

Physical Science – Electricity

Overview

This series of integrated activities (ten parts) leads students toward their exploration of a simple chemical battery (an ice tray battery). This activity is sometimes performed as a stand-alone observation of phenomena – whereas students construct the battery and observe it to generate voltage.

Here, in contrast to simply observing ‘*the phenomena*’ of the simple device, this series of activities incorporates and includes emphasis on 21st century 4C’s, selected ELA standards, mathematics (charting/graphing) as well as Oklahoma HS Science standards. Together, these culminate in small-team (groups of 3-4 students) work in the construction of a battery and the testing of a team-created hypothesis.

Relationship to Standards

- HS-PS2-5.** (PS3.A) Electrical energy may mean energy stored in a battery or energy transmitted by electric currents.
- HS-PS1-2.** Construct an explanation for the outcome of a simple chemical reaction based knowledge of the patterns of chemical properties. (REDOX).
- HS ELA.7** Conduct short research project to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject.
- HS ELA.8** Gather relevant information from multiple authoritative print and digital sources; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism.
- HS ELA.9** Draw evidence from informational texts to support analysis, reflection, and research.
- Math.A.1** Use units as a way to understand problems and interpret the scale and the origin in graphs and data displays.

Relationship to Concepts

Relationship Matrix: Activity-Parts vs. Concept-Categories

Activity / Concept	Science	ELA	Math	21st 4Cs	Method	x-Cutting	STEM
Part 01 Intro: Introduction to Electricity	yes	no	no	no	no	yes	no
Part 02 Complex Text: Reading	yes	yes	no	no	no	no	no
Part 03 Communicate: Make SLIDES	yes	yes	no	yes	no	no	yes
Part 04 Safety: SDS Data Sheets	yes	no	no	no	yes	no	no
Part 05 Elements: Zinc (Galvanized) and Copper	yes	no	no	no	no	yes	no
Part 06 Scientific Method: Hypothesis	yes	no	no	no	yes	no	no
Part 07 Critical Thinking: Read/Review/Respond	yes	yes	no	yes	no	yes	no
Part 08 Collaboration: Team Plan and Roles	yes	no	no	yes	yes	no	no
Part 09 Conduct Lab	yes	yes	yes	yes	yes	yes	yes
Part 10 Complete Report	yes	yes	yes	yes	yes	yes	yes

21st Century	Emphasis
Communication	Moderate
Creativity	Minor
Collaboration	Emphasized
Critical Thinking	Emphasized

Lab Concepts (Method)	Emphasis
Scientific method	Moderate
Lab procedures	Moderate
Lab safety	Emphasized
Use of equipment	Minor
Data gathering	Minor
Data measurement	Minor
Graphing and charting data	Minor
Calculations	N/A
Devise experiments	Moderate
Interpret results	Moderate

X-Cutting	Emphasis
Patterns	no
Cause and Effect: Mechanisms and explanations	yes
Scale, Proportion, and Quantity	yes
Systems and System Models	yes
Energy and Matter: Flows, cycles, and conservation	yes
Structure and Function	yes
Stability and Change	yes

STEM	Emphasis
Ask questions and define problems	yes
Develop and use models	yes
Plan and conduct investigations	yes
Analyze and interpret data	yes
Use mathematical and computational thinking	no
Construct explanations and design solutions	no
Engage in scientific argument from evidence	yes
Obtain, evaluate, and communicate information	yes

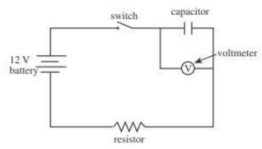
Part -01 Introduction to Electricity

<p>Approach (Instructor-Led)</p> <ul style="list-style-type: none"> • Scan pre-test (ACT practice exam 2008-2009 Item III). • Review correct responses and key concepts as an instructor-led/interactive discussion. (26-slide debrief). 	<p>Objectives (Recall/Recognize/Describe)</p> <ul style="list-style-type: none"> • Electricity is the movement of electrons. • Electricity includes static electricity, mechanically generated electricity, and chemically generated electricity. • Voltage requires the electric potential to differ between two points.
<p>Key Concepts</p> <p>What is voltage?</p> <p>What is a circuit?</p>	<p>Student Resources</p> <p>Google classroom access to debrief presentation on chrome book.</p>

About “Passage III” – an Electric Circuit

Passage III


An electrical circuit contained a 12-volt (V) battery, a resistor (a device that resists the flow of electricity), a capacitor (a device that stores electrical charge and electrical energy), a voltmeter (an instrument for measuring voltage), and a switch, as shown in Figure 1.



