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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]**

J U N 1 8 8 4 6 4 C 2 H 0 1

**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.**

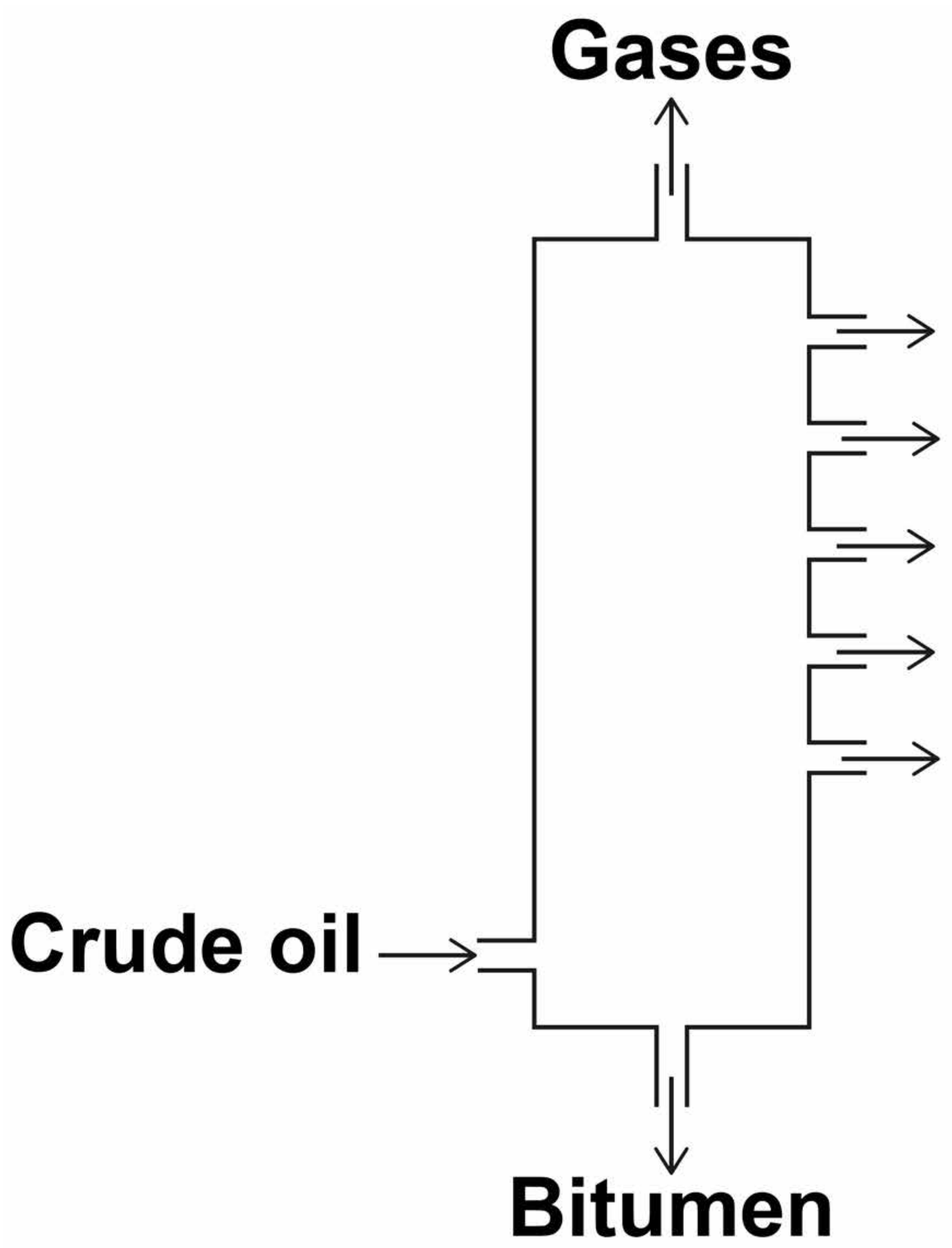
**DO NOT TURN OVER UNTIL TOLD TO DO SO**

