1) $\frac{1}{V}\frac{d_iS}{dt} = \frac{1}{V}\frac{d\xi}{dt}\frac{A}{T}$ $\quad k_F = k_r = k$

$$A = \mu_x - \mu_y = \mu_x^0 + RT\ln a_x - \mu_y^0 - RT\ln a_y$$

$$= -\Delta G^0_{rxn} + RT\ln\frac{a_x}{a_y}$$

$$= +RT\ln K_{eq} +$$

$$= +RT\ln\frac{k_F}{k_r} +$$

$$= RT\ln\frac{k_F a_x}{k_r a_y} = RT\ln\frac{R_F}{R_r}$$

$$\frac{1}{V}\frac{d\xi}{dt} = (R_F - R_r)$$

So $\frac{1}{V}\frac{d_iS}{dt} = (R_F - R_r)\frac{RT\ln\frac{R_F}{R_r}}{T}$

$$= \{\tfrac{1}{2}([X]_0 + [Y]_0) + \tfrac{1}{2}([X]_0 - [Y]_0)e^{-2kt} - \tfrac{1}{2}([X]_0 + [Y]_0) + \tfrac{1}{2}([X]_0 - [Y]_0)e^{-2kt}\}\, R\ln\frac{i + je^{-2kt}}{i - je^{-2kt}}$$

$$= 2je^{-2kt}\ln\frac{i + je^{-2kt}}{i - je^{-2kt}} \checkmark$$

2) integrate $d\mu = \bar{V}dp$ @ const T

assume $\bar{V}$ is constant $\quad \mu\Big|_P^{P+\Pi} = \bar{V}\left(p'\Big|_P^{P+\Pi}\right)$

$$\rightarrow \mu(P+\Pi) - \mu(P) = \bar{V}(P+\Pi-P) = \bar{V}\Pi$$

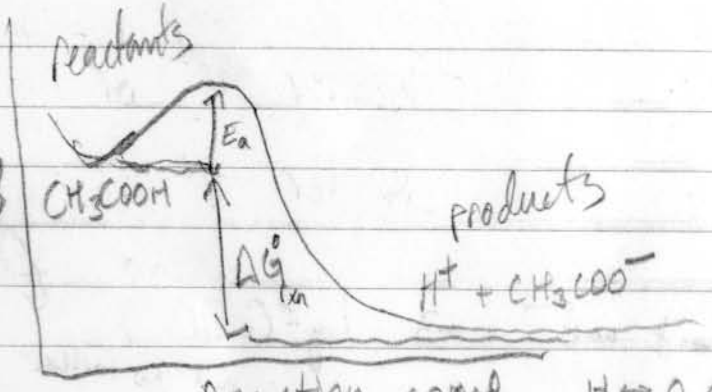
$$\rightarrow \mu(P+\Pi) = \mu(P) + \bar{V}\Pi \checkmark$$

3) $\rightarrow \left(\frac{\partial\left(\frac{-RT\ln K}{T}\right)}{\partial T}\right)_P = \frac{-\Delta H}{T^2}$ $\quad$ integrate

$$-R\cdot\int_{T_1}^{T_2} d(\ln K) = -\Delta H\int_{T_1}^{T_2}\frac{dT}{T^2}$$

$$-R\cdot\left(\ln K(T_2) - \ln K(T_1)\right) = -\Delta H\left(-\frac{1}{T_2} + \frac{1}{T_1}\right)$$

$$\ln\frac{K(T_2)}{K(T_1)} = -\frac{\Delta H}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$$

4) 

5) Diffusion, D, and friction, γ, coefficients

6) ii

7) it boils at a lower T
adding salt increases T of boiling
(cooks the spaghetti faster)

8) 1st

9) $\sqrt{3.0\times10^{-20}} = [Pb^{2+}] = (O^{2-})$
$= 1.732\times10^{-10}$

10) because $\mu_{gas} = \mu_{liq}$ for two phases in equilibrium, which is the case all along this isotherm, $\Delta\mu = \mu_{liq} - \mu_g = 0$

$d\mu = \Delta\mu = \int \bar{V} dp$ (see #2) and $d\mu = 0$

11) $+3$ for $\ln K = \frac{nFV_0}{RT}$ w/ 2 e^- transf
$+2$ " " "
$+1$ " " = sign wrong

12) μ_{pure} vs $\mu_{mix} = \mu_{pure} + RT\ln x_i$

$\mu_{pure} - \mu_{mix} = RT\ln x_i$ $\Delta G_{mix} = RT\sum x_i \ln x_i$ (to scale for each comp.)

13) $\left(\frac{\frac{1.89\,g}{M\ g/mol}}{0.0785\,kg}\right) \frac{2.4\ °C/molal}{0.64} = \frac{0.64}{0.64}$

$\frac{1}{M} = 0.011076$

$M = 90.3\ g/mol$

14) $k = k_0 e^{-E_a/RT} = 7.9 \times 10^{10}\ M^{-1}s^{-1}\ e^{\frac{-23000\ J/mol}{8.314 \cdot 300\,K}}$

$= 7.9 \times 10^{10}\ M^{-1}s^{-1}\ e^{-9.22}$

15) C