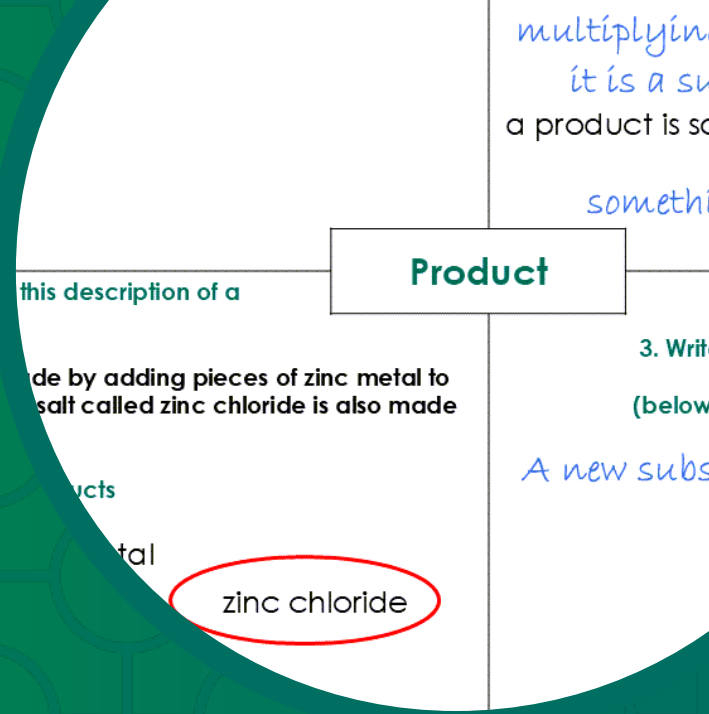
11–14 years

Introducing chemical change: Frayer models



ROYAL SOCIETY OF CHEMISTRY

Education
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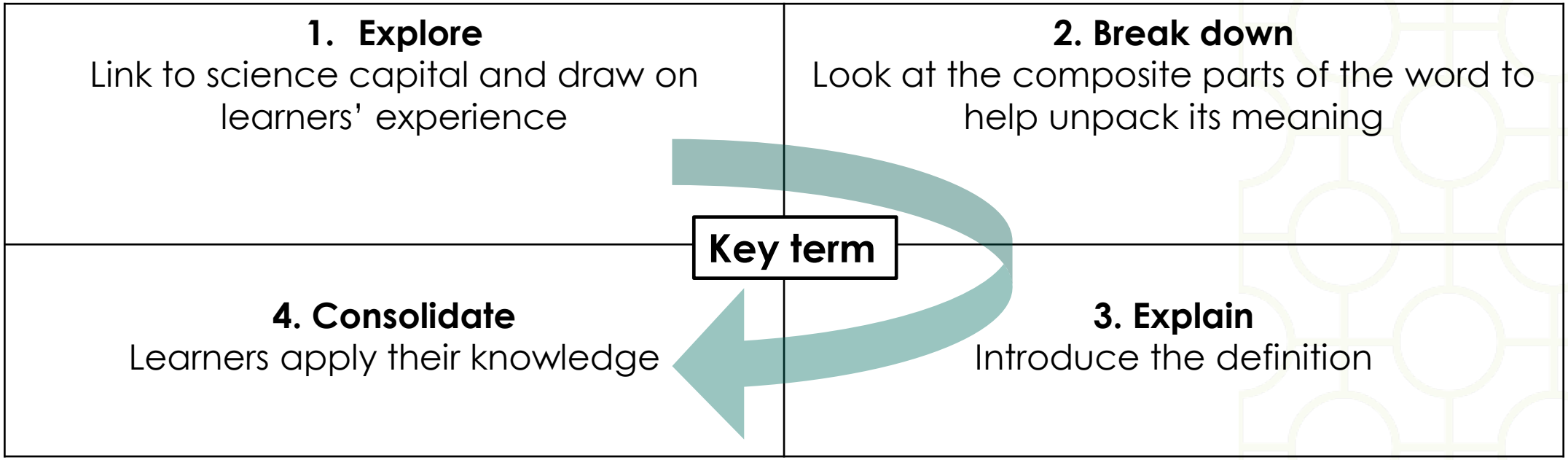
How to use Frayer models

Frayer models are a simple but effective way to develop learners' understanding of a new piece of vocabulary. You will see what your learners already know and identify any misconceptions they have.

There are four stages to work through, but you can adapt this model to best suit your learners. You can guide learners through all quadrants, but particularly quadrant 2 works best as a teacher-led discussion. Quadrant 3 might also need/benefit from some discussion.



Find more guidance including tips, adaptations and further reading, in the teacher notes: rsc.li/3Rej6T9.

Chemical reaction/change

1. What does the word 'reaction' mean to you? Where have you come across this word (or parts of this word) before?

Here are some ideas.

- Other similar words beginning with 're' are 'response' and 'repeat' – in what way are they similar to 'reaction'?
- What do we mean when we use the word 'reaction' to describe how someone behaves when something happens to them?

2. What do we know about the terms 'chemical reaction' or 'chemical change'?

Chemical reaction and chemical change are two terms for the same thing, so what do we mean by:

reaction

change

How is a **chemical** change different from a **physical** change?

4. Circle the statement below that applies to a chemical reaction or chemical change and not to a physical change.

A **one or more new substances are formed**

B **it may be accompanied by a transfer of energy to or from the surroundings**

C **it involves a change in state**

D **the atoms emit ionising radiation**

3. Write down what you think 'chemical reaction' means (complete the sentence).

When one or more new substances …

Compare what you wrote with the definition (slide 6).

