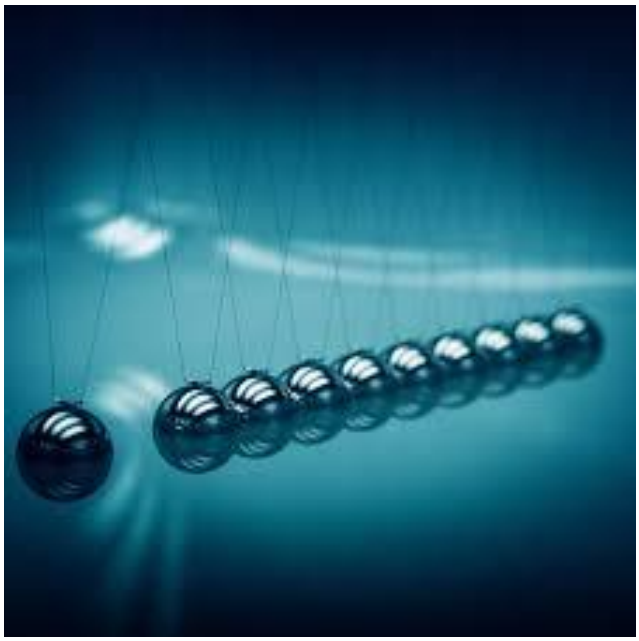
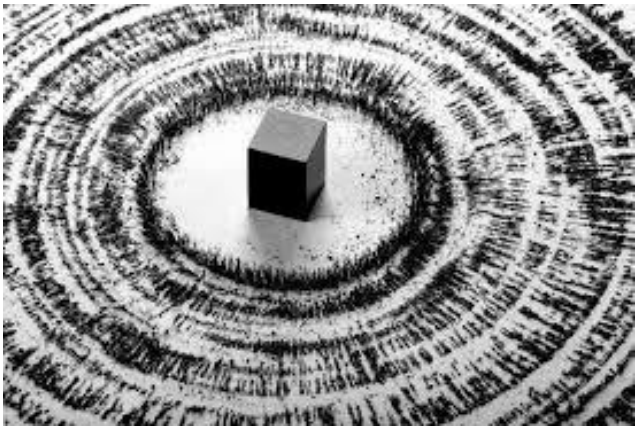
9 Week Unit



UNIT 1 FORCES AND INTERACTIONS



Third Grade | Rogers Public Schools

Unit 1: Forces and Interactions 9 weeks

In this first unit, students focus on understanding the cause and effect relationships of interactions between objects. Students will explore the effects of balanced and unbalanced forces on the motion of an object. As they explore, they will understand how force acts on a particular object and has both strength and direction. They will develop the understanding that an object at rest typically has multiple forces acting upon it, with a zero net force on the object. This will lead to the understanding that forces not adding to zero can cause changes in the object's speed or direction of motion.

Students will also explore patterns of an object's motion and use these patterns to predict future motion. They will explore different types of interactions: those where objects are in contact and those that do not require contact, like electric and magnetic forces. Students will understand the sizes of the forces in each situation depend on properties of the objects and their distances apart, as well as a magnet's orientation relative to another magnet.

Collaboratively, students will plan and conduct investigations to produce data that will serve as the basis for evidence of the effects of balanced and unbalanced forces on the motion of an object. Students will make observations and measurements of an object's motion and use this data as evidence that a pattern can be used to predict future motion. Students will ask questions and investigate cause and effect relationships of electric and magnetic interactions. Like scientists, students will use a variety of methods, tools and techniques to conduct investigations. They will use the engineering design process to solve a simple design problem by applying scientific ideas and understandings about magnets.

Unit 1 Performance Expectations

- **3-PS2-1 Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.** [**AR** Clarification Statement: Examples could include an unbalanced force on one side of a box can make it start moving or balanced forces pushing on a box from both sides will not produce any motion at all.] [Assessment Boundary: Assessment is limited to one variable at a time: number, size, or direction of forces. Assessment does not include quantitative force size, only qualitative and relative. Assessment is limited to gravity being addressed as a force that pulls objects down.]
- **3-PS2-2 Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.** [Clarification Statement: Examples of motion with a predictable pattern could include a child swinging in a swing, a ball rolling back and forth in a bowl, and two children on a see-saw.] [Assessment Boundary: Assessment does not include technical terms such as period and frequency.]
- **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.** [Clarification Statement: Examples of an electric force could include the force on hair from an electrically charged balloon or the electrical forces between a charged rod and pieces of paper; examples of a magnetic force could include the force between two permanent magnets, the force between an electromagnet and steel paperclips, and the force exerted by one magnet versus the force exerted by two magnets. Examples of cause and effect relationships could include how the distance between objects affects strength of the force or how the orientation of magnets affects the direction of the magnetic force.] [Assessment Boundary: Assessment is limited to forces produced by objects that can be manipulated by students, and electrical interactions are limited to static electricity.]
- **3-PS2-4 Define a simple design problem that can be solved by applying scientific ideas about magnets.*** [Clarification Statement: Examples of problems could include constructing a latch to keep a door shut and creating a device to keep two moving objects from touching each other.]

