14–16 years

Crude oil: 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. Quadrant 3 might also need/benefit from some 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/3Ys0jYi

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

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

This is the hazard symbol used for **flammable** substances.

What does it mean?

2. Break down the word 'flammability'.

flam-

List as many words as you can that begin with **flam**-

What do they all have in common?

able

Having the means, capacity or qualifications to do something.

-ity

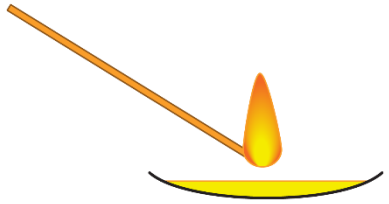
The suffix -ity means 'state of having (a particular quality)'
For example, oddity means something has the quality of being odd.

flammability

4. A teacher places a few drops of two fractions obtained from the fractional distillation of crude oil in different watch glasses and tries to make them catch fire by using a flame.

Fraction A – catches fire easily
Fraction B – does not catch fire

Which fraction has the highest flammability?



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

Put together your understanding of the parts flam-, able and -ity to form the definition.

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

1. What does the word ‘polymer’ mean to you?

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

Here are some ideas.

- Plastics are made of addition **polymers**. What names of plastics do you know that begin with the word prefix ‘**poly**’?
- In maths a **poly**gon is a 2D shape with at least three sides.

2. Break down the word ‘polymer’.

poly-

From the Greek word *poly*, meaning ‘many’

-mer

From the Greek word *meros*, meaning ‘part’ or ‘segment’

polymer

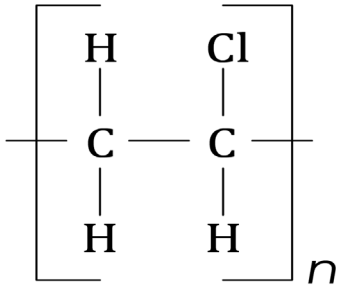
3. Write down what you think a ‘polymer’ is.

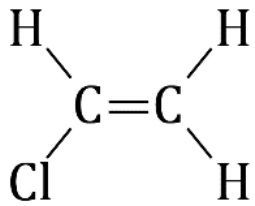
Put together your understanding of the parts poly- and -mer to form the definition.

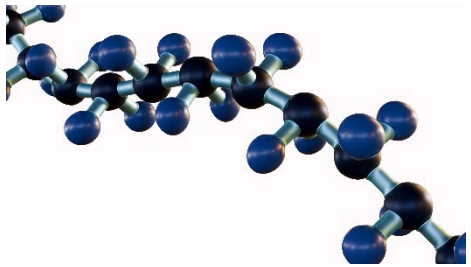
Compare what you wrote with the definition (slide 8).

4. Two of the images below represent polymers.

Which two?







homologous series

1. What does the term 'homologous' mean to you?

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

Here are some ideas.

- A **homo**nym is a word pronounced and spelt the same but having a different meaning such as novel (a book) and novel (new).
- **Homo**phones are words that sound the same but have different meanings and spellings like two, to and too.

2. Break down the term 'homologous series'

homo-

From Greek *homos:* 'one and the same'

-logous

From Greek *logos:* 'relation, reasoning, computation'

series

A number of discrete things of one kind.

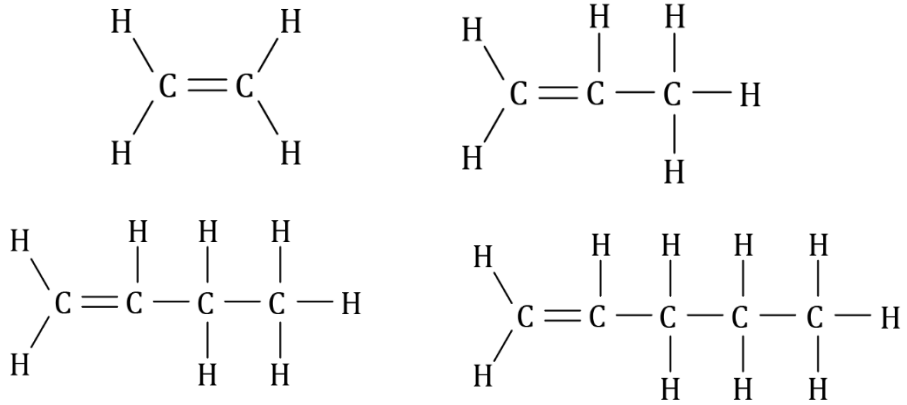
3. Fill in the gaps to describe what a 'homologous series' is.

