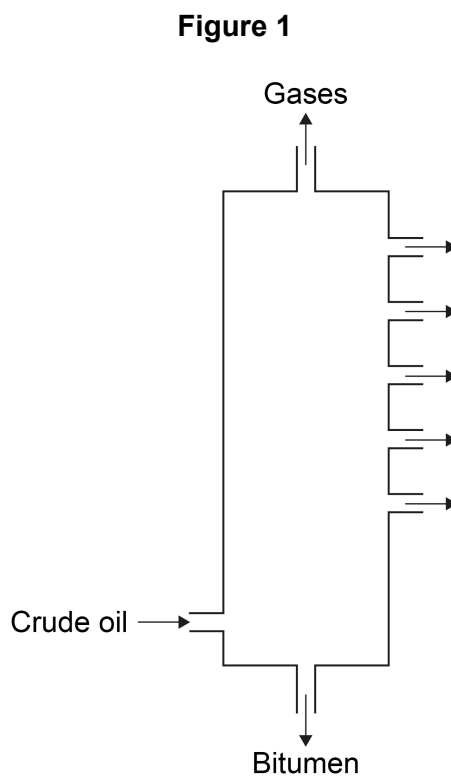


Crude oil is a mixture of hydrocarbons.

1.1

The hydrocarbons in crude oil are separated into fractions by fractional distillation.

Figure 1 shows a fractional distillation column.



Crude oil vapour passes up the column.

Complete the sentence.

Choose the answer from the box.

[1 mark]

condenses

dissolves

freezes

melts

Each fraction _____ at a different level.

1.2

Why do the fractions separate?

[1 mark]

Tick **one** box.

The fractions have different boiling points.

☐

The fractions have different flammability.

☐

The fractions have different melting points.

☐

The fractions have different viscosity.

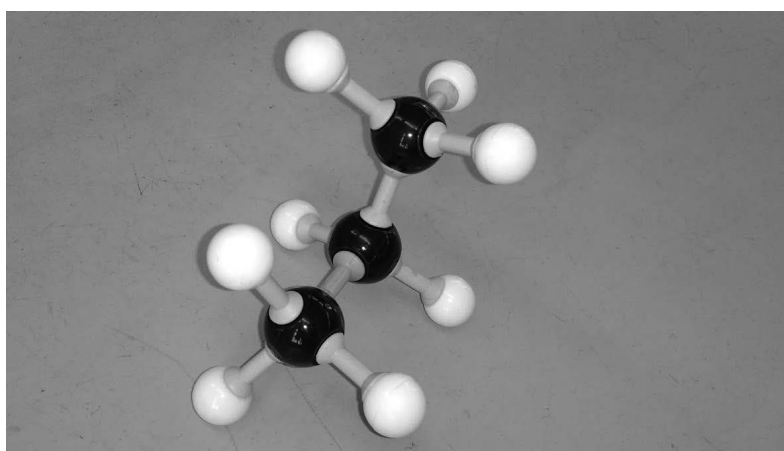
☐

Most of the hydrocarbons in crude oil are alkanes.

1.3

Figure 2 represents an alkane molecule.

Figure 2



Name the alkane.

[1 mark]

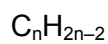
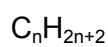
1.4

Methane (CH₄) is an alkane.

What is the general formula for alkanes?

[1 mark]

Tick **one** box.

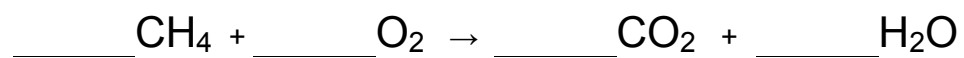
☐☐☐☐

1.5

Alkanes burn in oxygen.

Balance the equation for methane burning.

[1 mark]



1.6

Ethene is an alkene.

Which reagent is used to test for alkenes?

[1 mark]

Tick **one** box.

Anhydrous copper sulfate

☐

Bromine water

☐

Damp litmus paper

☐

Limewater

☐

This question is about hydrocarbons and crude oil.

2.1

Hydrocarbon fuels are produced from crude oil.

Describe how crude oil is separated into fractions.

[4 marks]

Answer **all** questions in the spaces provided.

This question is about crude oil and hydrocarbons.

Figure 1 shows a fractionating column used to separate crude oil into fractions.