In Unit 1, students will understand…

- Effects of balanced and unbalanced forces on the motion of an object.
- Each force acts on one particular object and has both strength and direction.
- An object at rest typically has multiple forces acting on it. The forces add to give zero net force on the object.
- Forces that do not sum to zero can cause changes in the objects speed or direction of motion.
- The patterns of an object's motion in various situations can be observed and measured. When the past motion exhibits a regular pattern, future motion can be predicted from it.
- Objects in contact exert forces on each other.
- Electric and magnetic forces between a pair of objects do not require that the objects be in contact.
- Cause and effect relationships of electric or magnetic interactions between two objects (size of force, properties of the objects, distance apart, and orientation relative to each other).
- Magnets and scientific ideas about magnets can be used to solve problems.

Unit 1 Essential Questions:

- How do equal and unequal forces on an object affect the object?
- How can magnets be used?
- How can we explain and predict interactions between objects?

Foundational Knowledge:

Prior to 3rd grade, students should have knowledge, understanding of, and experiences with the following ideas:

- Objects pull or push each other when they collide or are connected.
- When objects touch or collide, they push on one another and can change motion or shape.
- Pushes and pulls can have different strengths and directions.
- Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it.
- A bigger push or pull makes things speed up or slow down more quickly.
- An object sliding on a surface or sitting on a slope experiences a pull due to friction.

With the implementation of new standards, students may not have had opportunities to engage in these foundational understandings and ideas before 3rd grade. You may need to provide opportunities for students to experience these ideas as you move forward.

Additional Content Connections:

*These connections provide opportunities to score to other content standards with focused instruction.

ELA:

- ❖ Speaking and Listening
  - SL.3.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher led) with diverse partners on grade 3 topics and texts, building on others' ideas and expressing their own clearly.
  - SL.3.2 Determine the main ideas and supporting details of a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.

Math:

- ❖ Measurement and Data
  - 3.MD.A.2 Measure and estimate liquid volumes and masses of objects using standard units such as: grams, kilograms, liters, gallons, quarts, pints, and cups. Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units.
- ❖ Standards for Mathematical Practice
  - MP.2 Reason abstractly and quantitatively

Unit Vocabulary:

observe/observation	friction	magnet/magnetic
measure	motion	magnetic field
predict/prediction	stability	pole
force	gravity	repel
interact/interaction	gravitational pull	attract
balanced/unbalanced	electric/electricity	contact
energy	static electricity	electromagnet

Forces and Interactions

Students who demonstrate understanding can:

3-PS2-1 Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object. [**AR** Clarification Statement: Examples could include an unbalanced force on one side of a box can make it start moving or balanced forces pushing on a box from both sides will not produce any motion at all.] [Assessment Boundary: Assessment is limited to one variable at a time: number, size, or direction of forces. Assessment does not include quantitative force size, only qualitative and relative. Assessment is limited to gravity being addressed as a force that pulls objects down.]

3-PS2-2 Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion. [Clarification Statement: Examples of motion with a predictable pattern could include a child swinging in a swing, a ball rolling back and forth in a bowl, and two children on a see-saw.] [Assessment Boundary: Assessment does not include technical terms such as period and frequency.]

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. [Clarification Statement: Examples of an electric force could include the force on hair from an electrically charged balloon or the electrical forces between a charged rod and pieces of paper; examples of a magnetic force could include the force between two permanent magnets, the force between an electromagnet and steel paperclips, and the force exerted by one magnet versus the force exerted by two magnets. Examples of cause and effect relationships could include how the distance between objects affects strength of the force or how the orientation of magnets affects the direction of the magnetic force.] [Assessment Boundary: Assessment is limited to forces produced by objects that can be manipulated by students, and electrical interactions are limited to static electricity.]

3-PS2-4 Define a simple design problem that can be solved by applying scientific ideas about magnets.* [Clarification Statement: Examples of problems could include constructing a latch to keep a door shut and creating a device to keep two moving objects from touching each other.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices

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 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)

Connections to Nature of Science

Science Knowledge is Based on Empirical Evidence

- Science findings are based on recognizing patterns. (3-PS2-2)

Scientific Investigations Use a Variety of Methods

Science investigations use a variety of methods, tools, and techniques. (3-PS2-1)

Disciplinary Core Ideas

PS2.A: Forces and Motion

- 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. (Boundary: Qualitative and conceptual, but not quantitative addition of forces are used at this level.) (3-PS2-1)
- 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. (Boundary: Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.) (3-PS2-2)

PS2.B: Types of Interactions

- Objects in contact exert forces on each other. (3-PS2-1)
- 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)

Crosscutting Concepts

Patterns

- Patterns of change can be used to make predictions. (3-PS2-2)

Cause and Effect

- Cause and effect relationships are routinely identified. (3-PS2-1)
- Cause and effect relationships are routinely identified, tested, and used to explain change. (3-PS2-3)

Connections to Engineering, Technology, and Applications of Science

Interdependence of Science, Engineering, and Technology

- Scientific discoveries about the natural world can often lead to new and improved technologies, which are developed through the engineering design process. (3-PS2-4)