CHM 151 Q5a 25 Pts Fall 2004 Name: Key

SHOW WORK TO RECEIVE CREDIT

INFORMATION: molar masses: H = 1.008, N = 14.007, O = 16.00, Na = 23.00, Cl = 35.45, P = 31.00, Ca = 40.08, K = 39.10

1. (5 Pts) What is the molar concentration of chloride ions in a solution prepared by mixing 100 mL of 2.0 M KCl with 50 mL of a 1.5 M $CaCl_2$ solution?

$$100\ mL\ KCl \left| \frac{2.0\ mol\ KCl}{1000\ mL} \right| \frac{1\ mol\ Cl^-}{1\ mol\ KCl} = 0.20\ mol\ Cl^-$$

$$50\ mL\ CaCl_2 \left| \frac{1.5\ mol\ CaCl_2}{1000\ mL} \right| \frac{2\ mol\ Cl^-}{1\ mol\ CaCl_2} = 0.15\ mol\ Cl^-$$

$$0.35\ mol\ Cl^- \qquad \frac{0.35\ mol}{0.150\ L} = 2.33\ M\ Cl^-$$

2. (5 Pts) What volume of concentrated nitric acid (15.0 M) is required to make 100 mL of a 3.0 M nitric acid solution?

$$M_1V_1 = M_2V_2$$

$$(15.0\ M)(V_1) = (3.0\ M)(100\ mL)$$

$$V_1 = 20\ mL$$

3. (5 Pts) If 145 grams of potassium nitrate were added to water to make 1,500 mL of solution, what would be the molarity of the resulting solution?

$$145\ g\ KNO_3 \left| \frac{mol}{101.1\ g} \right| 1.500\ L = 0.956\ \frac{mol\ KNO_3}{L}$$

4. (7 Pts) During a titration the following data were collected. A 50 mL portion of an HCl solution was titrated with 0.50 M NaOH. It required 200 mL of the base to neutralize the sample. How many grams of acid are present in 500 mL of this acid solution?

$$HCl + NaOH \rightarrow H_2O + NaCl$$

50 mL; 0.50 mol/L; 200 mL

(Find M, then grams)

Conc HCl:

$$\frac{200\ mL\ NaOH \left| 0.50\ mol\ NaOH \right| 1\ mol\ HCl}{50 \times 10^{-3}\ L\ HCl \left| 1000\ mL\ NaOH \right| 1\ mol\ NaOH} = \frac{2.0\ mol\ HCl}{L}$$

then:

$$500\ mL \left| \frac{2.0\ mol\ HCl}{1000\ mL} \right| \frac{36.46\ g\ HCl}{mol\ HCl} = 36.46\ g\ HCl$$

5. (3 Pts) Identify the Brønsted acid in the following reaction.

$$NH_3 + H_2O \rightarrow NH_4^+ + OH^-$$

Acid = proton donor

CHM 151 Q5b 25 Pts Fall 2004 Name: Key

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INFORMATION: molar masses: H = 1.008, N = 14.007, O = 16.00, Na = 23.00, Cl = 35.45, P = 31.00, Ca = 40.08, K = 39.10

1. (5 Pts) What is the molar concentration of chloride ions in a solution prepared by mixing 110 mL of 2.0 M KCl with 50 mL of a 1.6 M $CaCl_2$ solution?

$$110\ \text{mL KCl} \left| \frac{2.0\ \text{mol KCl}}{1000\ \text{mL KCl}} \right| \frac{1\ \text{mol Cl}^-}{1\ \text{mol KCl}} = 0.22\ \text{mol Cl}^-$$

$$50\ \text{mL CaCl}_2 \left| \frac{1.6\ \text{mol CaCl}_2}{1000\ \text{mL CaCl}_2} \right| \frac{2\ \text{mol Cl}^-}{1\ \text{mol CaCl}_2} = 0.16\ \text{mol Cl}^-$$

$$0.38\ \text{mol Cl}^-\ \text{total}$$

$$\frac{0.38\ \text{mol Cl}^-}{0.160\ \text{L}} = 2.375$$

2. (5 Pts) What volume of concentrated nitric acid (15.0 M) is required to make 100 mL of a 5.0 M nitric acid solution?

$$M_1 V_1 = M_2 V_2$$

$$(15.0\ \text{M})(V_1) = (5.0\ \text{M})(100\ \text{mL})$$

$$V_1 = 33.3\ \text{mL}$$

3. (5 Pts) If 165 grams of potassium nitrate were added to water to make 1,500 mL of solution, what would be the molarity of the resulting solution?

$$165\ \text{g } KNO_3 \left| \frac{\text{mol}}{101.1\ \text{g}} \right| \frac{}{1.500\ \text{L}} = 1.09\ \frac{\text{mol } KNO_3}{\text{L}}$$

4. (7 Pts) During a titration the following data were collected. A 50 mL portion of an HCl solution was titrated with 0.50 M NaOH. It required 200 mL of the base to neutralize the sample. How many grams of acid are present in 500 mL of this acid solution?

$$HCl + NaOH \rightarrow H_2O + NaCl$$

50 mL; 0.50 mol/L; 200 mL

(Find M of HCl then find grams)

Conc. of HCl:

$$50 \times 10^{-3}\ \text{L}_{HCl} \left| \frac{200\ \text{mL NaOH}}{} \right| \frac{0.50\ \text{mol NaOH}}{1000\ \text{mL NaOH}} \left| \frac{1\ \text{mol HCl}}{1\ \text{mol NaOH}} \right. = 0.20\ \frac{\text{mol HCl}}{\text{L}_{HCl}}$$

Then:

$$500\ \text{mL HCl} \left| \frac{0.20\ \text{mol HCl}}{1000\ \text{mL HCl}} \right| \frac{36.46\ \text{g}}{\text{mol}} = 36.46\ \text{g HCl}$$

5. (3 Pts) Identify the Brønsted acid in the following reaction.

$$NH_3 + H_2O \rightarrow NH_4^+ + OH^-$$

Acid = proton donor