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## Changing pH Introduction

**Discovery Question:** How acidic or basic are leaves?

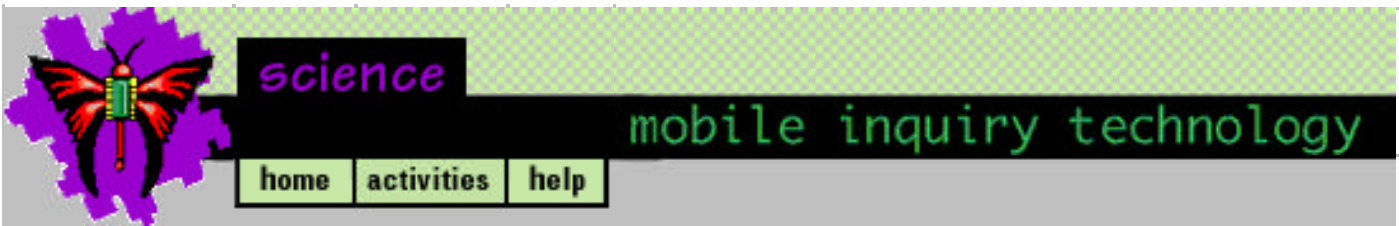


This activity enables you to explore acids and bases in the natural environment.

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## Thinking About the Question

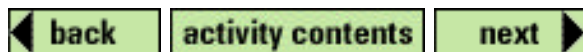
### How acidic or basic are leaves?

Chemicals are grouped together because of common properties. Acids are a group of sour chemicals. When a food tastes sour, like lemon juice or vinegar, it usually contains an acid. Bases have the opposite chemical properties of acids and feel slippery or soapy. Bases, like baking soda dissolved in water, have no strong taste.

Scientists have developed a scale to indicate how acidic or basic a solution is. You can test how acidic or basic a solution is by using a pH probe. The scale begins at 1, which indicates a very acidic solution, to 14, which indicates a very basic solution. A solution that has a pH of 7 (half way between 1 and 14) is considered neutral. In this activity you will test varying amounts of lemon juice in water and baking juice in water to understand the pH scale. After creating your scale, you will test leaves from different trees to determine their pH.

Your challenge is to investigate how adding different amounts of lemon juice to water will affect the pH, or acidity, of the solution. You will be able to use the pH probe to assist in your investigation. In your group spend a few minutes discussing and designing a procedure to be shown to your teacher.

Go to "Investigation I".





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## Changing pH Materials

- pH probe
- baking soda (approximately 1 teaspoon per group)
- graduate cylinder
- lemon juice (25 ml per group)
- clear plastic cup
- water (approximately 300 ml per group)
- small plastic bag that can be sealed
- samples of different varieties of leaves
- eye protection (optional based on school policy)

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## Changing pH Safety

Do not taste any of the solutions used in this activity due to possible contamination of the containers or strength of the acids and bases.

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## Changing pH Investigation I

### Testing the pH of lemon juice

1. Discuss an experimental procedure with your class. Before you begin your investigation make a prediction about the pH of water and how it will change as you add lemon juice.
2. Create a spreadsheet to record the pH of the lemon juice (5 ml, 10 ml, 15 ml, 20 ml, 25 ml), baking soda (5 ml, 10 ml, 15 ml, 20 ml, 25 ml), and leaf (type 1, type 2, type 3) solutions that you will mix. Refer to [Technical Hints](#) to see how to create a spreadsheet.



3. Obtain a clear plastic cup. Add 100 ml of water. Test the pH of the water by using the pH probe. Refer to [Technical Hints](#) to see how to use the DataLogger software to measure pH. Record your pH in your spreadsheet. Refer to [Technical Hints](#) to see how to transfer a spreadsheet.
4. Place 5 ml of lemon juice into your cup. Retest and record the pH of your solution.
5. Continue testing and recording pH after adding a 5 ml of lemon juice until you have added 25 ml of lemon juice to your water.
6. Answer Question 1 in "Analysis".



## Changing pH Investigation II

### Testing the pH of a baking soda solution

1. Fill a cup with 100 ml of water. Test the pH of the water by using the pH probe. Refer to [Technical Hints](#) to see how to use the DataLogger software to measure pH. Record your pH in your spreadsheet. Refer to [Technical Hints](#) to see how to transfer data to the spreadsheet.



