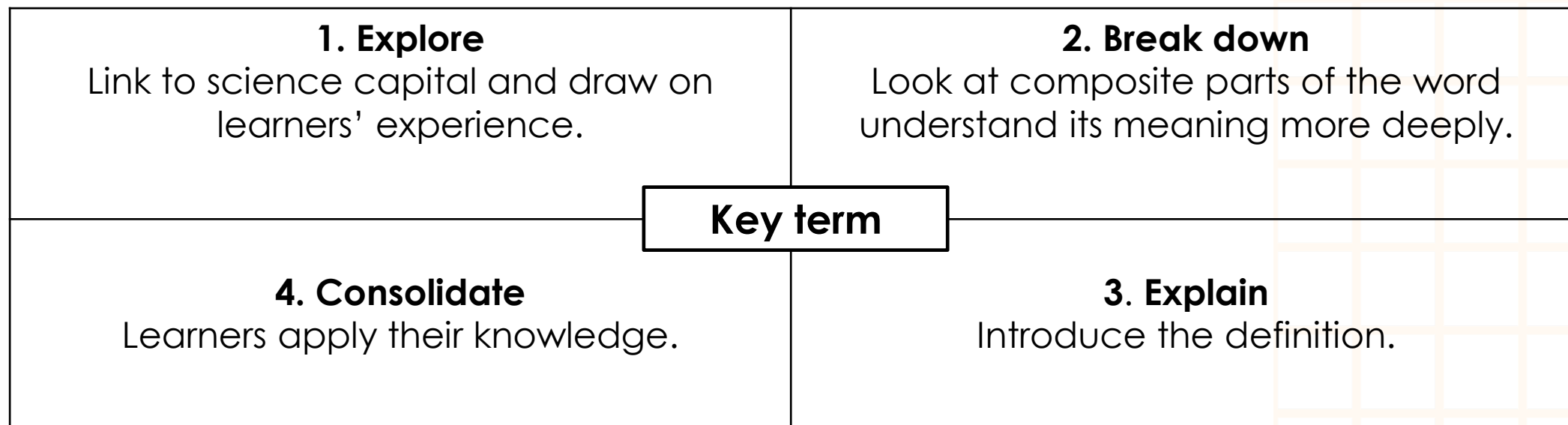**14–16 years**

Structure and bonding: Frayer models

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	**2. Break down**
Link to science capital and draw on learners' experience.	Look at composite parts of the word understand its meaning more deeply.

Key term

4. Consolidate	**3. Explain**
Learners apply their knowledge.	Introduce the definition.

Find more guidance, including tips, adaptations and further reading, in the teacher notes: rsc.li/444TbFh

1. What does the word atom 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 atom before? An atom bomb is a very powerful weapon.
- Atoms are very small.
- The word atom starts with 'a', like apart.
- Apart describes something that is separate from something else. In other words, it's **not** a part of something else.

2. Break down atom

a

not

tom

from tomos which means to cut

Suggest what atom means, by bringing the parts of the word together

Atom

4. Circle the diagram below that best illustrates a single atom of hydrogen

3. Complete the sentence starters about the word atom

Atoms are the smallest possible…

Copy the definition from the key terms list

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

Here are some ideas:

- The word compound contains 'com', like in the word compare.
- When you compare things, you bring them together to look at similarities and differences.
- Have you seen the word compound before? If a problem is made worse by something else bad happening, you could say it has compounded the problem.

2. Break down compound

com

with or together

pound

from position and means to put

Suggest what compound means, by bringing the parts of the word together

Compound

4. Circle the boxes that contain only one compound

3. Complete the sentence starter about the word compound

A compound is a pure substance made of two or more…

Copy the definition from the key terms list

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

Here are some ideas:

- The word molecule contains 'mol', like molar teeth, and the animal called a mole.
- Molecule contains 'cule', like miniscule which means really small.

2. What do we know about molecules?
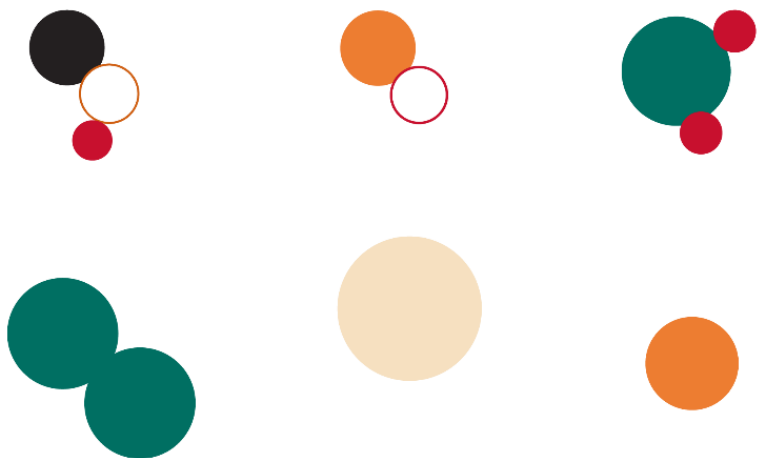
Molecules are made up of atoms.

They can be big (can you think of an example?) or small (can you think of an example?)

