Edexcel Chemistry IGCSE

Practical 3.16: Investigate the effect of different solids on the catalytic decomposition of hydrogen peroxide solution

Notes

The effect of different catalysts on the decomposition of hydrogen peroxide

Aim

To investigate the effect of using different catalysts has on the decomposition of hydrogen peroxide.

Equipment list

- Conical flask
- Gas syringe
- Bung and delivery tube
- Measuring cylinder
- Digital mass balance
- Timer

Chemicals required

- Hydrogen peroxide
- Manganese(IV) oxide
- Platinum
- Iron(V) oxide
- Vanadium(V) oxide

Method

1. Using a measuring cylinder, add 50 cm^3 of hydrogen peroxide to the conical flask.
2. Connect the gas syringe to the bung using the delivery tube. Make sure the syringe is closed so that the volume of gas is 0 cm^3.
3. Measure 0.5 g of the first catalyst being tested.
4. Add the first catalyst to the hydrogen peroxide and immediately attach the bung to the conical flask. Start the timer.
5. Measure the amount of gas in the gas syringe every 10 seconds. Record the results in a table. Stop timing after 60 seconds.
6. Repeat steps 1-5 with each of the other catalysts.

Key points

- Hydrogen peroxide slowly decomposes at room temperature:
  $2H_2O_2(aq) \rightarrow O_2(g) + 2H_2O(l)$
- The experiment could be carried out using an upside down measuring cylinder and water trough instead of the gas syringe.
- It is important that the catalysts each have the same mass and a similar surface area so that these factors do not affect the rate of reaction. In the same way, the same volume and concentration of hydrogen peroxide must be used for each experiment.
- The bung must be attached to the conical flask as soon as the catalyst is added to minimise the amount of gas lost at the start of the reaction.

Diagram

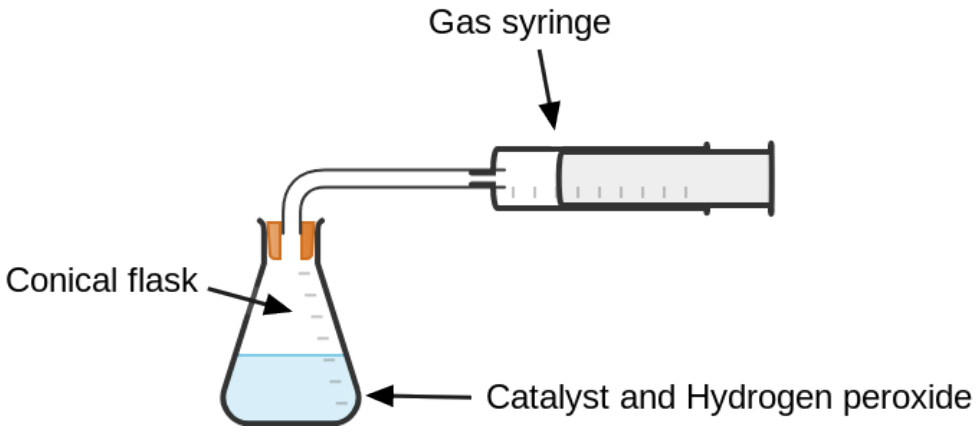

Figure 1 Experiment Setup

Chemix

Safety precautions

- Many powdered catalysts can be irritants if inhaled. Avoid spilling any of the catalysts and clear up any spillages immediately.
- Hydrogen peroxide is corrosive. Wash hands immediately if the skin comes into contact with the solution.
- Ensure the gas syringe is large enough to collect the gas being produced or equipment may get damaged.
- Be careful when handling glassware. Clear up any broken glass immediately.

Analysis of results

A catalyst speeds up the rate of reaction. This is because the catalyst provides an alternate reaction pathway with a lower activation energy so less energy is required for a successful collision. A catalyst is chemically unchanged at the end of the reaction so can be reused.

The results for the experiments can be recorded in a table similar to the one below:

Volume of gas produced at:	**10s**	**20s**	**30s**	**40s**	**50s**	**60s**
Manganese(IV) oxide						
Platinum						
Iron(v) oxide						
Vanadium(V) oxide						

The rates for each catalyst can be calculated using the equation:

Rate of reaction = volume of gas formed ÷ time

The catalyst with the fastest rate of reaction is the most effective catalyst. The results should show that manganese(IV) oxide is the best catalyst for the decomposition of hydrogen peroxide.