Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

GCSE CHEMISTRY

F

Foundation Tier — Paper 2F

Specimen 2018 (set 2) — Time allowed: 1 hour 45 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 100.
- 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.

0 1 This question is about hydrocarbons.

Table 1 gives information about four hydrocarbons.

The hydrocarbons are four successive members of a homologous series.

Table 1

Hydrocarbon	Formula	Boiling point in °C
A	C_4H_{10}	0
B		36
C	C_6H_{14}	69
D	C_7H_{16}	98

0 1 . 1 What is the formula of hydrocarbon **B**?

[1 mark]

Tick **one** box.

C_4H_{12} ☐

C_5H_{10} ☐

C_5H_{12} ☐

C_6H_{12} ☐

0 1 . 2 What is the simplest ratio of carbon : hydrogen atoms in a molecule of hydrocarbon **A?**

[1 mark]

Ratio = 2 **:** _____

0 1 . 3 Which hydrocarbon is a gas at room temperature (25 °C)?

[1 mark]

Tick **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 1 . 4 Which hydrocarbon is most flammable?

[1 mark]

Tick **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 1 . 5 Which **two** substances are produced when a hydrocarbon **completely** combusts in air?

[2 marks]

Tick **two** boxes.

Carbon ☐

Carbon dioxide ☐

Hydrogen ☐

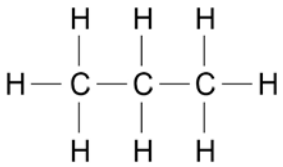
Sulfur dioxide ☐

Water ☐

Question 1 continues on the next page

Figure 1 shows the displayed structure of a hydrocarbon molecule.

Figure 1



0 1 . 6 What is the name of the hydrocarbon in **Figure 1**?

[1 mark]

Tick **one** box.

Butane ☐

Ethane ☐

Methane ☐

Propane ☐

0 1 . 7 Calculate the relative formula mass (M_r) of the hydrocarbon in **Figure 1**.

Relative atomic masses (A_r): H = 1 C = 12

[2 marks]

Relative formula mass (M_r) = _____

9

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

0 2 This question is about alloys of copper.

0 2 . 1 Complete the sentence.

Choose the answer from the box.

[1 mark]

aluminium	**iron**	**magnesium**	**tin**

Bronze is an alloy of copper and _____ .

Brass is an alloy of copper and zinc.

Table 2 shows the percentage by mass of copper and zinc in two types of brass.

Table 2

Type of brass	**Percentage (%) by mass**	
	Copper	**Zinc**
Red brass	90	10
Yellow brass	**X**	30

0 2 . 2 Calculate value **X** in **Table 2**.

[1 mark]

_____

Percentage by mass **X** = _____ %

0 2 . 3 Calculate the mass of copper in 1100 g of red brass.

[2 marks]

Mass = _____ g

0 2 . 4 What is meant by an alloy?

[1 mark]

0 2 . 5 Brass contains layers of atoms which can slide over each other.

Explain why red brass is softer than yellow brass.

Use **Table 2** and your own knowledge.

[2 marks]

0 2 . 6 Some musical instruments are made of brass.

Parts of these instruments can be gold plated.

What is the carat number of pure gold?

[1 mark]

Tick **one** box.

9 ☐ 18 ☐ 22 ☐ 24 ☐

8

0 3 Coal is used as a fuel in power stations.

Table 3 shows the percentage of carbon and sulfur in four different coal samples.

Table 3

Sample	Percentage (%) by mass in coal	
	Carbon	**Sulfur**
A	22.1	0.4
B	46.8	0.6
C	66.3	0.9
D	92.0	0.7

0 3 . 1 Sulfur produces a gas that causes acid rain.

Name the gas.

[1 mark]

0 3 . 2 Give **one** environmental effect caused by acid rain.

[1 mark]

0 3 . 3 Which coal sample produces the most acid rain from 1 kg of coal?

Use **Table 3**.

Give a reason for your answer.

[2 marks]

Sample _____

Reason _____

_____

0 3 . 4 Calculate the mass of coal sample **A** that would produce the same amount of carbon dioxide as 1kg of coal sample **C**.

