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|  | Activity 1-Acid Rain Effects |  |

**Teacher Instructions**

This activity can be found on: <https://www.teachengineering.org/activities/view/cub_air_lesson06_activity2>

Students conduct a simple experiment to model and explore the harmful effects of acid rain (vinegar) on living (green leaf and eggshell) and non-living (paper clip) objects.

This activity includes an instructional video showing the set up and procedure as well as representative results. All worksheets and reference sheets are also included at the above link. A glossary of terms is also included.

**Objective**

After this activity, students should be able to:

* Discuss how engineers are working to prevent pollution and acid rain.
* Use an indicator to differentiate between acidic, basic and neutral solutions.
* Use their observations to describe the cause-effect relationship of acid rain.
* Observe and describe some of the harmful effects of acid rain on living and non-living items.

**Materials**

Each group needs:

* 1 cup vinegar
* 1 cup distilled water
* 2 medium-sized eggshell pieces
* 2 small green leaves
* 2 paperclips
* 2 small- or medium-sized glass jars
* Masking tape and pen (for labeling containers)
* Two 1.5-inch strips of wide-range (0-14 pH) litmus paper; since groups need to use the comparison chart included with the litmus container, obtain enough dispensers for each group to have one; litmus paper is available from chemistry supply companies (such as Fisher) and well-equipped hardware stores.
* Acid Rain Effects Worksheet, 1 per student (for recording data and answering questions)

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|  | Activity 2 – Composting-Nature’s Disappearing Act |  |

**Teacher Instructions**

This activity can be found on: <https://www.teachengineering.org/activities/view/cub_environ_lesson05_activity2>

Students explore the concept of biodegradability by building and observing model landfills to test the decomposition of samples of everyday garbage items. They collect and record experiment observations over five days, seeing for themselves what happens to trash when it is thrown "away" in a landfill environment. This shows them the difference between biodegradable and non-biodegradable and serves to introduce them to the idea of composting. Students also learn about the role of engineering in solid waste management. This activity includes an instructional video showing the setup and procedure, as well as representative results. All worksheets and reference sheets are also included at the above link. A glossary of terms is also included.

**Objective**

After this activity, students should be able to:

* Define biodegradable and non-biodegradable.
* Explain how engineers work to reduce solid waste.
* Gather and record data and observations based on a landfill experiment.

**Materials**

Each group needs:

* 2-liter bottle, cut in half so the bottom half can serve as a stand to hold the top half turned upside down
* 3 cups soil; garden soil works best; avoid using potting soil because it does not have all of the organisms and bacteria that help with decomposition
* ¾ cup water
* 1 sheet paper, torn into small pieces; recycled paper or newspaper works
* 2 lettuce leaves, torn into small pieces
* 1 apple, sliced or diced into small pieces
* 2-3 plastic food containers, such as yogurt cups, cut into small pieces about ½ inch squares
* Rubber or latex gloves, one pair per student
* 2 spoons or Popsicle sticks
* Measuring cups, in sizes: 1 cup, ½ cup, ¼ cup
* Masking tape, 6-inch strip
* Marker or pen
* Nature's Disappearing Act Worksheet, one per student

For the entire class to share:

* 2 extras of the group landfill model setups, to serve as experimental controls
* Cloth rags, paper towels, broom, dustbin, sink - for clean up

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|  | Activity 3 – A Case for Protecting the Environment |  |

**Teacher Instructions**

The student will write an essay explaining why people should protect the environment and suggests how they can do that while still supplying human needs for food, shelter, and jobs.

**Objective**

This activity is designed to allow students to make careful observations and analyze and integrate them into a coherent essay.

**Materials:**

Writing paper, writing utensil

**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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| **Activity 3 – A Case for Protecting the Environment** |

**Writing Prompt:**

Dr. Jonas Salk, American physician and microbiologist said, “Eventually we'll realize that if we destroy the ecosystem, we destroy ourselves.”

Write an essay explaining why people should protect the environment and suggest how they can do that while still supplying human needs for food, shelter, and jobs.

Be sure to —

• clearly state your controlling idea

• organize and develop your explanation effectively

• choose your words carefully

• use correct spelling, capitalization, punctuation, grammar, and sentences

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|  | Activity 4 – What Goes Around Comes Around |  |

**Teacher Instructions**

This activity can be found on: <https://www.uen.org/lessonplan/view/1797>

The paths of water, carbon, and nitrogen are cyclic. In this lesson students will model the cycles of matter by creating an ecosystem in a jar. They will also give research-based oral presentations on the carbon, water, and nitrogen cycles. This activity provides instructions for guiding students in creating an ecosystem in a jar. Suggestions for organizing and pacing the project are given, but the teacher will be required to decide on the details of the project. Discussion questions are provided.

