume of acid and mass of zinc the same.

Sketch on the **graph** what their new results will look like. [2]

[Total: 5]

10

6 This question is about paints and dyes.

(a) Paint is made up of a binding material, a solvent and a pigment.

Link each **material** to its **job in the paint**.

Draw three straight lines.

| material         | job in the paint                         |
|------------------|------------------------------------------|
| solvent          | helps to stick the paint to the surface  |
| binding material | gives the paint its colour               |
| pigment          | thins the paint, making it easier to use |

[2]

(b) Jane paints a wall with emulsion paint.

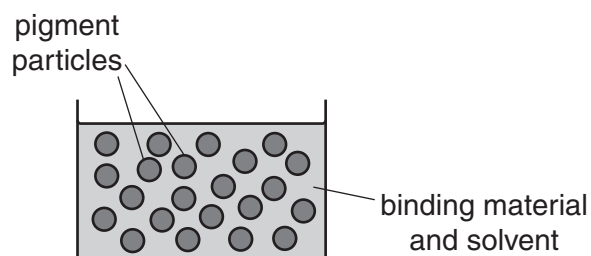
The paint dries slowly.

Describe how the paint dries.

.....  
..... [1]

11

(c) Look at the diagram of paint in a can.



Paint is a mixture.

What is the name of the type of **mixture** found in paint?

Choose from this list.

**colloid**

**compound**

**dye**

**solution**

answer ..... [1]

(d) Bob boils some onion skins in water.

He extracts a yellow dye.

What is the name given to this type of dye?

Choose from this list.

**natural**

**phosphorescent**

**synthetic**

**thermochromic**

answer ..... [1]

[Total: 5]

7 This question is about iron and aluminium.

(a) Look at the table.

It shows information about some properties of iron and aluminium.

| property                     | aluminium    | iron          |
|------------------------------|--------------|---------------|
| density in g/cm <sup>3</sup> | 2.7          | 7.9           |
| relative strength            | 1            | 2.7           |
| effect of moist air          | no corrosion | rusts quickly |
| electrical conductivity      | good         | good          |

Use the information in the table to answer the questions.

(i) Write down **one** way in which aluminium and iron are similar.

..... [1]

(ii) Write down **one** way in which aluminium is different to iron.

..... [1]

(b) The picture shows a scrap yard full of old cars.



The materials used to make these cars are recycled.

Write down **two** reasons, other than cost, why it is important to recycle these materials.

.....  
 .....  
 ..... [2]

[Total: 4]

- 8** This question is about the air.

Look at the table. It shows some of the gases in clean air.

| gas                                   | percentage in clean air |
|---------------------------------------|-------------------------|
| nitrogen                              |                         |
| oxygen                                | 21                      |
| other gases, including carbon dioxide | 1                       |

- (a)** Calculate the percentage of nitrogen in clean air from the data in the table.

answer .....%

**[1]**

- (b)** The percentages of carbon dioxide and oxygen in the air remain fairly constant.

Photosynthesis and respiration help to keep these fairly constant.

Explain how.

photosynthesis .....

.....

respiration .....

..... **[2]**

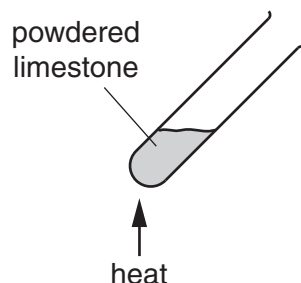
**[Total: 3]**

9 The chemical name for limestone is calcium carbonate,  $\text{CaCO}_3$ .

(a) Write down the total number of atoms in the formula  $\text{CaCO}_3$ .

..... [1]

(b) Jim heats some limestone.



Carbon dioxide,  $\text{CO}_2$ , is made.

Calcium oxide,  $\text{CaO}$ , remains in the test tube.

Write down the **balanced symbol** equation for this reaction.

..... [1]

(c) Cement is made when limestone is heated with clay.

Concrete is made from cement.

Look at the picture. It shows a bridge made of reinforced concrete.



How is concrete reinforced?

.....  
 ..... [1]

[Total: 3]

## Section C – Module C3

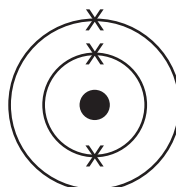
10 This question is about atoms.

Look at the diagrams. They show the atoms of some elements.

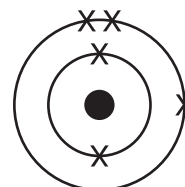
The letters do not represent the symbols for the elements.



