

Commercial batteries and fuel cells:

A galvanic cell is mainly used as a source of electrical energy. If two or more galvanic cells are connected in series, the arrangement is called a battery.

Commercial cells are classified as:-

- (i) Primary cell
- (ii) Secondary cell
- (iii) Fuel cell

(i) Primary cells:

Primary cells are the commercial cells in which electrical energy is obtained from chemical reactions only as long as the active materials are present. These cells are not chargeable and hence they cannot be re-used. Thus, the electrode reactions cannot be reversed in primary cells. Dry cell, Mercury cell are the example of primary cell.

~~Dry~~ cell:



Dry cell:

Dry cell also called ~~Le~~ Leclanche cell consists of a cylindrical zinc container that acts as an anode. A graphite rod is placed in the centre without touching the base and it acts as a cathode.

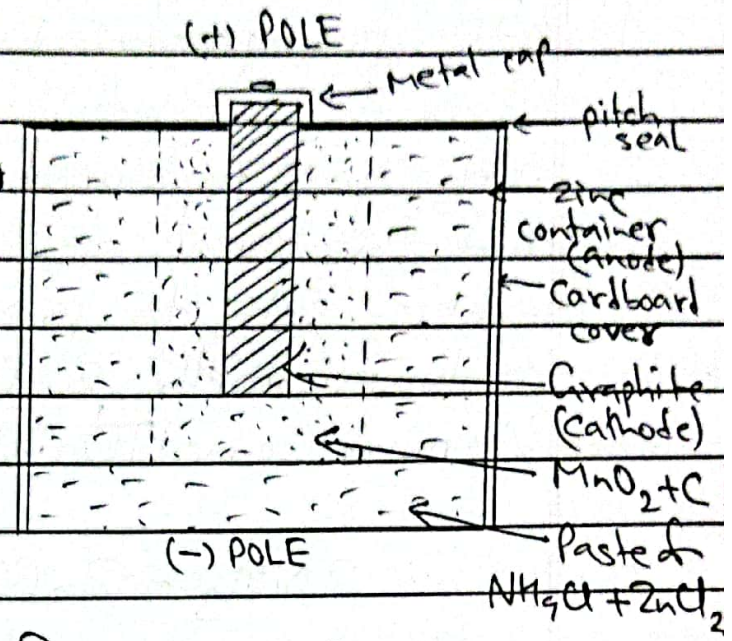
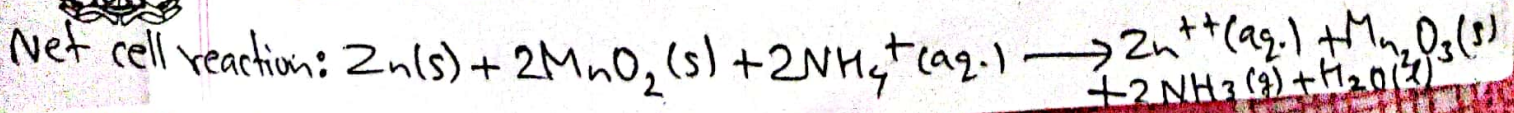
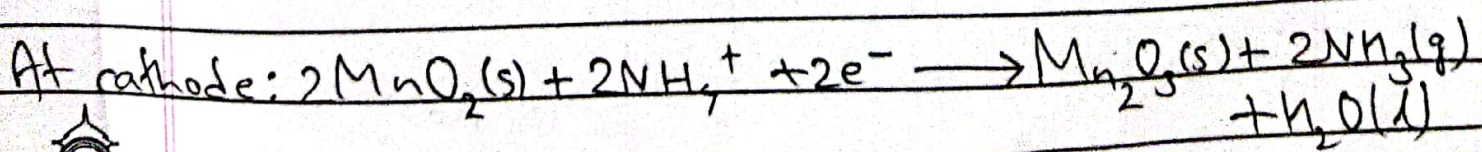
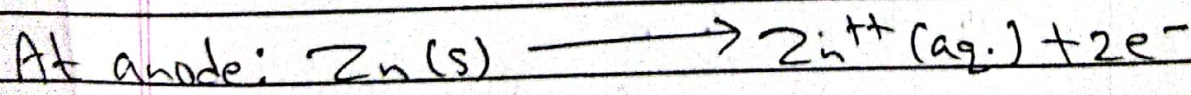