[2 marks]

_____

_____

Mass of coal sample **A** = _____ kg

0 3 . 5 Incomplete combustion of coal can produce carbon monoxide.

Carbon monoxide is a toxic gas.

Give **two** reasons why people may be unaware of the presence of carbon monoxide.

[2 marks]

1 _____

_____

2 _____

_____

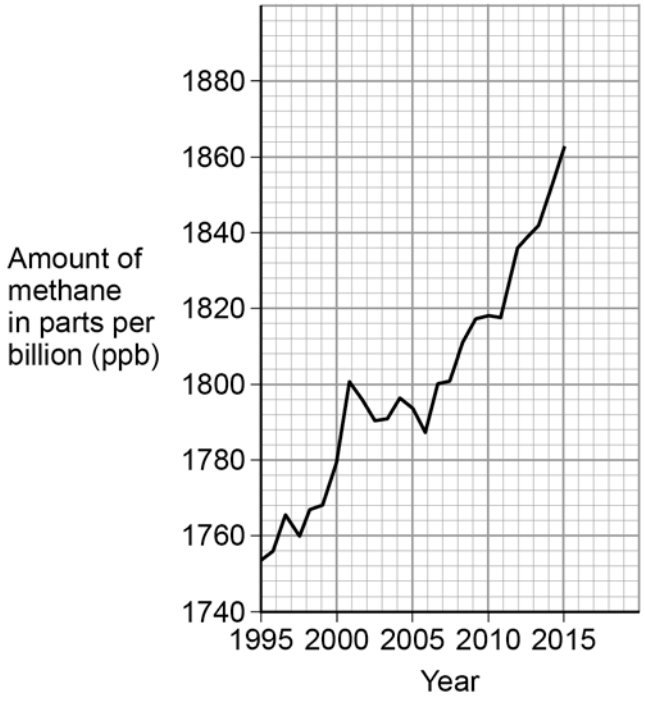
8

0 4 Methane gas is present in the atmosphere.

Most scientists think methane is a cause of global climate change.

Figure 2 shows the changes in the amount of methane in the atmosphere from 1995 to 2015.

Figure 2



0 4 . 1 Calculate the increase in the amount of methane between 1999 and 2012.

[2 marks]

Amount in 1999 _____ ppb

Amount in 2012 _____ ppb

Increase in amount of methane = _____ ppb

0 4 . 2 How did the amount of methane in the atmosphere change between 2003 and 2005?

[1 mark]

Tick **one** box.

Methane levels fell. ☐

Methane levels rose. ☐

Methane levels rose and fell. ☐

Methane levels stayed the same. ☐

0 4 . 3 Name **two** activities that increase the amount of methane in the atmosphere.

[2 marks]

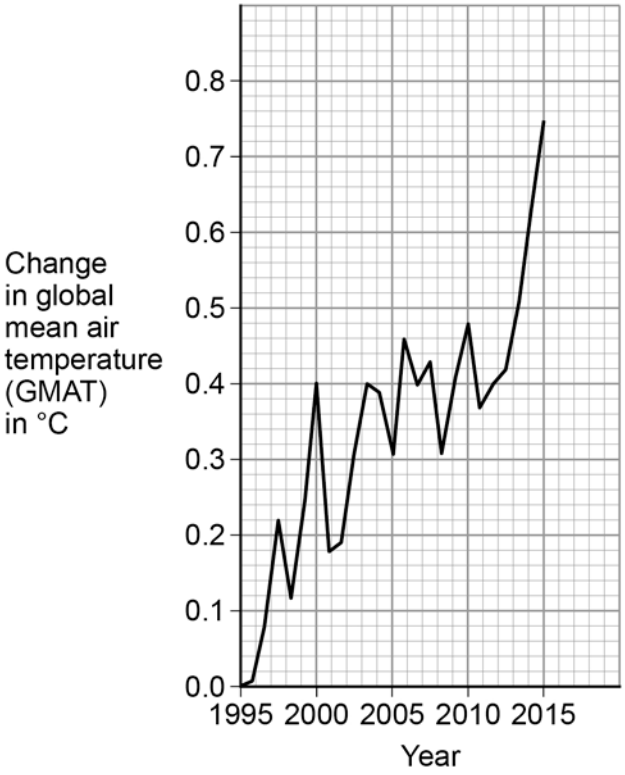
1 _____

2 _____

Question 4 continues on the next page

Figure 3 shows the changes in global mean air temperature (GMAT) from 1995 to 2015.

