

**Surname** \_\_\_\_\_

**Other Names** \_\_\_\_\_

**Centre Number** \_\_\_\_\_

**Candidate Number** \_\_\_\_\_

**Candidate Signature** \_\_\_\_\_

**GCSE**

**COMBINED SCIENCE: TRILOGY**

**Higher Tier**

**Chemistry Paper 2H**

**8464/C/2H**

**H**

**Wednesday 13 June 2018**

**Morning**

**Time allowed: 1 hour 15 minutes**

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

**[Turn over]**



**For this paper you must have:**

- **a ruler**
- **a scientific calculator**
- **the periodic table (enclosed).**

## **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**

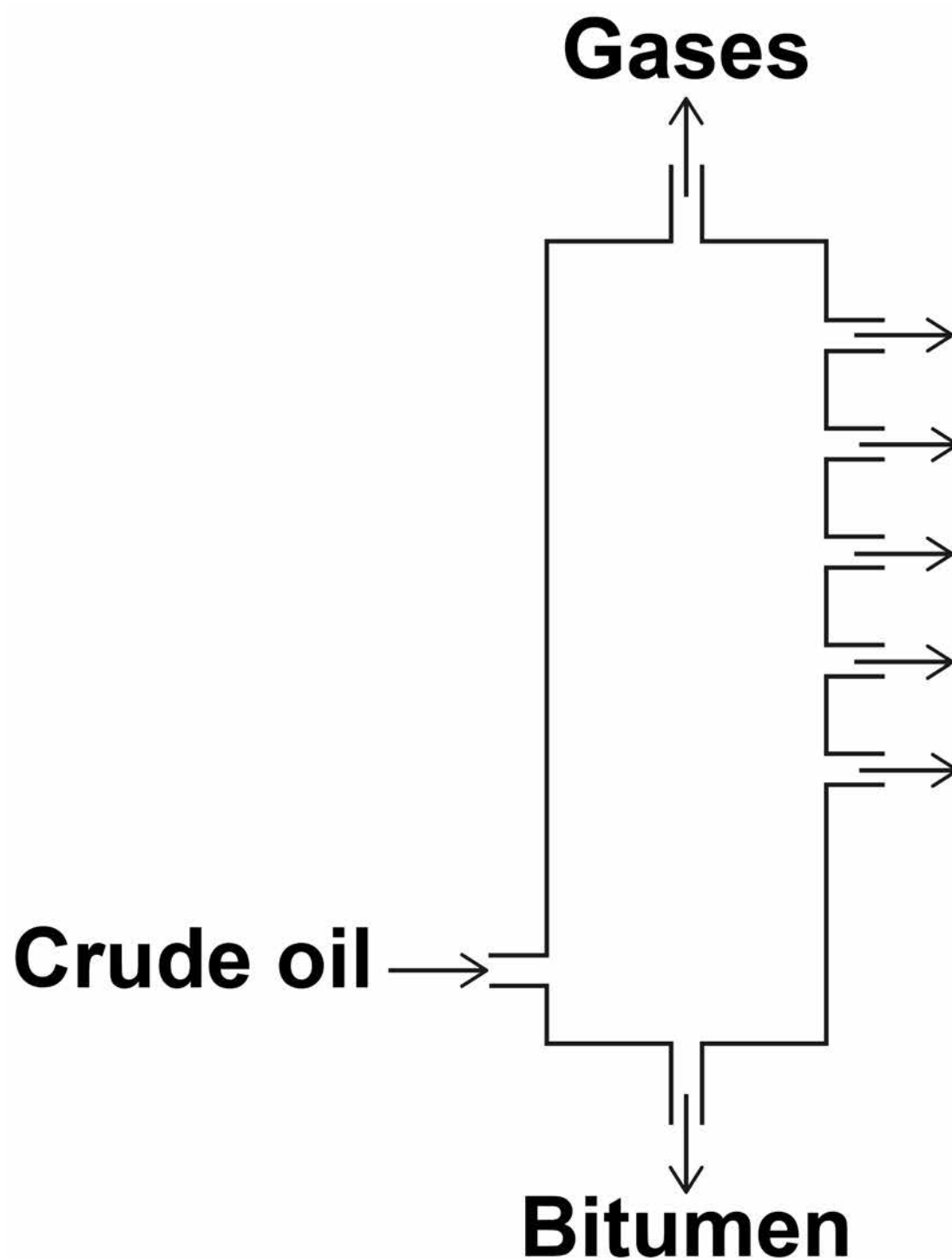
**Crude oil is a mixture of hydrocarbons.**

