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Electro-Analytical chemistry Ex.
B.Sc.Geo.Bot.&Bio/ Chem.students
1 st. semester

Model Answer

Part .1. Electro- Analytical part.

1- the answer must be include the definition of

a) Migration transport under potential gradient dE / dx

b) Diffusion Transport under concentration gradient. dC / dx

c) Convection Transport under density gradient. dw / dx

2- $Cd == Cd^{++} + 2e^-$

$$E_{befor} = E^o + 0.0591 / 2 \, Log \, [Cd^{++}]$$

$$= 0.34 + 0.0591/2 \log 10^{-3}$$
$$= 0.34 - 0.088 = 0.251 \text{ V}$$

$$Cd^{++} + Y^{4-} = CdY^{2-}$$

$$K_f = [CdY^{2-}] / [Cd^{++}][Y^{-4}]$$

$$[Cd^{++}] = [CdY2-] / K_f .[Y^{-4}]$$

$$E_{after} = 0.34 + 0.0591 / 2 \, Log \, [CdY^{2-}] / K_f .[Y^{4-}]$$
$$= 0.34 + 0.0591 / 2 \, Log \, [0.001] / 10^8 .[0.1- 0.001]$$

3- $Ag / AgCl / Cl^- / H^+_{inter}$/ lass membrane / $H^+_{ext} / Cl^- / Hg_2Cl_2 / Hg$

Reference electrode is $Ag / AgCl / Cl^-$

$$E_{ref.} = E^0 - 0.0591 \log. [Cl^-]$$

$$E_{cell} = (E_{ref\,1} + E_{m1}) - (E_{ref\,2} + E_{m2})$$

If $E_{ref\,1} = E_{ref\,2}$

$$E_{cell} = E_{m1} - E_{m2}$$

$$E_{m1} = K_1 + 0.0591 \log a_1$$

$$E_{m2} = K_2 + 0.0591 \log a_2$$

$$E_{cell} = K_1 + 0.0591 \log a_1 - K_2 - 0.0591 \log a_2$$

$$E_{cell} = K' + 0.0591 \log a_1$$

$$= K' - 0.0591 \text{ pH}$$

Where $K' = K_1 - K_2 - 0.0591 \log a_2$

If the two reference electrode are Ag / AgCl / Cl^- and the SEC.

$$K' = K_1 - K_2 + E_{SEC} - E_{Ag/AgCl} - 0.0591 \log a_2$$

4- The Answer should be includes.

$$RH_{2x} + xM^{2+} = RM_x + 2xH^+$$

Ca^{++} ISE the ion exchanger is aliphatic di ester of phosphoric acid dissolved in a polar solvent. The chain lengths about 8 – 16 carbon atoms.

The internal aqueous solution contain fixed concentration of $CaCl_2$

The reference electrode is Ag / AgCl / Cl^-

The equilibrium at each interface represented as

$$[(RO)_2 POO]_2 Ca = 2 (RO)_2 POO^- + Ca^{++}$$

The potential of the electrode is given by the equation

$$E = K + 0.0591/2 \log Ca^{++}$$

The Ca ISE described is reported to be independent of pH range between 5.5-11

5- ***Dropping mercury electrode (DME)***

Composition: mercury resevoir – capillary attached. Drops fall from the resevoir at constant rate usually between 5-30 drop / min. life time 5 – 30 sec / drop. Voltage scaning rate 50-200 mV / min.

Change in potential of DME can be neglected compared to life time.

The current measured obtained under practically potentiostatic condition.

i.e. D.C polarography.

Reference electrode S.C.E or Ag / AgCl / Cl^- or Hg/ Hg_2SO_4 / SO_4^{--} or Pt.

Polarogram. I vs. E curve.

Supporting electrolyte KCl.

Polarographic wave result from the reaction

$$Cd^{2+} + 2e^- + 2Hg = Cd(Hg)$$

Sharpe increase in current at $\simeq$ -2 V

Residual current i_r / migration current i_m / diffusion current i_d / limiting current i_L

$$i_L = i_d + i_m + i_r$$

With my best wishes

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