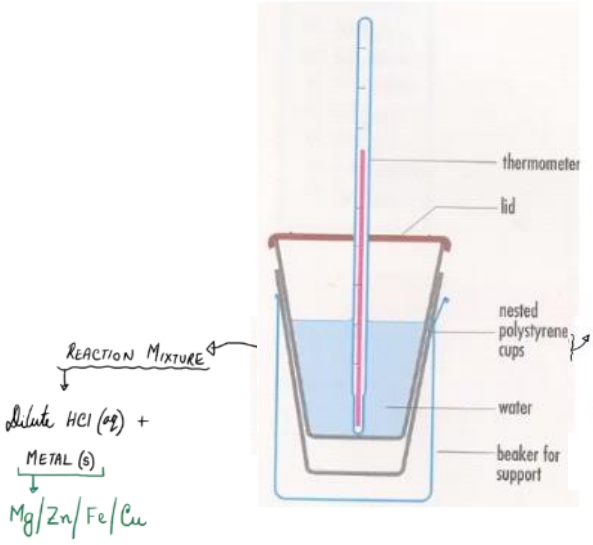
REACTIVITY-SERIES-4

EXPERIMENT: 01

TO INVESTIGATE THE TEMPERATURE RISE IN THE REACTIONS BETWEEN DIFFERENT METALS AND DILUTE HYDROCHLORIC ACID.

DIAGRAM:



TO RECORD THE CHANGE IN TEMPERATURE(TEMPERATURE RISE)

Procedure :

1. Measure 50 cm3 (volume) of 0.1 mol/dm3 (concentration) Hydrochloric acid by using a Measuring Cylinder. Ensure that the acid is in **excess** so that all of the metal reacting is **completely used up**.

2. Then transfer the Hydrochloric acid into the polystyrene cup. Measure the **initial temperature** of the acid using a Thermometer.
   [Try to keep the initial temperature of the acid same for all the four metals]

3. Add 0.01 **mol** (number of particles) of Magnesium powder to the acid in the polystyrene cup and stir with a glass rod immediately. Record the **final temperature** of the reaction mixture from the thermometer.

4. Repeat the entire process with other metals Zinc, Iron and Copper of 0.01 mol of each of them with fresh 50 cm3 of 0.1 mol/dm3 Hydrochloric acid.

Data :

EXPERIMENT #	VOLUME OF ACID / cm3	CONCENTRATION OF ACID / mol/dm3	METALS	NUMBER OF MOLES / mol	MASS / g	INITIAL TEMPERATURE / .C	FINAL TEMPERATURE / .C	TEMPERTATURE RISE / .C
01	50	0.1	Mg	0.01	0.01 * 24 = 0.24	25	50	50 - 25 = **25**
02	50	0.1	Zn	0.01	0.01 * 65 = 0.65	25	38	38 - 25 = **13**
03	50	0.1	Fe	0.01	0.01 * 56 = 0.56	25	33	33 - 25 = **8**
04	50	0.1	Cu	0.01	0.01 * 63.5 = 0.64	25	25	25 - 25 = **0**

NOTE:

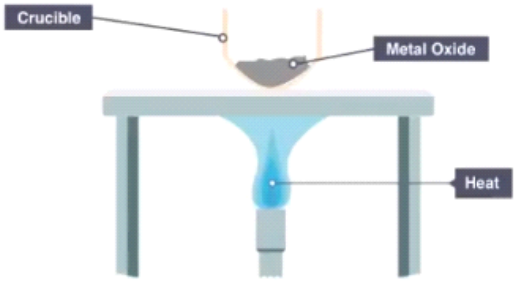
- For all the four experiments, volume and concentration of the acid is kept same for the test to be fair.
- For all the four experiments, number of moles of all the four metals are kept same for the test to be fair.
- Mass of the metal = Number of moles * Relative Atomic Mass of the metal
- The more reactive metal has more temperature rise.
- There is no temperature rise for Copper because it does not react with the acid.

Displacement Reaction Between A Metal and Another Metal Oxide -

For example, reaction between Copper (II) Oxide and Iron :

Copper (II) Oxide + Iron -----> Iron (II) Oxide + Copper

Since Iron is more reactive than Copper, Iron will displace Copper and form positive ions more readily. So, Iron reacts with the Oxide to form Iron (II) Oxide. In this process, the Copper (II) Oxide becomes Copper.



Action Of Heating On Metal Carbonates :

Some metal carbonates break down / decompose (chemically) on heating. This is known as **Thermal Decomposition**.

The stability of a metal carbonate on heating is related to the reactivity of the metal. **The more reactive a metal, the more difficult it is to decompose / break down its carbonate by heating**.

This means that a more reactive metal forms carbonate that are more stable to heating than others.

The thermal stability of a metal carbonate can be tested by heating them in a **dry test tube**:

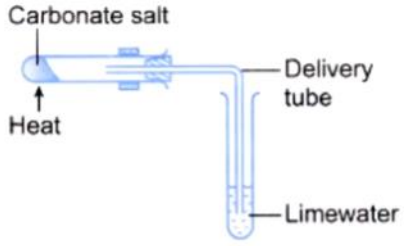


Figure *Heating carbonate salt*

When a metal carbonate decomposes / breaks down on heating, it releases the colorless gas Carbon Dioxide.

Metal Carbonate (s) ---> Metal Oxide (s) + Carbon Dioxide (g)

Limewater is Calcium Hydroxide solution, $Ca(OH)_2\ (aq)$.
It is a colorless solution.

When the Carbon Dioxide gas is released after the decomposition of metal carbonate, it passes through the delivery tube and goes to Limewater and turns it from **colorless** to **white / cloudy / milky**.

Summary Of Action Of Heating On Metal Carbonates:

METAL CARBONATES	OBSERVATION	COMMENT / NOTE
1. Potassium Carbonate, $K_2CO_3\ (s)$ 2. Sodium Carbonate, $Na_2CO_3\ (s)$ 3. Lithium Carbonate, $Li_2CO_3\ (s)$	Unaffected by heating	Potassium, Sodium and Lithium are higher up in the reactivity series. So, their carbonates are very stable to heating.
4. Calcium Carbonate, $CaCO_3\ (s)$ 5. Magnesium Carbonate, $MgCO_3\ (s)$ 6. Zinc Carbonate, $ZnCO_3\ (s)$ 7. Iron (II) Carbonate, $FeCO_3\ (s)$ 8. Lead (II) Carbonate, $PbCO_3\ (s)$ 9. Copper (II) Carbonate, $CuCO_3\ (s)$	Decompose / break down on heating to form their Metal Oxides and Carbon Dioxide gas.	These carbonates of metal are **below Lithium** in the reactivity series which decompose / break down on heating.
10. Silver Carbonate, $Ag_2CO_3\ (s)$	Decompose / break down on heating to form its Silver metal and Carbon Dioxide gas.	For Silver Carbonate, the Silver Oxide is thermally very unstable. So, it further break downs and forms the metal Silver.