AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

GCSE
COMBINED SCIENCE: TRILOGY

F

Foundation Tier
Chemistry Paper 2F

Wednesday 13 June 2018 Morning Time allowed: 1 hour 15 minutes

Materials
For this paper you must have:
- a ruler
- a scientific calculator
- the periodic table (enclosed).

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

Information
- The maximum mark for this paper is 70.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	

0 1 **Figure 1** represents an atom of sulfur.

Figure 1

$^{32}_{16}S$

0 1 . 1 Complete **Table 1**

[1 mark]

Table 1

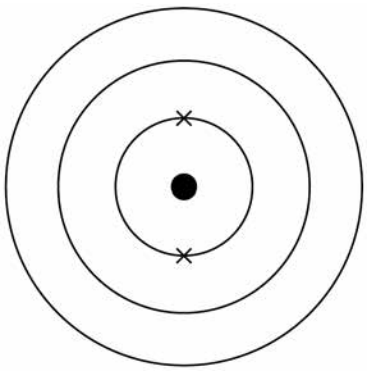
Particle	Number of particles in a sulfur atom
Electron	16
Neutron	
Proton	16

0 1 . 2 Sulfur is in Group 6 of the periodic table.

Complete the electronic structure of the sulfur atom represented in **Figure 2**

[1 mark]

Figure 2



Do not write outside the box

0 1 . 3 Sulfur reacts with oxygen to produce sulfur dioxide.

Complete the word equation for this reaction.

[1 mark]

sulfur + _____

0 1 . 4 What effect is caused by sulfur dioxide?

[1 mark]

Tick **one** box.

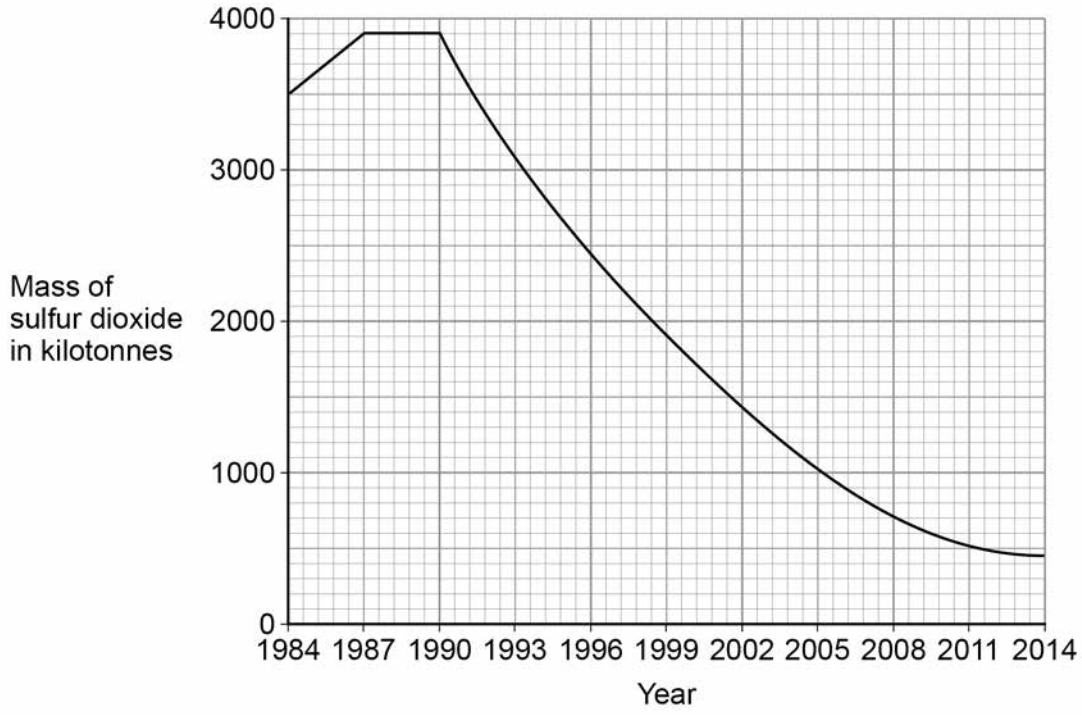
- Acid rain ☐
- Global dimming ☐
- Global warming ☐
- Sea levels rising ☐

Question 1 continues on the next page

Do not write outside the box

0 1 . 5 **Figure 3** shows the mass of sulfur dioxide in the Earth's atmosphere between 1984 and 2014

Figure 3



A student said:

'the mass of sulfur dioxide in the atmosphere decreased every year between 1984 and 2014'

Is the student correct?