**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



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.**

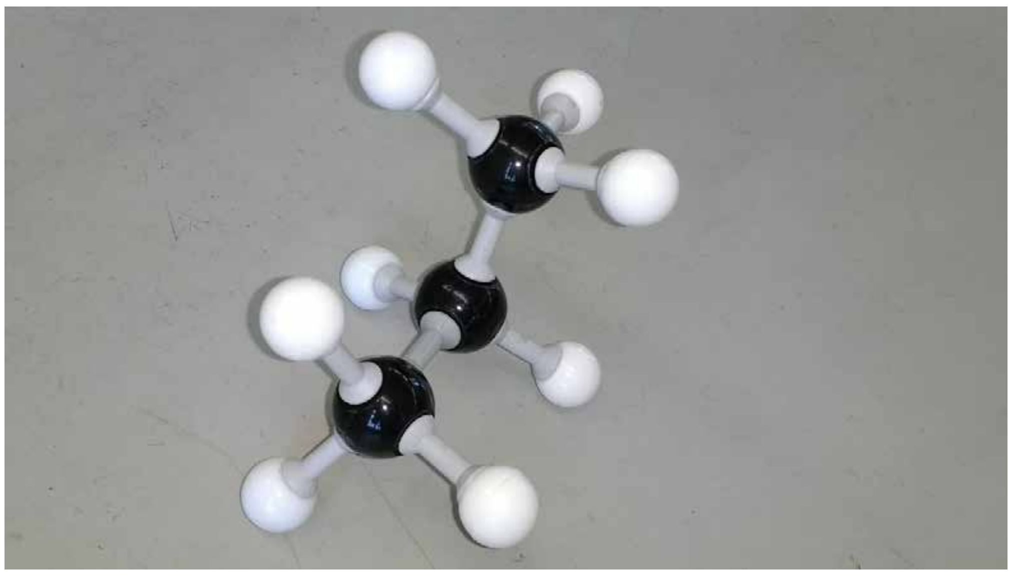
☐ **The fractions have different melting points.**

☐ **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]

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

**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

| | 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]**

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11

**[Turn over]**

**$\boxed{0}\boxed{1}.\boxed{8}$ Compare the TWO methods for the disposal of biodegradable plastic bags.**

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

11

**[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** ______________________________

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______________________________

**[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]**

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**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]**

