Unit 10: Magnetism and Electromagnetism

Unit #:	APSDO-00018809	Duration:	2.0 Week(s)	Date(s):	

Team:
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Grades:
8
Subjects:
Science

Unit Focus

In this unit, students will examine and apply ideas about magnetic and electromagnetic forces to explain a variety of phenomena including why some materials attract each other while other repel. Students will also continue to develop ideas that objects can exert forces on each other, even though the objects are not in contact, through fields. Students will be examine the nature of magnetism and electromagnetism, their source, and their application in widely used technologies. Students will learn how electricity can be used to create magnetism and how magnetism can be used to create electricity. Students will also continue to develop their understanding of important qualitative ideas about energy including the concepts of energy transfer and conservation. Summative assessments may include application problems, experimental designs, laboratory practices, data analyses, models, and position statements. These may be in the form of stand-alone tasks or as part of quizzes, tests, labs, or other assignments. Primary instructional materials may include the course textbook, supplemental print and online resources, and related laboratory equipment and materials.

Stage 1: Desired Results - Key Understandings

Established Goals

Next Generation Science Standards (DCI)
Science: 8

- A solution needs to be tested, and then modified on the basis of the test results in order to improve it. There are systematic processes for evaluating solutions with respect to how well they meet criteria and constraints of a problem. *ETS1.6.B3*
- A solution needs to be tested, and then

Transfer

T1 (T3) Collect, analyze, and evaluate the quality of evidence in relation to a question.
T2 (T5) Communicate scientific information clearly, thoroughly, and accurately.
T3 (T2) Design an investigation or model using appropriate scientific tools, resources, and methods.
T4 (T4) Develop a valid scientific conclusion, assess its validity and limitations, and determine future course of actions to inspire further questions.
T5 (T1) Integrate knowledge from a variety of disciplines and apply it to new situations to make sense of information, formulate insightful questions, and/or solve problems.
T6 (T6) Use mathematics to represent physical variables and their relationships, to make quantitative predictions, and to solve problems.

	Meaning	
modified on the basis of the test results, in order to improve it. *ETS1.6.B1* • Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process-that is, some of those characteristics may be incorporated into the new design. *ETS1.6.C1* • Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information. *PS4.6.C1* • Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. *PS2.6.B1* • Forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object (a charged object, or a ball, respectively). *PS2.6.B3* • Models of all kinds are important for testing solutions. *ETS1.6.B5* • Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. *ETS1.6.B4* • The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. *ETS1.6.C2* • The more precisely a design task''s criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification	**Understandings**	**Essential Questions**
	U1 (U429) Electric and magnetic forces depend on properties of the material such as their position and orientation relative to one another and do not require that the objects are touching each other. **U2** (U438) Electromagnetism and gravity are fundamental forces in our universe, which are represented by fields whose strength is determined by a variety of factors (e.g., distance, mass, charge). **U3** (U454) Each form of energy can be converted into other forms of energy or into work (e.g., kinetic to potential, mechanical to electrical). **U4** (U204) Possible solutions to a problem are limited by various constraints and criteria, such as available resources, materials, and societal considerations. **U5** (U202) Building and testing with physical models is the most effective way to identify unexpected failure points in a proposed solution. **U6** (U201) Designs can be conveyed through sketches, drawings, computer simulations, or physical models. These representations are useful in communicating possible solutions to others. **U7** (U200) Engineers begin developing solutions to problems by asking questions, making observations, and gathering background information to clearly understand the problem. **U8** (U203) Possible solutions can be evaluated and improved through systematic and iterative testing, as well as peer review and critique. **U9** (U204) Possible solutions to a problem are limited by various constraints and criteria,	**Q1** How can you make two magnets attract or repel each other? **Q2** How is a compass able to determine direction? **Q3** What does energy look and feel like? **Q4** How does energy convert to work or other forms of energy? **Q5** Why are some objects naturally magnetic, some never magnetic and others can become magnetized? **Q6** Where are the North and South poles of Earth geographically located? **Q7** What purpose does the Earth's magnetosphere serve? **Q8** What are magnetic domains?

of constraints includes consideration of scientific principles and other relevant knowledge that is likely to limit possible solutions. *ETS1.6.A1* • There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. *ETS1.6.B2* • When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object. *PS3.6.C1* *Science: 11* • Conservation of energy means that the total change of energy in any system is always equal to the total energy transferred into or out of the system. *PS3.9.B1* • Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. *PS3.9.B2* • Forces at a distance are explained by fields (gravitational, electric, and magnetic) permeating space that can transfer energy through space. Magnets or electric currents cause magnetic fields; electric charges or changing magnetic fields cause electric fields. *PS2.9.B3* • When two objects interacting through a field change relative position, the energy stored in the field is changed. *PS3.9.C1*	such as available resources, materials, and societal considerations. **U10** (U204) Possible solutions to a problem are limited by various constraints and criteria, such as available resources, materials, and societal considerations.	**Q9** What happens to the strength of a magnetic field as an object approaches the magnetic poles of the magnet? **Q10** What is produced around a wire carrying an electrical current? **Q11** How is a motor constructed? **Q12** How is a generator constructed? **Q13** How is voltage either stepped up or stepped down using a transformer? **Q14** (Q200) How do you approach an engineering problem in a systematic way in order to design an effective solution?
	Acquisition of Knowledge and Skill	
	Knowledge	**Skills**
		S1 Identify the unlabeled poles of a magnet using a labeled magnet and observing the behavior of the two magnets **S2** Determine where the magnetic poles of Earth are using a magnet **S3**

		Describe the difference between the geographic and magnetic poles of Earth **S4** Describe how electricity produces magnetic field and magnetic field can be used to produce electricity **S5** Describe the magnetic properties of a material based on how it reacts to other materials **S6** Describe the energy transfers in motors and generators **S7** Use a compass for navigation