Practice and PPQu – Rates of Reaction

Warm up questions

Explain the effect on rate of reaction when …

1. Temperature of a reaction is increased (4)

.....

.....

.....

.....

2. Concentration of acid in a reaction is increased (3)

.....

.....

.....

.....

3. Surface area of a solid in a reaction is increased (2)

.....

.....

.....

4. What is a catalyst? (2)

.....

.....

.....

5. How does a catalyst work? (2)

.....

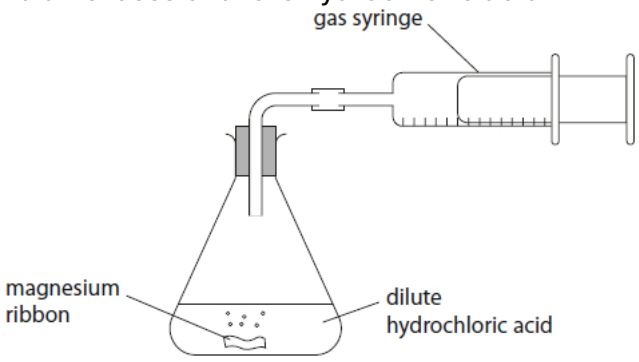
.....

.....

Chemistry CCA

Past Paper questions:

1. A student uses this apparatus to investigate the rate of reaction between magnesium and an excess of dilute hydrochloric acid.



She uses this method.

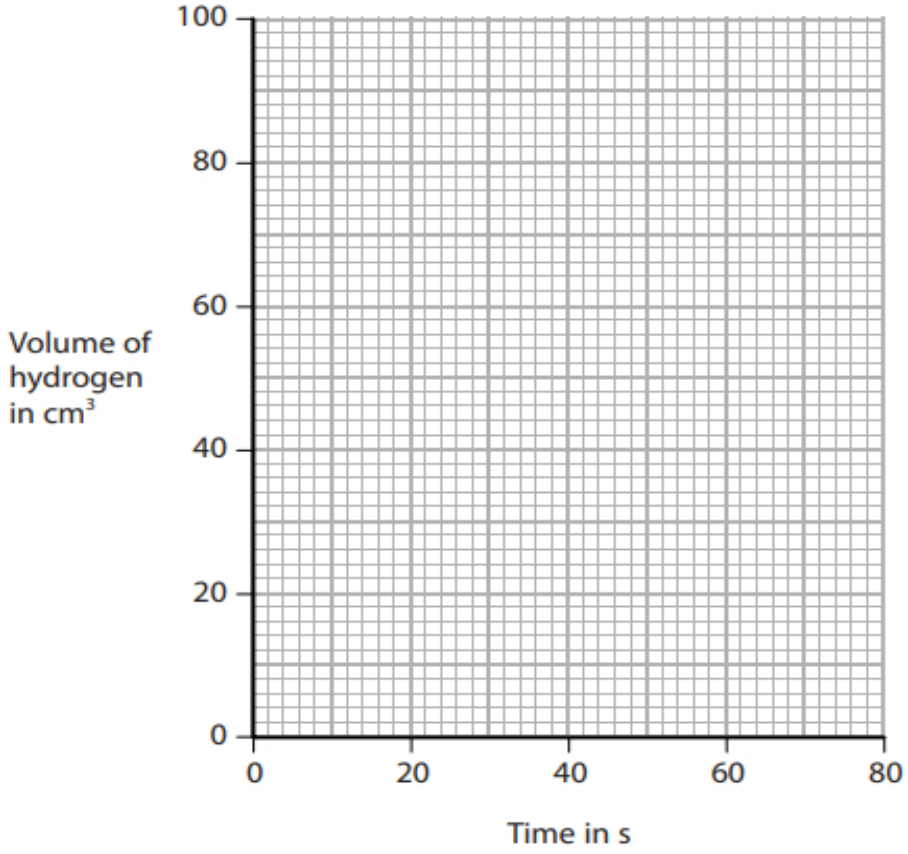
- use a graduated beaker to pour 50 cm^3 of dilute hydrochloric acid of concentration 2.00 mol/dm^3 into the conical flask
- add a piece of magnesium ribbon of mass 0.086 g to the acid and put the bung into the neck of the flask
- measure the total volume of gas collected every ten seconds until the reaction stops

The table shows the student's results.

