CHM151 Q5a 25 Pts FALL 2005 Name: Key

SHOW ALL WORK TO RECEIVE CREDIT. Molar masses: H = 1.01, Na = 23.0, C = 12.01, O = 16.00, Ca = 40.08

1. (5 Pts) Complete and balance the following complete neutralization reactions.

a. $CH_3COOH + NaOH \rightarrow H_2O + NaCH_3COO$

b. $2HNO_3 + Mg(OH)_2 \rightarrow 2H_2O + Mg(NO_3)_2$

c. $2H_3PO_4 + 3Ca(OH)_2 \rightarrow 6H_2O + Ca_3(PO_4)_2$

d. $HCl + KOH \rightarrow H_2O + KCl$

e. $H_2CO_3 + Sr(OH)_2 \rightarrow 2H_2O + SrCO_3$

2. (5 Pts) How many grams of $Ca(OH)_2$ are contained in 1500 mL of 0.0250 *M* $Ca(OH)_2$ solution?

$$1500\ mL \left| \frac{0.0250\ mol\ Ca(OH)_2}{1000\ mL} \right| \frac{74.1\ g\ Ca(OH)_2}{mol\ Ca(OH)_2} = 27.79\ g\ Ca(OH)_2$$

3. (5Pts) What is the molarity of $Ca(NO_3)_2$ in a solution resulting from mixing 150.0 mL of 0.0200 *M* HNO_3 with 150.0 mL of 0.0100 *M* $Ca(OH)_2$?

Ans: 5.00×10^{-3} *M* $Ca(NO_3)_2$

$2HNO_3(aq) + Ca(OH)_2(aq) \rightarrow 2H_2O(l) + Ca(NO_3)_2(aq)$

150.0 mL, 0.0200 mol/L | 150.0 mL, 0.0100 mol/L | ? mol/L

Based on HNO_3:

$$150.0\ mL\ HNO_3 \left| \frac{0.0200\ mol\ HNO_3}{1000\ mL\ HNO_3} \right| \frac{1\ mol\ Ca(NO_3)_2}{2\ mol\ HNO_3} \Big| \frac{}{300 \times 10^{-3}\ L} = 0.00500 \frac{mol\ Ca(NO_3)_2}{L_{Ca(NO_3)_2}}$$

Based on $Ca(OH)_2$:

$$150.0\ mL\ Ca(OH)_2 \left| \frac{0.0100\ mol\ Ca(OH)_2}{1000\ mL\ Ca(OH)_2} \right| \frac{1\ mol\ Ca(NO_3)_2}{1\ mol\ Ca(OH)_2} \Big| \frac{}{300 \times 10^{-3}\ L} = 0.00500 \frac{mol\ Ca(NO_3)_2}{L_{Ca(NO_3)_2}}$$

4. (5 Pts) What volume of 0.50 *M* KOH would be required to neutralize completely 500 mL of 0.25 *M* H_3PO_4 solution?

$3KOH(aq) + H_3PO_4(aq) \rightarrow 3H_2O(l) + K_3PO_4(aq)$

0.50 mol/L | 500 mL, 0.25 mol/L

$$500\ mL\ H_3PO_4 \left| \frac{0.25\ mol\ H_3PO_4}{1000\ mL\ H_3PO_4} \right| \frac{3\ mol\ KOH}{1\ mol\ H_3PO_4} \Big| \frac{1000\ mL\ KOH}{0.50\ mol\ KOH} = 750\ mL\ KOH$$

5. (5 Pts) Calculate the molarity of an H_2SO_4 solution if 40.0 mL of the H_2SO_4 solution reacts with 0.212 g of Na_2CO_3.

$H_2SO_4(aq) + Na_2CO_3(s) \rightarrow H_2O(l) + CO_2(g) + Na_2SO_4(aq)$

? mol/L, 40.0 mL | 0.212 g

$$0.212\ g\ Na_2CO_3 \left| \frac{mol\ Na_2CO_3}{106.01\ g\ Na_2CO_3} \right| \frac{1\ mol\ H_2SO_4}{1\ mol\ Na_2CO_3} \Big| \frac{}{40.0 \times 10^{-3}\ L_{H_2SO_4}} = 0.04999 \frac{mol\ H_2SO_4}{L_{H_2SO_4}}$$