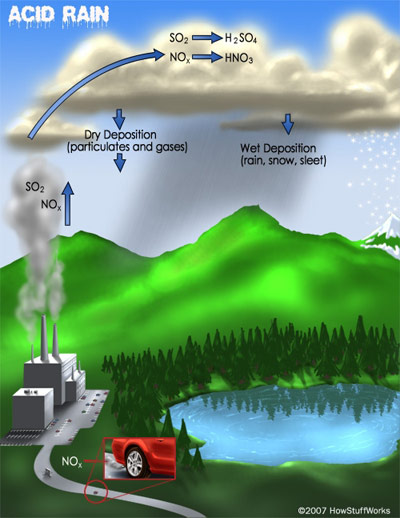
**Save the Stream! Buffering Acid Rain Investigation Lab** Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Background:**

Acid rain is a major environmental issue throughout much of the United States. Acid rain occurs when pollutants, such as sulfur dioxide from coal burning power plants and nitrogen oxides from car exhaust, combine with the moisture in the atmosphere to create sulfuric and nitric acids. Precipitation with a pH of 5.5 or lower is considered acid rain.

Acid deposition has negative effects on lakes, streams, soils, and the organisms that depend upon these environments. pH's in the range of 6.5 to 8.2 are optimal for most organisms, and below 5.0 is lethal to many fish species and plants. The degree to which acid deposition will impact plants and aquatic life is affected by the ability of soils to compensate for the acidity of the precipitation. Some soils contain mineral buffers that help stabilize the pH of acid rain. In today’s lab, we will discover which soil types are optimal at neutralizing acid precipitate from rainwater.

**Objective:**

You are an Illinois environmentalist working on a stream restoration project. The stream is located in Victoria Park Wetlands in Hoffman Estates, Illinois. Within the past year, fish fatality has soared and plant growth has decreased by nearly 50 percent. You have recently read news accounts about acid precipitation in this area, and you are worried that it may be affecting the stream’s ecosystem!

Your team of interns have gone out to the site and collected soil from the nearby stream. Like most soil found in Illinois, this soil has a high percentage of clay. The state government has allowed you to test three soil additives: peat moss, sand, and limestone. It is the role of you and your partner to determine:

* Which of the three soil additives best neutralizes acid precipitate in rainwater (if any)
* The optimal amount of additive that best neutralizes acid precipitate in rainwater

To do this, you and your partner will need to test the pH of the rainwater before and after soil exposure with all three additives.

Before you begin, you and your partner need to strategize a game plan and make predictions!

**Prelab Questions**: Answer the following questions with your partner. Once you have completed the questions and devised a plan, call instructor over for approval.

1. Which of the three additives (peat moss, sand, limestone) do you think will best absorb the acid from rainwater? Write down your hypothesis below.

Why? Explain your reasoning.

1. More specifically, how much additive do you think will best absorb the acid from rainwater? Write your hypothesis below.

Why? Explain your reasoning.

1. What happens if there is no relationship between soil and acid absorption? How will you determine this? (Hint: What is a null hypothesis?)
2. Determine the experimental game plan! Things to consider:

* What is going to be your independent and dependent variables? (Are you testing 1 additive at different amounts OR all additives at the same amount?)

**Write down your decision:**

* What are your constants? Remember, EVERYTHING must be the same except your independent variable.

**List your constants below:**

* How will you stay organized? How will you label the cups?

**Write down your decision.**

* Assign roles: You will need a stirrer (mixes rainwater and soil mixture) and a pourer/timer (pours rainwater while mixer mixes; allows 5 minutes for soil to absorb).

**Write down your decision:**

**Procedure for determine pH before and after soil exposure:**

1. **Prepare the pH sensor.**
   * The pH Sensor in pH soaking solution in a beaker; be careful not to tip over the beaker when connecting the sensor to the interface
   * Push the “on” button
2. **Measure the pH of the acid rainwater.**

* Place the tip of the pH Sensor into the acid rainwater. Make sure the glass

bulb at the tip of the sensor is completely submerged in the water

* When the pH value is stable, record it in your data table
* Hold the pH Sensor over the waste cup and rinse the tip with distilled water

1. **Prepare the soil.**
   * Add \_\_\_\_ teaspoons of \_\_\_\_\_\_\_\_\_\_\_\_ (your additive) to your plastic soil cup & mix
2. **Add \_\_\_\_\_\_ml of acidic rainwater**

* Helpful Hint!
* Add little increments of rainwater slowly while constantly stirring with the plastic spoon.

1. **Let the soil/water mixture sit for 2 minutes to allow for absorption.**
2. **Measure the pH of the soil/water mixture.**

* Place the tip of the pH Sensor into the soil/water mixture. Make sure the glass

bulb at the tip of the sensor is completely submerged in the soil.

* When the pH value is stable, record it in your data table
* Hold the pH Sensor over the waste cup and rinse the tip with distilled water

1. **Cleanup:**
   * Dispose plastic up and dirt in the garbage
2. **Repeat steps as needed.**

**Data Collection:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Soil Lake Samples | Sample A | Sample B | Sample C | Sample D |
| pH of rainwater before soil contact |  |  |  |  |
| pH of rainwater after soil contact |  |  |  |  |
| ∆pH |  |  |  |  |

1. Calculate the change in pH for each sample and record them in your data table.
2. Create a bar graph that describes the relationship between soil-type and change in pH. Be sure to include an appropriate title and axis.

Post-Lab Questions:

1. What did your results indicate? Explain.
2. Do you support or reject your hypothesis? Why?
3. Do you support or reject your null hypothesis? Why?
4. What are 3 possible sources of error in this experiment?
5. If you could re-do this experiment, what modifications would you make? List 3.