**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]**

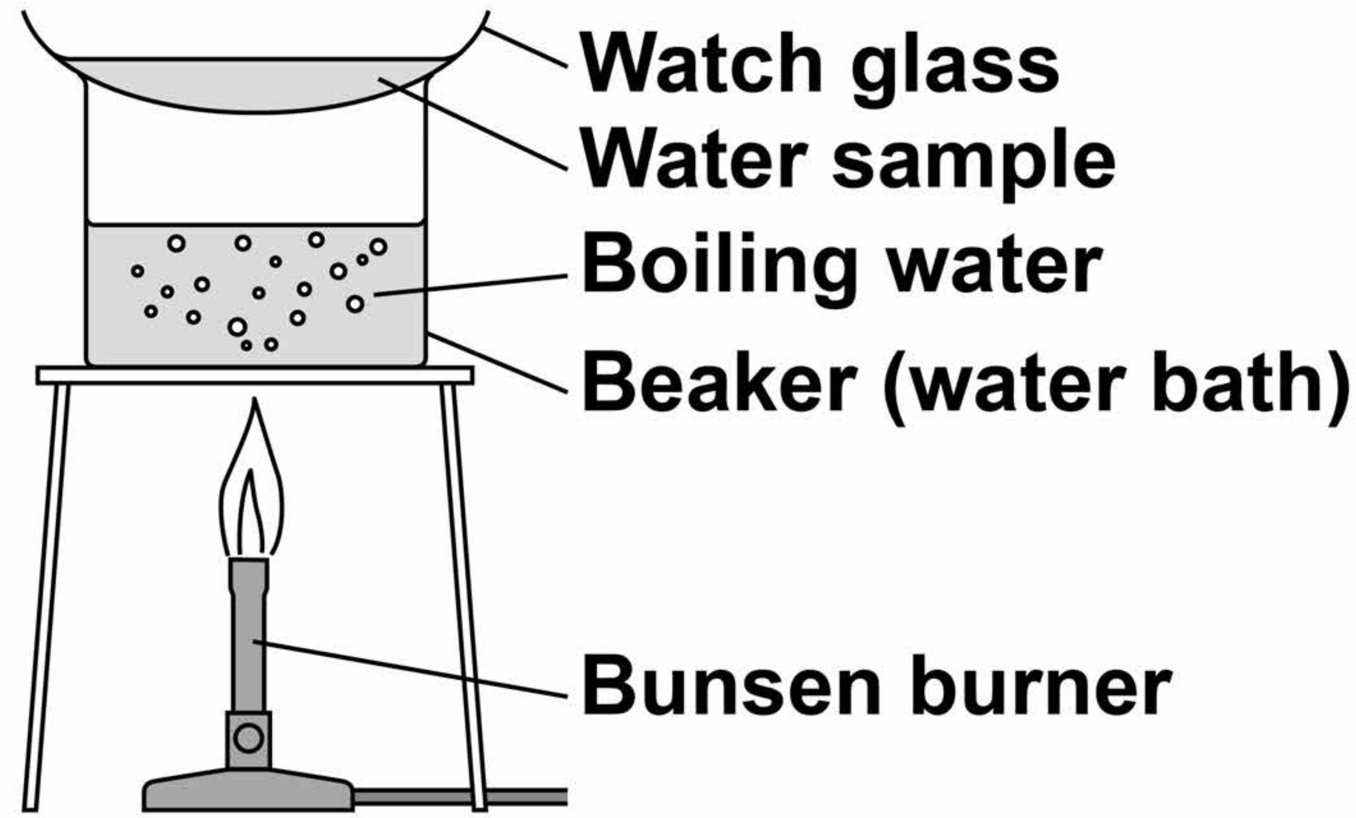
**[Turn over]**

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**



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[Turn over]

**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]**

______________________________________________

______________________________________________

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**Mass X = ______________________ g**



**[Turn over]**

**03.2** 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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**[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]**

**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]**

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**Mass of dissolved solids =**

______________________ **g**

**[Turn over]**

**9**

**0 4** **Fertilisers are formulations.**

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

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**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]

