A

AQA

Surname ______________________________

Other Names ______________________________

Centre Number ______________________________

Candidate Number ______________________________

Candidate Signature ______________________________

GCSE

COMBINED SCIENCE: TRILOGY

H

Higher Tier

Chemistry Paper 2H

8464/C/2H

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 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.

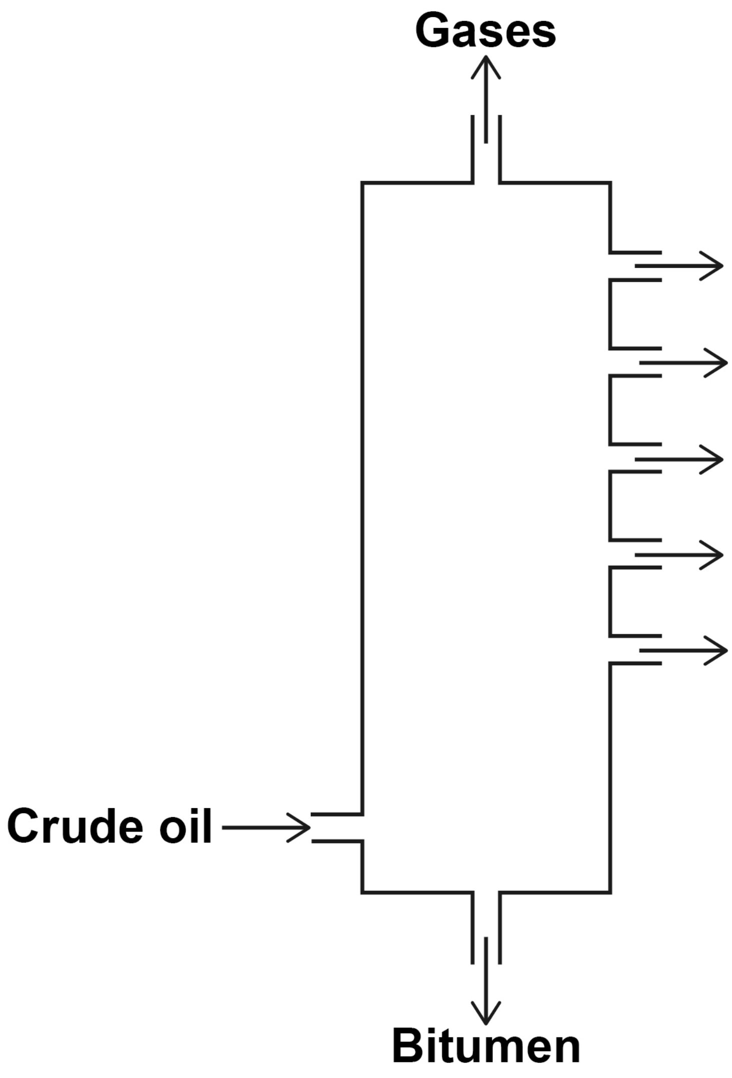
DO NOT TURN OVER UNTIL TOLD TO DO SO

0 1 Crude oil is a mixture of hydrocarbons.

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

FIGURE 1 shows a fractional distillation column.

FIGURE 1



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 1 . 2 Why do the fractions separate? [1 mark]

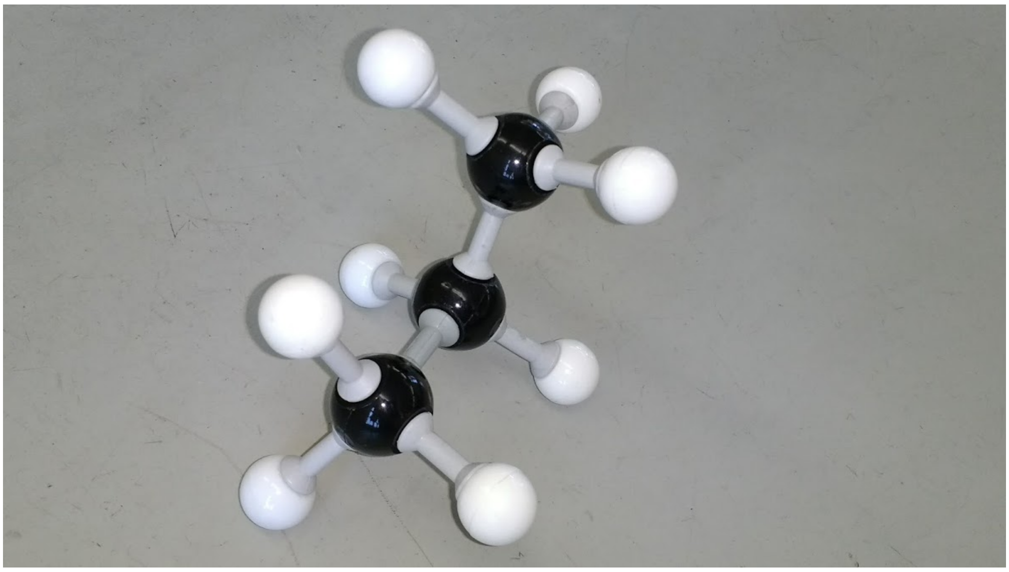
Tick ONE box.

