1. Write the crystallization reaction involving Na_3PO_4

$$3 Na^+_{(aq)} + PO_4^{3-}_{(aq)} \rightarrow Na_3PO_{4(s)}$$
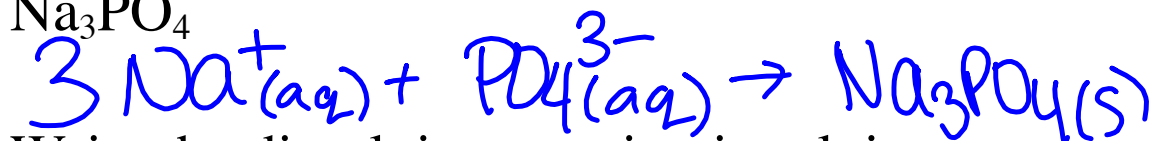
2. Write the dissolving reaction involving $C_2H_2(g)$

$$C_2H_{2(g)} \rightarrow C_2H_{2(aq)}$$
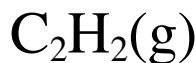
3. Write the equilibrium reaction for a saturated aqueous solution of $Fe(NO_3)_3$

$$Fe(NO_3)_{3(s)} \rightleftharpoons Fe^{3+}_{(aq)} + 3NO_3^{1-}_{(aq)}$$
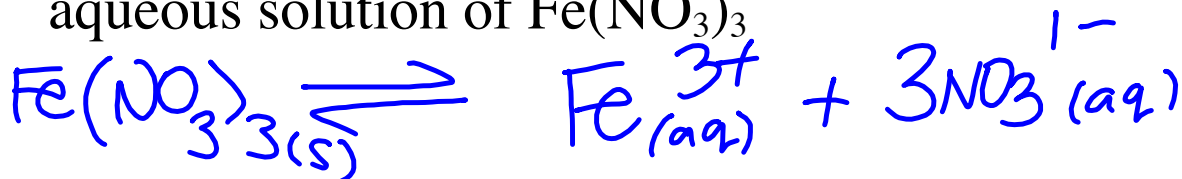
Calculating Solubility and Ion Concentration

- solubility is usually expressed as molar solubility
  with units $\frac{mol}{L}$

- can be expressed as $\frac{g}{L}$ or $\frac{g}{100 \text{ mL of solution}}$

ex. If the solubility of AgI is 3.45 g/100 mL of solution, what is the solubility in terms of g/L and mol/L?

① $\frac{g}{L} = \left(\frac{3.45g}{100mL}\right)\left(\frac{100mL}{1L}\right) = \boxed{34.5g}$

② $\frac{mol}{L} = \left(\frac{3.45g}{100mL}\right)\left(\frac{1mL}{10^{-3}L}\right)\left(\frac{mol}{234.8g}\right)$

Ag
I

$= 0.147 \frac{mol}{L}$

- to find the solubility experimentally, it is necessary to find the mass of solute required to make a known volume of a saturated solution

ex. If 0.750 L of a saturated AgCl solution contains 2.50 g AgCl, what is the molar solubility of AgCl?

$$\frac{mol}{L} = (2.50 g)\left(\frac{1\ mol}{143.4 g}\right)\left(\frac{1}{0.750\ L}\right)$$