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

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

**[Turn over]**

9

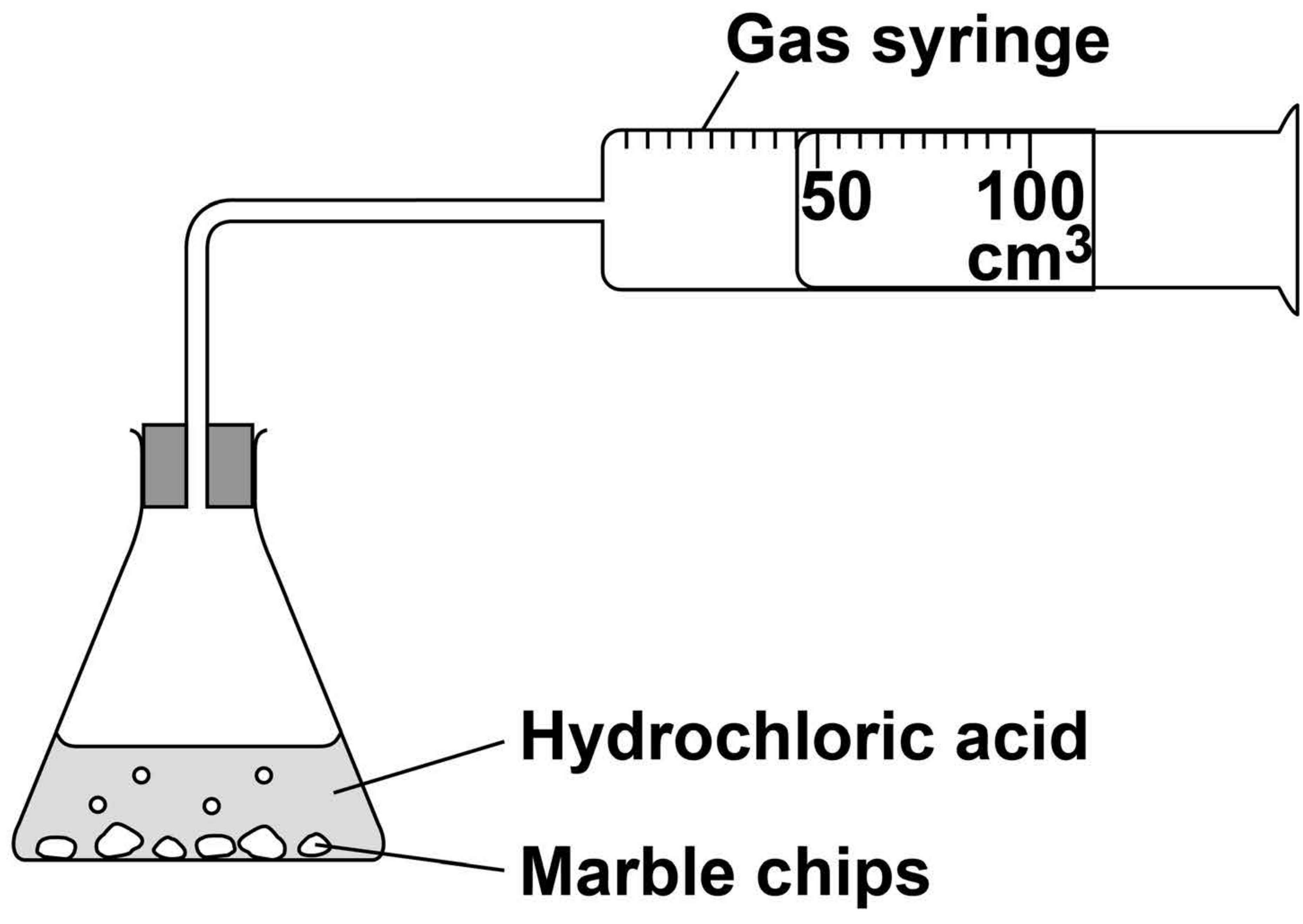
**0 5** **A student investigated the effect of the size of marble chips on the rate of the reaction between marble chips and hydrochloric acid.**

