**Question Bank -I**

# ELECTROCHEMISTRY and BATTERIES (2013-2014)

## **(Part – A) Short Answer Questions**

1. What is a reference electrode? Give two examples with their electrode reactions
2. Define specific conductance. Mention its units.
3. Differentiate between

a). Strong and weak electrolytes b) Metallic and electrolytic conductors.

c). Electrochemical cell and d). Single electrode potential and

Electrolytic cell standard electrode potential.

1. **What is salt bridge? Why is Salt Bridge used in electrochemical cells? (What is its role**

**in a galvanic cell?)**

1. Does the following cell work spontaneously at 25ºC, why? Why not?

Cu|cu+2 (1.0M) ||Ni+2 (1.0M)|Ni , E0 cu+2/cu=+0.34 E0Ni+2 /Ni = -0.25v.

1. Calculate the single electrode potential of Zn+2 (0.01M)| Zn at 250C given Eº Zn+2 | Zn = - 0.76 V.
2. What is Cell Constant? Give its units.
3. **What is the useful electrical energy obtained from Daniel cell under standard conditions? (Eº cell =1.1v)**
4. What is a Quinhydrone electrode ? Write its electrode reaction.
5. Calculate the EMF for the cell

Zn ‌│ Zn +2 ││ Ag + │ Ag given EO Zn+2 │Zn = - 0.762 v and EO Ag + │ Ag = 0.8 v

1. W rite down the cell reaction and cell representations of the Daniel cell.
2. The standard electrode potential Cu+2/Cu is 0.334v will copper displace hydrogen from acids why? Why not?
3. Describe the working of Glass – electrode
4. Write a note on calomel electrode
5. Discuss any two uses of EMF measurements.
6. **What are the factors effecting conductivity of electrolytes.**

17. Electrode potential of Zinc is assigned negative value, whereas that of copper positive value. Give reasons.

#### Part B (Long Answer type & Numerical Problems)

1. With the help of neat-labelled diagram, explain the construction of saturated calomel electrode. Write the pertinent electrode reaction?
2. A cell is constructed using SCE and Hydrogen electrode with an acid having [H+]=0.05N. Calculate the ECell if ESCE=0.242. What is the cell notation and cell reaction?
3. Calculate the Emf of cell.

Fe |Fe SO4 (0.05M)|| Cu SO4 (0.2M)| Cu

Eº Fe+2/Fe = - 0.44v, Eº cu+2 /cu =0.34v.

1. **Derive Nernst equation and give its applications**.
2. What is electrochemical series? Discuss its applications.
3. What is cell constant ? How is it determined?
4. Calculate the EMF for the following cell at 25ºc

Pb| Pb+2(0.001) ||Ag+­(0.01) | Ag

Eº for the cell is 0.925v

1. For the following Galvanic cell set up at 25ºc

Pt | S C E || H+ (Test) | Q, QH2 |Pt

(PH=?)

At what PH of the solution containing Quinhydrone electrode the cell EMF would be zero volts ESCE=0.242 V, Eº Q / QH2=0.700v.

1. Describe with the help of suitable example,diagram and electrode reaction for each of the following types of electrodes.
   * 1. Metal – Metal ion electrode
     2. Gas electrode
     3. Metal –insoluble metal salt electrode.
2. Emf of combined cell using Quinhydrone and saturated calomel electrodes at 25ºC was found to be 0.380v. Calculate the pH of unknown acid solution used in the experiment.
3. Describe a Quinhydrone electrode. Derive an expression for the potential of Quinhydrone electrode. Explain how pH of a solution could be determined using this electrode. (Give the redox reactions).
4. **Write the different types of electrode systems you have studied. Describe them with their electrode reactions & single electrode potential.**
5. **Write the cell reaction for the cell**

**Pt,H2 l HCl l AgCl l Ag**

**Eo for this cell is 0.222v . If measured emf of the cell is 0.385v. Calculate the pH of the Hcl solution (Pressure of Hydrogen = 1 atm )**

1. Calculate the single electrode potential of Cu+2 (0.1 M)/ Cu electrode at 25º C. Given E0 of Cu 0.34 volts.
2. Explain the principle involved in the potentiometric acid base titrations (strong acid Vs strong base) using a calomel and Quinhydrone electrode [Hint- Galvanic cell construction, Description, Cell notation, Cell reaction, Emf of Cell reaction]
3. The standard reduction potential of Cu+2 / Cu and Ag+/Ag electrodes are 0.337 and 0.799 V. Construct a galvanic cell using these electrodes. For what concentration of Ag+ will the cell emf be 0, if concentration of Cu+2 is 0.01M?
4. Calculate the emf of the following cell at 250C

Fe |Fe SO4 (0.01M)|| Cu SO4 (0.01M)|Cu. Given E0 of Fe &Cu as - 0.44 and 0.34V resp.

1. Predict whether Cu(s) can reduce Ag+ ion in an aqueous solution. Given standard reduction potentials Cu+2/Cu=0.34v Ag+/Ag=0.80v.
2. How would you represent copper, iron voltaic cell given std. reduction potentials of Cu and Fe are respectively 0.34v, -0.44v? Calculate the emf of cell.
3. A Hydrogen electrode was combined with a saturated calomel electrode. The emf of the combination was 0.673 volts. What is the pH of the solution if potential of SCE is 0.248 at the same temperature?
4. The standard electrode potential for Cu+2 / Cu and Cd+2/Cd are 0.337 and -0.403v. Construct a galvanic cell. Give the cell reaction, Calculate EMF of the cell and ΔGO.
5. Represent the cell,write electrode reactions and Ecell,for potentiometric redox titration .
6. . Describe the principle of conductometric titrations for-

a)strong acid VS strong base

b)weak acid VS strong base

1. Explain the principle involved in Potentiometric–metric titration using quinhydrone and calomel electrode.
2. In pH metric experiment using Glass – SCE combination the Emf of cell is found to be 178mv when a buffer solution of pH = 4.0 is used. Calculate the EGo of Glass electrode . State whether Glass electrode acts as anode or cathode . Justify your answer.

27. Write the cell reaction and calculate the emf of following cell at 25◦ C.

Zn(s) I Zn+2 (0.2M) II Ag+ (0.02M) I Ag(s)

Given E◦ Zn/Zn+2 =+0.76v , E◦ Ag/Ag+ = -0.8v

**BATTERIES**

1. Give an account of Lead Acid Accumulator
2. Differentiate between Primary & Secondary Batteries.
3. What are Fuel Cells? Describe in detail the working of Methanol– Oxygen Fuel

Cells.what are its applications.

1. **Write a note on Lithium ion secondary Cells.**
2. Describe the construction and working of Dry cell with relevant reactions.
3. What are the advantages,disadvantages and applications of Lithium ion cells.
4. **Describe the construction of lead-acid battery with reactions occurring during charging and discharging.**
5. Write a note on Nickel – Cadmium cells.( figure,description,reactions,applications)
6. What is the difference between a cell and a battery.

**[ Note : Question in bold letter are compulsory for all students in Assignments** ]