***Chapter-4***

***ELECTROCHEMISTRY & Battery technology***

***1 Mark Questions***

1. The electrolyte used in alkaline hydrogen-oxygen fuel cells is:

a. NaOH b. KOH

c. LiOH d.H2 &O

2. Which of the following is correct?

a. ΔH =nF[T(ðE/ðT)p-E] b. ΔH =nF[T(ðT/ðE)v-E]

c. ΔH =nF[T(ðE/ðT)v-E] d. ΔH =nF[T(ðT/ðE)p-E]

3. Which of the following electrolytes can be used for salt bridge?

a. CaCl2 b. NaCl

c. Na2SO4 d. KNO3

4. The operating temperature in case of alkaline fuel cell is:

a. 40-60oC b.50-70oC

c. 60-80oC d. 80-100oC

5. The fuel used in molten carbonate fuel cell is:

a. Oxygen b. Hydrogen

c. carbon d. Carbonate ions

6. The operating temperature in case of molten carbonate fuel cell is:

a.550oC b.260oC

c. 650oC d.360oC

7. The catalyst used in molten carbonate fuel cell is:

a. Platinum b. Nickel oxide

c. Rhodium d. Nickel

8. Which of the following reactions occurs at cathode during charging of lead storage battery?

1. Pb2+ + 2e- → Pb
2. Pb → Pb2+ + 2e-
3. Pb2+ + SO42- → PbSO4
4. PbSO4+2H2O → PbO2+4H++SO42-+ 2e-

9. In Li-ion battery, Poly propylene act as a

1. Anode
2. Electrolyte

c) cathode

d) separator

10. The electrochemical cell stops working after some time because:-

(a) Electrode potential of both the electrodes becomes zero.

(b) Electrode potential of both the electrodes becomes equal.

(c) One of the electrodes is eaten away.

(d) The cell reaction gets reversed.

1. An example of simple fuel cell is :-

(a) Lead storage battery (b) H2 - O2 cell

(c) Daniel cell (d) HgO - Zn cell

1. In molten carbonate fuel cell, anode is made of

(a) Ni (b) Pb

(c) Ag (d) Li

1. The role of ZnCl2 in dry cell is

(a) Formation of salt with ammonia

(b) Formation of complex with ammonia

(c) Formation of double salt with ammonia

(d) Corrosion of dry cell

1. In lithium ion batteries PC stands for

(a) Polycarbonates (b) Propyl chloride

(c) Propylene carbonate (d) Proxy compound

1. LIB is an example of

(a) Primary battery (b) Secondary battery

(c) Solar battery (d) Fuel battery

20. VRLA battery is

a) Nano battery b) Gel battery

c) Li ion battery d) Dry cell

***2-Mark Questions***

1. Electroplating is an important application of electrolysis. Justify the statement.

2. Can we store 1M CuSO4 in Ni vessel? Support your answer with reason.

Given E0(Cu2+/Cu) = -0.34 V; E0 (Ni2+/Ni) = 0.76 V

3. Following is an electrochemical cell:

Pt, Ti 3+| Ti 4+ || Fe 3+ | Fe 2+,Pt

Formulate the half-cell reactions for the same.

4. State whether the following representation of a galvanic cell is correct or not, Give reason.

Ag | Ag+ (1M) || Zn 2+ (1M)| Zn

Given E0 Ag +/Ag = +0.8 V and E0 Zn2+/Zn = - 0.76V

5. Non-conductive materials like plastic or rubber need to be plated so as to make them usable for manufacturing of wide range of toys at a much lesser cost. Sketch a flow chart of steps used inthis technique.

7. A fuel cell is considered better than an electrical power plant using the same fuel. Give reason.

8. Predict whether Zinc can or cannot evolve hydrogen on reacting with 1N H2SO4.

Given Eo (Zn 2+/Zn) = -0.76 V

9. Calculate the equilibrium constant for the reaction:

Cu +2Ag+ → Cu 2+ + 2Ag. Given E0 cell =+0.46V

10. “Photovoltaic cell is responsible for converting solar light into electricity”. Justify it.

