All questions are for both separate science and combined science students

Q1.

This question is about hydrocarbons.

A hydrocarbon has the formula C_6H_{14}

(a) Name the **two** elements in a hydrocarbon.

1 _____

2 _____

(2)

(b) How many atoms are there in one molecule of C_6H_{14}?

Tick (✓) **one** box.

2 ☐

6 ☐

14 ☐

20 ☐

(1)

C_6H_{14} is a member of a homologous series.

(c) What is the general formula for the homologous series that contains C_6H_{14}?

Tick (✓) **one** box.

C_nH_{2n-2} ☐

C_nH_{2n} ☐

C_nH_{2n+2} ☐

(1)

(d) Which homologous series has C_6H_{14} as a member?

Tick (✓) **one** box.

Alcohols ☐

Alkanes ☐

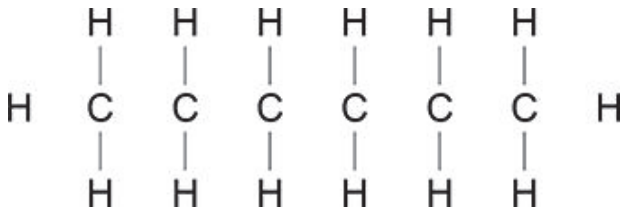
Alkenes ☐

Carboxylic acids ☐

(1)

(e) Complete **Figure 1** to show the displayed structural formula of C_6H_{14}

Figure 1



(1)

(f) Petrol contains C_6H_{14}

Petrol is burned in car engines.

What general name is used to describe petrol when petrol is burned to release energy?

_____

(1)

(g) Atmospheric pollutants are formed when C_6H_{14} undergoes incomplete combustion.

Complete the sentences.

Choose answers from the box.

ammonia	**carbon monoxide**	**coal**
soot	**sulfur**	**sulfur dioxide**

The solid atmospheric pollutant formed during incomplete combustion of C_6H_{14}

is _____ .

The gaseous atmospheric pollutant formed during incomplete combustion of C_6H_{14}

is _____ .

(2)

(h) A different organic compound ($C_{12}H_{26}$) can be broken down to produce C_6H_{14} and one other compound.

Complete the equation for the reaction.

$$C_{12}H_{26} \rightarrow C_6H_{14} + C\_\_\ H\_\_$$

(1)

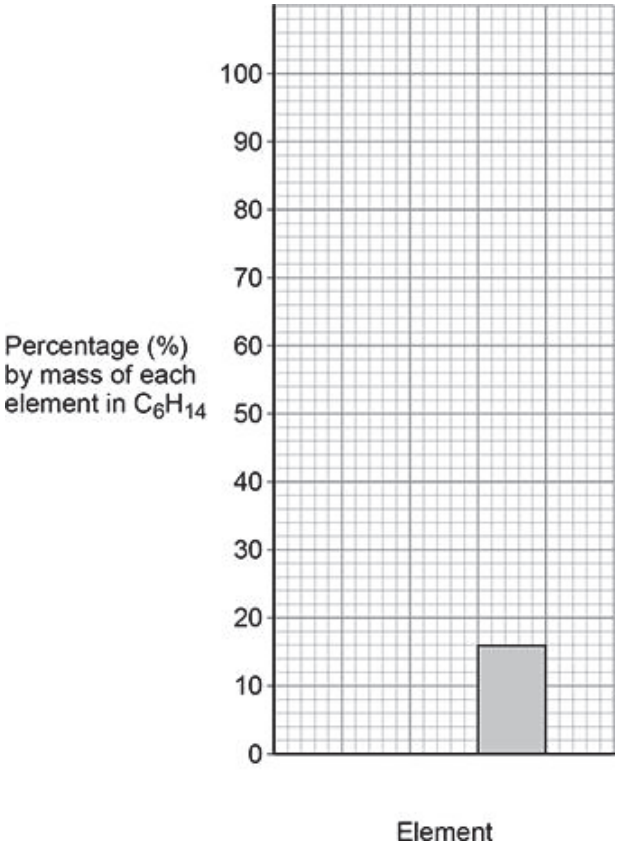
(i) The percentage by mass of each element in C_6H_{14} is:

- 84% C
- 16% H

Complete **Figure 2**.

You should:
- label each element on the *x*-axis
- plot the percentage by mass of C in C_6H_{14}

Figure 2



(2)

(Total 12 marks)

Q2.

This question is about hydrocarbons in crude oil.