- ☐ **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.

0 1 . 3 **FIGURE 2 represents an alkane molecule.**

FIGURE 2



Name the alkane. [1 mark]

____

[Turn over]

0 1 . 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 1 . 5 **Alkanes burn in oxygen.**

Balance the equation for methane burning.
[1 mark]

________________ CH_4 + ________________ O_2

$\rightarrow$ ________________ CO_2 + ________________ H_2O

01.6 **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 1 shows data from a life cycle assessment (LCA) for the disposal of 10 000 biodegradable plastic bags.

TABLE 1

	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 1 . 7 **Why are life cycle assessments (LCA) done?**
[1 mark]

0 1 . 8 **Compare the TWO methods for the disposal of biodegradable plastic bags.**

Use information from TABLE 1 [4 marks]

[Turn over]

0 2 This question is about the Earth's atmosphere.

0 2 . 1 Carbon dioxide is a greenhouse gas.

What is another greenhouse gas? [1 mark]

Tick ONE box.

☐ Argon

☐ Methane

☐ Nitrogen

☐ Oxygen

0 2 . 2 **Greenhouse gases cause global climate change.**

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

1 ______________________________________

____

____

2 ______________________________________

____

____

[Turn over]

0 2 . 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 2 . 4 **Give ONE way that carbon dioxide emissions can be reduced when a plastic bottle is manufactured. [1 mark]**

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[Turn over]

0 2 . 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]**

[Turn over]

12

0 3 A student investigated the mass of dissolved solids in 5 cm^3 samples of water.

FIGURE 3 shows the apparatus.

FIGURE 3

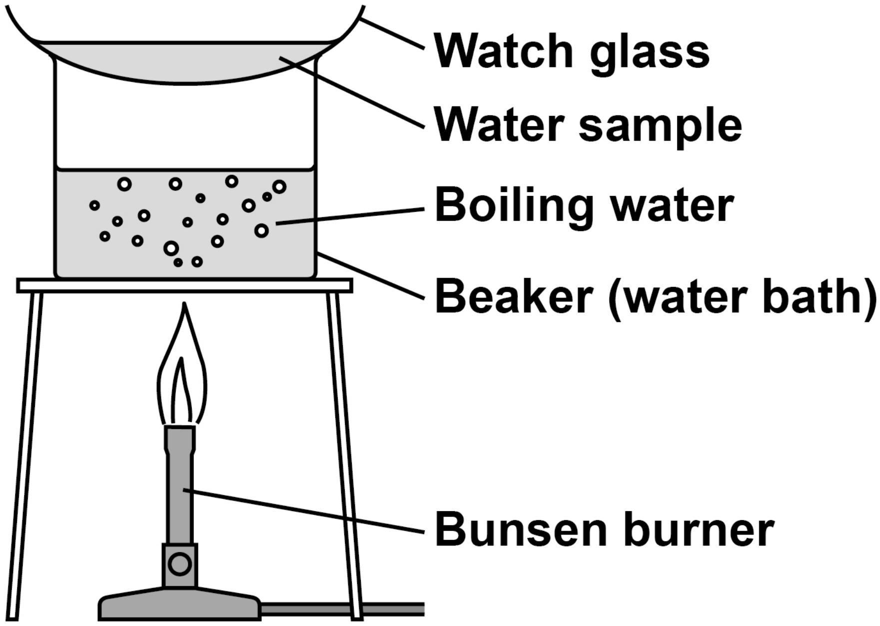

TABLE 2 shows the student's results.