11. PCB is manufactured on laminates by electrolessplating of copper. List out the essential chemical components used for this plating?

12. When Zn rod is dipped in ZnSO4 solution and form a half cell and it connect with reference electrode. Formulate the cell reaction for the complete cell.

***5-Mark Questions***

1. As there is natural deterioration of the surface of aluminium and its alloys due to the formation of aluminium oxide. Without use of electricity, you have to protect aluminium and its alloys. Then, how you can protect them without using electricity? Explain the process.
2. When the Zn electrode and Cu electrode are connected with each other and these two are separately connected with H2 electrode, what would happen? Justify with suitable equations.
3. In the secondary Lithium ion cell the charging and discharging process is similar to the doping and undoping process. Justify the statement with the help of diagram.
4. For the cell reaction: Ni | Ni 2+ || Ag+ | Ag,

Calculate the equilibrium constant at 25oC. How much maximum work would be obtained by

the operation if this cell? Eo (Ni+ |Ni) = -0.25 V ; Eo (Ag+/Ag) =0.80 V.

1. Compare how electrolessplating is different from electroplating with reference of Cu plating on articles.
2. Dry cell acts as irreversible cell. With the help of suitable diagram and chemical equation, demonstrate the working of dry cell.
3. Lead-acid battery is a type of secondary battery used in inverters. With the help of chemical equations, demonstrate the charging and discharging process of the lead -acid battery.
4. Lithium ion batteries possess certain outstanding characteristics in comparison to conventional batteries. With the help of suitable diagram and chemical equations, demonstrate these outstanding characteristics with reference to Li-ion cell.
5. Explain how photovoltaic cell is responsible for converting solar light into electricity with the help of suitable diagram.
6. PCB plays important role in many appliances that convert A.C. supply into 12volt D.C. supply which can charge a battery and D.C. fan. Discuss the steps involved in the preparation of PCB in detail.
7. Compare alkaline fuel cell with molten carbonate fuel cell with respect to their chemical equations.
8. Differentiate between electrolessplating and electroplating with examples especially with their chemical equations.
9. VRLA battery possesses certain outstanding characteristics in comparison to conventional lead-acid battery. Justify the statement.
10. Nanotechnology has become the new driving force of battery advancement in the 21st century. List out a few shortcomings of present battery technology. With the help of examples, explain how nanotechnology emerging as a solution for these shortcomings.
11. The e.m.f. of the cell Zn | ZnSO4.|| Cu | CuSO4 is 0.1675V and 0.1691 V at 25 oC and 0oC respectively. Calculate ΔH, ΔG & ΔS at 25 oC.
12. Calculate the e.m.f of the Zn-Ag cell at 25˚C when [Zn 2+] = 0.1M and [Ag +] =1M.

E˚cell = 1.56 volt at 25˚C.

***10-Mark Questions***

1. EMF of the cell : Cd | CdCl2 || AgCl | Ag is 0.6753 and 0.6915 at 25°C and 0°C respectively. Derive the relationship of among various thermodynamic variables with EMF and then calculate ∆H,∆S and ∆G at 25°C.

(4+2+2+2)

1. Fuel cell technology offers the opportunity of creating environmental friendly portable power supplies capable of producing enough energy to run devices and motor vehicles. Compare alkaline, molten carbonate and phosphoric acid fuel cell with respect to their
2. Chemical equations
3. Diagrams. (5+5)
4. Solar energy is the source of life on earth. Without it, we would not be here today on such a rich and diverse planet. One of the most exciting area of development has come in the form of solar cell .What is the basic principle and how it works? Explain with diagram. (2+4+4)
5. Lead-acid battery is a traditional battery used in inverters. Demonstrate the working of the lead -acid battery with the help of diagram and chemical equations. Also, compare the traditional version of this battery with modified version VRLA battery. (7+3)