Examine the Circuit

- switch
- 12 V battery
- resistor
- capacitor
- voltmeter

Understanding Volt



If the pipe is tilted up – there is a difference between the side that is higher compared to the side that is lower.

This difference in height determines if water will drain to the other side.

When two sides of an electric circuit are “NOT the same” – then there are some volts.

Student Instructions

1. Review the ACT questions briefly with your instructor. You do not need to try and answer them.
2. Review and PARTICIPATE in a discussion about an electric circuit with your instructor.

Part 02 Reading

<p>Approach (Individual Reading/Response)</p> <ul style="list-style-type: none"> • Instructor reads aloud the chapter summary. • Individually, students read chapter. • Individually, students respond to selected chapter questions. 	<p>Objectives (Reinforce/Infer)</p> <ul style="list-style-type: none"> • Relationship of voltage and current. • Contrast between series and parallel circuits.
<p>Key Concepts</p> <p>Electric charge and force</p> <p>Current</p> <p>Circuits</p>	<p>Student Resources</p> <p>Physical Science textbook. Google classroom</p> <p>DOCs.</p>

Student Instructions

- Follow along as instructor reads summary on page 611.
- Individually, read pages 585-607.
- Respond to prompts on page 612. In a DOC attached to this assignment, document your answers for question 9-14 with the number and letter answer.
- Respond to prompts on page 613. Then write a brief explanation/response for questions 15-18.

Part 03 Make Slides

<p>Approach (Student Created Slides)</p> <p>Drawing from Parts 01 and 02, students use Classroom to individually create a brief slide presentation.</p>	<p>Learning Objectives (Repeat/Reinforce)</p> <ul style="list-style-type: none"> • Electrical energy concepts • About the electric battery • Ways to generate electricity
<p>Key Concepts</p> <p>Electricity is the movement of electrons.</p> <p>This topic reviews similarities and differences of static electricity, mechanically generated electricity, and chemically generated electricity.</p> <p><i>All three types represent the movement of electrons.</i></p>	<p>Student Resources</p> <p>Google classroom SLIDES, textbook, web searches. Honeycuttscience topic 34 “Day 2” virtual textbook.</p>

Student Instructions

- Launch a SLIDE file attached to this assignment.
- This assignment is NOT for a doc file.
- On your SLIDE doc, summarize each of these topics:
 - Electrical energy concepts (one page on your SLIDE doc)
 - About the electric battery (one page on your SLIDE doc)
 - Ways to generate electricity (one page on your SLIDE doc)

DO NOT COPY/PASTE.

Students may draw-from any source of information that they choose. Topic 34 on Honeycutt

Science has three useful links on the "Day 2" virtual textbook.

Part 04 Safety Data Sheets

<p>Approach (Instructor Led Discussion)</p> <p>Use acetic acid SDS to review with class. Allow class to predict pH indicator with vinegar. Review concepts of acidic and alkaline.</p>	<p>Objectives (Predict/discover via web search)</p> <ul style="list-style-type: none"> Relationship of pH and hazardous material.
<p>Key Concepts</p> <p>White vinegar is diluted acetic acid. Each chemical has an SDS sheet (or, MSDS) providing key information.</p>	<p>Student Resources</p> <p>Google classroom link to Acetic Acid SDS stored on Honeycuttscience site.</p>

Safety Data Sheet
according to 29CFR1910/1200 and GHS Rev. 3

Effective date : 01.06.2015 Page 1 of 8

Acetic Acid,ACS

SECTION 1 : Identification of the substance/mixture and of the supplier


Product name : Acetic Acid,ACS
 Manufacturer/Supplier Trade name :
 Manufacturer/Supplier Article number : S25118
 Recommended uses of the product and uses restrictions on use:
 Manufacturer Details:
 AquaPhoenix Scientific
 9 Barnhart Drive, Hanover, PA 17331


