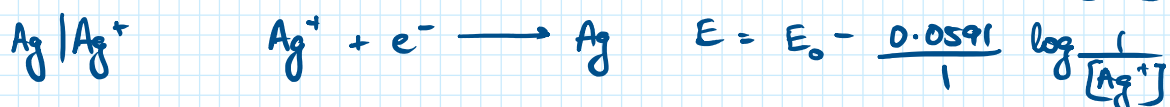
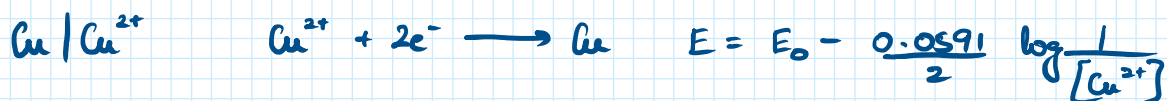
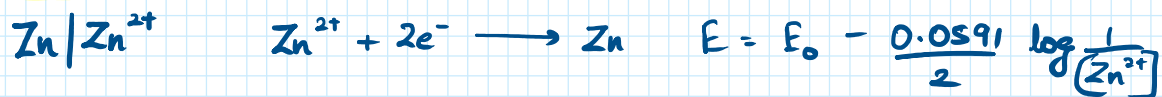


2. Types of Electrodes

06 October 2023 08:11

TYPES OF ELECTRODES

① Metal - metal ion electrode



② Metal - metal salt ion electrode

[OR]

Metal - metal in soluble salt ion electrode

• Calomel electrode



$$E = E^0 - \frac{0.0591}{2} \log [\text{Cl}^-]^2$$

$$E = E^0 - 0.0591 \log [\text{Cl}^-]$$

Both anode
and
cathode

• $\text{Ag} | \text{AgCl} | \text{Cl}^-$



$$E = E^0 - \frac{0.0591}{1} \log [\text{Cl}^-]$$

• $\text{Ag} | \text{Ag}_2\text{CrO}_4 | \text{CrO}_4^{2-}$



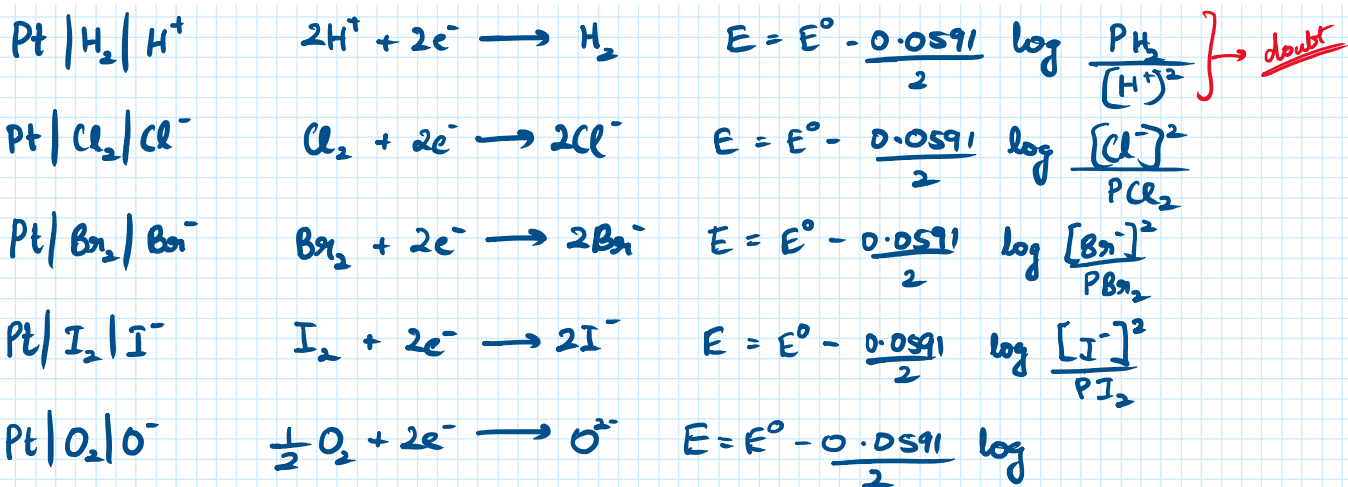
$$E = E^0 - \frac{0.0591}{2} \log [\text{CrO}_4^{2-}]$$