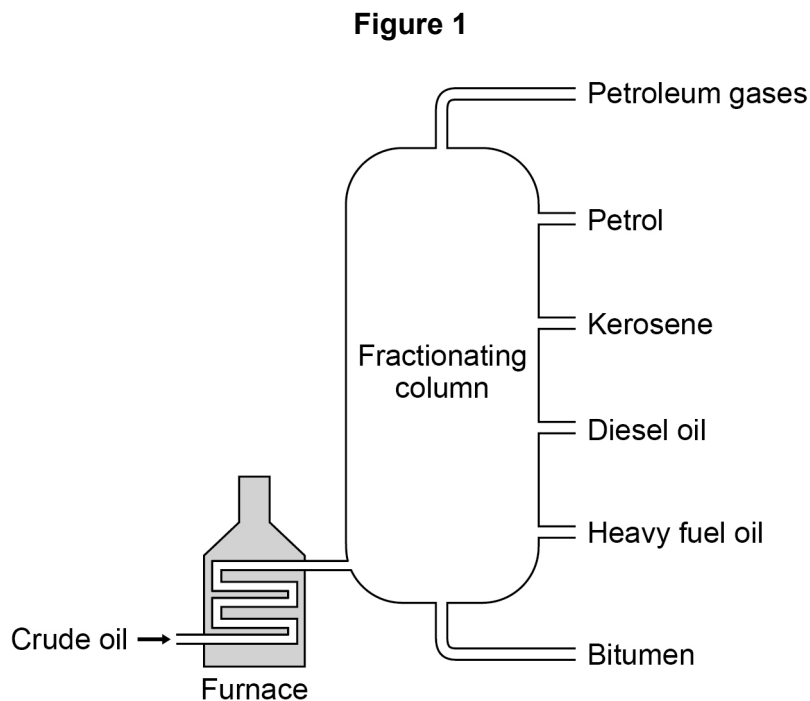


Table 1 gives information about some of the fractions.

Table 1

Fraction	Boiling point range in °C
Petroleum gases	Below 30
Petrol	40–110
Kerosene	180–260
Diesel oil	260–320
Heavy fuel oil	320–400
Bitumen	400–450

3.1 Suggest a suitable temperature for the furnace in **Figure 1**. **[1 mark]**

_____ °C

3.2 Explain why diesel oil collects above heavy fuel oil but below kerosene in the fractionating column.

Use **Table 1**. **[2 marks]**

3.3 Suggest **two** reasons why bitumen is **not** used as a fuel. **[2 marks]**

1 _____

2 _____

3.4

Petrol contains mainly alkanes.

Which of the following compounds is an alkane?

[1 mark]

Tick (✓) **one** box.

☐☐☐☐

Large hydrocarbon molecules in the diesel oil fraction are cracked to produce smaller hydrocarbon molecules.

3.5

Describe the conditions needed to crack hydrocarbon molecules from the diesel oil fraction.

[2 marks]

3.6

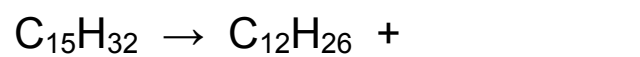
Explain why large hydrocarbon molecules in the diesel oil fraction are cracked to produce smaller hydrocarbon molecules.

[2 marks]

3.7

Complete the equation for the cracking of $C_{15}H_{32}$

[1 mark]



4.1

The atmosphere of Titan contains small amounts of propene.

Describe a test to show that propene is an unsaturated hydrocarbon.

Give the result of the test.

[2 marks]

Test _____

Result _____

This question is about the Earth's resources.

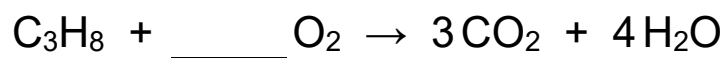
When most fuels burn carbon dioxide is produced.

Propane (C₃H₈) is a fuel.

5.1

Balance the equation for the combustion of propane.

[1 mark]

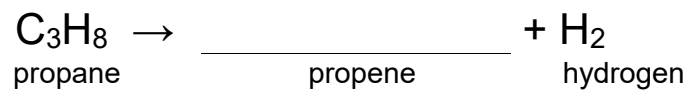


5.2

Propane can be cracked to produce propene and hydrogen.

Complete the symbol equation for the reaction.

[1 mark]



5.3

Propene is an alkene.

Describe the test for alkenes.

Give the colour change in the test.

[3 marks]

Test _____

Colour change _____ to _____

This question is about crude oil and alkanes.

