Name _____ Date _____

Acidity, Basicity, and Neutralization

The pH (potential of Hydrogen) scale is used to measure how acidic or basic a solution is. For the most part, pH values will range between 0 and 14. Solutions that have pH values below 7 are considered acidic, while pH values above 7 are considered basic. Neutral solutions have a pH of 7 and are neither acidic nor basic. Acid neutralization as well as the ability to determine the pH of a solution plays an important role in many aspects of our lives. In this experiment you will determine the pH values for several solutions. You will also see how adding a base to an acid (or vice versa) affects the pH value, as well as complete a simple titration experiment by neutralizing an acid and determining how much base was needed.

OBJECTIVES

In this experiment, you will

- Determine the pH levels of several solutions.
- Analyze the effects of combining acids and bases.
- Determine the amount of base necessary to neutralize a given amount of acid.

MATERIALS

distilled white vinegar	milk of magnesia
four 16 oz. styrofoam cups	stirring rod
measuring spoons	dropper
paper towels	iPod Touch
PASCO pH sensor	PASCO sensor interface
PASCO pH probe	

* The distilled white vinegar and milk of magnesia can be replaced by any suitable acid and base, respectively. The styrofoam cups can be replaced by any cups of similar size if necessary. The stirring rod can be replaced by a chopstick.

Figure 1 - PASCO pH Probe

PROCEDURE

1. Set up your iPod Touch and PASCO Hardware to collect data.
   a. Connect the sensor interface to the pH sensor.
   b. Connect the pH probe to the pH sensor.
   c. Turn the sensor interface device on and connect it to the iPod touch via Bluetooth.
   d. Open SPARKvue and create a new experiment, naming it 'pH test' and ensure you are measuring pH.

2. Measure the pH of the supplied Potassium Chloride (KCL) solution.
   a. Hold the pH probe facing upright so that the small bottle containing KCL solution will not spill when unscrewed.
   b. Unscrew the small bottle from the pH probe and set it on a level surface.
   c. In SPARKvue, select the 'pH test' experiment and begin collecting data.
   d. Scroll to the number value data screen (swipe two screens to the right from the graphical data interface).
   e. Place the tip of the pH probe into the solution and wait for the pH value to stabilize.
   f. Record the pH.
   g. Thoroughly rinse the tip of the pH probe with water and dry it with a paper towel.

3. Measure the pH of the distilled white vinegar solution.
   a. Pour a small amount of distilled white vinegar into one of the unused cups.
   b. Repeat parts e, f, and g from Step 2.

4. Measure the pH of the milk of magnesia solution.
   a. Pour a small amount of milk of magnesia into one of the cups.
   b. Repeat parts e, f, and g from Step 2.

5. Determine the amount of basic solution necessary to neutralize an acidic solution.
   a. Pour two tablespoons of distilled white vinegar into one of the unused cups.
   b. Place the tip of the pH probe into the solution and wait for the pH value to stabilize.
   c. Record the pH.
   d. Add one ½ teaspoon of milk of magnesia to the distilled white vinegar.
   e. Using your stirring rod, stir in the milk of magnesia and wait for the new pH value to stabilize.

f. Incrementally repeat parts d and e until you reach a pH of about six. Keep track of how many ½ teaspoons you add.
g. Using the dropper, depending on your current pH, add as many drops as necessary (one at a time) to reach a pH as close to seven as possible. When you reach a pH value of seven, you have reached what's called the equivalency point. Keep track of how many drops you add.
h. Thoroughly rinse the tip of the pH probe with water and dry it with a paper towel.

6. Determine the pH of tap water in Hawai'i.
   a. Pour a small amount of tap water into one of the unused cups.
   b. Repeat parts e, f, and g from Step 2.

7. Clean up the area you used to conduct your experiments and put things back where you obtained them from.

DATA

pH values for different solutions:

Solution	pH

Simplified titration experiment:

Initial solution	pH

Number of teaspoons of titrant added	Final pH value

PROCESSING THE DATA

1. In the space provided below, convert the number of drops from part g in Step 5 to teaspoons using the fact that one drop corresponds to 1/80 of a teaspoon.

2. In the space provided below, combine the values obtained from parts f and g in Step 5. This is the amount of milk of magnesia necessary to neutralize 2 tablespoons of distilled white vinegar. You should record this value in the data table provided.

3. Which solutions were basic?

4. Which solutions were acidic?

EXTENSION

1. State one reason why acid neutralization is important.
2. Research the pH values of distilled water, eggs, orange juice, and human blood.