Figure 3



0 4 . 4 What patterns in global mean air temperature (GMAT) between 1995 and 2015 are shown in **Figure 3**?

[2 marks]

Tick **two** boxes.

- The largest increase in GMAT was between 1995 and 1996. ☐
- There was a continuous increase in GMAT. ☐
- There was a fall in GMAT in some years. ☐
- There was an overall decrease in GMAT. ☐
- There was an overall increase in GMAT. ☐

0 4 . 5 Increasing air temperatures can result in rising sea levels.

Give **one** reason why.

[1 mark]

_____

0 4 . 6 What could be an effect of rising sea levels on coastal areas?

[1 mark]

Tick **one** box.

Reduced rainfall ☐

Flooding of low lying areas ☐

Global dimming ☐

More land for houses ☐

0 4 . 7 Between 2004 and 2010:

- the global mean air temperature (GMAT) increased by 0.09 °C
- global mean sea level (GMSL) increased by 9 mm.

Estimate the increase in GMSL produced by a 1 °C increase in GMAT.

[1 mark]

Tick **one** box.

0.1 mm ☐

1 mm ☐

10 mm ☐

100 mm ☐

10

0 5 A student investigates the effect of concentration on the rate of reaction.

The student reacts sodium thiosulfate solution with dilute hydrochloric acid.

This produces a cloudy mixture.

0 5 . 1 The cloudiness is produced by the formation of solid sulfur.

How should sulfur be written in the chemical equation for this reaction?

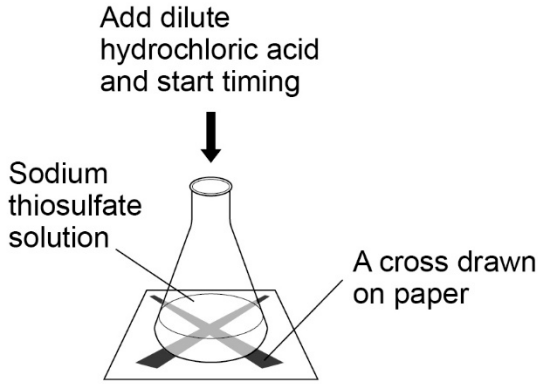
[1 mark]

Tick **one** box.

S(aq) ☐ S(g) ☐ S(l) ☐ S(s) ☐

Figure 4 shows some of the apparatus the student uses.

Figure 4



This is the method used.

1. Measure 40 cm^3 sodium thiosulfate solution into a conical flask.
2. Stand the flask on a piece of paper with a cross drawn on it.
3. Add 10 cm^3 of dilute hydrochloric acid to the flask.
4. Time how long it takes the cross to become no longer visible.
5. Repeat steps 1–4 twice more.
6. Repeat steps 1–5 with sodium thiosulfate solutions of different concentrations.

0 5 . 2 Which apparatus could be used to measure 10 cm^3 of dilute hydrochloric acid?

[1 mark]

Tick **one** box.

- Beaker ☐
- Boiling tube ☐
- Measuring cylinder ☐
- Test tube ☐

0 5 . 3 Draw **one** line from each type of variable to the description of the variable.

[2 marks]

Type of variable	**Description of the variable**
	Concentration of sodium thiosulfate solution
Dependent variable	Size of conical flask
	Size of cross drawn on paper
Independent variable	Time for cross to become no longer visible
	Volume of hydrochloric acid

0 5 . 4 The student draws a new cross for each experiment.

Suggest why this might give inaccurate results.

[1 mark]

_____

_____

Turn over ►

Table 4 shows the student's results for sodium thiosulfate solution with a concentration of 12 g/dm^3

Table 4

Time for cross to become no longer visible in s			
Trial 1	**Trial 2**	**Trial 3**	**Mean**
43	78	41	**X**

0 5 . 5 Calculate value **X** in **Table 4**.