A _____ of related molecules that react the _____ .

Compare what you wrote with the definition (slide 9).

4. The four molecules below all belong to the homologous series called 'alkenes'.

a) Fill in the blank to complete their general formula: $C_nH\_\_$



b) Predict the formula of the alkene with 23 carbon atoms.

1. What does the term ‘non-biodegradable’ mean to you?

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

Here are some ideas.

- What do you study in **bio**logy lessons?
- What is a **bio**fuel?
- What is a **bio**graphy?

2. Break down the term ‘non-biodegradable’.

non-
‘not’

bio-
Indicating or involving life or living organisms.

degrade
To break down or deteriorate chemically.

-able
Having the means, capacity or qualifications to do something.

non-biodegradable

4. A learner buries two carrier bags in the ground. Carrier bag A is non-biodegradable.

Carrier bag B is biodegradable.

The learner digs up the two carrier bags five years later. What do they find?

3. Write down what you think ‘non-biodegradable’ means.

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 'flammability' mean to you?

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

2. Break down the word 'flammability'.

flam-

From Latin 'flamma' – a flame

Words beginning with flam are often to do with fire or ignition.

able

Having the means, capacity or qualifications to do something.

-ity

The suffix -ity means 'state of having (a particular quality).'
For example, oddity means something has the quality of being odd.

flammability

Having the capacity to catch fire.

flammability

4. A teacher places a few drops of two fractions obtained from the fractional distillation of crude oil in different watch glasses and tries to make them catch fire by using a flame.

Fraction A – catches fire easily
Fraction B – does not catch fire

Which fraction has the highest flammability?

Fraction A, because it catches fire the most easily

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

How easy it is to ignite a substance (in other words, to cause a substance to catch fire using a flame).

Encourage learners to compare their attempted definition with this one.

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

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

2. Break down the word 'polymer'.

poly-

From the Greek word *poly*, meaning 'many'.

-mer

From the Greek word *meros*, meaning 'part' or 'segment'.

polymer

A molecule made from many parts.

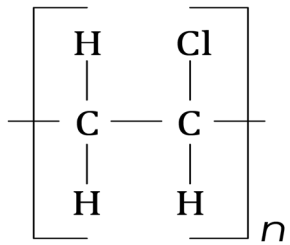
polymer

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

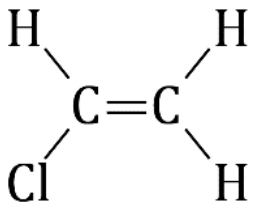
A very large molecule made by joining together lots of small molecules.

Encourage learners to compare their attempted definition with this one.

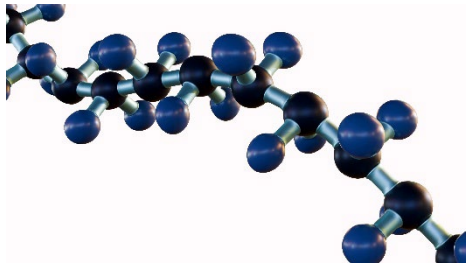
4. Two of the images below represent polymers. Which two?



polymer



monomer



polymer

homologous series

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

2. Break down the term 'homologous series'.

homo-

From Greek *homos* 'one and the same'

-logous

From *Greek logos* 'relation, reasoning, computation'

series

A number of discrete things of one kind.

homologous series

A series of related molecules with the same reactivity.

3. Fill in the gaps to describe what a 'homologous series' is.

A series of related molecules that react the same.

Encourage learners to compare their attempted definition with this one.

4. The four molecules below all belong to the homologous series called 'alkenes'.

a) What is their general formula?

C_nH_{2n}

b) Predict the formula of the alkene with 23 carbon atoms.

$C_{23}H_{46}$

1. What does the term 'non-biodegradable' mean to you?

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

2. Break down the term 'non-biodegradable'.

non-
'Not'

bio-
Indicating or involving life or living organisms.

degrade
To break down or deteriorate chemically.

-able
Having the means, capacity or qualifications to do something.

non-biodegradable
Not able to be broken down by living organisms.

non-biodegradable

4. A learner buries two carrier bags in the ground. Carrier bag A is non-biodegradable.

Carrier bag B is biodegradable.

The learner digs up the two carrier bags five years later. What do they find?

Carrier bag A will still be there.
Carrier bag B may no longer be there. It will have degraded.

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

Not able to be broken down by living organisms in the natural environment.

Encourage learners to compare their attempted definition with this one.

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

4. Consolidate

Learners apply their knowledge.

3. Explain

Introduce the definition.