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Conductors and Insulators Lesson Plan

Michigan Grade Level Content Expectations and Common Core State Standards

Sixth

SCIENCE

Inquiry Analysis and Communication

- S.IA.06.12 Evaluate data, claims, and personal knowledge through collaborative science discourse.
- S.IA.06.13 Communicate and defend findings of observations and investigations using evidence.
- S.IA.06.14 Draw conclusions from sets of data from multiple trials of a scientific investigation.

Inquiry Process

- S.IP.06.12—Design and conduct scientific investigations

SOCIAL STUDIES

P2 Inquiry, Research, and Analysis

- P2.5 Use deductive and inductive problem-solving skills as appropriate to the problem being studied.

ENGLISH LANGUAGE ARTS

Writing Standards (W)

Text Types and Purposes

- W.6.2d—Use precise language and domain-specific vocabulary to inform about or explain the topic.

Speaking and Listening (SL)

Comprehension and Collaboration

- SL.6.1c—Pose and respond to specific questions with elaboration and detail by making comments that contribute to the topic, text, or issue under discussion.

Language (L)

Conventions of Standard English

- L.6.1—Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
- L.6.2—Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

Knowledge of Language

- L.6.3—Use knowledge of language and its conventions when writing, speaking, reading, or listening.

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Seventh

SCIENCE

Inquiry Analysis and Communication

- S.IA.07.12 Evaluate data, claims, and personal knowledge through collaborative science discourse.
- S.IA.07.13 Communicate and defend findings of observations and investigations.
- S.IA.07.14 Draw conclusions from sets of data from multiple trials of a scientific investigation to draw conclusions.

Inquiry Process

- S.RS.07.12 Design and conduct scientific investigations.

SOCIAL STUDIES

P2 Inquiry, Research, and Analysis

- P2.5 Use deductive and inductive problem-solving skills as appropriate to the problem being studied.

ENGLISH LANGUAGE ARTS

Writing Standards (W)

Text Types and Purposes

- W.7.2d— Use precise language and domain-specific vocabulary to inform about or explain the topic.

Speaking and Listening (SL)

Comprehension and Collaboration

- SL.7.1c— Pose questions that elicit elaboration and respond to others' questions and comments with relevant observations and ideas that bring the discussion back on topic as needed.
- SL.7.1d—Acknowledge new information expressed by others and, when warranted, modify their own views.

Language (L)

Conventions of Standard English

- L.7.1—Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
- L.7.2-Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

Knowledge of Language

- L.7.3—Use knowledge of language and its conventions when writing, speaking, reading, or listening.

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Eighth & HSCE

SCIENCE

Scientific Inquiry

- E1.1A: Generate new questions that can be investigated in the laboratory or field.

Physics

- P1.1e Describe a reason for a given conclusion using evidence from an investigation
- P1.1f Predict results of changes in variables
- P1.1h Design and conduct investigations; draw conclusions
- P3.7g Propose a mechanism based on electric forces to explain current flow in an electric circuit.

Social Studies

P2 Inquiry, Research, and Analysis

- 8.P2.5 Use deductive and inductive problem-solving skills as appropriate to the problem being studied.

ENGLISH LANGUAGE ARTS

Writing Standards (W)

Text Types and Purposes

- W.8.2d— Use precise language and domain-specific vocabulary to inform about or explain the topic.
- W.9-10.2d—Use precise language and domain-specific vocabulary to manage the complexity of the topic.

Speaking and Listening (SL)

Comprehension and Collaboration

- SL.8.1c— Pose questions that connect the ideas of several speakers and respond to others' questions and comments with relevant evidence, observations, and ideas.
- SL.8.1d— Acknowledge new information expressed by others and, when warranted, qualify or justify their own views in light of the evidence presented.
- SL.9-10.1c—Propel conversations by posing and responding to questions that relate the current discussion to broader theme or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.
- SL.9-10.1d—Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.
- SL.11-12.1c—Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.
- SL.11-12.1d—Resond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task.

Language (L)

Conventions of Standard English

- L.8.1—Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
- L.9-10.1 Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
- L.11-12.1 Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

Knowledge of Language

- L.8.3—Use knowledge of language and its conventions when writing, speaking, reading, or listening.
- L.9-10.3—Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.
- L.11-12.3—Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.

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Grades 6-12 Literacy in History/Social Studies, Science, & Technical Subjects

Grade Bands 6th—8th , 9th—10th, & 11th—12th

Reading Standards for Literacy in Science & Technical Subjects

Key Ideas and Details

- RST.6-8.3—Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
- RST.9-10.3—Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
- RST.11-12.3—Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Integration of Knowledge and Ideas

- 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.
- RST.9-10.9—Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.
- RST.11-12.9—Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjec

Text Types and Purposes

- WHST.6-8.2—Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
- WHST.6-8.2d—Use precise language and domain-specific vocabulary to inform about or explain the topic.
- WHST.6-8.2f—Provide a concluding statement or section that follows from and supports the information or explanation presented.
- WHST 9-10.2—Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
- WHST 9-10.2d—Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.
- WHST 9-10.2f—Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).
- WHST 11-12.2—Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
- WHST.11-12.2e—Provide a concluding statement or section that follows from and support the information or explanation provided (e.g., articulating implications or the significance of the topic).

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Lesson Outcome

The student will identify conductors and insulators by using a simple circuit to test the conductivity of various materials.