Time in s	Volume of hydrogen in cm^3
0	0
10	29
20	52
30	67
40	76
50	81
60	84
70	84
80	84

(a) (i) Plot the student's results on the grid. (1)

(ii) Draw a curve of best fit. (1)



(b) (i) The student repeats the experiment using

- 0.043 g of magnesium ribbon
- 50 cm^3 of 2.00 mol/dm^3 hydrochloric acid

Draw, on the grid in part (a), the curve you would expect in this experiment.
Label this curve Y. (2)

(ii) The student repeats the experiment again, using

- 0.086 g of magnesium ribbon
- 50 cm^3 of 2.00 mol/dm^3 hydrochloric acid
  a slightly higher temperature than the first experiment

Draw, on the grid in part (a), the curve you would expect in this experiment.
Label this curve Z. (2)

(c) The expected volume of gas produced in the first experiment is 86 cm^3.
Suggest why the volume collected is less than the expected volume. (1)

.....

.....

(d) The student uses a graduated beaker to measure the volume of dilute hydrochloric acid.
Explain why it is not necessary to use a measuring cylinder in this experiment.
(2)

.....

.....

.....

.....

(e) The ionic equation for the reaction between magnesium and hydrochloric acid is

$$Mg(s) + 2H^+(aq) \rightarrow Mg^{2+}(aq) + H_2(g)$$

Use the information in this equation, and the particle collision theory, to explain why the rate of reaction decreases during each of the experiments. (3)

.....

.....

.....

.....

.....

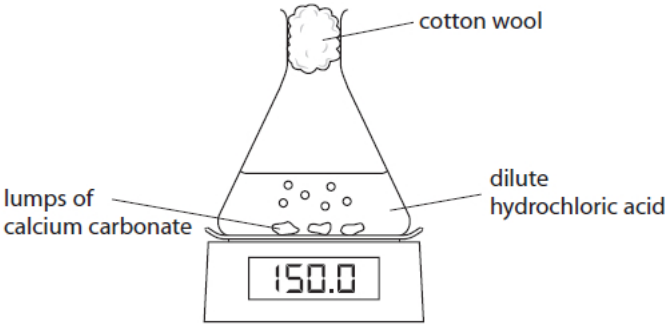
.....

.....

(Total for question = 12 marks)

2. A student uses this apparatus to investigate the rate of reaction between lumps of calcium carbonate and an excess of dilute hydrochloric acid.
The equation for the reaction is

$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$$



(a) Give a reason why the student puts cotton wool in the top of the flask. (1)

.....

.....

(b) The student records the mass of the flask and its contents every 20 seconds for two minutes.
The table shows her results.

Time in s	Mass in g
0	150.0
20	148.2
40	147.2
60	146.6
80	146.2
100	146.0
120	146.0

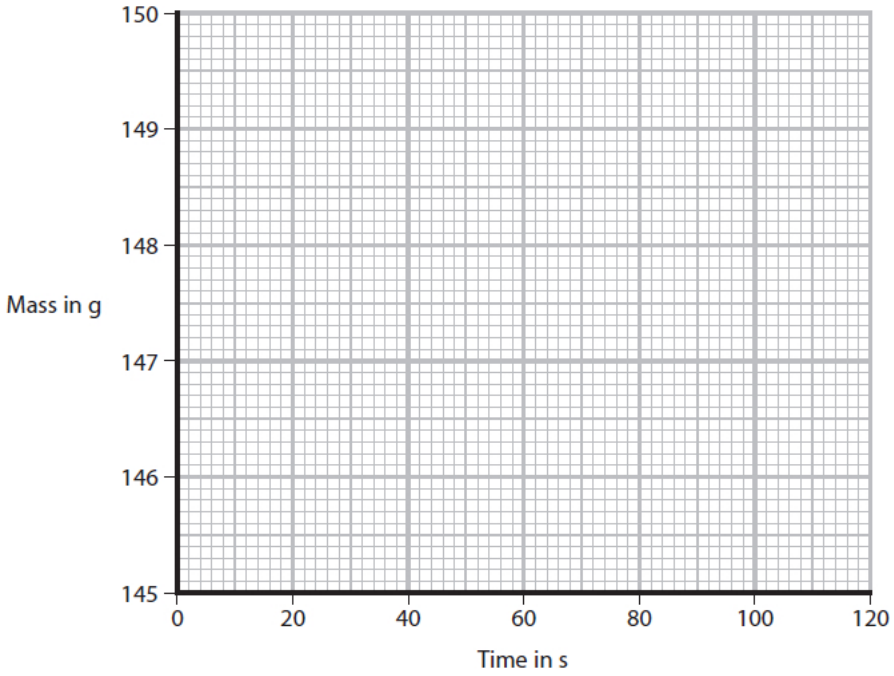
(i) The mean (average) rate of reaction can be calculated using the expression

