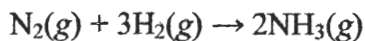


SHOW ALL WORK TO RECEIVE CREDIT. Molar Masses: H = 1.008, K = 39.10, N = 14.01, Na = 22.99, O = 16.00, S = 32.07

3 1. Ammonia, NH<sub>3</sub>, is produced industrially from nitrogen and hydrogen as follows:



30.0g, 10.0g

What mass, of which starting material, will remain when 30.0 g of N<sub>2</sub> and 10.0 g of H<sub>2</sub> react until the limiting reagent is completely consumed?

Based on N<sub>2</sub>:  $\frac{30.0g N_2}{28.02g N_2} \times \frac{2 mol NH_3}{1 mol N_2} = 2.141 mol NH_3$

Based on H<sub>2</sub>:  $\frac{10.0g H_2}{2.016g H_2} \times \frac{2 mol NH_3}{3 mol H_2} = 3.307 mol NH_3$

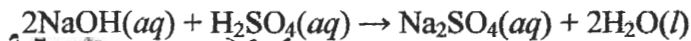
Find XS H<sub>2</sub>:  $(3.307 - 2.141) \times \frac{3 mol H_2}{2 mol NH_3} \times 2.016g H_2 = 3.526g H_2 \text{ in XS}$

5 2. You are provided with a 250 mL volumetric flask, deionized water and solid NaOH. How much NaOH should be weighed out in order to make 250. mL of 0.100 M solution?

$$\frac{250 mL}{1000 mL} \times 0.100 mol NaOH = 0.025 mol NaOH$$

$$0.025 mol NaOH \times 40.0 g NaOH/mol NaOH = 1.00 g NaOH$$

7 3. 25.0 mL of the 0.100 M aqueous NaOH is titrated against sulfuric acid, H<sub>2</sub>SO<sub>4</sub>, according to the equation



25.0 mL, 0.100 M, 28.62 mL, 0.100 M

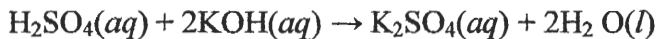
If the volume of sulfuric acid solution required to neutralize the NaOH is 28.62 mL, what is its concentration?

$$\frac{25.0 mL NaOH}{1000 mL} \times 0.100 mol NaOH = 0.0025 mol NaOH$$

$$\frac{0.0025 mol NaOH}{2 mol NaOH} \times 1 mol H_2SO_4 = 0.00125 mol H_2SO_4$$

$$\frac{0.00125 mol H_2SO_4}{28.62 \times 10^{-3} L H_2SO_4} = 0.04367 M H_2SO_4$$

5 4. Sulfuric acid (H<sub>2</sub>SO<sub>4</sub>) reacts with potassium hydroxide (KOH) as follows.



0.100 M, 25.00 mL, 0.0821 M

Calculate the volume of 0.100 M sulfuric acid required to neutralize 25.0 mL of 0.0821 M KOH. Show all your work.

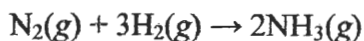
$$\frac{25.00 mL KOH}{1000 mL} \times 0.0821 mol KOH = 0.0020525 mol KOH$$

$$\frac{0.0020525 mol KOH}{2 mol KOH} \times 1 mol H_2SO_4 = 0.00102625 mol H_2SO_4$$

$$\frac{0.00102625 mol H_2SO_4}{0.100 mol H_2SO_4} \times 1000 mL = 10.26 mL H_2SO_4$$

SHOW ALL WORK TO RECEIVE CREDIT. Molar Masses: H = 1.008, K = 39.10, N = 14.01, Na = 22.99, O = 16.00, S = 32.07

8 1. Ammonia, NH<sub>3</sub>, is produced industrially from nitrogen and hydrogen as follows:



What mass, of which starting material, will remain when 25.0 g of N<sub>2</sub> and 10.0 g of H<sub>2</sub> react until the limiting reagent is completely consumed?

Based on N<sub>2</sub>:  $\frac{25.0 \text{ g } N_2}{28.02 \text{ g } N_2} \times \frac{1 \text{ mol } N_2}{1 \text{ mol } N_2} \times \frac{2 \text{ mol } NH_3}{3 \text{ mol } H_2} = 1.784 \text{ mol } NH_3$

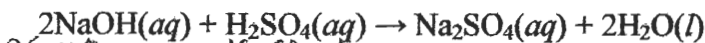
Based on H<sub>2</sub>:  $\frac{10.0 \text{ g } H_2}{2.016 \text{ g } H_2} \times \frac{3 \text{ mol } H_2}{3 \text{ mol } H_2} \times \frac{2 \text{ mol } NH_3}{3 \text{ mol } H_2} = 3.307 \text{ mol } NH_3$

Find XS H<sub>2</sub>:  $\frac{(3.307 - 1.784) \text{ mol } NH_3}{2 \text{ mol } NH_3} \times \frac{3 \text{ mol } H_2}{1 \text{ mol } H_2} \times 2.016 \text{ g } H_2 = 4.605 \text{ g } H_2 \text{ in XS}$

5 2. You are provided with a 250 mL volumetric flask, deionized water and solid NaOH. How much NaOH should be weighed out in order to make 250. mL of 0.200 M solution?

$$\frac{250 \text{ mL}}{1000 \text{ mL}} \times \frac{0.200 \text{ mol NaOH}}{1 \text{ mol}} \times 40.0 \text{ g} = 2.00 \text{ g NaOH}$$

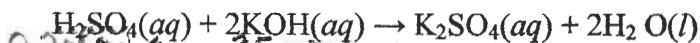
7 3. 25.0 mL of the 0.100 M aqueous NaOH is titrated against sulfuric acid, H<sub>2</sub>SO<sub>4</sub>, according to the equation



If the volume of sulfuric acid solution required to neutralize the NaOH is 18.62 mL, what is its concentration?

$$\frac{18.62 \times 10^{-3} \text{ L } H_2SO_4}{25.0 \text{ mL } NaOH} \times \frac{0.100 \text{ mol } NaOH}{1000 \text{ mL } NaOH} \times \frac{1 \text{ mol } H_2SO_4}{2 \text{ mol } NaOH} = 0.06713 \text{ mol } H_2SO_4 / L H_2SO_4$$

5 4. Sulfuric acid (H<sub>2</sub>SO<sub>4</sub>) reacts with potassium hydroxide (KOH) as follows.



Calculate the volume of 0.200 M sulfuric acid required to neutralize 35.0 mL of 0.0821 M KOH. Show all your work.

$$\frac{35.0 \text{ mL } KOH}{1000 \text{ mL } KOH} \times \frac{0.0821 \text{ mol } KOH}{1 \text{ mol } KOH} \times \frac{1 \text{ mol } H_2SO_4}{2 \text{ mol } KOH} \times 1000 \text{ mL } H_2SO_4 = 7.184 \text{ mL } H_2SO_4$$