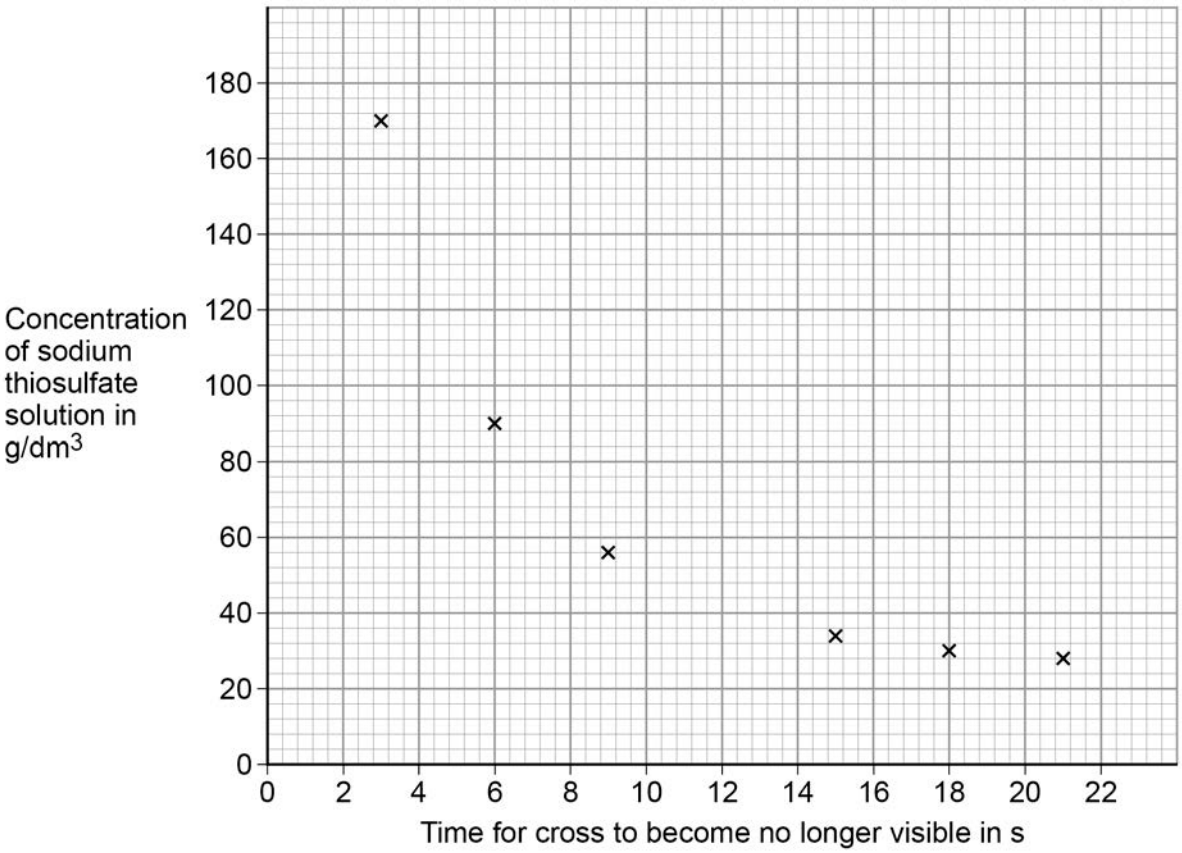
Do **not** use any anomalous results in your calculation.

[2 marks]

X = _____ s

0 5 . 6 **Figure 5** shows some of the student's results.

Figure 5



Draw a smooth curve of best fit on **Figure 5**.

[1 mark]

Question 5 continues on the next page

Turn over ►

0 5 . 7 Another student does the same investigation.

Both students have a similar pattern in their results.

Which word describes investigations performed by different students, which give a similar pattern of results?

[1 mark]

Tick **one** box.

