Surname ______________________

Other Names ______________________

Centre Number ______________________

Candidate Number ______________________

Candidate Signature ______________________

GCSE

COMBINED SCIENCE: TRILOGY

F

Foundation Tier

Chemistry Paper 2F

8464/C/2F

Wednesday 13 June 2018 **Morning**

Time allowed: 1 hour 15 minutes

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

At the top of the page, write your surname and other names, your centre number, your candidate number and add your signature.

[Turn over]

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INSTRUCTIONS

- **Use black ink or black ball-point pen.**
- **Answer ALL questions in the spaces provided. Do not write on blank pages.**
- **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.**

DO NOT TURN OVER UNTIL TOLD TO DO SO

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

FIGURE 1

$$^{32}_{16}\mathrm{S}$$

0 1 . 1 **Complete TABLE 1 [1 mark]**

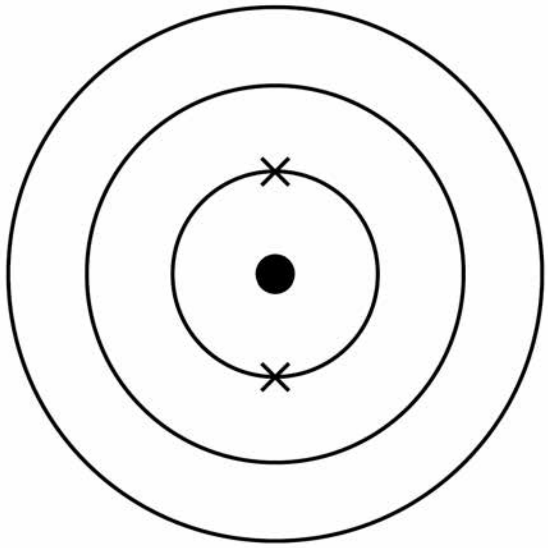
TABLE 1

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



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

Complete the word equation for this reaction. [1 mark]

sulfur + ________________________________

[Turn over]

0 1 . 4 **What effect is caused by sulfur dioxide?**
[1 mark]

Tick ONE box.

☐ **Acid rain**

☐ **Global dimming**

☐ **Global warming**

☐ **Sea levels rising**

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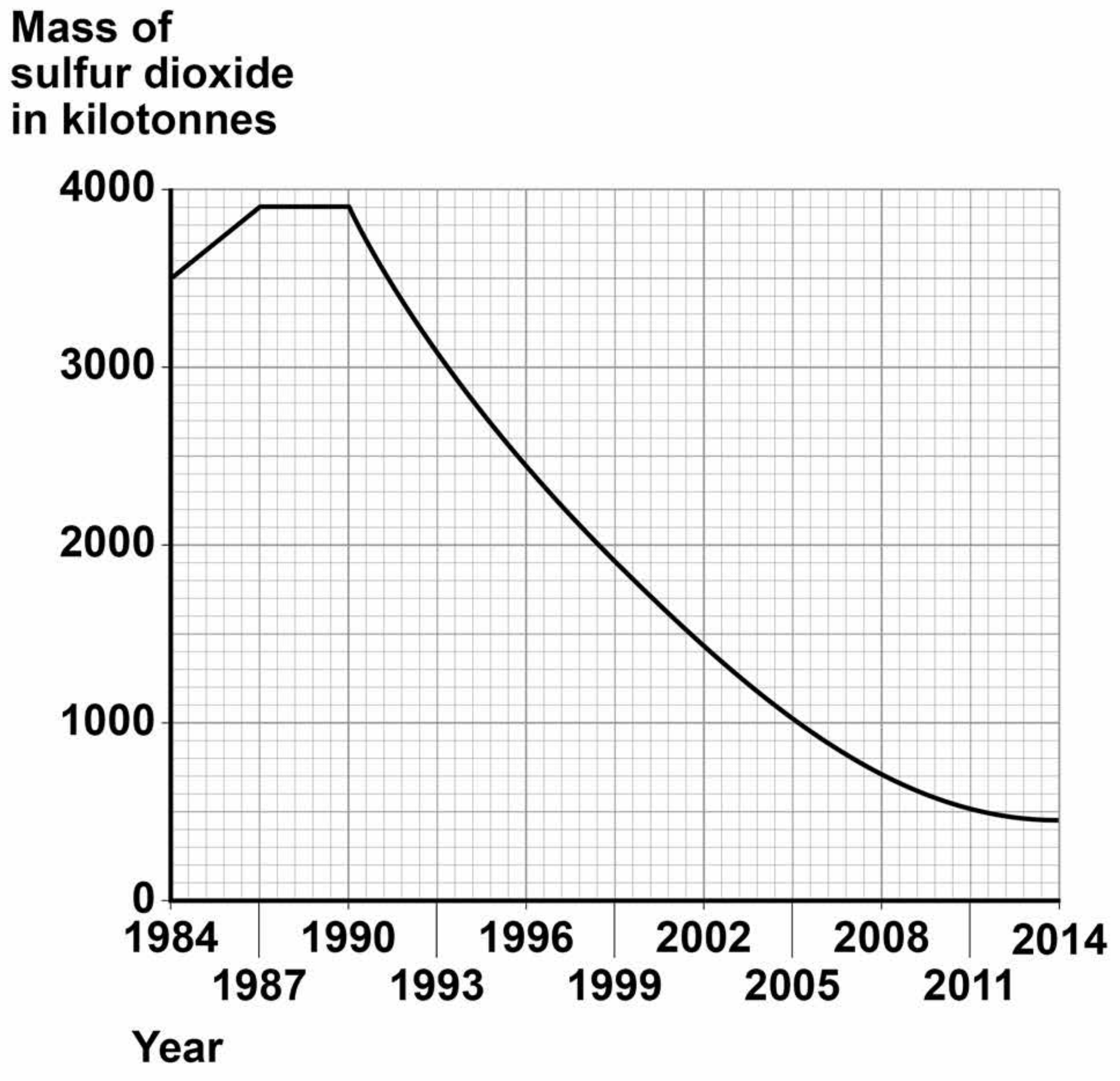
[Turn over]