**0 1 . 1**

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

**FIGURE 1 shows a fractional distillation column.**

**FIGURE 1**



**5**

**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.**

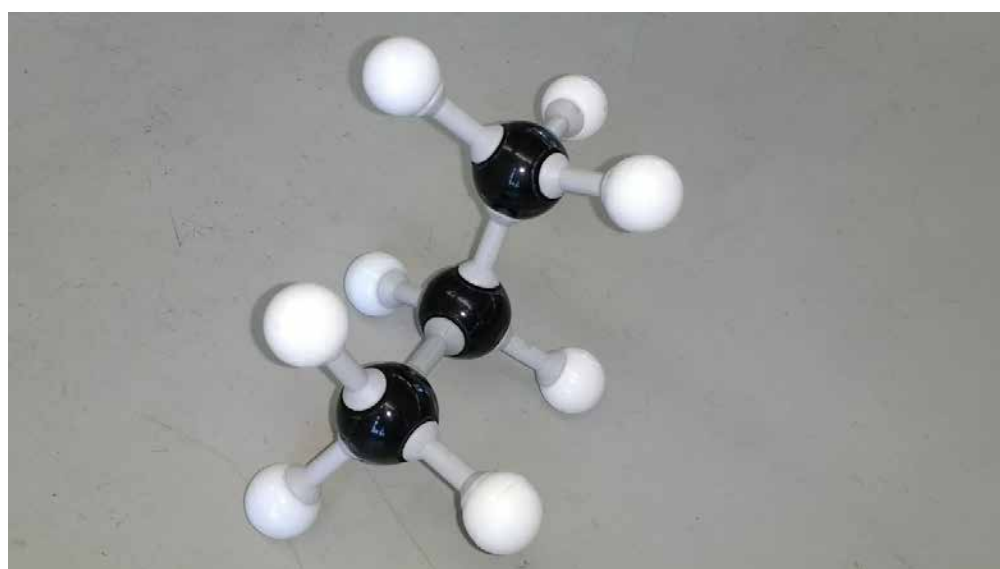
**The fractions have different viscosity.**



**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]**

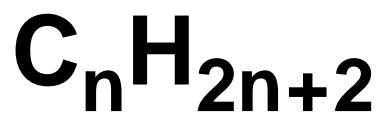
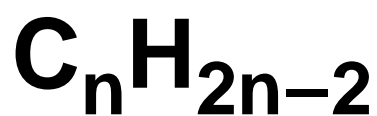
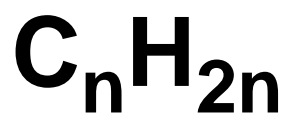
---

**[Turn over]**

**0 1 . 4** Methane (CH<sub>4</sub>) is an alkane.

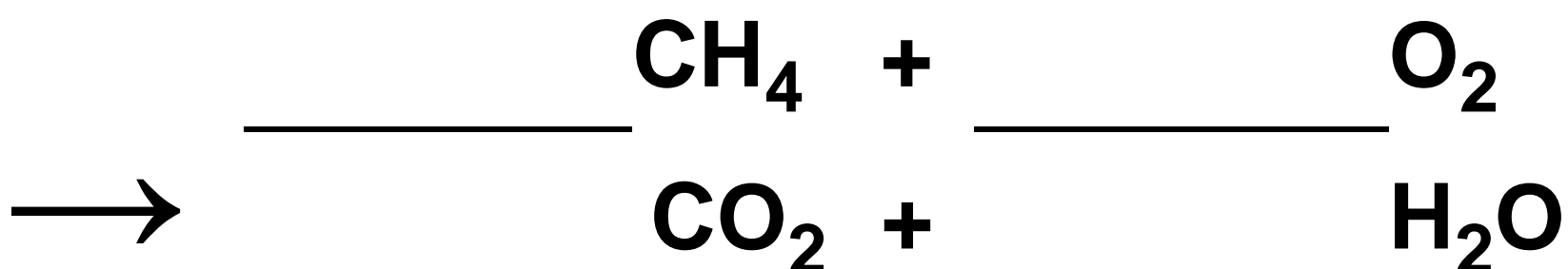
**What is the general formula for alkanes? [1 mark]**