- Accurate ☐
- Precise ☐
- Reproducible ☐
- Valid ☐

0 5 . 8 The more concentrated the sodium thiosulfate solution, the less time is taken for the cross to become no longer visible.

Give **two** reasons why.

[2 marks]

Tick **two** boxes.

- Particles are more spread out ☐
- Particles collide more frequently ☐
- Particles have more energy ☐
- Particles move more quickly ☐
- There are more particles in a fixed volume ☐

11

0 6 The Haber Process is used to produce ammonia from nitrogen and hydrogen.

The equation for the reaction is:

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

0 6 . 1 An ammonia molecule has the formula NH_3

How many atoms are there in one molecule of ammonia?

[1 mark]

Tick **one** box.

2 ☐ 3 ☐ 4 ☐ 6 ☐

0 6 . 2 What does the symbol $\rightleftharpoons$ mean?

[1 mark]

0 6 . 3 Draw **one** line from each gas to the source of that gas.

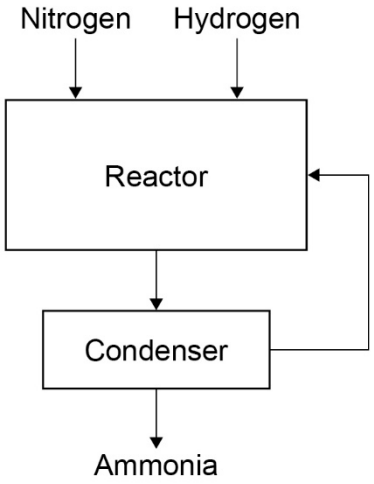
[2 marks]

Gas	Source
	Air
Hydrogen	Alcohol
	Ammonia
Nitrogen	Iron
	Natural gas

Question 6 continues on the next page

Figure 6 shows the Haber process.

Figure 6



A mixture of ammonia, hydrogen and nitrogen gases leave the reactor.

Table 5 shows the boiling points of the gases.

Table 5

Gas	**Boiling point in °C**
Ammonia	– 33
Nitrogen	– 196
Hydrogen	– 253

0 6 . 4 The mixture is cooled to a temperature at which **only** the ammonia condenses to a liquid.

Which temperature could be used?

[1 mark]

Tick **one** box.

– 20 °C ☐

– 40 °C ☐

– 200 °C ☐

– 260 °C ☐

0 6 . 5 What happens to the unreacted nitrogen?

[1 mark]

Tick **one** box.

Collected and sold ☐

Recycled to the reactor ☐

Released into the air ☐

Used as a catalyst ☐

Question 6 continues on the next page

Ammonia from the Haber process can be used to produce fertilisers.

Table 6 gives information about two compounds used in fertilisers.

Table 6

Fertiliser	Compound	Cost in £/kg
A	Potassium chloride	0.24
B	Diammonium phosphate	0.35

0 6 . 6 What type of bonding is present in potassium chloride?

[1 mark]

Tick **one** box.

Covalent ☐

Ionic ☐

Metallic ☐

0 6 . 7 Diammonium phosphate has the chemical formula $(NH_4)_2HPO_4$

Which **two** elements in $(NH_4)_2HPO_4$ improve agricultural productivity?

[2 marks]

Tick **two** boxes.

Chlorine ☐

Hydrogen ☐

Nitrogen ☐

Oxygen ☐

Phosphorus ☐

A farmer uses fertilisers **A** and **B** on a field with an area of 0.05 km^2

0 6 . 8 50 kg of fertiliser **A** will cover an area of 0.01 km^2

Calculate the cost of fertilising a field with an area of 0.05 km^2 with fertiliser **A**.

Use **Table 6**.

[2 marks]

Cost = £ _____

0 6 . 9 Fertiliser **B** is more expensive than fertiliser **A**.

Suggest why the farmer uses **both** fertilisers.

[1 mark]

12

Turn over for the next question

0 7 Potable water is water that is safe to drink.

Seawater can be changed into potable water by desalination.

0 7 . 1 Name the substance removed from seawater by desalination.

[1 mark]

0 7 . 2 Desalination requires large amounts of energy.

Desalination is only used when there is no other source of potable water.

Give **one** reason why.

