

ACID RAIN AND WEATHERING

- NGSSS:
 - SC.8.N.1.1 Define a problem from the eighth grade curriculum using appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions
 - SC.8.N.1.2: Design and conduct a study using repeated trials and replication
 - SC.8.N.1.3: Use phrases such as "results support" or "fail to support" in science, understanding that science does not offer conclusive 'proof' of a knowledge claim.
 - SC.8.N.1.6: Understand that scientific investigations involve the collection of relevant empirical evidence, the use of logical reasoning, and the application of imagination in devising hypotheses, predictions, explanations and models to make sense of the collected evidence
 - SC.6.E.6.1: Describe and give examples of ways in which Earth's surface is build up and torn down by physical and chemical weathering, erosion, and deposition.
 - SC.7.E.6.6: Identify the impact that humans have had on Earth such as deforestation, urbanization, desertification, erosion, air, and water quality, changing the flow of water.

- Common Core:
 - CCSS.ELA-Literacy.RST.6-8.3
Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
 - CCSS.ELA-Literacy.RST.6-8.4
Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6-8 texts and topics*.
 - CCSS.ELA-Literacy.RST.6-8.7
Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
 - CCSS.ELA-Literacy.RST.6-8.9
Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

Objectives: Students make simulated acid rain and test its reaction with a variety of materials as they relate the acidity of a solution to its pH factor, measure the change of pH of water as carbon dioxide is bubbled through it and demonstrate how acid rain can affect and damage materials.

Skills: Students gain experience conducting the following procedures:

- Setting up the equipment and work area to produce carbon dioxide gas by reacting baking soda and vinegar, and trapping the gas in the balloon.
- Bubbling the carbon dioxide gas through a straw into a beaker of distilled water to lower its pH, making a solution that simulates acid rain
- Testing the effect of the carbonic acid "rain" solution on various materials such as chalk, an iron nail, limestone, and marble, and observing for signs of any chemical reactions.

Materials:

- Eurosmart datalogger
- pH sensor
- Bottle
- Graduated cylinder
- Beakers (2)
- Pipet
- Balloon
- Straw
- Iron nail
- Rock samples: marble, limestone, chalk or similar
- White vinegar
- Water
- Spoon
- Funnel
- Bromothymol blue indicator solution
- Baking Soda

Driving Question: What effect can acid rain have on architectural materials?

Lab Summary: Students will make a list of ten famous buildings around the world and a list of materials they are made out of. Students will use their knowledge of acids, bases and the pH scale to investigate the effects of acid rain on the materials used to construct buildings and other structures. Students will create simulated acid rain by using the vinegar, water, bromothymol blue indicator solution and baking soda. They will use the vinegar and baking soda to cause a reaction and inflate a balloon. They will allow the gas from the balloon to bubble into the water and will record the pH levels throughout this process. Then they will place the simulated acid rain water on each of the samples of materials and observe each sample for signs of a reaction and record their findings on a chart.