Fig: Dry cell

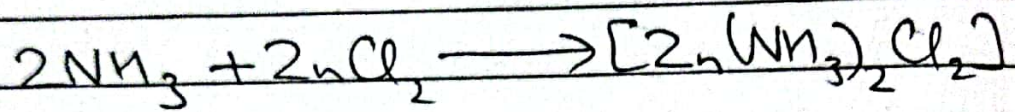
The space between anode and cathode is so packed that Zn container is in contact with NH_4Cl and ZnCl_2 paste while the graphite rod is surrounded by MnO_2 powder and carbon as shown in figure. The graphite rod is fitted with a metal cap and the cylinder is sealed at the top with pitch. The zinc container is covered with cardboard to protect it from the atmosphere.

The reaction takes place as:-



~~NH₃ gas produced combines with,~~

NH₃ gas produced may exert pressure and the seal of the cell would be broken. So, to prevent this, NH₃ gas combines with ZnCl₂ to form diamine zinc(II) chloride, [Zn(NH₃)₂Cl₂]



(ii) Secondary cells:

Secondary cells are those cells which can be recharged and can be used again and again. Thus, secondary cells are also called rechargeable or storage or accumulators cells. For example; lead storage batteries and nickel-cadmium storage cells.

Lead storage battery

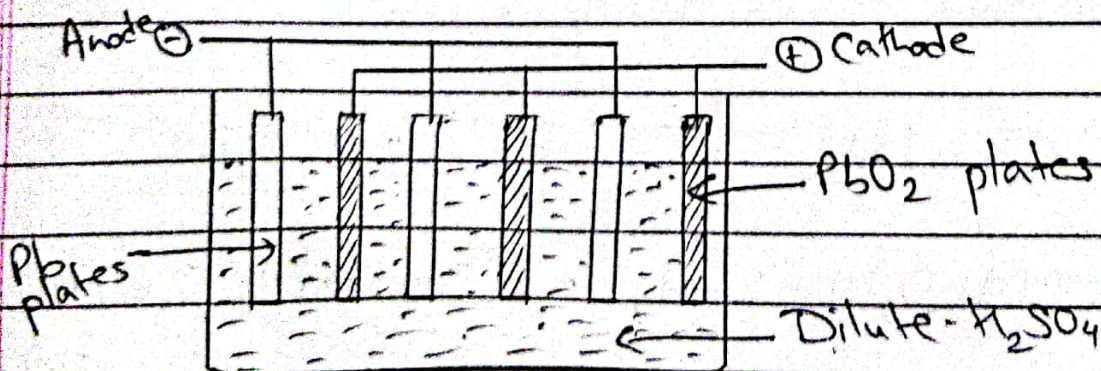
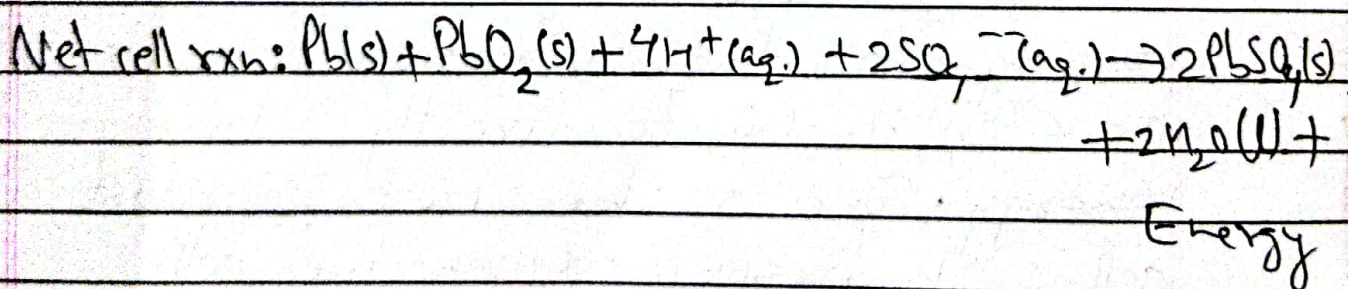
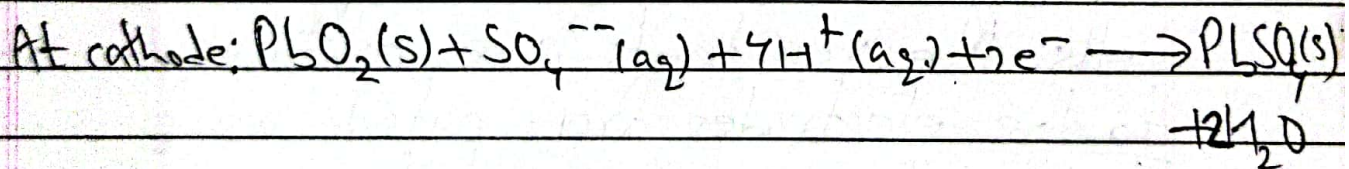
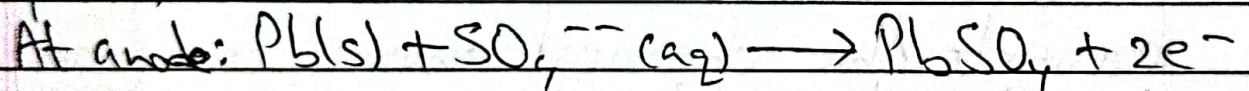


