

29/2/22

CHEMISTRY

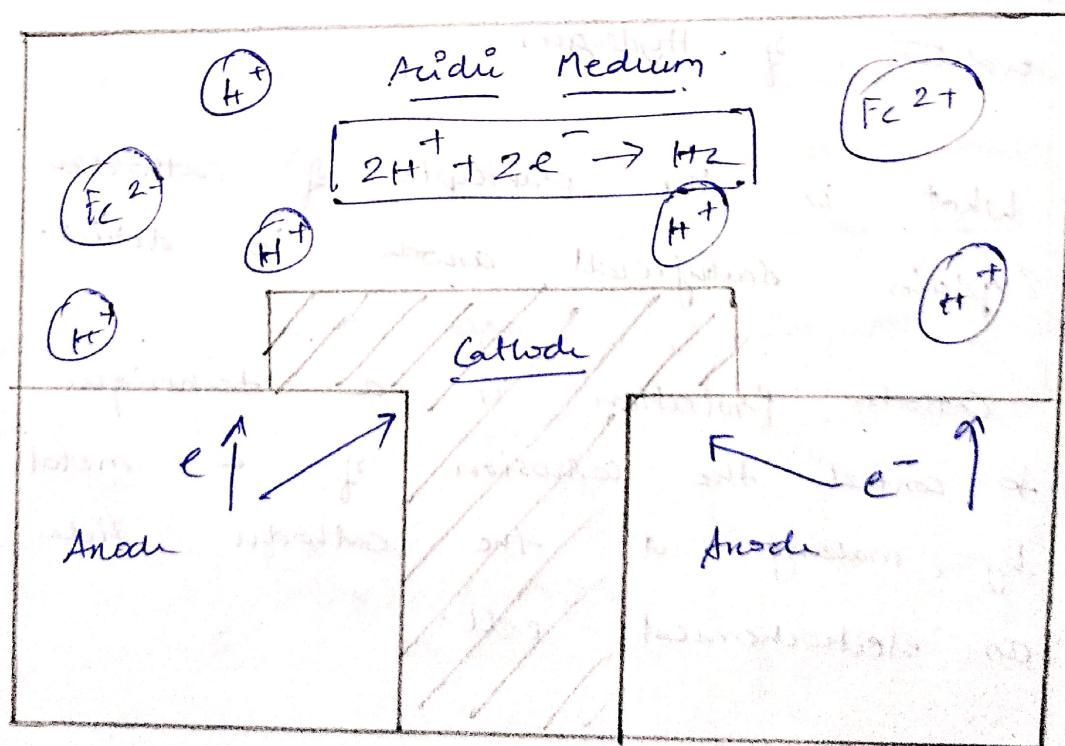
ASSIGNMENT - 1

Q.1. What is wet corrosion? Explain H₂ evolution mechanism with proper diagram.

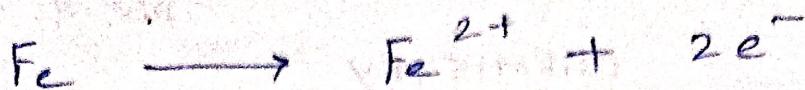
→ Wet corrosion of metals occurs through electron transfer, involving 2 processes, oxidation and reduction. The metal that loses electrons is called the anode. The one that gains e⁻ is called the cathode.

Wet corrosion requires an oxidation at anode and reduction at cathode.

H₂ Evolution Mechanism



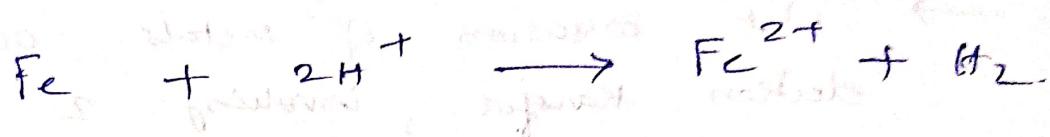
At anode,



At cathode, ~~participate~~



∴ Overall reaction,



→ H_2 gas liberates in the form of bubbles near the cathode. Thus, H_2 evolution type of ~~corrosion~~ corrosion is displacement of H^+ from acidic solution by metal ions.

→ All metals in electrochemical series get dissolved in acidic solution with simultaneous evolution of Hydrogen.

Q(2) What is the principle of cathodic protection? Explain sacrificial anode in detail.

