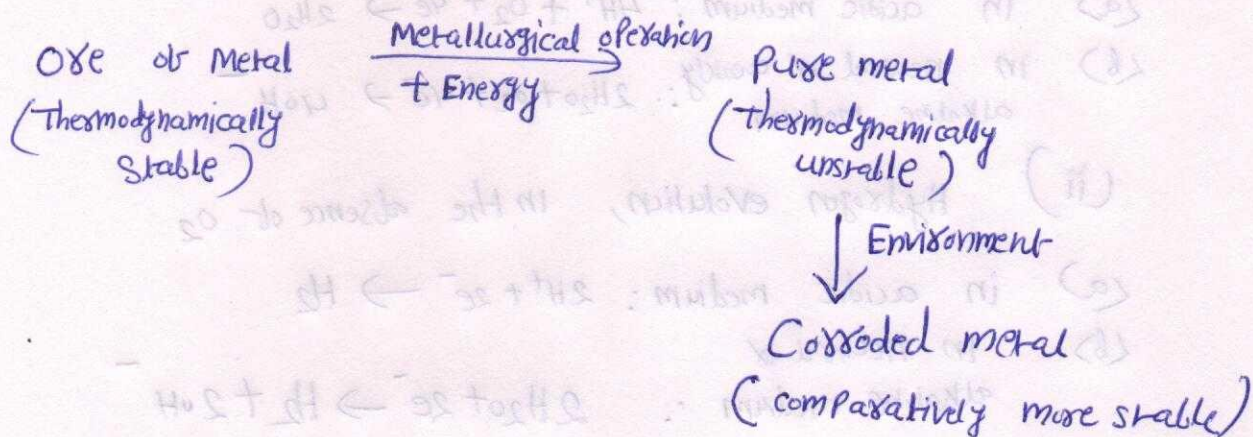


## Corrosion

### Corrosion :-

Corrosion is the process of gradual deterioration of metal from its surface due to the unwanted chemical or electrochemical interaction of metal with environment.

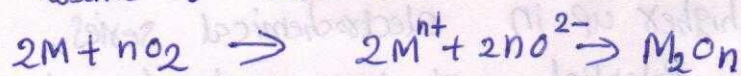
### Cause of corrosion



### Types of Corrosion

#### Dry / Chemical corrosion.

It generally takes place in absence of moisture.



A thin layer of oxide formed at the surface of metal can be

- (i) Stable  $\rightarrow$  Al
- (ii) unstable  $\rightarrow$  Ag, Au, Pt
- (iii) Volatile  $\rightarrow$  Mo
- (iv) ~~Po~~ Porous  $\rightarrow$

It takes place mostly under wet or moist conditions through formation of short-circuited galvanic cell.

- (i) Separate anodic & cathodic areas
- (ii) oxidation at anodic side
- (iii)  $H^+$  or  $O^{2-}$  are formed at cathodic areas.
- (iv) Diffusion of metallic & non-metallic ions & formation of corrosion product.



## Example of electrochemical corrosion

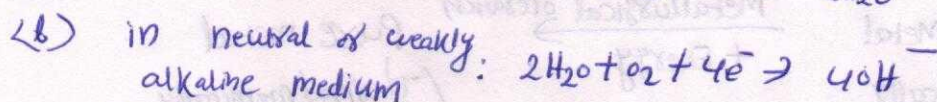
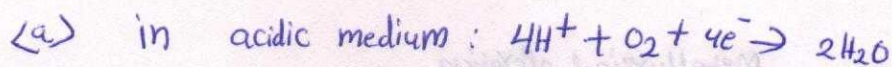
Rusting of iron.

At anode

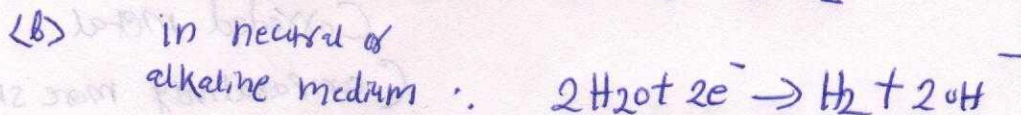
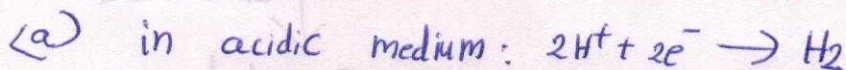


At cathode

(i) oxygen absorption.



(ii) Hydrogen evolution, in the absence of  $\text{O}_2$



## Types of Electrochemical Corrosions

### 1. Galvanic Corrosion.

It takes place when different metals are in contact & jointly exposed to corrosive atmosphere.