Rationale / Purpose for Lesson

As a follow-up to the making a simple circuit lesson plan on our website, this activity provides an opportunity to use the circuit to understand the nature of electricity. By testing common objects, students will discover both conductors and insulators of electricity. The knowledge of conductors and insulators can be extended to discussion on the travels of electricity and electric safety. Finally, this hands-on lesson allows students to use the scientific process to hypothesize, test, and compare results.

Resources / Materials Required

- Circuits made from the "Circuits and the Flow of Electricity" lesson plan.
    - Circuit kits used to make the circuits in the lesson included the following materials: 1-D Cell battery, Battery holder, 2 - 1.5 volt bulbs, 2 sockets for the light bulbs (or E-10 light bulb bases), and 4 pieces of 6-inch insulated strand copper wire (18–22 gauge), with one inch of insulation removed at each end wire. Materials for Circuit Kits can be purchased at a local hardware store.
- 2 paper fasteners or binder clips for each circuit being used.
- Classroom samples of conductors and insulators (ie. Metal paper clips, metal pens, aluminum foil, coins, keys, rubber bands, erasers, glass bottles, etc.). Make sure to have enough materials for each student group to test at least 6 objects.
- Copies of "Testing for Conductivity" instruction sheet (below).

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Anticipatory Set

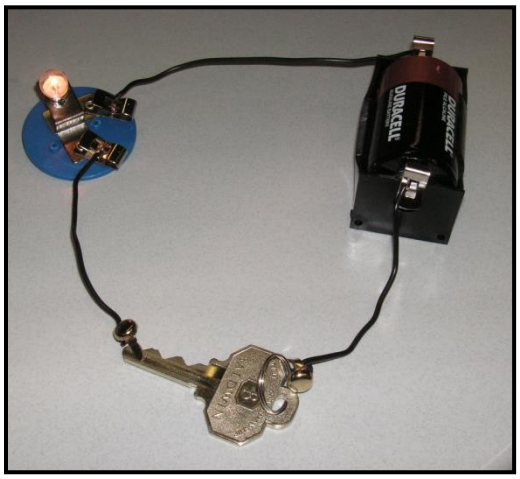
(If the "Circuits and the Flow of Electricity" lesson was not completed before this, set up an example of a simple circuit. Demonstrate and discuss the flow of energy.)

- Have students consider the circuit. Ask, "How is the light bulb able to receive power from the battery? How does the energy move from the battery to the light bulb?" The energy moves through the metal wire, because metal is a good **conductor** of electricity.
- Discuss the terms **conductor** and **insulator** so students understand that conductors carry electricity from one point to another and insulators stop the flow of electricity.
- Have students come up with a class definition for the terms conductor and insulator and post within the classroom.
- Have the students brainstorm ideas of how the circuit could be used to test materials for their conductivity.

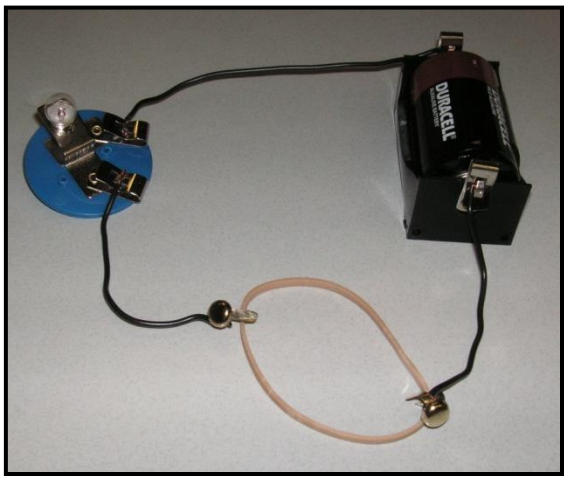
Procedures

- Select one conductor and one insulator from the classroom samples (such as a key and a rubber band as shown in the pictures.) Following procedures in Step 4 of the "Test for Conductivity" sheet, show how the circuit can be used to test for conductivity. Demonstrate what happens to the light bulb when both the conductor and insulator become a part of the circuit.

Conductor



Insulator



- Have groups of 3 or 4 students select at least 6 objects from the collection of classroom samples.
- Distribute the "Testing for Conductivity" worksheet to each group and have students follow the testing instructions.

Closure

- Have students discuss and compare their observations with other student groups.
- Have each group write a definition for "conductor" and "insulator."
    - Remind students how energy is carried when electrons move from one place to another. Discuss what conductors and insulators must do to the electrons of atoms in order to either carry or stop of the flow of electricity.

Extensions

- Discuss the importance or use of conductors and insulators in daily life.
- Write a letter from the point of view as a conductor or insulator (ex. "A day in the life of a conductor.")

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Name: _____ Date: _____

Testing for Conductivity

What will make the light bulb light up?

Directions

1. Select 6 objects from the gathered "Classroom Samples"
2. On the chart below, write the names of each object.
3. Predict whether the object is a conductor or insulator. Record your predictions.
4. Use your simple circuit to construct a conductivity tester.
    a. Your simple circuit should have two pieces of wire – one end of each piece of wire should be attached to the battery, the other end of each piece of wire should be attached to the light bulb.
    b. Remove the wire from the bottom of the battery; leave it connected to the light bulb. Wrap a paper fastener around the loose end of this wire.
    c. Attach a third piece of wire to the bottom of the battery. Wrap a paper fastener around the loose end of this wire.
5. Test your objects. One at a time, place each object between the paper fasteners, making sure they touch and have a good connection.
6. What happens to the light bulb when each object is introduced to the circuit? Record your observations for each object.

Predictions and Observations

OBJECT NAME	PREDICTION	RESULTS