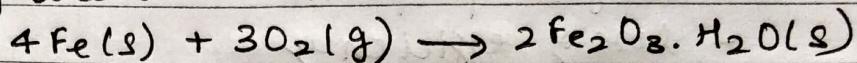


CORROSION AND CONTROL

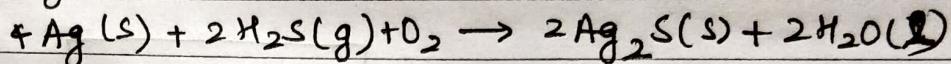
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* INTRODUCTION -

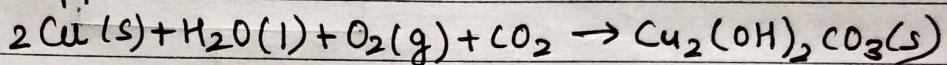
- defined as spontaneous destruction or deterioration of a metal by chemical, electrochemical or biochemical reaction.
- eg: Rusting of iron



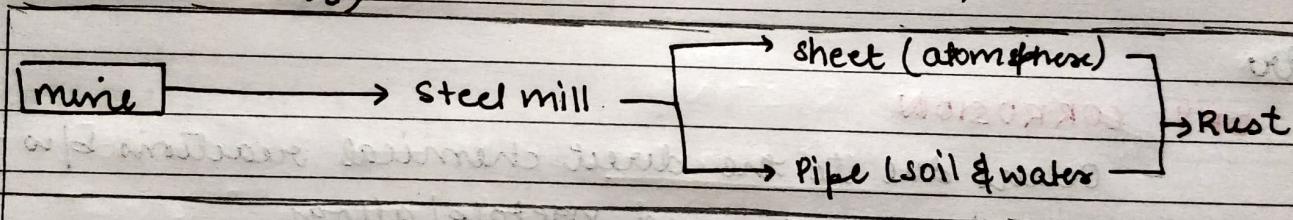
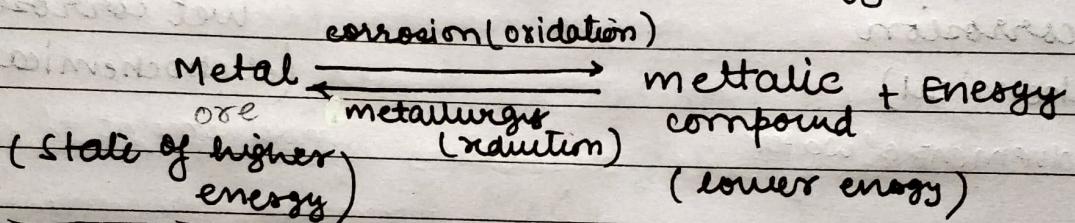
Tarnishing of silver



