BAL BHARATI PUBLIC SCHOOL, PITAMPURA, DELHI – 110034

Class- X

Chemistry

Laboratory Activity

Week- 9th Nov to 13th Nov'20 **No. of blocks- 1**

Guidelines

Dear Students

- Refer to the given video links and observe.
- Record the given experiment in the Chemistry practical file.

Topic: Laboratory Activity

Learning outcomes

Each student will be able to:

- observe different chemical reactions
- describe the reactivity series of metals
- acquire skills to perform experiments by observing videos and simulation

Lesson Development

Aim

a) Observing the action of Zn, Fe, Cu and Al metals on the following salt solutions:

i) Aqueous solution of $ZnSO_4$

ii) Aqueous solution of $FeSO_4$

iii) Aqueous solution of $CuSO_4$

iv) Aqueous solution of $Al_2(SO_4)_3$

b) Arranging Zn, Fe, Cu and Al (metals) in the decreasing order of reactivity based on the above result.

Material Required

Test tubes, test tube stand, Zinc granules, iron filings, Copper turnings, Aluminium foil and aqueous solutions of zinc sulphate, ferrous sulphate, copper sulphate and aluminium sulphate

Links for the experiment

http://amrita.olabs.edu.in/?sub=73&brch=3&sim=59&cnt=96

http://amrita.olabs.edu.in/?sub=73&brch=3&sim=59&cnt=4

Theory

Displacement reactions are based on the reactivity series, where a more reactive metal displaces a less reactive metal from its salt solution.

For three different metals A, B, C, if metal A replaces metal B from its aqueous solution then metal A is more reactive than metal B.

If metal C displaces metal B from its salt solution, but metal A displaces metal C from its salt solution it follows the increasing order of reactivity:
B < C < A.

Example: When pieces of Zn are dipped in copper sulphate solution, the blue colour of copper sulphate starts fading and reddish brown particles of copper settle at the bottom. This occurs because of the following reaction:

$$\underset{\text{Zinc}}{Zn(s)} + \underset{\substack{\text{Copper sulphate}\\\text{(blue)}}}{CuSO_4(aq)} \longrightarrow \underset{\substack{\text{Zinc sulphate}\\\text{(colourless)}}}{ZnSO_4(aq)} + \underset{\substack{\text{Copper}\\\text{(reddish brown)}}}{Cu(s)}$$

