CHM151 Quiz 3a 25 Pts Fall 2017 Name: Key

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1. (7 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 (M) concentration of the acid? (You will need to write a balanced equation for the reaction.)

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

$\frac{0.243\ mol}{L}$ $46.33\ mL$ $10.00\ mL$ $\frac{3\ mol}{L}$

$$10.00\times10^{-3}\ L_{HCl} \left|\ 46.33\ mL_{NaOH}\right| \frac{0.243\ mol\ NaOH}{1000\ mL\ NaOH} \left|\ \frac{1\ mol\ HCl}{1\ mol\ NaOH}\right. = 1.13\ \frac{mol\ HCl}{L_{HCl}}$$

2. (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?

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

$\frac{3.0\ mol}{L}$ $225\ mL$ $\frac{1.20\ mol}{L}$ $?\ mL$

$$225\ mL_{H_2SO_4} \left|\ \frac{3.0\ mol\ H_2SO_4}{1000\ mL\ H_2SO_4}\right| \frac{2\ mol\ NaOH}{1\ mol\ H_2SO_4} \left|\ \frac{1000\ mL\ NaOH}{1.20\ mol\ NaOH}\right. = 1125\ mL\ NaOH$$

3. (5 Pts) 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? (Na 22.99, O 16.00, H 1.008)

$$250.\ mL \left|\ \frac{0.100\ mol\ NaOH}{1000\ mL}\right| \frac{40.00\ g\ NaOH}{mol\ NaOH} = 0.9999\ g\ NaOH$$

1.00

4. (5 Pts) What is the molarity (M) of a solution prepared by diluting 125 mL of 0.150 M HCl solution to a volume of 500.0 mL?

Use $M_1V_1 = M_2V_2$

$(0.150\ M)(125\ mL) = M_2(500.0\ mL)$

$M_2 = 0.0375\ M$

5. (2 Pts) Complete and balance the following equation:

$2\ H_3PO_4(aq) + 3\ Ba(OH)_2(aq) \rightarrow 6\ H_2O(l) + Ba_3(PO_4)_2$ (s)

CHM151 Quiz 3b 25 Pts Fall 2017 Name: Key

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1. (7 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 20.00 mL of the acid, what is the molar (M) concentration of the acid? (You will need to write a balanced equation for the reaction.)

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

20.00 mL; ? mol/L; 0.243 mol/L; 46.33 mL

$$\frac{46.33\ \text{mL NaOH}}{20.00\times10^{-3}\ \text{L HCl}} \left|\frac{0.243\ \text{mol NaOH}}{1000\ \text{mL NaOH}}\right| \frac{1\ \text{mol HCl}}{1\ \text{mol NaOH}} = 0.563 \frac{\text{mol HCl}}{\text{L}_{HCl}}$$

2. (6 Pts) Automobile batteries use 3.0 *M* H_2SO_4 as an electrolyte. How many mL of 1.40 *M* NaOH will be needed to neutralize 225 mL of battery acid?

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

3.0 mol/L; 225 mL; 1.40 mol/L; ? mL

$$\frac{225\ \text{mL}\ H_2SO_4}{} \left|\frac{3.0\ \text{mol}\ H_2SO_4}{1000\ \text{mL}}\right| \frac{2\ \text{mol NaOH}}{1\ \text{mol}\ H_2SO_4} \left|\frac{1000\ \text{mL NaOH}}{1.40\ \text{mol NaOH}}\right| = 964\ \text{mL NaOH}$$

3. (5 Pts) 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? (Na 22.99, O 16.00, H 1.008)

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

4. (5 Pts) What is the molarity (M) of a solution prepared by diluting 145 mL of 0.150 M HCl solution to a volume of 500.0 mL?

use: $M_1V_1 = M_2V_2$

$(0.150\ M)(145\ mL) = M_2(500.0\ mL)$

$M_2 = 0.0435\ M$

5. (2 Pts) Complete and balance the following equation:

$2\,H_3PO_4(aq) + 3\,Ba(OH)_2(aq) \rightarrow 6\,H_2O(l) + Ba_3(PO_4)_2(s)$

CHM 151 Quiz 4a 25 Pts Fall 2017 Name: Key

Show all work to receive credit.

