11–14 years

Particle model: Frayer models

ROYAL SOCIETY OF CHEMISTRY

Education
Inspiring your teaching and learning

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 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.

1. Explore Link to science capital and draw on learners' experience	**2. Break down** Look at the composite parts of the word to help unpack its meaning.
4. Consolidate Learners apply their knowledge.	**3. Explain** Introduce the definition.

Key term

Find more guidance including tips, adaptations and further reading, in the teacher notes: rsc.li/4cmvSbS

Concentration

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

Here are some ideas:

- Have you seen the word concentration before, in science? If you dilute some fruit squash with water, you make it to a certain concentration (for example, one part squash, three parts water).
- Concentric circles have the same centre.
- Conferences are where people meet with each other to talk about the same thing.

2. Break down concentration

Con
with, together

centr
the middle

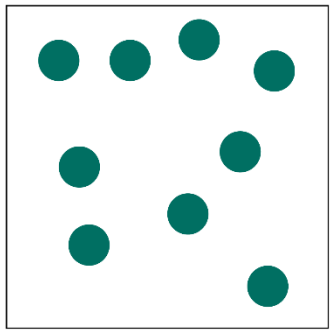
ation
the action or process of doing something

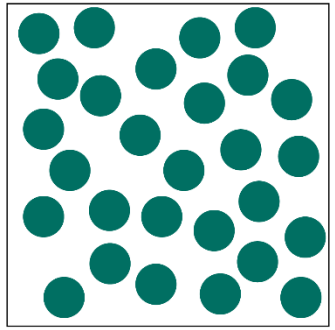
Suggest a meaning for concentration by bringing these word parts together

3. Complete the sentence starter about the word concentration

Concentration is the amount of solute present in…

4. Which of the following diagrams shows the more concentrated solution?





Copy the definition from the key terms list

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

Here are some ideas:

- Dissolve contains 'dis', like disappear or disarm. Both words involve something being apart from something else.
- Have you seen the word dissolve before? In film-making, one scene can dissolve into another.

2. Break down dissolve

Dis

from Latin word dis which means apart

solve

from Latin word solver which means loosen

Suggest a meaning for dissolve by bringing these word parts together

Dissolve

4. How is dissolving different from melting?

Answer the question by filling in the word gaps to complete the sentence below

When a solid melts, it changes state and turns into a _____, but it is still the same substance.

However, when one substance is dissolved in another substance, together they are now a _____.

3. Complete the sentence starter about the word dissolve

Dissolve is when a solute is added to a solvent and the solute…

Copy the definition from the key terms list

Sublime

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

Here is an idea:

- Have you heard the word sublime before? It is sometimes used like brilliant or amazing. ‘That cake was sublime!’

2. What do we know about sublime?

It’s from a latin word ‘sublimare’, which means to ‘lift up’ or ‘raise’.

You could picture the solid being lifted ‘above’ the liquid phase and straight to being a gas.

3. Complete the sentence starter about the word sublime

Sublime is when a solid is heated, gains energy and…

4. Give an example of a substance which does not sublime

Copy the definition from the key terms list

Diffusion

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

Here are some ideas:

- Substances can diffuse in and out of cells in the body. So, diffusion is about movement.
- An incense diffuser is used to release nice smells into the air.

2. What do we know about diffusion?

From Latin, 'diffundere' meaning 'to scatter or pour out in all directions'.

Diffusion is how a smell spreads across a room, like when someone sprays perfume.

Gases and liquids can diffuse.

Diffusion involves particles spreading out.

3. Complete the sentence starter about the word diffusion

Diffusion is the movement of a

substance from…

4. Circle one or more of the factors below which can affect the rate (speed) of diffusion

- Temperature
- Surface area
- Time of day
- Concentration gradient

Copy the definition from the key terms list

Exothermic

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

Here are some ideas:

- Exothermic contains ‘exo’, like in exoskeleton. For example, Iron Man’s exoskeleton suit is worn on the outside of the body (whereas a human skeleton is inside the body).
- Exothermic contains ‘therm’, like thermometer or thermal socks.

2. Break down exothermic

Exo

out, for example exit

thermic

heat

Suggest a meaning for exothermic by bringing these word parts together

3. Complete the sentence starter about the word exothermic

Exothermic is a physical change or chemical reaction which transfers…

4. Circle which of the following reactions are exothermic

You may find it useful to fill in the temperature difference column.