Molecules contain chemical bonds.

Molecule

4. Draw a ring around the images which represent molecules below

3. Complete the sentence starter about the word molecule

A molecule is two or more…

connected by…

Copy the definition from the key terms list

Element

1. What does the word element mean to you? Where have you come across this word before?

Here are some ideas:

- Have you seen the word element before? Sometimes it means parts, like the elements of a good story.
- The first school learners go to is sometimes called an elementary school (in the UK it is commonly called a primary school).

2. What do we know about elements?

Elements are in the periodic table, where they are arranged according to their properties.

Element is from the Latin word elementum: rudiment (simple), first principle, matter in its most basic form.

4. In the word equation below, circle the reactants and products which exist as elements in the equation

Sodium + copper sulfate → copper + sodium sulfate

3. Complete the sentence starter about the word element

An element is a pure substance made of only…

Copy the definition from the key terms list

1. What does the word bond mean to you? Where have you come across this word before?

Here are some ideas:

- Have you seen the word bond before? You might hear of pets that have strong bonds with their human owners.
- A group can bond together to become good friends or work well together, like a sports team.

2. What do we know about bonds?

Bonds hold particles together.

There are different types of bonds.

Bonds are due to charges/electrostatic attraction.

Bond

4. Name three types of chemical bonding which exist in chemistry

One type of bonding is ionic.

3. Complete the sentence starter about the word bond

A chemical bond is a strong (electrostatic) force of…

Copy the definition from the key terms list

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

Here are some ideas:

- Protons and electrons end in 'on' and are charged.
- Have you heard the word ion before? An ionic bond is a type of chemical bond.

2. What do we know about ions?
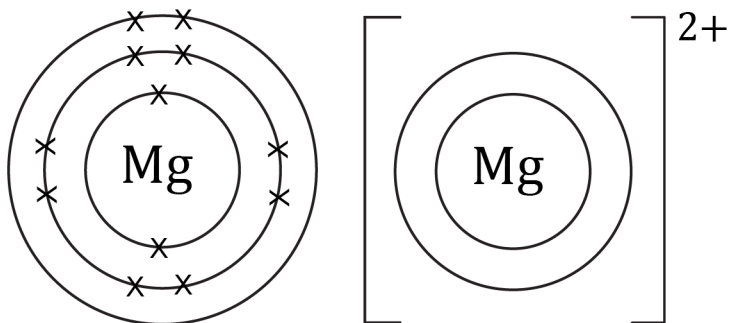
Ions are charged.

Ions form ionic compounds.

Ions are attracted to opposite charges.

Ion

4. Complete the electron configuration diagram for the magnesium ion shown on the right

The electron configuration diagram for a magnesium atom is provided on the left, to help you.

3. Complete the sentence about the word ion

An ion is a charged particle formed when one or more electrons are …

Copy the definition from the key terms list

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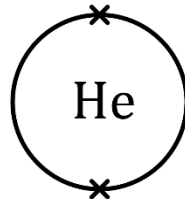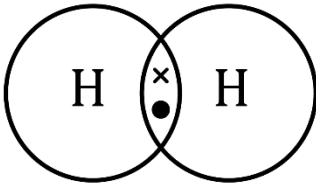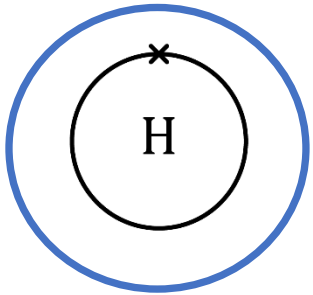
2. Break down atom

A-

Not

-tom

From word 'tomos' meaning to cut

Overall meaning: uncuttable or indivisible

Atom

4. Circle the diagram below that best illustrates a single atom of hydrogen

3. Define atom, in a chemistry context.

The smallest possible particle of an element; atoms are made up of protons, neutrons and electrons.

