CLASS X- PRACTICAL WORKSHEET

STUDY OF DISPLACEMENT REACTION & REACTIVITY SERIES

Experiment No: …4……. **Date: ……..**

Objective: To study the interaction of metals namely copper, iron, zinc and Aluminium with their salt solutions and arrange them according to their reactivity.

Principle: More reactive metals displace less reactive metals from their compounds.

Example: $CuSO_4 + Fe \rightarrow FeSO_4 + Cu$

	$FeSO_4$ Solution	**$CuSO_4$ Solution**	**$Al_2(SO_4)_3$ Solution**	**$ZnSO_4$ Solution**
Fe Metal	**No displacement**	**Displaces**	**No displacement**	**No displacement**
Cu Metal	**No displacement**	**No displacement**	**No displacement**	**No displacement**
Zn Metal	**Displaces**	**Displaces**	**No displacement**	**No displacement**
Al Metal	**Displaces**	**Displaces**	**No displacement**	**Displaces**

Requirements: : Test tubes, $CuSO_4$, $FeSO_4$, $Al_2(SO_4)_3$, $ZnSO_4$, Copper wire, Iron nail, zinc granules, Al powder, distilled water, test tube rack, beakers (100 ml) etc.

1. Prepare about 25 ml solutions of copper sulphate, ferrous sulphate aluminium sulphate and zinc sulphate.
2. Take 5 ml (each) of copper sulphate solution in four different test tubes and put an iron nail to first test tube, a small copper wire to the second little aluminium powder to the third and a small zinc granule to the fourth. Keep them aside.
3. Repeat the experiment with $Al_2(SO_4)_3$, $ZnSO_4$ and $FeSO_4$ solutions as well.
4. Wait for about 25-30 minutes and observe the change that takes place in each test tube.
5. Record your observation in the following table.
6. Write your comments/conclusions in the inference box.

	Experiment	**Observation**	**Inference**
Copper sulphate solution			
1	With Iron nail	1. Brown deposit on iron nail 2. Peacock blue colour of the solution changes to light green	Fe displaces Cu from $CuSO_4$
2	With Copper wire	1. No visible change	No displacement reaction
3	With Al metal	1. Brown deposit on Al metal 2. Peacock blue solution becomes colourless $[Al_2(SO_4)_3]$	Al displaces Cu from $CuSO_4$
4	With Zn metal	1. Brown deposit on Zn metal 2. Peacock blue solution becomes colourless	Zn displaces Cu from $CuSO_4$

Aluminium Sulphate solution			
1	With Iron nail	No visible change	No displacement reaction
2	With Copper wire	No visible change	No displacement reaction
3	With Al metal	No visible change	No displacement reaction
4	With Zn metal	No visible change	No displacement reaction

Ferrous sulphate solution			
1	With Iron nail	No visible change	No displacement reaction
2	With Copper wire	No visible change	No displacement reaction
3	With Al metal	1. Black deposit on Al metal 2. Light green solution becomes colourless	Al displaces Fe from $FeSO_4$ and forms $Al_2(SO_4)_{3(aq)}$
4	With Zn metal	1. Black deposit on Zn metal 2. Light green solution becomes colourless	Zn displaces Fe from $FeSO_4$ and forms $ZnSO_{4(aq)}$

Zinc sulphate solution			
1	With Iron nail	No visible change	No displacement reaction
2	With Copper wire	No visible change	No displacement reaction
3	With Al metal	1. Black deposit on Zn metal 2. Solution remains colourless	Al displaces Zn from $ZnSO_4$ and forms $Al_2(SO_4)_{3(aq)}$
4	With Zn metal	No visible change	No displacement reaction

Comment/Conclusion:

1. From the above experiment it is proved that stronger metals displace weaker metals from their compounds.
2. Out of the four metals tested, Aluminium is the strongest and Copper the weakest.
3. Therefore the reactivity order is: Cu < Fe < Zn < Al

Precautions:

1. Use concentrated solutions of copper sulphate, magnesium sulphate and ferrous sulphate.
2. The metal pieces should be free from rust (oxide coating) on their surface.