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'

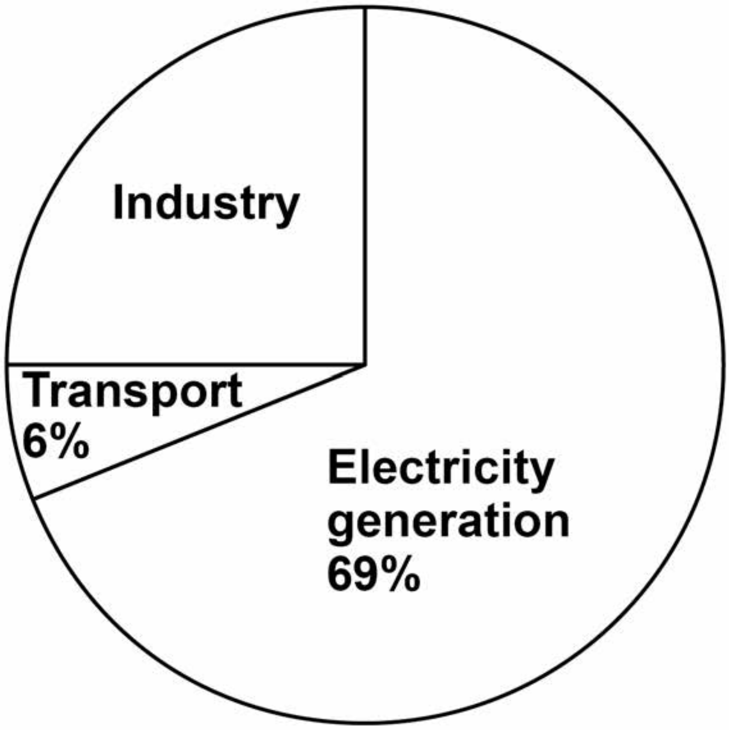
Is the student correct?

Use data from FIGURE 3 to justify your answer. [3 marks]

[Turn over]