6.1

Describe how crude oil is formed.

[3 marks]

6.2

Describe how crude oil is separated into fractions by fractional distillation.

[4 marks]

6.3

What is the general formula for alkanes?

[1 mark]

6.4

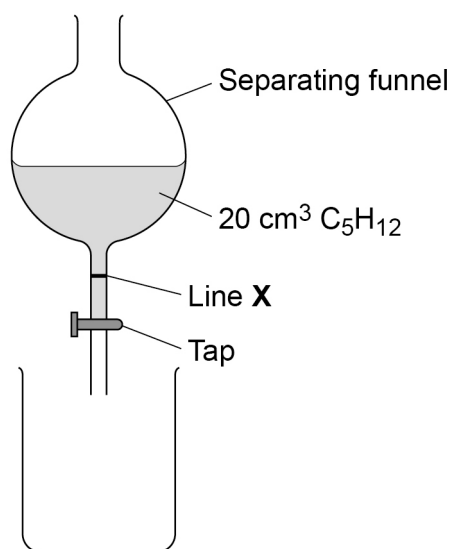
A student investigated one property of the alkanes C_5H_{12} , $\text{C}_{10}\text{H}_{22}$ and $\text{C}_{15}\text{H}_{32}$

This is the method used.

1. Pour 20 cm^3 of C_5H_{12} into a separating funnel.
2. Open the tap of the separating funnel and start a timer.
3. Stop the timer when the level of C_5H_{12} reaches line **X**.
4. Repeat steps 1 to 3 with $\text{C}_{10}\text{H}_{22}$ and $\text{C}_{15}\text{H}_{32}$

Figure 5 shows the apparatus used.

Figure 5



The level of C_5H_{12} takes 6.4 seconds to reach line **X**.

Predict the trend in times for the other two alkanes.

Give **one** reason for your answer.

[2 marks]

Trend _____

Reason _____

This question is about hydrocarbons.

Hexane and hexene are hydrocarbons containing six carbon atoms in each molecule.

Hexane is an alkane and hexene is an alkene.

7.1

Bromine water is added to hexane and to hexene.

What would be observed when bromine water is added to hexane and to hexene?

[2 marks]

Hexane _____

Hexene _____

Crude oil is a resource found in rocks.

Most of the compounds in crude oil are hydrocarbons.

8.1

Complete the sentence.

[1 mark]

Crude oil is formed by the decomposition of _____.

8.2

Alkanes are hydrocarbons.

Give the name of the alkane molecule that has three carbon atoms.

[1 mark]

Hydrocarbons are cracked to produce more useful alkanes and alkenes.

8.4

Decane ($\text{C}_{10}\text{H}_{22}$) is cracked to produce **two** products.

Complete the equation for the reaction.

[1 mark]



8.5

C_2H_4 is an alkene.

What is the test for alkenes?

Give the result of the test if an alkene is present.

[2 marks]

Test

Result

This question is about alkanes.

Table 1 shows information about some alkanes.

Table 1

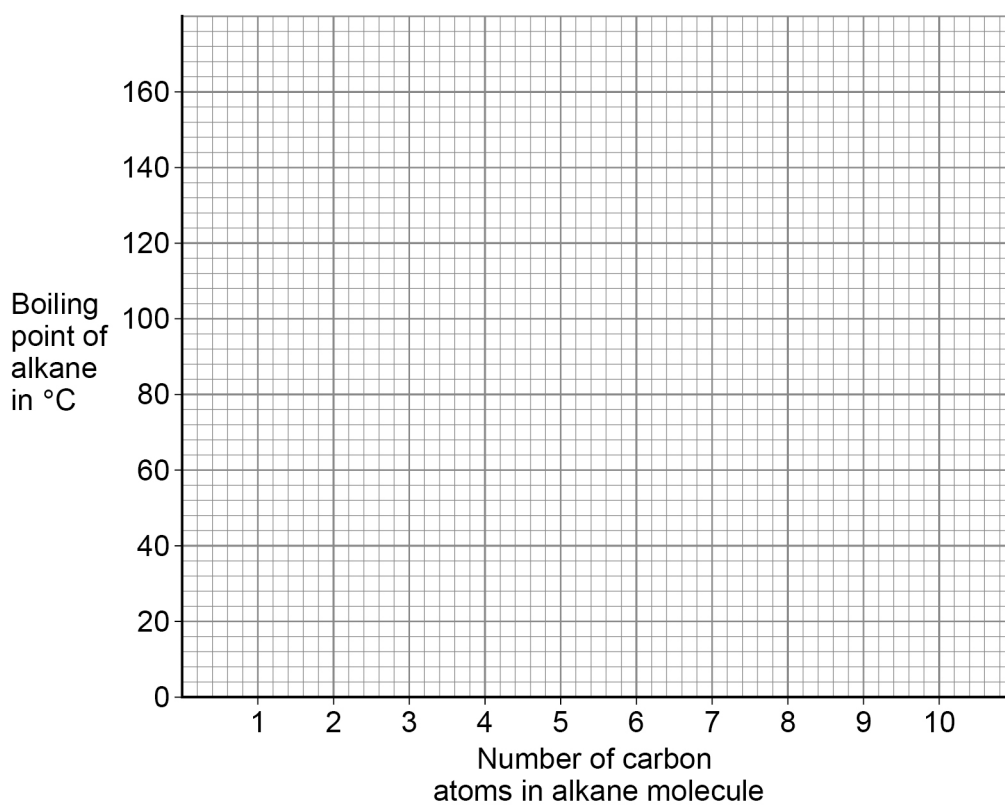
Number of carbon atoms in alkane molecule	Boiling point of alkane in °C
4	0
5	36
6	69
7	X
8	126
9	151

