

Chemistry 112
Second Hour Exam

Name: _____

Please show all work for partial credit

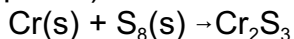
1. (13 points) What is the % composition of phosphorous in diphosphorous pentaoxide?
(If you are uncertain of the proper molecular formula, just write a formula down and solve the problem anyway.)



Mass of phosphorous	=2(30.97) = 61.94
Mass of Oxygen	=5(16.00) = 80
Total Mass	=141.94

$$\begin{aligned}\% \text{ Phosphorous} &= (\text{Mass P/ Total}) \times 100\% \\ &= 61.94/141.91 \quad \times 100\% \\ &= 43.64\%\end{aligned}$$

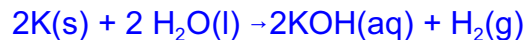
2. (12 points) Balance the following equations:



Iron reacts with oxygen to form iron(III)oxide (rust)



Solid potassium metal reacts with water to form aqueous potassium hydroxide and hydrogen (H₂) gas



3. (13 points) Given the balanced reaction equation: $2 \text{Na}(s) + \text{I}_2(g) \rightarrow 2\text{NaI}(s)$
 If I start my reaction with 10 g of Na and 10g of I_2 gas, and get 10 g of product, what was the % yield of my reaction.

If Na is limiting

$$10g \text{ Na} \times \frac{1 \text{ mole Na}}{22.99g \text{ Na}} \times \frac{2 \text{ mole NaI}}{2 \text{ mole Na}} \times \frac{149.8g \text{ NaI}}{1 \text{ mole NaI}} = 65.41g \text{ NaI}$$

If I_2 is limiting

$$10g \text{ I}_2 \times \frac{1 \text{ mole I}_2}{253.8g \text{ I}_2} \times \frac{2 \text{ mole NaI}}{1 \text{ mole I}_2} \times \frac{149.8g \text{ NaI}}{1 \text{ mole NaI}} = 11.80g \text{ NaI}$$

I_2 is smaller, so it is limiting so my theoretical yield is 11.8 g NaI
 So my % yield = (actual/theoretical) x 100%
 =(10.00/11.80) x100% = 84.7%

4. (12 points) Classify the following compounds as strong electrolytes (SE), weak electrolytes (WE) or non electrolytes (NE)

HNO_3 __SE (it's a strong acid)_____

$\text{C}_{12}\text{H}_{24}\text{O}_{11}$ (sucrose) _NE (it's not ionic so it can't make ions)_____

Ammonia (a weak base) __WE (weak base)_____

AgCl _WE (an insoluble salt)_____

AgNO_3 _SE (a soluble salt)_____

KOH __SE (Strong base)_____

5. (12 points) I am going to dissolve 5 g of iron(III) chloride in a flask to make 500mls of solution.

A. What is the molarity of iron(III) chloride in this solution?



$$\text{Molar mass} = 55.85 + 3(35.45) = 162.2\text{g}$$

$$\text{Moles} = 5 \text{ g} / 162.2 \text{ g/mole} = .03083 \text{ mole}$$

$$\text{Molarity} = \text{moles/liters} = .03083 \text{ moles}/.5\text{l} = .0617\text{M FeCl}_3$$

B. What is the molarity of the iron(III) ion in this solution?

When FeCl_3 dissolves you have the reaction

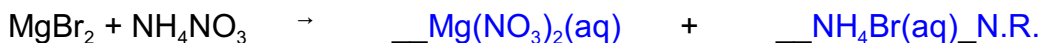


$$.0617 \text{ M FeCl}_3 = \frac{.0617 \text{ moles FeCl}_3}{\text{l}} \times \frac{1 \text{ mole Fe}^{3+}}{1 \text{ mole FeCl}_3} = \frac{.0617 \text{ mole Fe}^{3+}}{\text{l}} = .0617 \text{ M Fe}^{3+}$$

C. What is the molarity of the chloride ion in this solution?

$$.0617 \text{ M FeCl}_3 = \frac{.0617 \text{ moles FeCl}_3}{\text{l}} \times \frac{3 \text{ mole Cl}^-}{1 \text{ mole FeCl}_3} = \frac{.185 \text{ mole Cl}^-}{\text{l}} = .185 \text{ M Cl}^-$$

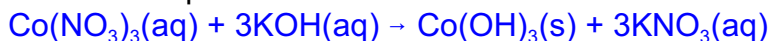
6. (12 points) Predict correct products (both soluble and insoluble) for the following precipitation reactions. Make sure you give the proper physical form for each product. If there is no solid product, mark the equation with an N.R. for no reaction.



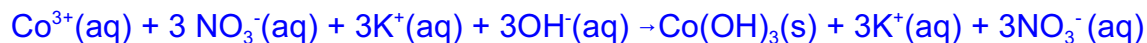
Note: I just asked for the chemical formulas of the products, not balanced equations

7. (13 points) Aqueous cobalt(III) nitrate reacts with potassium hydroxide to form solid cobalt (III) hydroxide and potassium nitrate Write this chemical reaction as a balanced equation in each of the following forms:

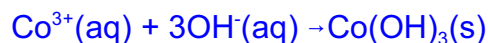
Molecular equation



Complete ionic equation

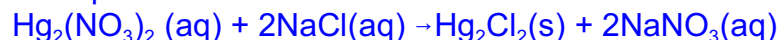


Net ionic equation



8. (13 points) I have 250 mls of 0.025M $\text{Hg}_2(\text{NO}_3)_2$ left over from a chemistry lab. I don't want to pour this mercury down the drain, so I am going to react it with NaCl to form a Hg_2Cl_2 precipitate that I can recover and dispose of by other means. How many mls of a 0.95M NaCl solution will I need to precipitate all of the mercury out of the solution?

Balanced Equation for reaction:



$$\text{Moles Hg}_2(\text{NO}_3)_2 = M \times V = .025\text{M} \times .25\text{L} = .00625 \text{ moles}$$

$$\begin{aligned} \text{Moles of NaCl} &= .00625 \text{ moles Hg}_2(\text{NO}_3)_2 \times (2 \text{ moles NaCl} / 1 \text{ mole Hg}_2(\text{NO}_3)_2) \\ &= .0125 \text{ moles NaCl} \end{aligned}$$

$$\begin{aligned} M &= \text{moles} / V; V = \text{moles} / M \\ &= .0125 \text{ moles} / .95\text{M} = .0132 \text{ L} = 13.2\text{mL} \end{aligned}$$