I. $CuSO_4$ solution in each test tube

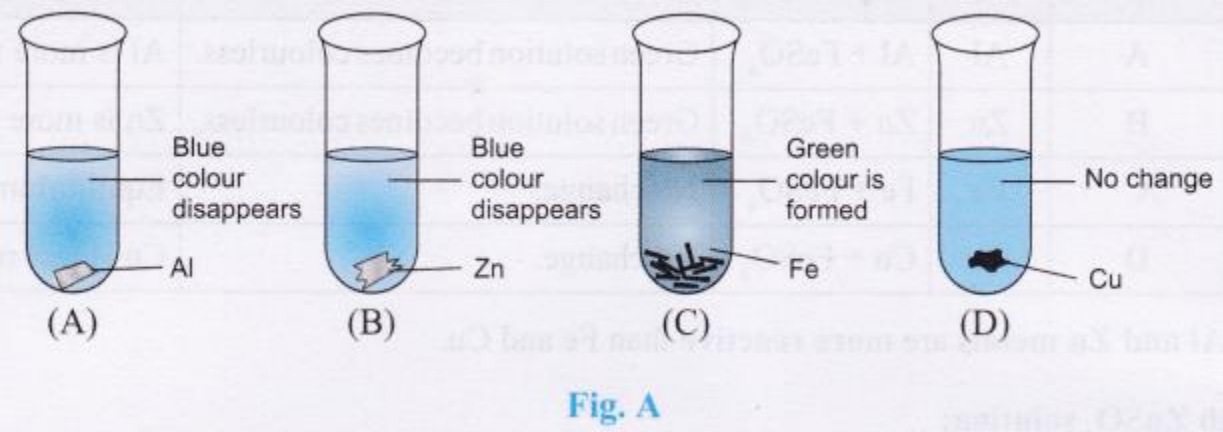

Fig. A

II. $FeSO_4$ solution in each test tube

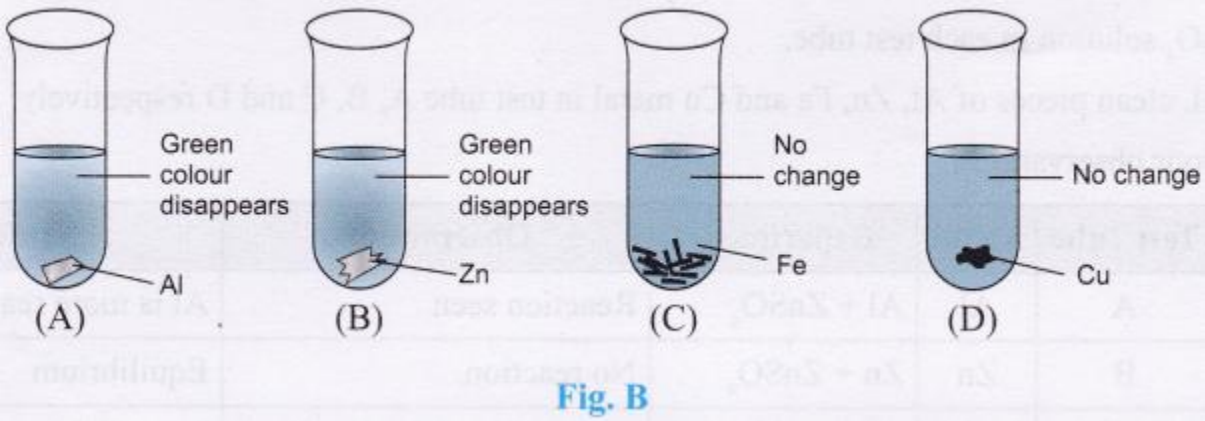

Fig. B

III. $ZnSO_4$ solution in each test tube

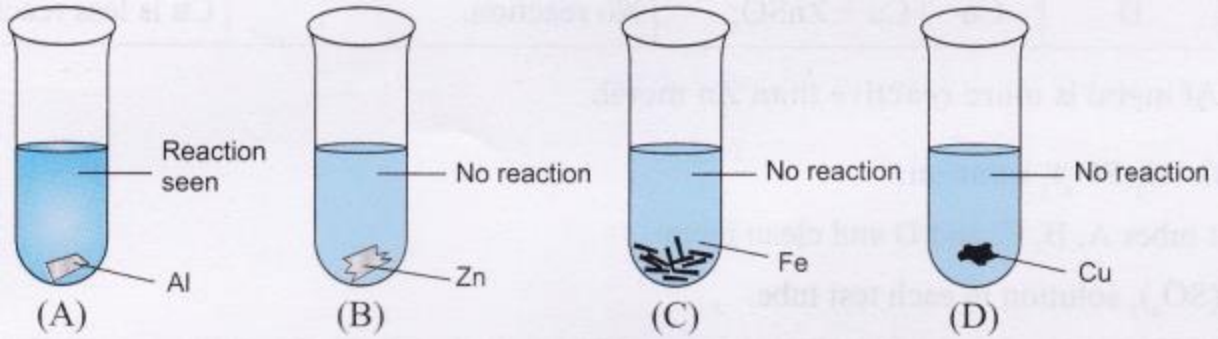

Fig. C

IV. $Al_2(SO_4)_3$ solution in each test tube

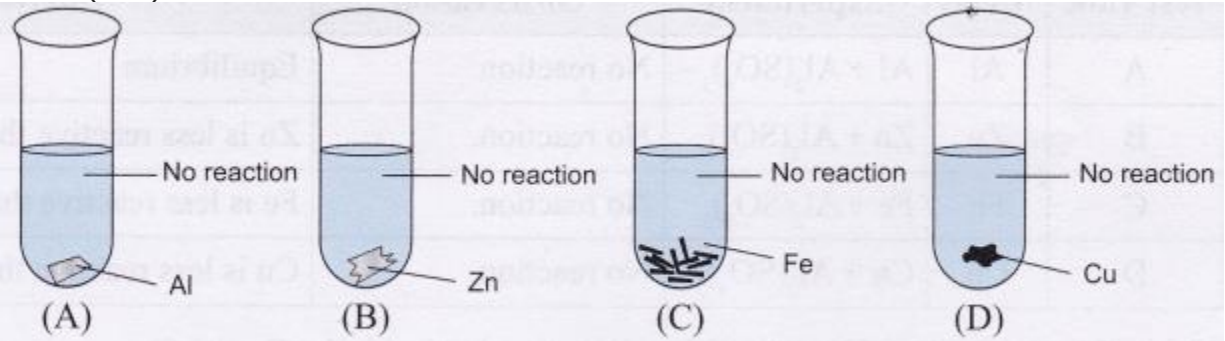

Fig. D

Observation Table

S.No.	Metal	Salt solution in which added	Observation	Inference
1.	Al	$Al_2(SO_4)_3$	No change observed	Metal cannot displace itself from its salt solution.
	Al	$FeSO_4$	Pale green colour of the solution disappears and it becomes colourless. Deposits on Al metal are seen. $2Al(s) + 3FeSO_4(aq) \longrightarrow Al_2(SO_4)_3 + 3Fe(s)$ (white; pale green; colourless; blackish gray)	Al displaces iron from the salt solution. Therefore, Al is more reactive than Fe.