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

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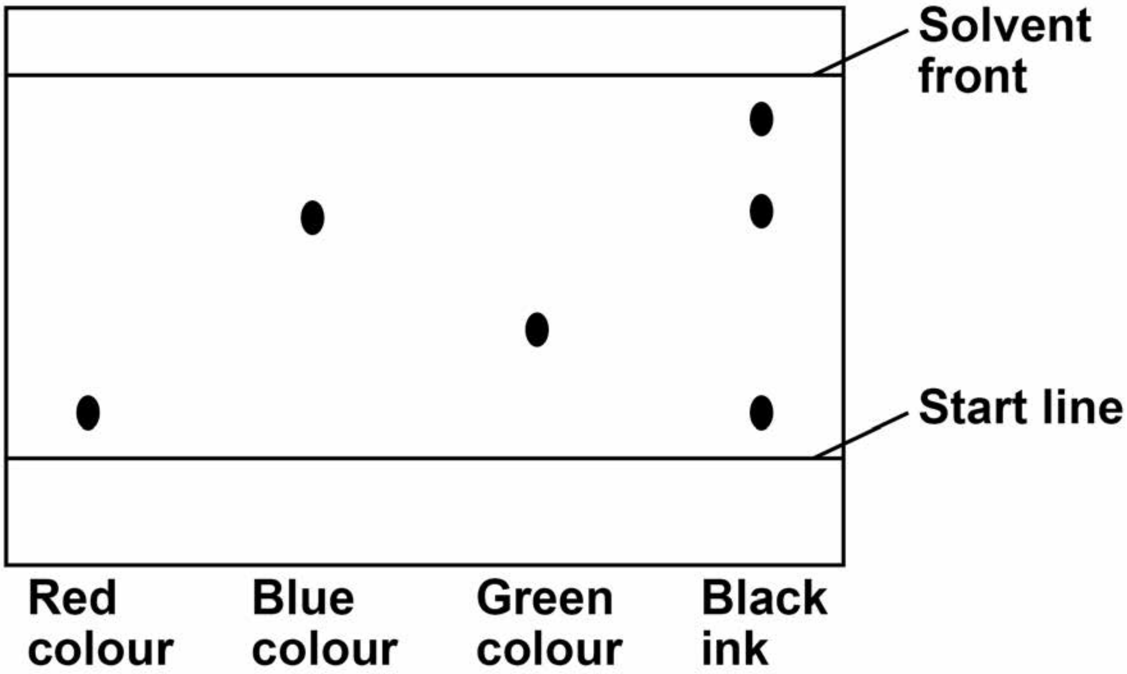
[Turn over]

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 ______________________________

____

____

0 2 . 3 **Use FIGURE 5, on page 12, to complete TABLE 2**

TABLE 2

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

[Turn over]

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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 = ______________________________

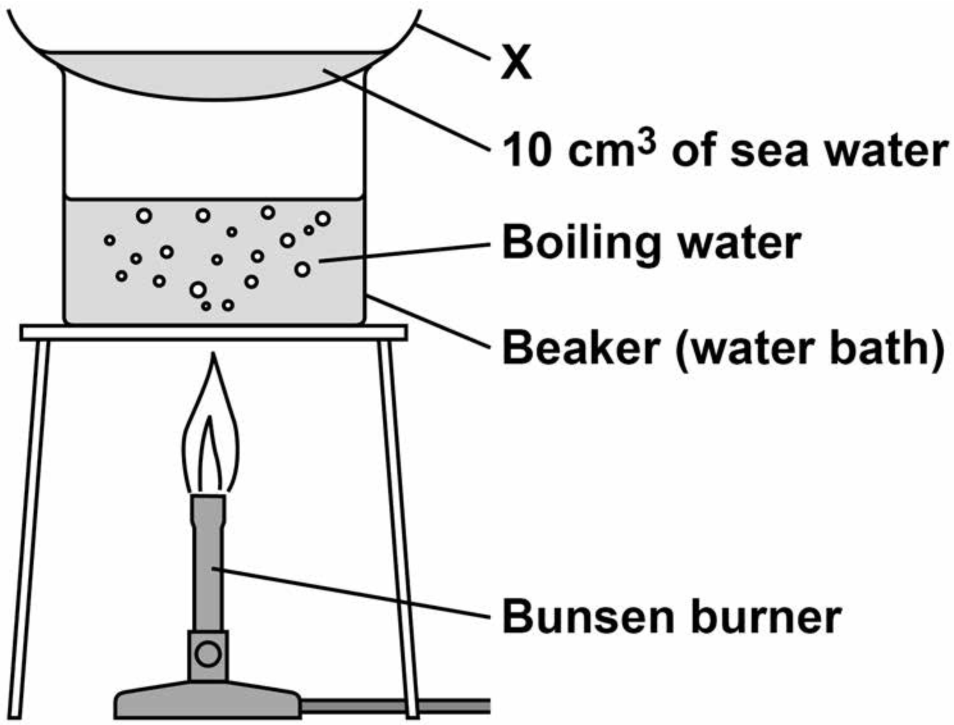
[Turn over]

8

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**

[Turn over]

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]

