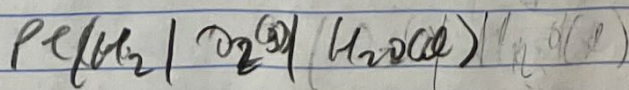
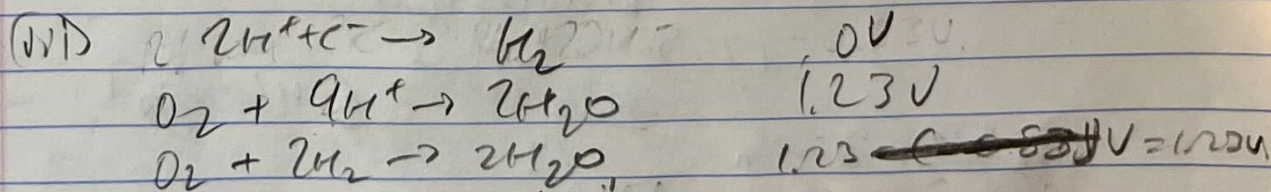
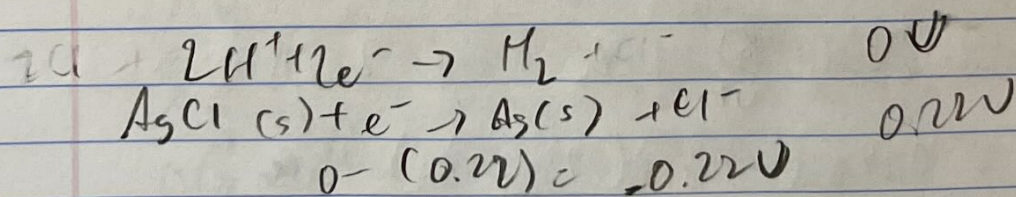
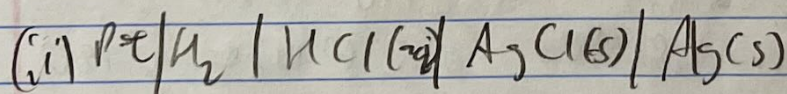
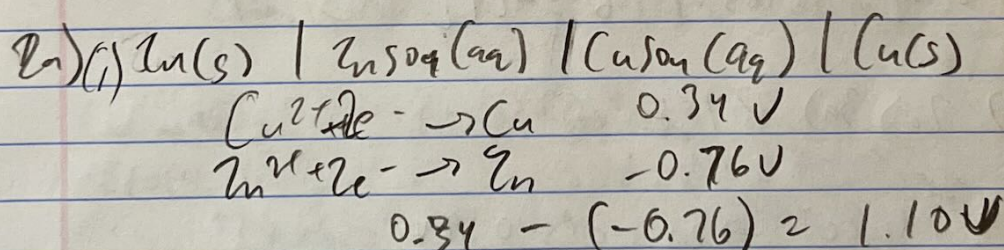
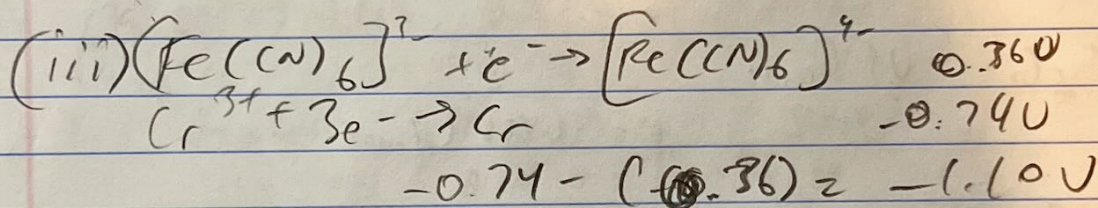
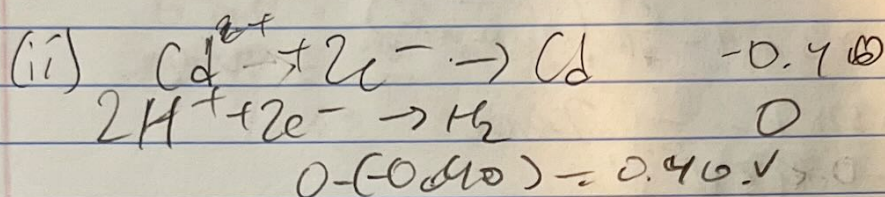
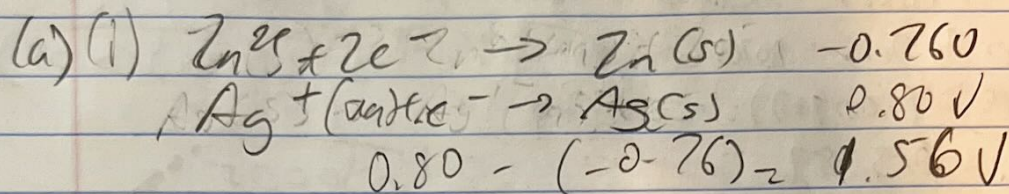