$$= 2.32 \times 10^{-2} \frac{mol}{L}$$

ex. If the molar solubility of PbI_2 is 1.37×10^{-3} M, how many grams of PbI_2 will dissolve in 450.0 mL?
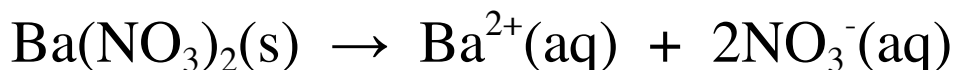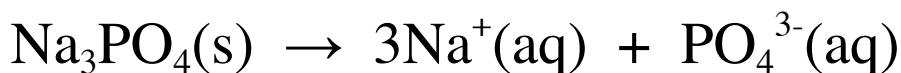
$$g = \left(1.37 \times 10^{-3} \frac{mol}{L}\right)(.450\ L)\left(\frac{461.0\ g}{mol}\right)$$
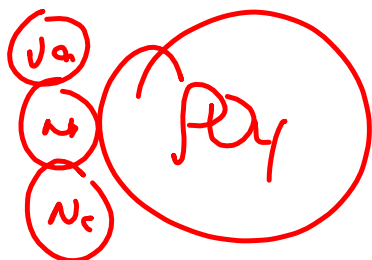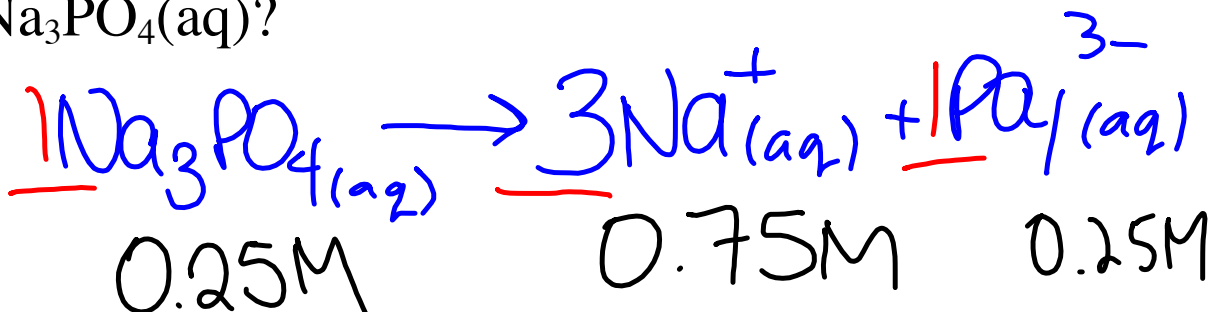
$$= 0.284 g$$

Pb =
I = 2( )

- when an ionic compound dissolves, it dissociates into ions
- you must be able to write the balanced dissociation equation and calculate the concentration of the ions in solution
- only two kinds of ions are formed (they may be polyatomic!!)

Dissociation Equation:

$$Na_3PO_4(s) \rightarrow 3Na^+(aq) + PO_4^{3-}(aq)$$

$$Ba(NO_3)_2(s) \rightarrow Ba^{2+}(aq) + 2NO_3^-(aq)$$

ex. What are the concentrations of ions in 0.25 M $Na_3PO_4(aq)$?

$$1Na_3PO_{4(aq)} \rightarrow 3Na^+_{(aq)} + 1PO_4^{3-}_{(aq)}$$

0.25M   0.75M   0.25M
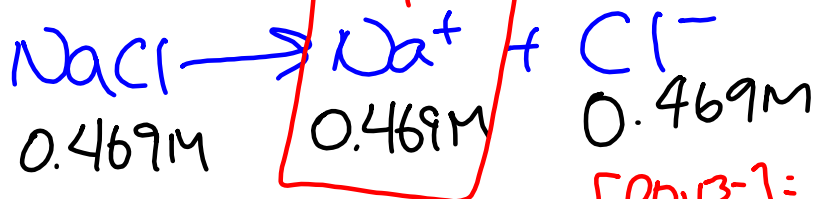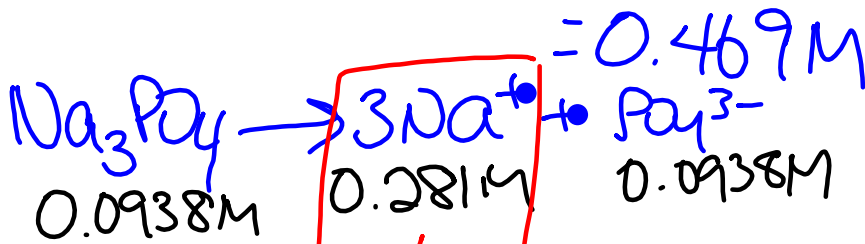
ex. What are the concentrations of ions when 150.0 mL of 0.250 M Na_3PO_4(aq) is mixed with 250.0 mL of 0.750 M NaCl(aq)?

$$C_1V_1 = C_2V_2 \qquad C_2 = \frac{C_1 V_1}{V_2}$$

C_1V_1 — Conc ($\frac{mol}{L}$) · vol (L)

C_2V_2 — V_2

① new $[Na_3PO_4] = \frac{(0.250M)(150.0mL)}{400.0mL}$

$= 0.0938M$

② new $[NaCl] = \frac{(0.750M)(250.0mL)}{400.0mL}$

$= 0.469M$

$Na_3PO_4 \longrightarrow 3Na^+ + PO_4^{3-}$
0.0938M   0.281M   0.0938M

$+$

$NaCl \longrightarrow Na^+ + Cl^-$
0.469M   0.469M   0.469M

$[PO_4^{3-}] = 0.0938M$

$[Cl^-] = 0.469M$

$[Na^+] = (0.281 + 0.469)$

$= 0.750M$