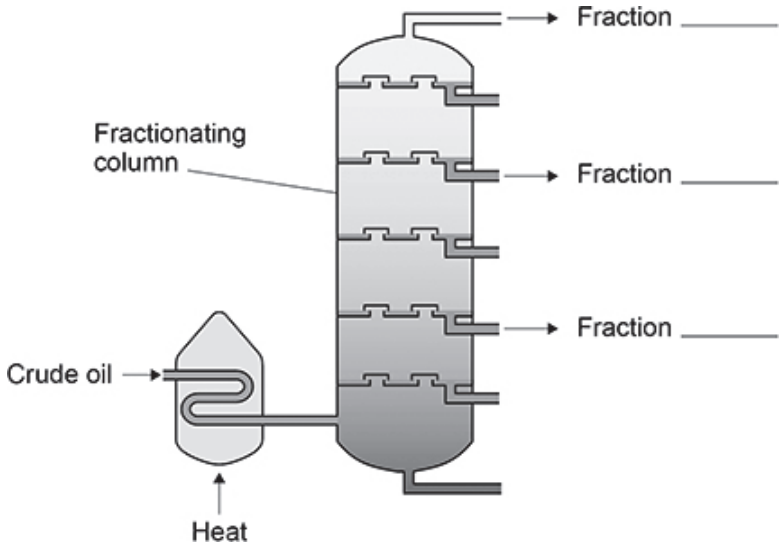
(a) **Table 1** shows information about three fractions obtained from crude oil.

Table 1

Fraction	Boiling point range in °C
A	200–300
B	100–150
C	Below 30

Figure 1 shows the fractionating column used to separate fractions **A**, **B** and **C**.

Figure 1



The temperature of the fractionating column is:

- 30 °C at the top
- 400 °C at the bottom.

Complete **Figure 1** to show where fractions **A**, **B** and **C** are collected.

(1)

(b) **Table 2** shows information about three fractions obtained from crude oil.

Table 2

Fraction	Range of number of carbon atoms in each molecule
Petrol	5–12
Diesel oil	15–19
Heavy fuel oil	20–40

Complete the sentences.

Choose answers from the box.

lower	the same	higher

Compared to petrol, the viscosity of heavy fuel oil is _____.

Compared to petrol, the flammability of diesel oil is _____.

(2)

Table 3 shows the percentage of two fractions obtained from two different sources of crude oil.

Table 3

Source	Percentage (%) of fraction	
	Kerosene	Heavy fuel oil
J	13	30
K	4	44

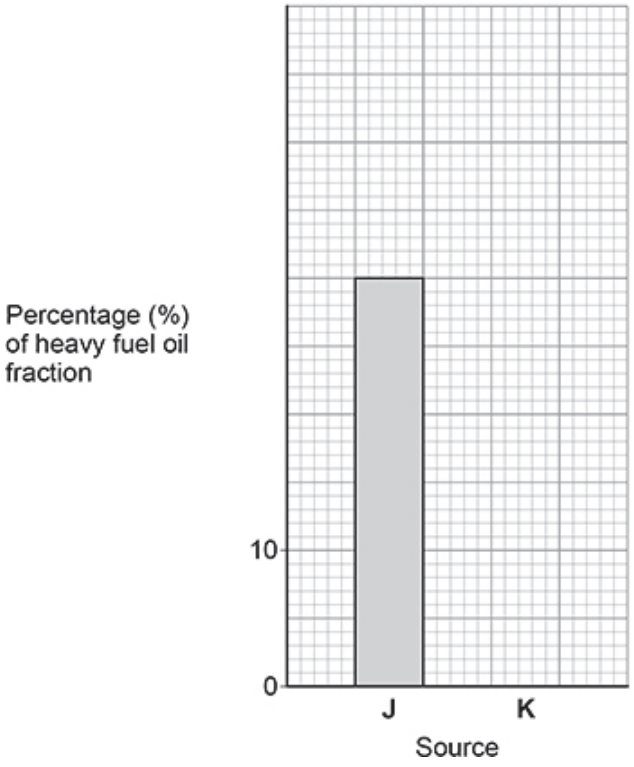
(c) Complete **Figure 2**.

You should:

- complete the *y*-axis scale
- plot the percentage of the heavy fuel oil fraction obtained from source **K**.

Use **Table 3**.

Figure 2



(2)

(d) Kerosene is in higher demand than heavy fuel oil.

Suggest why crude oil from source **J** is in higher demand than crude oil from source **K**.

Use **Table 3**.

_____

_____

(1)

Large hydrocarbon molecules can be cracked to produce smaller hydrocarbon molecules including alkanes.

(e) Which **two** of the following can be used to crack large hydrocarbon molecules?

Tick (✓) **two** boxes.

A catalyst ☐

A fertiliser ☐

Air ☐

Ozone ☐

Steam ☐

(2)

(f) Alkanes have the general formula C_nH_{2n+2}

Complete the formula of the alkane molecule containing 11 carbon atoms.

$C_{11}H$___

(1)

(g) C_2H_6 is an alkane.

Which type of bond is found in a C_2H_6 molecule?

Tick (✓) **one** box.

A double bond between two carbon atoms. ☐

A double bond between two hydrogen atoms. ☐

A single bond between two carbon atoms. ☐

A single bond between two hydrogen atoms. ☐

(1)

(h) Which **two** substances are produced when alkanes completely combust?

Tick (✓) **two** boxes.

Carbon ☐

Carbon dioxide ☐

Carbon monoxide ☐

Hydrogen ☐

Water ☐

(2)

(Total 12 marks)