

Quiz: Ch 19-20 Version M Key

$$1. \text{ a) } \Delta S^\circ = S^\circ_{\text{prod}} - S^\circ_{\text{react}} = 2(111) - [2(28) + 3(223)] = 222 - 725 = -503$$

$$\underline{\Delta S^\circ = -503 \text{ J/K} \cdot \text{mol}}$$

$$\text{b) } E^\circ_{\text{cell}} = E^\circ_{\text{red (cat)}} - E^\circ_{\text{red (an)}} \\ = 1.36 - (-1.66)$$

$$\underline{E^\circ_{\text{cell}} = 3.02\text{V}}$$

$$\text{c) } \Delta G^\circ = -nFE^\circ_{\text{cell}} \\ = -6(96500)(3.02) \\ = -1748580$$

$$\underline{\Delta G^\circ = -1750 \text{ kJ/mol}}$$

$$\text{d) } \Delta G^\circ = \Delta H^\circ - T\Delta S^\circ \\ -1750 \text{ kJ} = \Delta H^\circ + 298(0.503)$$

$$\Delta H^\circ = -1900 \text{ kJ/mol}$$

$$\Delta H^\circ = -1900 = 2(\Delta H_f) - 0$$

$$\Delta H_f = -949 \text{ kJ}$$

$$\underline{\Delta H_f = -949 \text{ kJ/mol}}$$

$$\text{e) } 180 \text{ s} * 50\text{C} / \text{s} * 1 \text{ F} / 96500 \text{ C} * 2 \text{ mol Al} / 6 \text{ F} = \underline{0.031 \text{ mol}}$$

$$\text{f) } \Delta G = \Delta G^\circ + RT \ln Q \\ -1450 \times 10^3 = -1750 \times 10^3 + 8.314(298) \ln Q$$

$$121 = \ln Q$$

$$Q = 3.86 \times 10^{52}$$

$$\underline{Q = 0 \text{ (if assumed equilibrium) or } 4 \times 10^{52}}$$

Quiz: Ch 19-20 Version N Key

$$1. \text{ a) } E^\circ_{\text{cell}} = E^\circ_{\text{red (cat)}} - E^\circ_{\text{red (an)}} \\ = .53 - (-.74) \\ = \underline{1.27\text{V}}$$

$$\text{b) } \Delta G^\circ = -nFE \\ = -6(96500)1.27 \\ = -735330$$

$$\underline{\Delta G^\circ = -735 \text{ kJ/mol}}$$

$$\text{c) } \Delta S^\circ = 2(102) - [2(24) + 3(116)] \\ = 204 - 396 = -192$$

$$\underline{\Delta S^\circ = -192 \text{ J/K}}$$

$$\text{d) } \Delta G = \Delta H - T\Delta S \\ -735 \times 10^3 = \Delta H + 298(+192)$$

$$\Delta H = -792546 / 2 =$$

$$\underline{\Delta H_f^\circ = -396 \text{ kJ/mol}}$$

$$\text{e) } 360 \text{ s} * 40.0 \text{ C / s} * 1 \text{ F} / 96500 * 3 \text{ mol I}_2 / 6 \text{ F} = 750$$

$$\text{moles I}_2 = 0.075$$

$$\begin{aligned} \text{f) } \Delta G &= \Delta G^\circ + RT \ln Q \\ -1750 \times 10^3 &= -735 \times 10^3 + RT \ln Q \\ -6.05 &= \ln Q \\ Q &= 0.00235 \text{ or } 0 \text{ (if assumed equilibrium)} \end{aligned}$$

Quiz: Ch 19-20 Version O Key

$$\begin{aligned} 1. \text{ a) } \text{Hg} &\rightarrow \text{Hg}_2^{2+} + 2\text{e}^- && \text{oxidation } E^\circ_{\text{red}} = .79\text{V} \\ \text{Ca}^{2+} + 2\text{e}^- &\rightarrow \text{Ca} && \text{reduction } E^\circ_{\text{red}} = -2.87\text{V} \\ E^\circ_{\text{cell}} &= E^\circ_{\text{red}}(\text{cat}) - E^\circ_{\text{red}}(\text{an}) = -2.87 - (.79) = \\ E^\circ_{\text{cell}} &= -3.66\text{V} \end{aligned}$$

$$\text{b) } \Delta G^\circ = -nFE^\circ = -2(96500)(-3.66)$$

$$\Delta G^\circ = + 706 \text{ kJ/mol}$$

$$\text{c) } \Delta S^\circ = [192.5 + 41.4] - [2(77.4) + 104.6]$$

$$233.9 - 259.4 = -25.5$$

$$\Delta S^\circ = -25.5 \text{ J/K} \cdot \text{mol}$$

$$\text{d) } \Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$$

$$706 \times 10^3 = \Delta H^\circ_{\text{rxn}} - 298(-25.5)$$

$$= \Delta H + 7599$$

$$698.781 = \Delta H_{\text{rxn}} = [\Delta H_f(\text{Hg}_2\text{Cl}_2) + 0] - [0 + -795.8]$$

$$= \Delta H_f + 795.8$$

$$\Delta H_f^\circ = -97.0 \text{ kJ/mol}$$

$$\text{e) } \Delta G = \Delta G^\circ + RT \ln Q$$

$$-600.0 \times 10^3 = 706 \times 10^3 + (8.314)(303) \ln Q$$

$$-1306 \times 10^3 = 2519 \ln Q$$

$$Q = 3.045 \times 10^{-23}$$

f) $.240 \text{ mol Hg} / 2.00 \text{ min} * 1 \text{ min} / 60 \text{ s} * 2 \text{ F} / 2 \text{ ml Hg} * 96500 \text{ C} / 1 \text{ F} = 386 \text{ A}$

Current = 193A

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