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Can We Neutralize Acid Rain?

An engineering design activity engaging Physical Science students in the process of developing possible solutions to the environmental issue of acid rain.

OBJECTIVES

8th Grade Physical Science

- Students will be able to develop a prototype that neutralizes the effects of acid rain, demonstrating proficiency with at least 4 out of 5 criteria on a performance rubric.
- Students will be able to identify the compound in coal combustion that contributes to acid rain.
- Students will be able to explain the effects of acid rain, citing specific evidence from their model.

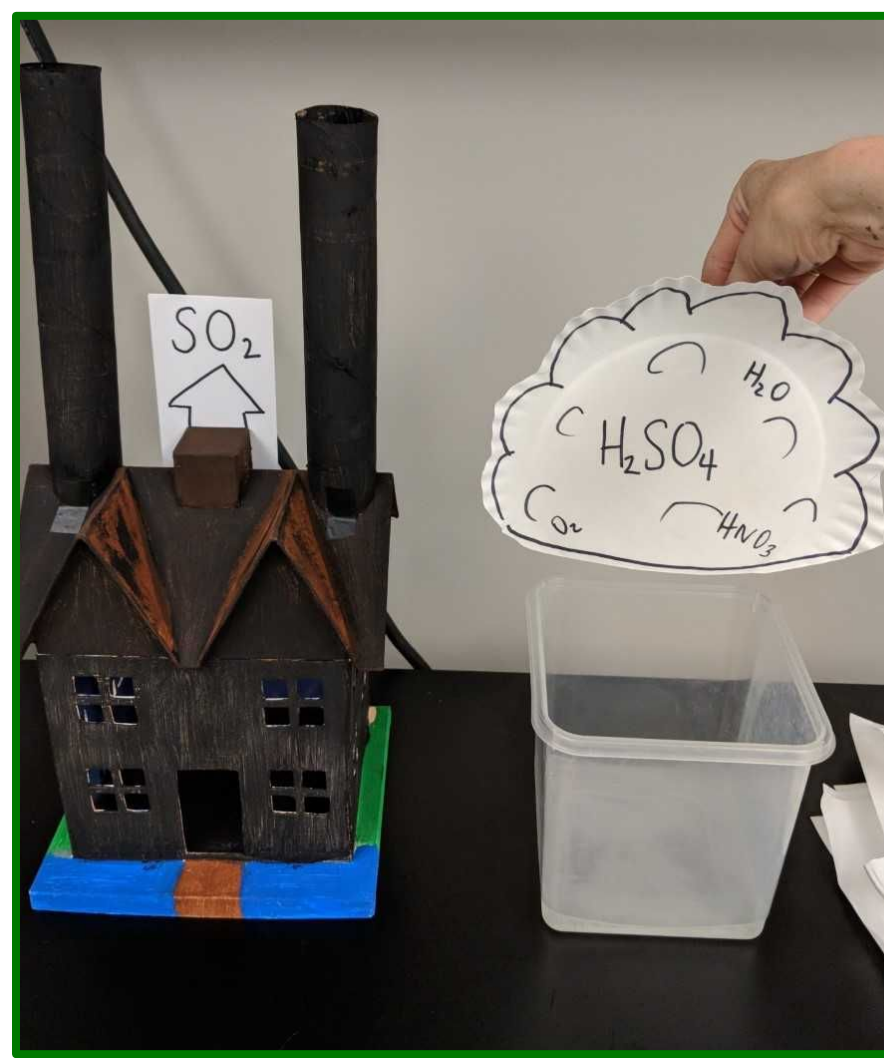
MATERIALS

Acid Rain Simulator

- Model of a coal power plant
- Plastic cup
- Large tupperware container
- Vinegar Solution

Student Materials (per group)

- One seedling plant
- pH indicator strips
- Building supplies (Plastic cups, straws, tape, popsicle sticks, toothpicks, string, aluminum foil)
- Baking Soda
- Tums
- Limestone Chunks
- Chalk



PROCEDURES

1. The teacher will show the simulation of the acid rain and explain the scope of their problem.

You are a farmer. A nearby coal plant is polluting the air, creating acid rain that is damaging your crops. After researching the causes and effects of acid rain, develop a prototype that will neutralize the acid rain before it hits your crops.



2. Students will use provided resources to research how acid rain is formed and the effects of this problem. They will summarize their research in a background knowledge paragraph.

3. Each student will sketch a design to protect their crop

and present to their groups. The group will select one student's design to modify.

4. When it is time to test, students will place their plant under the "acid rain cloud" and experience a rain shower. After the rain has stopped, students will test the pH of the soil, and record their pH.

5. Students will complete their project reflection to discuss the strengths and weaknesses of their design.

6. Students will present their reflections to the class.

INITIAL TEST RESULTS		
pH of soil	Structural Integrity Observations	Other Observations

OUTCOMES/ ESSENTIAL QUESTIONS

The first day of the project students will define the problem and research their situation. On the second day of the project, students will use the engineering design process to design, build, and test their prototype, and reflect on their engineering process.

REFERENCES

Teaching Engineering, Acid Deposition Reading:

https://www.teachengineering.org/content/cub/_activities/cub_air/cub_air_lesson06_activity2_reading.pdf

EPA: What is Acid Rain? <https://www.epa.gov/acidrain/what-acid-rain>

Encyclopedia Britannica: Acid Rain: <https://www.britannica.com/science/acid-rain>

Rubric-maker.com: <http://rubric-maker.com/index.php>

Exploring Engineering Careers

A station lab lesson to explore and reflect on different engineering careers with hands-on challenges in a middle school AVID class.