**Objective**

After this activity, students should be able to:

* Make observations.
* Use reference sources to obtain information.
* Make predictions.
* Identify variables.
* Plan investigation.
* Collect and record data.
* Analyze data and draw warranted information.
* Construct models.
* Understand science concepts.
* Use the language of science to communicate.

**Materials:**

* Large glass jar with lid
* Pond water or dechlorinated tap water
* Gravel or rocks
* Soil
* Pinch of grass seeds and/or pinch of clover seeds
* Mung bean seeds
* Earthworms
* Isopods
* Mealworms
* Crickets
* Strands of Anacharis, Fontinallis, and/or foxtail
* Duckweed
* Black ram's horn snails
* Guppies
* Daphnia

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|  | Activity 5 – Investigating Photosynthesis |  |

**Teacher Instructions**

This activity can be found on: <https://serc.carleton.edu/sp/mnstep/activities/35653.html>

This activity is designed to be used prior to any direct instruction for photosynthesis. In this inquiry lab, students design and conduct simple experiments using elodea and Bromthymol blue to determine whether plants consume or release carbon dioxide in the process of photosynthesis. Students will record their data which will be used to conclude whether carbon dioxide was consumed or released by the elodea. Through class discussion of student data, students will learn that carbon dioxide was consumed during photosynthesis. At the end of the class discussion students will be asked to answer 5 follow-up questions. Detailed instructions for the laboratory set up and procedures are included, along with a student handout. Helpful teaching notes and tips are also given.

**Objectives**

This activity is designed for students to **discover** that plants consume carbon dioxide when undergoing photosynthesis. Students will use higher-order thinking skills as they design their experiment, analyze their data and draw conclusions. Skills developed in this inquiry lab are as follows: creating and conducting a controlled experiment, using Bromthymol blue as an indicator for carbon dioxide, creating a data table on which to record data, and making observations. The key concept for this investigation is that plants use carbon dioxide, water, and sunlight to make glucose, oxygen, and water during the process of photosynthesis. Vocabulary words to be reviewed/learned during this lab are photosynthesis, carbon dioxide (CO2), autotroph, producer, elodea, flask, Bromothymol blue, and indicator solution.

**Materials**

* One student handout per student
* Elodea – two to four sprigs per lab group (found at pet stores)
* Flasks – 125 ml, two to four per lab group
* Rubber stoppers (#5) or parafilm, two or four per lab
* Bromothymol blue (BTB) 0.1 percent solution, diluted by adding seven drops per 30 ml of water used
* Water, enough to fill all flasks
* Light source
* Drinking straws – one per lab group

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|  | Activity 6 – Making a Greenhouse |  |

**Teacher Instructions**

This activity can be found on: <https://sealevel.jpl.nasa.gov/files/archive/activities/ts1hiac1.pdf><https://kamu.pbslearningmedia.org/resource/ess05.sci.ess.watcyc.lp_global1/global-climate-change-understanding-the-greenhouse-effect/>

Students study past climate change, explore the effect of greenhouse gases on Earth's atmosphere today, and consider human impact on global warming. This activity includes a very detailed lesson plan, links to short videos to be presented, and thorough instructions for creating greenhouse models that are used for data collection. Part One: Activity Three of this exercise requires a computer with a Flash Player, but the other parts of the activity can be done without this part if this is not available.

**Objective**

Students will be able to:

* Understand what global climate change is and how it affects our lives
* Learn about greenhouse gases and begin to consider what events are causing an increase in the amount of greenhouse gases in the atmosphere

**Materials:**

For each pair or small group of students:

* three thermometers
* two clear glass jars that will fit over the thermometers
* sun lamp or sunny windowsill
* paper towels
* Scientific notebooks or journals for recording data and observations
* Graph paper

One clock to be used by the entire class

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|  | Activity 7 – Solar Energy-Black or White? |  |

**Teacher Instructions**

This activity can be found on: <https://www.esi.utexas.edu/files/069-Lesson-Plan-Black-or-White-Solar-Energy.pdf>

The purpose of this activity is to show how color of an object has an effect on energy storage. Instructions for the activity are included in the above document.

**Objective**

Students will be able to:

1. Discuss the effect of colors on the amount of solar thermal energy absorbed.

2. Describe which colors absorb more/less solar energy.

3. Investigate the effect that colors have on solar thermal energy.

**Materials:**

For each group of 2-3 students:

• 1 clear plastic bottle

• 1 plastic bottle painted white

• 1 plastic bottle painted black

• 3 balloons of the same color