Pb # 4. a) $U_0 = 199$ kcal/mole

$$= \frac{199 \times 4186}{6.02 \times 10^{23}} = 1.38 \times 10^{-18}\ \text{J}/\ Li^{+}Cl^{-}\ \text{pair}$$

$$U_0 = -\frac{\alpha k e^2}{r_0}\left(1 - \frac{1}{m}\right) \Rightarrow \frac{|U_0| r_0}{\alpha k e^2} = 1 - \frac{1}{m}$$

$r_0 = 0.257$ nm

$\alpha = 1.7476$

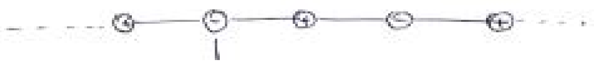
$$\Rightarrow m = \frac{1}{1 - \frac{|U_0| r_0}{\alpha k e^2}} = 8.39 \simeq 8$$

b) $m = 9$ $\quad \% m = 12.5\%$

$U_0 = 1.39 \times 10^{-18}$ J/ $Li^{+}Cl^{-}$ pair

$\% U_0 = 0.72\%$ $\Rightarrow$ U_0 is not very sensitive to to a change in m.

Pb # 5.



$$U = -\frac{ke^2}{r} - \frac{ke^2}{r} + \frac{ke^2}{2r} + \frac{ke^2}{2r} - \frac{ke^2}{3r} - \frac{ke^2}{3r} + \cdots$$

$$U = -\frac{2ke^2}{r}\left[1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \cdots\right]$$

We know that $\ln(1+x) = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \cdots$.

$\Rightarrow$ take $x = 1$ $\Rightarrow U = -\frac{2ke^2}{r}\ln 2 = -\frac{\alpha k e^2}{r}$

$$\Rightarrow \boxed{\alpha = 2\ln 2}$$