Product

1. What does the word ‘product’ mean to you? Where have you come across this word (or parts of this word) before?

Here are some ideas.

- A ‘product’ in maths is the answer you get when you multiply numbers together.
- In chemistry, the word ‘product’ is used more like in everyday use – to describe something that is produced by a process.
- Here is an example ‘the art student was really pleased with the finished product’.

2. What do we know about the word ‘product’?

It means something different in chemistry than in maths.

A product is something that is produced – what does ‘produced’ mean?

3. Write down what you think ‘product’ means (fill in the missing words).

A new _____ that

is _____

in a _____ reaction.

4. Identify the products from this description of a chemical reaction.

Hydrogen gas can be made by adding pieces of zinc metal to dilute hydrochloric acid. A salt called zinc chloride is also made by this reaction.

Draw a circle around the products.

zinc metal

hydrogen gas

zinc chloride

hydrochloric acid

Compare what you wrote with the definition (slide 7).

Chemical formula

1. What does the term 'chemical formula' mean to you? Where have you come across this phrase (or parts of this phrase) before?

Here are some ideas.

- A mathematical formula is a calculation for a specific purpose – for example $\text{density} = \frac{\text{mass}}{\text{volume}}$
- We might also use 'formula' to describe how to make a mixture – for example 'she followed the formula to make the perfume'
- A chemical formula is is made from the symbols for the elements.

2. What do we know about the term 'chemical formula'?

The word 'formula' has got several slightly different meanings – how does a chemical formula differ from a mathematical formula or a formula like a recipe?

3. Write down what you think 'chemical formula' means (fill in the missing words).

Uses chemical _____ to show the relative _____ of the atoms of each _____ in a substance.

4. Identify the row in the table that shows the relative number of atoms of each element shown by the chemical formula below.

H_2CO

	Carbon C	Cobalt Co	Hydrogen H	Oxygen O
A	2	0	1	1
B	0	2	1	0
C	1	0	2	1
D	0	1	2	0

Compare what you wrote with the definition (slide 8).

Chemical reaction/change

1. What does the word 'reaction' mean to you? Where have you come across this word (or parts of this word) before?

Here are some ideas.

- Other similar words beginning with 're' are 'response' and 'repeat' – in what way are they similar to 'reaction'?
- We also use 'reaction' to describe how someone behaves when something happens to them.

2. What do we know about the terms 'chemical reaction' or 'chemical change'?

Chemical reaction and chemical change are two terms for the same thing, so what do we mean by:

reaction

Something that happens – caused by something else.

change

A process where something becomes different.

The word 'chemical' is used to distinguish this type of change from a physical change.

3. Write down what you think 'chemical reaction' means (complete the sentence).

When one or more new substances …

are made from other substances.

(Below is the definition from the key terms list)

When one or more new substances are made from other substances.

4. Circle the statement below that applies to a chemical reaction or chemical change and not to a physical change.

A **one or more new substances are formed**

B **it may be accompanied by a transfer of energy to or from the surroundings**

C **it involves a change in state**

D **the atoms emit ionising radiation**

Product

1. What does the word 'product' mean to you? Where have you come across this word (or parts of this word) before?

Here are some ideas.

- A mathematical formula is a calculation for a specific purpose – for example $\text{density} = \frac{\text{mass}}{\text{volume}}$
- We might also use 'formula' to describe how to make a mixture – for example 'she followed the formula to make the perfume'
- A chemical formula is is made from the symbols for the elements.

2. What do we know about the word 'product'?

It means something different in chemistry than in maths …

In maths a product is what you get by multiplying numbers together. In chemistry it is a substance you get from a reaction.

A product is something that is produced – what does 'produced' mean?

Something that is made by a process.

3. Write down what you think 'product' means (fill in the missing words).

A new substance that is made in a chemical reaction.

(Below is the definition from the key terms list.)

A new substance that is made in a chemical reaction.

4. Identify the products from this description of a chemical reaction.

Hydrogen gas can be made by adding pieces of zinc metal to dilute hydrochloric acid. A salt called zinc chloride is also made by this reaction.

Draw a circle around the products.

zinc metal

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Chemical formula

1. What does the term 'chemical formula' mean to you? Where have you come across this phrase (or parts of this phrase) before?

Here are some ideas.

- A mathematical formula is a calculation for a specific purpose – for example $\text{density} = \frac{\text{mass}}{\text{volume}}$
- We might also use 'formula' to mean a particular mixture we have made – for example "she made some formula milk for her baby"
- A chemical formula is is made from the symbols for the elements.

2. What do we know about the term 'chemical formula'?

The word 'formula' has got several slightly different meanings – how does a chemical formula differ from a mathematical formula or a formula like a recipe?

In maths a formula shows us how to calculate something, e.g. $f = m \times a$

A formula is a mixture made for a specific purpose, such as a medicine.

A chemical formula contains symbols for the elements in a substance.

3. Write down what you think 'chemical formula' means (fill in the missing words).

Uses chemical symbols to show the relative number of the atoms of each element in a substance.

(Below is the definition from the key terms list.)

Uses chemical symbols to show the relative

4. Identify the row in the table that shows the relative number of atoms of each element shown by the chemical formula below.

H_2CO

	Carbon C	Cobalt Co	Hydrogen H	Oxygen O
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1. Explore

Link to science capital and draw on learners' experience.

2. Break down/'what do we know about X?'

Look at composite parts of the word to help unpack its meaning.

Or invite learners to suggest what, as a class, they already know about the key term (with the help of a few bullet points).

Select your key term

3. Explain

Introduce the definition.

4. Consolidate

Learners apply their knowledge.