Fig: Lead storage battery



Lead storage battery generally consists of six cells, which are connected in series to get 12 volt battery, each cell produce 2V. In each cell, the anode is made of spongy lead and a cathode is a grid of lead packed with lead dioxide (PbO_2). The electrolyte is the aqueous solution of H_2SO_4 which is

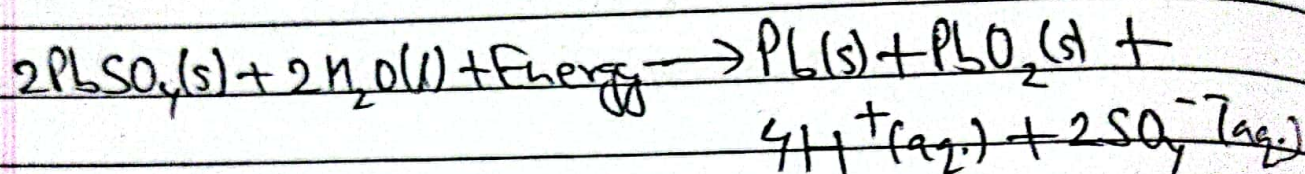
When a lead storage battery is in use, it is said to have discharged. During discharge of the battery, the following reactions take place,



During the discharge of the cell, sulphuric acid is consumed and hence the specific gravity of the electrolyte decreases gradually. The cell can be charged by passing electric current of suitable voltage in opposite



direction. Thus, the electrode reaction get reversed. Now, the electrolysis process takes place in which lead is deposited on the cathode, lead oxide is formed at the anode and sulphuric acid is regenerated in the cell.



(iii) Fuel cell:

A fuel cell is an electrochemical cell which converts the chemical energy of a fuel directly into electrical energy. In such cells, the reactants are continuously supplied to the electrodes from outside as fuels.

These cells are designed to convert the energy from the combustion of fuels such as CH_4 , H_2 , CO , etc directly into electrical energy. One of the most important fuel cell is hydrogen-oxygen fuel cell.



