PHYS 0109 Name_____
pre-test 2

You can use your book and your notes if you wish. You **cannot** work on this assignment with a friend.

Simple Rules for the Solubility of Salts in Water (From Zumdahl, Chemistry, 3e)

1. Most nitrate (NO_3^-) salts are soluble.
2. Most salts containing the alkali metal ions (Li^+, Na^+, K^+, Cs^+, Rb^+) and the ammonium ion (NH_4^+) are soluble.
3. Most chloride, bromide and iodide salts are soluble. Notable exceptions are salts containing the ions Ag^+, Pb^{2+}, and Hg_2^{2+}.
4. Most sulfate salts are soluble. Notable exceptions are $BaSO_4$, $PbSO_4$, $HgSO_4$, and $CaSO_4$.
5. Most hydroxide salts are only slightly soluble. The important soluble hydroxides are NaOH and KOH. The compounds $Ba(OH)_2$, $Sr(OH)_2$, and $Ca(OH)_2$ are marginally soluble.
6. Most sulfide (S^{-2}), carbonate (CO_3^{2-}), chromate (CrO_4^{2-}), and phosphate (PO_4^{-3}) are only slightly soluble.

1. a. Determine the concentration of Cl^- in 35 mL of a 0.500 M $MgCl_2$.

$$0.500\ M\ MgCl_2 \times \frac{2\ mol\ Cl^-}{1\ mol\ MgCl_2} = 1.00\ M\ Cl^-$$

b. 25.0 mL of a 0.350 M NaCl solution are added to 35.0 mL of a 0.500 M $MgCl_2$ solution. Assuming the volumes are additive, determine the concentration of Cl^- in M.

$$25.0\ mL\ NaCl\ soln \times \frac{0.350\ mol\ NaCl}{1000\ mL} \times \frac{1\ mol\ Cl^-}{1\ mol\ NaCl} = 0.00875\ mol\ Cl^-$$

$$35.0\ mL\ MgCl_2 \times \frac{0.500\ mol\ MgCl_2}{1000\ mL} \frac{2\ mol\ Cl^-}{1\ mol\ MgCl_2} = 0.0350\ mol\ Cl^-$$

$$0.04375\ mol\ Cl^-$$

$$\frac{0.04375\ mol\ Cl^-}{(.025 + .035)} = 0.7292 \Rightarrow 0.729\ M\ Cl^-$$

2. Silver oxide can be removed from silver using H_2. The following equation describes the reaction.

$$H_{2(g)} + Ag_2O_{(s)} \longrightarrow H_2O_{(g)} + 2\ Ag_{(s)}$$

Is this an oxidation-reduction reaction? What is being oxidized, how many electrons are moved from what element to what element?

Yes, an electron moves from a H atom (in H_2) to an Ag^+ ion in Ag_2O

3. 0.3400 g $Sr(NO_3)_2$ are placed in a 250.0-mL volumetric flask. Water is added so that the volume is 250.0 mL. What is the concentration, in M, of the solution?

$$0.3400 \text{ g } Sr(NO_3)_2 \times \frac{1 \text{ mol } Sr(NO_3)_2}{211.70 \text{ g } Sr(NO_3)_2} = 0.001606 \text{ mol } Sr(NO_3)_2$$

$$M = 0.001606 \text{ mol}/0.250 \text{ L} = 0.006424 \text{ M}$$

4. Lead ions react with iodide to form lead(II) iodide. How many grams of NaI are required to precipitate all of the lead from 25.0 mL of a 3.5 M lead(II) nitrate solution as lead(II) iodide.

a. balanced equation

$$Pb^{2+}_{(aq)} + 2I^-_{(aq)} \longrightarrow PbI_{2(s)}$$

$$2NaI_{(aq)} + Pb(NO_3)_2 \longrightarrow PbI_{2(s)} + 2NaNO_{3(aq)}$$

b. Grams of NaI

$$25.0 \text{ mL } Pb(NO_3)_2 \times \frac{3.5 \text{ mol } Pb(NO_3)_2}{1000 \text{ mL } Pb(NO_3)_2} \times \frac{2 \text{ mol } NaI}{1 \text{ mol } Pb(NO_3)_2} \times \frac{149.89 \text{ g}}{1 \text{ mol } NaI} = 26.2307$$

$$= 26 \text{ g } NaI$$

5. 44.30 mL of a 0.100 M NaOH solution are required to neutralize 0.5649 g of an unknown diprotic acid. Determine the molar mass of the diprotic acid?

$$44.30 \text{ mL} \times \frac{0.100 \text{ mol } NaOH}{1000 \text{ mL } NaOH \text{ soln}} \times \frac{1 \text{ mol acid}}{2 \text{ mol } NaOH} = 0.002215 \text{ mol}$$

$$\frac{0.5649 \text{ g}}{0.002215 \text{ mol}} = 255.034 = 255 \text{ g/mol}$$

6. Identify the products of the following reactions and write balanced chemical equations. If no reaction occurs, write NR.

1. $H_2SO_4(aq) + Mg(OH)_2(s) \rightarrow H_2O(l) + MgSO_4(aq)$

2. $BaCl_2(aq) + Pb(NO_3)_2(aq) \rightarrow PbCl_2(s) + Ba(NO_3)_2(aq)$

3. $K_2SO_4(aq) + NaCl(aq) \rightarrow$ NR

4. $3\ NaOH(aq) + H_3PO_4(aq) \rightarrow 3\ H_2O + Na_3PO_4(aq)$

5.(Hint: a violent reaction that releases gas occurs)

$Na(s) + HCl(aq) \rightarrow NaCl(aq) + H_2(g)$

6. $HNO_3(aq) + NaCl(aq) \rightarrow$ NR