• $\text{Pb} | \text{PbSO}_4 | \text{SO}_4^{2-}$

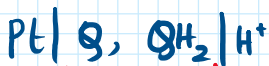
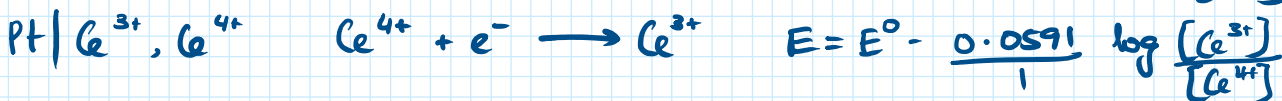
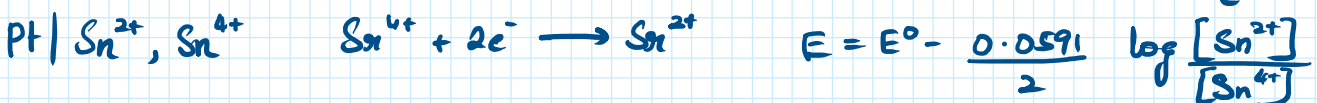
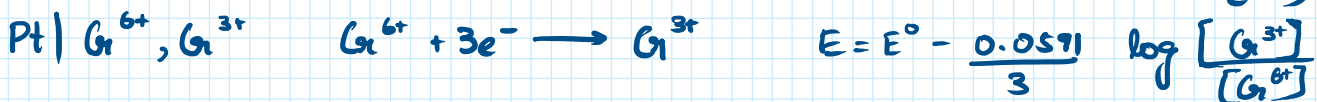
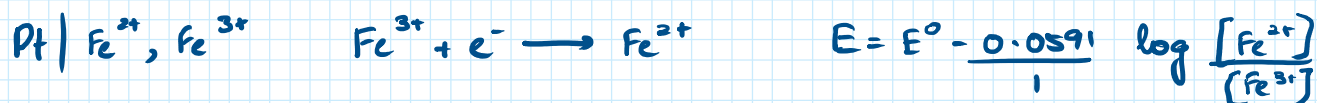


