



## Grade 3 - Unit 2 - Electromagnetic Forces

### Unit Focus

Throughout this inquiry-based unit, developed through a partnership with Central Connecticut State University, students will determine the cause and effect relationships of electrical or magnetic interactions between two objects not in contact with each other. Students will use magnets to apply their understanding of magnetic reactions and may define a simple design problem that can be solved with magnets. As a culminating experience, students will apply their understanding of electromagnetism to design, create and test a solution, using the Engineering Design Process, to a contamination spill where they will need to safely transport the contaminant.

### Stage 1: Desired Results - Key Understandings

Standard(s)	Transfer	
<b>Next Generation Science Standards (DCI)</b> Science: 3 <ul style="list-style-type: none"><li>At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (ETS1.3.B2)</li><li>Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (ETS1.3.C1)</li><li>Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. (PS2.3.A1)</li><li>The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. (PS2.3.A2)</li><li>Objects in contact exert forces on each other. (PS2.3.B1)</li><li>Electric, and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other. (PS2.3.B2)</li></ul> <b>Next Generation Science Standards (content standards)</b> Elementary Standards: 3 <ul style="list-style-type: none"><li>Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other. (3-PS2-3)</li></ul>	<i>Students will be able to independently use their learning to...</i> <b>T1</b> Make observations and ask questions to define a problem based on prior knowledge and curiosity that stimulates further exploration, analysis, and discovery. <b>T2</b> Use the scientific process to generate evidence that addresses the original questions.	
	<b>Meaning</b>	
	<b>Understanding(s)</b>	<b>Essential Question(s)</b>
	<i>Students will understand that...</i> <b>U1</b> Pushes and pulls have different strengths and directions. <b>U2</b> Electric and magnetic fields put forces on objects. <b>U3</b> The pattern of an object's motion in various situations can be observed and measured. Predictions can be made from these observations. Example: pendulum <b>U4</b> Electricity is the movement of charge. <b>U5</b> Magnets and electricity interact with one another. <b>U6</b> When a circuit is broken, charge does not flow. <b>U7</b> Electricity flows through circuits <b>U8</b> A magnetic field is produced when an electrical current is passed around an iron core. <b>U9</b> Electromagnets are useful tools.	<i>Students will keep considering...</i> <b>Q1</b> What effect does distance have on magnetic pull or push? <b>Q2</b> How do forces act on an object to make it move or stay still? <b>Q3</b> How does electricity relate to magnetism? <b>Q4</b> How is a magnetic field produced by electricity? <b>Q5</b> Under what scenarios can we make a temporary magnet?

## Stage 1: Desired Results - Key Understandings

- Define a simple design problem that can be solved by applying scientific ideas about magnets. (3-PS2-4)

### Madison Public Schools Profile of a Graduate

- Design: Engaging in a process to refine a product for an intended audience and purpose. (POG.2.2)
- Collective Intelligence: Working respectfully and responsibly with others, exchanging and evaluating ideas to achieve a common objective. (POG.3.1)

### Acquisition of Knowledge and Skill

#### Knowledge

*Students will know...*

**K1** The size and direction of the unbalanced force determines the motion of an object.

Example: Tug of War

**K2** Properties of repeated motion (effect) can be predicted from observations of pushes and pulls (cause). Example: Pendulum, swing, or movement of planets.

**K3** Objects in contact exert forces on each other (opposite direction).

**K4** Electrical and magnetic forces between a pair of objects do not require that the objects be in contact.

**K5** The size of the electric or magnetic force depends on the properties, distances, and orientation to each other.

**K6** Vocabulary: magnet, attract, repel, magnetic force, magnetic poles, magnetic field, electricity, circuit, current, field, pendulum, force, electromagnet

#### Skill(s)

*Students will be skilled at...*

**S1** Using observations to make predictions and find patterns in the motion of an object.

**S2** Asking questions to determine the interaction between two objects not in contact.

**S3** Making observations about the effects of pushes and pulls on an object.

**S4** Planning and conducting investigations to test predictions.

**S5** Using observations to make predictions of the effect of unbalanced force on the motion of the object.