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

## FIGURE 4



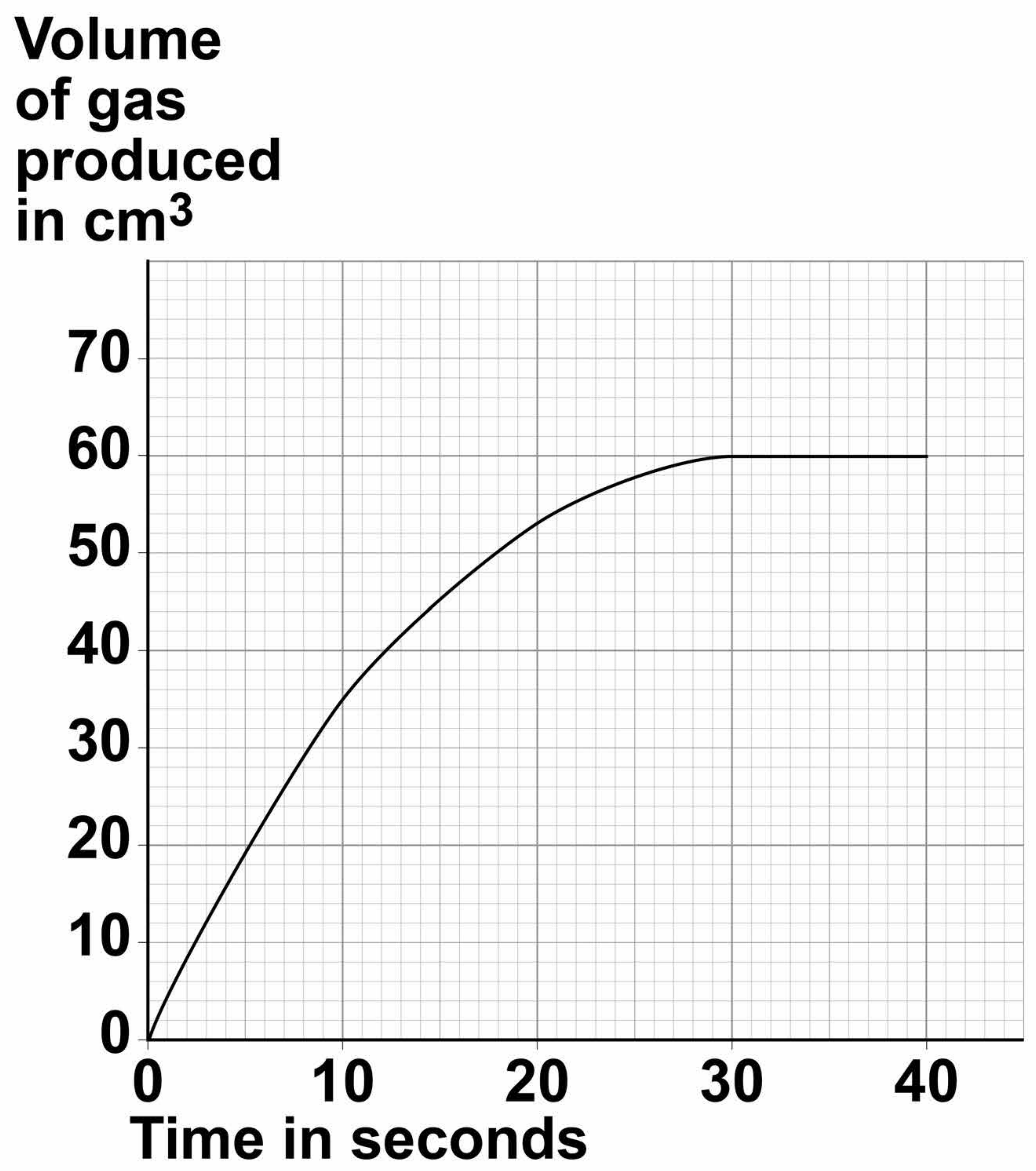

**0 5 . 1** **Complete the equation for the reaction. [2 marks]**

$CaCO_3$ + ______________ HCl

$\longrightarrow$ __________________________

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

