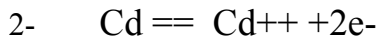




Model Answer

Part .1. Electro- Analytical part.

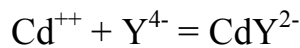
- 1- the answer must be include the definition of
- a) Migration transport under potential gradient dE / dx
 - b) Diffusion Transport under concentration gradient. dC / dx
 - c) Convection Transport under density gradient. dw / dx



$$E_{before} = E^{\circ} + 0.0591 / 2 \text{ Log } [Cd^{++}]$$

$$= 0.34 + 0.0591/2 \log 10^{-3}$$

$$= 0.34 - 0.088 = 0.251 \text{ V}$$

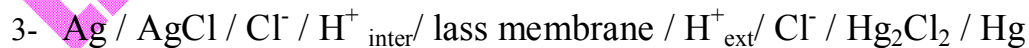


$$K_f = [CdY^{2-}] / [Cd^{++}][Y^{4-}]$$

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

$$E_{after} = 0.34 + 0.0591 / 2 \text{ Log } [CdY^{2-}] / K_f \cdot [Y^{4-}]$$

$$= 0.34 + 0.0591 / 2 \text{ Log } [0.001] / 10^8 \cdot [0.1 - 0.001]$$



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

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

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

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

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

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

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

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

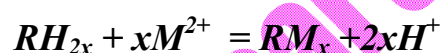
$$E_{\text{cell}} = K + 0.0591 \log a_1 \\ = K - 0.0591 \text{ pH}$$

$$\text{Where } K = K_1 - K_2 - 0.0591 \log a_2$$

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

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

4- The Answer should be includes.

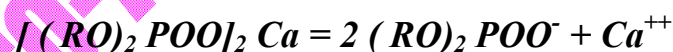


Ca⁺⁺ ISE the ion exchanger is aliphatic di ester of phosphoric acid dissolved in a polar solvent. The chain lengths about 8 – 16 carbon atoms.

The internal aqueous solution contain fixed concentration of CaCl₂

The reference electrode is Ag / AgCl / Cl⁻

The equilibrium at each interface represented as



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 scanning rate 50-200 mV / min.

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

Model Answer Dr / M.M. El-Rabiei

The current measured obtained under practically potentiostatic condition.

i.e. D.C polarography.

Reference electrode S.C.E or Ag / AgCl / Cl⁻ or Hg/ Hg₂SO₄ / SO₄⁻ or Pt.

Polarogram. I vs. E curve.

Supporting electrolyte KCl.

Polarographic wave result from the reaction



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

Dr/ Mohamed M. El-Rabiei

Electro-Analytical Chemistry