

Anoka Hennepin K-12 Curriculum Unit Plan

Department: Science
Unit Title: Magnetism and Electricity

Course/Grade Level: 4
Number of Lessons/Days: 16-18 days

Unit Summary: The main purpose of this unit is to teach about the relationship between magnetism and electricity. This unit is designed to be used in collaboration with hands-on inquiry and direct science instruction. Students will study how magnetism and electricity work separately and how they work together. Students will explore magnetism and electricity using hands-on experiments that allow them to collect data and make personal observations. The activities are designed to allow students to work in collaborative group structures in independent ways. Language Arts, with a focus on non-fiction, is integrated into this unit through leveled guided reading books, writing activities and reading strategy development.

DESIRED RESULTS (STAGE 1)

Program Understandings

- III. Students will understand that scientists use the properties and interactions of energy and matter to explain how the physical world works.
- IV. Students will understand that the study of science involves processes that unify science disciplines and provide students with ideas and structures to help them understand the natural world.
- V. Students will understand that the process of inquiry is the collection of information verified through observation and experimentation, which allow scientists to critically analyze, draw conclusions and make inferences about the natural world.
- VI. Students will understand that scientists use various communications to share knowledge and promote understanding about our natural world.
- VIII. Students will understand that scientist's use and design technology to answer questions, share information and solve problems.

Minnesota State/Local/Core Standards/Benchmarks and Technology Standard(s) addressed:

- **4.1.2.1:** Engineers design, create and develop structures, processes and systems that are intended to improve society and may make humans more productive.
 - **4.1.2.1.1 Impact of Designed World:** Describe the positive and negative impacts that the designed world has on the natural world as more and more engineered products and services are created and used.
- **4.1.2.2:** Engineering design is the process of identifying problems, developing multiple solutions, selecting the best possible solution, and building the product.
 - **4.1.2.2.1 Designs for Solving Problems:** Identify and investigate a design solution and describe how it was used to solve an everyday problem.
 - **4.1.2.2.2 Ideas & Constraints:** Generate ideas and possible constraints for solving a problem through engineering design.
 - **4.1.2.2.3 Evaluating Solutions:** Test and evaluate solutions, considering advantages and disadvantages of the engineering solution, and communicate the results effectively.
- **4.1.3.3:** The needs of any society influence the technologies that are developed and how they are used.
 - **4.1.3.3.1 Invention to New Inventions:** Describe a situation in which one invention led to other inventions.
- **4.2.3.1:** Energy appears in different forms, including heat and electromagnetism.
 - **4.2.3.1.1 Transfer of Heat Energy:** Describe the transfer of heat energy when a warm and a cool object are touching or placed near each other.
 - **4.2.3.1.2 Forces from Magnets:** Describe how magnets can repel or attract each other and how they attract certain metal objects.
 - **4.2.3.1.3 Conductors & Insulators:** Compare materials that are conductors and insulators of heat and/or electricity.

- **4.2.3.2:** Energy can be transformed within a system or transferred to other systems or the environment.
 - **4.2.3.2.1 Generating Heat Energy:** Identify several ways to generate heat energy.
 - **4.2.3.2.2 Simple Electric Circuits:** Construct a simple electrical circuit using wires, batteries and light bulbs.
 - **4.2.3.2.3 Electric Current & Magnetism:** Demonstrate how an electric current can produce a magnetic force

Overarching Understanding(s) from Curriculum Map/Course Understandings:

Students will understand that...

- energy appears in different forms and can be transferred within and between systems.
- scientific investigations require us to ask questions, make observations, plan and create tests to verify predictions with evidence and data, and generate further questions
- scientists use and interpret data from multiple observations and repeated experiments to draw logical conclusions.
- scientists use a variety of written and oral communication skills to convey their findings.
- scientists work individually and collaboratively to understand the natural world and learn from one another.
- scientists develop models to understand how systems work to predict future occurrences.
- technology helps us answer questions, solve problems and share information more efficiently.
- engineers and scientists design and apply technology either as a product or a process to accomplish a task.

Topical Understanding(s) Specific to Unit:

Students will understand that...

- electric currents and magnets can exert a force on each other.
- basic electricity has applications in everyday life.
- there is a process to test and verify predictions.
- charts and graphs can be used to record scientific data.

Essential Question(s) from Curriculum Map. Course Essential Questions:

To understand, students will need to consider such questions as....

- Where does energy come from and where does it go?
- How do scientists share what they know with others?
- What is scientific inquiry?
- How do we test a scientific prediction?
- How do models help scientists/engineers?
- How does science impact the world around us?
- Why do we keep improving our technology?

Topical Essential Questions for Unit:

- Where does heat come from and where does it go?
- How does a magnet exert force?
- What is the relationship between electricity and magnetism?
- How is electricity used in our lives?
- How do scientists/engineers answer the questions or problems they form?

To understand, students will need to...

- know...** Students will need to know the following in order to... (e.g. facts, concepts, generalizations, rules, theories, principles)
- magnets attract and repel each other and certain kinds of metals.
 - electricity requires a complete circuit through which the electrical current can pass.
 - difference between a conductor and an insulator.
 - magnetism and electricity are related.
 - materials can become electrically charged.
 - electrical charges can be moved from one place to another.
 - difference between a scientific prediction and a guess.
 - steps of the scientific process and the engineering process

Advanced Learners:

Know how static electricity differs from an electric current.
 Know the conditions necessary for static electricity to be evident.
 Know the difference between parallel and series circuits.

ESSENTIAL VOCABULARY

MCA Essential Vocabulary

- **circuit:** a pathway along which electricity flows
- **conductor:** a material that allows electricity to flow through it
- **constraints:** limits on the choices you have in solving a problem
- **electromagnet:** a magnet that uses electricity to turn it on and off
- **magnetic force:** the push or pull of objects created by a magnetic object
- **heat transfer:** the movement of heat
- **insulator:** a material that stops the flow of electricity
- **technology:** something designed and created to solve problems

Magnetism and Electricity Unit Essential Vocabulary

- attract: a force that pulls objects together
- current electricity: the constant flow of an electric charge
- electricity: the flow of electrical energy
- repel: a force that pushes objects apart

- Common misunderstanding(s):
 - Electricity only comes from the wall socket.
 - Anything metal is magnetic
 - Conductors are only iron or steel

- be able to...** (Students will be able to DO... skills, procedures, processes)
- identify objects that attract magnets.
 - build an electrical circuit.
 - identify objects and materials that conduct electricity.
 - demonstrate how an electromagnet works.
 - generate electric current using a wire and magnet.
 - generate a scientific prediction.
 - test and verify their scientific prediction.
 - use observing, communicating, comparing, organizing to convey findings.
 - complete the steps of the engineering process to create an electromagnet
 - generate investigable questions and test them

Advanced Learners:

Identify the properties of static electricity.
 Build parallel or complex circuits (using resistors, multiple switches, etc)