**FIGURE 5**

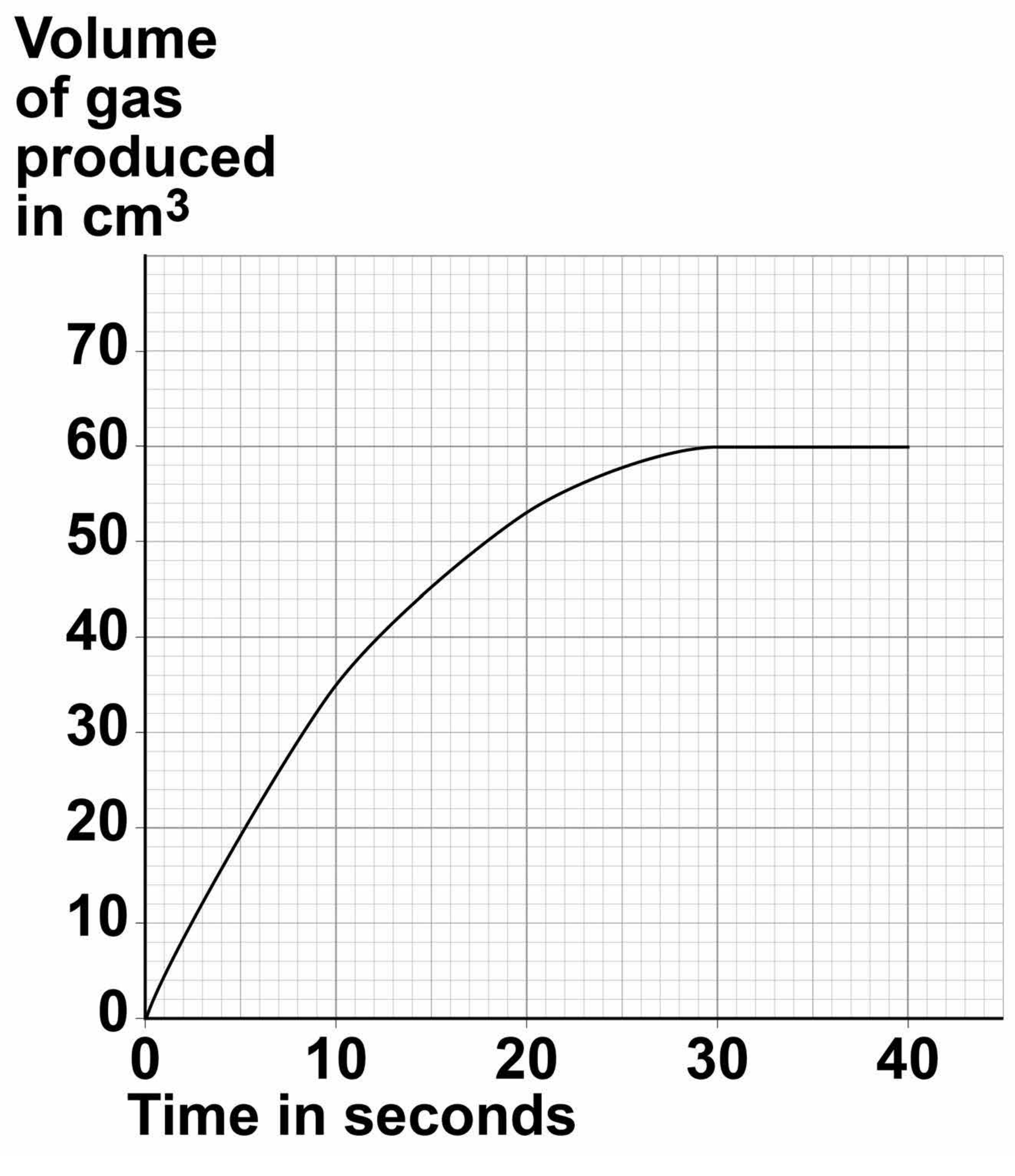


**0 5 . 2** **Describe the trend shown in FIGURE 5.**

**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 |

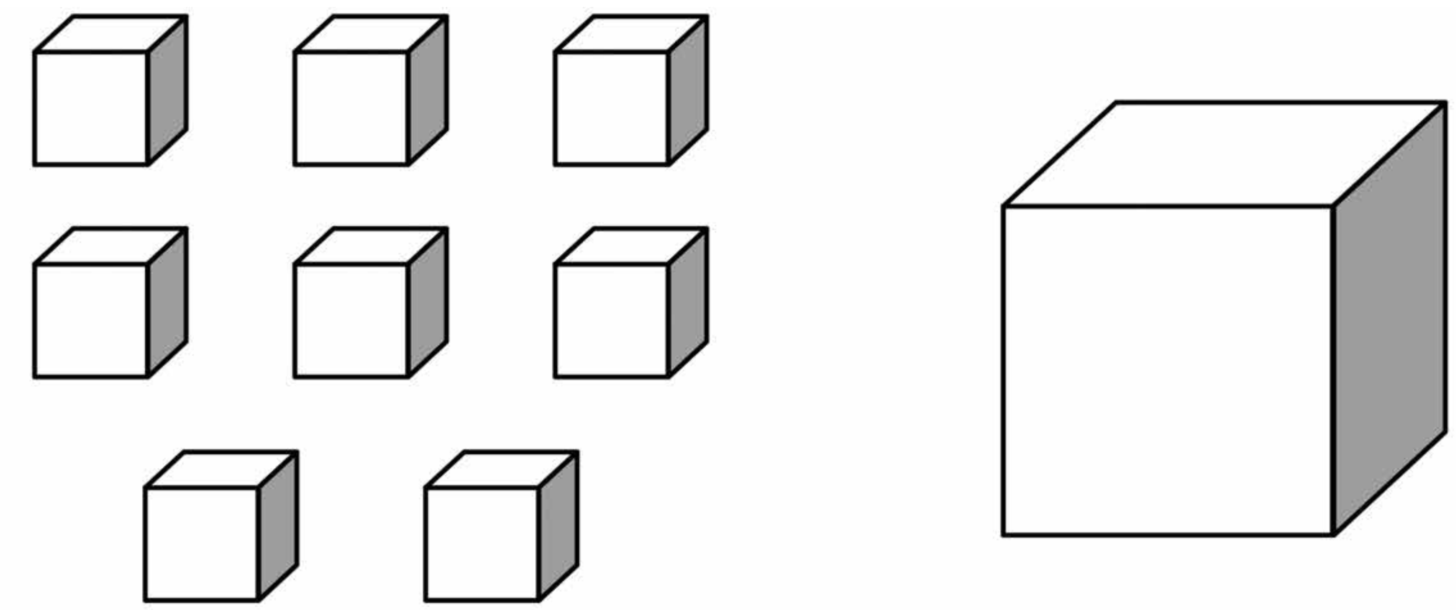
**0 5 . 5** **Give ONE conclusion about how the size of the marble chips affects the rate of the reaction. [1 mark]**