**Tick ONE box.**



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

**Balance the equation for methane burning. [1 mark]**





**0 1 . 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**

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



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

---

---

---

11

**[Turn over]**



**01.8**

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

**Use information from TABLE 1, on page 10.  
[4 marks]**

---

---

---

---

---

---

---

---

---

---



---

---

---

---

---

---

---

**[Turn over]**

<b>11</b>



**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**



**02.2** 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]

---

---

---

**[Turn over]**

**02.5 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]**

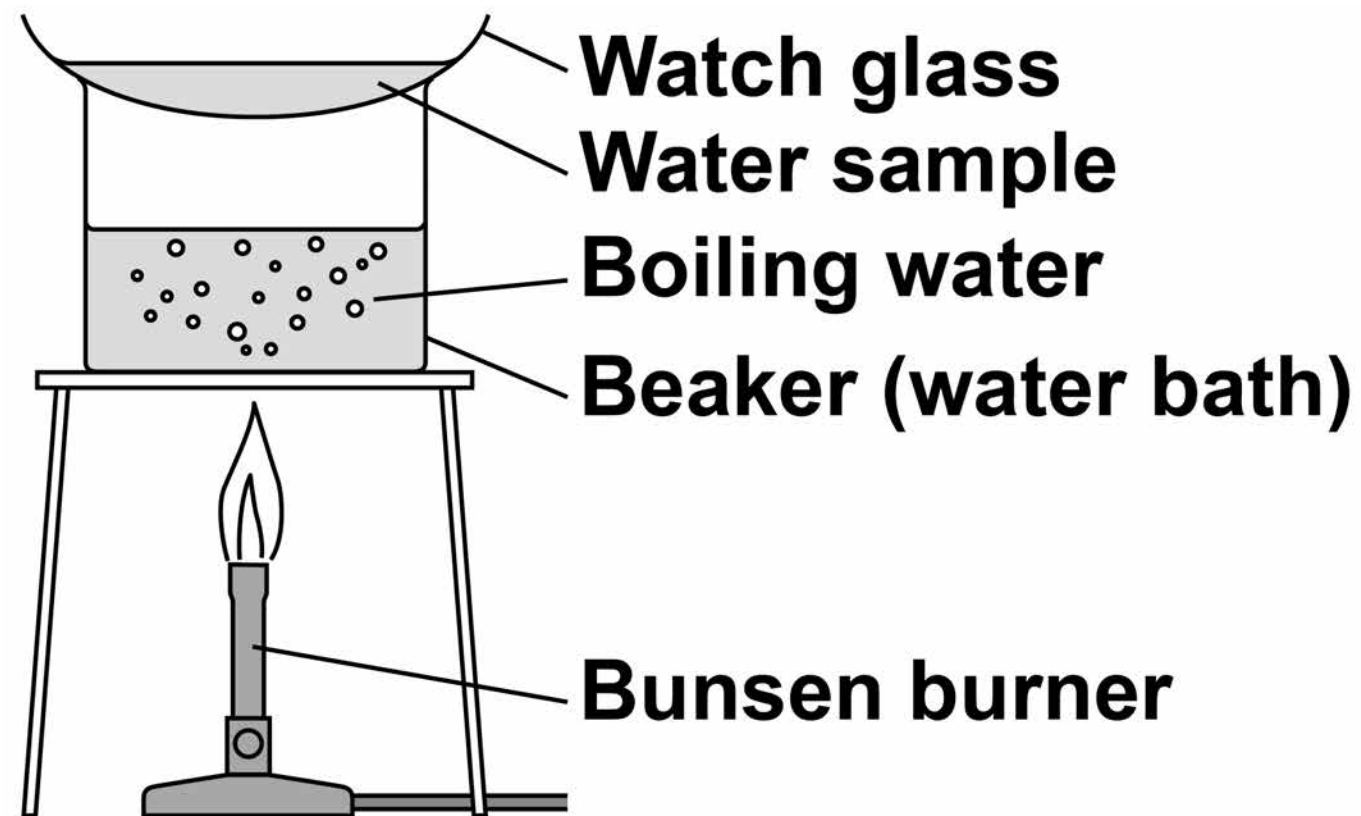
<b>12</b>

**0 3**

**A student investigated the mass of dissolved solids in 5 cm<sup>3</sup> samples of water.**

**FIGURE 3 shows the apparatus.**

**FIGURE 3**



**BLANK PAGE**

**[Turn over]**



**TABLE 2 shows the student's results.**

**TABLE 2**

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



**03.1 Calculate mass X in TABLE 2 [1 mark]**

---

---

---

**Mass X = \_\_\_\_\_ g**

**[Turn over]**



**03.2** 5 cm<sup>3</sup> is a small volume of water for each experiment.

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

**Advantage** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Disadvantage** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



