Representing elements and compounds: teacher guidance

This resource forms part of the **Review my learning** series from the Royal Society of Chemistry. The worksheets assess learners' understanding of content from common 11–14 and 14–16 curriculums. They can be used to identify knowledge gaps and misconceptions once that part of the curriculum has been taught.

The Representing elements and compounds worksheets cover the following topics:

- chemical symbols
- chemical formulas of elements
- chemical formulas of simple molecular compounds
- empirical formulas of ionic compounds
- the use of models to represent elements and compounds
- the chemical formula of a polymer
- comparing different types of representation.

Scaffolding

Level 1 (*) is a scaffolded worksheet which supports learners in a variety of ways, such as selecting words from a word bank, providing answer options to choose from or completed examples. Level 2 (**) is a partially scaffolded worksheet with a reduced level of support, such as partially completed sentences or a wider range of answer options to select from. Level 3 (***) is an unscaffolded worksheet in which most of the tasks involve answering questions with a minimum of prompts.

Metacognition

The 'What do I understand?' page is common to all levels of worksheet and can be used both to identify areas needing whole class attention and as an indicator for learners to help guide their revision.

Below you will find model answers for each level and guidance on learners' misconceptions. Learners can use the model answers to self- or peer assess.

When to use

The worksheets can be used in a variety of ways:

- To assess learners' knowledge at the beginning or end of a period of teaching. Match the level of the worksheet to the support needs of the learners.
- To assess knowledge during a period of teaching once learners have completed the relevant topic.

- As part of revision.
- As a refresher exercise for teachers or non-subject specialists.

There is also scope to increase the level of worksheet used as learners progress through their curriculum.

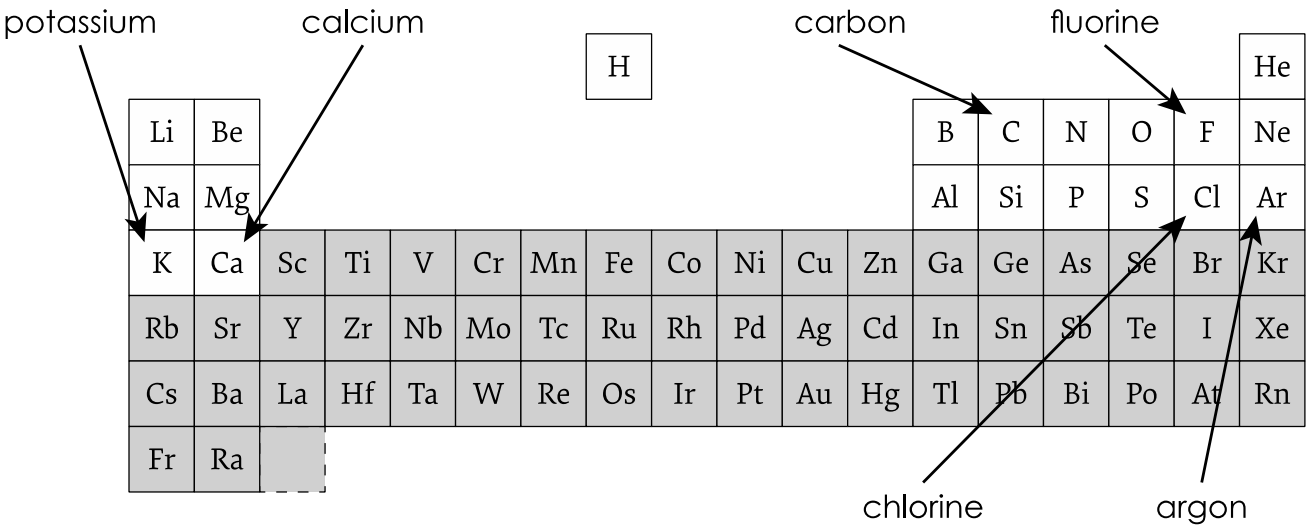
Further support

For more resources to support teaching of this topic and address any misconceptions identified, go to **rsc.li/3vkZZzj**.

Answers

Representing elements and compounds: knowledge check

1.1 (Level 1, 2 and 3)



Guidance: Learners need to be familiar with the symbols for the first twenty elements. Learners need to be aware that the first letter in a chemical symbol is always a capital letter. Subsequent letters are lower case. Chemical symbols that are derived from other languages may present difficulty for some learners. For example, the symbol for sodium, Na, comes from the Latin name '*natrium*' and the symbol for potassium, K, comes from the Latin name '*kalium*'.

1.2 (Level 1 and 2)

a) An element consists of **one type** of atom only.

b) There are 92 naturally occurring **elements**.

c) A chemical symbol represents one atom of an element. For example, the symbol Ne represents one atom of **neon**.

d) Some elements naturally exist as two or more atoms bonded together to form **molecules**.

e) A molecule of chlorine gas has the chemical formula $\mathrm{Cl_2}$. The subscript '2' shows that there **are two atoms** of chlorine bonded together in one molecule.

(Level 3)

(a) One type of atom.

(b) 92

(c) neon

(d) molecules

(e) There are two atoms of chlorine bonded together in one molecule

Guidance: Learners need to realise that elements can exist as individual atoms or as molecules. A common misconception is that elements only exist as atoms and molecules are always compounds. The use of molecular model kits can help learners with their understanding.