[1 mark]

Water from lakes and rivers can be treated to make it potable.

0 7 . 3 The first stage is to filter the water from lakes and rivers.

Why is the water filtered?

[1 mark]

0 7 . 4 Chlorine gas is then added to the filtered water.

Why is chlorine gas used to treat water?

[1 mark]

0 7 . 5 Describe a test for chlorine gas.

Give the result of the test if chlorine is present.

[2 marks]

Test

Result

Question 7 continues on the next page

Some students investigated different water samples.

Table 7 shows some of their results.

Table 7

Water	pH	Mass of dissolved solid in g/dm^3
Tap water	6.5	0.5
Seawater	8.1	35.0
Pure water		

0 7 . 6 Complete **Table 7** to show the expected results for pure water.

[2 marks]

0 7 . 7 What mass of dissolved solid is present in 100 cm^3 of the sample of tap water?

[1 mark]

Tick **one** box.

0.05 g ☐

0.5 g ☐

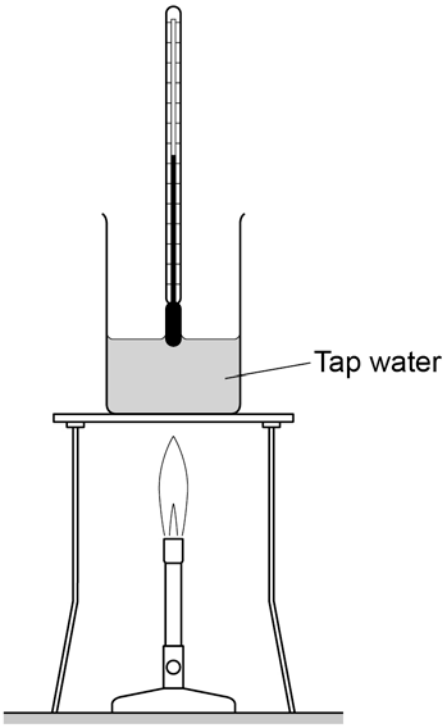
5 g ☐

50 g ☐

0 7 . 8 Boiling points can be used to show whether substances are pure.

Figure 7 shows the apparatus the students used to find the boiling point of tap water.

Figure 7



The students made a mistake setting up the apparatus.

What mistake did the students make?

[1 mark]

_____

_____

10

Turn over for the next question

0 8 Burgundy Mixture is a formulation used to kill fungi on grapevines.

It is made by mixing two compounds, **A** and **B**.

The ratio by mass of **A** : **B** in the mixture is 1 : 8

0 8 . 1 Calculate the mass of **A** needed in a mixture containing 125 g of **B**.

[2 marks]

Mass of **A** = _____ g

Scientists test a solution of compound **A**.

Table 8 shows their results.

Table 8

Test	**Result**
Add sodium hydroxide solution	Blue precipitate
Add dilute hydrochloric acid and barium chloride solution	White precipitate

0 8 . 2 Which **two** ions are in compound **A**?

Choose the answers from the box.

[2 marks]

bromide	**chloride**	**copper**
iron(II)	**iron(III)**	**sulfate**

_____ ions and _____ ions

0 8 . 3 The scientists think that compound **B** is sodium carbonate.

Describe how the scientists can test a solution of **B** to see if sodium ions are present.

Give the result of the test if sodium ions are present.

[2 marks]

0 8 . 4 Describe how the scientists can test a solution of **B** to see if carbonate ions are present.

Give the result of the test if carbonate ions are present.

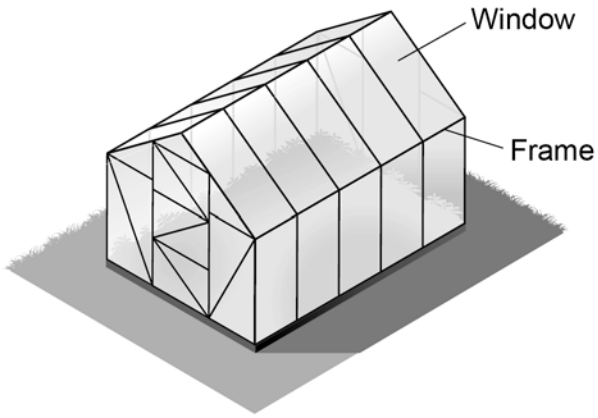
[3 marks]

9

Turn over for the next question

0 9 **Figure 8** shows a greenhouse.