**03.3** Potable water is NOT pure water.

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

---

---

---

---

**[Turn over]**

**03.4** 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]**

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

**03.5** 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**

**[Turn over]**

<hr/>
<b>9</b>



**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  
( $\text{NH}_4\text{NO}_3$ ).

Relative formula mass ( $M_r$ ):  
 $\text{NH}_4\text{NO}_3 = 80$

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]**

**BLANK PAGE**



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

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

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

**[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.**

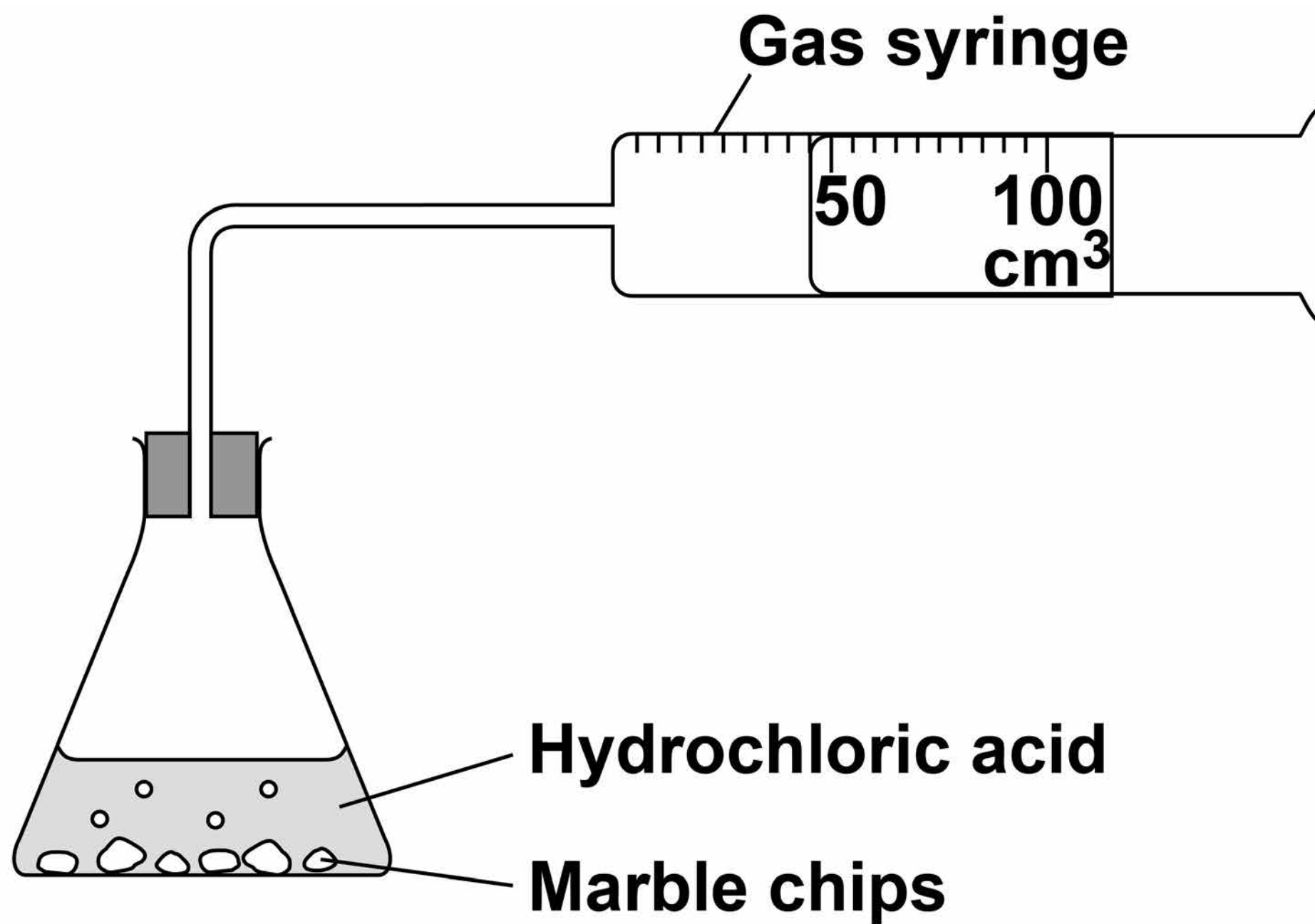
**This is the method used.**

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

**FIGURE 4, on page 33, shows the apparatus.**



FIGURE 4



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



→

\_\_\_\_\_

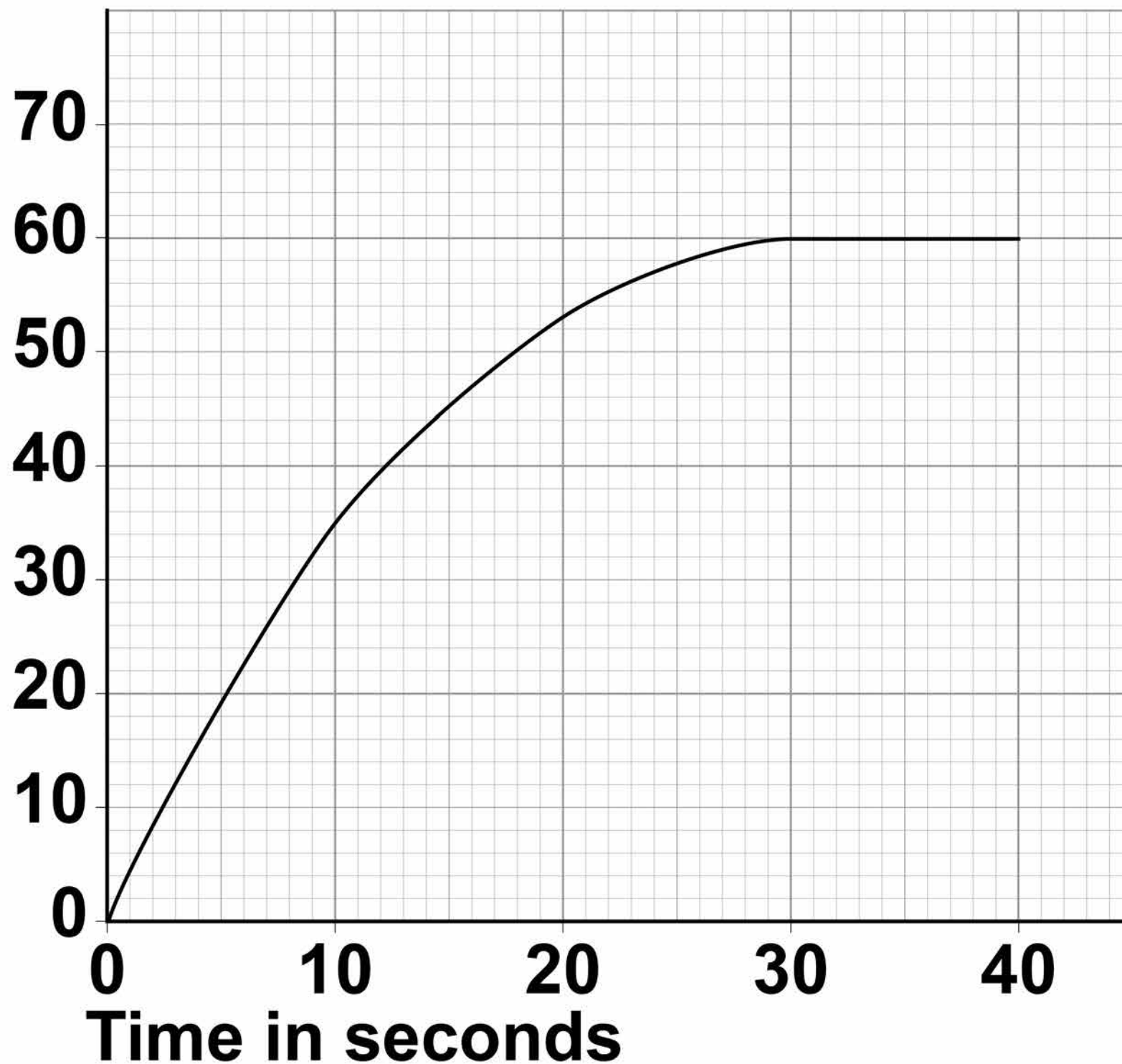
[Turn over]



