REACTIVITY-SERIES-3

EXPERIMENT: 01
TO INVESTIGATE THE DISPLACEMENT REACTIONS OF METALS IN THEIR SALT SOLUTION WITH ANOTHER DIFFERENT METAL.

PROCEDURE :

1. Put the following salt solutions in five separate test tubes -
   - Magnesium Sulfate solution ----------> colorless solution
   - Zinc Sulfate solution ----------> colorless solution
   - Iron (II) Sulfate solution ----------> (Pale) Green solution
   - Lead (II) Nitrate solution ----------> colorless solution
   - Copper (II) Sulfate solution ----------> Blue solution
2. Put a clean piece of Magnesium metal into each solution in the test tubes.
3. Repeat the experiment using fresh salt solutions with clean piece of Zinc, Iron, Lead and Copper metals.

NOTE: The metals must be of **same mass** and **same surface area** in all the experiments. Also, the solutions must be of **same volume** in all the experiments. This is done to ensure that all the experiments are fair (in comparisons).

OBSERVATION :

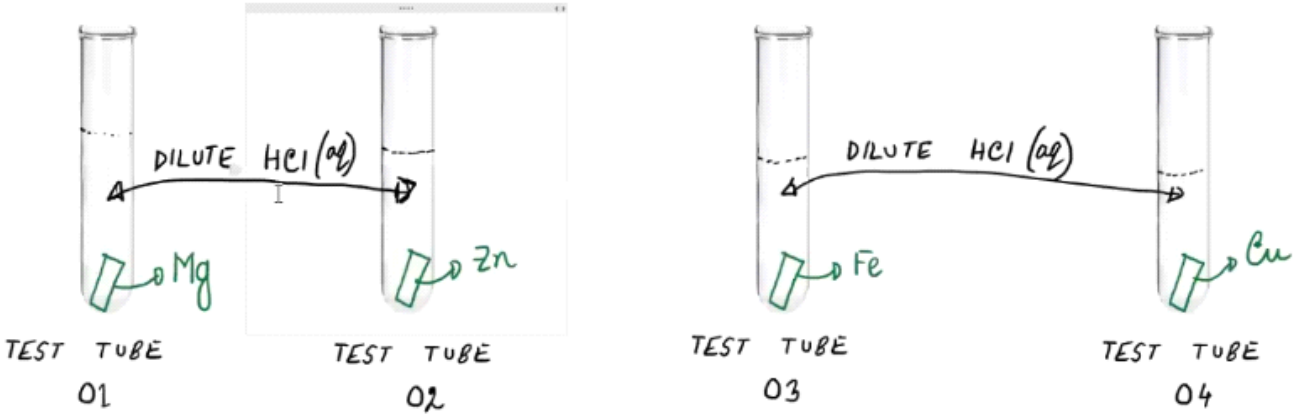
SALT SOLUTIONS	MAGNESIUM SULFATE	ZINC SULFATE	IRON (II) SULFATE	LEAD (II) NITRATE	COPPER (II) SULFATE
METALS					
MAGNESIUM		Mg (s) + ZnSO4 (aq) ---> MgSO4 (aq) + Zn (s) • Solution remains **unchanged** • Grey solid deposits of Zinc is formed	Mg (s) + FeSO4 (aq) ---> MgSO4 (aq) + Fe (s) • Solutions turns from (Pale) Green to colorless • Grey solid deposits of Iron is formed	Mg (s) + Pb(NO3)2 (aq) ---> Mg(NO3)2 (aq) + Pb (s) • Solution remains **unchanged** • Grey solid deposits of Lead is formed	Mg (s) + CuSO4 (aq) ---> MgSO4 (aq) + Cu (s) • Solution turns from Blue to colorless • Pink-Brown solid deposits of Copper is formed
ZINC	Zn (s) + MgSO4 (aq) ---> No reaction No observation		Zn (s) + FeSO4 (aq) ---> ZnSO4 (aq) + Fe (s) • Solutions turns from (Pale) Green to colorless • Grey solid deposits of Iron is formed	Zn (s) + Pb(NO3)2 (aq) ---> Zn(NO3)2 (aq) + Pb (s) • Solution remains **unchanged** • Grey solid deposits of Lead is formed	Zn (s) + CuSO4 (aq) ---> ZnSO4 (aq) + Cu (s) • Solution turns from Blue to colorless • Pink-Brown solid deposits of Copper is formed
IRON	Fe (s) + MgSO4 (aq) ---> No reaction No observation	Fe (s) + ZnSO4 (aq) ---> No reaction No observation		Fe (s) + Pb(NO3)2 (aq) ---> Fe(NO3)2 (aq) + Pb (s) • Solutions turns from colorless to (Pale) Green solution • Grey solid deposits of Lead is formed	Fe (s) + CuSO4 (aq) ---> FeSO4 (aq) + Cu (s) • Solution turns from Blue to (Pale) Green • Pink-Brown solid deposits of Copper is formed
LEAD	Pb (s) + MgSO4 (aq) ---> No reaction No observation	Pb (s) + ZnSO4 (aq) ---> No reaction No observation	Pb (s) + FeSO4 (aq) ---> No reaction No observation		Pb (s) + CuSO4 (aq) ---> PbSO4 (aq) + Cu (s) • Solution turns from Blue to colorless • Pink-Brown solid deposits of Copper is formed

COPPER	Cu (s) + MgSO4 (aq) ---> No reaction No observation	Cu (s) + ZnSO4 (aq) ---> No reaction No observation	Cu (s) + FeSO4 (aq) ---> No reaction No observation	Cu (s) + Pb(NO3)2 (aq) ---> No reaction No observation

Experiment 02 -

To investigate the reactions between different metals and dilute Hydrochloric acid -

Diagram :



Procedure :

1. Take four separate identical test tubes and put a fixed volume of dilute Hydrochloric acid in each of them. Make sure that each test tube contains the **same volume** and **same concentration of Hydrochloric acid**.

2. Put a small piece of **same size / same surface area** of Magnesium, Zinc, Iron and Copper into each of the test tubes respectively. Then look out for any observation.

3. Fizzing / Bubbles / Effervescences are seen only in the first three test tubes, which contains Magnesium, Zinc and Iron. But there is no observation in the last test tube which contains Copper.
   [Because Magnesium, Zinc and Iron are **above** Hydrogen in the reactivity series, so they react with the acid. But Copper is **below** Hydrogen in the reactivity series, so it does not react].

Results :

METALS	OBSERVATION WITH HYDROCHLORIC ACID
1. Magnesium	Reacts vigorously with lots of fizzing / bubbles. Also, the test tube gets very hot as the reaction releases a lot of heat energy.
2. Zinc	Reacts steadily. Also, fizzing / bubbles are seen.
3. Iron	Reacts slowly and also, fizzing / bubbles are seen.
4. Copper	No observation is seen as no reaction occurs.

Note:
All these reactions are called **Exothermic** reactions. So, these reactions release heat energy, so their test tubes get hot. That means in each of these three tests, the temperature **rises**.

In order to make the investigation fair, we kept the **volume** and **concentration** of acid **same** and also, the **surface area / size** of the metals same.