1.3 (Level 1 and 2)

a) more

b) covalent

c) one; three

d) two

e) molecule

(Level 3)

(a) One type of atom.

(b) covalent

(c) one; three

(d) two

(e) molecule

Guidance: A common misunderstanding is that all compounds consist of molecules. Learners commonly refer to molecules of ionic compounds, for example describing a molecule of sodium chloride, and this is incorrect. They need to realise that only covalent substances form molecules. Ionic compounds form large ionic structures.

1.4 (Level 1)

(a) false

(b) true

(c) true

(d) false

(e) false

(Level 2 and 3)

ionic; sodium; chloride; one; empirical; one; two

Guidance: The guidance in question 1.3 also applies to this question. A common error in learners' understanding is describing sodium chloride as containing one sodium atom and one chloride atom and representing it as a particle containing two atoms, instead of as an ionic lattice. Unfortunately, this misunderstanding is also found on several websites.

Representing elements and compounds: test myself

2.1 (Level 1, 2 and 3)

S_8 represents **a molecule**.

Guidance: See guidance for question 1.2.

2.2 (Level 1, 2 and 3)

Ni represents an element.

Guidance: See guidance for questions 1.1 and 1.2.

2.3 (Level 1, 2 and 3)

The chemical formula for an element that exists as single atoms is **Ar**.

Guidance: See guidance for question 1.2.

2.4 (Level 1, 2 and 3)

NO and NH_3 represent compounds.

Guidance: See guidance for questions 1.1 and 1.2. If learners do not clearly distinguish between upper- and lower-case letters when writing chemical formulas, NO can appear to be No, the element nobelium and not the compound NO.

2.5 (Level: 1, 2 and 3)

The formula is NH_3.

Guidance: Using models is another way to represent elements and compounds. They can provide more information about a molecule than a molecular formula, but learners need to be aware of the actual sizes of the molecules represented.

2.6 (Level: 1, 2 and 3)

There are **four** atoms of hydrogen in one molecule of CH_3COOH.

Guidance: See guidance for question 1.3.

2.7 (Level 1)

a) one

b) one

c) one magnesium ion to one oxide ion

(Level 2 and 3)

The ratio of magnesium ions to oxide ions is **1:1**.

Guidance: See guidance for question 1.4. Learners need to realise that chemical formulas for molecules are molecular formulas and chemical formulas for ionic compounds are empirical formulas.

2.8 **(Level: 1)**

a) two

b) one

c) two sodium ions to one oxide ion

(Level: 2 and 3)

The ratio of sodium ions to oxide ions is **2:1**.

Guidance: See guidance for question 2.7.

2.9 **(Level 1, 2 and 3)**

The element is **C**.

Guidance: See guidance for questions 1.3, 1.4, 2.4, 2.5 and 2.7.

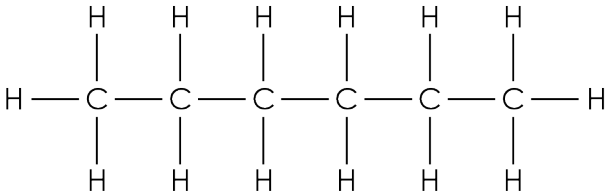
2.10 **(Level 1, 2 and 3)**

The ionic compound is **D**.

Guidance: See guidance for questions 1.3, 1.4, 2.4, 2.5 and 2.7.

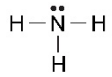
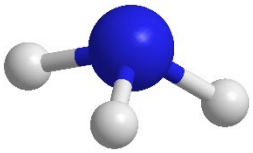
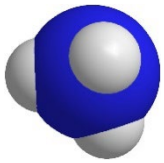
Representing elements and compounds: feeling confident?

3.1 **(Level 1, 2 and 3)**



Guidance: Learners may draw this showing the zig-zag chain of carbon atoms, especially if they have used model kits to make the structure. Help can be provided by allowing learners to join three monomers of ethene to make a section of a poly(ethene) molecule.

3.2 (Level 1, 2 and 3)

	NH_3			
Does it show the different types of atoms?	✓	✓	✓ **Guidance**: The spheres differ in size and colour.	✓ **Guidance**: The spheres differ in size and colour.
Does it show how the atoms are arranged?	✗	✓	✓	✓
Does it show the molecule in three dimensions?	✗	✗	✓	✓
Does it show the chemical bonds?	✗	✓	✓	✓ **Guidance**: Learners may query this as the closely packed model does not have 'stick' bonds, but the nature of a covalent bond is shared electrons, so this is a better representation of ammonia.

Guidance: This question can be used to encourage learners to assess the advantages and disadvantages of different types of models or formulas.

Representing elements and compounds: what do I understand?

Mini-topic	Assessed via:
I can write names of the elements from their chemical symbols.	1.1, 1.2
I can write chemical formulas of elements.	1.2, 2.2, 2.3
I can write chemical formulas of simple molecular compounds.	1.3, 2.1, 2.5, 2.6, 3.2
I can write chemical formulas of ionic compounds.	1.4, 2.7, 2.8
I can use models to represent elements and compounds.	1.2, 1.3, 1.4, 2.5, 2.9, 2.10, 3.2
Feeling confident? topics	**Assessed via:**
I can write the chemical formula of a polymer.	3.1
I can compare different types of representation.	3.2