2. Place 5 ml (approximately 1 teaspoon) of baking soda into your plastic cup. Mix thoroughly. Retest and record the pH of your solution.
3. Continue testing and recording pH after adding 5 ml of baking soda until you have added 25 ml of baking soda to your water.
4. Answer Questions 2-4 in "Analysis".



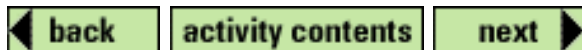
## Changing pH Investigation III

### Testing the pH of different kinds of leaves

1. Obtain a small plastic bag. Place a small amount of water in the bag. Tear one type of leaf into small pieces. Seal the bag and carefully crush the leaves into the water. Continue crushing the leaves for 5 minutes being careful not to tear the bag.
2. Test the pH of the leafy solution by using the pH probe. Refer to [Technical Hints](#) to see how to use the DataLogger software to measure pH. Record the names and pH of the leaf in your spreadsheet. Refer to [Technical Hints](#) to see how to transfer data to the spreadsheet.



3. Repeat the process for the remaining two types of leaves that you selected. Record their pH on the spreadsheet.
4. Answer Question 5 in "Analysis".

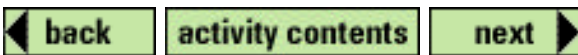






## Changing pH Technical Hints

- [Creating a spreadsheet](#)
- [Using the DataLogger software to measure pH](#)
- [Transferring data to your spreadsheet](#)
- [Using a draw program to create a pH scale](#)



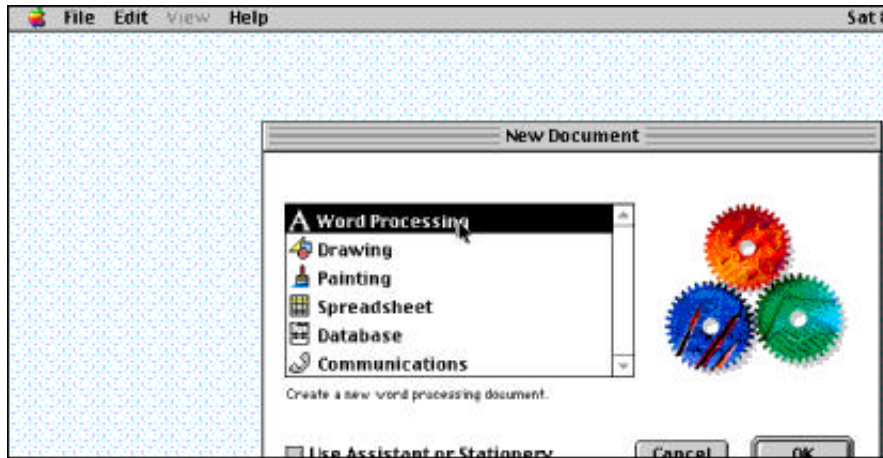


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### Changing pH Technical Hints

#### To create a spreadsheet:

1. Select the spreadsheet option in ClarisWorks.



2. Type the items (water, lemon juice at 5 ml, 10 ml, 15 ml, 20 ml, 25 ml, baking soda at 5 ml, 10 ml, 15 ml, 20 ml, 25 ml, leaf for type #1, type #2, and type #3 that you are testing in Column A. Place the pH values in Column B.

	A	B	C	D	E	F	G	H
1	Items							
2	Water							
3	Lemon Juice							
4	5 ml							
5	10 ml							
6	15 ml							
7	20 ml							
8	25 ml							
9	Baking Soda							
10	5 ml							
11	10 ml							
12	15 ml							
13	20 ml							
14	25 ml							
15	Leaf							
16	maple							
17	sak							
18	evergreen							
19								
20								
21								
22								
23								
24								

