

CHEMISTRY STUDY MATERIALS FOR CLASS 12

(NCERT BASED KEY POINTS OF CHAPTER -03)

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(Key Learning of Electrochemistry)

31. At equilibrium, cell potential E_{cell} becomes zero
32. Relationship between equilibrium constant K_c and standard cell potential E°_{cell} :

$$E^{\circ}_{\text{cell}} = \frac{0.0591}{n} \log K_c \text{ (At 298K)}$$

33. Work done by an electrochemical cell is equal to the decrease in Gibbs energy $\Delta G^{\circ} = -nFE^{\circ}_{\text{cell}}$
34. The substances which allow the passage of electricity through them are known as conductors.
35. Every conducting material offers some obstruction to the flow of electricity which is called resistance. It is denoted by R and is measured in ohm.
36. The resistance of any object is directly proportional to its length l and inversely proportional to its area of cross section A .

$$R = \frac{l}{A} \rho$$

ρ is called specific resistance or resistivity. Its SI unit is ohm metre.

37. The inverse of resistance is known as conductance, G

$$G = \frac{1}{R}$$

Unit of conductance is ohm^{-1} or mho.

It is also expressed in Siemens denoted by S .

38. The inverse of resistivity is known as conductivity. It is represented by the symbol κ . The SI unit of conductivity is Sm^{-1} . But it is also expressed in Scm^{-1}

$$\kappa = \frac{1}{\rho} = G \frac{l}{R \cdot A} = G \cdot \frac{l}{A}$$

So, conductivity = Conductance \times Cell constant

39. For measuring the resistance of an ionic solution, there are 2 problems:
- Firstly, passing direct current changes the composition of the solution
 - Secondly, a solution cannot be connected to the bridge like a metallic wire or a solid conductor.
40. This can be resolved by using a source of alternating current and the second problem is resolved by using a specially designed vessel called conductivity cell.

41. A conductivity cell consists of 2 Pt electrodes coated with Pt black. They have area of cross section A and are separated by a distance l. Resistance of such a column of solution is given by the equation:

$$R = \rho \frac{l}{A} = \frac{1}{\kappa} \cdot \frac{l}{A}$$

Where $\frac{l}{A}$ is called cell constant and is denoted by the symbol G^*

42. Molar conductivity of a solution is defined as the conducting power of all the ions produced by dissolving 1 mole of an electrolyte in solution.

$$\text{Molar conductivity } \Lambda_m = \frac{\kappa \times 1000}{M}$$

Where κ = Conductivity

and M is the molarity Unit of Molar conductivity is $\text{Scm}^2 \text{mol}^{-1}$

43. Equivalent conductivity is the conductivity of all the ions produced by dissolving one gram equivalent of an electrolyte in solution.

$$\text{Equivalent conductivity } \Lambda_e = \frac{\kappa \times 1000}{N}$$

Unit of equivalent conductivity is $\text{S cm}^2 (\text{g equiv})^{-1}$

44. Kohlrausch's Law of independent migration of ions: According to this law, molar conductivity of an electrolyte, at infinite dilution, can be expressed as the sum of individual contributions from its individual ions. If the limiting molar conductivity of the cations is noted by $\lambda^0_{(+)}$ and that of the anions by $\lambda^0_{(-)}$, then the limiting molar conductivity of electrolyte is:

$$\text{as: } \lambda^0_m = n_{(+)}\lambda^0_{(+)} + n_{(-)}\lambda^0_{(-)}$$

$$\text{For NaCl, } \lambda^0_m (\text{NaCl}) = \lambda^0_{(\text{Na}^+)} + \lambda^0_{(\text{Cl}^-)}$$

Where v_+ and v_- are the number of cations and anions per formula of electrolyte

45. Degree of dissociation: It is ratio of molar conductivity at a specific concentration 'c' to the molar conductivity at infinite dilution.