→ Cathodic protection is a technique used to control the corrosion of a metal surface by making it the cathodic side of an electrochemical cell.

Principle : In electrochemical corrosion,

anode is the one which undergoes corrosion and cathode remains protected. In cathodic protection, the metal to be protected is forced from ~~turns~~ to be the cathode.

Types :

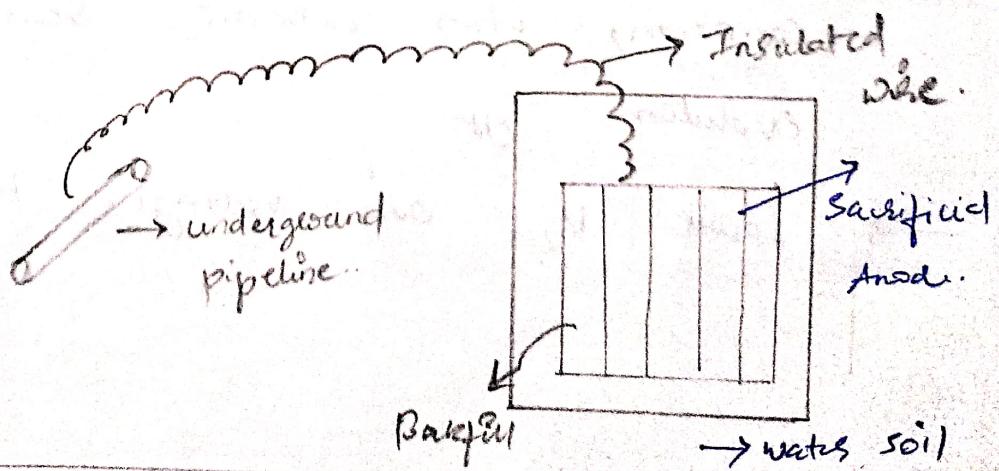
- (1) Sacrificial Anode Method.
- (2) Impressed Current Method.



Sacrificial Anode Method.

Here, the structure to be protected is connected to a small block or piece of more active / anodic metal. This metal acts like the anode. The corrosion attack is concentrated at this more active metal and it slowly undergoes oxidation.

→ This metal is then replaced when it is exhausted. To increase electrical contact, sacrificial anode is placed in the back-filled with $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$. Metals commonly used as sacrificial anode are : Mg, Zn, Al, & their alloys.



(*)

Advantages:

- No external power is required
- Installation cost is less
- Easy to install

(*)

Applications:

This method can be applied for protection of ft pipes, cables, marine structures, water tanks etc.

Q3. Discuss factors affecting corrosion based on nature of metal.

→

(1) Galvanic series:

Metal having higher position in Galvanic series has a high tendency to act as anode. It hence gets corroded.

→ More difference in Galvanic series will cause more corrosion.

(2)

H₂ over voltage:

→ The metal with lower H₂ over voltage on its surface is more susceptible to corrosion, when cathodic reaction is H₂ evolution type.

→ Lower H₂ over voltage, Higher corrosion.

(3) Nature of corrosion Product

- The corrosion product formed like metal oxide may act as protective film & if it is stable, Non porous and insoluble.
- If it acts as protective film & prevents further corrosion.
- If it is unstable, it enhances corrosion.

(4) Purity of Metals

- Pure metals are resistive to corrosion.
- If there are impurities in a metal, a local galvanic cell is created with the metal as anode and impurity as cathode.
- In case of alloys, if solution is homogeneous, it resists corrosion and local galvanic cell.

