OCR
Oxford Cambridge and RSA

GCSE Chemistry A (Gateway Science)

J248/04 Chemistry A C4-C6 and C7 (Higher Tier)

Question Set 13

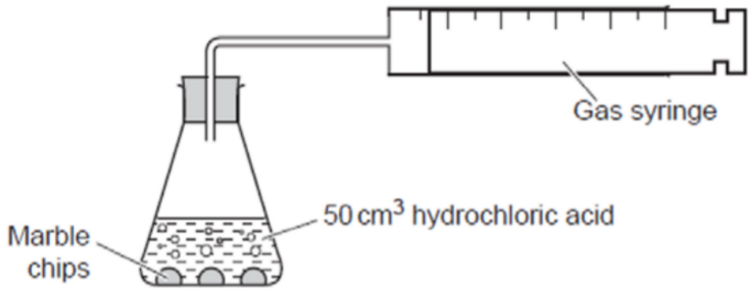
1 A student investigates the reaction between marble chips, $CaCO_3$, and hydrochloric acid.

Calcium chloride, $CaCl_2$, carbon dioxide and water are made.

(a) Write a **balanced symbol** equation for the reaction. **[2]**

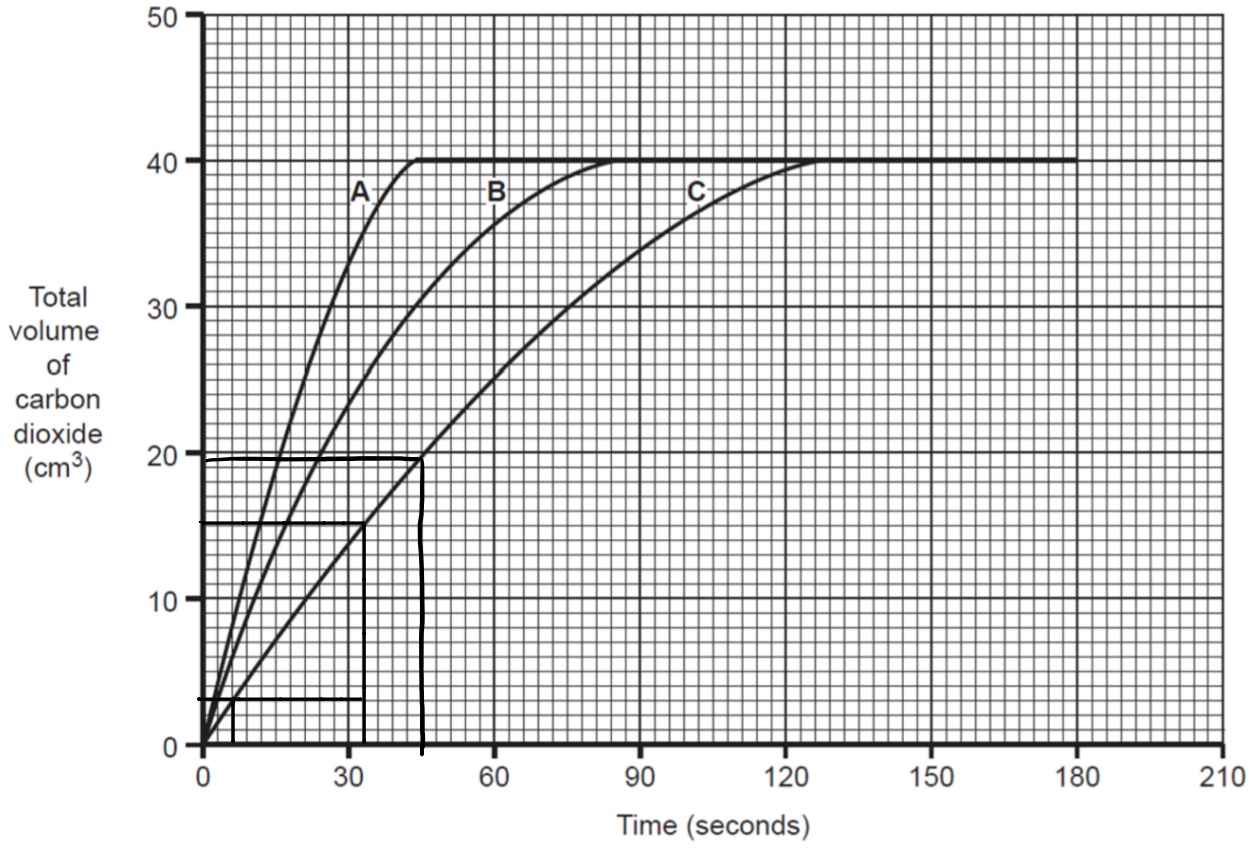
$CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H_2O$

(b) The student does three experiments, **A**, **B** and **C**.



In each experiment she uses a different size of marble chip. She uses the same mass of marble in each experiment. She also uses the same concentration of acid.

Look at the graph of her results.



(i) Look at the line for experiment **B** on the graph.

When is the rate of reaction **greatest**?

Choose your answer from the list.

0 – 30 seconds

30 – 60 seconds

60 – 90 seconds

90 – 120 seconds

Answer = 0-30 seconds **[1]**

(ii) Look at the line for experiment **C**.

Calculate the **rate of reaction** during the first 45 seconds.

Give your answer to **2** significant figures.

$\frac{19.5\ cm^3}{45s} = 0.43\ cm^3/s$

Answer = 0.43 cm^3/s **[3]**

(c) The rate of reaction between marble and hydrochloric acid can be decreased by:

- Using a more dilute solution of hydrochloric acid
- Cooling the acid.

Explain how each of these methods make the reaction slower.

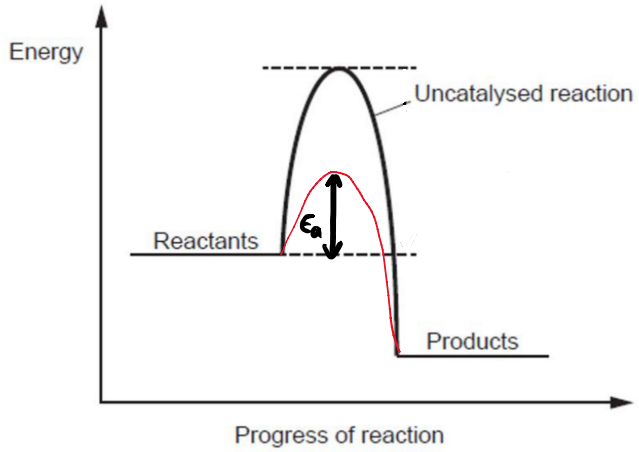
Use ideas about collisions between particles. **[4]**

Dilute acid contains fewer acid particles in same volume. This means there is less chance of collisions, and so a decreased rate of successful collisions, as less collisions per unit time

Cooling the acid causes the speed of the particles to reduce, again reducing the rate of successful collisions, as they have less kinetic energy so less collisions per unit time

(d) A catalyst can be used to increase the rate of a reaction.

Look at the energy profile diagram for a reaction **without** a catalyst.



Complete the energy profile diagram to show

(i) The reaction profile for the reaction with a catalyst. **[1]**

(ii) Label the **activation energy** for the reaction **with** a catalyst. **[1]**

Total Marks for Question Set 13: 12