The metal which is higher up in electrochemical series, with more negative electrode potential will form anode & undergo corrosion.

For examples,  $\text{Zn-Cu} \rightarrow \text{Zn}$  behaves as anode where oxidation & corrosion occurs &  $\text{Cu}$  behaves as cathode & is protected.

Galvanic corrosion can be minimised by

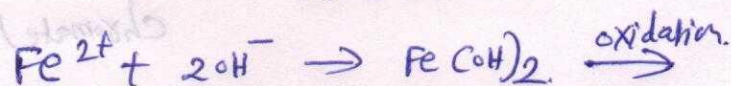
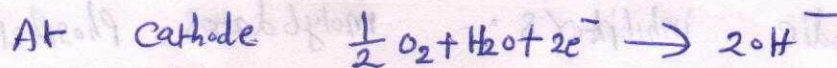
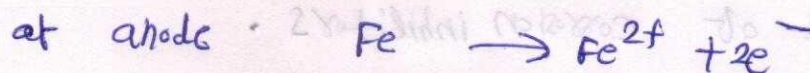
(i) Avoiding galvanic couple.

(ii) Providing an insulating material bet<sup>n</sup> the two metals.

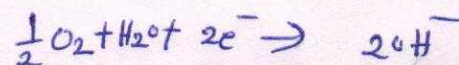
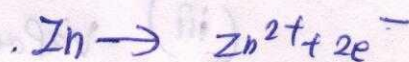
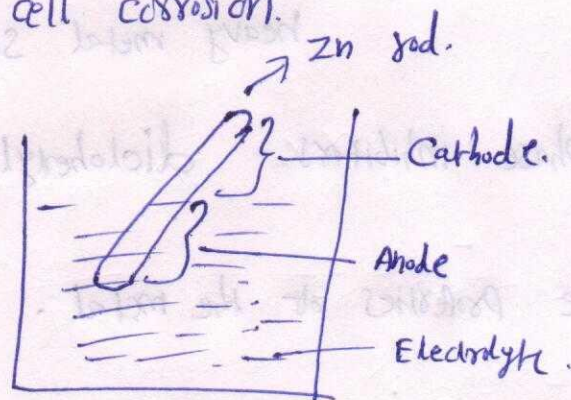


## 2. Pitting corrosion:

Consider a drop of water resting on the surface of metal. The metal surface which is covered by the drop has low oxygen concentrations & acts as an anode. The uncovered metal surface due to high oxygen acts as cathode.

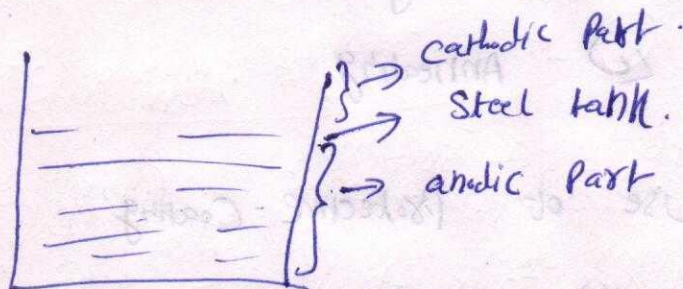


## 3. Concentration cell corrosion.



$\text{Zn}(\text{OH})_2$  as the corrosion product.

## 4. Water-line corrosion.



## Factors Influencing Corrosion.

### Nature of metal

1. Purity of metal.
2. Physical state of metal.
3. Nature of oxide film.
4. Position of in the Galvanic Series
5. Relative area of anode

### Nature of environment

- Temperature
- Humidity.
- Effect of pH.
- Nature of electrolyte.
- Presence of impurities in atmosphere



## Protective Measures Against Corrosion:

### (1) Modification of the environment.

#### (a) Removal of corrosion stimulants.

for  $O_2 \rightarrow N_2H_4, Na_2SO_4$  etc.

for acids  $\rightarrow$  neutralized by lime.

#### (b) Use of corrosion inhibitors.

(i) Anodic inhibitors:- molybdates, phosphates & chromate.

(ii) Cathodic inhibitors:- Amines, mercaptans, heavy metal soaps, substituted urea.

(iii) Vapour phase inhibitors:- dichloroethyl ammonium nitrite.

### (2) Modification of the properties of the metal.

(a) alloying

(b) Relining

(c) Annealing

### (3) Use of Protective Coating.

(a) Metallic coating.

(b) Inorganic coating

(c) Organic coating.