Electrochemistry B.Sc. (II) Sub
D.B. College (Jaynagar)
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- Cathode $O_2(g) + 4H^+(aq) + 4e^- \rightarrow 2H_2O(l)$; ($E^\circ = 1.23V$)

Here Fe^{2+} ions move through water on the surface of the iron object. (If water present is saline, it will help more in carrying the current in the miniature cells thus formed and will enhance corrosion). The overall reaction of the miniature cell is the sum of the cathode and anode reactions as follows:

$$2Fe(s) + O_2(g) + 4H^+(aq) \longrightarrow 2Fe^{2+}(aq) + 2H_2O(l); E^\circ_{cell} = 1.67V$$

The Fe^{2+} ions are further oxidised by atmospheric oxygen to Fe^{3+} (as Fe_2O_3) and comes out as rust in the form

of a hydrated iron (III) oxide expressed as $Fe_2O_3 \cdot XH_2O$.

$$4Fe^{2+}(aq) + O_2(g) + 4H_2O(l) \longrightarrow 2Fe_2O_3(s) + 8H^+$$

H^+ ions produced in the above reaction help ~~further in oxidised by~~ rusting

Impurities present in iron also enhance rusting by setting a number of miniature cells. Very pure iron does not rust quickly.

- PREVENTION FROM CORROSION

Corrosion of a metal is prevented by applying Protective Coating (such as greese, Pain or metal coating) on its (metals) surface.

