Question #84313, Chemistry / General Chemistry | for completion

What method would you choose to find the rate of reaction between magnesium and hydrochloric acid? Explain why this method is better than four possible alternative.

Explain homogeneous and heterogeneous catalysis and give example of their application

Answer:

The equation for the reaction is:

magnesium + hydrochloric acid → magnesium chloride + hydrogen

$Mg(s) + 2HCl(aq) → MgCl_2(aq) + H_2(g)$

Students follow the rate of reaction between magnesium and the acid, by measuring the amount of gas produced at 10 second intervals.

3 cm of magnesium ribbon typically has a mass of 0.04 g and yields 40 cm^3 of hydrogen when reacted with excess acid. 50 cm^3 of 1M hydrochloric acid is a six-fold excess of acid.

In this reaction, the magnesium and acid are gradually used up. However the acid is in excess, so it is mainly the loss of magnesium (surface area becomes smaller) that causes the change in the rate.

If a graph of volume (y-axis) against time (x-axis) is drawn, the slope of the graph is steepest at the beginning. This shows that the reaction is fastest at the start. As the magnesium is used up, the rate falls. This can be seen on the graph, as the slope becomes less steep and then levels out when the reaction has stopped (when no more gas is produced).

The reaction is exothermic, but the dilute acid is in excess and the rise in temperature is only of the order of 3.5˚C. There is some acceleration of the reaction rate due to the rise in temperature. Some students might notice the flask becoming slightly warm and they could be asked how this would affect the rate of reaction, and how they might adapt the experiment to make it a 'fair test'.