Questions:

1. What happens when (Write balanced chemical equations for the reaction involved):

Iron filings are kept in blue coloured copper sulphate solution for 30 minutes and why?	Brown solid Cu settles down and blue colour of the solution changes to light green due to the formation Iron sulphate ($FeSO_4$) as Fe displaces Copper from Copper sulphate. $Fe_{(s)} + CuSO_{4(aq)} \rightarrow FeSO_{4(aq)} + Cu_{(s)}$
Zinc shavings are kept in green coloured Ferrous sulphate solution for 30 minutes and why?	Black precipitate of Fe settles down and light green solution becomes colourless as Zn displaces Fe from $FeSO_4$. $Zn_{(s)} + FeSO_{4(aq)} \rightarrow Fe_{(s)} + ZnSO_{4(aq)}$
Iron filings are kept in colourless lead nitrate solution for one day and why?	Black deposit of Pb and colourless solution becomes light green as Fe displaces Pb from $Pb(NO_3)_2$ $Fe_{(s)} + Pb(NO_3)_{2(aq)} \rightarrow Pb_{(s)} + Fe(NO_3)_{2(aq)}$
Aluminium metal pieces are kept in blue coloured copper sulphate solution for 30 minutes and why?	Brown solid copper settles down and blue solution becomes colourless as Al displaces Cu from $cuSO_4$ $2Al_{(s)} + 3CuSO_{4(aq)} \rightarrow 3Cu_{(s)} + Al_2(SO_4)_{3(aq)}$

2. Will you store copper sulphate solution in a zinc vessel? Give reasons to your answer. Write balanced chemical reaction involved.
   Ans: No, Zn will displace Cu: (Problems: - Precious copper sulphates solution will be lost in two ways: (i) Zn reacts with it and (ii) there will be holes developed on Zn due to the displacement reaction between Cu and Zn)

3. Railway tracks are connected to Mg or Zn metal after a particular distance. Give reasons for the same. Write balanced chemical reaction involved. (Ans: This is done in order to prevent rusting of Railway tracks. Mg being more reactive will not allow railway track to undergo rusting. This type of prevention of corrosion is known as sacrificial protection as Mg sacrifices itself to protect Fe from rusting. $3Mg + Fe_2O_3 \rightarrow 2Fe + 3MgO$)
4. Zinc blocks are welded to the hulls of ships. Give reasons. Write balanced chemical reaction involved. (Ans: This is done in order to prevent rusting of hull of the ship. Zn being more reactive will not allow hull to undergo rusting. This type of prevention of corrosion is known as sacrificial protection as Zn sacrifices itself to protect Fe from rusting. $3Zn + Fe_2O_3 \rightarrow 2Fe + 3ZnO$)

Multiple choice questions

1.	Out of the following pairs of metallic salts, the pair of salts whose each salt forms coloured solution when dissolved separately in two beakers containing water is a) $CuSO_4$, $ZnSO_4$ b) $FeSO_4$, $ZnSO_4$ c) $FeSO_4$, $CuSO_4$ d) $CuSO_4$, $Al_2(SO_4)_3$
2.	A piece of granulated Zinc was added to 5 mL of freshly prepared $CuSO_4$ solution kept in a test tube. After one hour the colour of the solution was observed to change from a) Blue to colourless b) Green to colourless

	c) Colourless to blue d) Blue to green
3.	Can we store $ZnSO_4$ in aluminium container and why? a) Yes, because aluminium is less reactive than Zinc. b) No, because aluminium is more reactive than Zinc. c) Yes, because $ZnSO_4$is colourless. d) None of these.
4.	What is the colour of Zn metal a) Grey b) White c) Black d) Brown
5.	To show that zinc is more reactive than copper the correct procedure is a) Prepare $CuSO_4$ soln and dip Zn strip in it. b) Prepare $ZnSO_4$ and dip Cu in it. c) Heat Zn and Cu strips together. d) Add dil. HNO_3 on both strips.
6.	On the basis of reactions identify the most reactive metals i) $A + BX \rightarrow AX + B$ ii) $C + AY \rightarrow CY + A$ a) A ,C b) B , C c) C , A d) C , B
7	For doing displacement reactions in the laboratory, the form in which Zn metal is available is a) Filings b) Strips c) Turnings d) Granules