TABLE 2

Type of water	Mass in g			
	Watch glass	Watch glass and dissolved solids	Dissolved solids in 5 cm^3 of water	Dissolved solids in 1000 cm^3 of water
Sea water	9.34	9.48	0.14	28.00
River water	9.15	9.23	0.08	X
Rainwater	8.93	8.93	0.00	0.00

0 3 . 1 **Calculate mass X in TABLE 2 [1 mark]**

____

____

____

Mass X = ______________________ g

0 3 . 2 $5\ cm^3$ is a small volume of water for each experiment.

Give ONE advantage and ONE disadvantage of using a larger volume. [2 marks]

Advantage ______________________________

____

____

Disadvantage ______________________________

____

____

0 3 . 3 Potable water is NOT pure water.

Describe the difference between potable water and pure water. [1 mark]

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____

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0 3 . 4 **Potable water is obtained from both groundwater AND from sea water.**

Describe how groundwater and sea water are treated to produce potable water. [3 marks]

[Turn over]

0 3 . 5 **The percentage by mass of dissolved solids in a 6.50 g sample is 2.2%**

Calculate the mass of the dissolved solids.
[2 marks]

____

____

____

____

____

____

Mass of dissolved solids =

_________________________________ **g**

9

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[Turn over]

0 4 **Fertilisers are formulations.**

0 4 . 1 **What is a formulation? [1 mark]**

0 4 . 2 **A bag of fertiliser contains 14.52 kg of ammonium nitrate (NH_4NO_3).**

Relative formula mass (M_r): NH_4NO_3 = 80

Calculate the number of moles of ammonium nitrate in the bag of fertiliser.

Give your answer in standard form to 2 significant figures. [4 marks]

Moles of ammonium nitrate =

_______________ mol

[Turn over]

0 4 . 3 **The fertiliser also contains potassium chloride.**

Explain why potassium chloride has a high melting point. [4 marks]

9

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[Turn over]

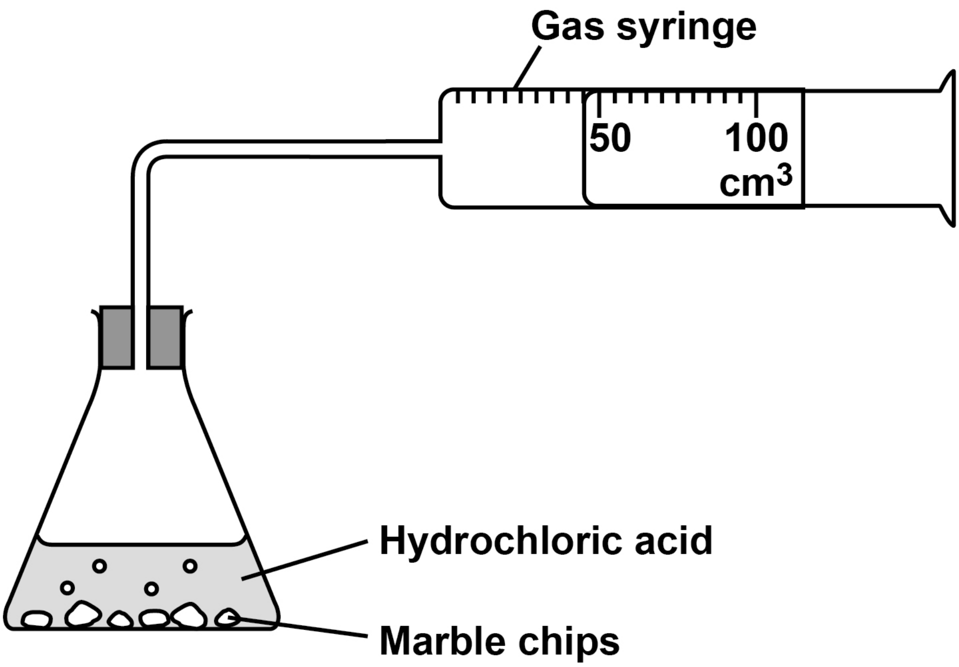
0 5 A student investigated the effect of the size of marble chips on the rate of the reaction between marble chips and hydrochloric acid.

This is the method used.

1. Add 10 g of marble chips into the flask.
2. Add 50 cm^3 of hydrochloric acid, connect the gas syringe and start a timer.
3. Record the volume of gas produced every 10 seconds.