OBJECTIVES

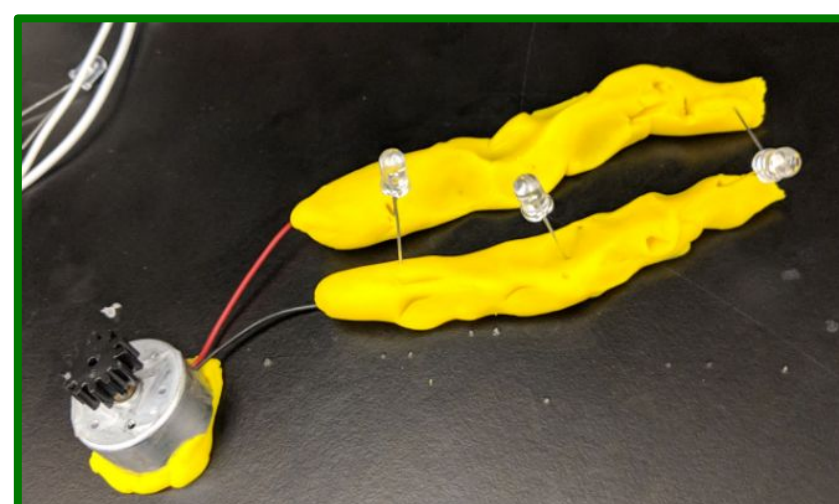
6-8th Grade AVID

- Students will be able to differentiate between the technology produced by specific engineers.
- Students will be able to specify at least four skills an engineer would need in order to successfully utilize the engineering design process, referencing specific actions from their labs.
- Students will be able to reflect on which engineering career is most aligned to their interests and abilities.

MATERIALS

Electrical Engineering Station

- 2 cups of Playdough
- 2 cups of modeling clay
- 4 AA batteries with battery holder
- 10 LED lights
- DC motor with wire attachments



Aerospace Engineering Station

- Paper
- Computer with access to the [Fold N Fly](http://www.foldnfly.com) website

Computer Engineering Station

- Computer

Biomedical Engineering Station

- 10 sheets of paper
- 50 plastic straws
- 20 rubber bands
- 5 pieces of cardboard

Civil Engineering Station

- 75 Popsicle sticks
- 10 clothespins
- Class set of "hard hats"

PROCEDURES

1. After a discussion of the engineering design process, students will rotate through five different engineering stations. Each station includes a challenge activity, "Fun Facts" about that career, and links to enrichment resources.

Civil Engineering Station:

- Students will collaborate to build and test a bridge that will hold a specific weight.



Electrical Engineering Station:

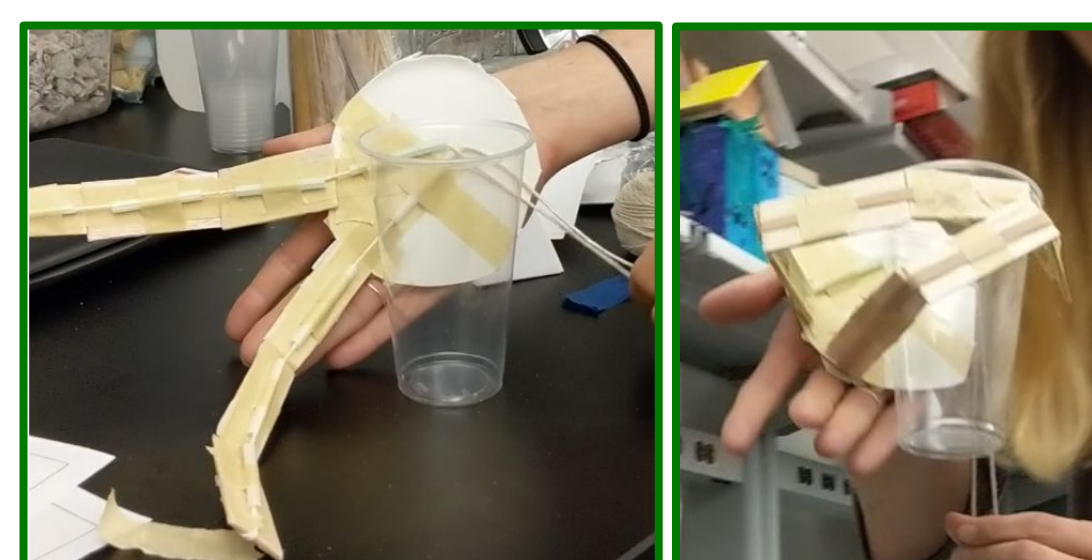
- Students will use a "squishy circuit" to explore circuits with motors, LED lights, and insulators.

Biomedical Engineering Station:

- Students will work together to build an artificial hand.

Aerospace Engineering Station:

- Students will build, test, and compare different paper airplane designs.



Computer Engineering Station:

- Students will use the Accenture Intelligence Space Exploration website to simulate machine learning in an exploration robot.

REFERENCES

Career One Stop.org

Fold N Fly: <http://www.foldnfly.com>

Accenture Intelligence Space Exploration: <https://hourofcodeai.accenture.com/welcome>

Squishy Circuits: <http://courseweb.stthomas.edu/apthomas/SquishyCircuits/buildingCircuits.htm>

TEAK Mechanical Hand Lesson:

<https://www.rit.edu/kgcoe/sites/rit.edu/kgcoe/files/docs/Mechanical%20Hand%20Lesson%20Plan.pdf>

OUTCOMES/ ESSENTIAL QUESTIONS

Students will use their experiences from the stations to reflect on the skills necessary for different engineering careers, and which careers most align with their current interests.