Supplier Details:
 Fisher Science Education
 15 Jet View Drive, Rochester, NY 14624

Emergency telephone number:
 Fisher Science Education Emergency Telephone No.: 800-535-5053

SECTION 2 : Hazards Identification

Classification of the substance or mixture:

 **Flammable**
 Flammable liquids, category 3

 **Corrosive**
 Serious eye damage, category 1
 Skin corrosion, category 1A

Flammable liq. 3
 Skin Corr. 1A
 Eye Damage. 1
 Acute toxicity, dermal. 4
 Acute toxicity, oral. 5
 Acute toxicity, inhalation. 3

Signal word : Danger

Instructor Reminders for Guided Discussion

Safety data sheets (SDS) and material safety data sheets (MSDS) are documents that list information relating to occupational safety and health for the use of various substances and products.

SDSs are a widely used system for cataloging information on chemicals, chemical compounds, and chemical mixtures.

SDS information may include instructions for the safe use and potential hazards associated with a particular material or product, along with spill-handling procedures.

The older MSDS formats could vary from source to source within a country depending on national requirements; however, the newer SDS format is internationally standardized.

Part 05 Zinc (Galvanized) and Copper

<p>Approach (Instructor Guided)</p> <p>As a class, research reactions associated with zinc, copper and vinegar. Identify electron exchange. Explain the "battery" we will be making.</p>	<p>Learning Objectives</p> <ul style="list-style-type: none"> • Describe an ice-cube battery. • Recognize properties of galvanized nail. • Describe electron exchange of zinc/copper. • Recognize Redox as an important chemistry concept.
<p>Key Concepts</p> <p>What is galvanized?</p> <p>Why is iron sometimes galvanized?</p> <p>What is Redox?</p>	<p>Student Resources</p> <p>Web search, instructor provided links via Classroom. An incomplete example of the battery (component parts displayed).</p>

Student Instructions

- As a class, research reactions associated with zinc, copper and vinegar.
- Identify electron exchange.
- Explain the "battery" we will be making

Part 06 Scientific Method (and Hypothesis)

<p>Approach (Individual Effort)</p> <p>Brainstorm and review scientific method and principles. Clarify a science hypothesis as part of the scientific method. Clarify independent and dependent variables. Each student documents their individual hypothesis.</p>	<p>Learning Objectives (Application)</p> <p>Write a hypothesis statement.</p>
<p>Key Concepts</p> <p>A hypothesis cannot be “proven true” – rather it can be supported or refuted by an experiment.</p>	<p>Student Resources</p> <p>Google DOCS.</p>

Student Instructions

Write a hypothesis statement for each of the following:

- Change the amount of vinegar.
- Change the type of vinegar.
- Change the number of cells used.
- Increase the number of nails used.
- Increase the amount of copper used.
- Place the battery on the ground compared to on the table.

About "Hypothesis"

- A hypothesis is like an educated guess.
- Sometimes a hypothesis is a proposed solution to a problem.
- A hypothesis cannot be proven correct from the data obtained in an experiment, rather the hypothesis is either supported by the data collected or refuted by the data collected.

Examples:

1. If I replace the battery in my car, then my car will get better gas mileage.
2. If I eat more vegetables, then I will lose weight faster.
3. If I add fertilizer to my garden, then my plants will grow faster.
4. If I brush my teeth every day, then I will not develop cavities.
5. If I take my vitamins every day, then I will not feel tired.

Part 07 Read/Review/Respond

Approach (Critical Thinking) Re-engage with prior textbook reading. Respond to five critical thinking prompts.	Learning Objectives Connect science concepts to real-world problems.
Key Concepts Energy is all around us. Modern societies depend on electric energy every day. Access to electric power has dramatically altered society.	Student Resources Physical science textbook. Web searches. Google classroom DOC.

Student Instructions

Find "electricity" in the Physical Science textbook.

