

Alkanes and alkenes

Task A

The table on the right shows the names of some alkanes, the number of carbon atoms in their molecules, and their boiling points.

The boiling points are measured in **kelvin (K)** to avoid negative numbers.

| name of alkane | number of carbon atoms | approximate boiling point (K) |
|----------------|------------------------|-------------------------------|
| methane | 1 | 110 |
| ethane | 2 | 185 |
| propane | 3 | 230 |
| butane | 4 | 275 |
| pentane | 5 | 310 |
| hexane | 6 | 340 |
| heptane | 7 | 370 |
| octane | 8 | 400 |
| nonane | 9 | 425 |
| decane | 10 | 445 |
| undecane | 11 | 470 |
| dodecane | 12 | 490 |
| hexadecane | 16 | 560 |
| eicosane | 20 | 615 |

- On graph paper, plot a graph of boiling point against number of carbon atoms.
 - Put the boiling points up the side. Go from 0K to 700K, and use 1 small square (2mm) for each 10K. Your axis will be 14cm long.
 - Put the number of carbon atoms along the bottom. Go from 0 to 20, and use 3 small squares (6mm) for each atom. Your axis will be 12cm long.
- Look carefully at your graph. Write down what happens to the boiling point as the number of carbon atoms goes up.
- Room temperature is about 300K. Any alkanes with a boiling point less than this will be gases. Which alkanes are gases?
 - Alkanes with more than 14 carbon atoms are usually solids. Which alkanes are solids?
 - Any alkanes that are not in your answers to a) or b) are liquids. Which alkanes are liquids?

Task B

Read the information in the box, then answer question 4.

Long alkanes with lots of carbon atoms are not very good as fuels. If they are heated strongly on a catalyst, they can be broken into smaller molecules, which do make good fuels. This reaction is called **cracking**. Some of the smaller molecules are **alkenes**. Alkenes are like alkanes, but two of their carbon atoms are joined by two bonds (a **double bond**), not just one bond.

- What is "cracking"?
 - What is the difference between alkanes and alkenes (apart from their name!)?
 - What is a "double bond"?

- The structural formula of propene is
$$\begin{array}{c} \text{H} & \text{H} & \text{H} \\ | & | & | \\ \text{H}-\text{C} & -\text{C} & =\text{C} \\ | & & | \\ \text{H} & & \text{H} \end{array}$$
 and its molecular formula is C_3H_6 .

Draw the **structural formulae** and **molecular formulae** for the first seven alkenes (from ethene with 2 carbon atoms to octene with 8 carbon atoms – methene does not exist). Write down the **names** of the molecules (naming them is similar to alkanes, but the names end in **ene**, not **ane**).

- Work out the molecular formula for eicosene (20 carbon atoms).