$$E = E^0 - \frac{0.0591}{2} \log [\text{SO}_4^{2-}]$$

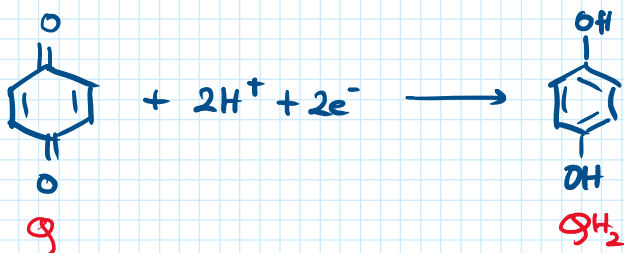
③ Gas electrode



④ Oxidation - reduction electrode

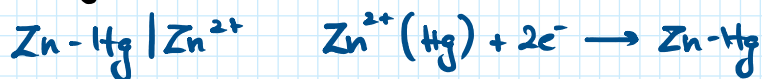


Q - quinone
QH₂ - hydroquinone

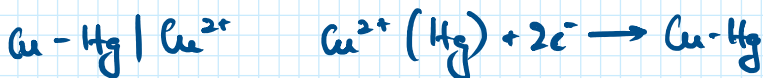


$$E = E^{\circ} - \frac{0.0591}{2} \log \frac{[OH_2]}{[Q][H^+]^2}$$

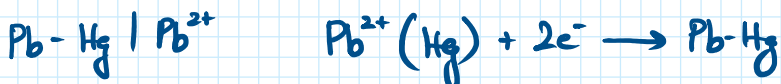
⑤ Amalgam electrode



$$E = E^0 - \frac{0.0591}{2} \log \frac{[Zn-Hg]}{[Zn^{2+}]}$$



$$E = E^0 - \frac{0.0591}{2} \log \frac{[Cu \cdot H_2]}{[Cu^{2+}]}$$



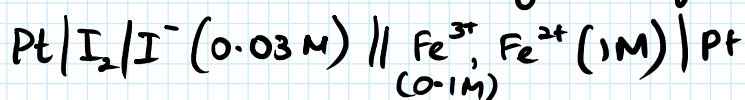
$$E = E^{\circ} - \frac{0.0591}{2} \log \frac{[Pb-Hg]}{[Pb^{2+}]}$$

⑥ Ion selective electrodes

Eg: glass electrode

PROBLEMS

① Calculate E_{cell} , E°_{cell} at 25°C for the following cell



$$E^{\circ}_{\text{Fe}^{3+}/\text{Fe}^{2+}} = 0.77 \text{ V (cathode)}$$

$$E^{\circ}_{\text{I}_2/\text{I}^{-}} = 0.54 \text{ V (Anode)}$$



$$Q = \frac{[\text{Fe}^{2+}]^2}{[\text{I}^{-}]^2 \times [\text{Fe}^{3+}]^2}$$

$$= \frac{1^2}{(0.03)^2 (0.1)^2}$$

$$E^{\circ}_{\text{cell}} = E^{\circ}_{\text{c}} - E^{\circ}_{\text{a}}$$

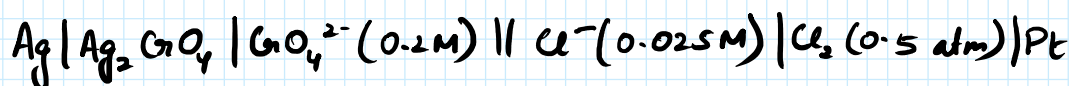
$$= 0.77 - 0.54$$

$$= 0.23 \text{ V}$$

$$E_{\text{cell}} = E^{\circ}_{\text{cell}} - \frac{0.0591}{2} \log \left(\frac{1^2}{(0.03)^2 (0.1)^2} \right)$$

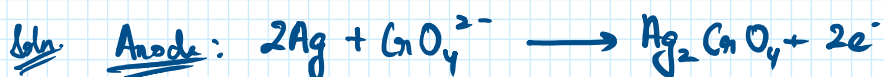
$$= \underline{\underline{0.08 \text{ V}}}$$

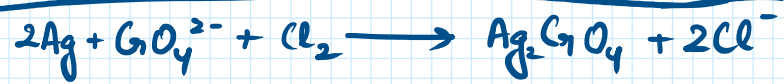
② Calculate E_{cell} , E°_{cell} at 25°C for:



$$E^{\circ}_{\text{Ag}_2\text{CrO}_4/\text{Ag}} = 0.446 \text{ V (Anode)}$$

$$E^{\circ}_{\text{Cl}_2/\text{Cl}^{-}} = 1.359 \text{ V (Cathode)}$$





$$E_{\text{cell}}^{\circ} = E_{\text{cathode}}^{\circ} - E_{\text{anode}}^{\circ}$$

$$= 1.359 - 0.446$$

$$= \underline{\underline{0.913 \text{ V}}}$$

$$E_{\text{cell}} = E_{\text{cell}}^{\circ} - \frac{0.0591}{2} \log \frac{[\text{CrO}_4^{2-}]}{[\text{Cl}^-]}$$

$$= 0.913 - \frac{0.0591}{2} \log \left(\frac{0.2}{0.025} \right)$$

$$= 0.913 - 0.027$$

$$= \underline{\underline{0.886 \text{ V}}}$$