Chemical Reactions – 2019 Nov IGCSE

1. 0620/31/O/N/19/No.3

A student investigated the reaction between zinc carbonate and an excess of dilute hydrochloric acid.

$$ZnCO_3 + 2HCl \rightarrow ZnCl_2 + CO_2 + H_2O$$

The rate of reaction can be found by measuring the decrease in the mass of the reaction mixture over time.

(a) Describe **one** other practical method for measuring the rate of this reaction.

.....

.....

.....

.....

..... [3]

(b) When 6.25 g of zinc carbonate is used, 2.20 g of carbon dioxide is formed.

Calculate the mass of zinc carbonate that forms 11.00 g of carbon dioxide.

mass of zinc carbonate = ... g [1]

(c) What effect do the following have on the rate of this reaction?

- Decreasing the temperature of the reaction mixture.
  All other conditions are kept the same.

.....

- Increasing the concentration of hydrochloric acid.
  All other conditions are kept the same.

.....

[2]

(d) Carbon dioxide is formed:

- when an acid reacts with a carbonate
- as a product of the complete combustion of carbon-containing substances.

State **two** other sources of carbon dioxide.

1 .....

2 .....

[2]

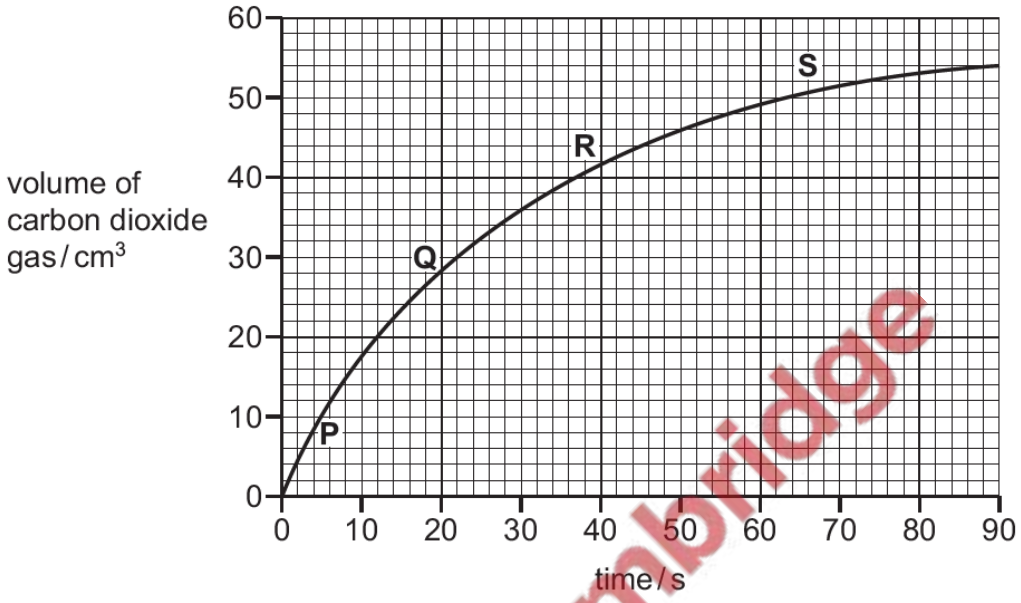
[Total: 8]

2. 0620/32/O/N/19/No.3

(a) A student investigated the reaction of calcium carbonate with an excess of dilute hydrochloric acid by measuring the volume of carbon dioxide produced at 10 second intervals.

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

The results are shown on the graph.



(i) How long did it take from the start of the experiment to collect 30 cm^3 of carbon dioxide?

..... s [1]

(ii) At which point on the graph, **P**, **Q**, **R** or **S**, was the rate of reaction fastest?
Use the graph to explain your answer.

.....

..... [2]

(iii) When 0.225 g of calcium carbonate is used, 54.0 cm^3 of carbon dioxide is formed.

Determine the mass of calcium carbonate needed to form 216 cm^3 of carbon dioxide.

mass of calcium carbonate = ... g [1]

(iv) What effect do the following have on the rate of this reaction?

- Increasing the temperature of the reaction mixture.
  All other conditions are kept the same.

.....

- Using larger pieces of calcium carbonate.
  All other conditions are kept the same.

.....

[2]

(b) In industry, calcium oxide is made from calcium carbonate by thermal decomposition.

$$CaCO_3 \xrightarrow{\text{heat}} CaO + CO_2$$

(i) Why is this described as *thermal decomposition*?

.....

..... [2]

(ii) State **one** other use of calcium carbonate in industry.

..... [1]

(iii) Calcium oxide is used to treat acidic industrial waste.

State the type of chemical reaction that occurs.