FIGURE 4 shows the apparatus.

FIGURE 4



0 5 . 1 **Complete the equation for the reaction.**
[2 marks]

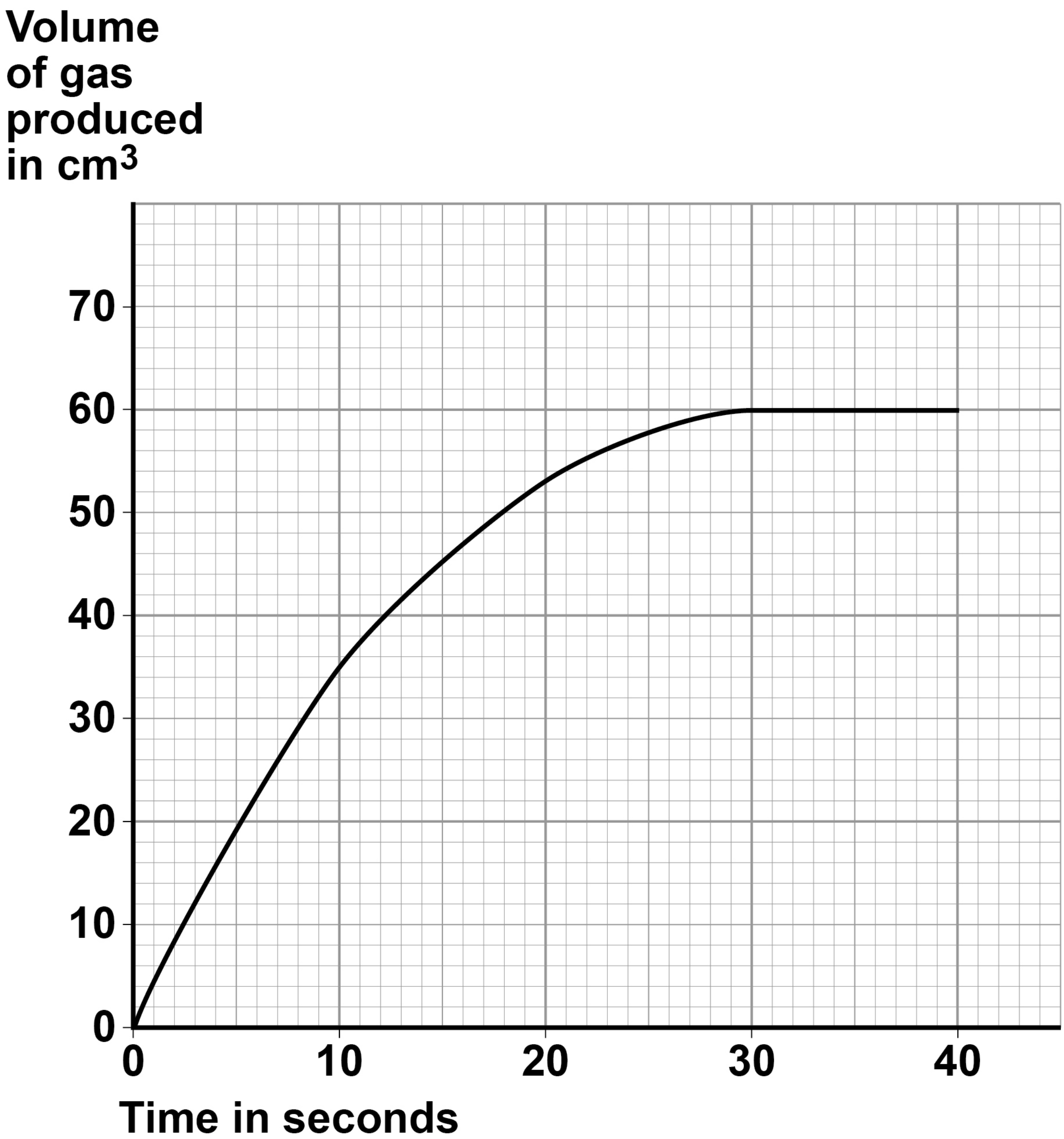
$CaCO_3$ + ________________ HCl

$\rightarrow$ ______________________________________

[Turn over]

FIGURE 5 shows the student's results.

