1. A teacher shows a class an experiment in which liquid paraffin is cracked.

Here is a diagram of the equipment used.

Source: Royal Society of Chemistry

1. Suggest what happens to liquid paraffin **when** it is ‘cracked’.

Answer: The molecules in paraffin are broken down to form smaller molecules.

1. Porcelain chips are used because they catalyse the reaction.

What is the meaning of the word ‘catalyse’?

Answer: To make the reaction take place at a faster rate.

1. Using the diagram, what evidence is there that smaller molecules are made in the experiment?

Explain your answer.

Answer: A product gas is formed from the liquid paraffin.

 The gas has a lower boiling point than the liquid paraffin.

 This is because the gas contains smaller molecules.

1. Using the diagram, describe how you think the experiment works.

Answer: Liquid paraffin and porcelain chips are heated with a Bunsen flame.

 The liquid paraffin boils and turns into a vapour.

 The paraffin molecules break down due to heat and the catalyst.

 The smaller molecules are then collected in the test tube as a gas.

1. What evidence is there from the diagram that the product gas is insoluble in water?

Answer: The product gas is collected over water, and if it were soluble, it would dissolve.

Paraffin is a mixture of large molecules.

The structure of one of these molecules is shown below.



1. Which elements are present in the molecule?

Answer: Hydrogen and carbon.

1. What is the name of substances containing the elements in part f)?

Answer: Hydrocarbons.

1. This molecule is also a member of a homologous series.

What is a homologous series?

Answer: One in which molecules differ by a CH2 unit.

 They also contain the same functional group.

1. What is the name of this homologous series?

Answer: The alkanes.

1. What is the general formula of the homologous series in part i)?

Answer: CnH(2n+2)

1. The molecule above is called dodecane.

What is the molecular formula of dodecane?

Answer: C12H26

1. Which of these molecules do not belong to the same homologous series as dodecane?

Write ‘Yes’ or ‘No’ into the right-hand column in the table.

|  |  |
| --- | --- |
| **Molecular formula of substance** | **The same homologous series as dodecane (‘Yes’ or ‘No’)** |
| C8H16 | Answer: No. |
| C13H28 | Answer: Yes. |
| C5H12 | Answer: *Yes.* |
| C23H46 | Answer: *No.* |
| C50H102 | Answer: *Yes.* |

1. The molecules made from cracking long chain molecules can be very useful.

Give a use for these molecules.

|  |  |
| --- | --- |
| **Smaller alkanes** | Answer: Petrol. |
| **Alkenes** | Answer: Polymers / solvents. |

1. When a long chain molecule is cracked, a substance called ethene is normally made.
2. Draw the structure of an ethene molecule.



1. To which homologous series does ethene belong?

Answer: The alkenes.

Another molecule that has a similar name to ethene is ethane.

One of these molecules is described as ‘saturated’ and the other as ‘unsaturated’.

1. What is the meaning of each of these terms?

Answer: Saturated – contains carbon single bonds only.

 Unsaturated – contains one or more carbon double bonds.

1. Write ‘unsaturated’ or ‘saturated’ in the correct spaces next to the names below:

|  |  |
| --- | --- |
| **Ethene** | Answer: Unsaturated. |
| **Ethane** | Answer: Saturated. |

1. Complete the word equation that shows octane being cracked to make ethene.

Write the name of the other product into the space.

Octane 🡪 hexane + ethene