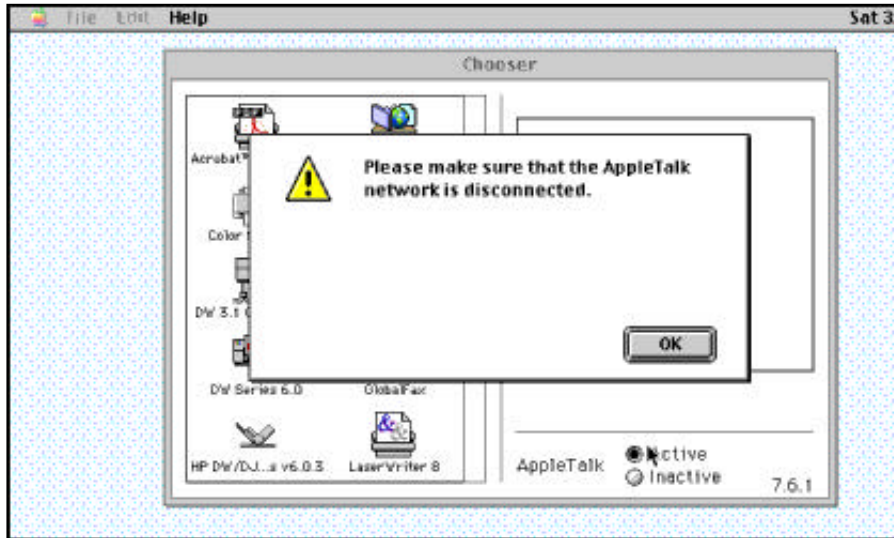
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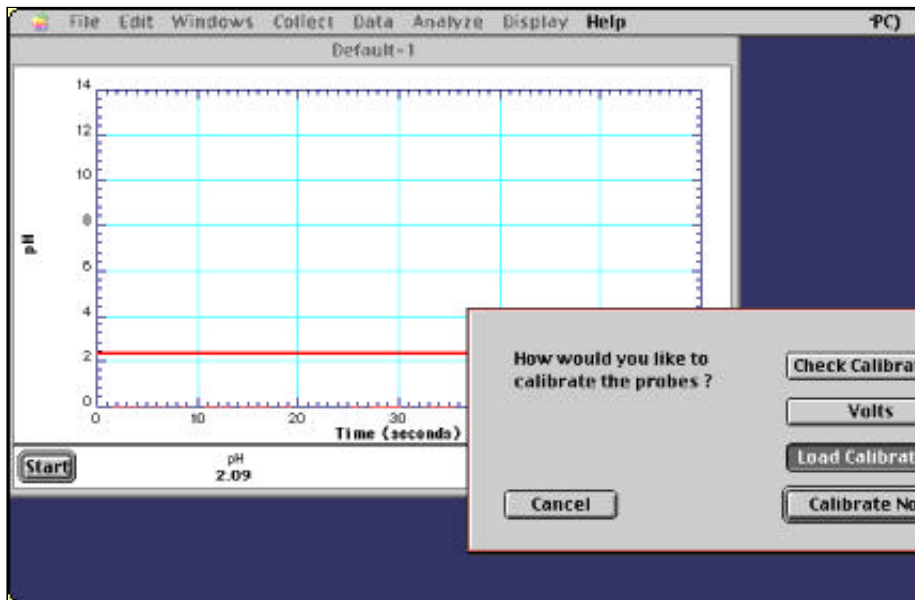
## mobile inquiry technology Changing pH Technical Hints

### To use the DataLogger software to measure pH:

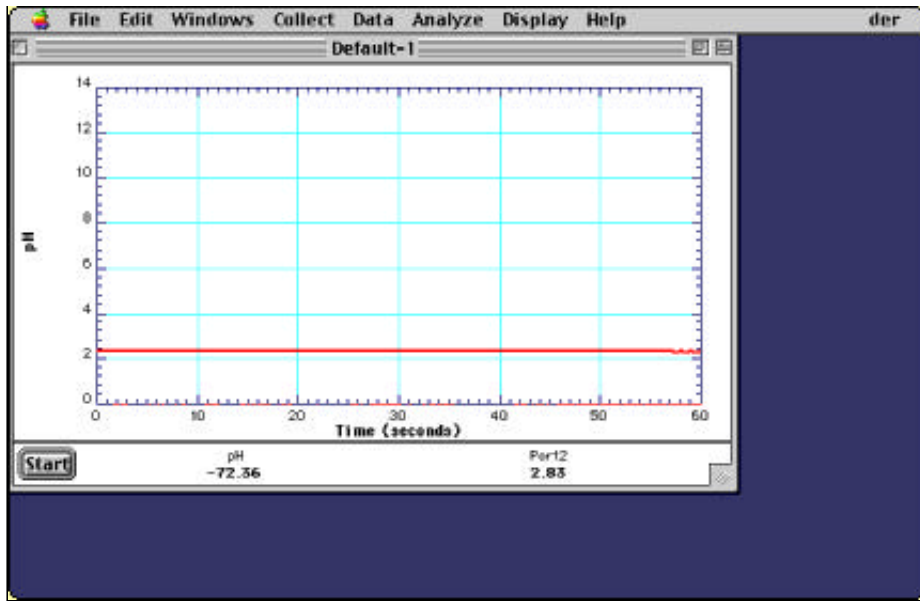
1. Open the Chooser from under the Apple menu. Make sure AppleTalk is inactive.