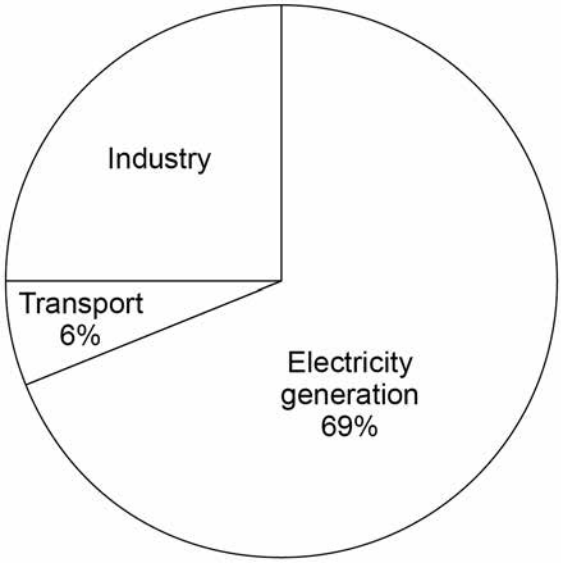
Use data from **Figure 3** to justify your answer.

[3 marks]

Do not write outside the box

0 1 . 6 **Figure 4** shows the percentage of sulfur dioxide released by human activities.

Figure 4



Calculate the percentage of sulfur dioxide released by industry.

[2 marks]

Percentage = _____ %

9

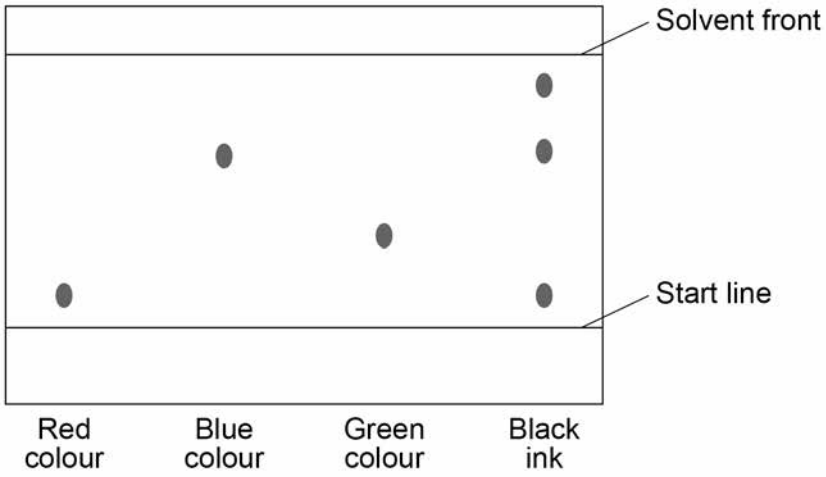
Turn over for the next question

Do not write outside the box

0 2 A student used paper chromatography to identify the colours in a black ink.

Figure 5 shows the student's results.

Figure 5



0 2 . 1 What colours are in the black ink?

[2 marks]

0 2 . 2 Suggest which colour is least soluble in the solvent.

Give a reason for your answer.

[2 marks]

Colour _____

Reason _____

Do not write outside the box

0 2 . 3 Use **Figure 5** to complete **Table 2**

Table 2

	Distance in mm
Distance moved by green colour	
Distance moved by solvent	

Calculate the R_f value for the green colour.