**FIGURE 5** shows the student's results.

**FIGURE 5**

**Volume  
of gas  
produced  
in  $\text{cm}^3$**



**0 5 . 2** Describe the trend shown in **FIGURE 5.**

**Use values in your answer.  
[3 marks]**

---

---

---

---

---

---

---

---

---

---

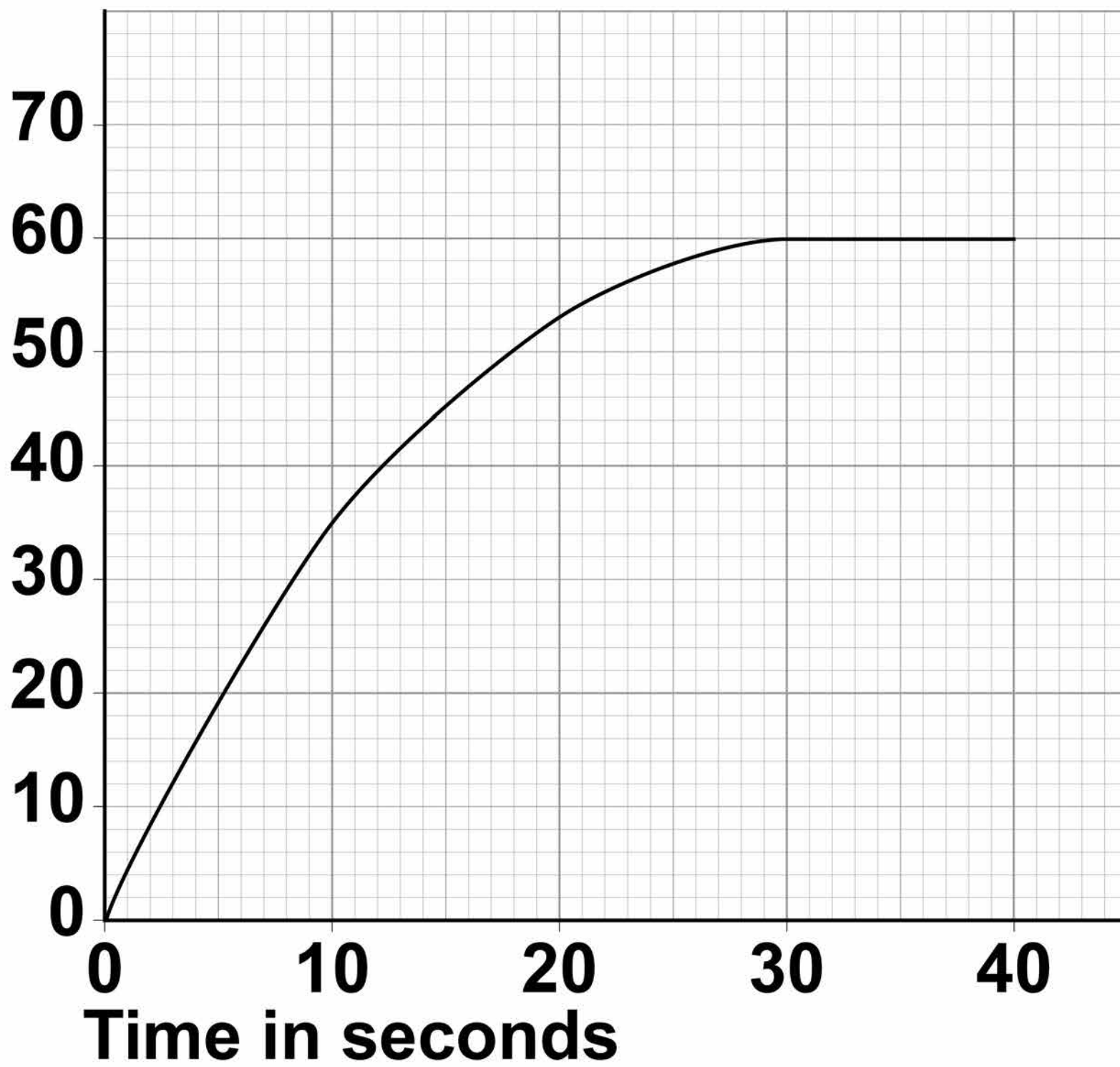
---

---

**[Turn over]**

**Repeat of FIGURE 5**

**Volume  
of gas  
produced  
in  $\text{cm}^3$**



**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**

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

**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<sup>3</sup> of gas. [1 mark]

---

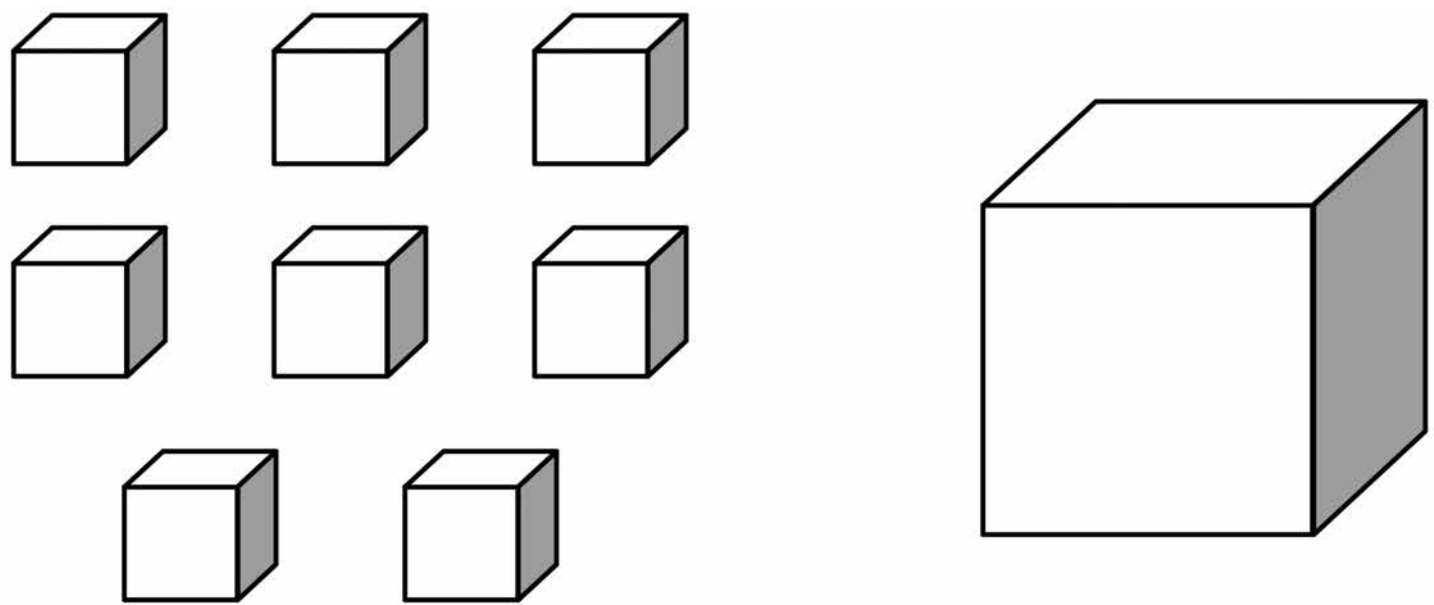
---

---

**[Turn over]**



- 05.7** FIGURE 6 shows eight small cubes, each  $1\text{ cm} \times 1\text{ cm} \times 1\text{ cm}$ , and one large cube,  $2\text{ cm} \times 2\text{ cm} \times 2\text{ cm}$

