1.1

(a) Reduction

1st: $Cu^{2+} + 2e^- \longleftrightarrow Cu^0$

2nd: $2H_2O + 2e^- \longleftrightarrow H_2\uparrow$

PF

3rd: $Cl^- + 2e^- \longleftrightarrow Cl^0$

(b) Reduction

1st: $Sn^{4+} + 2e^- \longleftrightarrow Sn^{2+}$

PF

2nd: $2H^+ + 2e^- \longleftrightarrow H_2\uparrow$

3rd: $Sn^{2+} + 2e^- \longleftrightarrow Sn^0$

(c) Reduction

1st: $Cl^- + 2e^- \longleftrightarrow Cl^0$

2nd: $Zn^{2+} + 2e^- \longleftrightarrow Zn^0$

PF

1.2

$m_0 = 0.620\ \omega^{1/2} \nu^{-1/6}$; $\omega = 2\pi f$

$\nu = \eta/\rho \sim 0.010\ cm^2 s^{-1}$; H_2O $\eta_{20°C}$

$10\ Hz = f \rightarrow \omega = 2\pi f = 62.8\ s^{-1}$

$A = 0.70\ cm^2$

$[Fe^{2+}] = 0.010\ M$ $D_{Fe,H_2O} = 5.2 \times 10^{-6}\ cm^2/s$

$i = n^2 A m_0 \cdot c^*$

$i = 0.62\ n^2 A\ 0.01\ \omega^{1/2} \nu^{-1/6} c^*$

$i = (0.62)(1)(96{,}485\ C/mol)(0.30\ cm^2)\times$
$(5.2 \times 10^{-6}\ cm^2 s^{-1})^{2/3} (62.8\ s^{-1})^{1/2} \times$
$(1.0 \times 10^{-5}\ mol/cm^3)(0.010\ cm^2 s^{-1})^{-1/6}$

$i = 9.2 \times 10^{-4}\ A$

1.5 $f = E_{coll} \cdot A \left[1 - \exp\left(\frac{-t}{R_s \cdot C_{coll} \cdot A}\right)\right]$

$\tau = R_s \cdot C_{coll} \cdot A$

$f = 1$ when $t \to \infty$

At 63% complete f,

$0.63 \frac{E}{R_s} = \frac{E}{R_s}\left(1 - \exp\left(\frac{-t}{\tau}\right)\right)$

$t = \tau$

So:

$R_s(\Omega)$	$\tau(\mu s)$	$3\tau(\mu s)$
1	2	6
10	20	60
100	200	600

1.6

$i = 70$ mA

i (mA)	v (V s^{-1})
0.04	0.02
2	1
40	20

1.7 $A^{3+} + 2e^- \rightleftharpoons A^+$ $E^{0\prime} = -0.500\,V$ vs. NHE

$[A^{3+}] = 2.00 \times 10^{-3} \frac{mole}{L}$ or $2.00 \times 10^{-6} \frac{mole}{cm^3}$

$[A^+] = 1.00 \times 10^{-6}$ mole/cm³

XS SE → No migration!

$i_{lim,c} = -4.00 \times 10^{-6}$ A $\quad i_{lim,a} = 2.40 \times 10^{-6}$ A

(a.) E_{y_2} vs. NHE = ??

$$E_{y_2} = E^{0\prime} - \frac{RT}{nF} \ln \frac{m_0}{m_R}$$

$$m_R = -i_{L,a} / nFAC_R^*$$

$$m_0 = i_{L,c} / nFAC_0^*$$

$$\frac{m_0}{m_R} = -\frac{i_{L,c}}{i_{L,a}} \cdot \frac{C_R^*}{C_0^*}$$

$$E_{1/2} = -0.500 - \frac{RT}{nF} \ln \frac{i_{L,c}\, C_R^*}{-i_{L,a}\, C_0^*}$$

