Chem 311 Name:
Fall 2007
Quiz 6

The following cell was constructed and produced a cell voltage of 0.588 V. Calculate the concentration of the NaI(aq).

$Pb_{(s)} \mid PbI_{2(s)} \mid NaI_{(aq)} \parallel NaCl_{(aq)}(0.100\ M) \mid AgCl_{(s)} \mid Ag_{(s)}$

$PbI_{2(s)} + 2e^- \leftrightarrow Pb_{(s)} + 2I^-$ $E^0 = -0.366$ V
$AgCl_{(s)} + e^- \leftrightarrow Ag_{(s)} + Cl^-$ $E^0 = 0.222$ V

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$E = E_+ - E_- = 0.588$ V

$E_+ = E^0_+ - 0.05916 \log [Cl^-] = 0.222 - 0.05916 \log(0.100) = 0.281$ V

$E_- = E^0_- - 0.05916/2 \log [I^-]^2 = -0.366 - 0.05916/2 \log([I^-])^2$

$0.588 = 0.281 - \{-0.366 - 0.05916/2 \log([I^-])^2\}$

$10^{\{2*(.588-.281-.366)/0.05916\}} = [I^-]^2 = 0.0100$

$[I^-] = 0.100$ M

Or

$E = (E^0_+ - E^0_-) - 0.05916/2 \log [I^-]^2/[Cl^-]^2$
$0.588 = (0.222 - (-.366)) - 0.05916/2 \log [I^-]^2/[0.100]^2$
$0.000 = 0.05916/2 \log [I^-]^2/[0.100]^2$
$0.000 = \log [I^-]^2/[0.100]^2$
Therefore, $[I^-] = [Cl^-] = 0.100$ M