$$\text{mean rate of reaction} = \frac{\text{mass lost}}{\text{time taken to lose this mass}}$$

Calculate the mean rate of reaction during the first 20 seconds.
Give a unit. (2)

mean rate of reaction = ... unit

(ii) Plot the student's results.
Draw a curve of best fit. (2)



(iii) Explain why the rate of reaction decreases during the experiment. (2)

.....

.....

.....

.....

(iv) Give a reason why the last two mass readings are the same. (1)

.....

.....

(c) The student repeats the experiment using the same mass of calcium carbonate, but in powdered form instead of lumps.
(i) Give two other variables that she should control. (2)

1 .....

2 .....

(ii) Explain why the rate of reaction is greater when using powder instead of lumps of calcium carbonate. (2)

.....

.....

.....

.....

(iii) Suggest how the graph would be different when the reaction is repeated using the same mass of calcium carbonate, but in powdered form instead of lumps. (1)

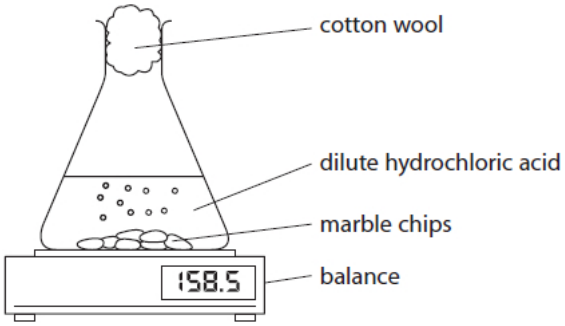
.....

.....

.....

(Total for question = 13 marks)

3. A student uses this apparatus to investigate the rate of reaction between marble chips and dilute hydrochloric acid.



(a) During the reaction, the reading on the balance decreases because mass is lost from the flask.

(i) Explain how using the cotton wool increases the accuracy of this investigation. (2)

.....

.....

.....

.....

(ii) Why is mass lost from the flask? (1)

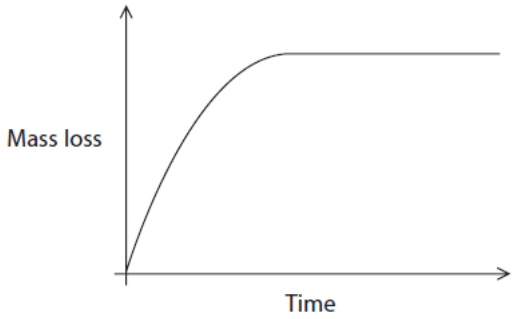
- ☐ A acid particles are moving
- ☐ B gas is given off
- ☐ C heat energy is produced
- ☐ D marble chips are dissolving

(b) This is the equation for the reaction between marble chips and dilute hydrochloric acid.

Complete the equation by adding the state symbols. (2)

$CaCO_3$ (.....) + 2HCl (.....) → $CaCl_2$ (.....) + H_2O (.....) + CO_2 (.....)

(c) The student uses large marble chips in the investigation.
This is a graph of his results.



The student repeats the experiment using the same total mass of smaller marble chips.
On the graph, draw the curve that would be obtained.
[assume the marble chips are in excess] (2)

(d)

(d) The rate of this reaction can be altered by increasing the temperature or by increasing the concentration of the hydrochloric acid.
(i) Explain, using the particle collision theory, how increasing the concentration of the hydrochloric acid would affect the rate of this reaction. (3)

.....

.....

.....

.....

.....

.....

(ii) Explain, using the particle collision theory, how increasing the temperature would affect the rate of this reaction. (3)

.....

.....

.....

.....

.....

.....

(Total for question = 13 marks)