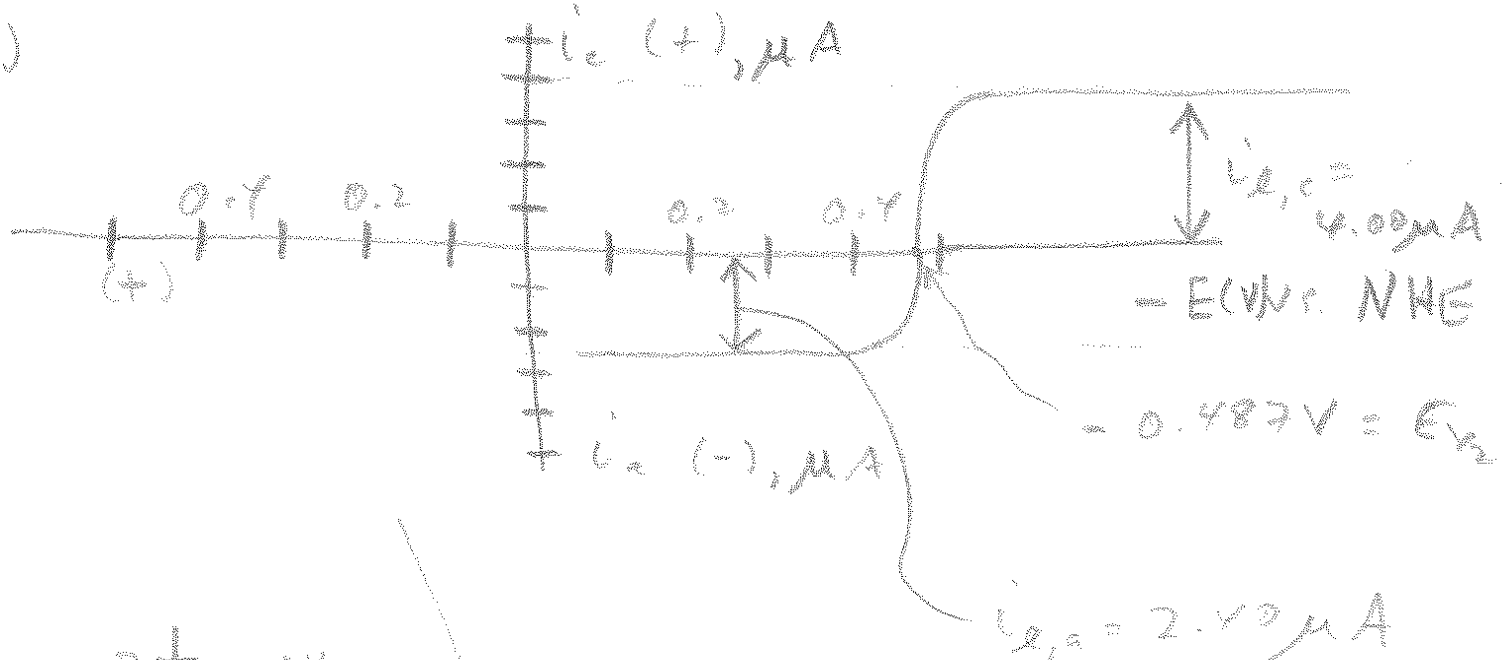
$$E_{1/2} = -0.500 - \frac{RT}{nF} \ln \frac{(4.00\times10^{-6}\,A)(1.00\times10^{-6}\ mole/cm^3)}{(2.40\times10^{-6}\,A)(2.00\times10^{-6}\ mole/cm^3)}$$