Use the equation:

$$R_f = \frac{\text{distance moved by green colour}}{\text{distance moved by solvent}}$$

[4 marks]

R_f value = _____

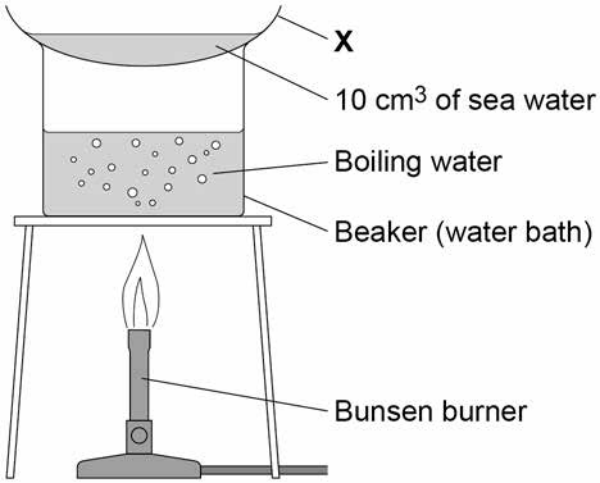
8

Turn over for the next question

0 3 A student tested a sea water sample for dissolved solids.

Figure 6 shows the apparatus.

Figure 6



0 3 . 1 What is apparatus **X** on **Figure 6**?

[1 mark]

Tick **one** box.

Boiling tube ☐

Condenser ☐

Funnel ☐

Watch glass ☐

Do not write outside the box

0 3 . 2 The student did the test four times.

The student calculated the mass of solid on apparatus **X** after heating.

Table 3 shows the student's results.

Table 3

	Test 1	**Test 2**	**Test 3**	**Test 4**
Mass of solid in grams	0.12	0.29	0.14	0.15

Calculate the mean mass of solid.

Do not include the anomalous result in your calculation.

Give your answer to 2 significant figures.

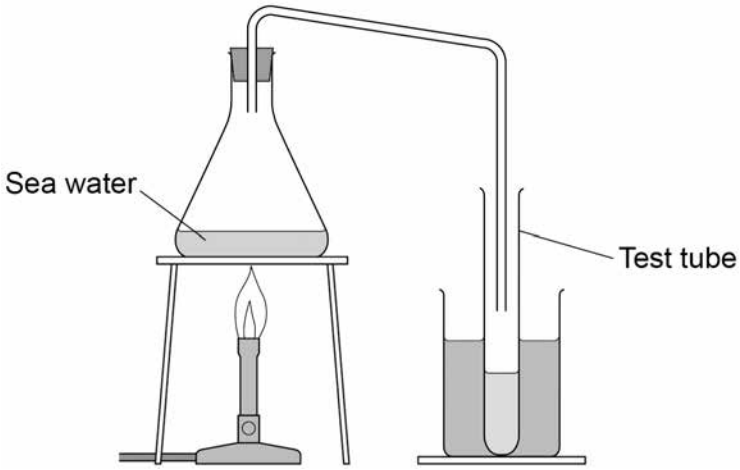
[3 marks]

Mean mass = _____ g

Question 3 continues on the next page

The student distilled a sample of sea water in the apparatus shown in **Figure 7**

Figure 7



0 3 . 3 What change of state is happening at the surface of the sea water in **Figure 7**?

[1 mark]

0 3 . 4 Describe how the water in the test tube in **Figure 7** is different from the sea water.

[1 mark]

0 3 . 5 Why does producing drinking water from sea water using distillation cost a lot of money?

[1 mark]

Do not write outside the box

0 3 . 6 River water is filtered then sterilised to make drinking water.

Why are these **two** processes done?

[2 marks]

Filtering _____

_____

Sterilising _____

_____

9

Turn over for the next question

Do not write outside the box

0 4 . 1 What percentage of the Earth's atmosphere is nitrogen?

[1 mark]

Tick **one** box.

5% ☐ 20% ☐ 50% ☐ 80% ☐

0 4 . 2 During the first billion years of the Earth's existence the amount of nitrogen in the atmosphere increased.

Give **one** source of this nitrogen.

[1 mark]

_____

0 4 . 3 Nitrogen is used to make ammonia.

The word equation for the reaction is:

nitrogen + hydrogen _____ ammonia

Write the correct symbol in the equation to show that it is a reversible reaction.

[1 mark]

0 4 . 4 A reversible reaction can reach equilibrium.

Complete the sentence.

