

Grade 1 Science, Quarter 3, Unit 3.1
Force and Motion

Overview

Number of instructional days: 11 (1 day = 40 minutes)

Content to be learned

- Observe and sort objects that are and are not attracted to magnets.
- Show how pushing/pulling moves or does not move an object.
- Predict the direction an object will or will not move if a force is applied to it.
- Show that different objects fall to Earth unless something is holding them up.

Science processes to be integrated

- Conduct investigations to make observations, collect and record data, make predictions, and identify and describe phenomena.
- Summarize data collected over time.
- Make predictions based on observations and data.
- Identify the structures within a simple system.
- Describe the interactions between forces and the structures in a simple system.

Essential questions

- How do forces affect objects?
- What effect do magnets have on various objects

Written Curriculum

Grade-Span Expectations

PS 3 - The motion of an object is affected by forces.

PS3 (K-4) INQ+ SAE –8

Use observations of magnets in relation to other objects to describe the properties of magnetism (i.e., attract or repel certain objects or has no effect)

PS3 (K-2)–8 Students demonstrate an understanding of (magnetic) force by ...

8a observing and sorting objects that are and are not attracted to magnets.

PS3 (K-4)-INQ+SAE –7

Use data to predict how a change in force (greater/less) might affect the position, direction of motion, or speed of an object (e.g., ramps and balls).

PS3 (K-2) –7 Students demonstrate an understanding of motion by...

7a showing how pushing/pulling moves or does not move an object.

7b predicting the direction an object will or will not move if a force is applied to it.

Students demonstrate an understanding of force by...

7c showing that different objects fall to earth unless something is holding them up.

Clarifying the Standards

Prior Learning

In kindergarten, students observed and sorted objects that are and are not attracted to magnets. They showed how pushing/pulling moves or does not move an object and predicted the direction an object will or will not move if a force is applied to it.

Current Learning

At the reinforcement level of instruction, first graders observe and sort objects that are and are not attracted to magnets. Students may utilize magnets to test a variety of objects to determine whether they are attracted to a magnet. As students work with magnets, they may notice that opposite poles of magnets attract (i.e., pull), while similar poles of two magnets repel (i.e., push) each other. Centers or cooperative learning activities may be used to reinforce the concept of magnetism.

In addition, at the reinforcement level of instruction, students show how pushing and pulling moves or does not move an object, and they predict the direction an object will or will not move if a force is applied. To create a conceptual understanding of push and pull forces, students engage in simple investigations, which could include giving them multiple opportunities to explore the effects of pushing and pulling a variety of objects (e.g., blocks, balls, marbles, toy cars) on various surfaces (e.g., carpeting, tile, cement, rubber mats). These investigations allow students to observe the different ways that objects

move (slide, roll, spin) and can help them begin to understand the concept of friction and how it affects the motion of objects when a force has been applied. Students should draw conclusions as to what causes objects to roll versus what causes objects to slide and why objects move better or farther on different surfaces. Additional activities may include ramps and marbles; bowling; straws to apply a blowing force to move objects varying in size, shape, and material; paper airplanes; and playground equipment (i.e., visits to a playground to use equipment such as slides, swings, monkey bars, and seesaws).

At the developmental level of instruction, first graders show that different objects fall to Earth unless something is holding them up. This is students' first formal opportunity to experience the effects of gravity. Simple experiments can be done to support this concept such as jumping, jumping rope, trying to keep balloons in the air, and dropping objects from varying heights (e.g., parachutes, balls). They should also have opportunities to show that objects fall to the ground when pushed off a table but do not fall if placed solidly on a table.

Future Learning

Second graders will demonstrate an understanding of motion by showing how pushing/pulling moves or does not move an object. They will predict the direction an object will or will not move if a force is applied to it and will show that different objects fall to Earth unless something is holding them up.

In grades 3 and 4, students will demonstrate an understanding of motion by predicting the direction and describing the motion of objects (of different weights, shapes, sizes, etc.) if a force is applied to it. They will describe change in position relative to other objects or background. Students will demonstrate an understanding of force (e.g., push-pull, gravitational) by investigating and describing that different amounts of force change the direction/speed of an object in motion, and they will conduct experiments to demonstrate that different objects fall to Earth unless something is holding them up. Students will demonstrate an understanding of (magnetic) force by using prior knowledge and investigating to predict whether an object will be attracted to a magnet. They will describe what happens when like and opposite poles of a magnet are placed near each other and will explore the relative strength of magnets (i.e., size, number, properties).