	Al	$ZnSO_4$	No change in colour of the solution, but a new coating is seen on Al. $2Al(s) + 3ZnSO_4(aq) \longrightarrow Al_2(SO_4)_3 + 3Zn(s)$ colourless → colourless; deposits on Al	Al displaces Zn from the salt solution, therefore Al is more reactive than Zn.
	Al	$CuSO_4$	Blue colour of the solution disappears and it becomes colourless. Reddish brown deposits are seen on Al. $2Al(s) + 3CuSO_4(aq) \longrightarrow 3Cu(s) + Al_2(SO_4)_3(aq)$ white, blue → reddish brown, colourless	Al displaces Cu from the salt solution, therefore Al is more reactive than Cu.
2.	**Fe**	$Al_2(SO_4)_3$	No change observed $Fe(s) + Al_2(SO_4)_3(aq) \longrightarrow$ No Reaction.	Fe cannot displace Al from the salt solution, therefore, Fe is less reactive than Al.
	Fe	$FeSO_4$	No change observed	Metal cannot displace itself from its salt solution.
	Fe	$ZnSO_4$	No change observed $Fe(s) + ZnSO_4(aq) \longrightarrow$ No Reaction	Fe cannot displace Zn from the salt solution, therefore, Fe is less reactive than Zn.
	Fe	$CuSO_4$	Blue solution changes to pale green, reddish brown Cu gets deposited on Fe filings. $Fe(s) + CuSO_4(aq) \longrightarrow FeSO_4(aq) + Cu(s)$ blue → pale green; reddish brown	Fe displaces Cu from the salt solution, therefore, Fe is more reactive than Cu.
3.	**Cu**	$Al_2(SO_4)_3$	No change observed $Cu(s) + Al_2(SO_4)_3(aq) \longrightarrow$ No Reaction	Cu cannot displace Al from salt solution, therefore, Cu is less reactive than Al.
	Cu	$FeSO_4$	No change observed $Cu(s) + FeSO_4(aq) \longrightarrow$ No Reaction	Cu cannot displace Fe from salt solution, therefore, Cu is less reactive than Fe.
	Cu	$ZnSO_4$	No change observed $Cu(s) + ZnSO_4(aq) \longrightarrow$ No Reaction	Cu cannot displace Zn from the salt solution, therefore, Cu is less reactive than Zn.
	Cu	$CuSO_4$	No change observed	Metal cannot displace itself from its salt solution.

4.	**Zn**	$Al_2(SO_4)_3$	No change observed $Zn(s) + Al_2(SO_4)_3(aq) \longrightarrow$ No Reaction	Zn cannot displace Al from salt solution, therefore, Zn is less reactive than Al.
	Zn	$FeSO_4$	Pale green solution becomes colourless, Fe gets deposited on Zn granules. $Zn(s) + \underset{\text{pale green}}{FeSO_4(aq)} \longrightarrow \underset{\text{colourless}}{ZnSO_4(aq)} + \underset{\text{blackish grey}}{Fe(s)}$	Zn displaces Fe from salt solution, therefore, Zn is more reactive than Fe.
	Zn	$ZnSO_4$	No change observed	Metal cannot displace itself from its salt solution.
	Zn	$CuSO_4$	Blue solution becomes colourless, reddish brown Cu gets deposited on Zn granules. $Zn(s) + \underset{\text{blue}}{CuSO_4(aq)} \longrightarrow \underset{\text{colourless}}{ZnSO_4(aq)} + \underset{\text{reddish brown}}{Cu(s)}$	Zn displaces Cu from the salt solution, therefore, Zn is more reactive than Cu.

Result

1. Al is able to displace Fe, Cu and Zn from their salt solutions, therefore Al is the most reactive.
2. Cu is unable to displace any metal among Al, Fe and Zn from their salt solutions, therefore Cu is the least reactive.
3. Fe is unable to displace Zn from its salt solution, whereas Zn is able to displace Fe from its salt solution, therefore Zn is more reactive than Fe.
4. The decreasing order of reactivity for these metals follow the order:
   Al > Zn > Fe > Cu.

Precautions

1. Handle the chemicals carefully.
2. Clean each metal with sand paper.
3. Observe the changes carefully as few reactions may occur slowly.
4. Do not taste the chemicals.
5. Wash your hands properly after the experiment.