2. Attach the pH probe to port 1 of the interface box. Connect the serial port at the back of the computer to the modem/printer port.
3. Double click on the DataLogger software. It will automatically open. From the Collect menu choose Calibrate. Select Load Calibration for Just Port #1. From Experiment Files select pHtitration.CLB.



4. Select the Collect menu and choose Data Rate. For this activity select 1 point per second.
5. From the Display menu select One Graph. Also from the Display menu choose Set All Min, Max. For this experiment, select 0-30 for seconds. Click OK. Select 0-14 for pH. Click OK.



6. Click on Start to begin collection.

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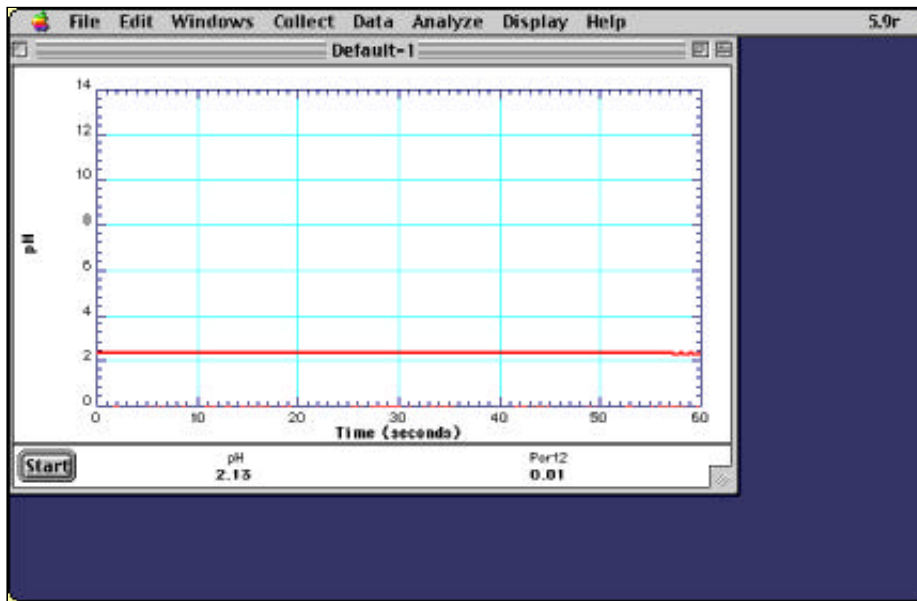


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### Changing pH Technical Hints

#### To transfer data to your spreadsheet:

1. Select Data Table A from the Windows menu. Highlight the last row of data and press Open Apple and the C key at the same time on the computer.
2. Open your pH spreadsheet. Choose an area away from your chart and press Open Apple and the V key at the same time. Select the pH and click in the appropriate box. Choose Paste from the Edit menu to place the pH. Highlight the original data and click delete.



