

Organising elements

This resource accompanies the infographic poster **The key elements of the periodic table** in *Education in Chemistry* which can be viewed at: rsc.li/3LsJZkd

Learning objectives

- 1 Explore the properties of common elements, commenting on similarities and differences.
- 2 Consider how common elements might be grouped, based on their properties.
- 3 Use given information to construct a simple table of elements.
- 4 Reflect on the arrangement of the periodic table, and how this supports chemists to make predictions about elements.

Introduction

The periodic table is an invaluable resource for chemists – it helps them to understand how and why elements behave the way they do and make predictions about how they'll react. It's particularly useful because, as well as listing all the known elements, it arranges them in a way that gives us further hints about what they're like. We are lucky that the arrangement of the modern periodic table has already been done for us, but this was not a straightforward task and took years to develop. In this task, learners will construct their own table of elements. To make the task simpler, they will use a limited number of elements but follow similar thought processes to the original developers of the periodic table.

How to use the resource

Print and cut out (or ask your learners to cut out) the set of nine element cards on page three. If you want to use these again then print them on card and/or laminate them. Using a different colour of card stock for each set will help to keep the cards in the correct sets.

Alternatively, use the slides to display the unknown elements and their properties instead of printing out the cards. The elements don't have to be physically sorted for learners to access the questions.

Ask learners to work in pairs or small groups to encourage discussion of their reasons for grouping the cards together. This discussion will help them with their explanations when completing the questions.

Scaffolding

For questions 1–3, use simple verbal prompts and examples to encourage learners to consider how they've grouped materials in the past and what we mean by the word 'properties'.

Why don't we make shoes out of gold? Why is gold a good material to make jewellery from? How do you know something is a metal?

For question 4, prompt learners to put the elements in order of increasing mass first, if needed. You can also show learners how the masses would be arranged through the table using simple numbers (eg 1–9).

For question 5, encourage learners to look at the relative atomic masses displayed on the periodic table if necessary.

<h1>A</h1> <p>Type: non-metal</p> <p>Colour: reddish-brown</p> <p>State (at room temperature): liquid</p> <p>Information: can be used as a flame retardant</p>	<h1>B</h1> <p>Type: metal</p> <p>Colour: silvery-white</p> <p>State (at room temperature): solid</p> <p>Information: sinks in water and burns with a bright white light</p>	<h1>C</h1> <p>Type: non-metal</p> <p>Colour: yellowish-green</p> <p>State (at room temperature): gas</p> <p>Information: kills bacteria – used to treat drinking water</p>
<h1>D</h1> <p>Type: metal</p> <p>Colour: silvery-white</p> <p>State (at room temperature): soft solid</p> <p>Information: tarnishes rapidly in air, more dense than water, reacts with water</p>	<h1>E</h1> <p>Type: metal</p> <p>Colour: silvery</p> <p>State (at room temperature): soft solid</p> <p>Information: tarnishes rapidly in air, floats on water, reacts vigorously with water</p>	<h1>F</h1> <p>Type: metal</p> <p>Colour: silvery</p> <p>State (at room temperature): soft solid</p> <p>Information: burns in air, sinks in water, reacts with water</p>
<h1>G</h1> <p>Type: metal</p> <p>Colour: silvery</p> <p>State (at room temperature): soft solid</p> <p>Information: tarnishes rapidly in air, floats on water, reacts vigorously with water – igniting with a lilac flame</p>	<h1>H</h1> <p>Type: non-metal</p> <p>Colour: silvery-grey</p> <p>State (at room temperature): solid</p> <p>Information: used in dyes and photographic chemicals</p>	<h1>I</h1> <p>Type: metal</p> <p>Colour: silvery</p> <p>State (at room temperature): soft solid</p> <p>Information: ignites in air, floats on and reacts violently with water</p>

Answers

- Any sensible answer that separates based on descriptions is acceptable, but one example might be:
A, C, H – non-metals
B, D, E, F G, I – metals
- (a) Similar to G: E or I
Explanation: float on water, react with water, react with air

(b) Very different to G: A, C, or H
Explanation: all non-metals, all different colours, A and C are a liquid and gas, respectively.

3.

	Group 1	Group 2	Group 3
Element 1	Element: C	Element: D	Element: G
Element 2	Element: A	Element: B	Element: E
Element 3	Element: H	Element: F	Element: I
Reasons for putting these elements together	Non-metals	Silvery solids, more dense* than water	Soft metals, float on water and react with water

*The phrase 'more dense' is used here instead of 'floats on water' because Calcium (element D) floats on water due to the bubbles formed when it reacts, despite it having a density of 1.55 g cm^{-3} .

4.

Group 1	Group 2	Group 3
Element: E Mass: 23	Element: B Mass: 24	Element: C Mass: 35.5
Element: G Mass: 39	Element: D Mass: 40	Element: A Mass: 80
Element: I Mass: 85.5	Element: F Mass: 88	Element: H Mass: 127

5.

Element	Identity	Explanation
A	Bromine	The relative atomic mass is the same as on the card.
B	Magnesium	
C	Chlorine	Any sensible answer that identifies the element based on the description is also acceptable. Eg. Potassium ignites with a lilac flame when it reacts with water.
D	Calcium	
E	Sodium	
F	Strontium	An answer that would not be sufficient to give a single identification is not acceptable. Eg. Rubidium is a silver solid.
G	Potassium	
H	Iodine	
I	Rubidium	

6. Elements are arranged within the same groups as in the periodic table and the mass increases in the same way through the table. Elements with similar properties are grouped together, which helps us predict how elements might behave.