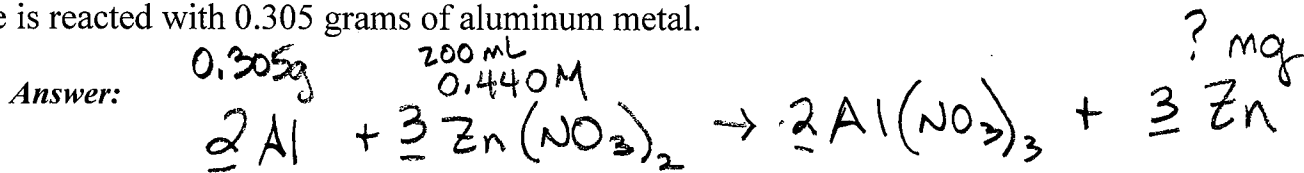


STOICHIOMETRY - LECTURE NOTES

Homework Answers (solutions to the homework) (the 4's) - Craig

EXAMPLE #7:

In a single replacement reaction, aluminum metal replaces zinc in a zinc nitrate solution. Calculate the mass (in mg) of zinc metal produced in this reaction when 200 mL of a 0.440 M solution of zinc nitrate is reacted with 0.305 grams of aluminum metal.

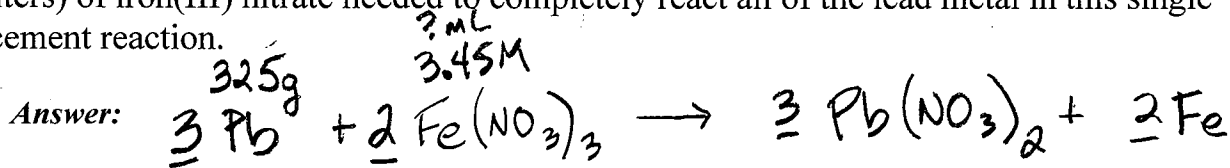


L.R. STEP:
$$\frac{200 \text{ mL}}{1000 \text{ mL}} \times \frac{1 \text{ L}}{0.440 \text{ mol}} \times \frac{2 \text{ mol Al}}{3 \text{ mol Zn}(\text{NO}_3)_2} \times \frac{26.98 \text{ g}}{1 \text{ mol Al}} = 1.58 \text{ g}$$

Al is L.R. ! IF ALL 200 mL OF THE 0.440 M $\text{Zn}(\text{NO}_3)_2$ WERE REACTED, ONE WOULD NEED AT LEAST 1.58g OF Al. We DO NOT HAVE ENOUGH Al. $\text{Zn}(\text{NO}_3)_2$ IS IN EXCESS.

EXAMPLE #8:
$$\frac{0.305 \text{ g Al}}{26.98 \text{ g}} \times \frac{1 \text{ mol Al}}{2 \text{ mol Al}} \times \frac{3 \text{ mol Zn}}{1 \text{ mol Zn}} \times \frac{65.39 \text{ g}}{1 \text{ g}} \times \frac{1000 \text{ mg}}{1} = 1.11 \times 10^3 \text{ mg}$$

325 grams of lead metal is mixed with a 3.45 M solution of iron(III) nitrate. Calculate the volume (in milliliters) of iron(III) nitrate needed to completely react all of the lead metal in this single replacement reaction.



- NOT A L.R. PROBLEM!

- START WITH THE "SET" THAT IS COMPLETE!

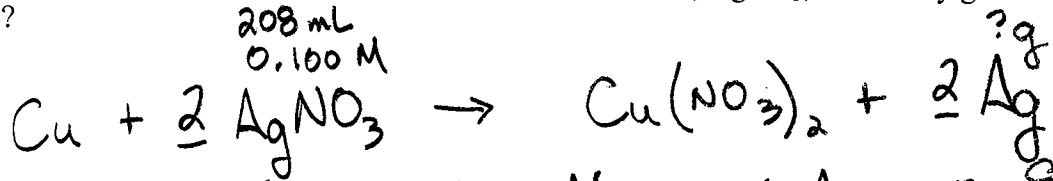
$$\frac{325 \text{ g}}{207.2 \text{ g}} \times \frac{1 \text{ mol Pb}}{3 \text{ mol Pb}} \times \frac{2 \text{ mol Fe}(\text{NO}_3)_3}{1 \text{ mol Fe}(\text{NO}_3)_3} \times \frac{1 \text{ L}}{3.45 \text{ mol Fe}(\text{NO}_3)_3} \times \frac{1000 \text{ mL}}{1 \text{ L}} = 303 \text{ mL Fe}(\text{NO}_3)_3$$

3.45 M

HOMEWORK PROBLEMS :

4a.) When copper ions replace silver ions in 208 mL of 0.100 M silver nitrate, AgNO₃, how many grams of silver will be produced?

Answer:



- IF YOU ARE GIVEN THE VOLUMES AND MOLARITY, ALWAYS START WITH THE VOLUME.