Ch 421 HW 5
6 (a) 2a) 3a) 4a)

I pledge my honor that I
have abided by the Honor
Pledge of the University of
Michigan



3a) $\text{Cd}^{2+} + \text{Ag}(s) + \text{Br}^- \rightarrow \text{Cd}(s) + \text{AgBr}(s)$

$\text{Cd}^{2+} + 2e^- \rightarrow \text{Cd}(s) \quad -0.40 \text{ V}$

$\text{AgBr}(s) + e^- \rightarrow \text{Ag}(s) + \text{Br}^- \quad 0.0713 \text{ V}$

$E^\circ_{\text{cell}} = 0.0713 - (-0.40) = 0.4713 \text{ V}$

$E_{\text{cell}} = 0.3287 \text{ V}$

$E_{\text{cell}} = -0.3287 - \frac{RT}{vF} \ln \left(\frac{1}{0.0005} \right)$

$= -0.3287 - \frac{RT}{2 \cdot F} \ln 2000$

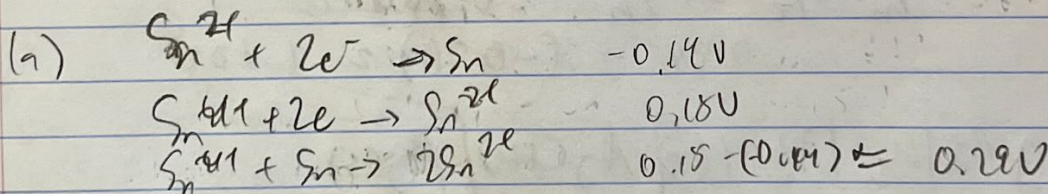
$= -0.43 \text{ V}$

4a) $\Delta G = -vFE_{\text{cell}}$

$v = 2 \quad F = 96485 \text{ C/mol}$

$\Delta G = -2 \cdot 96485 \cdot 1.16 = -222 \text{ kJ/mol}$

6p: (a) 2a) 3a) P 1,5



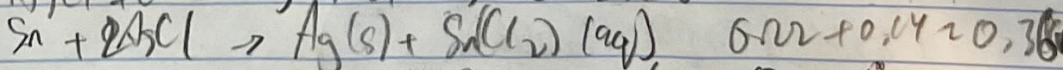
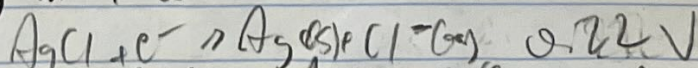
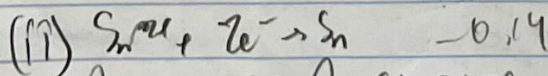
$E^\circ_{\text{cell}} = \frac{RT}{vF} \ln K \quad v = 2$

$0.29 = \frac{(8.314 \text{ J/mol} \cdot \text{K})}{2 \cdot 96485 \text{ C/mol}} \ln K$

$v = 96485 \text{ C/mol}$

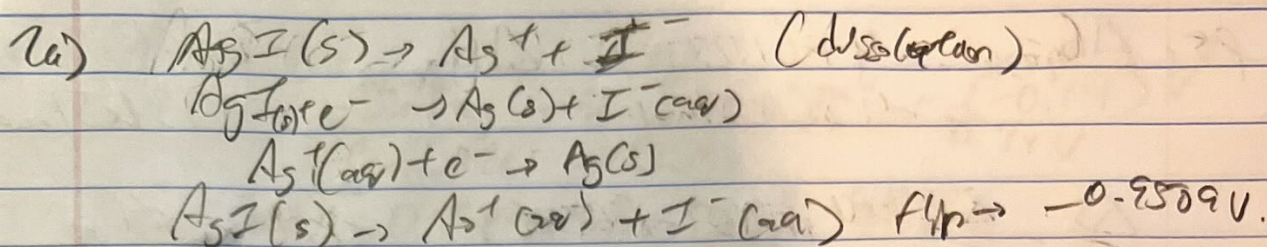
$22.588 = \ln K$

$K = e^{22.588} = 6.44 \times 10^9$

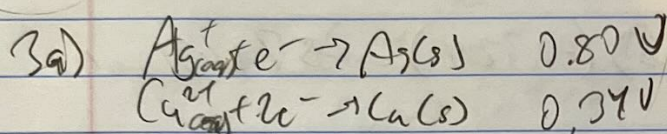


$E^\circ_{\text{cell}} = \frac{RT}{vF} \ln K \Rightarrow \ln K = 28.037 \Rightarrow K = 1.5 \times 10^{12}$