Hydrogen-oxygen fuel cell:

Hydrogen-oxygen fuel cell

consists of porous carbon electrodes containing suitable catalyst (generally finely divided platinum and palladium) incorporated in them. Concentrated KOH or NaOH solution is

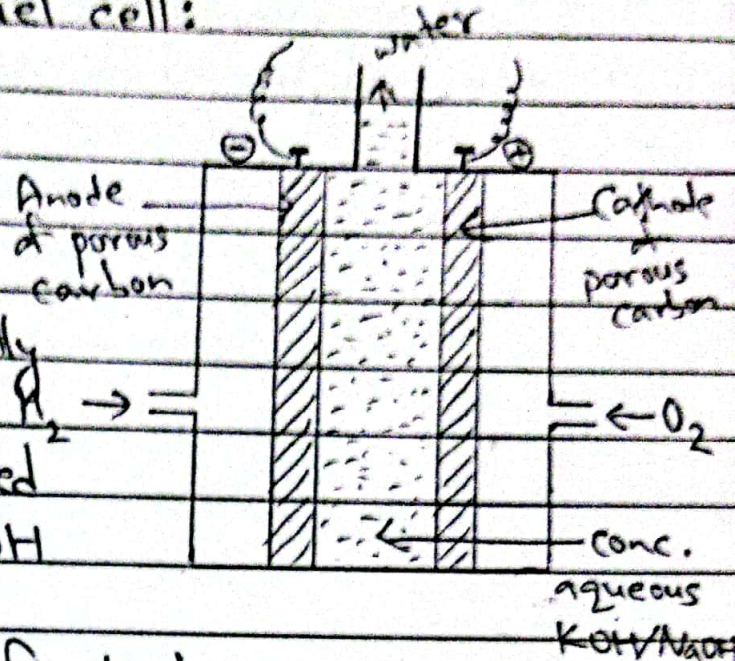


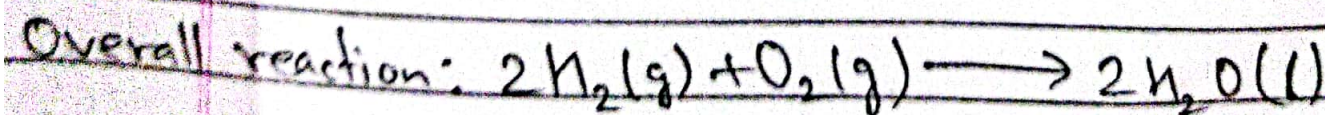
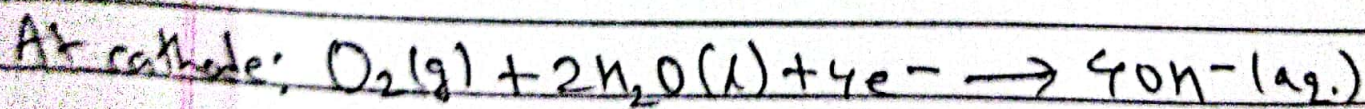
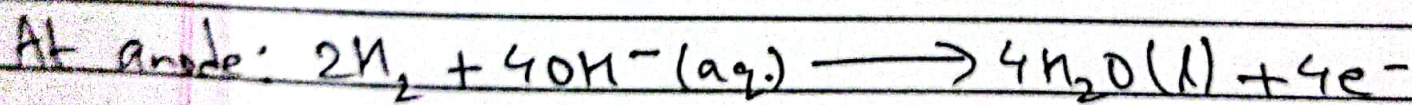
Fig: Hydrogen-oxygen fuel cell

placed between the electrodes which acts

as an electrolyte. Hydrogen

and oxygen gases are bubbled through the porous electrode into the KOH or NaOH solution under a pressure of 50 atm and about 250°C

The reaction takes place as:-



The reactants (i.e. H_2 and O_2) are fed continuously to the electrodes and the product (i.e. H_2O)

are removed continuously from the electrolyte (i.e. KOH/NaOH) compartments.