

Batteries

These are source of electrical energy which may have one or more cells connected in series.

For a good quality battery it should be reasonably light. compact and its voltage should not vary appreciably during its use.

Primary Batteries

In the primary batteries, the reaction occurs only once and after use over a period of time battery becomes dead and cannot be reused again.

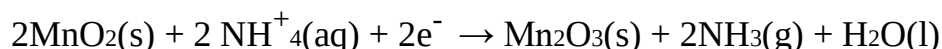
(i) Dry cell or Leclanche cell

Anode-Zinc container

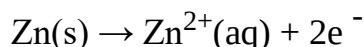
Cathode-Graphite rod surrounded by MnO_2 powder

Electrolyte-Paste of $\text{NH}_4\text{Cl} + \text{ZnCl}_2$

Cathode reaction,



Anode reaction,



Cell potential 1.25 V to 1.5 V

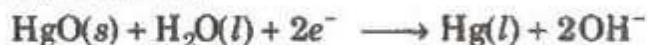
(ii) Mercury cell

Anode-Zn-Hg amalgam

Cathode-Paste of ($\text{HgO} + \text{C}$)

Electrolyte-Moist paste of KOH-ZnO

Cathode reaction,



Anode reaction,



Net reaction,



Cell potential 1.35 V

Secondary Batteries

These cells can be recharged and can be used again and again, e.g.,

(i) Lead Storage battery

Anode-Spongy lead

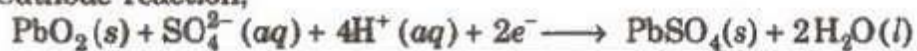
Cathode-Grid of lead packed with PbO_2

Electrolyte-38% H_2SO_4 by mass

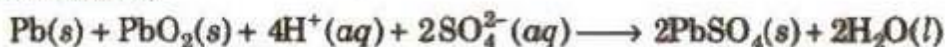
Anode reaction,



Cathode reaction,



Net reaction,



When recharged the cell reactions are reversed.

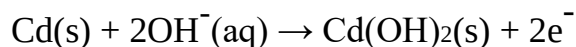
(ii) Nickel-cadmium storage cell

Anode-Cadmium

Cathode-Metal grid containing NiO_2

Electrolyte-KOH solution

Anode reaction,



Cathode reaction,



Net reaction,



Cell potential = 1.4 V

Fuel Cells

Galvanic cells which use energy of combustion of fuels like H_2 , CH_4 , CH_3OH , etc., as the source to produce electrical energy are called fuel cells. The fuel cells are pollution free and have high efficiency.

Hydrogen-Oxygen Fuel Cell

Electrodes-Made of porous graphite impregnated with catalyst (Pt, Ag or a metal oxide).

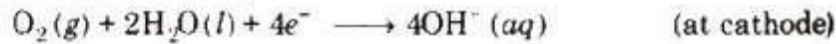
Electrolyte-Aqueous solution of KOH or NaOH

Oxygen and hydrogen are continuously fed into the cell.

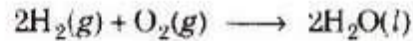
Oxidation Half-cell reaction,



Reduction half-cell reaction,



Net reaction,



EMF of the cell 1 V.

Thermodynamic efficiency of a fuel cell,

$$\eta = \frac{\Delta G}{\Delta H} = \frac{-nFE}{\Delta H}$$

Corrosion

Slow formation of undesirable compounds such as oxides, sulphides or carbonates at the surface of metals by reaction with moisture and other atmospheric gases is known as corrosion.

Factors Affecting Corrosion

1. Reactivity of metals
2. Presence of moisture and atmospheric gases like CO_2 , SO_2 , etc.
3. Presence of impurities
4. Strains in the metal
5. Presence of electrolyte

Rusting of Iron-Electrochemical Theory

An electrochemical cell, also known as corrosion cell, is developed at the surface of iron.

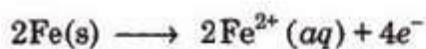
Anode- Pure iron

Cathode-Impure surface

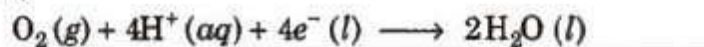
Electrolyte,



Anode reaction,



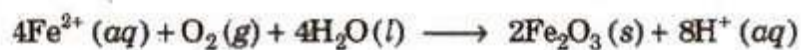
Cathode reaction,



Net reaction,



At surface,



Rusting of iron can be prevented by the following methods :

1. Barrier protection through coating of paints or electroplating.
2. Through galvanisation or coating of surface with tin metal.
3. By the use of antirust solutions (bis phenol).
4. By cathodic protection in which a metal is protected from corrosion by connecting it to another metal that is more easily oxidised.