..... [1]

[Total: 10]

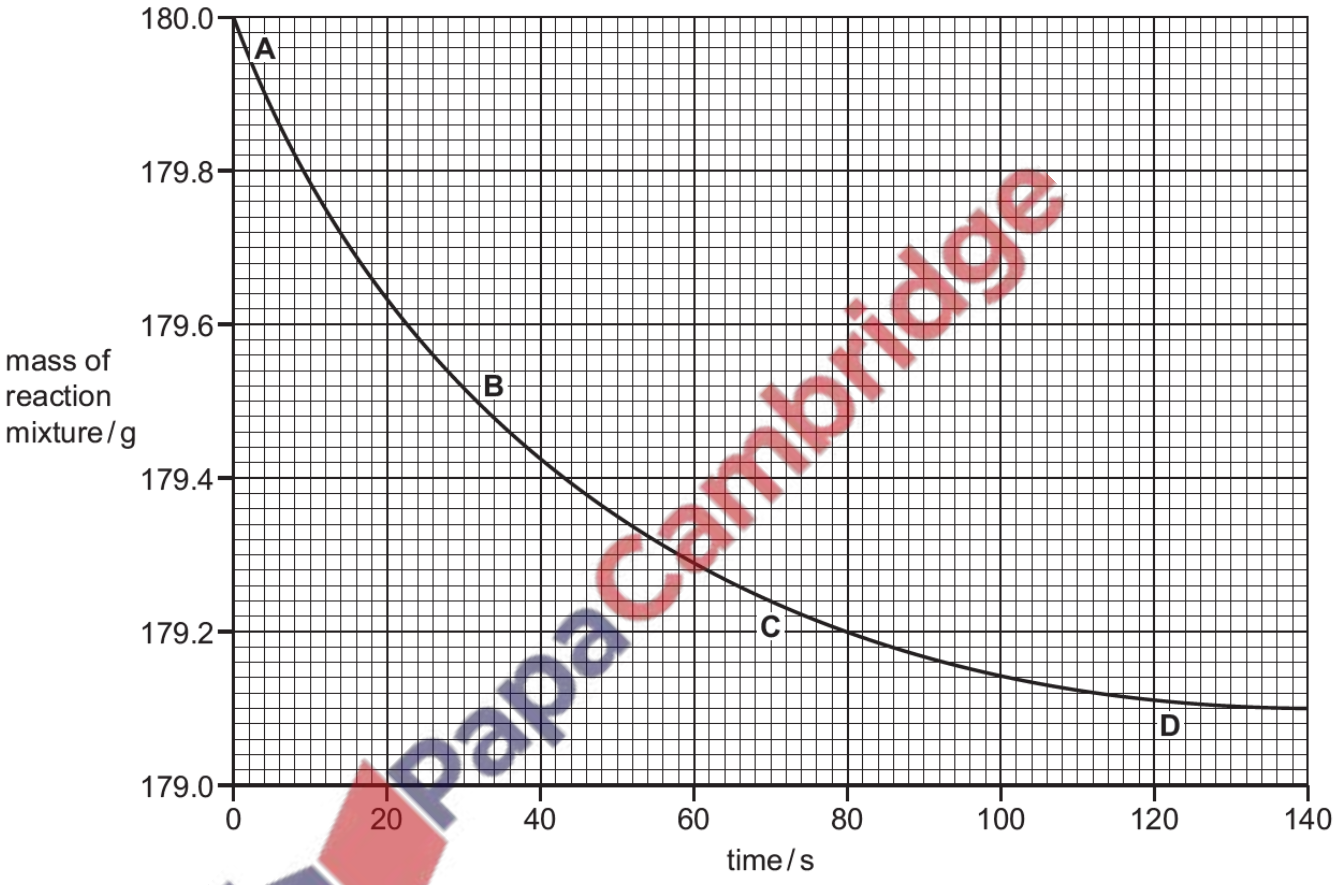
3. 0620/33/O/N/19/No.3

A student investigated the reaction of magnesium carbonate with an excess of dilute hydrochloric acid.

$$MgCO_3 + 2HCl \rightarrow MgCl_2 + CO_2 + H_2O$$

The rate of reaction can be found by measuring the decrease in the mass of the reaction mixture over time.

The results are shown on the graph.



(a) Determine the mass of the reaction mixture after 58 seconds.

..... [1]

(b) At which point on the graph, **A**, **B**, **C** or **D**, was the rate of reaction the fastest?
Use the graph to explain your answer.

.....

..... [2]

(c) When 0.42 g of magnesium carbonate is used, 120 cm^3 of carbon dioxide is formed.

Determine the volume of carbon dioxide produced when 1.26 g of magnesium carbonate reacts completely.

volume of carbon dioxide = ... cm^3 [1]

(d) What effect do the following have on the rate of this reaction?

- Decreasing the concentration of the acid.
  All other conditions are kept the same.

.....

- Using smaller pieces of magnesium carbonate.
  All other conditions are kept the same.

.....

[2]

[Total: 6]