

ELECTRO CHEMISTRY

TOPIC-7

Types of cells, primary, secondary and fuel cells, construction and working

VERY SHORT ANSWER QUESTIONS

1. What is primary cell?

Ans:

In this cell, once the chemicals have been consumed, further reaction is not possible. It cannot be regenerated by reversing the current flow through the cell using an external direct current source of electrical energy. The most common example of this type is dry cell

2. What is Secondary cell?

Ans:

The cell in which original reactants are regenerated by passing direct current from external source, i.e., it is re-charged, is called secondary cell. Lead storage battery is the example of this type.

3. What is Fuel Cell?

Ans:

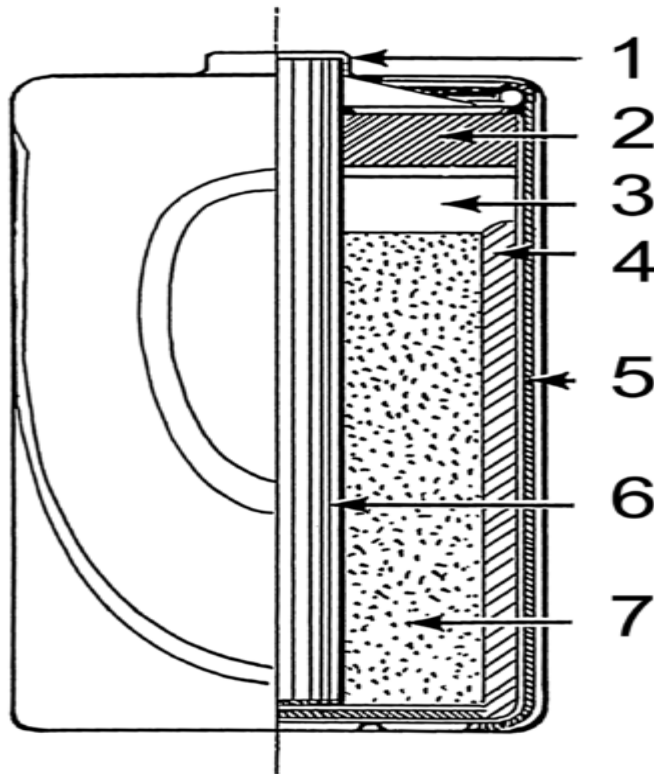
Fuel cells are another means by which chemical energy may be converted into electrical energy. The main disadvantage of a primary cell is that it can deliver current for a short period only. This is due to the fact that the quantity of oxidising agent and reducing agent is limited. But the energy can be obtained indefinitely from a fuel cell as long as the outside supply of fuel is maintained. One of the examples is the hydrogen-oxygen fuel cell.

SHORT ANSWER QUESTIONS

1. Explain a primary voltaic cell?

Ans: PRIMARY VOLTAIC CELL (THE DRY CELL)

In this cell, once the chemicals have been consumed, further reaction is not possible. It cannot be regenerated by reversing the current flow through the cell using an external direct current source of electrical energy. The most common example of this type is dry cell.



1. Brass cap
2. Plastic seal
3. Expansion space
4. Porous cardboard
5. Zinc can
6. Carbon rod
7. Chemical mixture

The container of the dry cell is made of zinc which also serves as one of the electrodes. The other electrode is a carbon rod in the centre of the cell. The zinc container is lined with a porous paper. A moist mixture of ammonium chloride, manganese dioxide, zinc chloride and porous inert filler occupy the space between the paper lined zinc container and the carbon rod. The cell is sealed with a material like wax.

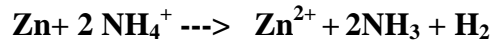
As the cell operates, the zinc is oxidised to Zn^{2+}



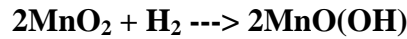
The electrons are utilized at carbon rod (cathode) as the ammonium ions are reduced.



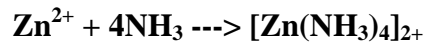
The cell reaction is



Hydrogen is oxidized by MnO_2 in the cell.

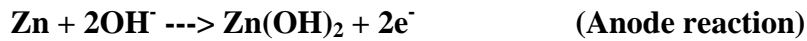


Ammonia produced at cathode combines with zinc ions to form complex ion.



E_{cell} is 1.6 volt

Alkaline dry cell is similar to ordinary dry cell. It contains potassium hydroxide. The reaction in alkaline dry cell are:



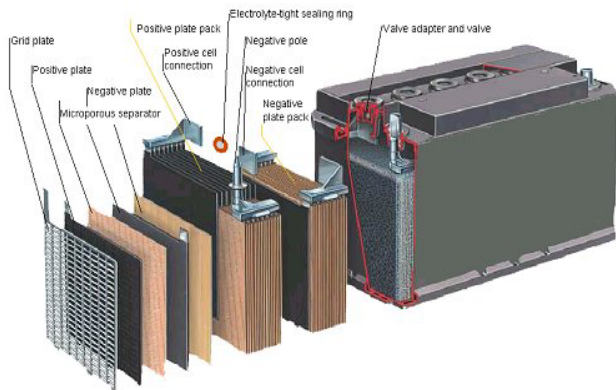
E_{cell} is 1.5 volt.

2. Explain a secondary voltaic cell?

Ans:

SECONDARY VOLTAIC CELL (LEAD STORAGE BATTERY)

The cell in which original reactants are regenerated by passing direct current from external source, i.e., it is re-charged, is called secondary cell. Lead storage battery is the example of this type.