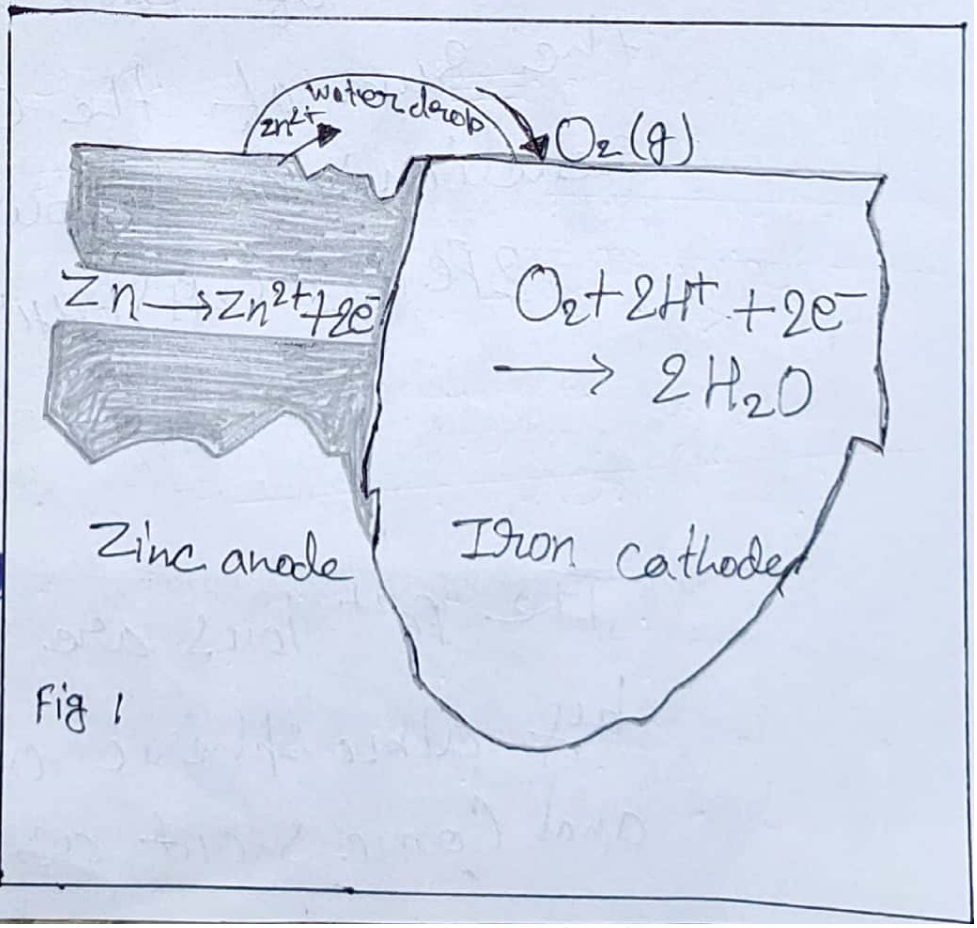

Fig 1

In Case of iron this Coating is done in two ways: (i) electrolysis (Cr, Ni and Cd Coating) (ii) dipping iron objects in a molten metal (Zn and Sn Coating). Use of zinc Coating to protect iron is called Galvanisation. In galvanising iron, zinc being more reactive than iron serves as an anode and is oxidised. ($E^\circ_{Zn^{2+}/Zn} = -0.76V$ and $E^\circ_{Fe^{2+}/Fe} = -0.44V$).

Here it is important to note that iron does not rust even after zinc Coating is broken which is not true in Case of tin Coating over iron ($E^\circ_{Sn^{2+}/Sn} = -0.14V$).

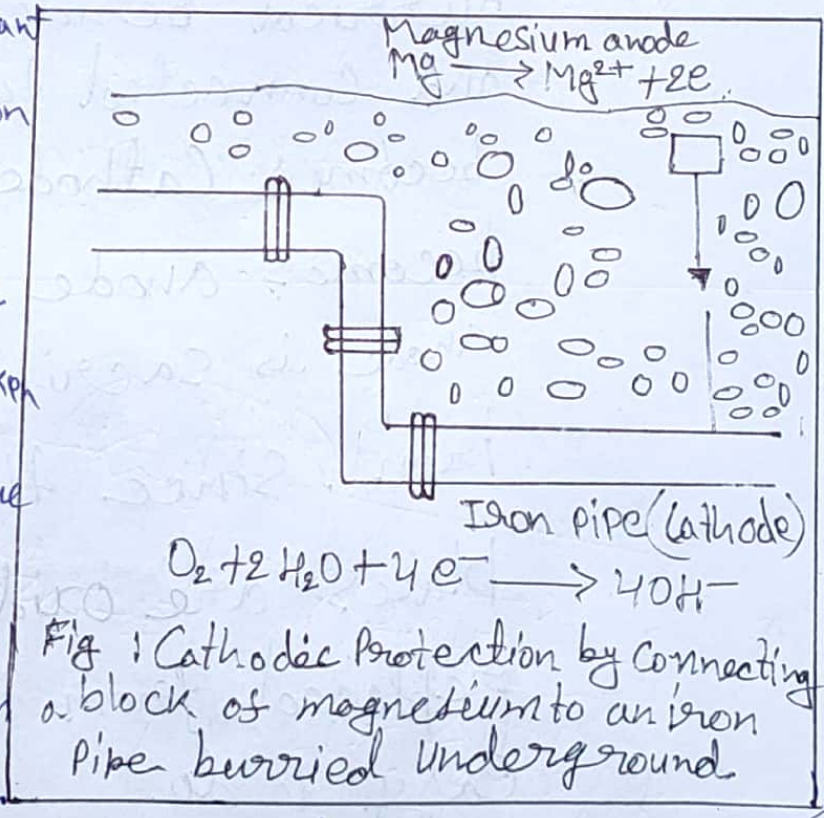

Fig : Cathodic Protection by Connecting a block of magnesium to an iron Pipe burried Underground

Now if the Coating is broken, iron is exposed and iron being more active than both Copper and tin, is corroded.

Here iron corrodes more rapidly than it does in the absence of tin, But tin Protects copper in the same way as zinc protects iron ($E°_{Cu^{2+}/Cu} = 0.34V$) Instead of Coating more reactive metals on iron the use of such metals is made as sacrificial anode. This method of Preventing iron from Corrosion is Called CATHODIC PROTECTION. In this method, a Plate of reactive metal (Zn or Mg) is burried beside the iron Pipe or tank and Connected to it by wires. Here iron becomes Cathode and reactive metal becomes anode. The reactive metal anode is sacrificed to protect the iron. Since these reactive metal plates are oxidised quickly, they are replaced from time to time which is easy to do.