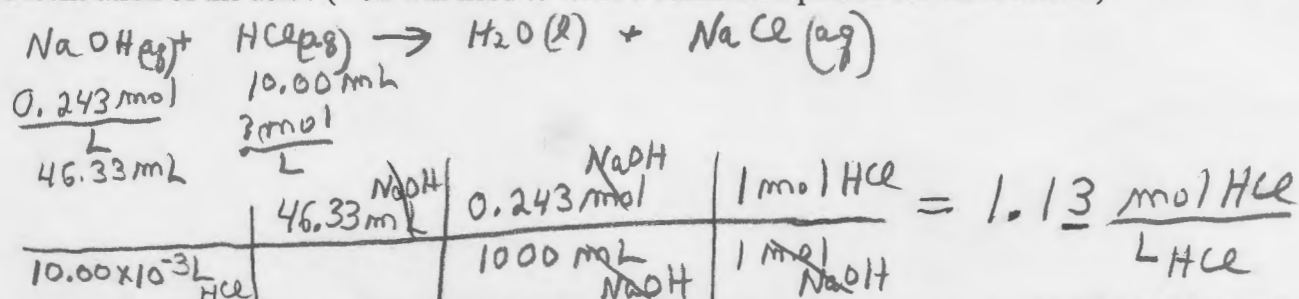
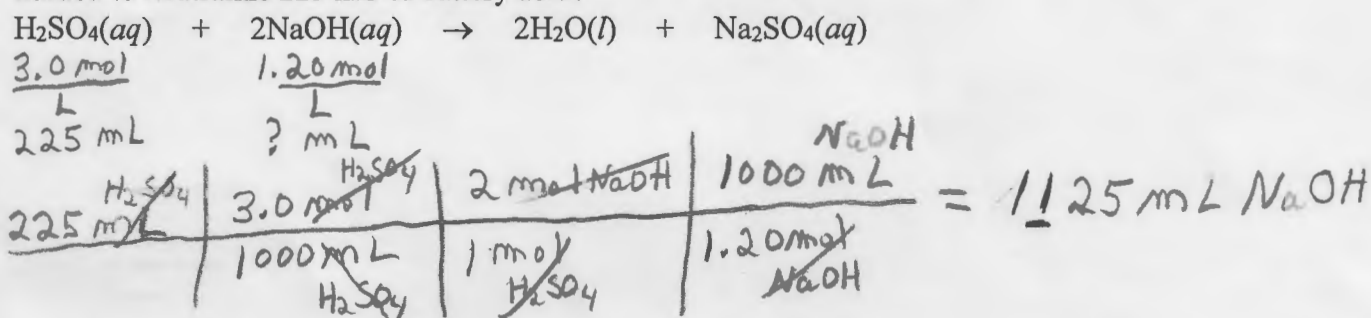


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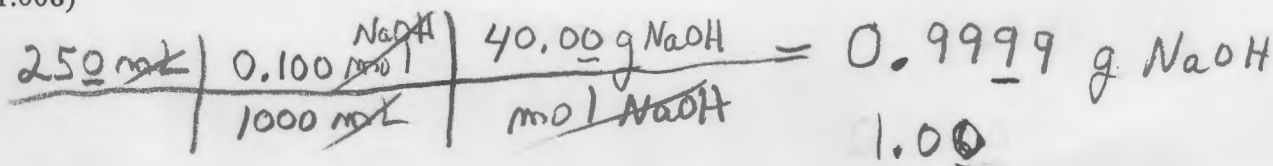
1. (7 Pts) A standard solution of 0.243 M NaOH was used to determine the concentration of a hydrochloric acid solution. If 46.33 mL of NaOH is needed to neutralize 10.00 mL of the acid, what is the molar (M) concentration of the acid? (You will need to write a balanced equation for the reaction.)



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?



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)

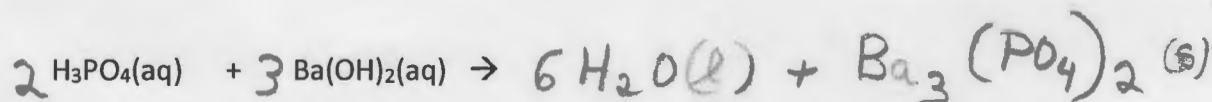


4. (5 Pts) What is the molarity (M) of a solution prepared by diluting 125 mL of 0.150 M HCl solution to a volume of 500.0 mL?

$$\text{Use } M_1V_1 = M_2V_2 \quad (0.150 \text{ M})(125 \text{ mL}) = M_2(500.0 \text{ mL})$$

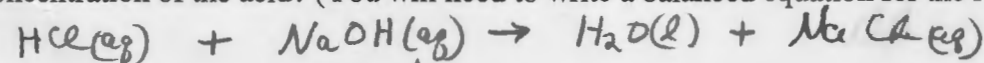
$$M_2 = 0.0375 \text{ M}$$

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



Show all work to receive credit.

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.)