(5) Physical state of Metal

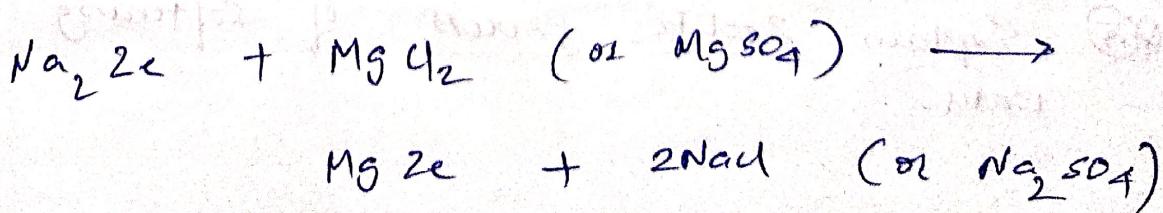
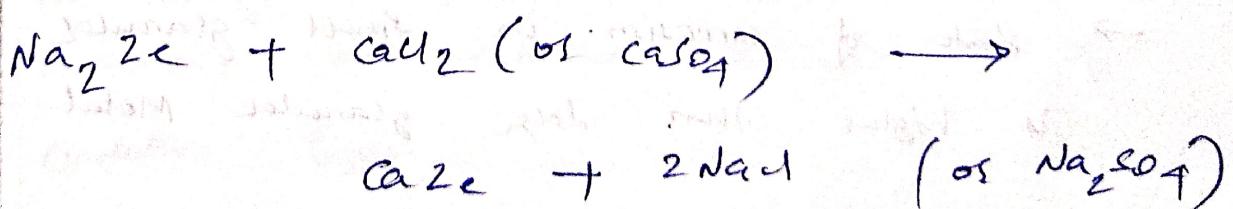
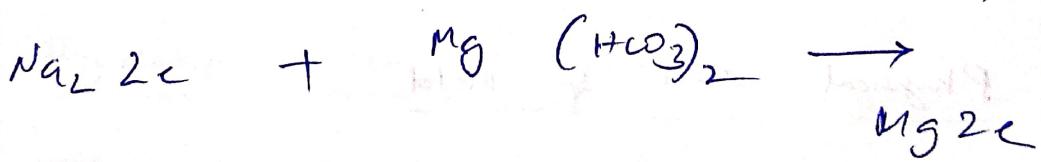
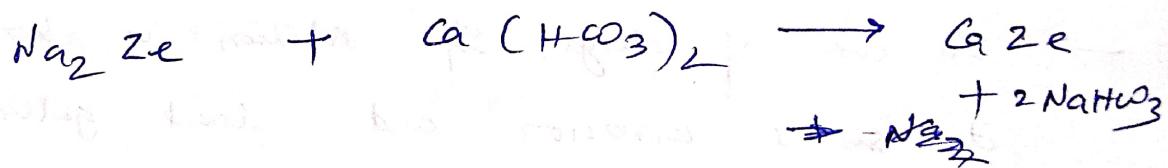
- Stressed metal has higher rate of corrosion.
- Rate of corrosion is small granular metal is higher than large granular metal.

Q(5) Explain Zeolite process of softening of water.

→ Zeolite is chemically hydrated sodium aluminium silicate $\text{Na}_2\text{O} \cdot \text{Al}_2\text{O}_3 \cdot x\text{SiO}_2 \cdot y\text{H}_2\text{O}$ where,
 ~~$n=2$~~ $y = 2-6$.

② Process :

- Zeolite softener softener is made up of a cylinder in which there is a bed of zeolite - Hard water is percolated through the bed of zeolite at a specific rate.
- The hardness producing ions like Ca^{2+} , Mg^{2+} etc are retained by zeolite forming CaZe and MgZe . To the outgoing water contains sodium salts.
- Reactions taking place are :



Q. 5 Define Scales and Sludges. Give their
Give causes, disadvantages and Removal
processes of it.

- In boilers, water evaporates constantly, and the concentration of dissolved salts increases progressively.
- When their concentration reaches saturation point, they are thrown out of water in the form of precipitate on the inner walls of the boiler.
- If the precipitate is in the form of loose and slimy material, it is called a sludge.
- If it forms hard, adhering crust on the inner wall of a boiler, it is called a scale.

(*)

Disadvantages of Sludge Formation

(1)

They are poor conductors of heat and tend to waste a lot of generated heat.

(2)

If both sludges and scale are formed, sludges get trapped in scales and are deposited as scales.

(3)

If disturbs working of boilers.

* Prevention of Sludge formation

1. By using well softened water
2. By frequently performing 'Blow down operation'

* Scales are very hard to remove and are the main main source for trouble for boilers.

Disadvantages of scales

- ① Wastage of fuel.
- ② Lowering of Boiler safety.
- ③ Decrease in efficiency.
- ④ Danger of explosion.

* Removal of Scales

- ① With the help of scrapes or piece of wood or wire brush if they adhere loosely.
- ② By giving thermal shocks, if brittle.
- ③ By dissolving them with addition of chemicals.
- ④ By frequent 'Blow down operation'.