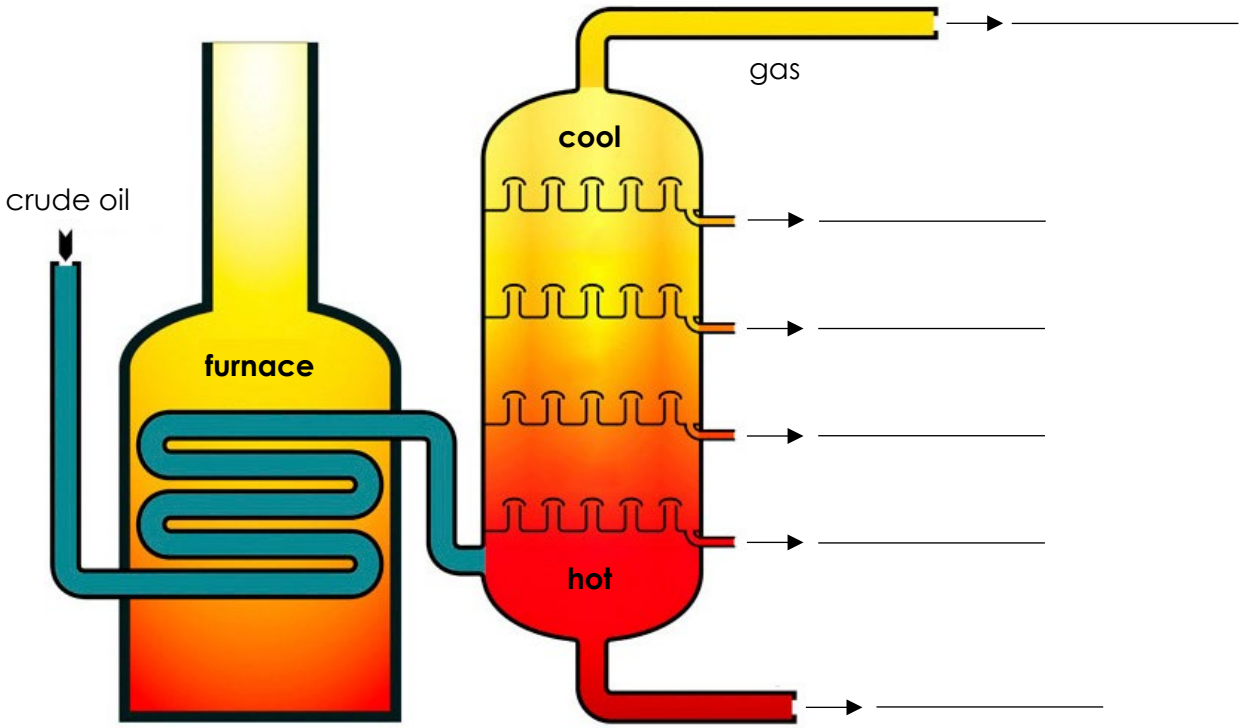
Fractional distillation and hydrocarbons: knowledge check

1.1 The diagram shows crude oil being separated into fractions in a fractionating column.

Use the words listed to label each of the fractions produced.

liquified petroleum gas **diesel** **kerosene**

petrol **heavy fuel oil** **bitumen**



1.2 Choose some of the correct sentence endings from those provided (A to H) to match each of the sentence starters in the table.

Write the correct letter into the box provided for each sentence starter. The first one has been done for you.

Crude oil contains …	H
Fractional distillation is used to …	
During fractional distillation, the hydrocarbon fractions …	
The hydrocarbons are separated according to …	
The fractionating column is …	

A	… evaporate and then condense.
B	… cooler at the bottom
C	… melt and then freeze.
D	… separate crude oil into hydrocarbon fractions.
E	… hotter at the bottom.
F	… their different boiling points.
G	… separate pure water from salt water.
H	… a mixture of hydrocarbons.

1.3 Use some of the words to complete the gaps in the following sentences.

hydrogen **C_nH_{2n+2}** **carbon** **two** **C_3H_8**

C_nH_{2n} **oxygen** **C_3H_6** **three** **fractions** **C_2H_6**

The mixtures of hydrocarbons collected from the fractionating column are called _____ .

Hydrocarbons are compounds containing _____ and _____ only.

The hydrocarbons in crude oil are mostly alkanes, which have the general formula _____ . For example, a molecule of ethane, which contains _____ carbon atoms, has the formula _____ .

1.4 Use some of the words to complete the gaps in the following sentences.

bitumen **higher** **weaker** **covalent bonds** **melt**

intermolecular forces **stronger** **condense**

liquified petroleum gas **lower**

Small alkane molecules have weak _____ and low boiling points. They do not _____ in the fractionating column and leave as _____.

Larger alkane molecules have _____ intermolecular forces. Energy is needed to break the intermolecular forces, so alkanes with larger molecules have _____ boiling points.

Fractional distillation and hydrocarbons: test myself

Answer questions 2.1 to 2.2 by circling the correct answer(s). There may be more than one correct answer in each question.

