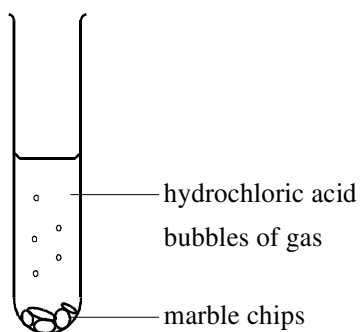


### C6 Assessed Rates 3

1. Clare added hydrochloric acid to marble chips (calcium carbonate).



The reaction was slow.

Some changes which may speed up the reaction are listed in the table.  
Put ticks in **THREE** boxes to show which of the changes speed up the reaction.

Change	Tick if reaction speeds up
adding more of the acid to the test tube	
warming the test tube and contents	
using more concentrated acid	
grinding up the chips before adding the acid	
adding water to the test tube	

(3)  
(Total 3 marks)

2. Calcium carbonate reacts with dilute hydrochloric acid.  
During the reaction carbon dioxide and water are formed.

(a) (i) Write the word equation for this reaction.

.....  
.....

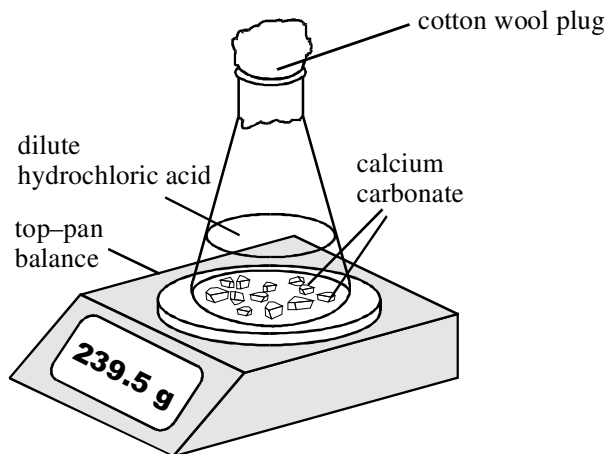
(2)

(ii) Describe the test for carbon dioxide.

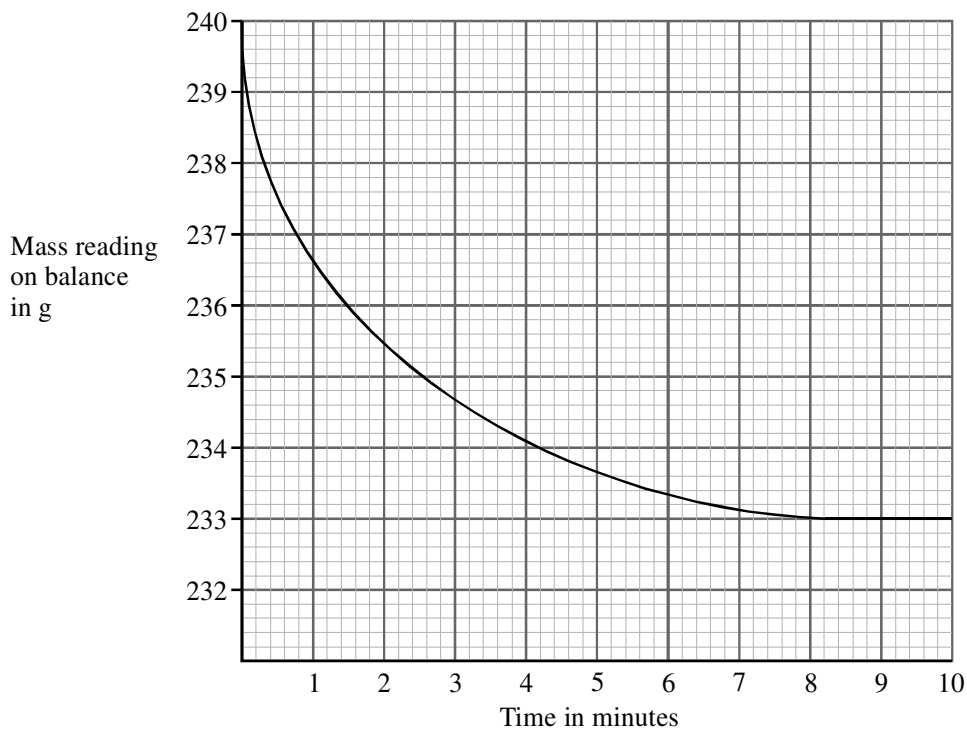
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.....  
.....  
.....  
.....

