

14–16 years



Elements, compounds and mixtures: Frayer models



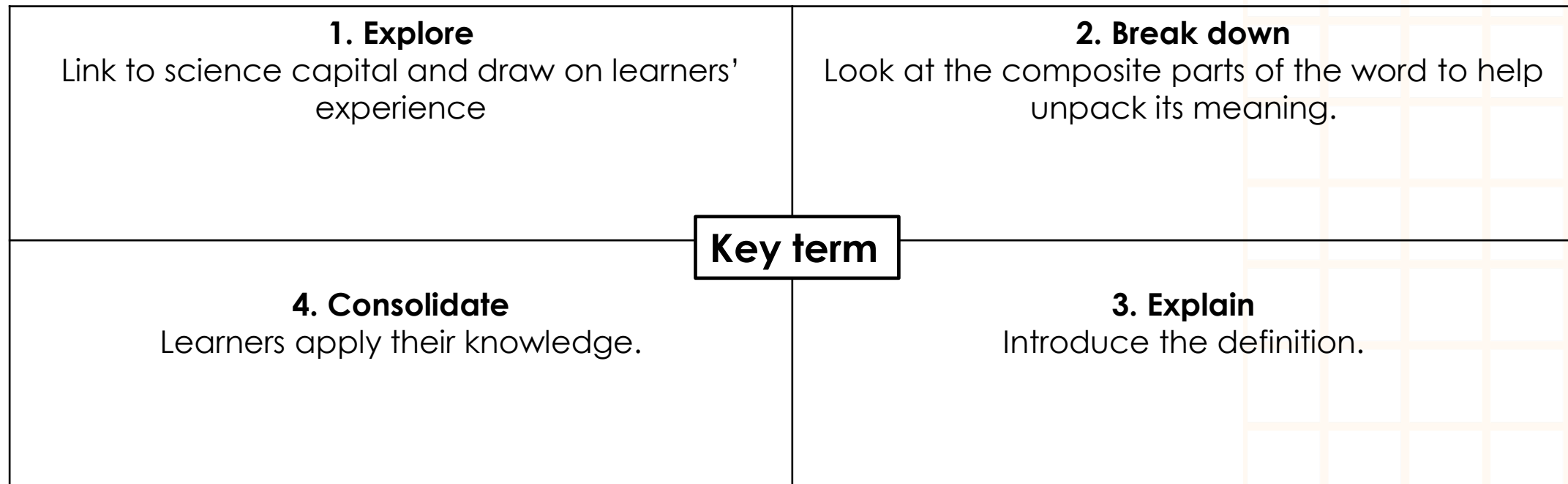
Education
Inspiring your teaching and learning

Downloaded from rsc.li/4j5xfyj,
unscaffolded version and teacher
notes also available

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 learners can 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/4j5xfyj](https://www.rsc.li/4j5xfyj)



1. What does the word 'dilute' mean to you?

Where have you come across this term (or parts of this term) before?

Here are some ideas.

- You may have diluted a drink to make it taste less strong. For example, what happens to the taste of your drink when the ice in it melts?
 - **Dis**location means 'apart from its location'.

2. Break down the word 'dilute'.

di-

- **Di-** is a shortened form of the prefix **dis-**
- **Disease** means 'apart from being at ease'.
 - **Distant** means 'to stand apart'.
- What does the prefix '**dis**' or '**di**' mean?

dilute

-lute

From Latin *luĕre* 'to wash'

4. A learner makes up two solutions.

In solution A, she dissolves 10 g of solute in 100 cm³ of solvent.

In solution B, she dissolves 2 g of solute in 100 cm³ of solvent.

Which solution is more dilute? Explain your answer.

3. Write down what you think 'dilute' means.

Put together your understanding of the parts di- and -lute to form the definition.

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



1. What does the word 'concentrated' mean to you?

Where have you come across this word (or parts of this word) before?

Here are some ideas.

- You might ask someone to make you a drink from a concentrated fruit juice or squash. What does this mean?
- If a perfume is very **concentrated**, you only need to use a little of it. Why?

2. Break down the word 'concentrated'.

con-

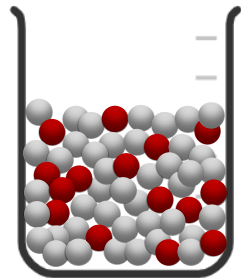
Prefix meaning 'with' or 'together'.

centr-

From classical Latin centrum meaning 'centre'.

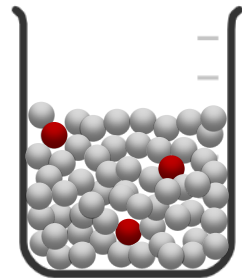
concentrated

4. Explain which image represents a more concentrated solution?



Solution X

- solvent
- solute



Solution Y

3. Write down what you think 'concentrated' means.

Put together your understanding of the parts of the word to form the definition.

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



1. What does the word 'precipitate' mean to you?

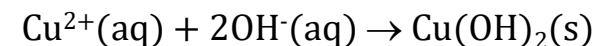
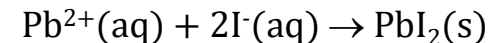
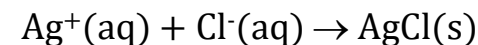
Where have you come across this word (or parts of this word) before?

Here's an idea.

- In meteorology, **precipitation** is used to refer to water falling from the sky. This is usually rain, but it can also be snow, sleet or hail.