[1 mark]

Equilibrium is reached when the forward reaction and the reverse reaction happen at the same _____ .

0 4 . 5 Fertilisers are formulations containing nitrogen.

What is a formulation?

[1 mark]

_____

_____

Do not write outside the box

0 4 . 6 **Table 4** shows percentages of chemical elements in a fertiliser.

Table 4

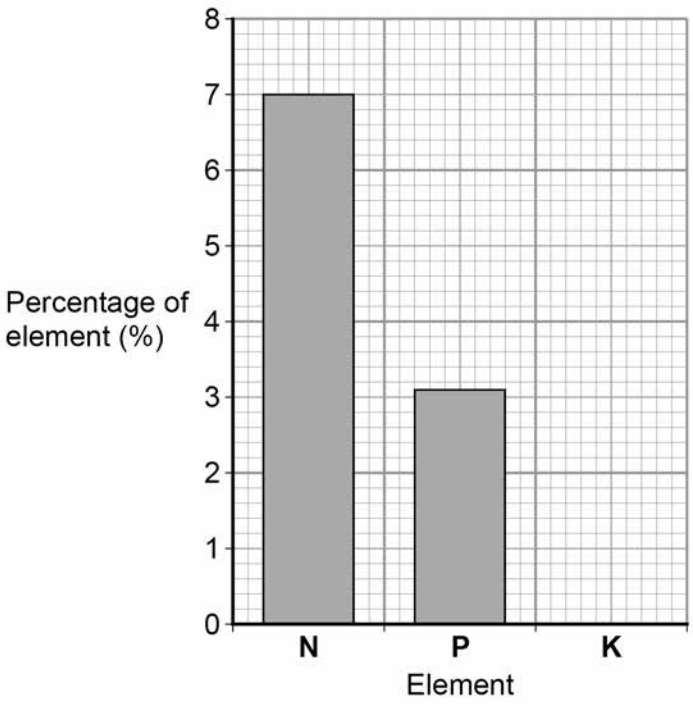
Element	Percentage (%)
Nitrogen (N)	7.0
Phosphorus (P)	3.1
Potassium (K)	5.8

Draw the bar for potassium on **Figure 8**

Use the information in **Table 4**

[1 mark]

Figure 8



Do not write outside the box

0 4 . 7 A fertiliser contains 0.225 g of iron per 3.0 g of fertiliser.

Which calculation gives the percentage of iron in the fertiliser?

[1 mark]

Tick **one** box.

$\frac{0.225}{3.0 \times 100}$ ☐

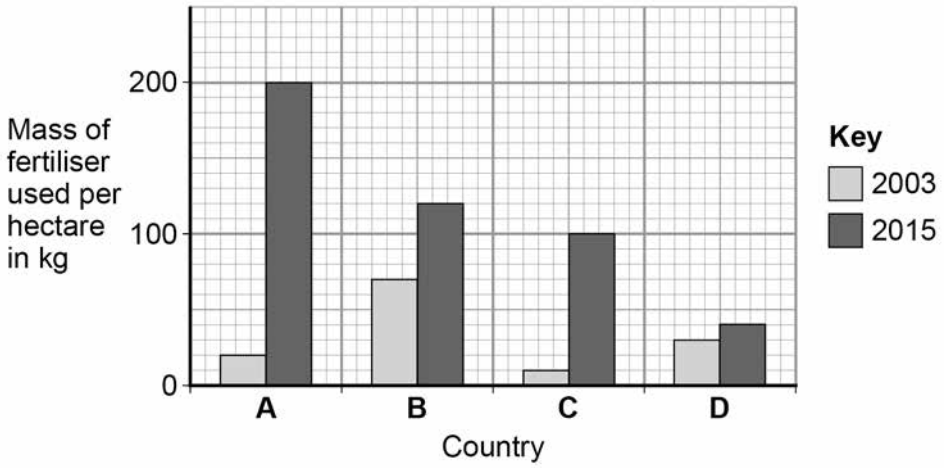
$\frac{3.0 \times 100}{0.225}$ ☐

$\frac{0.225 \times 3.0}{100}$ ☐

$\frac{0.225 \times 100}{3.0}$ ☐

0 4 . 8 **Figure 9** shows the use of fertiliser in four different countries, **A**, **B**, **C** and **D**, in 2003 and 2015

Figure 9



A student said:

'**much** more fertiliser was used in 2015 than in 2003'

Is the student correct?