Figure 8



A greenhouse frame can be made from wood or aluminium.

Table 9 gives some information about wood and aluminium.

Table 9

	Wood	**Aluminium**
Raw material	Renewable	Non-renewable
Mass of greenhouse frame in kg	80	20
Useful lifetime in years	20	50
End of useful life	Can be chopped up and used as fuel	Can be recycled into new aluminium products

0 9 . 1 Evaluate the use of each material for making greenhouse frames.

Use **Table 9**.

[4 marks]

0 9 . 2 Greenhouse frames are transported by lorry.

The lorry used can carry a maximum load of 12 tonnes.

Calculate the largest number of wooden greenhouse frames which could be transported by the lorry.

Use **Table 9**.

1000 kg = 1 tonne

[2 marks]

Number of wooden greenhouse frames = _____

Question 9 continues on the next page

0 9 . 3 It is more sustainable to make greenhouse frames from recycled aluminium than from aluminium from aluminium ore.

Give **two** reasons why.

[2 marks]

1 _____

_____

2 _____

_____

0 9 . 4 Greenhouse windows can be made from glass or from polymers.

Table 10 gives information about glass and a polymer.

Table 10

	Glass	**Polymer**
Density in g/cm^3	2.8	1.2
Cost in £ per m^2	20	28
Effect of sunlight	No effect	Discolours over time

Suggest **one** advantage of making greenhouse windows from the polymer rather than from glass.

Use **Table 10**.

[1 mark]

_____

_____

9

1 0 This question is about alkenes and crude oil.

1 0 . 1 Pentene is an alkene molecule containing five carbon atoms.

Complete the formula for pentene.

[1 mark]

C ___ H ___

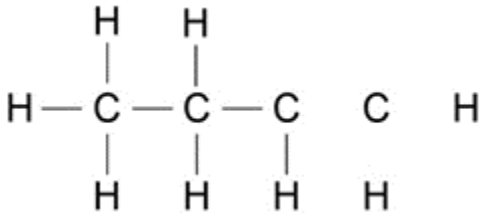
1 0 . 2 Butene is an alkene molecule containing four carbon atoms.

Figure 9 shows all of the atoms and some of the bonds in the displayed formula for butene.

Complete the displayed formula by adding the remaining bonds.

[1 mark]

Figure 9



Question 10 continues on the next page

Pentene and butene are produced from crude oil.