(3)

- (b) Some students investigated the rate of reaction of lumps of calcium carbonate with hydrochloric acid. They carried out the reaction in a flask on a top pan balance as shown below.



The students recorded the mass at known times after the start. Their results are shown on the graph.



- (i) How does the mass of the reaction mixture change during the reaction?

.....

(1)

(ii) Explain why this change in mass takes place.

.....  
.....  
.....  
.....

(2)

(iii) Use the graph to find the reading on the balance at the end of this reaction.

.....

(1)

(c) The experiment was repeated using the same masses of acid and calcium carbonate as in the first experiment but using powdered calcium carbonate instead of lumps.  
How did the rate of reaction change when powder was used instead of lumps?

.....

(1)

(d) Suggest THREE ways of increasing the rate of reaction of a finely powdered solid with an acid.

1 .....

2 .....

3 .....

(3)

(Total 13 marks)

3. Catalytic converters are now fitted to many car exhaust systems. They are used to convert harmful gases into less harmful ones.

(a) What is a catalyst?

.....  
.....  
.....  
.....

(2)

- (b) Diagrams A and B show two ways in which the catalyst could be arranged in a catalytic converter.



**A**  
Catalyst on inside surface  
of single tube



**B**  
Catalyst on inside surface  
of many small tubes

Explain why the arrangement in diagram B is better for a catalytic converter.

.....  
.....  
.....  
.....

(2)

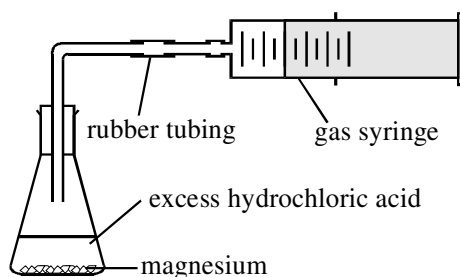
- (c) Explain why the converter works faster when the exhaust system is warm.

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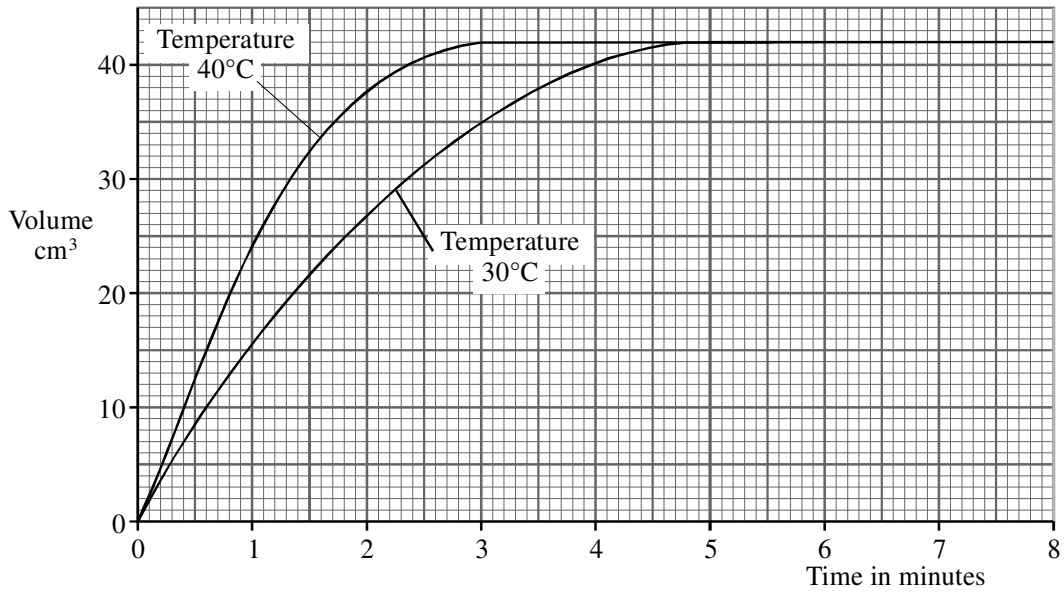
(3)

(Total 7 marks)

4. When magnesium ribbon reacts with hydrochloric acid, it produces hydrogen. John used this apparatus to investigate the reaction.



He carried out his experiment at two different temperatures. His results are shown on the graph.



State what the graphs show about the rates of reaction and explain your answer in terms of the behaviour of the particles.



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(Total 4 marks)

Total =            /27      Grade =

- 24-27 A\*
- 20-23 A
- 17-19 B
- 14-16 C
- 10-13 D
- <12 E

To improve my grade

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