Use data from **Figure 9** to justify your answer.

[3 marks]

10

Turn over for the next question

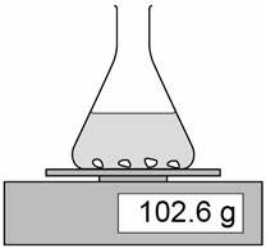
0 5 A student investigated the effect of the size of marble chips on the rate of the reaction between marble chips and hydrochloric acid.

This is the method used.

1. Add 10.0 g of marble chips into the flask.
2. Add 50 cm^3 of hydrochloric acid and start a timer.
3. Record the mass lost from the flask every 10 seconds.
4. Repeat steps 1 to 3 with different sizes of marble chips.

Figure 10 shows the apparatus.

Figure 10



0 5 . 1 Draw **one** line from each type of variable to the correct example of the variable.

[2 marks]

Type of variable	Example of variable
	Mass lost from flask
Independent	Size of flask
	Size of marble chips
Control	
	Time taken
	Volume of acid

Do not write outside the box

0 5 . 2 The equation for the reaction is:

$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$$

Name the **three** products.

[2 marks]

1 _____

2 _____

3 _____

0 5 . 3 Another student suggests putting some cotton wool in the top of the flask.

Suggest why this improves the investigation.

[1 mark]

_____

_____

0 5 . 4 The reaction produces 1.6 g of gas in 30 seconds.

Calculate the mean rate of the reaction in the first 30 seconds.

Use the equation:

$$\text{mean rate of reaction} = \frac{\text{mass of product produced in grams}}{\text{time in seconds}}$$

[1 mark]

_____

_____

Mean rate of reaction = _____

0 5 . 5 What is the unit for the mean rate of reaction calculated in question **05.4**?

[1 mark]

Tick **one** box.

g ☐ g/s ☐ s ☐ s/g ☐

Turn over ►

Do not write outside the box

0 5 . 6 **Table 5** shows the student's results.

Table 5

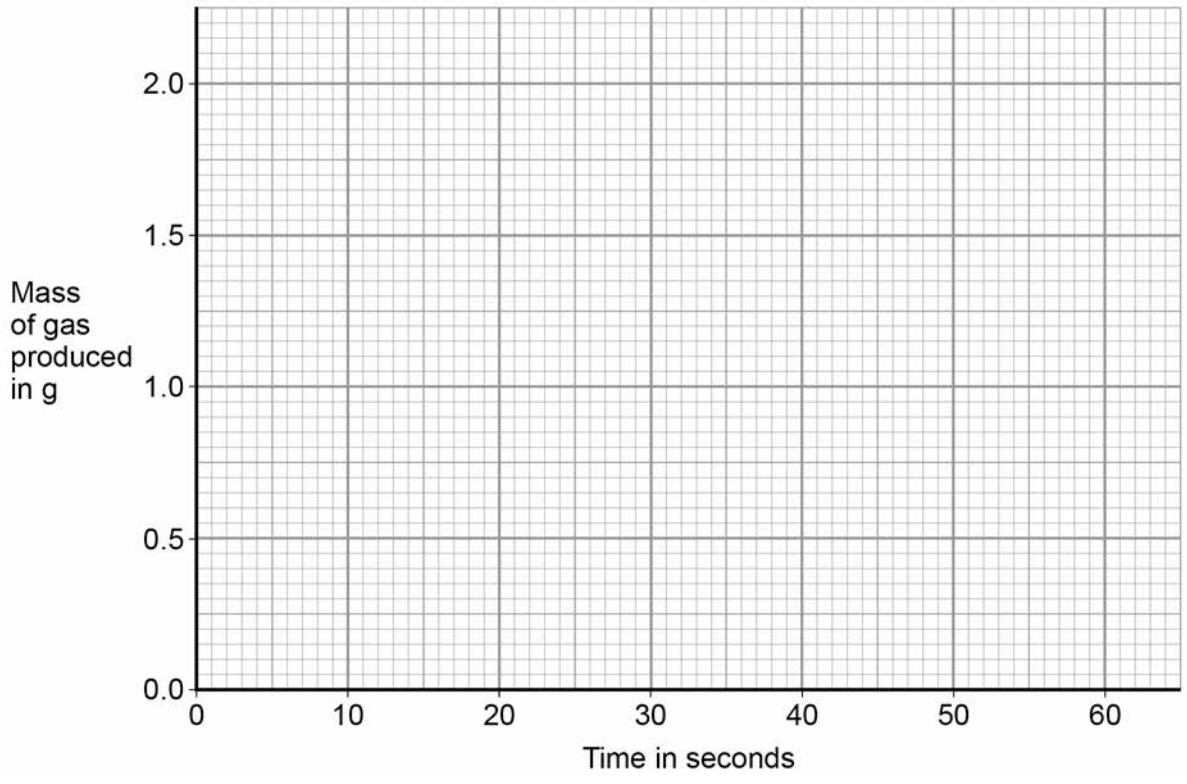
Time in seconds	Mass of gas produced in g
0	0.0
10	0.8
20	0.6
30	1.6
40	1.8
50	2.0
60	2.0

