14–16 years

Atomic model: Frayer models

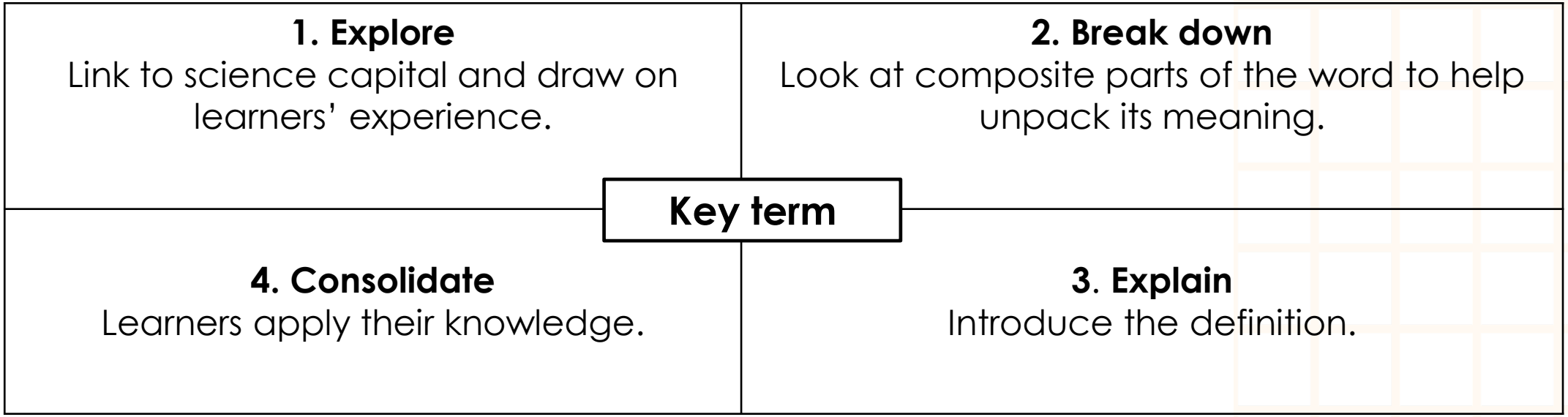
ROYAL SOCIETY OF CHEMISTRY

Education
Inspiring your teaching and learning

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.



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

Proton

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

2. Break down proton

prot

on

3. Write down what you think proton means

4. State the relative mass, charge and location of the proton in the atom

Relative mass	Charge	Location (nucleus or shell)

Copy the definition from the key terms list

Neutron

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

2. Break down neutron

neutr

on

3. Write down what you think neutron means

4. State the relative mass, charge and location of the neutron in the atom

Relative mass	Charge	Location (nucleus or shell)

Copy the definition from the key terms list

Electron

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

2. Break down electron

electr

on

3. Write down what you think electron means

4. State the relative mass, charge and location of the electron in the atom

Relative mass	Charge	Location (nucleus or shell)

Copy the definition from the key terms list

Nucleus

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

2. What do we know about nucleus?

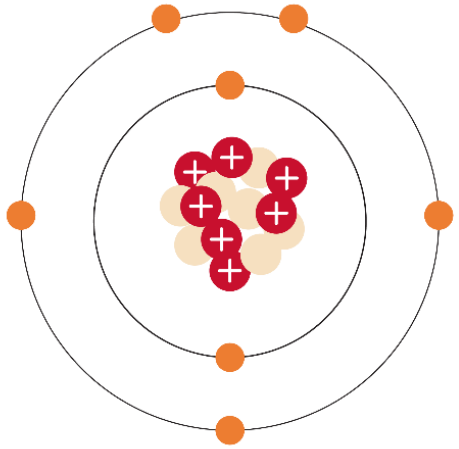
A nucleus is at the centre of an atom, it has a positive charge.

In Latin, it means kernel or little nut.

3. Write down what you think nucleus means

4. This is an atom of nitrogen

- **Write down how many protons, neutrons and electrons it has**
- **Label the nucleus**



Copy the definition from the key terms list

Electron shell/energy level

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

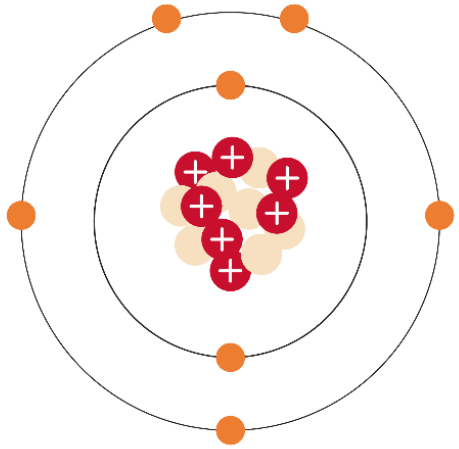
2. What do we know about shells?

Shells are parts of an atom. They are around the nucleus and they contain electrons.

Shell can mean to enclose in a case.