___

___

___

___

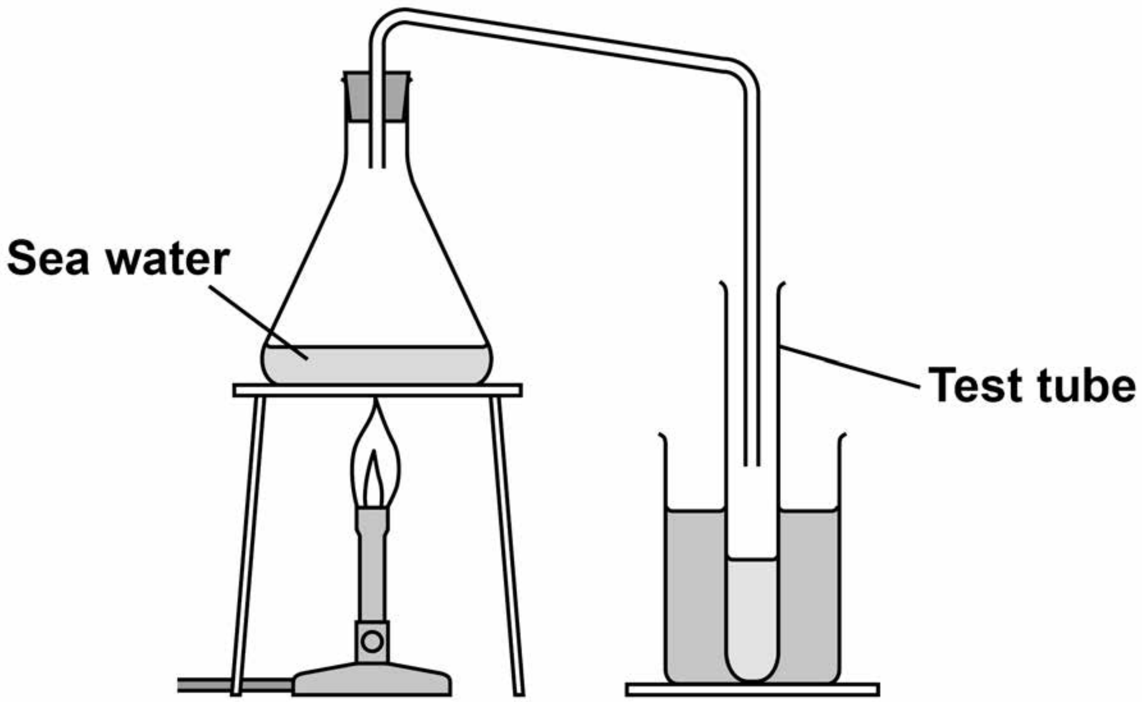
___

Mean mass = ______________________________ g

[Turn over]

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]

____

____

____

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

Why are these TWO processes done?
[2 marks]

Filtering ________________________________

____

____

Sterilising ________________________________

____

____

9

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]

