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SARDAR PATEL UNIVERSITY
M. Sc. (Semester – IV) Examination
Thursday, 27th October 2016
2.00 p.m. to 5.00 p.m.
PS04CANC02: Electro analytical Methods

Note: **Figures to the right indicate full marks**   **Total Marks: 70**

Q. 1   Select the correct answer (Only Code)   (08)

[1]   Which one of the following electrode is not selective towards H$^+$ ions?

(a) Glass electrode,   (b) Quinhydrone electrode,
(c) Hydrogen gas electrode, (d) Calomel electrode

[2] 10^{-6} M HCl is diluted to 100 times. Its P^H is
(a) 6.0   (b) 8.0   (c) 6.95   (d) 9.5

[3]   Faraday equals to

(a) e × N   (b) e / N   (c) N/e   (d) e × V

[4]   In Polarography, which salt is widely used as a supporting electrolyte for
aqueous media ;

(a) KNO_3, (b) KCl, (c) $KMnO_4$ (d) $K_2Cr_2O_7$

[5]   Standard free energy change is

(a) nEF   (b) — nEF   (c) nE^{0}F   (d) — nE^{0}F

[6]   Quality of deposits are improved by

(a) knocking (b) stirring   (c) Heating   (d) cooling

[7]   At 90^{0}C, pure water has $H_3O^+ = 10^{-6}$ moles/lit. The value of K_w at 90^{0}C is

(a) 10^{-6} (b) 10^{-14} (c) 10^{-12} (d) 10^{-8}

[8]   Specific resistance is

(a) $\rho = R\frac{a}{l}$ (b) $\rho = R \frac{l}{a}$ (c) $\rho = \frac{a}{Rl}$ (d) $\rho = \frac{la}{R}$

Q.2 Answer the following in short; (ANY SEVEN) (14)

(a) Give detailed classification of electro analytical methods.

(b) What will be the value of Ecell when Ag and Cu electrodes with unit activities are in contact? [$E^0_{Cu^{+2}/Cu}$ = 0.337 volt, $E^0_{Ag/Ag+}$= 0.7999volt.]

(c) Why calibration of glass electrode is needed?

(d) State advantages and disadvantages of hydrogen electrode.

(e) Define: Volt, Formal potential, Equivalent conductance, & limiting current,

(g) Discuss Hydrogen-Oxygen coulometer.

(h) State advantages and disadvantages of DME.

(i) When a conductance cell was filled with 0.01 M KCl solution, whose specific conductance is 0.001409 mho/cm,it has resistance of 161.8ohm.
When filled with 0.005MNaOH it has resistance of 190ohm.
Calculate cell constant θ,specific conductance of NaOH solution.

Q.3 [a] Deduce the equation: $E = E^0 - \dfrac{0.0591}{n} \log K$, for the general reaction (06)
aA+bB $\rightleftharpoons$ cC+dD utilizing 1st & 2nd law of thermodynamics.

[b] (i) A platinum electrode is immersed in a solution which is 1×10^{-1} M in (03)
KMnO₄ & 5×10^{-4} M in MnSO₄.
Calculate electrode potential at 25^0C for P^H = 0. (E_{MnO4^-/Mn^+} = 1.51V)

(ii) State applications of ion selective electrodes. δR (03)

[b] (i) The cell in which following reaction occurs.$2Fe^{2+} +2I^- \rightarrow 2Fe^{3+}+I_2$ (03)
(E^0cell =0.236v at 298^0K). Calculate ΔG & Kc for the cell reaction.
(R = 1.982 cal/deg/mole. F=96487 & E = 0)

(ii) Deduce the relation: $P^H = P^{Kw} - P^{Kb}$ for a weak base. (03)

Q.4 [a] [i] Differentiate between Direct potentiometry and Potentiometric (03)
titrations and state advantages of Potentiometric titrations overordinary titrations.

[ii] Oxidation potential of Pt/Cl₂/Cl⁻ & Pt/I₂/I⁻ are -1.36v & -0.54v (03)
respectively. Show that Cl⁻ ion can oxidizes I⁻ to I and calculate K.

[b] Answer **ANY TWO** of the followings: (06)

[i] Discuss physical characteristics of metal deposits.

[ii] Calculate time needed for a constant current of 0.96A to deposited 0.5 gms of CO(II) as elemental CO on the surface of a cathode.(Molecular Mass of CO is 58.13, F = 96500)

[iii] Discuss constant potential electrolysis.

[iv] State advantages of coulometric titrations.

Q.5 **[a]** Give advantages and disadvantages of high frequency conductometry. **(06)**

[b] Discuss various types of conductometric titrations. **(06)**

OR

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

Q.6 **[a]** State advantages of polarography technique and obtain the equation for Half **(06)** wave potential: $E_{1/2} = E^0 + \frac{0.0591}{n} \log \left[\frac{Dred}{Doxi} \right]^{1/2}$.

[b] Answer **ANY TWO** from the followings: **(06)**

[i] Discuss Current sampled and pulse polarography.
[ii] Write a note on diffusion current.

[iii] Enlist advantages and disadvantages of amperometric titration.

[iv] The following data were collected for three dropping mercury electrodes. Complete the data for electrode A & C.

DME	A	B	C
Flow rate, mg/s	0.982	3.92	6.96
Drop time,(Sec)	6.53	2.36	1.37
I_d /C,μA/m.mole	?	4.86	?

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