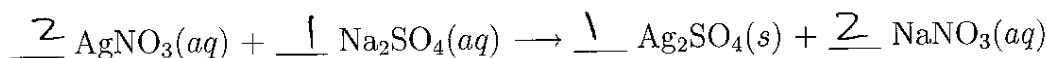
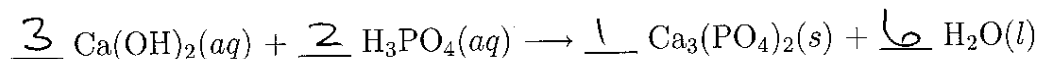


Name KEY Rec. Instr. _____

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1. [6 points] Balance the following equations:



2. [5 points] Classify each of the following aqueous solutions as a nonelectrolyte, weak electrolyte, or strong electrolyte:

HClO₄HNO₃NH₄ClCH₃COCH₃ (acetone)CoSO₄

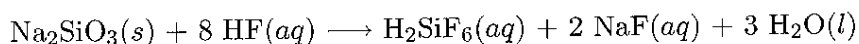
strong

strong

strong

non-electrolyte

strong

3. [19 points] Hydrofluoric acid, HF(aq), cannot be stored in glass bottles because the silicate in the glass is attacked by the HF(aq). Sodium silicate (Na₂SiO₃), for example, reacts as follows:

- (a) How many moles of HF are needed to react with 0.300 moles of Na₂SiO₃?
 (b) How many grams of NaF form when 0.500 moles of HF reacts with excess Na₂SiO₃?
 (c) How many grams of Na₂SiO₃ can react with 0.800 g of HF?

$$\textcircled{a} \frac{0.300 \text{ moles Na}_2\text{SiO}_3}{1 \text{ mole Na}_2\text{SiO}_3} \left| \frac{8 \text{ moles HF}}{\text{Chem. Eq.}} \right. = 2.4 \text{ moles HF}$$

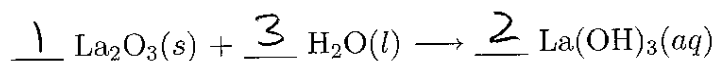
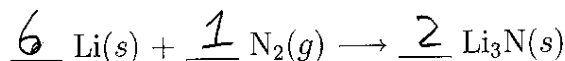
$$\textcircled{b} \frac{0.500 \text{ moles HF}}{8 \text{ moles HF}} \left| \frac{2 \text{ moles NaF}}{1 \text{ mole NaF}} \right| \frac{41.9878 \text{ g}}{1 \text{ mole NaF}} = 5.25 \text{ g HF}$$

$$\textcircled{c} \frac{0.800 \text{ g HF}}{20.006 \text{ g}} \left| \frac{1 \text{ mole HF}}{8 \text{ moles HF}} \right| \frac{1 \text{ mole Na}_2\text{SiO}_3}{1 \text{ mole Na}_2\text{SiO}_3} \left| \frac{122.067 \text{ g}}{1 \text{ mole Na}_2\text{SiO}_3} \right. = 0.610 \text{ g Na}_2\text{SiO}_3$$

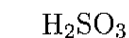
Name KEY Rec. Instr. _____

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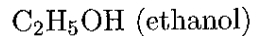
1. [6 points] Balance the following equations:



2. [5 points] Classify each of the following substances as a nonelectrolyte, weak electrolyte, or strong electrolyte in water:



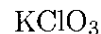
weak



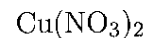
non-electrolyte



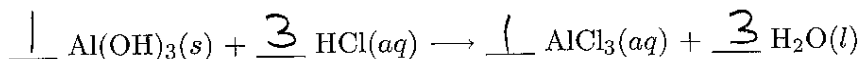
weak



strong



strong

3. [19 points] Several brands of antacids use $\text{Al}(\text{OH})_3$ to react with stomach acid, which contains primarily HCl :

(a) Balance this equation.

(b) Calculate the number of grams of HCl that can react with 0.500 g of $\text{Al}(\text{OH})_3$.(c) Calculate the number of grams of AlCl_3 and the number of grams of H_2O formed when 0.500 g of $\text{Al}(\text{OH})_3$ reacts.

$$\textcircled{b} \frac{0.500 \text{ g Al}(\text{OH})_3}{78.001 \text{ g}} \left| \frac{1 \text{ mole Al}(\text{OH})_3}{1 \text{ mole Al}(\text{OH})_3} \right| \frac{3 \text{ moles HCl}}{1 \text{ mole Al}(\text{OH})_3} \left| \frac{36.461 \text{ g}}{\text{mole HCl}} \right| = 0.701 \text{ g HCl}$$