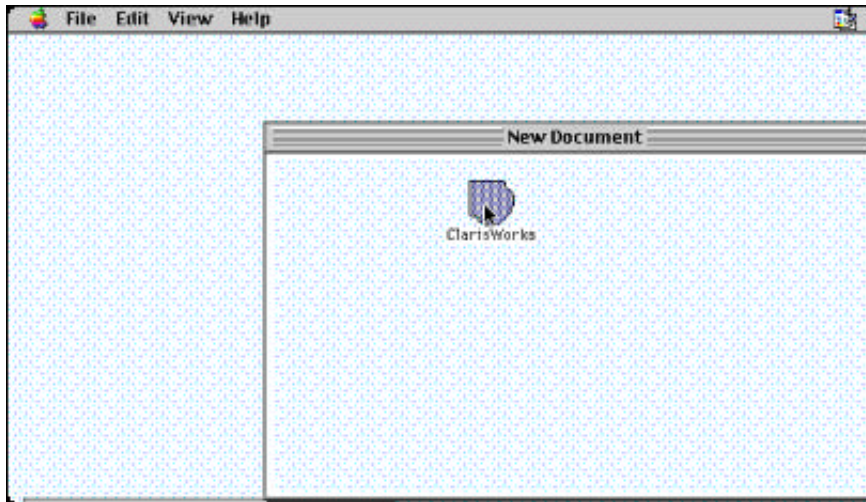
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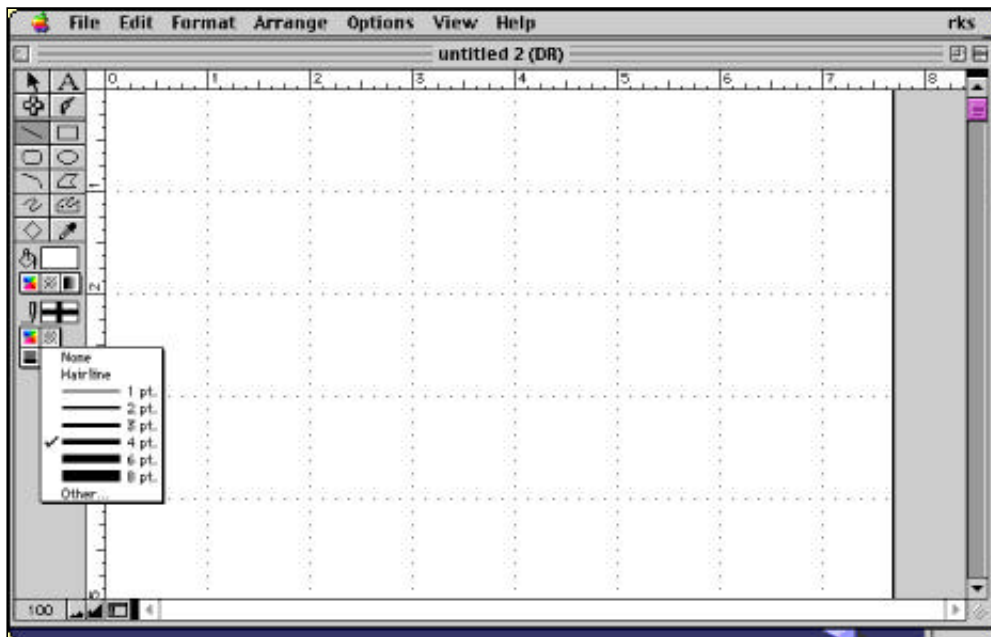
## mobile inquiry technology Changing pH Technical Hints