FIGURE 5

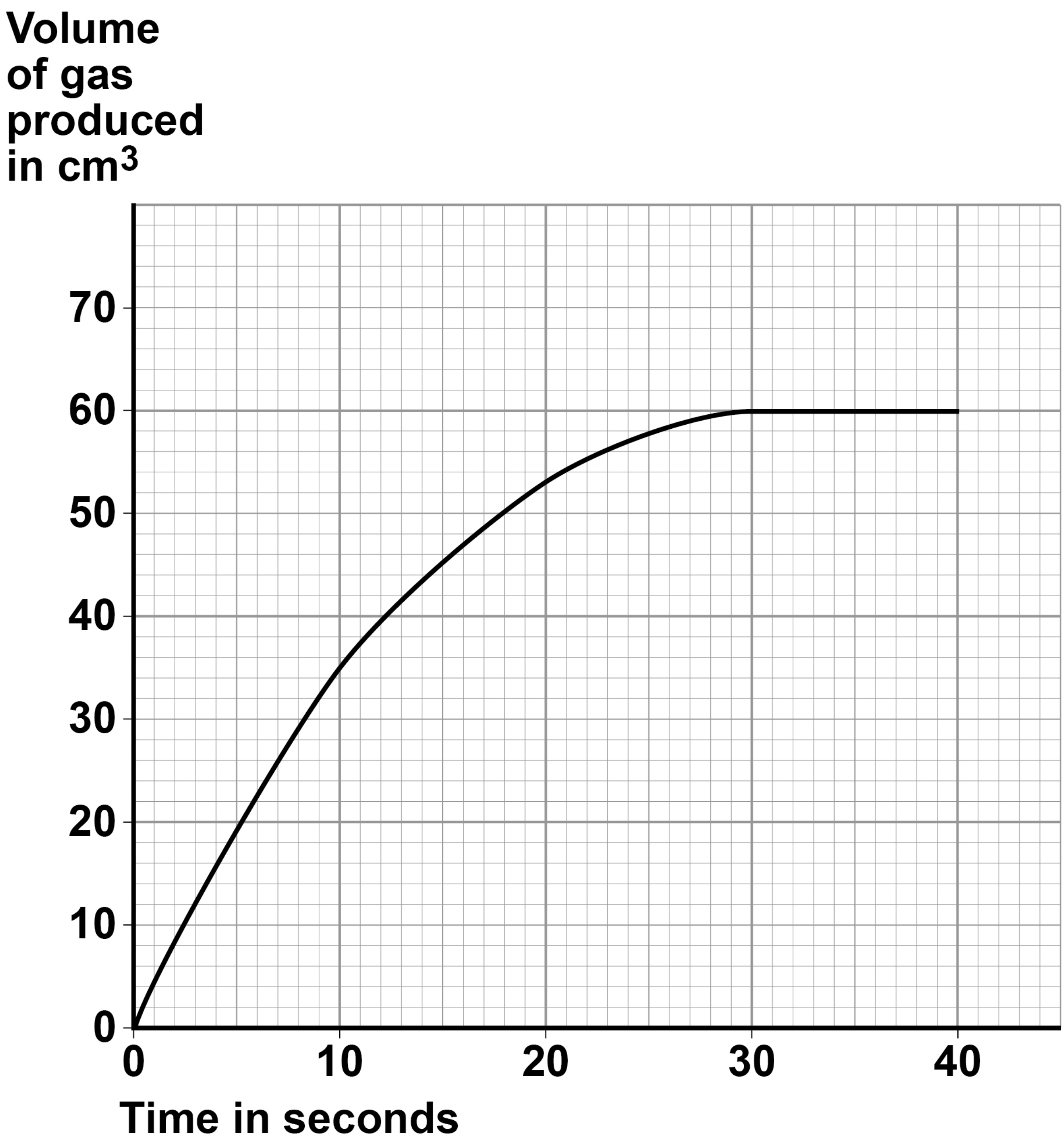


0 5 . 2 **Describe the trend shown in FIGURE 5, on page 30.**

Use values in your answer. [3 marks]

[Turn over]

Repeat of FIGURE 5



0 5 . 3 **Describe how you would use FIGURE 5 to find the rate of the reaction at 15 seconds.**

You do NOT need to do a calculation.
[2 marks]

0 5 . 4 **Give the units for the rate of this reaction.**
[1 mark]

[Turn over]

TABLE 3 shows the results of the investigation.