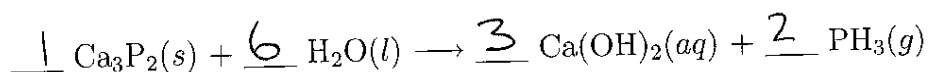
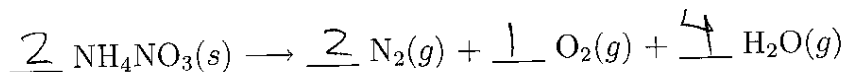
$$\textcircled{c} \frac{0.500 \text{ g Al}(\text{OH})_3}{78.001 \text{ g}} \left| \frac{1 \text{ mole Al}(\text{OH})_3}{1 \text{ mole Al}(\text{OH})_3} \right| \frac{1 \text{ mole AlCl}_3}{1 \text{ mole Al}(\text{OH})_3} \left| \frac{133.339 \text{ g}}{\text{mole AlCl}_3} \right| = 0.855 \text{ g AlCl}_3$$

$$\frac{0.500 \text{ g Al}(\text{OH})_3}{78.001 \text{ g}} \left| \frac{1 \text{ mole Al}(\text{OH})_3}{1 \text{ mole Al}(\text{OH})_3} \right| \frac{3 \text{ moles H}_2\text{O}}{1 \text{ mole Al}(\text{OH})_3} \left| \frac{18.015 \text{ g}}{\text{mole H}_2\text{O}} \right| = 0.346 \text{ g H}_2\text{O}$$

Name KEY Rec. Instr. _____

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1. [6 points] Balance the following equations:

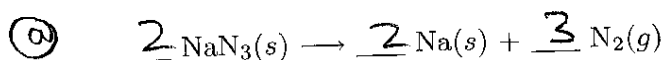


2. [4 points] An aqueous solution of an unknown solute is tested with litmus paper and found to be acidic. The solution is weakly conducting compared with a solution of NaCl of the same concentration. Which of the following substances could the unknown be:

KOH

NH₃HNO₃KClO₂H₃PO₃CH₃COCH₃ (acetone)

3. [20 points] Automotive air bags inflate when sodium azide, NaN₃, rapidly decomposes to its component elements:



(a) Balance this equation.

(b) How many moles of N₂ are produced by the decomposition of 1.50 moles of NaN₃?(c) How many grams of NaN₃ are required to form 10.0 g of nitrogen gas?(d) How many grams of NaN₃ are required to produce 10.0 ft³ of nitrogen gas if the gas has a density of 1.25 g/L? (1 liter = 0.035314 ft³)

$$\textcircled{b} \quad \frac{1.50 \text{ moles NaN}_3 \left| \begin{array}{l} 3 \text{ moles N}_2 \\ \hline 2 \text{ moles NaN}_3 \\ \text{chem eq} \end{array} \right.}{\phantom{1.50 \text{ moles NaN}_3}} = 2.25 \text{ moles N}_2$$

$$\textcircled{c} \quad \frac{10.0 \text{ g N}_2 \left| \begin{array}{l} \text{mole N}_2 \\ \hline 28,014 \text{ g} \\ \text{mw N}_2 \end{array} \right| \begin{array}{l} 2 \text{ moles NaN}_3 \\ \hline 3 \text{ moles N}_2 \\ \text{chem eq.} \end{array} \left| \begin{array}{l} 65.01 \text{ g} \\ \hline \text{mole NaN}_3 \\ \text{mw NaN}_3 \end{array} \right.}{\phantom{10.0 \text{ g N}_2}} = 16.9 \text{ g NaN}_3$$

$$\textcircled{d} \quad \frac{10.0 \text{ ft}^3 \text{ N}_2 \left| \begin{array}{l} 1 \text{ liter} \\ \hline 0.035314 \text{ ft}^3 \\ \text{ft}^3 \rightarrow \text{liter} \end{array} \right| \begin{array}{l} 1.25 \text{ g} \\ \hline \text{liter} \\ \text{density N}_2 \end{array} \left| \begin{array}{l} \text{mole N}_2 \\ \hline 28,014 \text{ g} \\ \text{mw N}_2 \end{array} \right| \begin{array}{l} 2 \text{ mole NaN}_3 \\ \hline 3 \text{ moles N}_2 \\ \text{chem eq} \end{array} \left| \begin{array}{l} 65.01 \text{ g} \\ \hline \text{mole NaN}_3 \\ \text{mw NaN}_3 \end{array} \right.}{\phantom{10.0 \text{ ft}^3 \text{ N}_2}} = 5.48 \times 10^2 \text{ g NaN}_3$$