DEPARTMENT OF CHEMISTRY
Midterm Examination

Chemistry 2351 (Inorganic Chemistry I)

27 February, 2014

Name: _____

Student ID Number:_____

Answer questions in the space provided. You have a maximum of **80 minutes**. Use the back of the page for scrap paper or if you need more space to answer a question. There are 4 pages, including this cover page. There are 23 points on the test.

Some formulae and constants you might find useful:

$$\Delta H_{\mathrm{L}}^{\circ} = \frac{N_{\mathrm{A}} z_{\mathrm{A}} z_{\mathrm{B}} e^2}{4\pi\varepsilon_0 d}\left(1 - \frac{d^*}{d}\right)\mathcal{A} \qquad \text{(Born-Meyer Equation)}$$

$$\Delta H_{\mathrm{L}}^{\circ} = \frac{n z_{\mathrm{A}} z_{\mathrm{B}}}{r_{\mathrm{A}} + r_{\mathrm{B}}}\left(1 - \frac{d^*}{r_{\mathrm{A}} + r_{\mathrm{B}}}\right)\mathcal{K} \qquad \text{(Kapustinskii Equation)}$$

$$\Delta E = \Delta E^{\circ} - \frac{RT}{nF}\ln Q = \Delta E^{\circ} - \frac{0.0592}{n}\log Q$$

$$E(\mathrm{X}^+,\mathrm{X}) = E^{\circ}(\mathrm{X}^+,\mathrm{X}) - \frac{0.0592\nu}{n}\mathrm{pH}$$

$$E^{\circ} = \frac{(nE^{\circ})' + (nE^{\circ})'' + \cdots}{n' + n'' + \cdots}$$

$\Delta G° = -nF\Delta E°$

$\Delta G° = -RT\ln K_{\mathrm{eq}}$

lattice type	*Madelung Constant ($\mathcal{A}$)*	
caesium chloride (CsCl)	1.76267	
rock salt (NaCl)	1.74756	
rutile (TiO_2)	2.3850	
fluorite (CaF_2)	2.51939	
sphalerite (ZnS cubic)	1.63805	
wurtzite (ZnS hexagonal)	1.64132	

$N_{\mathrm{A}} = 6.022 \times 10^{23}$ mol^{-1}
$d^* = 0.345$ Å
$\mathcal{K} = 1.21$ MJ Å mol^{-1}
$e = 1.6022 \times 10^{-19}$ C
$\varepsilon_0 = 8.8542 \times 10^{-12}$ C^2 J^{-1} m^{-1}
Å $= 1 \times 10^{-10}$ m
$F = 96\,485$ C mol^{-1}
R = 8.315 J K^{-1} mol^{-1} = 0.0821 L atm K^{-1} mol^{-1}