____

____

____

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

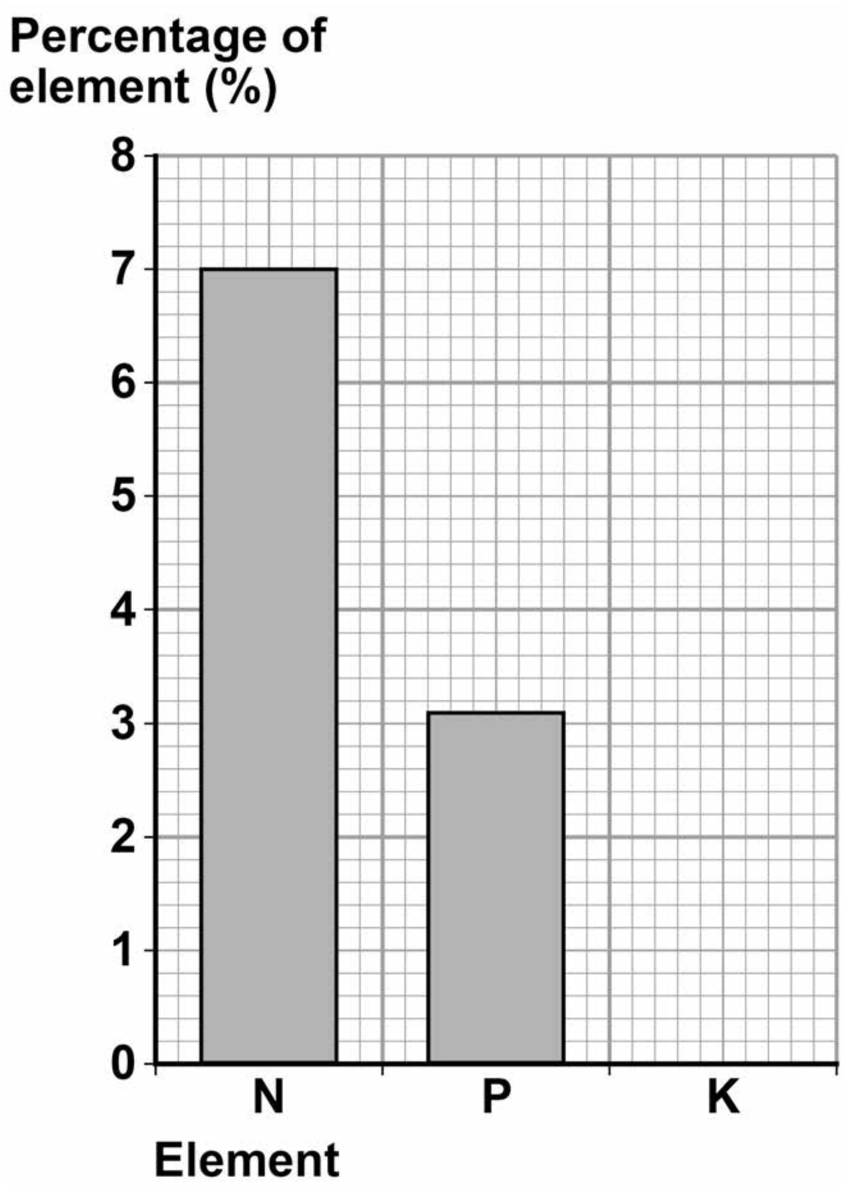
TABLE 4

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



[Turn over]

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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.

