

CONCEPT: DAVIES EQUATION

We learned that the activity coefficient and ionic strength of a solution could be closely and accurately related by using the extended *Debye-Huckel equation*:

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

When the size parameter of the ion is unknown we can instead use the *Davies Equation*.

- Because of the lack of a size parameter this formula is most useful for monovalent ions.

$$\log \gamma = -0.51z^2 \left(\frac{\sqrt{\mu}}{1 + \sqrt{\mu}} - 0.3\mu \right)$$

Ionic Strength	Ionic Charge (z)		
	± 1	± 2	± 3
0.001	0.97	0.87	0.73
0.005	0.93	0.74	0.51
0.010	0.90	0.66	0.40
0.050	0.82	0.45	0.16
0.100	0.78	0.36	0.10
0.200	0.73	0.28	0.06
0.500	0.69	0.23	0.04
0.700	0.69	0.23	0.04

From the *Davies Equation*, all ions with the same magnitude in charge will have the same activity coefficient.

EXAMPLE: Calculate the activity coefficient of Ca^{2+} in 0.025 M $\text{Ca}_3(\text{PO}_4)_2$.

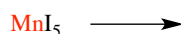
CONCEPT: DEPENDENCE OF SOLUBILITY ON PH

Recall that ionic compounds are composed of an anion and cation, either of which can create an acidic, basic or neutral solution.

Cations \oplus

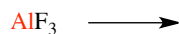
□ Transition Metals

___ or higher charge will be acidic, less than ___ will be neutral



□ Main Group Metals

___ or higher charge will be acidic, less than ___ will be neutral



□ Positive Amines

Positively charged amines are acidic



Cations can create solutions that are either acidic or neutral.

- _____ the pH increases the solubility of sparingly acidic salts.

Anions \ominus

□ Add an H^+ to the anion and if you create a weak acid then your negative ion is basic.



□ Add an H^+ to the anion and if you create a strong acid then your negative ion is neutral.



Anions can create solutions that are either basic or neutral.

- _____ the pH increases the solubility of sparingly basic salts.

Amphoteric

□ Acidic



□ Basic



PRACTICE: DEPENDENCE OF SOLUBILITY ON PH CALCULATIONS 1

EXAMPLE 1: BaCO_3 is the slightly soluble ionic salt that results from the reaction between Ba(OH)_2 and H_2CO_3 . Identify the effect of increasing acidity on the solubility of the given compound.

EXAMPLE 2: Which salts will be more soluble in an acidic solution than in pure water?

- a. CuBr
- b. Ag_2SO_4
- c. BaSO_3
- d. Sn(OH)_2
- e. KClO_4