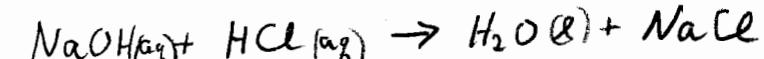


SHOW ALL WORK TO RECEIVE CREDIT

Atomic masses: K 39.10, C 12.01, O 16.00, H 1.008, Na 22.99, N 14.01, P 30.97, Cl 35.45, S 32.07.

1. (5 Pts) A standard solution of 0.243 M NaOH was used to determine the concentration of a hydrochloric acid solution. If 46.33 mL of NaOH is needed to neutralize 10.00 mL of the acid, what is the molar concentration of the acid?



$$\frac{0.243 \text{ mol}}{L} \quad | \quad \frac{10.00 \text{ mL}}{? \text{ mol}}$$

$$\frac{46.33 \text{ mL}}{10.00 \times 10^{-3} \text{ L}}$$

$$\frac{10.00 \times 10^{-3} \text{ L HCl}}{? \text{ mol}}$$

$$\frac{\cancel{NaOH} \cancel{3 \text{ mol}}}{46.33 \times 10^{-3} \text{ L}} \quad | \quad \frac{0.243 \text{ mol}}{1 \text{ mol NaOH}} \quad | \quad \frac{1 \text{ mol HCl}}{1 \text{ mol NaOH}} = \frac{1.13 \text{ mol HCl}}{1 \text{ L HCl}}$$

2. (6 Pts) A 0.00100 mol sample of $\text{Ca}(\text{OH})_2$ requires 25.00 mL of aqueous HCl for neutralization according to the reaction below. What is the concentration of the HCl?



$$\frac{0.00100 \text{ mol}}{25.00 \text{ mL}}$$

$$\frac{? \text{ mol}}{L}$$

$$\frac{0.00100 \text{ mol Ca(OH)}_2}{2 \text{ mol HCl}}$$

$$\frac{25.00 \times 10^{-3} \text{ L HCl}}{? \text{ mol}}$$

$$\frac{1 \text{ mol Ca(OH)}_2}{2 \text{ mol HCl}}$$

$$= \frac{0.0800 \text{ mol HCl}}{L \text{ HCl}}$$

3. (6 Pts) Automobile batteries use 3.0 M H_2SO_4 as an electrolyte. How many mL of 1.20 M NaOH will be needed to neutralize 225 mL of battery acid?



$$\frac{3.0 \text{ mol}}{L}$$

$$\frac{1.20 \text{ mol}}{L}$$

$$\frac{225 \text{ mL}}{? \text{ mL}}$$

$$\frac{225 \text{ mL}}{1000 \text{ mL H}_2\text{SO}_4}$$

$$\frac{? \text{ mL}}{3.0 \text{ mol H}_2\text{SO}_4}$$

$$\frac{1000 \text{ mL H}_2\text{SO}_4}{3.0 \text{ mol}}$$

$$\frac{NaOH}{2 \text{ mol}}$$

$$\frac{1.20 \text{ mol}}{1 \text{ mol H}_2\text{SO}_4}$$

$$\frac{NaOH}{1000 \text{ mL}}$$

$$\frac{1.20 \text{ mol}}{1 \text{ mol NaOH}}$$

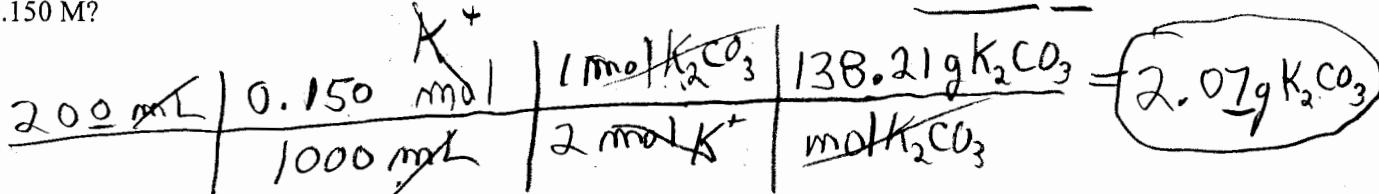
$$= \frac{1125 \text{ mL NaOH}}{1100 \text{ mL}}$$

4. (4 Pts) What is the concentration of ammonium ions in 1.6 M ammonium phosphate, $(\text{NH}_4)_3\text{PO}_4$?

3 NH_4^+ ions per formula unit SO:

$$3 \times 1.6 = 4.8 \text{ M } \text{NH}_4^+$$

5. (4 Pts) What mass of K_2CO_3 is needed to prepare 200. mL of a solution having a potassium ion concentration of 0.150 M?



$$\frac{1000 \text{ mL}}{2 \text{ mol K}^+}$$

$$\frac{1 \text{ mol K}_2\text{CO}_3}{1 \text{ mol K}^+}$$

$$\frac{138.21 \text{ g K}_2\text{CO}_3}{1 \text{ mol K}_2\text{CO}_3}$$

$$\frac{138.21 \text{ g K}_2\text{CO}_3}{1 \text{ mol K}_2\text{CO}_3}$$

$$= 2.07 \text{ g K}_2\text{CO}_3$$