☐ $\dfrac{0.225}{3.0 \times 100}$

☐ $\dfrac{3.0 \times 100}{0.225}$

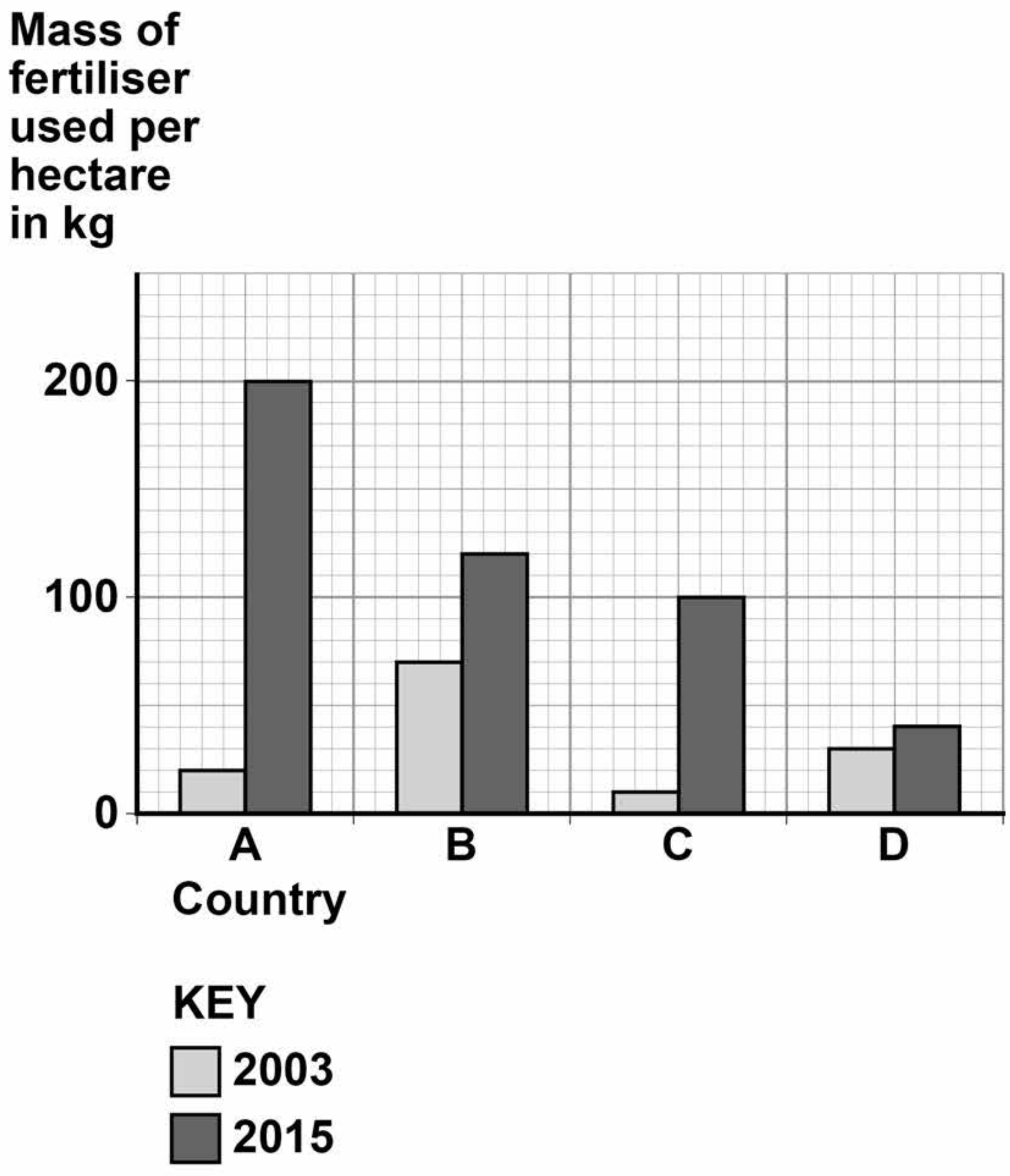
☐ $\dfrac{0.225 \times 3.0}{100}$

☐ $\dfrac{0.225 \times 100}{3.0}$

[Turn over]

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]

[Turn over]

10

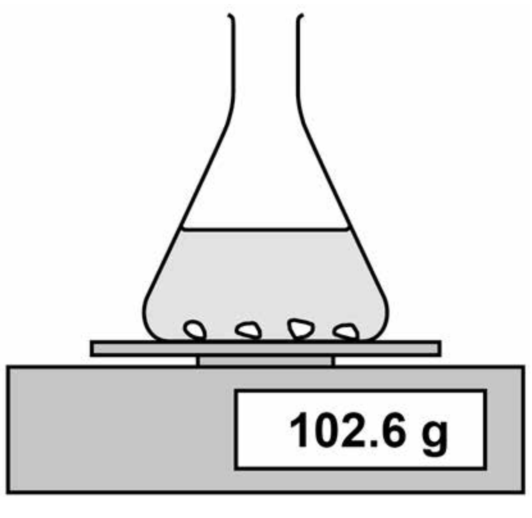
0 5 A student investigated the effect of the size of marble chips on the rate of the reaction between marble chips and hydrochloric acid.

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

[Turn over]

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 = ____________________

[Turn over]

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05.5 **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]