Chapter 17, page 582

On a doc, based on your reading, respond to the following prompts:

- Q1. How can this information be applied to a young-person's life?
- Q2. How does this information apply to (or impact) communities?
- Q3. When do scientists need to apply this information? How?
- Q4. How would a person from 100 years ago view this information?
- Q5. How does this topic connect to other science topics or math?

Part 08 Initiate the Team

<p>Emphasis on Team Collaboration</p> <p>Establish team with clearly assigned roles.</p> <p>Agree upon a team hypothesis and document the lab procedures.</p>	<p>Learning Objectives (Team Dynamics)</p> <p>Establish division of responsibility.</p> <p>Agree upon personal accountability</p>
<p>Key Concepts</p> <p>Laboratory teams require a breadth of skills and expertise including safety, process, standards, and assembly/execution. These, are in addition to data gathering and analysis.</p>	<p>Student Resources</p> <p>Google DOCs.</p>

Student Instructions

<p><i>A FORM TEAM</i></p> <p>Form a team of 3-4 people.</p> <ul style="list-style-type: none"> • Assign a lab leader. • Assign a process leader. • Assign a safety sheriff. • Assign a manufacturer. <p><i>(Note: manufacturing will require assistance from other members).</i></p> <p><i>B START THE DELIVERABLE</i></p> <ul style="list-style-type: none"> • Attach a DOC to this assignment. • Share the DOC with each of your team members. 	<p><i>C MAKE A LAB PROCEDURE</i></p> <ul style="list-style-type: none"> • Format the DOC Times New Roman 12, double spaced. <p><i>Make a list of team members and their roles.</i></p> <ul style="list-style-type: none"> • Copy/paste your team's hypothesis. • Write your team's lab procedures including three major sections: <ol style="list-style-type: none"> 1. Lab start up (will include safety debrief). 2. Conduct the lab. 3. Complete/clean up.
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Part -09 Conduct Lab

<p>Approach</p> <p>Follow previously established guidelines including safety procedure, PPE, assembly, test sequences, and data observations (measurement of voltage).</p>	<p>Learning Objectives (Discovery)</p> <p>Predict/confirm/refute hypothesis</p> <p>Observe chemical energy release in volts</p>
<p>Key Concepts</p> <p>Lab roles, lab processes including procedures, safety, data collection and recording.</p>	<p>Student Resources</p> <p>Chrome book and previously compiled DOCs.</p> <p>Link access to instructor provided instructions and SDS sheet.</p>

Student Instructions

View web links if needed – otherwise create initial battery and test for increase/decrease in voltage according to your team’s hypothesis.

Part -10 Complete Report

<p>Approach (Small team collaboration)</p> <p>Compile a final report for team submission.</p>	<p>Learning Objectives</p> <p>Communicate in text and visual formats.</p>
<p>Key Concepts</p> <p>Household products can be dangerous and also useful to create interesting phenomena such as electricity. Simple circuits with small voltage can be assembled easily. Vinegar is an acid – a diluted form of acetic acid (with very low pH). The chemical process observed was a Redox chemical reaction – with electrons donated from one metal to another. SDS sheets contain a wealth of safety information. A lab team has several specific roles which must work together for a single purpose.</p>	<p>Student Resources</p> <p>List of activities/parts covered in this series as a reminder to students about key concepts covered.</p>

Student Instructions

Write a final report summarizing major concepts covered, reinforces, and discovered.

Filename: Topic 34 Integrated Activities (Make Battery).docx
Directory: C:\Users\skythinking\Documents\10 John\00 Keota\40 Physical
Science
Template: C:\Users\skythinking\AppData\Roaming\Microsoft\Templates\Normal.
dotm
Title:
Subject:
Author: skythinking
Keywords:
Comments:
Creation Date: 2/29/2020 11:54:00 AM
Change Number: 26
Last Saved On: 2/29/2020 5:18:00 PM
Last Saved By: skythinking
Total Editing Time: 323 Minutes
Last Printed On: 2/29/2020 5:18:00 PM
As of Last Complete Printing
Number of Pages: 13
Number of Words: 1,734 (approx.)
Number of Characters: 9,886 (approx.)