It is denoted by α .

$$\alpha = \frac{\lambda^c_m}{\lambda^0_m}$$

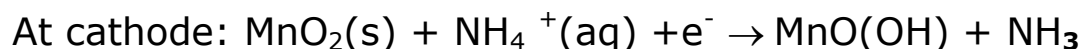
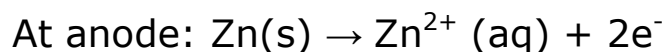
By using α , we can calculate the dissociation constant of acid as:

$$K_a = \frac{c\alpha^2}{1-\alpha}$$

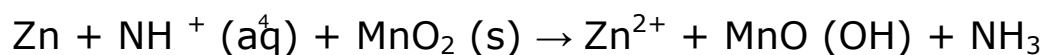
46. Faraday constant: It is equal to charge on 1 mol of electrons. It is equal to 96487 C mol^{-1} or approximately equal to 96500 C mol^{-1} .

47. Faraday's first law of electrolysis: The amount of substance deposited during electrolysis is directly proportional to quantity of electricity passed.
48. Faraday's second law of electrolysis: If same charge is passed through different electrolytes, the mass of substance deposited will be proportional to their equivalent weights.
49. Products of electrolysis: The products of electrolysis depend upon the nature of electrolyte being electrolyzed and the nature of electrodes. If electrode is inert like platinum or gold, they do not take part in chemical reaction i.e. they neither lose nor gain electrons. If the electrodes are reactive then they will take part in chemical reaction and products will be different as compared to inert electrodes.
50. The products of electrolysis also depend upon the electrode potentials of oxidizing and reducing species. Some of the electrochemical processes although feasible but slow in their rates at lower voltage these do not take place. They require extra voltage, i.e. over voltage at which these processes will take place. The products of electrolysis also differ in molten state and aqueous solution of electrolyte.
51. Primary cells. A primary cell is a cell in which electrical energy is produced by the reaction occurring in the cell, e.g. Daniell cell, dry cell, mercury cell. It cannot be recharged.

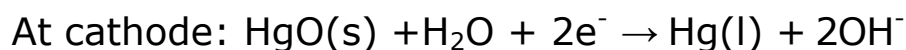
52. Dry Cell:



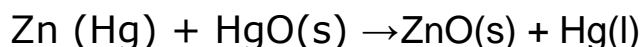
The net reaction:



53. Mercury Cell. The electrolyte is a paste of KOH and ZnO.

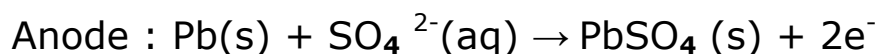


The net reaction:



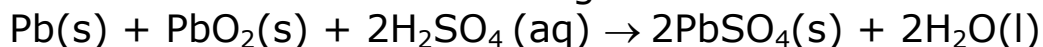
54. Secondary cells. Those cells which are used for storing electricity, e.g., lead storage battery, nickel – cadmium cell. They can be recharged.

55. Lead storage battery:





The overall cell reaction consisting of cathode and anode reactions is:

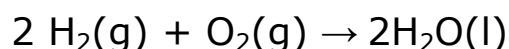
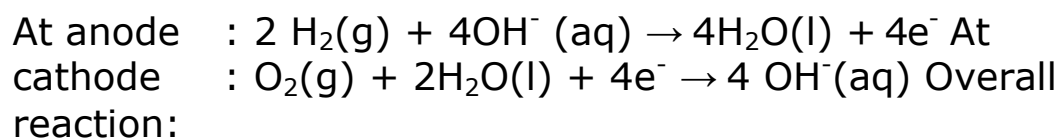


On recharging the battery, the reaction is reversed.

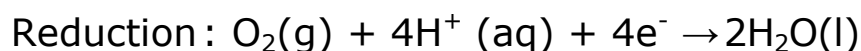
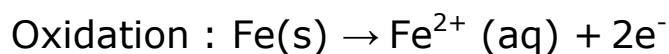
56. Nickel cadmium cell: It is another type of secondary cell which has longer life than lead storage cell but more expensive to manufacture. The overall reaction during discharge is



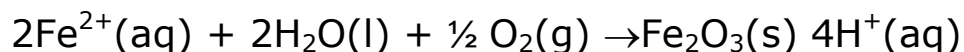
57. Fuel cells:



58. Corrosion:



Atmosphere oxidation:



59. Galvanization. It is a process of coating zinc over iron so as to protect it from rusting.

60. Cathodic protection: Instead of coating more reactive metal on iron, the use of such metal is made as sacrificial anode.
