

# CLASS –XII CHEMISTRY

## UNIT-3 ELECTROCHEMISTRY TOPIC –BATTERIES

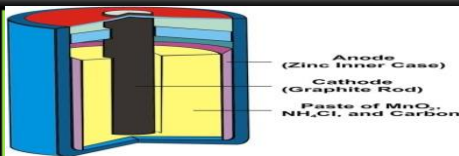
**PRIMARY BATTERIES** - The reaction occurs only once and cannot be reused

### BATTERIES

Battery consists of one or more than one cells connected in series.

**PRINCIPLE** :based on galvanic cell where chemical energy of the redox reaction is converted into electrical energy.

**SECONDARY BATTERIES**-These can be reused by recharging the battery.



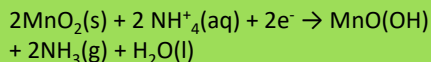
### DRY CELL (LECLANCHE CELL)

**Anode** - is made up of Zinc container  
**Cathode**-is Graphite rod surrounded by  $\text{MnO}_2$  powder  
**Electrolyte**-used is Paste of  $\text{NH}_4\text{Cl}$  +  $\text{ZnCl}_2$   
**Cell potential** : 1.5 V

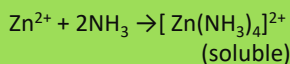
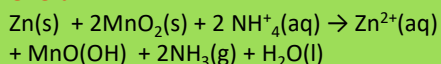
#### CELL REACTIONS:

**At Anode**  $\text{Zn(s)} \rightarrow \text{Zn}^{2+}(\text{aq}) + 2\text{e}^-$

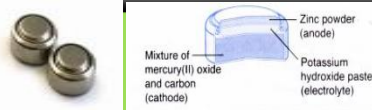
**At Cathode**



#### Overall :



Dry cell do not have a long life as ammonium chloride is acidic, corrodes the Zn container even if the cell is not in use.

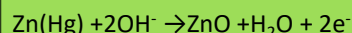


### MERCURY CELL

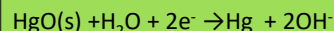
**Anode**- is made up of Zn-Hg amalgam  
**Cathode**- is made up of Paste of  $\text{HgO}$  and Carbon  
**Electrolyte**- used is moist paste of  $\text{KOH}$ -ZnO  
**Cell Potential** - 1.35V

#### Cell Reactions:

**At Anode:**



**At Cathode:**



#### Overall :



**Use** -in low current devices like watches, hearing aids etc.as its potential is low i.e.1.35V.

This cell shows constant potential in its lifetime as no ions are involved whose concentration will change.

### FUEL CELL

Principle based on Galvanic cell i.e. Convert chemical energy of combustion of fuels directly into electrical energy, no thermal devices are required.  
 Examples:-  $\text{H}_2$  - $\text{O}_2$  ,  $\text{CH}_3\text{OH}$  -  $\text{O}_2$  , $\text{CH}_4$  -  $\text{O}_2$  etc.

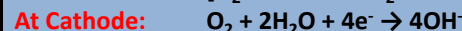
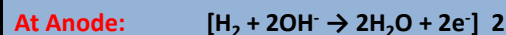
#### Hydrogen-Oxygen( $\text{H}_2$ - $\text{O}_2$ )Fuel Cell:

**Electrodes**-Both anode and cathode are made up of porous graphite impregnated with catalysts like finely divided Pt or Pd metal for increase the rate of electrode reactions .

**Electrolyte**-Aqueous solution of NaOH

Oxygen and hydrogen are continuously fed into the cell.

#### Cell Reactions-



**Used** in Apollo Space Missions to provide power /electricity and also provide water to Astronauts for drinking purposes.

#### Advantages:

1. The fuel cells are pollution free as water formed as a by product
2. Cell works until  $\text{H}_2$ /  $\text{O}_2$  are being supplied at 525 K, 50 atm.
3. It has high efficiency 70% while Power plants thermal 40%
4.  $\text{H}_2$  and  $\text{O}_2$  are raw cheap materials.



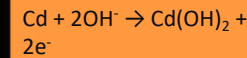
### NICKEL-CADMIUM STORAGE (Ni-Cd)CELL

**Anode**-Cadmium  
**Cathode**-Metal grid containing  $\text{NiO(OH)}$   
**Electrolyte**-KOH solution.

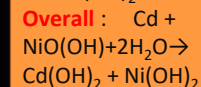
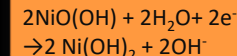
**Cell Potential**-1.2 V

#### Cell Reactions:

**At Anode :**

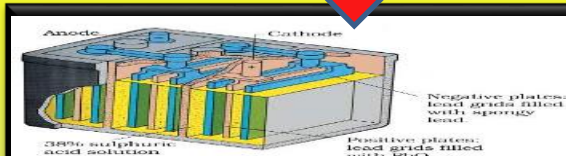


**At Cathode :**



Longer life than Pb storage battery but expensive .

**Used** : in cordless and wireless telephones, emergency lighting etc.



### LEAD STORAGE BATTERY

Lead storage battery is the combination of 3 to 6 voltaic cells in series.

**Anode**-Spongy lead ( Pb)

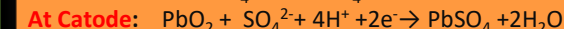
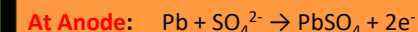
**Cathode**-Grid of lead packed with  $\text{PbO}_2$

**Electrolyte**-38%  $\text{H}_2\text{SO}_4$  by mass

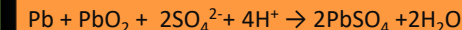
**Cell Potential** : 6V to 12 v

#### Cell Reactions:

**Discharging Process:** Behave like electrochemical Cell

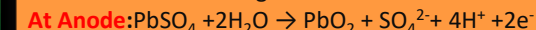


**Overall :**

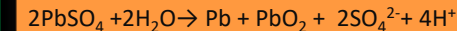


#### Recharging Process:-

Connect with DC voltage > 12V



**Overall :**



**Used:** In Automobiles , invertors