

1. (3 Pts) What is the resulting concentration when 455.8 mL of a 0.0786 M Na₂SO₄ solution is evaporated to a volume of 50.00 mL?

$$M_1 V_1 = M_2 V_2$$

$$(0.0786 M)(455.8 \text{ mL}) = M_2 (50.00 \text{ mL})$$

$$M_2 = 0.717$$

2. (3 Pts) What concentration H₃PO₄ results when 50.00 mL of 0.355 M H₃PO₄ solution is diluted to 400.0 mL?

$$M_1 V_1 = M_2 V_2$$

$$(0.355 M)(50.00 \text{ mL}) = M_2 (400.0 \text{ mL})$$

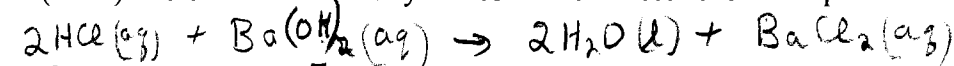
$$M_2 = 0.0444$$

3. (4 Pts) How many grams of HNO₃ are present in 450.0 mL of 0.0550 M HNO₃ solution?

$$\frac{450.0 \text{ mL}}{1000 \text{ mL}} \times 0.0550 \frac{\text{mol}}{\text{L}} \times 63.018 \frac{\text{g}}{\text{mol}} = 1.56 \text{ g HNO}_3$$

4. 25.00 mL of 0.505 M hydrochloric acid solution is reacted with 20.50 mL of 0.303 M barium hydroxide solution. You must write a balanced equation.

a. (4 Pts) Determine how many moles of the excess reactant is present when the reaction is done.



$$\begin{array}{l} 25.00 \text{ mL} \\ 0.505 \frac{\text{mol}}{\text{L}} \end{array} \quad \begin{array}{l} 20.50 \text{ mL} \\ 0.303 \frac{\text{mol}}{\text{L}} \end{array}$$

? mol (pick a reactant and do two calculations)

Based on HCl

$$\frac{25.00 \text{ mL}}{1000 \text{ mL}} \times 0.505 \frac{\text{mol}}{\text{L}} \times \frac{2 \text{ mol H}_2\text{O}}{2 \text{ mol HCl}} = 0.012625 \text{ mol H}_2\text{O}$$

Based on Ba(OH)₂

$$\frac{20.50 \text{ mL}}{1000 \text{ mL}} \times 0.303 \frac{\text{mol}}{\text{L}} \times \frac{2 \text{ mol H}_2\text{O}}{1 \text{ mol Ba(OH)}_2} = 0.012423 \text{ mol H}_2\text{O}$$

subtracting gives $2.02 \times 10^{-4} \text{ mol H}_2\text{O}$

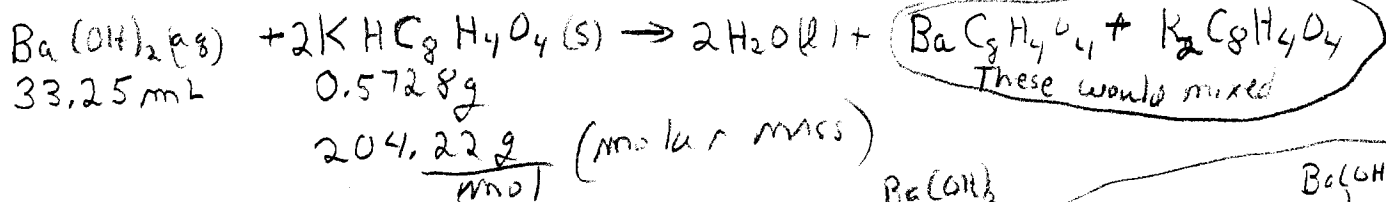
b. (4 Pts) Determine the concentration (in moles per liter) of the remaining (excess) reactant.

$$\frac{2.02 \times 10^{-4} \text{ mol H}_2\text{O}}{2 \text{ mol H}_2\text{O}} \times \frac{2 \text{ mol HCl}}{1 \text{ mol Ba(OH)}_2} = 2.02 \times 10^{-4} \text{ moles HCl}$$

$$\frac{2.02 \times 10^{-4} \text{ moles}}{(0.02500 + 0.02050) \text{ L}} = 0.0044 \frac{\text{mol}}{\text{L}} \text{ HCl}$$

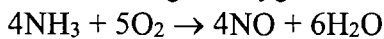
Key

5. (4 Pts) A barium hydroxide solution is being standardized with potassium hydrogen phthalate (KHP). If it took 33.25 mL of the barium hydroxide solution to neutralize 0.5728 grams KHP, what was the molarity of the barium hydroxide solution? You must write a balanced equation.



$$\frac{33.25 \times 10^{-3} \text{ L Ba}(\text{OH})_2}{0.5728 \text{ g KHP}} \times \frac{\text{mol KHP}}{204.22 \text{ g KHP}} \times \frac{1 \text{ mol Ba}(\text{OH})_2}{2 \text{ mol KHP}} = 0.04218 \frac{\text{mol Ba}(\text{OH})_2}{\text{L Ba}(\text{OH})_2}$$

6 (3 Pts) Determine the number of moles of water produced by the reaction of 155 g of ammonia and 356 g of oxygen.



155 g 356 g

Based on:

$$\text{NH}_3: \frac{155 \text{ g NH}_3}{17.034 \text{ g NH}_3} \times \frac{6 \text{ moles H}_2\text{O}}{4 \text{ mol NH}_3} = 13.6 \text{ mole H}_2\text{O}$$

Based on:

$$\text{O}_2: \frac{356 \text{ g O}_2}{32.00 \text{ g O}_2} \times \frac{6 \text{ mol H}_2\text{O}}{5 \text{ mol O}_2} = 13.35 \text{ mol H}_2\text{O}$$

Since O_2 is the Limiting Reactant.