It consists of a group of lead plates bearing compressed spongy lead, alternating with a group of lead plates bearing lead dioxide, PbO₂. These plates are immersed in a solution of about 30% H₂SO₄. When the cell discharges; it operates as a voltaic cell. The spongy lead is oxidized to Pb²⁺ ions and lead plates acquire a negative charge.



Pb²⁺ ions combine with sulphate ions to form insoluble lead sulphate, PbSO₄, which begins to coat lead electrode.



The electrons are utilized at PbO₂ electrode.



Overall cell reaction is:



E_{cell} is 2.041 volt.

When a potential slightly greater than the potential of battery is applied, the battery can be re-charged.



After many repeated charge-discharge cycles, some of the lead sulphate falls to the bottom of the container, the sulphuric acid concentration remains low and the battery cannot be recharged fully.

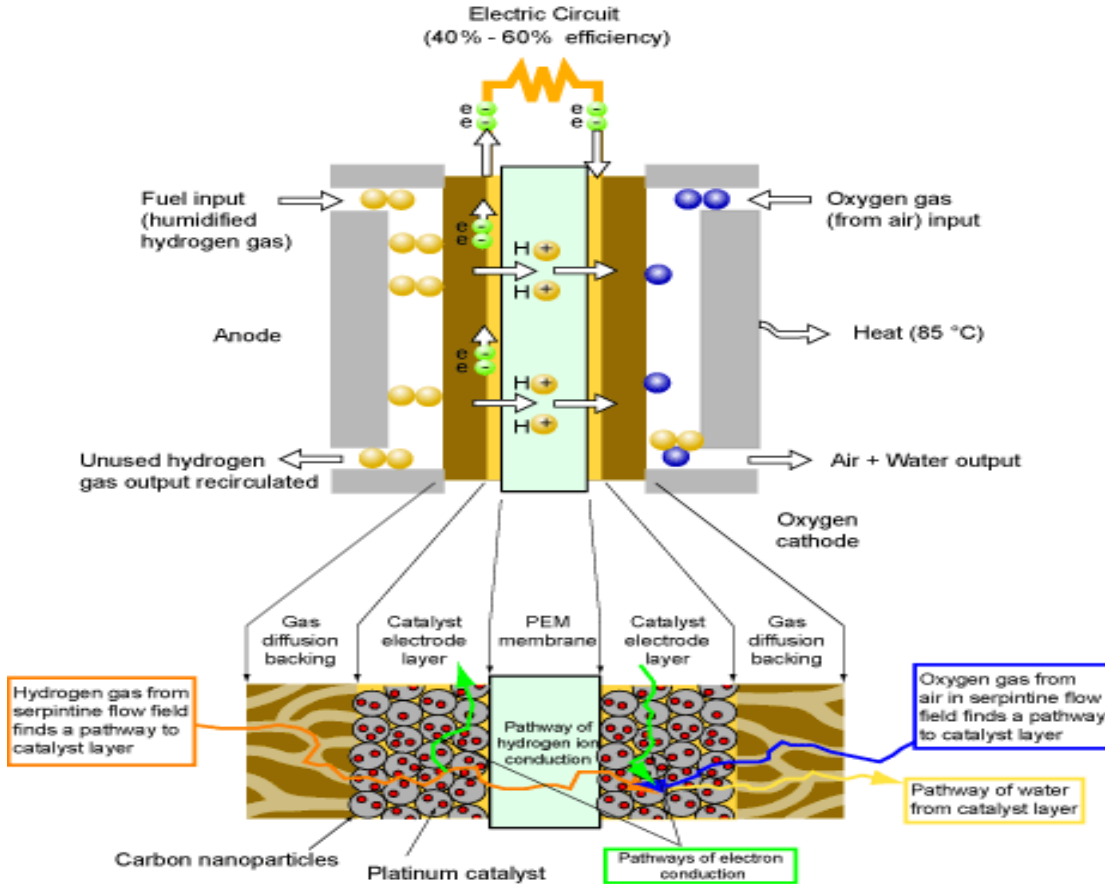
LONG ANSWER QUESTIONS

1. Explain Construction and working of Fuel Cell?

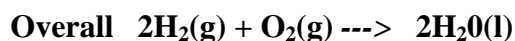
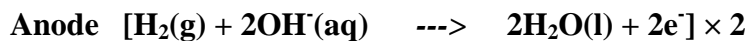
Ans:

FUEL CELL

Fuel cells are another means by which chemical energy may be converted into electrical energy. The main disadvantage of a primary cell is that it can deliver current for a short period only. This is due to the fact that the quantity of oxidising agent and reducing agent is limited. But the energy can be obtained indefinitely from a fuel cell as long as the outside supply of fuel is maintained.



One of the examples is the hydrogen-oxygen fuel cell. The cell consists of three compartments separated by a porous electrode. Hydrogen gas is introduced into one compartment and oxygen gas is fed into another compartment. These gases then diffuse slowly through the electrodes and react with an electrolyte that is in the central compartment. The electrodes are made of porous carbon and the electrolyte is a resin containing concentrated aqueous sodium hydroxide solution. Hydrogen is oxidised at anode and oxygen is reduced at cathode. The overall cell reaction produces water. The reactions which occur are:



These types of cells are used in space-crafts. Fuel cells are efficient and pollution free.