**FIGURE 6**

**Total volume of small cubes  
=  $8\text{ cm}^3$**

**Volume of large cube =  $8\text{ cm}^3$**

**Total surface area of small  
cubes =  $48\text{ cm}^2$**

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

---

---

---



---

---

Surface area of the large cube =  
\_\_\_\_\_ cm<sup>2</sup>

**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]**

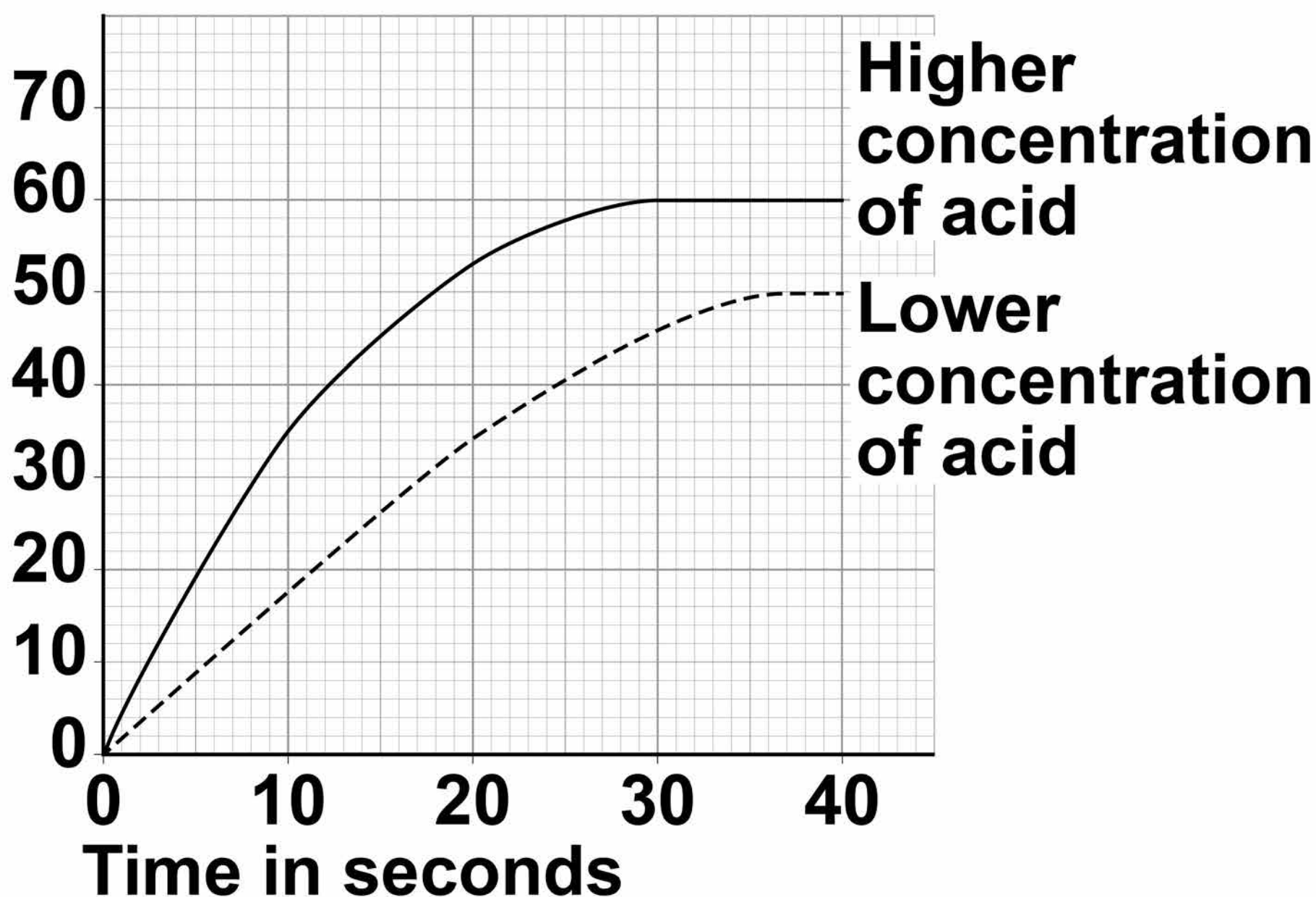


**05.9** The student repeated the investigation with small marble chips using hydrochloric acid with a lower concentration.