9.1

Plot the data from **Table 1** on **Figure 2**.

[2 marks]

Figure 2



9.2 Predict the boiling point **X** of the alkane with seven carbon atoms in a molecule.

Use **Table 1** and **Figure 2**.

[1 mark]

X = _____ °C

9.3 **Figure 2** is **not** suitable to show the boiling point of the alkane with three carbon atoms in a molecule.

Suggest **one** reason why.

[1 mark]

9.4 What is the state at 20 °C of the alkane with four carbon atoms in a molecule?

Use **Table 1**.

[1 mark]

Table 1 is repeated below.

Table 1

Number of carbon atoms in alkane molecule	Boiling point of alkane in °C
4	0
5	36
6	69
7	X
8	126
9	151

The alkane with nine carbon atoms in a molecule is called nonane.

9.5

Complete the formula of nonane.

[1 mark]

C₉H ____

9.6

Nonane will condense lower in a fractionating column during fractional distillation than the other alkanes in **Table 1**.

Explain why.

You should refer to the temperature gradient in the fractionating column.

[2 marks]

This question is about cycloalkenes.

Cycloalkenes are ring-shaped hydrocarbon molecules containing a double carbon-carbon bond.

Cycloalkenes react in a similar way to alkenes.

10.1

Describe a test for the double carbon-carbon bond in cycloalkene molecules.

Give the result of the test.

[2 marks]

Test _____

Result _____

This question is about alkenes and alcohols.

Ethene is an alkene produced from large hydrocarbon molecules.

Large hydrocarbon molecules are obtained from crude oil by fractional distillation.

11.1

Name the process used to produce ethene from large hydrocarbon molecules.

[1 mark]

11.2

Describe the conditions used to produce ethene from large hydrocarbon molecules.

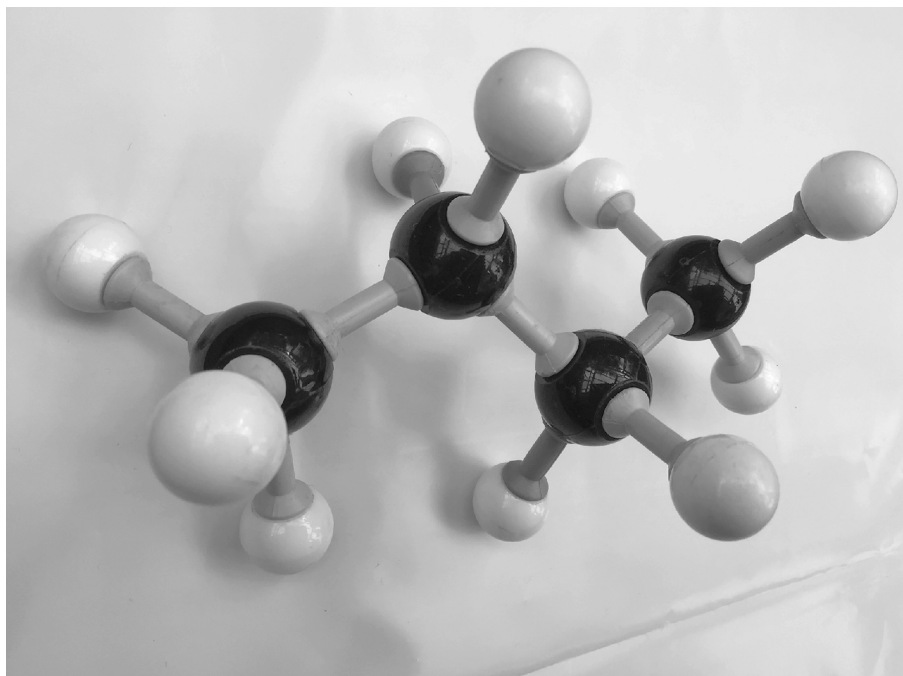
[2 marks]

