

Assignment

Chapter 3: Electrochemistry

1. Define molar conductivity of a solution and write their units and the relation between the two. How does molar conductivity changes with change in concentration of solution for weak and strong electrolyte.
2. What are fuel cells? Give electrode reactions of H₂-O₂ fuel cell. Name any other fuel which can be used instead of H₂.
3. The resistance of a conductivity cell containing 0.001 M KCl solution is 1500 Ω at 298K. What is the cell constant, if the conductivity of 0.001 M KCl solution at 298K is 0.146X10⁻³ Scm⁻¹?
(0.219 cm⁻¹)
4. The E^o values corresponding to the following two reduction electrode processes are:
Cu⁺ / Cu = +0.52 V; Cu²⁺ / Cu⁺ = +0.16 V
Formulate the galvanic cell for their combination. What will be the standard cell potential for it? Calculate Δ_rG^o for the cell reaction? (F = 96500 Cmol⁻¹)
5. Account for the following :
 1. Alkaline medium inhibits the rusting of iron.
 2. Iron does not rust even if the zinc coating is broken in a galvanized iron pipe.
6. Three iron sheets have been coated separately with three metals (A, B and C) whose standard electrode potentials are given below:

Metal	A	B	C	Iron
E ^o values	-0.46 V	-0.66 V	-0.20 V	-0.44 V

Identify in which case rusting will take place faster when coating is damaged.
7. In the button cell , widely used in watches , the following reaction takes place
$$\text{Zn}_{(s)} + \text{Ag}_2\text{O}_{(s)} + \text{H}_2\text{O}_{(l)} \longrightarrow \text{Zn}^{2+}_{(aq)} + 2 \text{Ag}_{(s)} + 2\text{OH}^-$$
Determine E^o and ΔG^o for the reaction.
(given: E^o_{Ag⁺ / Ag} = 0.80 V , E^o_{Zn²⁺ / Zn} = -0.76 V)
(E=1.56 V, ΔG^o = -301.08 KJ mol⁻¹)
8. Write the reactions occurring during the electrolysis of ;
 - a) Solution of dil. Sulphuric acid using platinum electrodes.
 - b) Aqueous Silver Nitrate solution using Silver electrodes.
 - c) Aqueous Sodium Chloride solution.
9. In a Leclanche cell, write the following :
 - a) The chemical equations involved at the cathode.
 - b) Change in oxidation state of Mn
 - c) The complex entity formed between Zn²⁺ (aq.) and NH₃(g).

10. $\text{Cu}^{2+} + 2\text{e}^- \longrightarrow \text{Cu} \quad E^\circ = +0.34 \text{ V}$
 $\text{Ag}^+ + \text{e}^- \longrightarrow \text{Ag} \quad E^\circ = +0.80 \text{ V}$
 (a) Construct a galvanic cell using the above data.
 (b) For what concentration of Ag^+ ions will the emf of the cell be zero at 25°C , if the concentration of Cu^{2+} is 0.01 M ? [$\log 3.919 = 0.593$] (calc. not reqd.)
11. A voltaic cell is set up at 25°C with the following half-cells;
 $\text{Al} | \text{Al}^{3+} (0.001 \text{ M})$ and $\text{Ni} | \text{Ni}^{2+} (0.50 \text{ M})$
 Calculate the cell voltage [$E^\circ_{\text{Ni}^{2+} | \text{Ni}} = -0.25 \text{ V}$, $E^\circ_{\text{Al}^{3+} | \text{Al}} = -1.66 \text{ V}$]
 (1.45 V)
12. How many coulombs of electric charge must be passed through a solution of silver nitrate to coat a silver sheet of area 100 cm^2 on both the sides with a 0.005 mm thick layer. Density of silver is 10.5 g/cm^3 . Relative atomic mass of silver is 108.
 (938.2 C)
13. (i) State Kohlrausch law of independent migration of ions. Write an expression for the molar conductivity of acetic acid at infinite dilution according to Kohlrausch law.
 (ii) Calculate Λ_m^0 for acetic acid. Given that
 $\Lambda_m^0 (\text{HCl}) = 426 \text{ Scm}^2 \text{ mol}^{-1}$
 $\Lambda_m^0 (\text{NaCl}) = 126 \text{ Scm}^2 \text{ mol}^{-1}$
 $\Lambda_m^0 (\text{CH}_3\text{COONa}) = 91 \text{ Scm}^2 \text{ mol}^{-1}$ (391 $\text{Scm}^2\text{mol}^{-1}$)
14. What type of battery is lead storage battery? Write the anode and the cathode reactions and overall reaction occurring in a lead storage battery when current is drawn from it.
15. Calculate the emf of the following cell at 298K :
 $\text{Fe}(\text{s}) | \text{Fe}^{2+}(0.001\text{M}) || \text{H}^+(1\text{M}) | \text{H}_2(\text{g})(1\text{bar}), \text{Pt}(\text{s})$
 Given $E^\circ_{\text{cell}} = 0.44\text{V}$
16. Santa and Banta are good friends. They are horticulturists and grow kninnow (citrus crop) in Abohar in southern Punjab. Santa wanted to spray his crop with a fungicide. Banta advised him to use a safe copper based fungicide. He tells Santa to spray his crop with Boredeaux mixture [$\text{CuSO}_4 + \text{Ca}(\text{OH})_2$]. Santa took some water in a galvanized iron bucket to dissolve copper sulphate but Banta stopped him from doing so.

Read the above passage and answer the following questions.

- Why Banta stopped Santa from dissolving Copper Sulphate in water?
- Suggest an alternative procedure to Santa.
- What are the values associated with Banta's advise to Santa.