[1] Acids and Bases Project

**THE MOST COVETED BILLBOARD IN ROCHESTER IS FINALLY AVAILABLE** AND YOUR RESEARCH TEAM HAS DONE SOME INCREDIBLE WORK IN THE FIELD OF ACID/BASE CHEMISTRY AND YOU NEED TO SHARE YOUR FINDINGS WITH THE PUBLIC!!! BUT… THERE ARE SEVERAL OTHER RESEARCH TEAMS THAT WILL FIGHT YOU FOR THIS ADVERTISEMENT SPACE. YOUR JOB IS TO USE YOUR KNOWLEDGE OF CHEMISTRY TO PROVE WHY YOUR RESEARCH SHOULD BE BLOWN UP ON THE BILLBOARD. YOU WILL PRESENT TO THE ADVERTISMENT COMMITTEE YOUR BILLBOARD DESIGN AND JUSTIFICATION FOR WHY YOU DESERVE THIS SPACE.

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# How does acid rain affect aquatic life?

Acid rain is a serious environmental problem that affects large parts of the United States and Canada. Acid rain is particularly damaging to lakes, streams, and forests and the plants and animals that live in these ecosystems.

**Support your ad with science**: <http://ei.cornell.edu/watersheds/Acid_Rain_Experiments.pdf>

**Materials**

• distilled water

• Buffered Solution: add 1/2 tsp baking soda to 1 liter distilled water

• Acid Rain Solution: add 4 ml 1M H2SO4 to 2 liters distilled water.

• pH meter, test kit, pH paper, or Universal Indicator Solution

• beakers or clear plastic cups (200-ml size, two per student or group

• 25-ml graduated cylinders (one per student or group of students)

• 10-ml pipette (one per student or group of students)

• safety goggles

• gloves

• optional: alkalinity test kit

**Procedure**

1. Put 25 ml distilled water into one beaker and 25 ml Buffered Solution into another.

2. Add 6 drops Universal Indicator Solution to each beaker. {Note the color differences between the two solutions. The distilled water is slightly acidic because of dissolved carbon dioxide; the baking soda solution is slightly basic.}

3. Using a pipette, carefully add Acid Rain Solution drop by drop to the beaker containing distilled water, swirling after each addition until the color stabilizes. How much do you need to add to make the solution turn pink and stay that color, indicating that it is acidic?

4. Using a 25-ml graduated cylinder, carefully add Acid Rain Solution to the cup containing the buffered solution. Add a few ml at a time, swirling and observing the color changes. How much do you need to add to make the solution turn a stable pink?

5. Optional: Measure the alkalinity of distilled water and of Buffered Solution, then relate the alkalinity measurements to the amounts of acid needed to cause a pH change in the two solutions.

**Discussion**

• Why were there differences in the amount of acid needed to change the pH of these two solutions?

• What is a buffer?

• How does this relate to lakes in New York State?

**Your research should include**: Explanation of what acid rain is and the effects it has on aquatic life in terms of pH levels. Research different bodies of water and the pH levels that these bodies of water need to be in order to support the plant and animal life within it.

**Your billboard design should include**: The facts of the issue and solutions for this issue. Data on pH levels of water with and without acid rain. Why is this important for the public to know?

[2] Acids and Bases Project

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# What is the pH diet?

The serious athlete or non-athlete must learn to recognize and expel the enemy from within by facing his or her own demons that are, or will, continue to haunt one while depleting one's cellular energy, namely, low chronic acidosis. All food diets are either acid-forming or alkaline-forming. So what is the acid-alkaline diet and should we all participate in it for healthier lives?

**Resources**:

* <http://www.acidalkalinediet.net/acid-alkaline-diet.php>
* <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3195546/>

**Support your ad with science**: Test the pH of specific foods outlined in the pH diet. Choose an indicator that you feel would be best to use. Compare your findings with what the research says.

**Your research should include**: What is the acid-alkaline diet and what does a typical diet look like? What data or research has been done to prove that this is or is not a healthy option?

**Your billboard design should include**: Either share with the public that this is a diet everyone should try or warn them against it. You choose your stance based on your research. It should contain supporting facts about what it is and the effects it has on the body (digestive system, circulatory system, excretory system, etc.)

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# Is Alkaline Water the best water to drink?

Some people believe that alkaline water helps our bodies metabolize nutrients and expel toxins more efficiently than regular tap water, leading to better health and performance. What does the research say? Should we all convert to drinking alkaline water? Will we live longer and/or healthier lives as a result?

**Resources**:

* <http://www.good4utah.com/story/d/story/how-alkaline-water-could-benefit-your-health/32723/Dod-iXJkU0e9oS5BW8VvDw>
* <http://www.precisionnutrition.com/alkaline-water-legit-or-hoax>

**Support your ad with science**: Test the pH of different types of water (tap, distilled, etc). You may want to compare this to other beverages intended to be healthy for you.

**Your research should include**: Explanation of what alkaline water is. Compare and contrast different types of water in terms of acidity/alkalinity levels. Advantages and disadvantages of alkaline water. Effects of alkaline water on the body and the chemistry behind it.

**Your billboard design should include**: Your stance on alkaline water. Will you promote it or warn the public against it? Provide data and evidence to support your stance.

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# What is the ideal pH for fertilizer?