v22



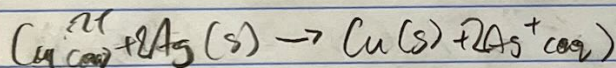
$\sqrt{2}$
 $E^\circ_{\text{cell}} = \frac{RT}{nF} \ln K$
 $-0.9509 = \frac{25.7 \text{ mV}}{1} \ln K$
 $\ln K = -37.02 \Rightarrow K = 8.29 \times 10^{-17}$



For an $\text{Ag}(s)$ eq. $n=2$

$0.34 \text{ V} - 0.80 \text{ V} = -0.46 \text{ V}$

$\Delta G = -nFE^\circ_{\text{cell}} = -2(96485 \text{ C/mol})(-0.46)$
 $= 89650 \text{ J/mol}$



$\Delta H = 105.58 \text{ kJ/mol}$

$\Delta S = -72.68 \text{ J/mol}\cdot\text{K}$

$\Delta G = 71.11 \text{ kJ/mol}$

$\Delta H = 2(105.58) - 64.77 = 146.39 \text{ kJ/mol}$

$\Delta G = 2(71.11) - 65.49 = 76.73 \text{ kJ/mol}$

$\Delta S = 2(-72.68) - (-99.6) = -244.96 \text{ J/mol}\cdot\text{K}$

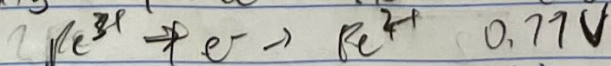
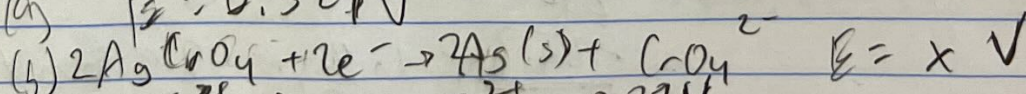
$\Delta G = \Delta H - T\Delta S$

$\Delta G = 146.39 - (298 + 35)(\frac{244.96}{1000}) = 76.94 \text{ kJ/mol}$

PI $\Delta G = -nFE^\circ \quad n=2$

$-67800 = -2(96485 \text{ C/mol})(E)$

(a) $E = 0.324 \text{ V}$



$0.77 - (x) = 0.324 \text{ V}$

$x = 0.446 \text{ V}$

P5. $\Delta G_{293K} = -4F(1.2335) = -476 \text{ kJ/mol}$ $\Delta G_{303K} = -4F(1.2251) = -473 \text{ kJ/mol}$

$$\frac{\Delta S}{nF} = \frac{\Delta E_{\text{cell}}}{\Delta T} = \frac{1.2251 - 1.2335}{303 - 293} = -8.4 \times 10^{-4} \text{ V/K}$$

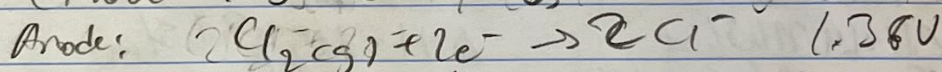
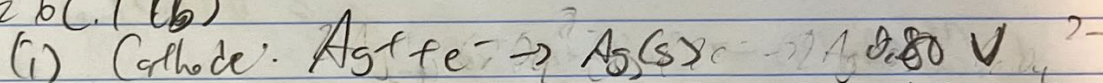
$$\Delta S = 4F(-8.4 \times 10^{-4}) = -324 \text{ J/mol K}$$

$\Delta H_{293K} = -476 + (293)(-0.324) = -570 \text{ kJ/mol}$

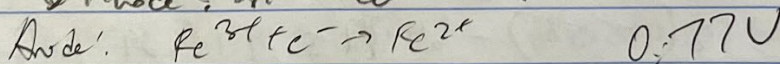
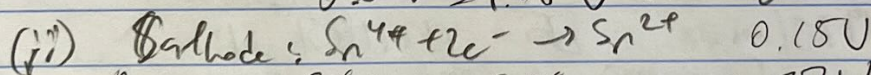
$\Delta H_{303K} = -473 \text{ kJ/mol} + 303(-0.324) = -571 \text{ kJ/mol}$

Bonus.