### To use a draw program to create a pH scale:

1. Open the ClarisWorks draw program by selecting it from the opening menu.

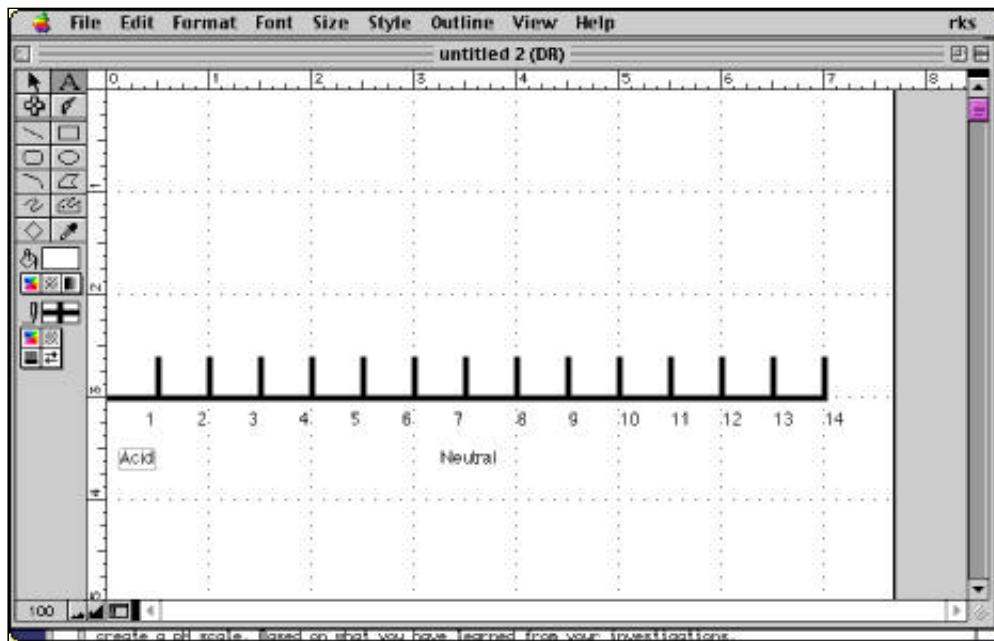


2. Select the line from the left menu. Click on your choice for the size of the line in the left margin (Tool panel). Select Show Rulers from the View menu. Click and drag your line to the appropriate size (0 to 7) on the work area. This will allow every half mark to represent a number on the pH scale.
3. Make a hash mark by returning to the line in the left menu. Make a mark at the 1/2 location on your line. While the squares are still on the hash mark, select Copy from the Edit menu. Select Paste from the Edit menu, and click on the hash mark. Drag it to the 1 location on your line. Continue until the complete line is divided into halves.



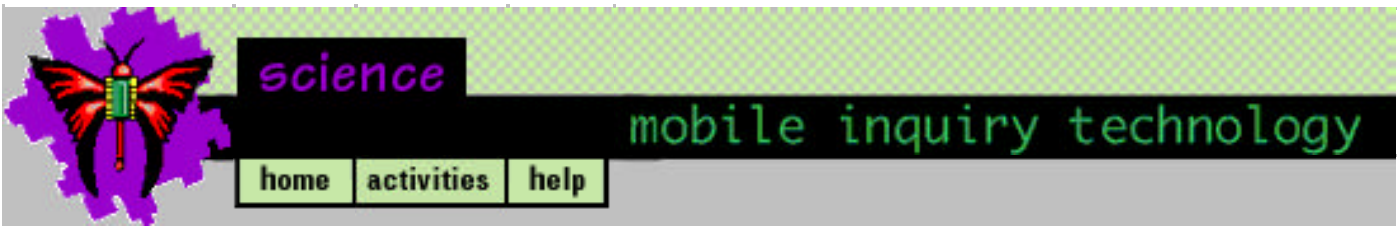
4. To add text to the drawing, click on the large A (Text tool) from the Tool panel. Place your cursor on the screen where you would like to add text. A small box with a cursor will appear. Type your label or sentence and click outside of the text box to obtain the design squares. The Arrow tool will be automatically activated

so that you can move the text around on the screen.



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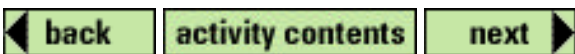
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## Changing pH Analysis

Answer the following questions on paper:

- What was the pH of the water? Using your data, describe how the pH of the water changed as you added the lemon juice? If you know that tap water is neutral (not an acid or a base) and lemon juice is an acid, what type of pH values indicate an acid?
- How did the pH of the water change as you added baking soda? How does the pH of water compare to the pH of the baking soda solution? If you know that tap water is neutral (not an acid or a base) and a baking soda solution is a base, what type of pH values indicate a base?
- How does the pH value of an acid compare to that of a base? The pH scale ranges from 1-14.
- Make a line that starts with the number 1 and finishes with the number 14 in a draw program. Make sure that the number 7 is at the center. Refer to [Technical Hints](#) to see how to use a draw program to create a pH scale. Based on what you have learned from your investigations, label which values represent acids and which represent bases on your pH scale. Mark the numbers that represent stronger acids and stronger bases.
- Were your leaf solutions acids or bases? Place the names of your leaf selections at the appropriate location on your pH scale.







## Changing pH Further Investigation

- Create and compare pH scales for pond, field, and forest locations by collecting and testing samples of organic substances (leaves, grass, bark, etc.) found at each site.
- Investigate and relate how soils found around your environment vary in pH.

