# *Section 14B*

**1)** Define what acids and bases in terms of Arrhenius, Bronsted, and Lewis.

**2)** What relationship is there between the hydronium ion and an hydrogen +1 ion?

**3)** Determine if the following acids are weak or strong:

a) $HNO_3$ b) $CH_3COOH$ c) $HClO_4$ d) $HClO$ e) $HI$

**4)** Name the acids that were used in question **5**.

**5)**

| ***Strong Acid*** | | ***Weak Acid*** | |
|---|---|---|---|
| **$HCl$** | | **$HC_2H_3O_2$** | |
| **$HNO_3$** | | **$HF$** | |
| **$H_2SO_4$** | | **$HCOOH$** | |
| **$HBr$** | | **$NH_4^+$** | |
| **$HClO_4$** | | **$C_6H_5COOH$** | |
| **$HI$** | | **$HNO_2$** | |

| ***Strong Base*** | | ***Weak Base*** | |
|---|---|---|---|
| **$NaOH$** | | **$NH_3$** | |
| **$KOH$** | | **$CH_3NH_2$** | |
| **$Ba(OH)_2$** | | **$C_5H_5N$** | |
| **$LiOH$** | | | |

**6)** Predict the products of the following reactions, make sure to balance the reactions:

a) ____ $HNO_{3(aq)}$ + ____ $Ca(OH)_{2(s)}$ →

b) ____ $H_2SO_{4(aq)}$ + ____ $Al(OH)_{3(s)}$ →

c) ____ $HCl_{(aq)}$ + ____ $NH_{3(aq)}$ →

d) ____ $CH_3COOH_{(aq)}$ + ____ $NaOH_{(aq)}$ →

e) ____ $NH_4^+{}_{(aq)}$ + ____ $KOH_{(aq)}$ →

**6)** Write out the net-ionic equations for the five chemical reactions from number **5**. (*Be sure to include states of matter*)

**7)** Predict the products and balance the following reactions, be sure to include states of matter.

a) ____ $HCl_{(aq)}$ + ____ $Na_2CO_{3(s)}$ →

b) ____ $HNO_{3(aq)}$ + ____ $K_2S_{(s)}$ →

Acids and Bases

| **Calculate the pH of the each of the following solutions** | |
|---|---|
| **a) 0.0350 M HCl** | e) $2.65\times10^{-5}$ M $H_2SO_4$ |
| **b) $8.50\times10^{-2}$ M $HNO_3$** | f) $7.55\times10^{-6}$ M NaOH |
| **c) $1.50\times10^{-8}$ M HCl** | g) $4.55\times10^{-4}$ $H_2SO_4$ |
| **d) $9.67\times10^{-2}$ M LiOH** | h) $8.95\times10^{-4}$ M KOH |

| **Write a balanced equation for the reaction between the following compounds, predict the products and write out states of matter.** |
|---|
| **1. hydrochloric acid and sodium hydroxide** |
| **2. aqueous hydrobromic acid and aqueous ammonia** |
| **3. aqueous barium hydroxide and aqueous phosphoric acid** |
| **4. aqueous perchloric acid and solid magnesium hydroxide** |
| **5. aqueous acetic acid and aqueous potassium hydroxide** |
| **6. aqueous nitric acid and aqueous pyridine** |
| **7. aqueous benzoic acid and solid calcium hydroxide** |
| **8. solid sodium bicarbonate and aqueous hydrochloric acid** |
| **9. aqueous potassium carbonate and aqueous nitric acid** |
| **10. aqueous sulfuric acid and solid copper (II) carbonate** |
| **11. solid aluminum carbonate and aqueous acetic acid** |
| **12. aqueous sodium bicarbonate and hydrofluoric acid** |

## LAB

The following reactions will be run more as a demonstration than as a formal lab report, however after each reaction there are several questions that you will answer. View it as a homework assignment with a lab component.

I) Acid Dilution

1. Obtain 6M HCl
2. Perform calculations to figure out how to dilute to 150 mL of 2.0 M HCl
3. Perform dilution

II) Basic Solution

1. Perform calculations to create a 50 mL of 2.0 M NaOH solution
2. Obtain 50 mL of water and place in a beaker.
3. Use a thermometer and measure the temperature of the water.
4. Add the NaOH to the water and swirl. Periodically check the temperature. Be sure to record the highest obtained temperature.

III) Acid/Base Reaction

1. Obtain a beaker that is at least 150 mL in size
2. Pour all 50 mL of your basic solution from (II) in beaker.
3. Measure out 50 mL of your acidic solution created in (I).
4. Pour the acid into the beaker.
5. Using pH paper determine the approximate pH.
6. Pour the resulting mixture down the drain and rinse out beaker.

IV) Limiting Reagent

1. Obtain 50 mL of stock 0.299 M NaOH.
2. Place 50 mL in a beaker.
3. Using the remainder of your acid solution add the acid to the beaker.
4. Using pH paper, get an approximate measure of the pH of the solution.
5. Pour the solution down the drain.

V) Gas Forming Reaction

1. Obtain 0.1 mole of calcium carbonate, the calcium carbonate can be in powder or chip form.
2. Place calcium carbonate in a beaker.
3. Using the last 50 mL from the solution created in (I) add the HCl to the beaker.
4. Using pH paper, get an approximate measure of the pH of the solution.

*Questions*

I) Acid Dilution

1. Show calculation for dilution
2. What is the concentration of $H^+$?
3. What is the concentration of $Cl^-$?
4. What is the pH of the solution?

II) Basic Solution

1. Show calculations for how you made the solution.
2. What is the $[Na^+]$ and $[OH^-]$?
3. What was the temperature change?
4. Can you explain why the temperature changed the way it did?
5. What is the pH of the solution?

III) Acid/Base Reaction

1. How many moles of each reactant were used?
2. Write a net-ionic equation for the reaction?
3. What was the pH?
4. What should have been the pH and why should it have been that?

IV) Limiting Reagent

1. Write a balanced equation for the reaction.
2. Which compound is the limiting reagent?
3. How many moles of the excess reagent should have been left over after the reaction had run to completion?
4. What was the approximate pH of the solution? What should have been the pH of the solution?

V) Gas Forming Reaction

1. Show calculations to determine what mass of calcium carbonate was needed?
2. Calculate how many moles of HCl were used.
3. Write a balanced equation for this reaction.
4. What mass of $CO_2$ was created? How do you know this was created?
5. What was the pH and why was it so?