Scales on copper



- reverse process of extractive metallurgy



corrosion is oxidation of metal

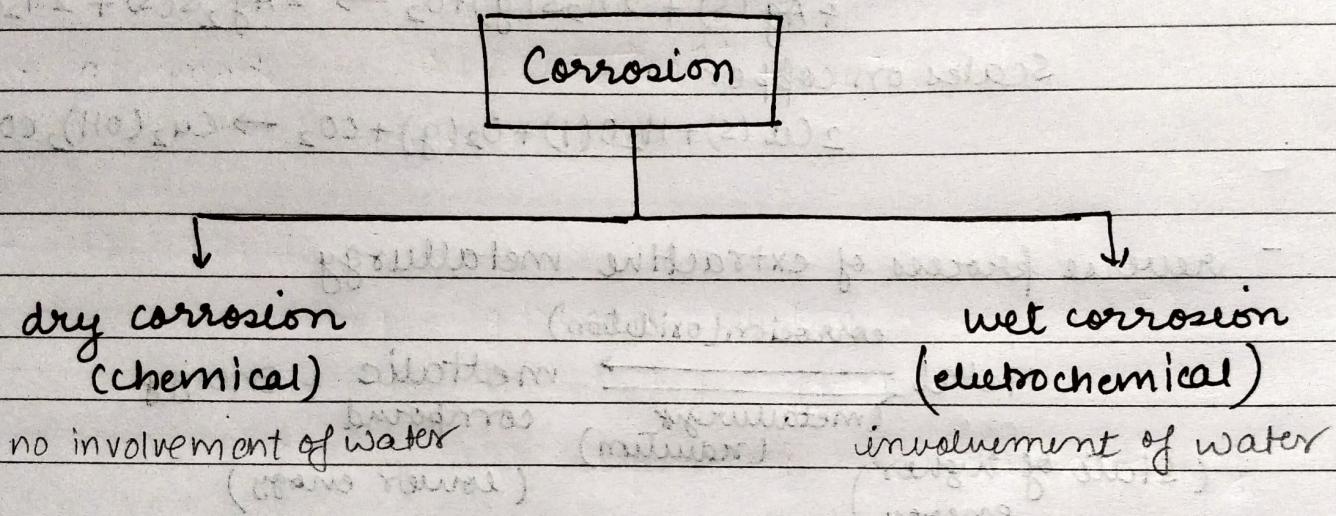
- Importance of Corrosion study

- human life and safety
- cost of corrosion
- Conservation of material
- Academic interest

- Consequences of Corrosion

- Maintenance and operation cost
- Plant shutdown, loss of production

- contamination and loss of valuable
- Effects on safety
- loss of Aesthetic value
- loss of ~~technical importance~~ technically important surface properties
- loss of efficiency



DRY CORROSION

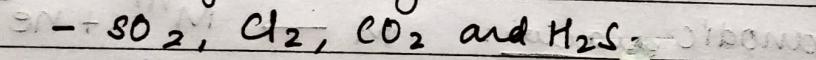
- Occurs due to the direct chemical reactions b/w the environment and metals/ alloys.
- presence of an electrolyte (medium) is not at all essential for
- types
 1. oxidation (due to reaction with oxygen)
 2. other gases (CO_2 , H_2S , SO_2 , X_2)
 3. liquid metal (Hg)

→ corrosion by oxygen (gas):

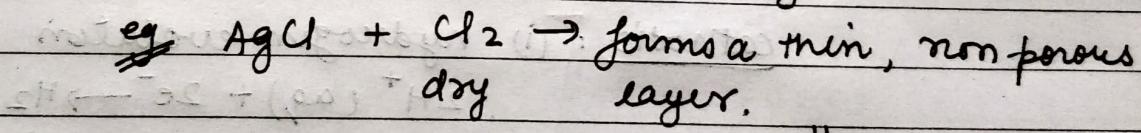
- occurs when metals are attacked by dry oxygen
- metal + oxygen → metal oxide
- Nature of the oxide film:
 - Non-porous
 - adherent
 - Stable
 - Protective
 - continuous

it protects the metal under the corroded layer
- if a stable film formed
eg : Al, Sn, Pb and Cu
- Unstable metal film decomposes back into the metal and oxygen
eg. Ag, Au, Pt
- volatile film layer as soon as it is formed, thereby accelerating the corrosion
eg. ~~MnO₃~~ M₂O₃

→ corrosion by other gases:-



This kinda corrosion depends on the chemical affinity b/w the metal and the gas.



intensity of corrosion decreases

(protective layer is formed)

→ corrosion by liquid metal

- occurs when a ^{molten} liquid is continuously passed on a solid metal surface or an alloy
- maybe be either due to the dissolution of the molten liquid due to penetration of the molten liquid into metal phase.

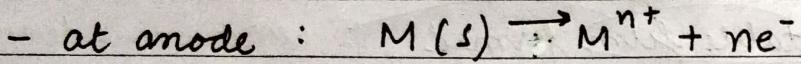
WET CORROSION

- occurs due to existence of separate anodic and cathodic regions, b/w which current flows through the conducting solution

Mandate for wet corrosion \rightarrow anode

\rightarrow cathode

\rightarrow electrolyte



\hookrightarrow (corrosive region)

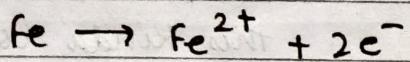
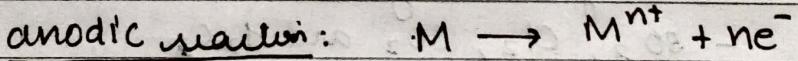
- at cathodes :-

case I: hydrogen evolution (excess of H^+)

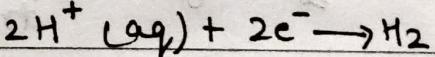
case II: Absorption of oxygen

\rightarrow any case, depending upon the nature of corrosive environment.

