Big Idea:
How can we use our understandings about magnets be used to solve problems?

Guiding Questions:
Part A: *What are the relationships between electrical and magnetic forces?*
Part B: *How can we use our understandings about magnets be used to solve problems*?

21st Century Themes/Skills:

DCI (Disciplinary Core Ideas)	*Science and Engineering Practices*	*Crosscutting Concepts*	*Student Learning Objectives*	*Differentiated Activities (Consider the 5 Es)*	*Resources/Technology*	*Formative Assessments*	*Benchmark Assessment*
PS2.B: Types of Interactions 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.	**Asking Questions and Defining Problems** Asking questions and defining problems in grades 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships. -Ask questions that can be investigated based on patterns such as cause and effect relationships.	**Cause and Effect** Cause and effect relationships are routinely identified, tested, and used to explain change.	Students will ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other. Students will investigate and confirm their understanding of how magnets attract and repel other magnets.	Engage: demonstration of attraction and repulsion using two bar magnets.	For this unit, use the McCracken Teacher Manual, which includes activities and assessments.	-Activity Student Sheets of Responses (see links in Resources/Technology for each lesson) -Class discussion -Science journal entries -Predictions -Questions -Observations -Group collaboration -Planned and conducted experiments -Exit Slips (paper-based, Google Forms, Google Classroom post, etc.)	
				Explore: Stations of magnetic explorations	See page 21 for materials per station		
				Explain: discussion about the results the students discovered in regards to magnets to ensure they are prepared for the next lessons.	Magnets Song		
				Elaborate: Discuss and introduce students to what we will be doing further in investigation of magnets			
PS2.B: Types of Interactions • 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. (3-PS2-3),(3-PS2-4) **ETS1.A: Defining and Delimiting Engineering Problems** • Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (3-5-ETS1-1)	**Analyzing and Interpreting Data** • Analyze and interpret data to make sense of phenomena using logical reasoning. (3-LS3-1) **Asking Questions and Defining Problems** • Ask questions that can be investigated based on patterns such as cause and effect relationships. (3-PS2-3) • Define a simple problem that can be solved through the development of a new or improved object or tool. (3-PS2-4) • Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and const	**Cause and Effect** • Cause and effect relationships are routinely identified, tested, and used to explain change. (3-PS2-3)	Students will begin to understand the concept of a controlled experiment. Students will conduct an experiment in a systematic way. Students will determine that the strength of combined magnets is stronger than that of one magnet. Students will gain understanding that the strength of magnets does not go up exponentially when more magnets are added.	Engage: Discussion of how magnets are used to solve real world problems	See Page 31		
				Explore: Plan and conduct an investigation of how the strength of a magnet changes when more than one is added together	Materials Needed: Each group of 4 students will need: • 4 flexible magnets or disc magnets • 2 plastic cups • 1 tongue depressor • 1 jumbo paper clip • 6 washers		
				Explain: Class discussion of results from investigation and the strength of multiple magnets			
				Elaborate: Connect to real world			
				Evaluate: See formative assessments			
PS2.B: Types of Interactions 0 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. (3-PS2-3)	3-PS2-4. Define a simple design problem that can be solved by applying scientific ideas about magnets. -Asking questions (science) and defining problems (engineering) -Planning and carrying out investigations -Analyzing and interpreting data -Using mathematics and computational thinking -Constructing explanations (science) and designing solutions (engineering) -Engaging in argument from evidence -Obtaining, evaluating, and communicating information	3-PS2-3. Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.	Students make predictions and test various items for their magnetic interaction. Students observe that magnetic objects are affected by the strength of the magnet and the distance from the magnet.	Engage: Magnetism Scavenger Hunt under the classroom finding 10 objects that are magnetic.	See page 34		
				Explore: Students will sort objects into magnetic and nonmagnetic by hand first; then sort using a magnet			
				Explain: Explain possible solutions using recorded observations and explanations. Discuss the vocabulary term "magnetic" Listens critically to others' explanations			
				Elaborate: Sort materials using a variety of tools and methods; real world connections			
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. (3-PS2-3),(3-PS2-4)	Asking Questions and Defining Problems Asking questions and defining problems in grades 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships. Ask questions that can be investigated based on patterns such as cause and effect relationships. (3-PS2-3) Define a simple problem that can be solved through the development of a new or improved object or tool. (3-PS2-4) Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations	Cause and Effect Cause and effect relationships are routinely identified. (3-PS2-1)	Students will demonstrate that magnetic objects are affected by the distance from the magnet. Students will use a magnet to make a paperclip "walk" on a paper plate. Students investigate how many paper plates through which the magnetic field will pass.	Engage: Class discussion on magnetic forces. Can you feel magnetic forces in the air? Can you feel a magnetic force pass through your hand? Have students interact with magnetics to respond.			
				Explore: Have students explore how distance affects magnetism using magnets, paper clips, and a ruler. Explore what happens if you place a paper plate in between the magnetic and the paper clips. Investigate what happens if you were to keep adding paper plates in between.			
				Explain: Define magnetic field and its impact on this experiment			

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	provide evidence to support explanations or design solutions. Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (3-PS2-1) Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. (3-PS2-2)			Elaborate: Repeat the experiment with various different objects			
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. (3-PS2-3),(3-PS2-4)	Asking Questions and Defining Problems Asking questions and defining problems in grades 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships. Ask questions that can be investigated based on patterns such as cause and effect relationships. (3-PS2-3) Define a simple problem that can be solved through the development of a new or improved object or tool. (3-PS2-4) Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2	Cause and Effect Cause and effect relationships are routinely identified. (3-PS2-1)	The students will build a simple electromagnet and explore its properties. Students observe that the strength of the electromagnet can be increased by increasing the number of coils wrapped around the iron bolt. Students observe that wrapping the coils tightly together also increases the strength of the electromagnet. Students will also observe that the electromagnet can be turned on and off.	Enage: Class discussion about our knowledge of magnets; show video on Crane Car with electromagnet at work Explore: Build a simple electromagnet and explore its properties. Explain: Explain possible solutions using recorded observations and explanations; Listens critically to others' explanations Elaborate: how they might be able to make their electromagnets even stronger; class discussion on electromagnets; show how engineers use electromagnets	Crane Car Video Explore Activity (Page 43)		