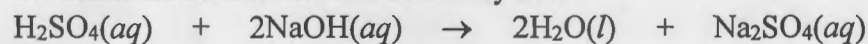


$$\frac{20.00 \text{ mL}}{? \text{ mol/L}}$$

$$\frac{0.243 \text{ mol/L}}{46.33 \text{ mL}}$$

$$\frac{20.00 \times 10^{-3} \text{ L HCl}}{46.33 \text{ mL NaOH}} \times \frac{0.243 \text{ mol NaOH}}{1000 \text{ mL NaOH}} \times \frac{1 \text{ mol HCl}}{1 \text{ mol NaOH}} = 0.563 \frac{\text{mol HCl}}{\text{L HCl}}$$

2. (6 Pts) Automobile batteries use 3.0 M H₂SO₄ as an electrolyte. How many mL of 1.40 M NaOH will be needed to neutralize 225 mL of battery acid?



$$\frac{3.0 \text{ mol/L}}{225 \text{ mL}}$$

$$\frac{1.40 \text{ mol/L}}{? \text{ mL}}$$

$$225 \text{ mL}$$

$$? \text{ mL}$$

$$\frac{225 \text{ mL H}_2\text{SO}_4}{3.0 \text{ mol/L H}_2\text{SO}_4} \times \frac{2 \text{ mol NaOH}}{1 \text{ mol H}_2\text{SO}_4} \times \frac{1000 \text{ mL}}{1.40 \text{ mol NaOH}} = 964 \text{ mL NaOH}$$

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)

$$\frac{250 \text{ mL}}{1000 \text{ mL}} \times 0.200 \text{ mol/L} \times 40.0 \text{ g NaOH/mol} = 2.00 \text{ g NaOH}$$

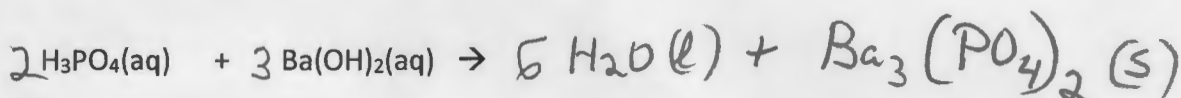
4. (5 Pts) What is the molarity (M) of a solution prepared by diluting 145 mL of 0.150 M HCl solution to a volume of 500.0 mL?

use: $M_1V_1 = M_2V_2$

$$(0.150 \text{ M})(145 \text{ mL}) = M_2(500.0 \text{ mL})$$

$$M_2 = 0.0435 \text{ M}$$

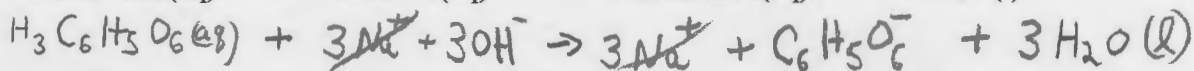
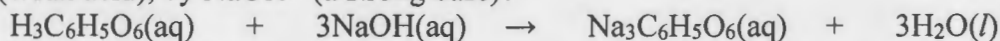
5. (2 Pts) Complete and balance the following equation:



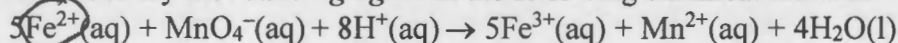
Key

Show all work to receive credit.

1. (3 Pts) What is the net ionic equation for the complete neutralization of citric acid, $\text{H}_3\text{C}_6\text{H}_5\text{O}_6$ (weak acid), by NaOH (a strong base)?



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

 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?

$$M_1 V_1 = M_2 V_2$$

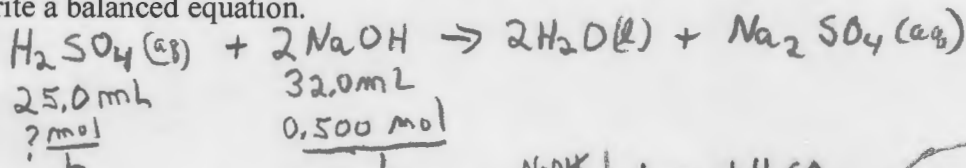
$$(2.50\text{M})(250.0\text{mL}) = (12.0\text{M})(V_2)$$

$$V_2 = 52.1\text{mL}$$

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]

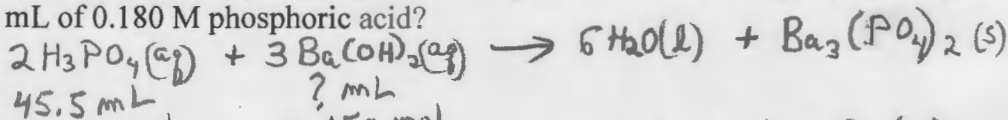
$$\frac{250.0\text{mL}}{1000\text{mL}} \times \frac{0.125\text{mol}}{1\text{mol}} \times \frac{74.55\text{g}}{1\text{mol}} = 2.33\text{g KCl}$$

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.



$$\frac{0.0250\text{L H}_2\text{SO}_4}{32.0\text{mL NaOH}} \times \frac{0.500\text{mol NaOH}}{1000\text{mL NaOH}} \times \frac{1\text{mol H}_2\text{SO}_4}{2\text{mol NaOH}} = 0.320 \frac{\text{mol H}_2\text{SO}_4}{\text{L H}_2\text{SO}_4}$$

6. (6 Pts) Write the balanced molecular equation for the acid-base neutralization reaction between $\text{H}_3\text{PO}_4(\text{aq})$ and $\text{Ba}(\text{OH})_2(\text{aq})$. How many mL of 0.150 M $\text{Ba}(\text{OH})_2$ are required to neutralize 45.5 mL of 0.180 M phosphoric acid?



$$\frac{45.5\text{mL H}_3\text{PO}_4}{1000\text{mL H}_3\text{PO}_4} \times \frac{0.180\text{mol H}_3\text{PO}_4}{1\text{mol H}_3\text{PO}_4} \times \frac{3\text{mol Ba}(\text{OH})_2}{2\text{mol H}_3\text{PO}_4} \times \frac{1000\text{mL Ba}(\text{OH})_2}{0.150\text{mol Ba}(\text{OH})_2} = 81.9\text{mL Ba}(\text{OH})_2$$

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

$$\frac{x}{\text{Cl}} + \frac{3(-2)}{\text{O}} = -1$$

$$x = +5$$

Cl

$$O = -2$$