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

**FIGURE 7**

**Volume  
of gas  
in  $\text{cm}^3$**



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

---

---

---

---

---

---

---

---

---

---

---

---

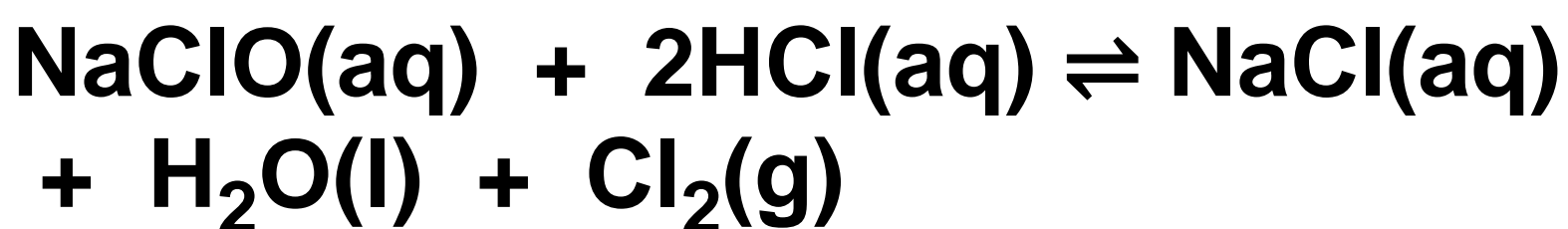
**[Turn over]**

<b>17</b>

**0 6**

**Bleach is a solution of sodium hypochlorite (NaClO).**

**Chlorine gas is produced when bleach reacts with hydrochloric acid.**

**0 6 . 1**

**Give the test and result for chlorine gas. [2 marks]**

---

---

---



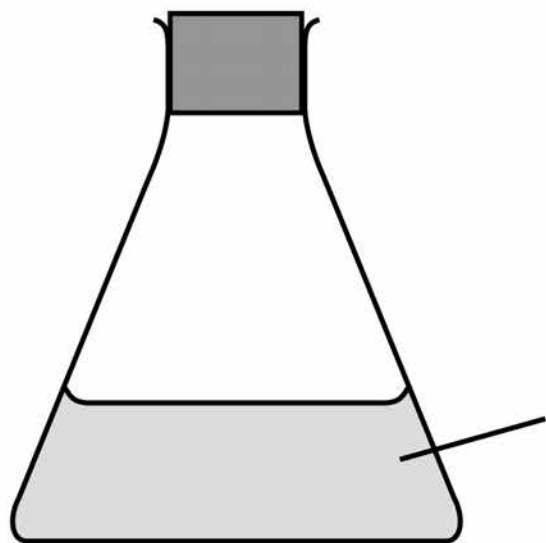
**BLANK PAGE**

**[Turn over]**



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

**FIGURE 8**



**Sodium hypochlorite  
solution and hydrochloric  
acid**

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

---

---

---

---

---

---

---

---

---

---

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

**The stopper is replaced.**

**Explain what happens to the equilibrium. [4 marks]**

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

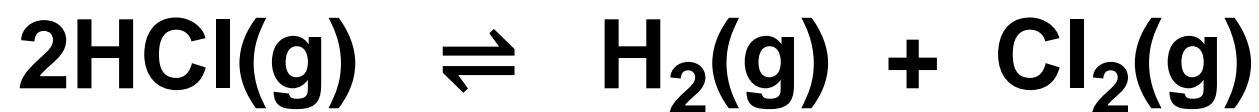
---

---

**[Turn over]**



**Chlorine gas is also produced when hydrogen chloride decomposes.**



**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]**

---

---

---

---

---

---

---



**06.5**

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

---

---

---

---

---

---

---

---

**END OF QUESTIONS**

<b>12</b>



**There are no questions printed on this page.**

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
<b>TOTAL</b>	

### Copyright information

For confidentiality purposes, from the November 2015 examination series, acknowledgements of third party copyright material will be published in a separate booklet rather than including them on the examination paper or support materials. This booklet is published after each examination series and is available for free download from [www.aqa.org.uk](http://www.aqa.org.uk) after the live examination series.

Permission to reproduce all copyright material has been applied for. In some cases, efforts to contact copyright-holders may have been unsuccessful and AQA will be happy to rectify any omissions of acknowledgements. If you have any queries please contact the Copyright Team, AQA, Stag Hill House, Guildford, GU2 7XJ.

Copyright © 2018 AQA and its licensors. All rights reserved.

**IB/M/Jun18/CD/8464/C/2H/E2**

