Announcements

To join clicker to class today (Clickers with LCD display joins automatically):

- Turn on the Clicker (the red LED comes on).
- Push "Join" button followed by "20" followed by the "Send" button (switches to flashing green LED if successful).

- Exam scores posted on D2L
- Please report errors by next Wednesday.

- Even if the weather is nice do not forget to wear appropriate clothing to lab!

Review

- Solute Types
  - Electrolytes dissolve in water to produce electrically conducting solutions.
    - Usually salts (ionic compounds)
    - + and – ions are separately solvated

    Chang Fig 4.2
  - Non-electrolytes dissolve in water to produce non-conductive solutions.
    - Molecular compounds
    - Dissolve poorly if not polar.
- Liquids that mix are called miscible, those that don't immiscible.

Review

- % by mass or % w/w
  - =(100%)(mass solute)/(mass of sol'n)
- ppm = parts per million
  - $=(10^6 ppm)$(mass solute)/(mass of sol'n)
  - Equivalent to (mg solute)/(kg sol'n)
- ppb = parts per billion
  - $=(10^9 ppb)$(mass of solute)/(mass of sol'n)
- ppt = parts per trillion
  - $=(10^{12}$ ppt)(mass of solute)/(mass of sol'n)
- M = molarity
  - mol solute/L sol'n

How we use Molarity

- Ex: Suppose we want to react 1.0×10^{-5} moles of $CaCO_3$ (~2 mg) in the following reaction:
  - $H_2SO_4(aq) + CaCO_3(s) \longrightarrow CaSO_4(aq) + H_2O + CO_2(g)$
    - Converts $CaCO_3$ into $CaSO_4$, which is slightly water soluble.
    - How acid rain damages buildings.
  - Have a 4.5×10^{-5} M solution
  - How many mL of solution do we need?

Converting between mg/kg and M

- Molarity of $CHCl_3$ (residual from disinfection) in drinking water?
  - 2 µg/kg
  - MM($CHCl_3$)= 119.38 g/mol
  - D(H_2O@ 25 ˚C)=0.996 g/mL

mg $CHCl_3$/kg sol'n --> mol $CHCl_3$/kg sol'n-->mol $CHCl_3$/g sol'n

--> mol $CHCl_3$/mL sol'n-->mol $CHCl_3$/L sol'n

Concentration Unit Conversions

- What is the ppb of Cl^- in a 0.050 M $CaCl_2$ solution?
  - Solution density = 0.995 g/mL
  - MM(Ca^+) = 40.08 g/mol
  - MM(Cl^-) = 35.45 g/mol

Solubilities (M)

	F^-	Cl^-	NO^{3-}	SO_4^{2-}	CO_3^{2-}	S^{2-}	OH^-
Na^+	1	6	10	1	2	2	11
Mg^{2+}	2×10^{-3}	6	5	3	9×10^{-6}	RXN	3×10^{-5}
Al^{3+}	8×10^{-2}	3	8	1	-	RXN	3×10^{-4}
K^+	16	5	3	6×10^{-1}	11	high	19
Ca^{2+}	3×10^{-4}	3	5	4×10^{-3}	9×10^{-5}	3×10^{-3}	2×10^{-2}
Fe^{2+}	-	5	5	2	7×10^{-6}	1×10^{-9}	1×10^{-5}
Cu^{2+}	low	5	7	1	1×10^{-5}	1×10^{-18}	6×10^{-7}
Ag^+	14	1×10^{-5}	13	4×10^{-2}	2×10^{-4}	2×10^{-17}	1×10^{-9}
Pb^{2+}	3×10^{-3}	1×10^{-2}	2	1×10^{-4}	4×10^{-7}	1×10^{-14}	2×10^{-5}

Soluble, slightly soluble, insoluble

Solubility Vocabulary

- Unsaturated solution = a solution which can still dissolve more of the solute.
- Saturated solution = a solution in which no more solute can dissolve (solid stays on the bottom).
- Super saturated solution = a solution which temporarily has more solute in it than it can hold. A sudden shock can cause it to come out of solution.