Che 111: Chapter 4 Practice Problems Key

1. Balance the following equations.

   a. ____$Fe_2O_3(s)$ + _3___ $H_2(g)$ → __2__$Fe(s)$ + __3__ $H_2O(l)$

   b. __3__$SCl_2(l)$ + __4__ $NaF(s)$ → ____ $S_2Cl_2(l)$ + ____$SF_4(g)$ + __4__ $NaCl(s)$

   c. ____ $PCl_5(s)$ + __4__ $H_2O(l)$ → ____ $H_3PO_4(aq)$ + __5__$HCl(aq)$

   d. __2__$As(s)$ + _5___$Cl_2(g)$ → ___2_ $AsCl_5(s)$

   e. _2___ $C_2H_5SH(l)$ + __9__ $O_2(g)$ → __4__$CO_2(g)$ + __6__ $H_2O(l)$ + __2__ $SO_2(g)$

   f. __2__ $N_2O_5(g)$ → __4__ $NO_2(g)$ + ____ $O_2(g)$

   g. _3___ $Mg(s)$ + __2__$Cr(NO_3)_3(aq)$ → _3___ $Mg(NO3)_2(aq)$ + __2__ $Cr(s)$

   h. _6___ $H_2O(g)$ + __4__$NO(g)$ → __5__ $O_2(g)$ + __4__ $NH_3(g)$

2. The primary use of 1,2-dichloroethane, ClCH2CH2Cl, is to make vinyl chloride, which is then converted into polyvinyl chloride (PVC) for many purposes, including plastic pipes. Balance the following equation, which describes the industrial reaction for producing 1,2-dichloroethane.

$$\_\_2\_\_C_2H_4 + \_\_4\_\_ HCl + \_\_\_\_ O_2 \rightarrow \_\_2\_\_ClCH_2CH_2Cl + \_\_2\_\_H_2O$$

3. Predict whether each of the following substances is **soluble** or **insoluble** in water.
   a. $MgSO_4$ (fireproofing) _____soluble_____
   b. barium sulfate (used in paints) _____insoluble_____
   c. $Bi(OH)_3$ (used in plutonium separation)_____insoluble_____
   d. Ammonium sulfite (used in medicine and photography)____soluble_____

4. Sodium sulfate, which is used to make detergents and glass, is one product of the reaction of sodium chloride, sulfur dioxide, water, and oxygen. The other product is hydrogen chloride. Write a balanced equation, without including states, for this reaction. (remember that some elements are described with formulas containing subscripts such as oxygen, O_2)

$$4\ NaCl + 2\ SO_2 + 2\ H_2O + O_2 \rightarrow 2\ Na_2SO_4 + 4\ HCl$$

5. Nitric acid, HNO_3, which is used to make fertilizers and explosives, is made industrially in the three steps described below. Write a balanced equation, without including states, for each of these steps.

   a. Ammonia reacts with oxygen to form nitrogen monoxide and water.

   $4\ NH_3 + 5\ O_2 \rightarrow 4\ NO + 6\ H_2O$

   b. Nitrogen monoxide reacts with oxygen to form nitrogen dioxide.

   $2\ NO + O_2 \rightarrow 2\ NO_2$

   c. Nitrogen dioxide reacts with water to form nitric acid and nitrogen monoxide

   $3\ NO_2 + H_2O \rightarrow 2\ HNO_3 + NO$

6. For each of the following pairs of formulas, predict if they would react to yield a precipitate. If there is no reaction, write, "No Reaction". If there is a reaction, write the complete equation for the reaction.

   a. 3 KOH (aq) + __$Cr(NO_3)_3$ (aq) → 3 KNO_3 (aq) + __ $Cr(OH)_3$ (s)

   b. $Mg(C_2H_3O_2)_2$ (aq) + NaCl (aq) → $MgCl_2$ (aq) + $NaC_2H_3O_2$ (aq)
      NO REACTION