Reaction	Temperature before (°C)	Temperature after (°C)	Temperature difference
A + B	23	56	
F + M	22	10	
T + Q	10	78	

Copy the definition from the key terms list

Endothermic

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

Here are some ideas:

- Endothermic contains ‘endo’, like in endoscopy – looking inside the body with a camera.
- Endothermic contains ‘therm’, like thermometer or thermal socks.

2. Break down endothermic

Endo

in

thermic

heat

Suggest a meaning for endothermic by bringing these word parts together

3. Complete the sentence starter about the word endothermic

Endothermic is a physical change or chemical reaction which transfers…

4. Circle which of the following reactions are endothermic

You may find it useful to fill in the temperature difference column.

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Copy the definition from the key terms list

Concentration

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

2. Break down concentration

Con

With, together, collecting

centr

Central point, the middle

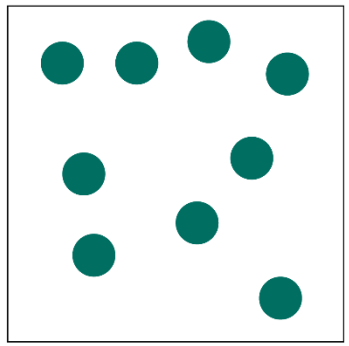
ation

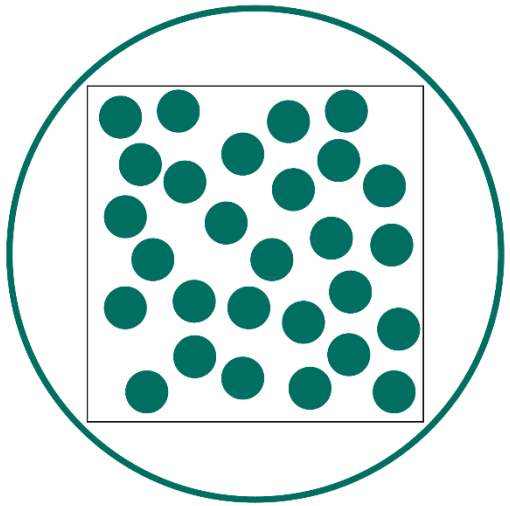
The action or process of doing something

3. Define concentration, in a chemistry context

The amount of solute present in a known volume of solution.

4. Which of the following diagrams shows the more concentrated solution?





Dissolve

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

2. Break down dissolve

Dis

From Latin, 'dis' = apart

solve

From Latin, 'solvere' = loosen

3. Define dissolve

When a solute is added to a solvent and the solute breaks into much smaller particles and spreads out.

4. How is dissolving different from melting?

When a solid melts, it changes state and turns into a liquid, but it is still the same substance.

However, when one substance is dissolved in another substance, together they are now a solution.

Sublime

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

2. What do we know about sublimation?

Sublime

From Latin, 'sublimare'
Meaning 'to lift up' or 'to raise'

Related to 'sublime', also from Latin meaning 'high up'

3. Define sublime

When a solid is heated, gains energy and turns into a gas, without turning into a liquid first

4. Give an example of a substance which does not sublime

e.g. water. Anything that when heated in its solid state, becomes a liquid before becoming a gas.

Diffusion

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

2. What do we know about diffusion?

Diffusion

From Latin, 'diffundere' meaning 'to scatter or pour out in all directions'.

From Latin prefix dis = 'apart' and
fundere = 'to pour'

3. Define diffusion

The movement of a substance from an area of high concentration to an area of low concentration.

4. Name one factor which can affect the rate (speed) of diffusion

Temperature
Surface area
Concentration gradient

Exothermic

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

2. Break down exothermic

Exo

Out, for example the exit is where you go out

thermic

Heat

Put the words together and exothermic means to give out heat.

3. Define exothermic

A physical change or chemical reaction which transfers energy to its surroundings, causing the surroundings to get hotter.

4. Circle which of the following reactions are exothermic

You may find it useful to fill in the temperature difference column.

Reaction	Temperature before (°C)	Temperature after (°C)	Temperature difference
A + B	23	56	+33
F + M	22	10	-12
T + Q	10	78	+68

Endothermic

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

2. Break down endothermic

Endo

In

thermic

Heat

Put the words together and endothermic means to take in heat.

3. Define endothermic

A physical change or chemical reaction which transfers energy from its surroundings, causing the surroundings to get cooler.

4. Circle which of the following reactions are endothermic

You may find it useful to fill in the temperature difference column.

Reaction	Temperature before (°C)	Temperature after (°C)	Temperature difference
A + B	23	56	+33
F + M	22	10	-12
T + Q	10	78	+68

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.