2.1 Which **two** of the following formulas represent a hydrocarbon?

HCl

$C_6H_{12}O_6$

CO_2

CH_3COOH

C_2H_4

C_5H_{12}

CH_3OH

2.2 Which alkane has the highest boiling point?

CH_4

$C_{20}H_{42}$

C_7H_{16}

$C_{70}H_{142}$

2.3 The hydrocarbons in the liquified petroleum gas fraction contain between one and four carbon atoms.

Give two properties of these hydrocarbons.

[*Hint: think about their boiling points, viscosity and ease of ignition.*]

_____

_____

2.4 Name two products that are produced in the incomplete combustion of methane.

_____

_____

2.5 Complete the general equation representing the complete combustion of a hydrocarbon.

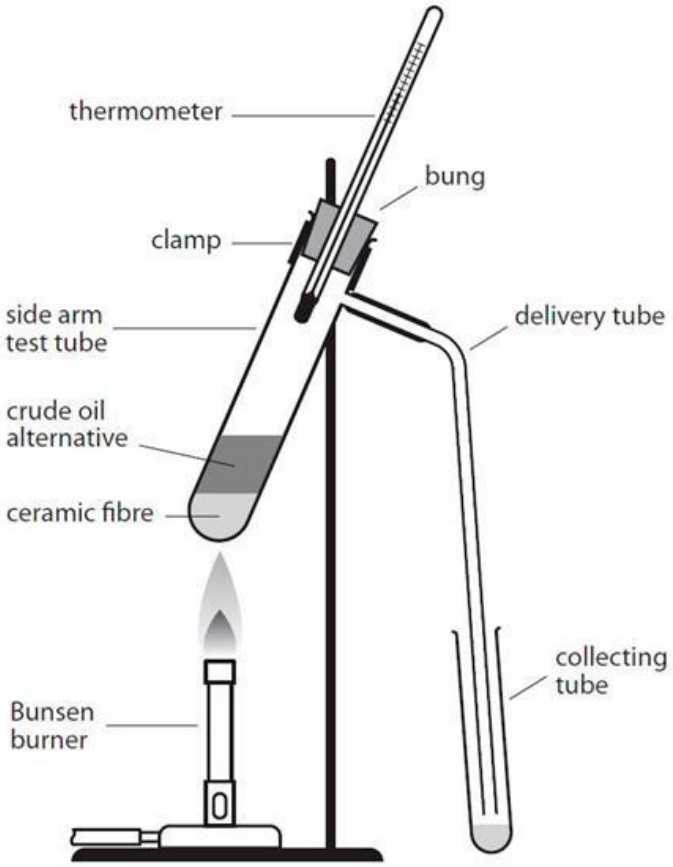
hydrocarbon + _____ → _____ + water

2.6 Complete the balanced symbol equation representing the complete combustion of propane by adding the correct formulas, including state symbols, and numbers.

$$C_3H_8(g) + \_\_\_\_\_ O_2(g) \rightarrow \_\_\_\_\_ + \_\_\_\_\_$$

Fractional distillation and hydrocarbons: feeling confident?

3.1 The diagram shows the apparatus used by learners during the fractional distillation of a crude oil alternative. During the experiment, the learners collected four different fractions.



The table shows some of the observations recorded by the learners when they tested the properties of each fraction.

Fraction	Temperature range over which the fraction was obtained/°C	Colour	Viscosity	Ease of ignition
1	20–100	very pale yellow		
2	100–150			
3	150–200		doesn't flow very easily	difficult to ignite
4	200–250	brown		

Make predictions about the missing observations and complete the gaps in the table using some of the words and phrases listed.

very difficult to ignite **yellow** **high viscosity**

easy to ignite **green** **very easy to ignite**

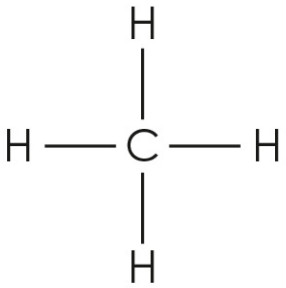
light brown **low viscosity** **flows quite easily**

3.2 The table includes some of the names, molecular formulas and displayed formulas for the first four alkanes.

Complete the table by selecting the correct molecular formulas and displayed formulas from those listed.

butane methane pentane

C_2H_6 C_3H_8

Alkane	Molecular formula	Displayed formula
	CH_4	
ethane		
propane		
	C_4H_{10}	

Fractional distillation and hydrocarbons: what do I understand?

Think about your answers and confidence level for each mini-topic. Decide whether you understand it well, are unsure or need more help. Tick the appropriate column.

Mini-topic	I understand this well	I think I understand this	I need more help
I can describe the process of fractional distillation.			
I can explain why crude oil can be separated into fractions.			
I can identify a hydrocarbon from its molecular formulae.			
I can write the general and molecular formulas for alkanes.			
I can describe how the length of the hydrocarbon chain affects its boiling point.			
I can compare the physical properties of the fractions.			
I can compare complete and incomplete combustion.			
Feeling confident? topics	**I understand this well**	**I think I understand this**	**I need more help**
I can predict the results of an experiment in which a crude oil alternative undergoes fractional distillation.			
I can give the molecular and displayed formulas of the first four alkanes.			