SARDAR PATEL UNIVERSITY
M. Sc. FOURTH SEMESTER Examination 2016
Monday, 11th April 2016,
Time: 2.30 p.m. to 5.30 p.m.
PS04CPHC03,
ELECTRO ANALYTICAL METHODS

Total Marks: 70

N.B. Figures to the right indicate marks.

Q-1 Choose appropriate answers. (only code) [08]

1. 0.023 gms of sodium metal is reacted with 100cm³ of water. The P^H of the resulting solution is
(a) 11 (b) 10 (c) 12 (d) 9

2. The P^{OH} of a NaOH solution is 11.30. What is the $[H^+]$ for this solution
(a) 2.0×10^{-3} (b) 2.5×10^{-3}
(c) 4.0×10^{-3} (d) 6.2×10^{-3}

3. In static method the value of current is

(a) Zero (b) < 0 (c) > 0 (d) one

4. Unit of electrical conductance is

(a) Volt (b) Ampere (c) Coulomb (d) Siemens

5. For the reaction, $Ni_{(s)} + 2Ag_{(0.002M)} \rightarrow Ni^{+2}_{(0.160M)} + 2Ag_{(s)}$
($E^0_{cell} = 1.05$ v), E_{cell} is

(a) 0.914 (b) 0.919 (c) 0.9614 (d) 9.49

6. The specific conductance of a decinormal solution of KCl solution is 0.0112mhos. The resistance of this cell is 55ohm. What is the cell constant for this cell
(a) 0.680 (b) 0.616 (c) 0.691 (d) 0.634

7. Ilkovic equation is
(a) $i_d = 607nDcm^{2/3}t^{1/6}$ (b) $i_d = 607nDcm^2 t^{1/6}$
(c) $i_d = 607nDcm^{1/6}t^{1/6}$ (d) $i_d = 607nD^{1/2} cm^{2/3}t^{1/6}$

8. For monobasic weak acids P^H equals to

(a) Log Ka (b) $< \log Ka$ (c) $> \log Ka$ (4) $- \log Ka$

Q-2 Answer **any seven** of the following [14]

1. Calculate equilibrium constant for the reaction:
   $$Cu_{(s)} + 2Ag^+_{(aq)} \rightarrow Cu^{+2} + 2Ag_{(s)}$$
   (Given : (E^0_{cell} = 0.46 v and E_{cell} = 0.0 v)

2. Calculate the P^H of N/100 H_2SO_4 solution and N/10 NaOH solution.

3. State advantages of electrochemical reactions.

4. State sources of emf observed in glass electrode.

5. Differentiate between direct potentiometry and Potentiometric titrations.

6. A solution of P^H = 9 is one thousand times as basic as solution. Calculate the P^H of the solution.

7. Write a short note on silver coulometer.

8. How basicity of an acid is determined by conductometry measurement.

9. State advantages of dropping mercury electrode.

Q-3

(a) Calculate P^H of a solution after mixing 50ml 0.1M acetic acid solution [06] with 20 ml sodium hydroxide solution (Ka = 1.8×10^{-5}) .
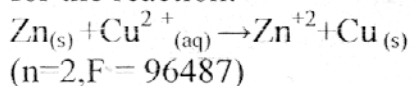
(b) (i) Discuss antimony electrode. [03]

   (ii) Why electrochemistry held central position in the field of chemistry. [03]

OR

(b)

(i) Calculate P^H of 10^{-8}N HCl solution. [03]

(ii) The E^0_{cell} for the Denial cell is 1.1V.Calculate standard Gibb's free energy [03] for the reaction:
   $$Zn_{(s)} + Cu^{2+}_{(aq)} \rightarrow Zn^{+2} + Cu_{(s)}$$
   (n=2,F = 96487)

Q-4

(a) For the cell, [06]
   Pt/Cl$_{2(gas)}$(1 bar)/HCl(a=1)/AgCl$_{(s)}$/Ag. Calculate E^0 for the electrode Ag/AgCl/Cl$^-$ using following data.
   (E_{cell} = 1.1369V, E^0_{Cl/Cl^-} = 1.3592V)

②

(b) Discuss applications of coulometric methods. State advantages of coulometric titrations. **[06]**

OR

(b) The complete electrolytic deposition of Zn ore after appropriate treatment required 18.5 minutes at a current of 1.15 ampere. Determine the quantity of deposited Zn and content of Zn in percentage. **[06]**

Q-5

(a) The resistance of a cell containing 0.1 gms equivalent of KCl in 100ml at 25^0C was found to be 3468.7 ohms. The specific conductance of this solution is 0.01268 ohm^{-1}cm^{-1}.Exactly 0.1N solution of another substance in the same cell has resistance of 4573.4ohms. Calculate the equivalent conductance of this electrolyte at a given concentration. **[06]**

(b) State Kohlrausch's law of independent migration of ions. Discuss its applications. **[06]**

OR

(b) Differentiate high frequency and low frequency conductometry. State advantages and disadvantages of high frequency conductometry. **[06]**

Q-6

(a) Explain current variation with DME containing polarogram of 1M HCl and 5×10^{-4} M Cd^{+2}(in 1M HCl).Discuss limiting current, Diffusion current and Polarographic current. **[06]**

(b) **[06]**

(i) P-phenylene diamine present in 0.488mM concentration had applied current of 29 UA and transition time of 76.8sec.What is the electron charge involved if electrode had surface area of 1.71cm^2 & $D = 0.92 \times 10^{-5}$ cm^2/sec. **[03]**

(ii) An organic compound undergoes a two electrode reduction at DME.A diffusion current of 10.1UA was produced by 9.6×10^{-4}M solution of the compound. Calculate diffusion coefficient of the compound. (Flow rate = 0.982 mg/sec. & Drop time = 6.53 second. **[03]**

OR

(b) Discuss current sampled polarography, pulse polarography and differential pulse polarography. **[06]**

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