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

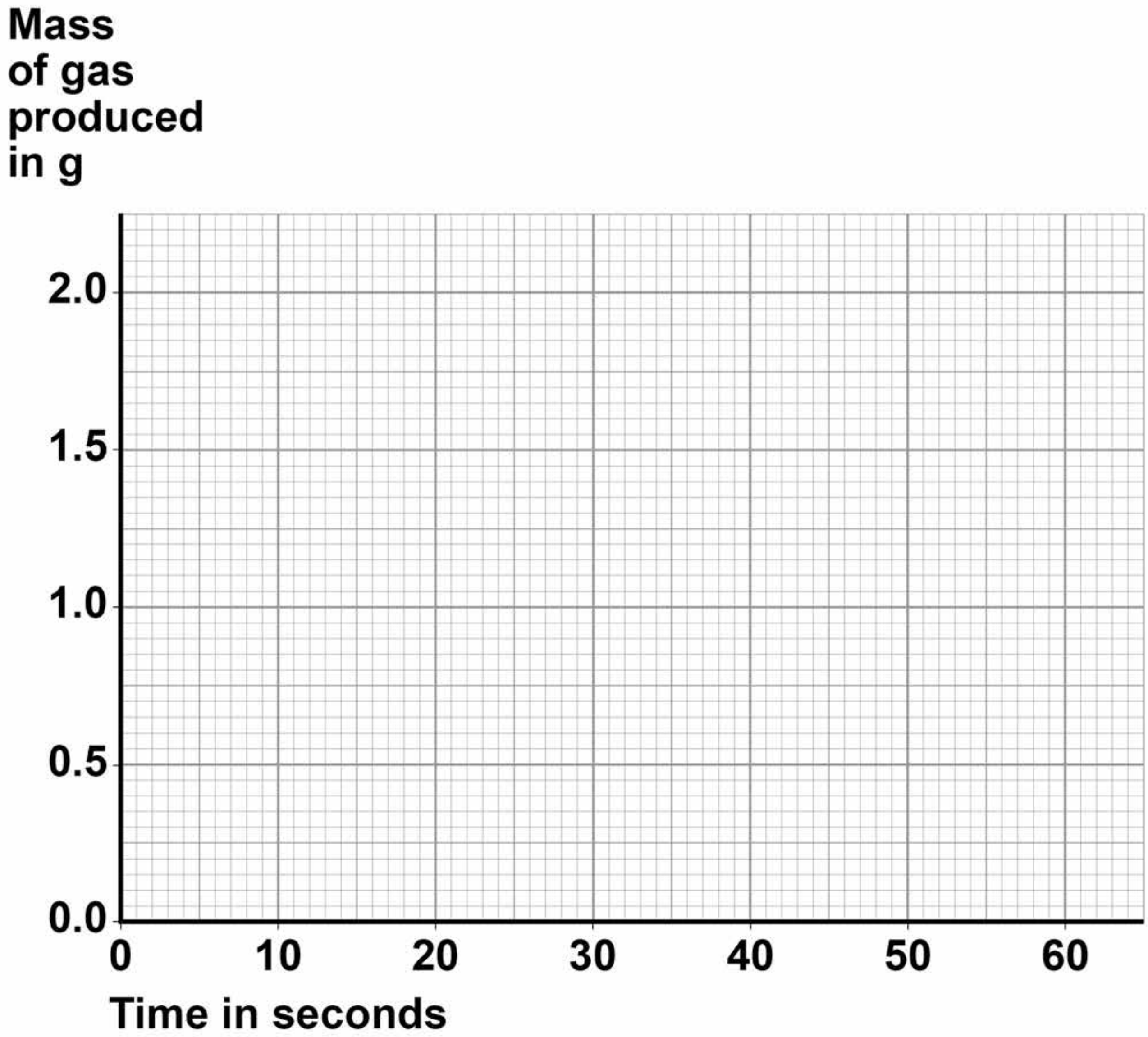
TABLE 5

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]

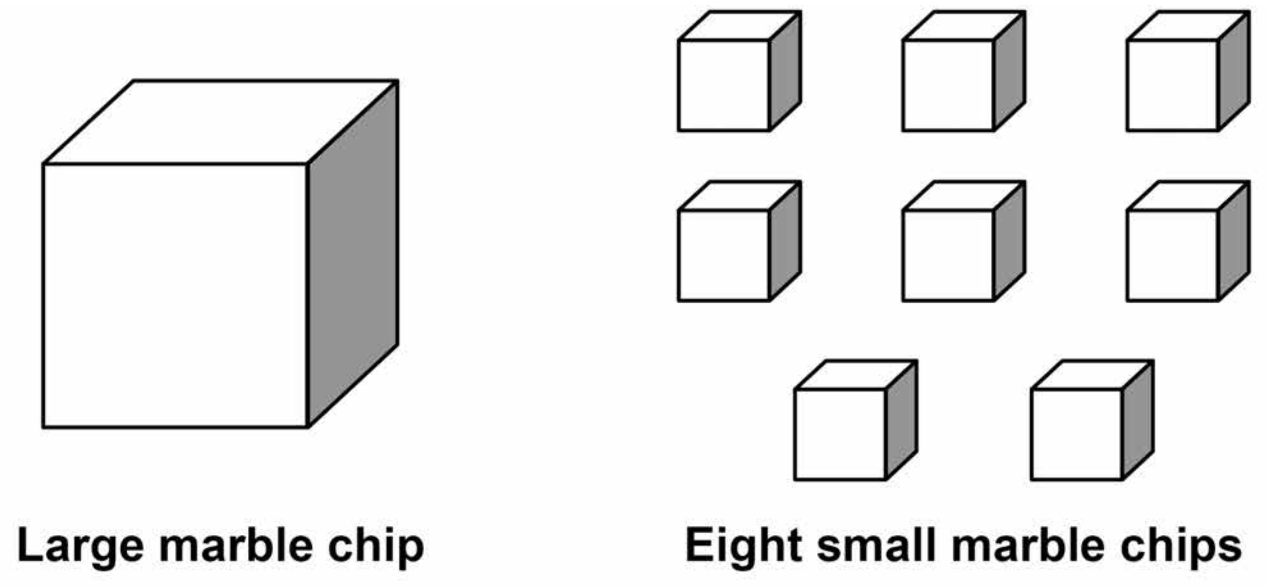
FIGURE 11



[Turn over]

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.**

[Turn over]