- e.g. : IRON RUSTING



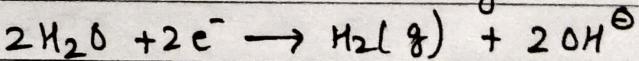
Cathodic : (i) hydrogen evolution



[deoxygenated ($no O_2$) & acidic medium]

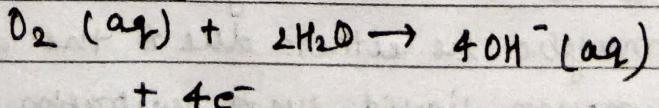
Case I

H_2 is liberated along with OH^- ion



[deoxygenated and neutral]

(ii) Reduction of oxygen in neutral medium:-



[aerated + neutral]

Case II

Role of dust

dust holds moisture
and increases the rate
of the corrosion.

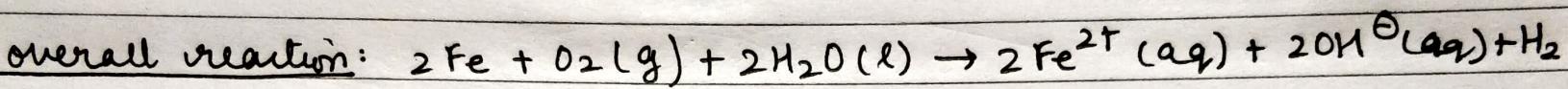
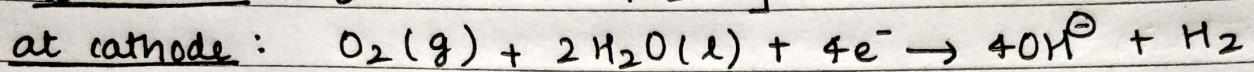
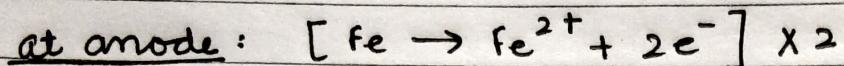
it does not act as a
protective layer.

it stays and holds moisture
and increases the rate of
corrosion.

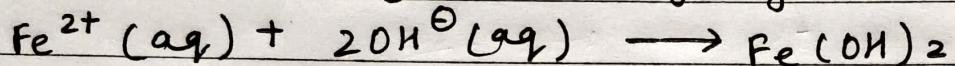


→ Mechanism of Rusting

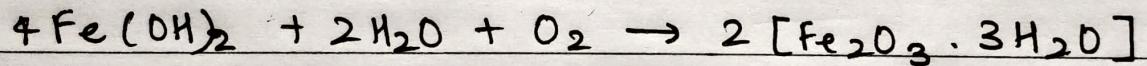
Rusting of iron takes place when iron is exposed to oxygen in the presence of humidity/moisture



Reaction to the formation of hydrated ferric oxide (rust)

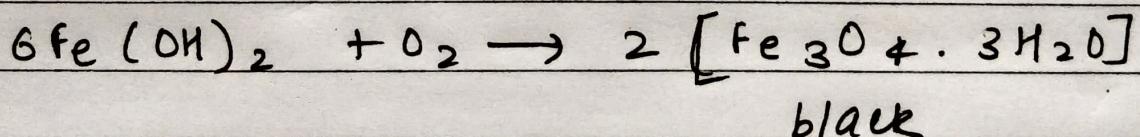


in presence of enough oxygen, ferrous hydroxide reacts with moisture and oxygen to give YELLOW rust



Yellow rust

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



black

Mechanism of