TABLE 3

Relative size of marble chips	Volume of gas produced in cm^3 after given time in seconds					
	10 s	20 s	30 s	40 s	50 s	60 s
Small	35	53	60	60	60	60
Medium	21	39	51	58	60	60
Large	14	29	39	48	58	60

0 5 . 5 Give ONE conclusion about how the size of the marble chips affects the rate of the reaction. [1 mark]

____

____

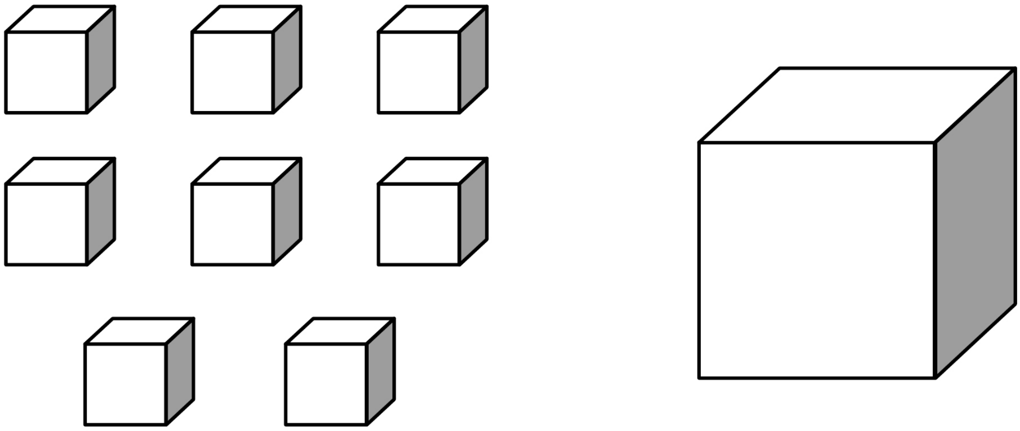
____

0 5 . 6 **Suggest why all three sizes of marble chips produce a maximum volume of 60 cm^3 of gas.**
[1 mark]

[Turn over]

05.7 FIGURE 6 shows eight small cubes, each 1 cm x 1 cm x 1 cm, and one large cube, 2 cm x 2 cm x 2 cm

FIGURE 6



Total volume of small cubes = 8 cm^3

Volume of large cube = 8 cm^3

Total surface area of small cubes = 48 cm^2

Calculate the surface area of the large cube. [2 marks]

____

____

____

____

____

Surface area of the large cube =

_________________________________ cm^2

0 5 . 8 **Explain why the size of the marble chips affects the rate of the reaction.**