**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 × 1 cm × 1 cm, and one large cube, 2 cm × 2 cm × 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 = ________________ $cm^2$

**05.8** **Explain why the size of the marble chips affects the rate of the reaction.**

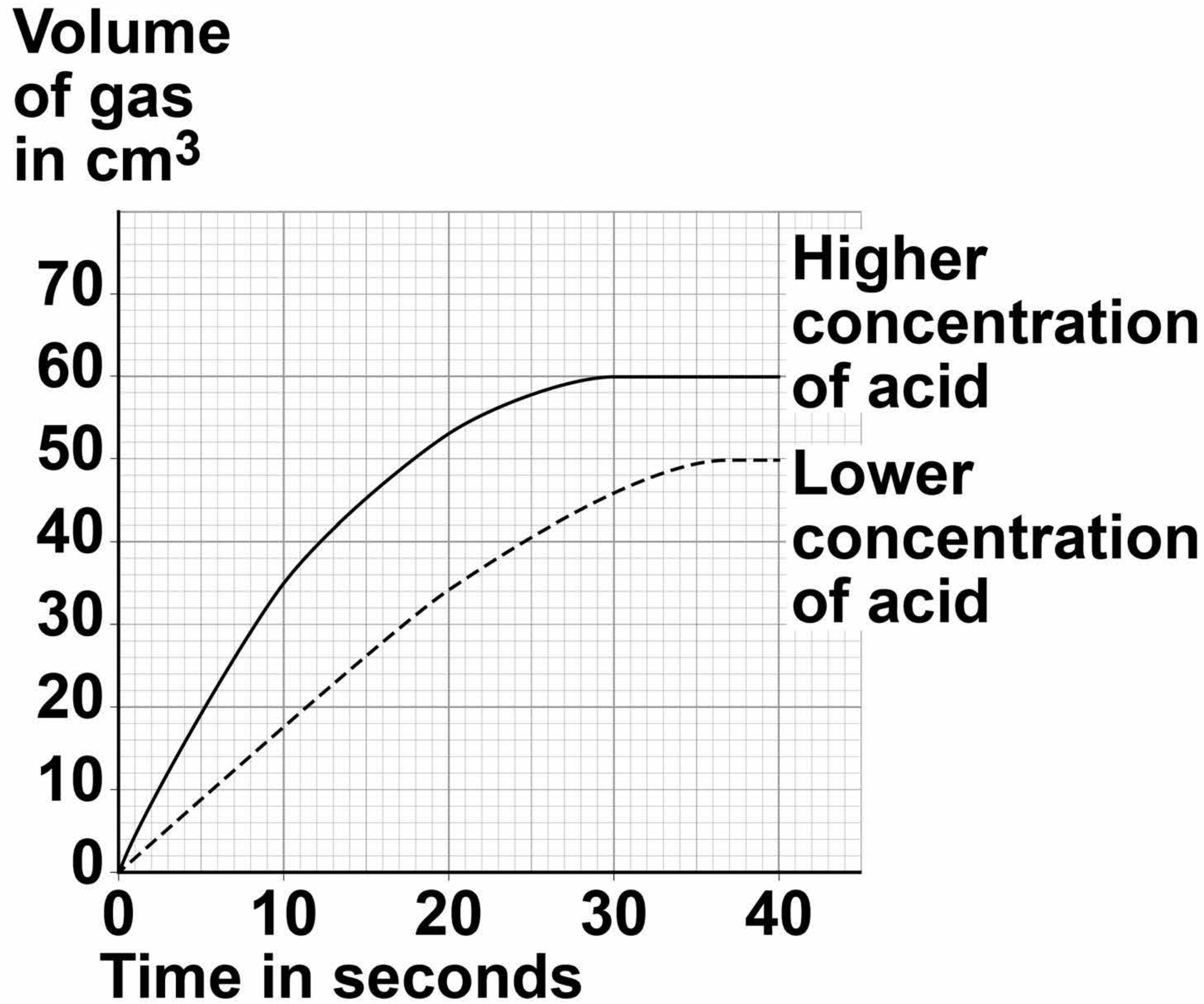
**Give your answer in terms of ‘collision theory’. [2 marks]**