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

2. Break down compound
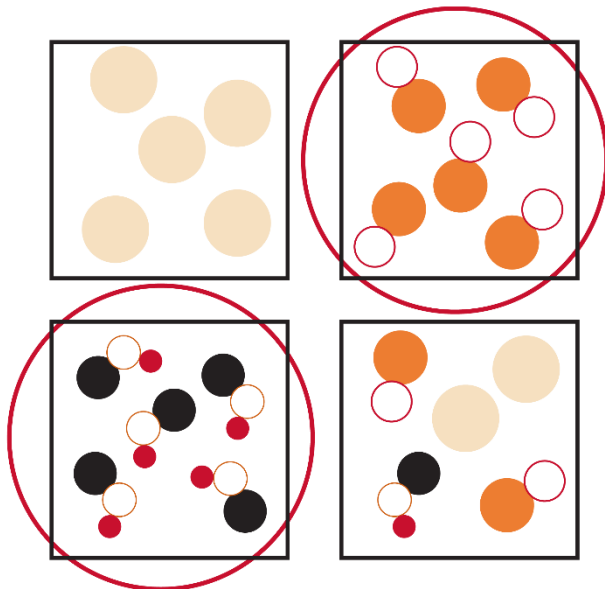
com-

With, together

-pound

Originally from 'position', meaning 'to put'

Overall meaning: to put together

Compound

4. Circle the boxes that contain only one compound

3. Define compound, in a chemistry context

A pure substance made of two or more different elements whose atoms are joined by chemical bonds; the atoms are in a fixed ratio.

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

2. What do we know about molecules?
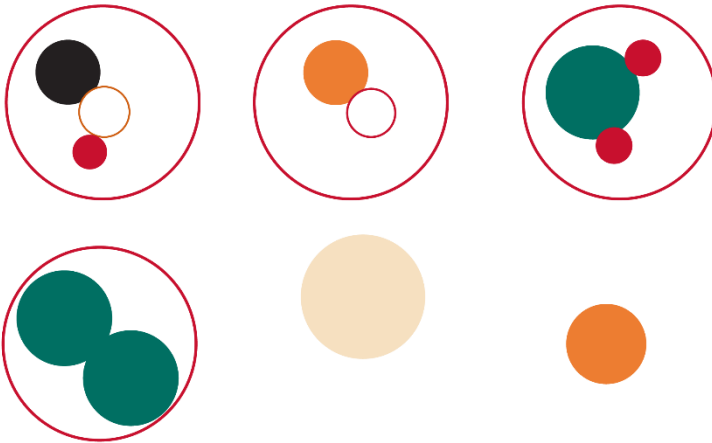
Molecule

From French word 'molécule'

Means 'extremely minute particle'

First used as a scientific word by Amedeo Avogadro in 1811

Molecule

4. Draw a ring around the images which represent molecules below

3. Define molecule, in a chemistry context

Two or more atoms connected by chemical bonds.

1. What does the word element mean to you? Where have you come across this word before?

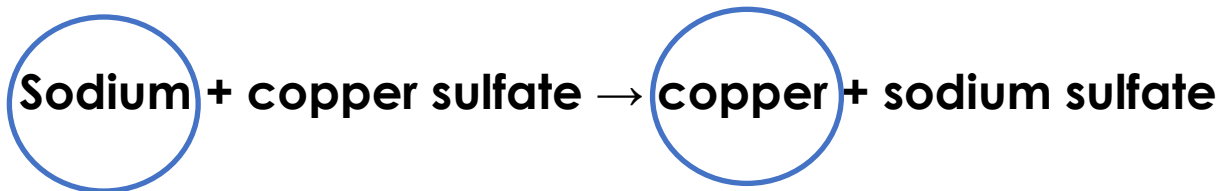**2. What do we know about elements?**

Element

From Latin word 'elementum'

Rudiment (simple), first principle, matter in its most basic form

Element

4. In the word equation below, circle the reactants and products which exist as elements in the equation

3. Define element, in a chemistry context

A pure substance made of only one type of atom.

(Sodium) + copper sulfate → (copper) + sodium sulfate

1. What does the word bond mean to you? Where have you come across this word before?

2. What do we know about bonds?

Bond

From Proto-Indo-European word 'bhendh '

Meaning 'to bind or fasten'

Comes from the same root word as band, bandage, bandana, bundle and ribbon

Bond

4. Name three types of chemical bonding which exist in chemistry

Ionic
Covalent
Metallic

3. Define bond, in a chemistry context

A strong (electrostatic) force of attraction holding atoms together.

1. What does the word ion mean to you? Where have you come across this word (or parts of this word) before?
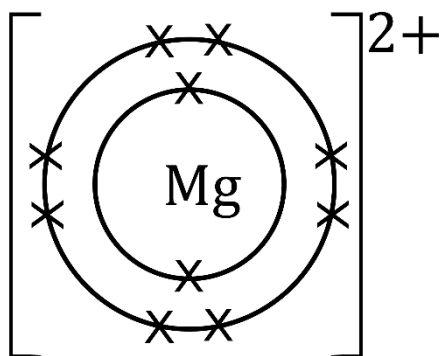
2. What do we know about ions?

Ion

Meaning 'to go'

It is called this because ions move towards the opposite charge

Ion

4. Draw the electron configuration diagram for a magnesium ion

3. Define ion, in a chemistry context

A charged particle formed when one or more electrons are lost or gained from an atom or molecule.

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.