Plot the data from **Table 5** on **Figure 11**

Draw a line of best fit.

[3 marks]

Figure 11



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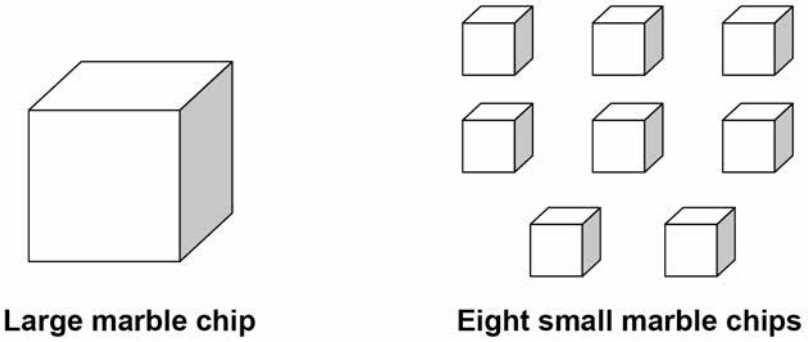
0 5 . 7 **Figure 12** shows a large marble chip and eight small marble chips.

Figure 12



The large marble chip has the same total volume as the eight small marble chips, but a different surface area.

Why do the eight small marble chips react faster than the large marble chip?

[1 mark]

Tick **one** box.

The eight small marble chips have a larger surface area, so less frequent collisions. ☐

The eight small marble chips have a larger surface area, so more frequent collisions. ☐

The eight small marble chips have a smaller surface area, so less frequent collisions. ☐

The eight small marble chips have a smaller surface area, so more frequent collisions. ☐

11

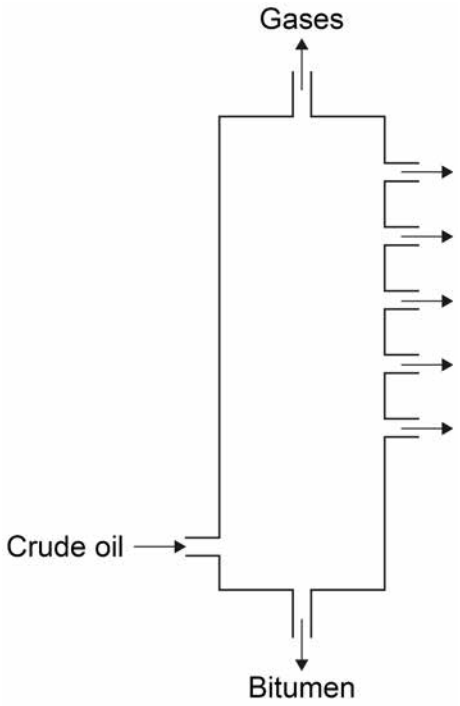
Turn over for the next question

0 6 Crude oil is a mixture of hydrocarbons.

