

Activity Worksheet
CHEM 212

1. Write the definition of ionic strength in words and state the equation.

Measure of the total ions in solution

$$\mu = \frac{1}{2} (C_1 Z_1^2 + C_2 Z_2^2 + C_3 Z_3^2 + \dots)$$

C_i = concentration

Z_i = charge

2. What is the effect of increased ionic strength (and increasingly charged ionic atmosphere) on the solubility of sparingly soluble salts?

$\uparrow \mu \rightarrow \uparrow$ solubility

this is because as ionic strength increases, γ^{\pm} dec.

Thus $K_{sp} = [\text{anion}] \gamma^{\pm} [\text{cation}] \gamma^{\pm}$, thus to satisfy K_{sp} ,

3. What is an ionic atmosphere and why is it important? increase

as the ionic strength increases, the repulsive or attractive charges between any two ions is decreased. The increased number of ions in solution, they interact less intensely and ion + atmosphere contains less net charge.

4. Define activity coefficient in words. Why don't we always use activities instead of concentration?

$\gamma^{\pm} \equiv$ activity coefficient

indicates deviation from ideality or the reference state.

At $\mu < 0.1M$, activity \approx concentration

so its easier to use concentration & ignore γ^{\pm} which

5. State the Extended Debye Huckel equation, which can be used to calculate the activity coefficient. is hard to know.

$$\log \gamma = \frac{-0.51 z^2 \sqrt{\mu}}{1 + \left(\frac{a \sqrt{\mu}}{305} \right)}$$

a = ion size

μ = ionic strength

γ^{\pm} = activity coefficient

6. Under what conditions can you assume $A=[C]$ or $\gamma=1$ for the following systems?
Neutral molecules (eg benzene)

always $\gamma=1$ $A=[C]$

Gases

pressures < 1 bar γ or fugacity $= 1$

High ionic strength

$[C] < 0.1$ M

Dilute solutions

$\gamma \approx 1$

Solids

always $\gamma=1$ for a pure solid
perfect crystal

aqueous solns

$\gamma \approx 1$ for $[\text{soln}] < 0.1$ M