Name: ANSWER KEY

Chemistry 30

Unit 5: Acids & Bases

Assignment 3 – Neutralization and Titration **16 max**

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3 1. The substances listed in the chart below were tested with indictors methyl red, phenol red, and thymol blue. Complete the chart indicating what colors would be seen with each indicator.

	methyl red	**phenol red**	**thymol blue**
acid rain (pH = 6.3)	yellow	yellow	yellow
ammonia water (pH = 11.2)	yellow	red	blue

3 2. Write **balanced** neutralization reactions for the following:

a. the reaction between hydrobromic acid, HBr, and potassium hydroxide, KOH.

$HBr + KOH \rightarrow KBr + H_2O$

b. the reaction between nitric acid, HNO_3 and magnesium hydroxide, $Mg(OH)_2$

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

c. the reaction between phosphoric acid, H_3PO_4 and sodium hydroxide, NaOH

$H_3PO_4 + 3\ NaOH \rightarrow Na_3PO_4 + 3\ H_2O$ (different answers are possible)

2 3. What is the molarity of a 25 mL solution of HCl that is titrated to an end point by 10 mL of a 0.200 M solution of NaOH?

$HCl(aq) + NaOH(aq) \rightarrow NaCl(aq) + H_2O(aq)$

$M_A = M_A$ **$M_B = 0.200$**
$V_A = 25$ **V_B** = 10

$M_AV_A = M_BV_B$

$M_A\ (25) = (0.200)\ (10)$

$M_A = 0.0800$ M = [HCl] **answer: [HCl] = *0.0800 M***

2 4. What is the molar concentration of a 50-mL solution of $Ba(OH)_2$ that is titrated to an end point by 15 mL of a 0.00300 M solution of HCl?

$2\ HCl(aq) + Ba(OH)_2(aq) \rightarrow BaCl_2(aq) + 2\ H_2O\ (l)$

$M_A = 0.00300$ $M_B = M_B$
$V_A = 15$ $V_B = 50$

$M_AV_A = 2\ M_BV_B$

$(0.00300)\ (15) = 2\ (M_B)\ (50)$ **answer**

$M_B = 4.5 \times 10^{-4}$ M **$[Ba(OH)_2] = 4.5 \times 10^{-4}$ M**

2 5. What is the molarity of a 21 mL nitric acid solution that completely neutralizes 25.0 mL of a 0.300 M solution of NaOH?

$HNO_3(aq) + NaOH(aq) \rightarrow NaNO_3(aq) + H_2O(l)$

$M_A = M_A$ $M_B = 0.300$
$V_A = 21$ $V_B = 25.0$

$M_AV_A = M_BV_B$

$(M_A)\ (21) = (0.300)\ (25.0)$

$M_A = 0.357$ M **Answer: $[HNO_3] = 0.357$ M**

2 6. What is the molar concentration of a 45.0 mL solution of KOH that is completely neutralized by 15.0 mL of a 0.500 M H_2SO_4 solution?

$H_2SO_4 + 2\ KOH \rightarrow K_2SO_4 + 2\ H_2O$

$M_A = 0.500$ $M_B = M_B$
$V_A = 15$ $V_B = 45$

$M_AV_A = 2\ M_BV_B$

$(0.500)\ (15) = 2\ (M_B)\ (45)$

$M_B = 0.333$ M **Answer: [KOH] = 0.333 M**

2 7. A neutral solution is produced when 42.00 mL of a 0.150 M NaOH solution is used to titrate 50.00 mL of a sulfuric acid (H_2SO_4) solution. What is the concentration of the sulfuric acid solution before titration?

$H_2SO_4 + 2\ NaOH \rightarrow Na_2SO_4 + 2\ H_2O$

$M_A = M_A$ $M_B = 0.150$
$V_A = 50.00$ $V_B = 42.00$

$2\ M_AV_A = M_BV_B$

$2\ (M_A)\ (50) = 2\ (0.150)\ (42.00)$

$M_A = 0.063$ M **Answer: $[H_2SO_4] = 0.063$ M**