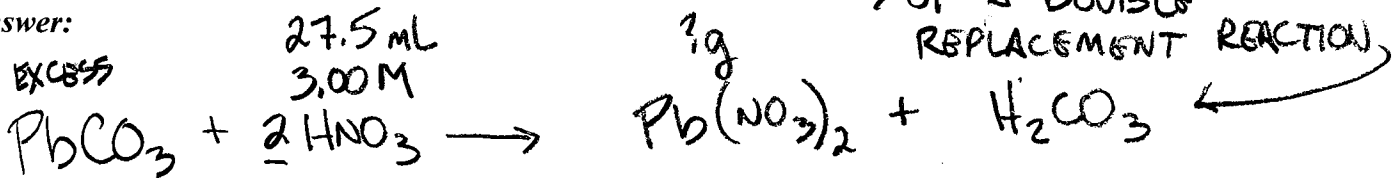
$$\frac{208 \text{ mL}}{1000 \text{ mL}} \times \frac{1 \text{ L}}{1 \text{ L}} \times \frac{0.100 \text{ mol AgNO}_3}{\text{L}} \times \frac{2 \text{ mol Ag}}{2 \text{ mol AgNO}_3} \times \frac{107.87 \text{ g}}{1 \text{ mol Ag}} =$$

2.24 g Ag

THIS IS NOT GIVEN IN THE QUESTION, BUT IT IS A PRODUCT

4b.) When an excess of lead(II) carbonate, PbCO₃ (s), reacts with 27.5 mL of 3.00 M nitric acid, HNO₃ (aq), what mass (in grams) of lead(II) nitrate, Pb(NO₃)₂ (aq), will be formed?

Answer:

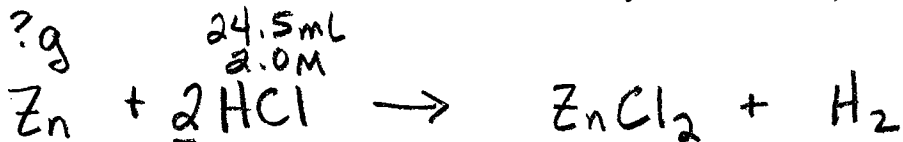


$$\frac{27.5 \text{ mL}}{1000 \text{ mL}} \times \frac{1 \text{ L}}{1 \text{ L}} \times \frac{3.00 \text{ mol HNO}_3}{\text{L}} \times \frac{1 \text{ mol Pb}(\text{NO}_3)_2}{2 \text{ mol HNO}_3} \times \frac{207.2 \text{ g} + 2(14.01 \text{ g}) + 6(16.00 \text{ g})}{1 \text{ mol Pb}(\text{NO}_3)_2} =$$

13.7 g Pb(NO₃)₂

4c.) How much (in grams) zinc metal will react with 24.5 mL of 2.0 M hydrochloric acid, HCl?

Answer:

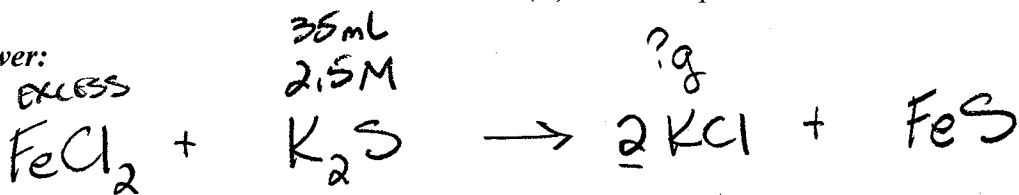


$$\frac{24.5\text{ mL}}{1000\text{ mL}} \times \frac{1\text{ L}}{1\text{ L}} \times \frac{2.0\text{ mol HCl}}{1\text{ L}} \times \frac{1\text{ mol Zn}}{2\text{ mol HCl}} \times \frac{65.39\text{ g}}{1\text{ mol Zn}} = 1.60\text{ g Zn}$$

NOT A LIMITING REACTANT PROBLEM. BE SURE TO BALANCE THE EQUATION BEFORE YOU DO THE MATH - EVEN THOUGH YOU ARE NOT ASKED ABOUT EITHER OF THE PRODUCTS.

4d.) When an excess of iron(II) chloride reacts with 35.0 mL of 2.5 M potassium sulfide, what mass (in grams) of potassium chloride will be formed? Also, iron(II) sulfide is produced?

Answer:



$$\frac{35\text{ mL}}{1000\text{ mL}} \times \frac{1\text{ L}}{1\text{ L}} \times \frac{2.5\text{ mol K}_2\text{S}}{1\text{ L}} \times \frac{2\text{ mol KCl}}{1\text{ mol K}_2\text{S}} \times \frac{39.1\text{ g} + 35.45\text{ g}}{1\text{ mol KCl}} =$$

$$13.0\text{ g KCl}$$