CHM151 Quiz 4a 25 Pts Fall 2005 *Student:* Key

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_3, is produced industrially from nitrogen and hydrogen as follows:

$$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$$

30.0 g 10.0 g

What mass, of which starting material, will remain when 30.0 g of N_2 and 10.0 g of H_2 react until the limiting reagent is completely consumed?

Based on N_2: $\frac{30.0\text{ g } N_2}{28.02\text{ g } N_2} \left| \frac{\text{mol } N_2}{1\text{ mol } N_2} \right| \frac{2\text{ mol } NH_3}{1\text{ mol } N_2} = 2.141\text{ mol } NH_3$

Based on H_2: $\frac{10.0\text{ g } H_2}{2.016\text{ g } H_2} \left| \frac{\text{mol } H_2}{3\text{ mol } H_2} \right| \frac{2\text{ mol } NH_3}{3\text{ mol } H_2} = 3.307\text{ mol } NH_3$

Find XS H_2: $(3.307 - 2.141)\text{ mol } NH_3 \left| \frac{3\text{ mol } H_2}{2\text{ mol } NH_3} \right| \frac{2.016\text{ g } H_2}{1\text{ mol } H_2} = 3.526\text{ g } H_2$ 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?

$$\frac{250\text{ mL}}{1000\text{ mL}} \left| \frac{0.100\text{ mol NaOH}}{1\text{ L}} \right| \frac{40.0\text{ g NaOH}}{\text{mol NaOH}} = 0.9999\text{ g NaOH}$$

0.100 g NaOH

(7) 3. 25.0 mL of the 0.100 *M* aqueous NaOH is titrated against sulfuric acid, H_2SO_4, according to the equation

$$2NaOH(aq) + H_2SO_4(aq) \rightarrow Na_2SO_4(aq) + 2H_2O(l)$$

25.0 mL, 0.100 mol/L NaOH; 28.62 mL, 3 mol/L H_2SO_4

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

$$\frac{\text{☺}}{28.62\times10^{-3}\text{ L } H_2SO_4} \left| \frac{25.0\text{ mL NaOH}}{} \right| \frac{0.100\text{ mol NaOH}}{1000\text{ mL NaOH}} \left| \frac{1\text{ mol } H_2SO_4}{2\text{ mol NaOH}} \right| = 0.04367\frac{\text{mol } H_2SO_4}{\text{L}_{H_2SO_4}}$$

(5) 4. Sulfuric acid (H_2SO_4) reacts with potassium hydroxide (KOH) as follows.

$$H_2SO_4(aq) + 2KOH(aq) \rightarrow K_2SO_4(aq) + 2H_2O(l)$$

0.100 mol/L; 25.00 mL; 0.0821 mol/L

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

$$\frac{25.00\text{ mL KOH}}{1000\text{ mL KOH}} \left| \frac{0.0821\text{ mol KOH}}{1\text{ L}} \right| \frac{1\text{ mol } H_2SO_4}{2\text{ mol KOH}} \left| \frac{1000\text{ mL } H_2SO_4}{0.100\text{ mol } H_2SO_4} \right| = 10.26\text{ mL } H_2SO_4$$

CHM151 Quiz 4b 25 Pts Fall 2005 *Student:* Key

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_3 , is produced industrially from nitrogen and hydrogen as follows:

$$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$$

What mass, of which starting material, will remain when 25.0 g of N_2 and 10.0 g of H_2 react until the limiting reagent is completely consumed?

Based on N_2: $\frac{25.0\ g\ N_2}{28.02\ g\ N_2} \left| \frac{1\ mol\ N_2}{1\ mol\ N_2} \right| \frac{2\ mol\ NH_3}{1\ mol\ N_2} = 1.784\ mol\ NH_3$

Based on H_2: $\frac{10.0\ g\ H_2}{2.016\ g\ H_2} \left| \frac{1\ mol\ H_2}{3\ mol\ H_2} \right| \frac{2\ mol\ NH_3}{3\ mol\ H_2} = 3.307\ mol\ NH_3$

Find XS H_2: $\frac{(3.307 - 1.784)\ mol\ NH_3}{2\ mol\ NH_3} \left| \frac{3\ mol\ H_2}{1\ mol\ H_2} \right| \frac{2.016\ g\ H_2}{1\ mol\ H_2} = 4.605\ g\ H_2$ 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?

$$\frac{250.\ mL}{1000\ mL} \left| \frac{0.200\ mol\ NaOH}{1\ mol} \right| \frac{40.0\ g}{mol} = 2.00\ g\ NaOH$$

(7) 3. 25.0 mL of the 0.100 *M* aqueous NaOH is titrated against sulfuric acid, H_2SO_4, according to the equation

$$2NaOH(aq) + H_2SO_4(aq) \rightarrow Na_2SO_4(aq) + 2H_2O(l)$$

25.0 mL, 0.100 mol/L; 18.62 mL, ? mol/L

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

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

(5) 4. Sulfuric acid (H_2SO_4) reacts with potassium hydroxide (KOH) as follows.

$$H_2SO_4(aq) + 2KOH(aq) \rightarrow K_2SO_4(aq) + 2H_2O(l)$$

0.200 mol/L, ? mL; 35.0 mL, 0.0821 mol/L

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

$$\frac{35.0\ mL\ KOH}{1000\ mL\ KOH} \left| \frac{0.0821\ mol\ KOH}{} \right| \frac{1\ mol\ H_2SO_4}{2\ mol\ KOH} \left| \frac{1000\ mL\ H_2SO_4}{0.200\ mol\ H_2SO_4} \right| = 7.184\ mL\ H_2SO_4$$