1. (3 Pts) What is the net ionic equation for the complete neutralization of citric acid, $H_3C_6H_5O_6$ (weak acid), by NaOH (a strong base)?

$H_3C_6H_5O_6(aq) + 3NaOH(aq) \rightarrow Na_3C_6H_5O_6(aq) + 3H_2O(l)$

$H_3C_6H_5O_6(aq) + 3Na^+ + 3OH^- \rightarrow 3Na^+ + C_6H_5O_6^- + 3H_2O(l)$

$H_3C_6H_5O_6(aq) + 3OH^- \rightarrow C_6H_5O_6^- + 3H_2O(l)$

2. (2 Pts) Identify the *reducing agent* in the following chemical reaction.

$5Fe^{2+}(aq) + MnO_4^-(aq) + 8H^+(aq) \rightarrow 5Fe^{3+}(aq) + Mn^{2+}(aq) + 4H_2O(l)$ Fe^{2+}

3. (3 Pts) A student needs to prepare 250.0 mL of a 2.50 *M* HCl solution using the stock solution 12.0 *M* HCl. What volume of 12.0 *M* HCl is required for this dilution?

$M_1V_1 = M_2V_2$

$(2.50M)(250.0\,mL) = (12.0\,M)(V_2)$

$V_2 = 52.1\,mL$

4. (3 pts) How many grams of KCl are present in 250.0 mL of a 0.125 *M* solution? [Molar mass: KCl, 74.55 g/mol]

$$\frac{250.0\,mL}{1000\,mL} \left| \frac{0.125\,mol}{} \right| \frac{74.55\,g}{mol} = 2.33\,g\,KCl$$

5. (6 Pts) A 25.0-mL sample of a H_2SO_4 is titrated with 0.500 *M* NaOH. At the endpoint, it is found that 32.0 mL of titrant (NaOH) was used. What was the concentration (M) of the acid? First write a balanced equation.

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

25.0 mL, ? mol/L; 32.0 mL, 0.500 mol/L

$$0.0250\,L_{H_2SO_4} \left| \frac{32.0\,mL\,NaOH}{} \right| \frac{0.500\,mol\,NaOH}{1000\,mL\,NaOH} \left| \frac{1\,mol\,H_2SO_4}{2\,mol\,NaOH} \right| = 0.320\,\frac{mol\,H_2SO_4}{L_{H_2SO_4}}$$

6. (6 Pts) Write the balanced molecular equation for the acid-base neutralization reaction between $H_3PO_4(aq)$ and $Ba(OH)_2(aq)$. How many mL of 0.150 M $Ba(OH)_2$ are required to neutralize 45.5 mL of 0.180 M phosphoric acid?

$2H_3PO_4(aq) + 3Ba(OH)_2(aq) \rightarrow 6H_2O(l) + Ba_3(PO_4)_2(s)$

45.5 mL, 0.180 mol/L; ? mL, 0.150 mol/L

$$45.5\,mL\,H_3PO_4 \left| \frac{0.180\,mol\,H_3PO_4}{1000\,mL\,H_3PO_4} \right| \frac{3\,mol\,Ba(OH)_2}{2\,mol\,H_3PO_4} \left| \frac{1000\,mL\,Ba(OH)_2}{0.150\,mol\,Ba(OH)_2} \right| = 81.9\,mL\,Ba(OH)_2$$

7. (2 Pts) For the chlorate ion, ClO_3^-, what are the oxidation states of the Cl and O, respectively?

$\frac{X}{Cl} + \frac{3(-2)}{O} = -1$ $X = +5$ (Cl) $O = -2$