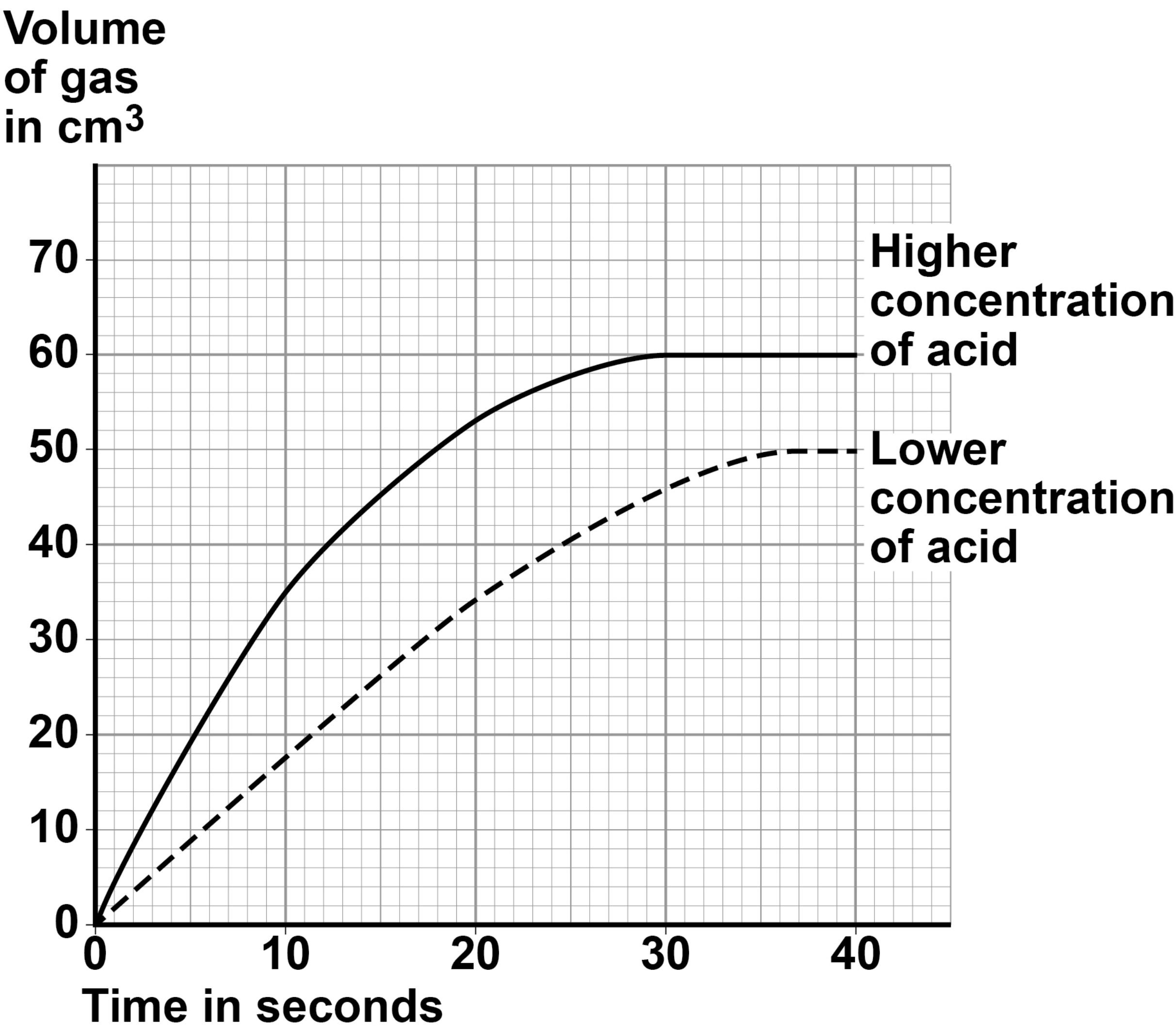
Give your answer in terms of 'collision theory'. [2 marks]

[Turn over]

0 5 . 9 **The student repeated the investigation with small marble chips using hydrochloric acid with a lower concentration.**

FIGURE 7 shows the volume of gas produced during the first 40 seconds.

FIGURE 7



Explain why the results for the lower concentration of acid are different from the results for the higher concentration of acid. [3 marks]

[Turn over]

17

0 6 Bleach is a solution of sodium hypochlorite (NaClO).

Chlorine gas is produced when bleach reacts with hydrochloric acid.

$$NaClO(aq) + 2HCl(aq) \rightleftharpoons NaCl(aq) + H_2O(l) + Cl_2(g)$$

0 6 . 1 Give the test and result for chlorine gas.
[2 marks]

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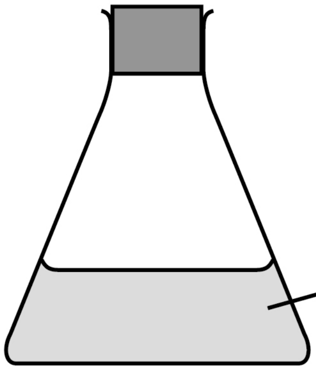
[Turn over]

FIGURE 8 shows a sealed flask of sodium hypochlorite and hydrochloric acid at equilibrium.

FIGURE 8



0 6 . 2 Explain why equilibrium is reached in this reaction. [2 marks]

0 6 . 3 **The stopper in FIGURE 8, on page 42, is removed and hydrochloric acid is added.**

The stopper is replaced.

Explain what happens to the equilibrium.
[4 marks]

Chlorine gas is also produced when hydrogen chloride decomposes.

$2HCl(g) \rightleftharpoons H_2(g) + Cl_2(g)$

The forward reaction is endothermic.

0 6 . 4 **Predict the effect of increasing the temperature on the amount of chlorine gas produced at equilibrium.**

Explain your answer using Le Chatelier's Principle. [2 marks]

0 6 . 5 **Explain the effect of increasing the pressure on this equilibrium. [2 marks]**

END OF QUESTIONS

12

There are no questions printed on this page.

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