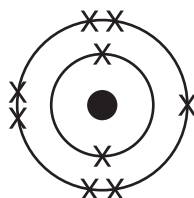
A



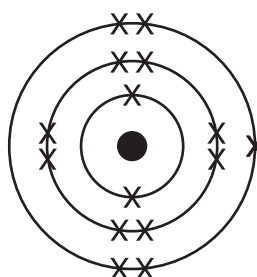
B



C



D



E

(a) (i) Element **B** is in Group 1.

How can you tell?

..... [1]

(ii) Element **E** is in Period 3.

How can you tell?

..... [1]

(iii) Which element forms an ion with a charge of  $-1$ ?

Choose **A**, **B**, **C**, **D** or **E**.

..... [1]

(b) Element **D** has an atomic number of 9.

What is the **name** of the element with atomic number 9?

Use the Periodic Table on the back page to help you.

..... [1]

16

- (c) The nucleus of an atom contains protons and neutrons.

Complete the table to show the **relative charge** and **relative mass** of a neutron.

|         | relative charge | relative mass |
|---------|-----------------|---------------|
| proton  | +1              | 1             |
| neutron | .....           | .....         |

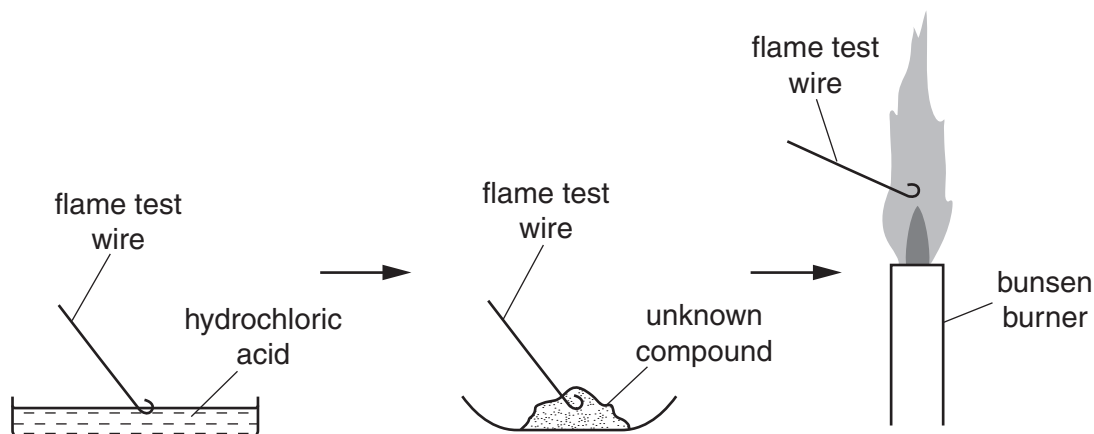
[1]

[Total: 5]

11 Irene and Bert have three unknown compounds **X**, **Y** and **Z**.

They want to identify the metals lithium, sodium and potassium in the compounds.

They use a flame test.



(a) Complete the table.

Choose your answers from **lithium**, **sodium** and **potassium**.

| compound | flame colour | metal present |
|----------|--------------|---------------|
| <b>X</b> | lilac        | .....         |
| <b>Y</b> | red          | .....         |
| <b>Z</b> | yellow       | .....         |

[2]

(b) Sodium metal is stored under oil.

Explain why.

.....  
 .....  
 ..... [2]

(c) Potassium reacts with chlorine.

Write down the **name** of the compound made.

..... [1]

[Total: 5]

12 Copper is a **transition element**.

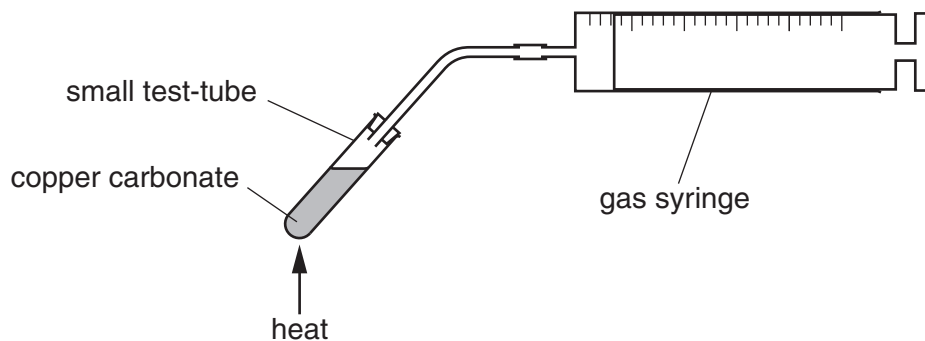
(a) Write down the name of another transition element.