3. Write down what you think electron shell/energy level means

4. This is an atom of nitrogen. Label the electron shells



Copy the definition from the key terms list

Isotope

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

2. Break down isotope

iso

tope

3. Write down what you think isotope means

4. Why can the following carbon atoms be classed as isotopes? To answer this question, fill in the word gaps to complete the sentence below.

$$^{12}_{6}C \quad ^{13}_{6}C \quad ^{14}_{6}C$$

These carbon atoms can be classed as isotopes because they have the same number of _____ but different numbers of _____.

Copy the definition from the key terms list

Proton

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

2. Break down proton

Prot

Meaning 'first', supposedly because the nucleus of hydrogen contains one proton.

on

from the word ion, meaning charged

3. Define proton

A positively charged subatomic particle with a relative mass of 1, found in the nucleus of an atom.

4. State the relative mass, charge and location of the proton in the atom

Relative mass	Charge	Location (nucleus/shell)
1	+1	Nucleus

Neutron

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

2. Break down neutron

neutr

neutral

on

from the word ion, meaning charged
electrically neutral particle of the atom

3. Define neutron

A subatomic particle with no charge and a relative mass of 1, found in the nucleus of an atom.

4. State the relative mass, charge and location of the neutron in the atom

Relative mass	Charge	Location (nucleus/shell)
1	0	Nucleus

Electron

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

2. Break down electron

electr

charged with electricity

on

from the word ion, meaning charged

3. Define electron

A negatively charged subatomic particle with very little mass found in the electron shells/energy levels of atoms.

4. State the relative mass, charge and location of the electron in the atom

Relative mass	Charge	Location (nucleus/shell)
1/1840 or negligible	-1	shell

Nucleus

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

2. What do we know about nucleus?

Nucleus

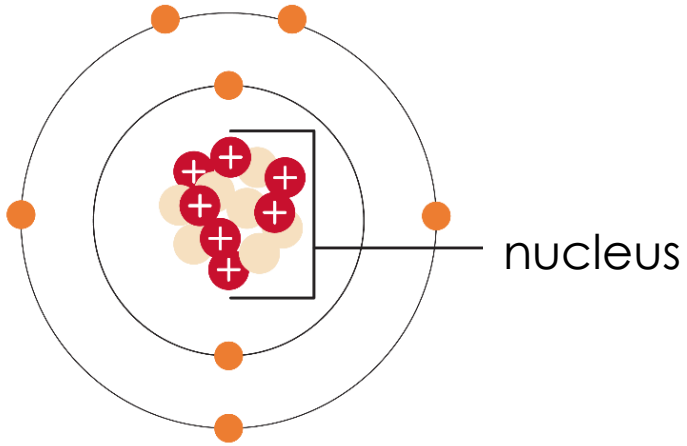
In Latin, it means kernel or little nut.

3. Define nucleus, in a chemistry context

The positively charged centre of the atom consisting of protons and neutrons.

4. This is an atom of nitrogen

- **Write down how many protons, neutrons and electrons it has**
- **Label the nucleus**



7 protons
7 neutrons
7 electrons

Electron shell

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

2. What do we know about shell?

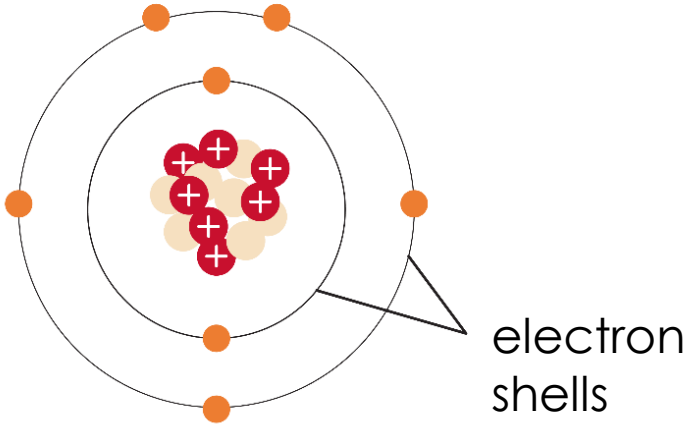
Shells are parts of an atom. They are around the nucleus and they contain electrons.

Shell can mean to enclose in a case.

3. Define shell, in a chemistry context

A region surrounding the nucleus of an atom where electrons are found; each level has a maximum number of electrons it can hold.

4. This is a nitrogen atom. Label the electron shells



Isotope

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

2. Break down isotope

iso

equal to, the same

tope

place

Despite having different atomic masses, the various forms of an element occupy the same place on the periodic table.

3. Define isotope

Atoms with the same number of protons but different numbers of neutrons.

4. Why can the following carbon atoms be classed as isotopes? To answer this question, fill in the word gaps to complete the sentence below.

$$^{12}_{6}C \quad ^{13}_{6}C \quad ^{14}_{6}C$$

These carbon atoms can be classed as isotopes because they have the same number of protons but different numbers of neutrons.

Example layout

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.