CHM 151
Recitation #4, 24 September 2008

1. Nitric acid (HNO_3) is a leading industrial chemical used in the production of fertilizers and explosives. One step in the industrial production of nitric acid is the reaction of ammonia with molecular oxygen to form nitrogen monoxide (NO):

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

a) In a study of this reaction, a chemist mixed 125 g of ammonia (NH_3) with 256 g of oxygen gas (O_2) and allowed them to react to completion. Which reactant is the **limiting reagent**?
[Molar masses: NH_3 = 17.03 g/mol, O_2 = 32.00 g/mol, NO = 30.01 g/mol, H_2O = 18.02 g/mol]

b) How many **grams** of NO are produced in the above reaction, assuming complete reaction?

c) How many **grams** of excess reactant remain after the reaction is complete?

2. Which of the following compounds is a **strong** electrolyte?

a) H_2O b) N_2 c) $CaBr_2$
d) $C_6H_{12}O_6$ (glucose) e) CH_3COOH

3. According to the solubility rules, which one of the following compounds is **insoluble** in water?

a) Na_3PO_4 b) Li_3PO_4 c) $Ca_3(PO_4)_2$ d) $(NH_4)_3PO_4$ e) Cs_3PO_4

4. Which of the following is **true** when solutions of Na_2SO_4 and $Ba(OH)_2$ are mixed.

a) NaOH precipitates.
b) Na_2SO_4 precipitates.
c) $Ba(OH)_2$ precipitates.
d) $BaSO_4$ precipitates.
e) No precipitate will form.

5. Write the **net ionic equation** for the reaction of cobalt(II) sulfate and sodium sulfide is:

SOLUBLE COMPOUNDS	**INSOLUBLE EXCEPTIONS**
Compounds containing alkali metal ions (Li^+, Na^+, K^+, Rb^+, Cs^+) and the ammonium ion (NH_4^+)	None
Nitrates (NO_3^-), bicarbonates (HCO_3^-), and chlorates (ClO_3^-)	None
Halides (Cl^-, Br^-, I^-)	Halides of Ag^+, Hg_2^{2+}, and Pb^{2+}
Sulfates (SO_4^{2-})	Sulfates of Ag^+, Ca^{2+}, Sr^{2+}, Ba^{2+}, and Pb^{2+}
INSOLUBLE COMPOUNDS	**SOLUBLE EXCEPTIONS**
Carbonates (CO_3^{2-}), phosphates (PO_4^{3-}), chromates (CrO_4^-), and sulfides (S^{2-})	Compounds containing alkali metal ions and the ammonium ion
Hydroxides (OH^-)	Compounds containing alkali metal ions and the Ba^{2+} ion