Use the Periodic Table on the back page to help you.

..... [1]

(b) David investigates the heating of copper carbonate.

Look at the diagram. It shows the apparatus he uses.



When copper carbonate is heated, carbon dioxide and copper oxide are made.

This reaction is a **thermal decomposition** reaction.

What is meant by thermal decomposition?

.....  
.....  
..... [2]

[Total: 3]

- 13** In the late 1800s, photographers burned magnesium to produce a magnesium flashlight.

This was used for indoor photography.



- (a)** Magnesium burns in oxygen to make magnesium oxide.

Write the **word equation** for this reaction.

..... [1]

- (b)** Magnesium oxide contains  $\text{Mg}^{2+}$  and  $\text{O}^{2-}$  particles.

What type of particles are  $\text{Mg}^{2+}$  and  $\text{O}^{2-}$ ?

Choose from this list.

**atoms**

**ions**

**isotopes**

**molecules**

answer ..... [1]

- (c)** Look at the statements about magnesium oxide.

Put a tick (✓) in the box next to the correct statement.

magnesium oxide is an element

☐

magnesium oxide conducts electricity when solid

☐

magnesium oxide has a very high melting point

☐

[1]

[Total: 3]

Turn over

14 This question is about metals.

Look at the table.

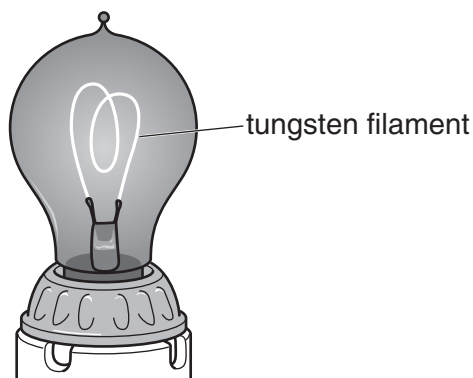
It shows some information about six metals.

| metal     | melting point in °C | density in g/cm <sup>3</sup> | tensile strength | cost      |
|-----------|---------------------|------------------------------|------------------|-----------|
| aluminium | 661                 | 2.7                          | medium           | medium    |
| copper    | 1083                | 8.9                          | medium           | medium    |
| gold      | 1065                | 19.3                         | low              | very high |
| lead      | 328                 | 11.3                         | low              | low       |
| iron      | 1535                | 7.9                          | very high        | low       |
| tungsten  | 3407                | 19.4                         | high             | high      |

(a) Which metal has a low tensile strength and a low cost?

..... [1]

(b) In an electric light bulb, the tungsten filament is heated until it glows white-hot.



The tungsten is at a temperature of over 2000 °C.

Explain why tungsten is chosen for this use.

Use the table to help you.

.....  
 ..... [1]

21

- (c) This deep-sea diver wears a belt with weights on it to keep him on the sea bed.



Gold and tungsten both have a very high density, but are **not** used to make the weights.

- (i) Explain why gold and tungsten are not used.

Use the table to help you.

.....  
 ..... [1]

- (ii) Suggest a metal that could be used to make the diver's weights.

Choose from the table.

metal .....

Explain your answer.

.....  
 ..... [1]

[Total: 4]

**END OF QUESTION PAPER**

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# The Periodic Table of the Elements

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|                               |                             |                                                                         |                                     |                               |                                  |                                |                               |                                  |                                    |                                   |                                                                                     |                             |                             |                               |                               |                              |                         |
|-------------------------------|-----------------------------|-------------------------------------------------------------------------|-------------------------------------|-------------------------------|----------------------------------|--------------------------------|-------------------------------|----------------------------------|------------------------------------|-----------------------------------|-------------------------------------------------------------------------------------|-----------------------------|-----------------------------|-------------------------------|-------------------------------|------------------------------|-------------------------|
| 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                                                              | 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                                                          | 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                                                          | 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   |                         |
| [223]<br>Fr<br>francium<br>87 | [226]<br>Ra<br>radium<br>88 | [227]<br>Ac*<br>actinium<br>89                                          | [261]<br>Rf<br>rutherfordium<br>104 | [262]<br>Db<br>dubnium<br>105 | [266]<br>Sg<br>seaborgium<br>106 | [264]<br>Bh<br>bohrium<br>107  | [277]<br>Hs<br>hassium<br>108 | [268]<br>Mt<br>meitnerium<br>109 | [271]<br>Ds<br>darmstadtium<br>110 | [272]<br>Rg<br>roentgenium<br>111 | Elements with atomic numbers 112-116 have been reported but not fully authenticated |                             |                             |                               |                               |                              |                         |

\* The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.

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