$$E_{y_2} = -0.500 - \frac{RT}{nF}(-0.1823) = -0.500 + 0.013$$

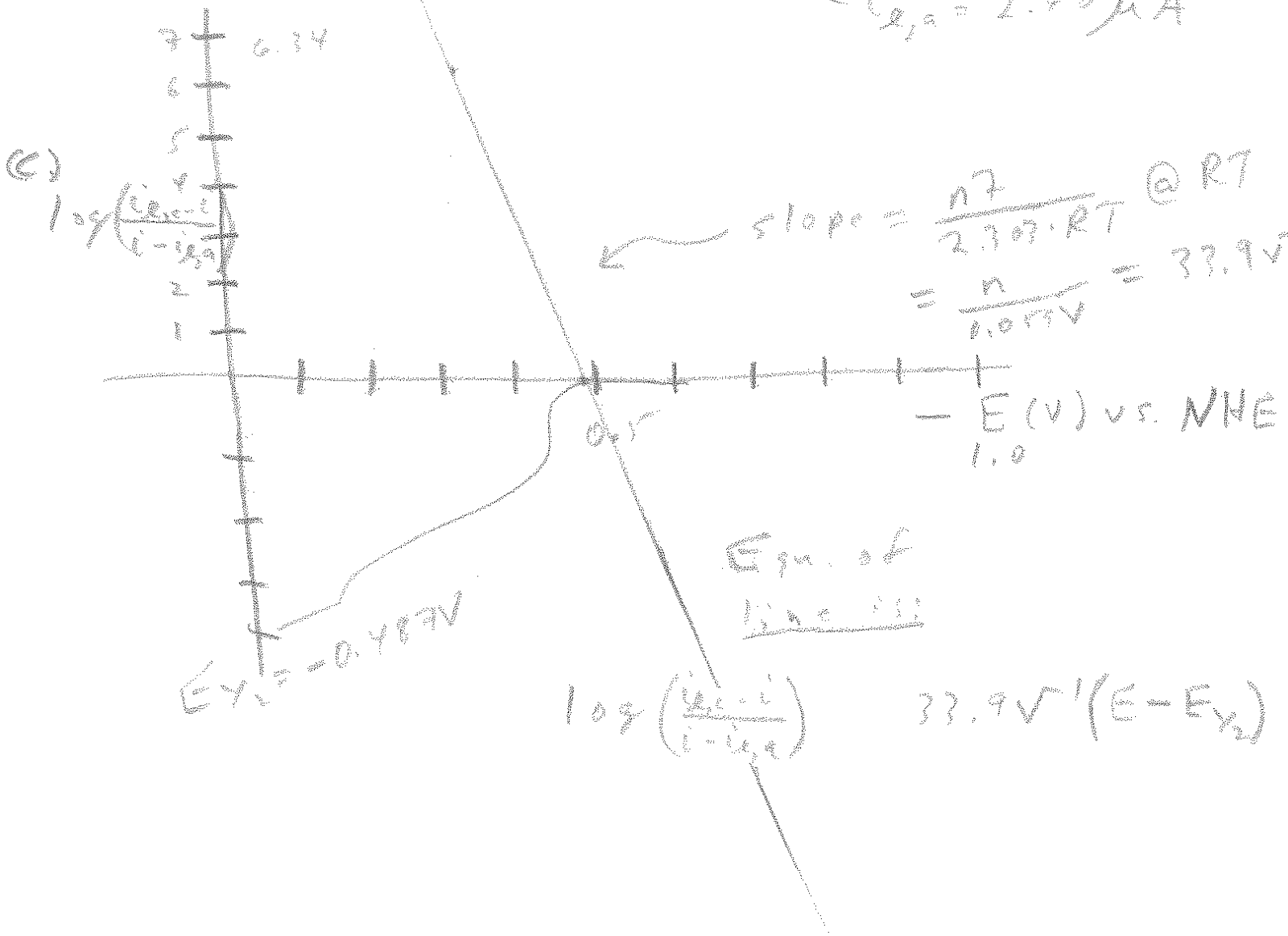
$$\boxed{E_{y_2} = -0.487\ V \text{ vs. NHE}}$$

1.7 (cont'd)

(b)



(c)



$\leftarrow$ slope $= \frac{n\mathcal{F}}{2.30 \cdot RT}$ @ RT

$= \frac{n}{0.059\,V} = 33.9\,V^{-1}$

E_{rev} of Ferricinium

$\log\left(\frac{i_a - i}{i - i_c}\right) = 33.9\,V^{-1}(E - E_{rev})$