[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**



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

**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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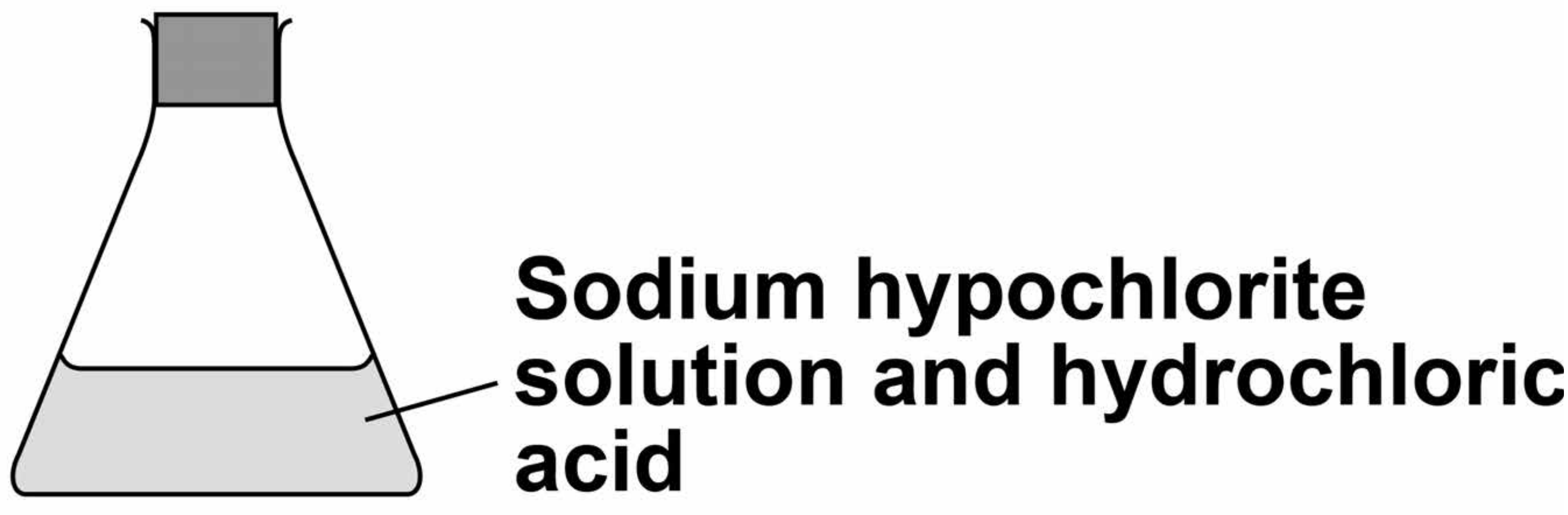
[Turn over]

**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]**

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**06.3** **The stopper in FIGURE 8 is removed and hydrochloric acid is added.**

**The stopper is replaced.**

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

**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]**

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12

**END OF QUESTIONS**

# There are no questions printed on this page.

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

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