The pH of the soil governs what nutrients are available to plants. If the soil pH is above or below the recommended range, nutrients may not be soluble (absorbable by plants) or they may be so soluble that they become Phytotoxic. Therefore, a plant can show signs of nutrient deficiencies or toxicity even when the correct amount of fertilizer is applied to that plant.

**Resources**:

* <http://vric.ucdavis.edu/pdf/Soil/ChangingpHinSoil.pdf>
* <http://newstimes.augusta.com/odds-ends/2015-02-22/fertilizer-program-is-necessary-component-of-healthy-lawn>
* <http://hillsborough.ifas.ufl.edu/residential_lg/FAQs/fertilizer_pH.shtml>

**Support your ad with science**: <http://ei.cornell.edu/watersheds/Acid_Rain_Experiments.pdf>

**Materials:** Same as for Experiment Problem #1, plus:

• assorted soil samples

• coffee filters

• rubber bands

**Procedure:**

Design an experiment or set of experiments that use the materials provided to address one or more of these questions:

1. Does soil change the pH of water that drains through it?

2. Can soil reduce the acidity of water draining into a lake?

3. Do some types of soil buffer drainage water better than do other soil types?

4. Can the buffering capacity of soils be depleted?

5. Does the buffering capacity of a soil relate to the alkalinity of water that has drained through it?

6. What components of soil provide its buffering capacity?

**Your research should include**: Ideal pH of soil/fertilizer for different plants. Have a focus on types of plants and locations of these plants in the world. What is pH? Why is a particular pH range supportive of plant growth?

**Your billboard design should include**: Inform the public on the importance of pH levels for plant growth. Maybe you will advertise for a particular brand/type of fertilizer or advertise your own fertilizer creation that will be best for plant growth. Support your ad with facts and data from your research and experimentation.

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# What are the effects of overusing Antacids?

Antacids are among the most commonly used over-the-counter (OTC) medication after pain, cough, cold and smoking cessation drugs. We all experience indigestion at some point or the other in life. And for some of us, heartburn and indigestion are a daily occurrence. Antacids are a quick, inexpensive and easily accessible remedy. As an over-the-counter product its use is fairly unrestricted despite warnings on package inserts. It is therefore possible that some of the digestive symptoms that you may be experiencing may in fact be due to the overuse of antacids.

**Resource:**

* <http://www.newindianexpress.com/cities/bengaluru/Controlling-Indigestion-Problems/2015/03/18/article2718322.ece>
* <http://www.healthhype.com/symptoms-of-antacid-overuse-and-excess.html>

**Support your ad with science**: Design a procedure to test the effects and pH of using antacids as prescribed and overusing them. Add different types and amounts of antacids to hydrochloric acid (highly concentrated acid in your stomach) and take note of pH values.

**Your research should include**: Explanation of what antacid is, what it is used for, and the science behind why antacids work the way they do. What could be the negative effects of overusing antacids? How does this relate to pH and acids and bases? What are the effects on antacids on your circulatory system and digestive system?

**Your billboard design should include**: Warnings about overuse of antacids. Should include supporting data and science behind it. The costs and benefits of using antacids. Side effects to be aware of when overusing. How much is considered too much?

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# How could exercise be a problem for your body’s pH levels?

The pH of your blood is normally between 7.35 and 7.45, just slightly above neutral. The term "pH" -- which stands for potential hydrogen -- gives you an idea of a substance's acidity or alkalinity. Strenuous physical activity is even a strain on your blood, which can cause your blood pH to drop or become more acidic. Why is that? How does lactic acid play a role? How does your blood pH stay regulated?

**Resource**:

* <http://www.chemistry.wustl.edu/~edudev/LabTutorials/Buffer/Buffer.html>
* <http://www.livestrong.com/article/473009-decrease-in-ph-of-blood-caused-by-exercise/>

**Support your ad with science**: Design an experiment in which you qualitatively and quantitatively measure the way muscles feel after doing different amounts of exercise. Relate muscle pains to the amount of lactic acid being released and connect this to changes of pH levels in the body.

**Your research should include**: Identification of ideal pH levels for blood and different ways in which that pH level is offset with a specific focus on exercise. Why does exercising change your blood’s pH levels? How does the body work to regulate this pH? Why is it so important that your blood maintain a specific pH level?

**Your billboard design should include**: Inform the public about the effects that exercising has on the pH of your blood. Why does this matter? What can you do to help your body regulate this pH? You could even advertise your own creation of a drug or technique that would support regulation of your body’s pH.

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# How acidic or basic can something we ingest be?

Test the acidity/alkalinity of different acidic and basic substances that people typically ingest. What is the lowest and highest pH that we can ingest without doing harm to our bodies?

**Resource**: <http://www.chemistry.wustl.edu/~edudev/LabTutorials/Buffer/Buffer.html>

**Support your ad with science:** Add at least 10 different acidic/basic substances to hydrochloric acid (the highly concentrated acid in your stomach) and see how pH is affected. Do some research to determine some of the most acidic and the most basic items that could be ingested and test them for yourself.

**Your research should include**: Do some research to figure out the acidity of different substances we ingest. Do we ingest any substances that we shouldn’t because of its extreme acidic or basic levels? What would be the effects of ingesting something highly acidic or highly basic? Does our body have some way of regulating this if we do?

**Your billboard design should include**: Create a pH scale that includes at least 10 different substances with varying pH levels. Inform the public of what you find and warn them of any dangerous substances they should be cautious of ingesting!