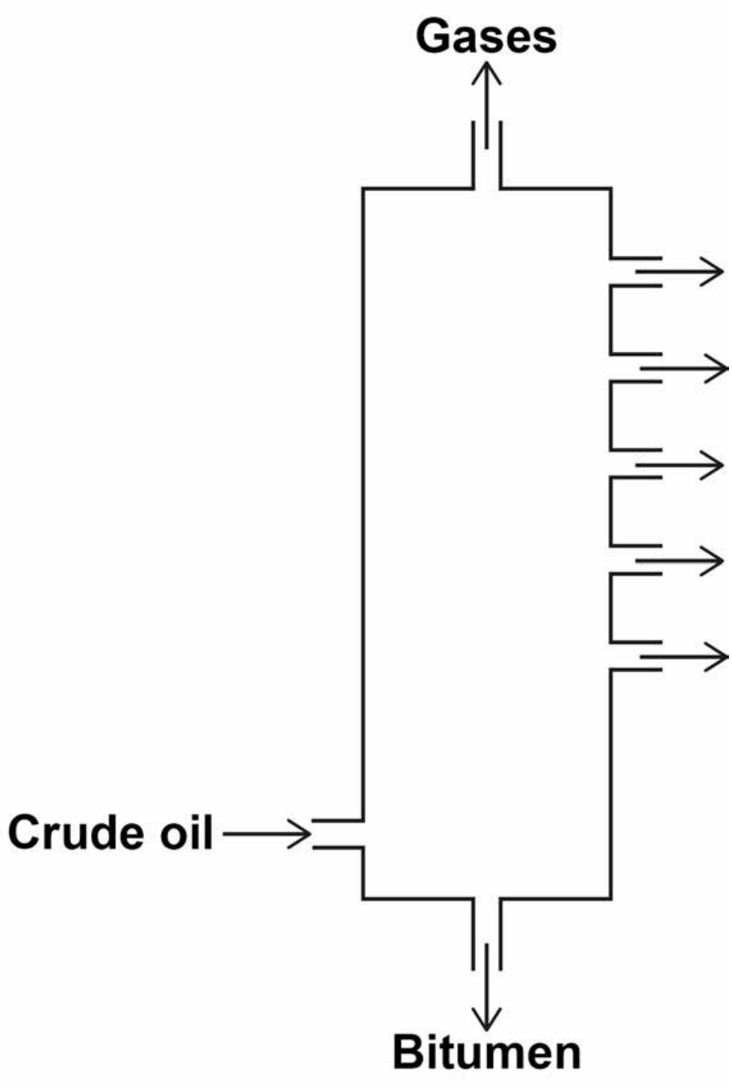
11

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 list. [1 mark]

- **condenses**
- **dissolves**
- **freezes**
- **melts**

Each fraction ____________________________

at a different level.

[Turn over]

0 6 . 2 **Why do the fractions separate? [1 marks]**

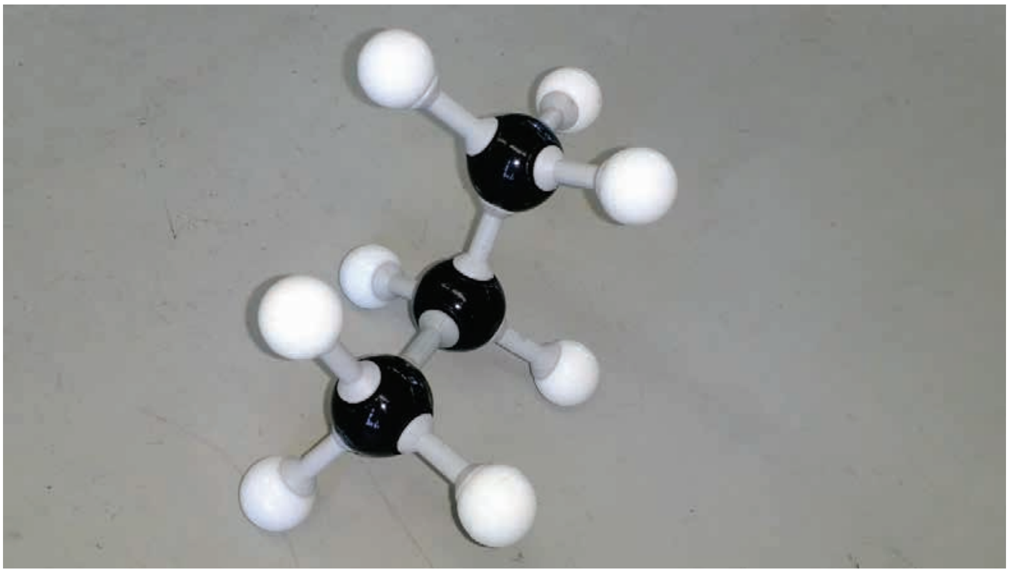
Tick ONE box.

- [ ] **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]

____

[Turn over]

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**

[Turn over]

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, on page 46
[4 marks]

[Turn over]

11

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**

07.2 **Greenhouse gases cause global climate change.**

Give TWO effects of global climate change.
[2 marks]

1 ____

2 ____

[Turn over]

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

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

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