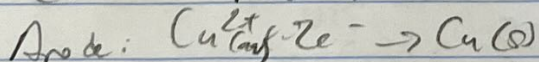
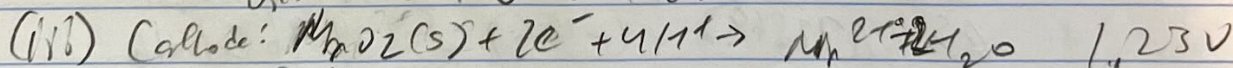
E6C.1(b)



$$0.80 \text{ V} - 1.36 \text{ V} = -0.56 \text{ V}$$



$$0.15 - 0.77 \text{ V} = -0.62 \text{ V}$$



$$1.23 - 0.34 = 0.89 \text{ V}$$

E6C5(a) $\Delta E_{\text{cell}} = -\frac{RT}{nF} \ln Q$

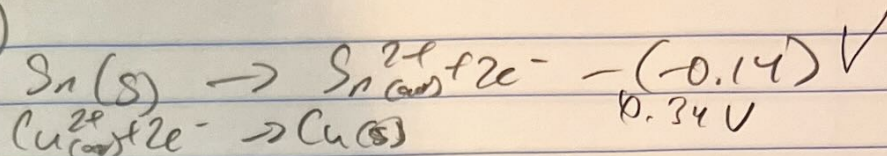
$$= -\frac{RT}{2F} \ln\left(\frac{Q}{100}\right)$$

$$= -\frac{25.7 \text{ mV}}{2} \ln\left(\frac{1}{100}\right) = 29.6 \text{ mV}$$

E6C5(b). $\Delta E_{\text{cell}} = -\frac{RT}{3F} \ln\left(\frac{80}{6}\right) = -\frac{25.7 \text{ mV}}{3} \ln 13.3 = -20.7 \text{ mV}$

E 602(b)

(i)



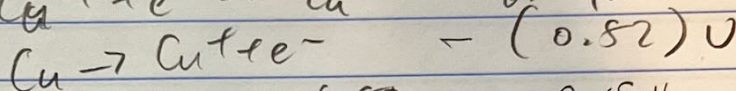
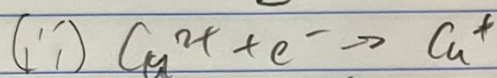
$$0.34 + 0.14 = 0.48 \text{ V}$$

$$E_{\text{cell}} = \frac{RT}{vF} \ln K \quad v=2$$

$$0.48 \text{ V}$$

$$\frac{0.0257 \text{ V}}{2} = \ln K \Rightarrow \ln K = 37.35$$

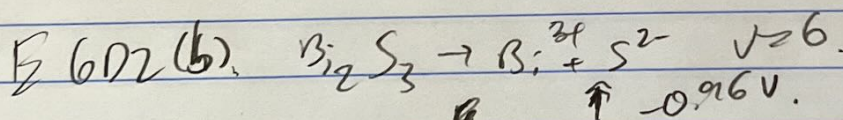
$$K = 1.67 \times 10^{16}$$



$$0.34 - 0.52 = -0.18 \text{ V} \quad v=1$$

$$-0.18 \text{ V} = \frac{RT}{F} \ln K$$

$$\frac{-0.18 \text{ V}}{0.0257 \text{ V}} = \ln K \Rightarrow \ln K = -7.00 \Rightarrow K = 9.08 \times 10^{-4}$$



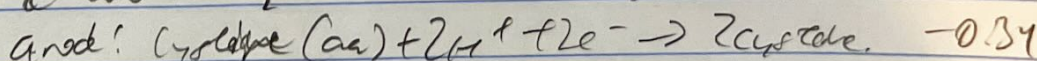
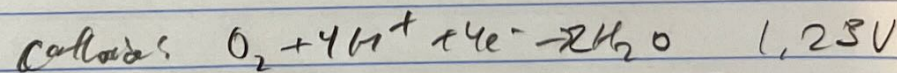
$$\uparrow -0.96 \text{ V}$$

$$-0.96 = \frac{RT}{6F} \ln K$$

$$-0.96$$

$$\frac{-0.96 \text{ V}}{0.0257 \text{ V}} = \ln K \Rightarrow \ln K = -22.4 \Rightarrow K = 4.6 \times 10^{-10}$$

E 602(b)



$$1.23 - (-0.34) = 1.57 \text{ V}$$

$$\Delta G = -vFE = -4(96485 \text{ C/mol})(1.57) = -606 \text{ kJ}$$