HOMEWORK PROBLEMS:

5a.) When 7.24 moles of magnesium, $Mg_{(s)}$, and 3.86 moles of oxygen gas, $O_{2\,(g)}$, react to form magnesium oxide, $MgO_{(s)}$, how much product will be produced?

L.R. 7.24 mol 3.86 mol ? mol

$2\,Mg + O_2 \rightarrow 2\,MgO$

L.R. STEP:

$$7.24 \text{ mol } Mg \left| \frac{1 \text{ mol } O_2}{2 \text{ mol } Mg} \right. = 3.62 \text{ mol } O_2$$

If you used all 7.24 moles of magnesium, you would only use (need) 3.62 moles of oxygen gas. Magnesium is the limiting reactant. There will be extra (or excess) oxygen gas.

$$7.24 \text{ mol } Mg \left| \frac{2 \text{ mol } MgO}{2 \text{ mol } Mg} \right. = 7.24 \text{ mol } MgO$$

5b.) 0.550 liters of a 2.33 molar solution of ammonium phosphate reacts with 88.2 grams of lead(II) acetate. Calculate the mass (in grams) of the precipitate, lead(II) phosphate when the reaction runs to completion. Also, ammonium acetate is produced in the reaction.

0.550 L, 2.33 M

88.2 g L.R.

$$2\,(NH_4)_3PO_4 + 3\,Pb(C_2H_3O_2)_2 \rightarrow Pb_3(PO_4)_2 + 6\,NH_4C_2H_3O_2$$

ppt.

L.R. STEP:

$$0.550\,L \left| \frac{2.33\ mol\ (NH_4)_3PO_4}{L} \right| \frac{3\ mol\ Pb(C_2H_3O_2)_2}{2\ mol\ (NH_4)_3PO_4} \left| \frac{325.288\ g}{1\ mol\ Pb(C_2H_3O_2)_2} \right| =$$

$$= 625\ g\ Pb(C_2H_3O_2)_2$$

If you reacted 0.550 liters of a 2.33 molar solution of ammonium phosphate solution, you would need AT LEAST 625 grams of lead(II) acetate to completely react all the ammonium phosphate solution. The limiting reactant is lead(II) acetate. You do not have enough lead(II) acetate to react all the ammonium phosphate solution.

$Pb(C_2H_3O_2)_2$

$$88.2\ g \left| \frac{1\ mol\ Pb(C_2H_3O_2)_2}{325.288\ g} \right| \frac{1\ mol\ Pb_3(PO_4)_2}{3\ mol\ Pb(C_2H_3O_2)_2} \left| \frac{810.94\ g}{1\ mol\ Pb_3(PO_4)_2} \right| =$$

$$= 73.3\ g\ Pb_3(PO_4)_2$$

5c.) In a synthesis reaction, 50.3 grams of barium reacts with 88.2 grams of chlorine gas. Calculate the mass in milligrams of the product, barium chloride that is produced in this reaction.

L.R. $50.3\text{ g}\ Ba + 88.2\text{ g}\ Cl_2 \rightarrow ?\text{ mg}\ BaCl_2$ BALANCED AS WRITTEN!

L.R. STEP:

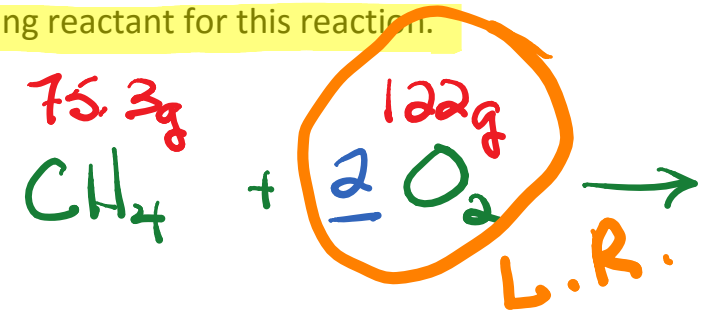
$$50.3\text{ g Ba} \left| \frac{1\text{ mol Ba}}{137.33\text{ g}} \right| \frac{1\text{ mol } Cl_2}{1\text{ mol Ba}} \left| \frac{70.9\text{ g}}{1\text{ mol } Cl_2} \right| = 26.0\text{ g } Cl_2$$

If you used (reacted) all 50.3 grams of barium you would only need 26.0 grams of chlorine gas. The limiting reactant is barium. You will have extra (excess) chlorine gas.

$$50.3\text{ g Ba} \left| \frac{1\text{ mol Ba}}{137.33\text{ g}} \right| \frac{1\text{ mol } BaCl_2}{1\text{ mol Ba}} \left| \frac{208.23\text{ g}}{1\text{ mol } BaCl_2} \right| \frac{10^3\text{ mg}}{1\text{ g}} =$$

$$= 7.63 \times 10^4\text{ mg } BaCl_2$$

5d.) In a combustion reaction, 75.3 grams of methane gas, CH_4 , reacts with 122 grams of oxygen gas. Identify the limiting reactant for this reaction.



L.R. STEP:

$$75.3\text{g } CH_4 \left| \frac{1 \text{ mol } CH_4}{16.042\text{g}} \right| \frac{2 \text{ mol } O_2}{1 \text{ mol } CH_4} \left| \frac{32\text{g}}{1 \text{ mol } O_2} \right. = 300.\text{g } O_2$$

If you reacted all 75.3 grams of methane, CH_4, you would need 300.41142 grams of oxygen gas. The limiting reactant is oxygen gas. You will consume (use up) all the oxygen gas before you have a chance to use all the methane.

5e.) 287 mL of 2.33 molar solution of silver(I) nitrate reacts with 339 mL of a 1.88 molar solution of calcium chloride. Calculate the mass (in grams) of the precipitate silver(I) chloride that is formed. Also, calcium nitrate is the other product.

L.R.

287 mL
2.33 M
$2\ AgNO_3$ +

339 mL
1.88 M
$CaCl_2$ $\longrightarrow$

? g
$2\ AgCl$ (ppt.) + $Ca(NO_3)_2$

L.R. step:

$$287\text{ mL} \left| \frac{1\text{ L}}{10^3\text{ mL}} \right| \frac{2.33\text{ mol } AgNO_3}{\text{L}} \left| \frac{1\text{ mol } CaCl_2}{2\text{ mol } AgNO_3} \right| \frac{\text{L}}{1.88\text{ mol } CaCl_2} \left| \frac{1000\text{ mL}}{\text{L}} \right| =$$

$$= 178\text{ mL } CaCl_2$$

If you reacted all 287 mL of a 2.33 molar solution of silver(I) nitrate solution with a 1.88 molar solution of calcium chloride, you would only use 178 mL of the calcium chloride solution. The limiting reactant is silver(I) nitrate. You would have extra (excess) calcium chloride.

$$287\text{ mL} \left| \frac{1\text{ L}}{10^3\text{ mL}} \right| \frac{2.33\text{ mol } AgNO_3}{\text{L}} \left| \frac{2\text{ mol } AgCl}{2\text{ mol } AgNO_3} \right| \frac{143.32\text{ g}}{1\text{ mol } AgCl} = 95.8\text{ g } AgCl$$