2. What do we know about precipitates?

Each of the equations below are simple ionic equations for precipitation reactions. What do they have in common?



State symbols: (s) solid; (l) liquid; (g) gas; (aq) aqueous

precipitate

4. A learner investigated the effect of concentration on rate of reaction using the reaction shown below:



They measured the reaction rate by timing how long it took for a set amount of precipitate to form. Which product is the precipitate?

3. Complete the sentence about the formation of precipitates by choosing the correct option.

A precipitate is **a soluble/an insoluble** substance formed from the reaction of two **soluble/insoluble** substances.

Compare your answer with the definition (slide 9).



1. What does the word 'formulation' mean to you?

Where have you come across this term (or parts of this term) before?

Here are some ideas.

- What different types of **formula** have you met in chemistry?
 - Milk for babies is often referred to as baby **formula** milk.
- **Educ~~ation~~** (noun) is the process of acquiring knowledge and understanding.
- **Condens~~ation~~** (noun) is anything that has condensed from a vapour.

2. Break down the word 'formulation'.

formula-

A formula gives the proportions of the different components in a substance or mixture.

-ation or -tion

Suffix meaning 'the action or resulting state'.

formulation

4. A sample of stainless steel contains:

72.3% Fe; 16% Cr; 7.5% Mn; 4% Ni; 0.15% C and 0.05% P.

Explain why this is an example of a formulation.

3. Write down what you think a formulation is.

Put together your understanding of the parts of the word to form the definition.

Compare what you wrote with the definition (slide 10).



1. What does the word 'dilute' mean to you?

Where have you come across this term (or parts of this term) before?

2. Break down the word 'dilute'.

di-

Prefix meaning 'apart' or 'not'.

-lute

From Latin *luere* 'to wash'.

dilute

washed apart

dilute

4. A learner makes up two solutions.

In solution A, she dissolves 10 g of solute in 100 cm³ of solvent.

In solution B, she dissolves 2 g of solute in 100 cm³ of solvent.

Which solution is the more dilute? Explain your answer.

Solution B is more dilute because it contains less solute dissolved in 100 cm³ of the solvent.

3. Write down what you think 'dilute' means (below is the definition from the key terms list).

When there is not very much solute dissolved in a particular volume of solvent.

Encourage learners to compare their attempted definition with this one.



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

2. Break down the word 'concentrated'.

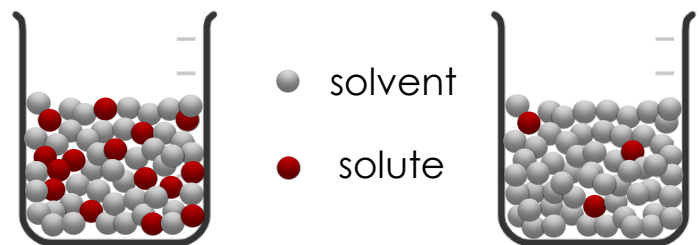
con-
Prefix meaning 'with' or 'together'

centr-
From **classical Latin** 'centrum' meaning centre

concentrated
Brought together to a common centre

concentrated

4. Explain which image represents a more concentrated solution



Solution X

Solution Y

● solvent
● solute

Solution X is more concentrated because there are more particles of solute dissolved in the same volume of solvent.

3. Write down what you think 'concentrated' means (below is the definition from the key terms list).

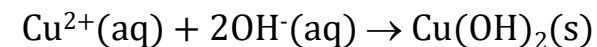
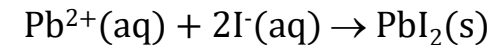
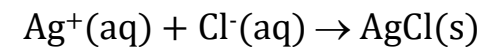
When there is a lot of solute dissolved in a particular volume of solvent.

Encourage learners to compare their attempted definition with this one.

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

2. What do we know about precipitates?

Each of the equations below are simple ionic equations for precipitation reactions. What do they have in common?



State symbols; (s) solid; (l) liquid; (g) gas; (aq) aqueous

They all form a solid from two aqueous solutions.

precipitate

4. A learner investigated the effect of concentration on rate of reaction using the reaction shown below:



They measured the reaction rate by timing how long it took for a set amount of precipitate to form. Which product is the precipitate?

S(s) or sulfur

3. Complete the sentence about the formation of precipitates by choosing the correct option.

A precipitate is an **insoluble** substance formed from the reaction of two **soluble** substances.

(below is the definition from the key terms list)

An insoluble solid that is formed within a solution during a chemical reaction between two soluble substances.

formulation

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

2. Break down the word 'formulation'.

formula-

A formula gives the proportions of the different components in a substance or mixture.

-ation or -tion

Suffix meaning 'the action or resulting state'.

formulation

The state obtained from mixing components in a specific proportion.

**4. A sample of stainless steel contains;
72.3% Fe; 16% Cr; 7.5% Mn; 4% Ni; 0.15% C and 0.05% P
Explain why this is an example of a formulation.**

This is a formulation because the stainless steel is a mixture containing elements in carefully measured proportions.

3. Write down what you think a formulation is (below is the definition from the key terms list).

A mixture that has been designed as a useful product, made by mixing substances in carefully measured quantities, such as paint or medicines.

Encourage learners to compare their attempted definition with this one.

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

4. Consolidate

Learners apply their knowledge.

3. Explain

Introduce the definition.