This question is about hydrocarbons and the uses of hydrocarbons.

12.1

Figure 6 shows a model of an alkane.

Figure 6



What is the name of the alkane in **Figure 6**?

[1 mark]

12.2

What is a hydrocarbon?

[1 mark]

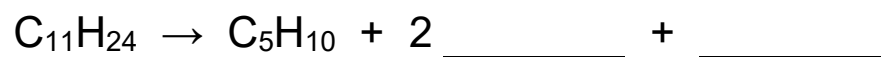
Large hydrocarbon molecules are cracked.

12.3

When $C_{11}H_{24}$ is cracked, three products are formed.

Complete the equation for the reaction.

[2 marks]



12.4

Explain why **one** of the products of cracking is in high demand.

[2 marks]

This question is about the fractions obtained from crude oil.

13.1

Crude oil is separated into fractions by fractional distillation.

The fractions obtained from crude oil include:

- lubricating oil
- naphtha
- petroleum gases.

Table 3 shows the boiling point range of these fractions.

Table 3

Fraction	Boiling point range in °C
Lubricating oil	300–350
Naphtha	90–200
Petroleum gases	< 25

Explain how these fractions are obtained from crude oil by fractional distillation.

[4 marks]

13.2

Fractions from crude oil can be processed to produce feedstock for the petrochemical industry.

Which **two** are useful materials produced from this feedstock?

[2 marks]

Tick (✓) **two** boxes.

Alloys

☐

Ceramics

☐

Detergents

☐

Fertilisers

☐

Solvents

☐

Another fraction obtained from crude oil is petrol.

13.3

Petrol contains a hydrocarbon with the formula C_9H_{20}

Complete the equation for the complete combustion of C_9H_{20}

You should balance the equation.

[2 marks]



13.4

Table 4 shows information about two more fractions obtained from crude oil.

Table 4

Fraction	Range of number of carbon atoms in each molecule
Kerosene	11–15
Heavy fuel oil	20–40

A student predicted that heavy fuel oil is more viscous than kerosene.

The student's prediction was correct.

Justify the student's prediction.

[2 marks]

The heavy fuel oil fraction can be processed to produce smaller hydrocarbon molecules.

13.5

Name the process which produces smaller hydrocarbon molecules from heavy fuel oil.

Give the conditions used in this process.

[3 marks]

Name of process _____

Conditions _____

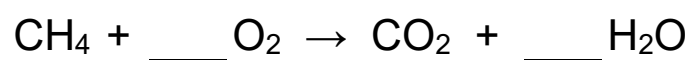
The combustion of fuels is a source of atmospheric pollutants.

14.1

Methane is a fuel.

Balance the equation for the combustion of methane.

[1 mark]



14.2

Many fuels are mixtures.

Petrol and diesel are mixtures of hydrocarbons.

Table 1 shows properties of petrol and of diesel.

Table 1

	Petrol	Diesel
Range of number of carbon atoms in a hydrocarbon molecule	4 to 12	12 to 20
Range of boiling points in °C	40 to 205	250 to 350

Compare the properties of petrol and diesel.

Use **Table 1**.

[2 marks]

15.1

Describe how crude oil is separated into fractions.

[4 marks]

15.2

The fractions from crude oil contain alkanes.

Explain why alkanes are cracked.

[2 marks]

15.3

Alkenes are produced in cracking.

The general formula for the homologous series of alkenes is C_nH_{2n}

Which formula represents an alkene?

[1 mark]

Tick (✓) **one** box.

C_2H_2

☐

C_2H_4

☐

C_2H_6

☐

C_3H_8

☐