0 6 . 1 The hydrocarbons in crude oil are separated into fractions by fractional distillation.

Figure 13 shows a fractional distillation column.

Figure 13



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.

Do not write outside the box

0 6 . 2 Why do the fractions separate?

[1 mark]

Tick **one** box.

The fractions have different boiling points. ☐

The fractions have different flammability. ☐

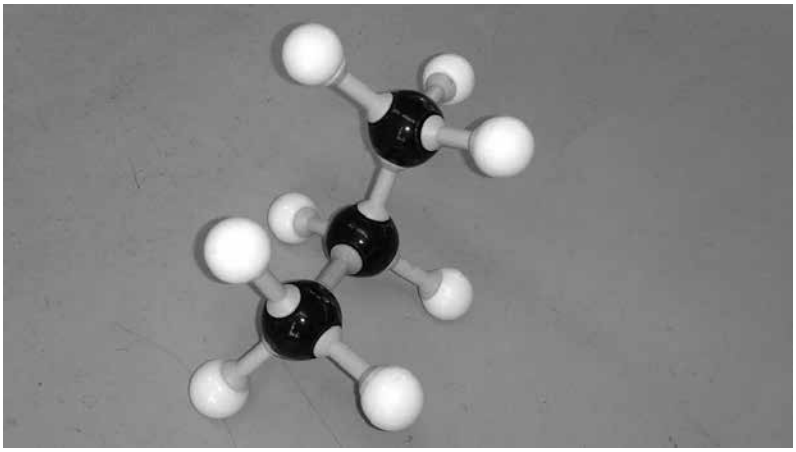
The fractions have different melting points. ☐

The fractions have different viscosity. ☐

Most of the hydrocarbons in crude oil are alkanes.

0 6 . 3 **Figure 14** represents an alkane molecule.

Figure 14



Name the alkane.

[1 mark]

Do not write outside the box

0 6 . 4 Methane (CH_4) is an alkane.

What is the general formula for alkanes?

[1 mark]

Tick **one** box.

- C_nH_n ☐
- C_nH_{2n} ☐
- C_nH_{2n-2} ☐
- C_nH_{2n+2} ☐

0 6 . 5 Alkanes burn in oxygen.

Balance the equation for methane burning.

[1 mark]

$$\_\_\_\_ CH_4 + \_\_\_\_ O_2 \rightarrow \_\_\_\_ CO_2 + \_\_\_\_ H_2O$$

0 6 . 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 ☐

Table 6 shows data from a life cycle assessment (LCA) for the disposal of 10 000 biodegradable plastic bags.

Table 6

	Burning and using the energy to generate electricity	Landfill
Mass of carbon dioxide produced in kg	25	15
Mass of solid residue in kg	0.050	0.070
Mass of sulfur dioxide produced in kg	0.20	0.30

0 6 . 7 Why are life cycle assessments (LCA) done?

[1 mark]

0 6 . 8 Compare the **two** methods for the disposal of biodegradable plastic bags.

Use information from **Table 6**

[4 marks]

11

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0 7 This question is about the Earth's atmosphere.

0 7 . 1 Carbon dioxide is a greenhouse gas.

What is another greenhouse gas?

[1 mark]

Tick **one** box.

Argon ☐

Methane ☐

Nitrogen ☐

Oxygen ☐

0 7 . 2 Greenhouse gases cause global climate change.

Give **two** effects of global climate change.

[2 marks]

1 _____

_____

2 _____

_____

0 7 . 3 4.1 kg of a plastic, used to make plastic bottles, has a carbon footprint of 6.0 kg of carbon dioxide.

Calculate the carbon footprint of **one** plastic bottle of mass 23.5 g

[2 marks]

_____

_____

_____

_____

Carbon footprint = _____ kg of carbon dioxide

Do not write outside the box

0 7 . 4 Give **one** way that carbon dioxide emissions can be reduced when a plastic bottle is manufactured.

[1 mark]

0 7 . 5 Explain how the percentages of nitrogen, oxygen and carbon dioxide in the Earth's atmosphere today have changed from the Earth's early atmosphere.

[6 marks]

12

END OF QUESTIONS

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