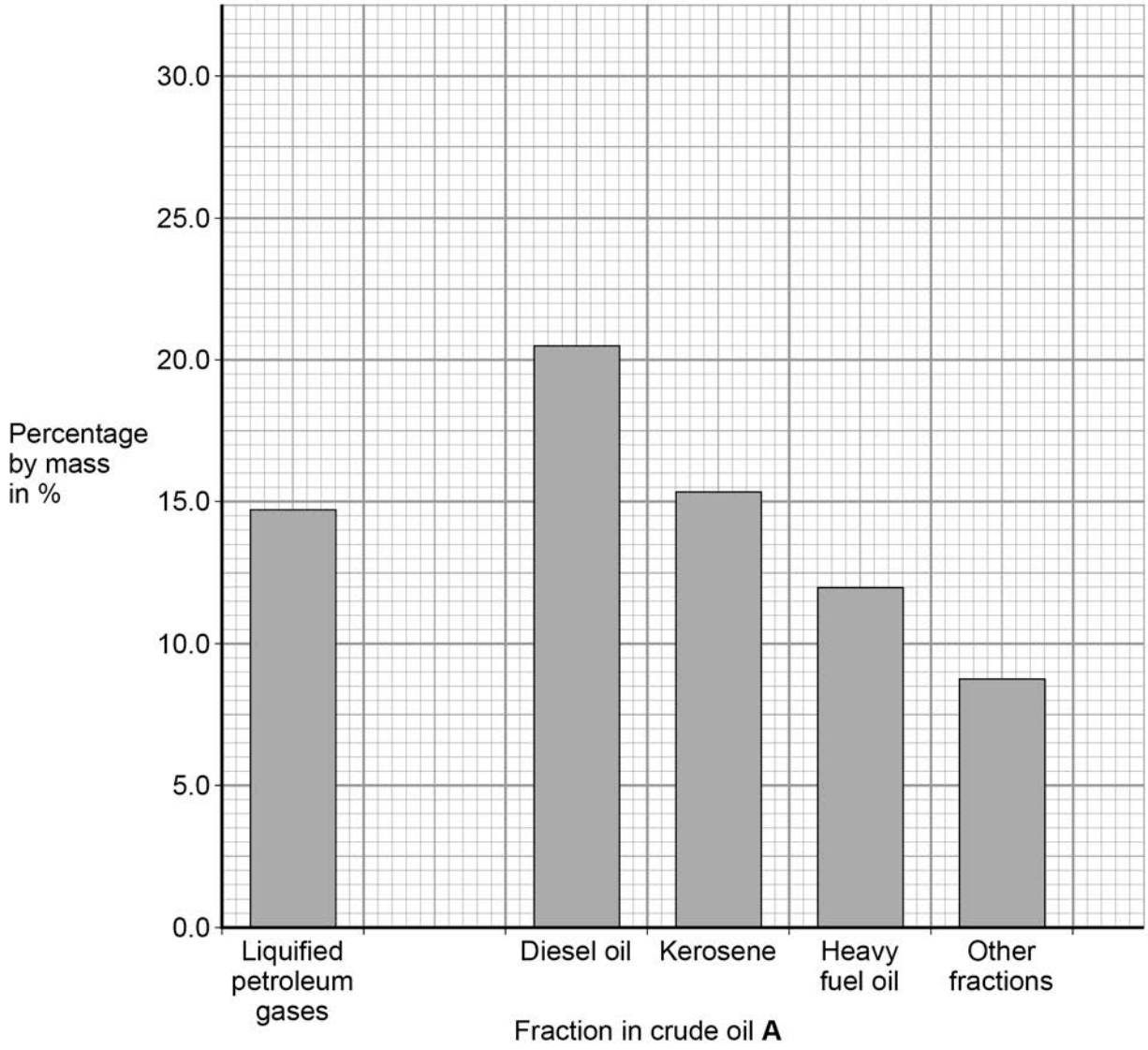
Table 11 shows the percentages of different fractions in two samples of crude oil.

Table 11

Fraction	**Percentages by mass in %**	
	Crude oil A	**Crude oil B**
Liquefied petroleum gases	14.7	7.1
Petrol	28.6	11.1
Diesel oil	20.5	17.2
Kerosene	15.4	38.5
Heavy fuel oil	12.0	16.0
Other fractions	8.8	10.1

Figure 10 shows the percentages of different fractions in crude oil **A**.

Figure 10



1 0 . 3 Plot the data for petrol in **Table 11** on **Figure 10**.

[1 mark]

Question 10 continues on the next page

Turn over ►

1 0 . 4 What mass of crude oil **A** is needed to obtain 12 tonnes of heavy fuel oil?

Use **Table 11**.

[1 mark]

Tick **one** box.

10 tonnes ☐

100 tonnes ☐

1000 tonnes ☐

10 000 tonnes ☐

1 0 . 5 Liquefied petroleum gases, petrol and diesel oil are used as car fuels.

Calculate the total mass of car fuel that can be produced from 2000 kg of crude oil **B**.

Use **Table 11**.

[3 marks]

Mass of car fuel = _____ kg

1 0 . 6 Crude oil **B** is a better source of hydrocarbons for cracking than crude oil **A**.

Suggest why.

Use **Table 11**.

[1 mark]

1 0 . 7 Alkenes are obtained from crude oil using fractional distillation followed by cracking.

Explain how alkenes are produced using fractional distillation followed by cracking.

[6 marks]

14

END OF QUESTIONS

There are no questions printed on this page

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