

*PRABHAT SENIOR
SECONDARY PUBLIC SCHOOL*

SESSION:-2009-10

**CHEMISTRY
INVESTIGATORY PROJECT**

ON

STUDY OF EFFECT
OF METAL COUPLING
ON RUSTING OF IRON

UNDER GUIDANCE:-

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SUBMITTED BY:-

ASHISH PANDEY

CLASS:-XII-Sci.

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CERTIFICATE

This is to certify that the project titled “*Study of effect of metal coupling in rusting of Iron*” was completed under my guidance and supervision by *Ashish Pandey* a student of XII-Sci. ,*Prabhat Senior Secondary Public School* within the stipulated time as prescribed by CBSE.

Mrs. Neena Nigam
Principal

Mr. Harsh Mishra
Teacher

ACKNOWLEDGEMENT

I gratefully acknowledge my sincere thanks to our chemistry teacher Mr. Harsh Mishra for his remarkable, valuable guidance and supervision throughout the project work.

I also express my thanks to my parents for their valuable support and for all sort of assistance for completing he project.

ASHISH PANDEY
XII-Science

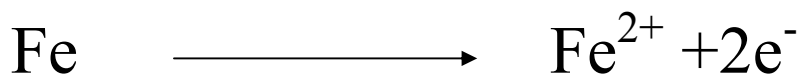
OBJECTIVE

The goal of the project is to investigate effect of metal coupling on the rusting of iron. Metal coupling effects the rusting of iron. We will have to study the change in rate of rusting when an iron nail is coupled with metals more electro-positive than iron and with metals which are less electro-positive than iron.

INTRODUCTION

Metals and alloys undergo rusting and corrosion. The process by which some Metals when exposed to atmospheric conditions i.e., moist air, carbon dioxide form undesirable compounds on the surface is known as Corrosion. The compounds formed are usually oxides. Rusting is also a type of corrosion but the term is restricted to iron or products made from it. Iron is easily prone to rusting making its surface rough. Chemically, rust is a hydrated ferric oxide $\text{Fe}_2\text{O}_3 \cdot n\text{H}_2\text{O}$. Rusting may be explained by an electrochemical mechanism. In the presence of moist air containing dissolved oxygen or carbon dioxide, the commercial iron behaves as if composed of small electrical cells. At

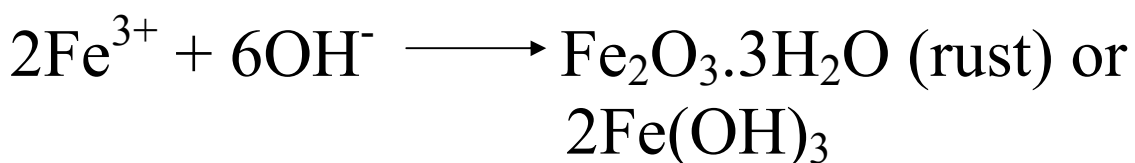
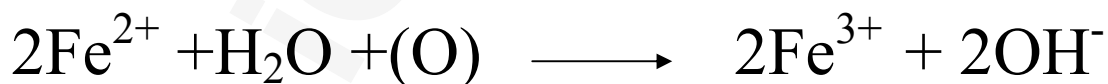
anode of cell, iron passes in to solution as ferrous ions.



The electrons from the above reaction move towards the cathode and form hydroxyl ions



Under the influence of dissolved oxygen the ferrous ions and hydroxyl ions interact form rust, i.e., hydrated ferric oxide.



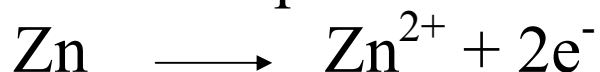
If supply of oxygen is limited the corrosion product may be black anhydrous magnetite, Fe_3O_4 .

METHODS OF PREVENTING CORROSION

Some of the methods used to prevent corrosion are discussed here :

1. **Barrier Protection.** In this method, a barrier film is introduced between iron surface and atmospheric air. The film is obtained by painting , varnishing etc.

2. **Galvanization.** The metallic iron is covered by a layer of more active metal such as zinc. The active metal loses electrons in preference to iron



Thus, protecting iron from rusting and corrosion.

MATERIALS AND **EQUIPMENTS**

- Two petridishes
- Four test-tubes
- Four iron nails
- Beaker
- Sand paper
- Wire gauge
- Gelatin
- Copper, Zinc and Magnesium strips
- Potassium ferricyanide solution
- Phenolphthalein

EXPERIMENTAL

PROCEDURE

1. Clean the surface of iron nails with the help of sand paper. Wash them with carbon tetrachloride and dry on filter paper.
2. Wind a clean zinc strip around one nail, a clean copper wire around the second and clean magnesium strip around the third nail. Put all these three and the fourth nail in Petri dishes so that they are not in contact with each other.
3. **Preperation of Agar-Agar solution.** Heat about three gram of agar agar in 100 ml of water taken in a beaker until solution becomes clear. At about 1 ml of 0.1 M potassium ferri-cyanide solution,

1 ml of phenol-phthalein solution and stir well the contents.

4. Fill the petridishes with hot agar agar solution in such a way that only lower half of the nails are covered with the liquids.
5. Keep the covered petridishes undisturbed for one day or so.
6. The liquid sets to a gel on cooling .Two types of patches are observed around the rusted nail,one is blue and the other pink.Blue patch is due to the reaction between ferrous ions and potassium ferricyanide to form potassium ferro-ferricyanide $KFe[Fe(CN)_6]$ where as pink patch is due to the formation of hydroxyl ions which turns colourless phenolphthalein to pink.