Additional Findings

Young students should view, describe, and discuss all kinds of moving things (e.g., themselves, insects, birds, trees, doors, rain, fans, swings, balls), keeping notes, drawing pictures to suggest their motion, and raising questions (e.g., Do they move in a straight line? Is their motion fast or slow? How can you tell?). The questions count more than the answers at this stage. Students should gain varied experiences in getting things to move or not move and in changing the direction or speed of things that are already in motion. By the end of grade 2, students should know that things move in many different ways (e.g., straight, zigzag, round and round, back and forth, fast and slow) and the way to change how something is moving is to give it a push or a pull. (*Benchmarks for Science Literacy*, p. 89)

When addressing force and motion in grades K–2, the focus should be on motion and encouraging children to be observant about when and how things move or do not move. Young students should observe motion everywhere, making lists of different kinds of motion and which things move in similar ways. Gravity and magnetism are forces that young students can begin to explore as they attempt to understand the world around them. They should notice that things near Earth fall to the ground unless something holds them up and that magnets can be used to make some things move without being touched, thereby learning that forces can act at a distance with nothing in between. Students need multiple

opportunities to observe and describe how forces cause change to the behavior of objects. (*Benchmarks for Science Literacy*, p. 94)

During their early years, children’s natural curiosity leads them to explore the world by observing and manipulating common objects and materials in their environment. Children compare, describe, and sort as they begin to form explanations of the world. Developing a subject-matter knowledge base to explain and predict the world requires many experiences over a long period. Young children bring experiences, understanding, and ideas to school; teachers provide opportunities to continue children’s explorations in focused settings with other children using simple tools such as magnifiers and measuring devices. When students describe and manipulate objects by pushing, pulling, throwing, dropping, and rolling, they begin to focus on the position and movement of objects—describing location using words such as *up*, *down*, *in front of*, or *behind* and discovering the various kinds of motion and forces required to move or control objects. By experimenting with magnetism, students begin to understand that phenomena can be observed, measured, and controlled in various ways. (*National Science Education Standards*, pp. 123 and 126)

Younger students, between 7 to 9 years, were found to think of force in terms of anger or feelings. Children naturally bring to their learning alternate meanings of *force*, and many studies have reported force as being associated with coercion or opposing resistance. In addition, forces are frequently associated with physical activity and muscular strength of living things. Teachers should recognize that students might have difficulty developing a conceptual understanding of forces and how they interact with objects because students have established alternative meanings for words that teachers use in a scientific sense. (*Making Sense of Secondary Science*, pp. 148–151)

Research shows that children tend to see objects as either at rest or moving. Children less frequently focus on the period of change when an object speeds up or slows down (*Making Sense of Secondary Science*, p. 155). Teachers may need to encourage students to describe the motion of objects as they change position and how the motion changes over time.

Notes About Resources and Materials

Books

- Pushes and Pulls (6 days) 2010–2011
- Bradley, K. (2005). *Forces Make Things Move*. New York: HarperCollins.
- Branley, F. (1996). *What Makes a Magnet?* New York: HarperCollins.
- Fowler, A. (1995). *What Magnets Can Do*. Danbury, CT: Children’s Press.
- Parkes, B. (1998). *Magnets*. Marlborough, MA: Newbridge Educational Publishing.

Helpful Websites

- www.atozteacherstuff.com
- <http://pbskids.org/zoom/activities/sci>
- www.sciencekids.co.nz/gamesactivities/forcesinaction.html
- www.sciencea-z.com
- www.internet4classrooms.com/science_elem_magnets.htm
- www.brainpopjr.com/science/forces/pushesandpulls/grownups.weml
- www.fossweb.com (Science Foss website)

Lesson Plans

- www.uen.org/Lessonplan/preview.cgi?LPid=28150
- www.uen.org/Lessonplan/preview.cgi?LPid=28207

Helpful Videos

- Bill Nye the Science Guy: Outer Space Way Out There
- The Magic School Bus Plays Ball
- Sid the Science Kid: Sid in Motion

Recommended Materials

- Lakeshore Learning magnet kit
- Lakeshore Learning unbreakable magnets

Grade 1 Science, Quarter 3, Unit 3.2
Earth Materials

Overview

Number of instructional days: 11 (1 day = 40 minutes)

Content to be learned

- Describe, compare, and sort rocks and soils by similar or different physical properties (e.g., size, shape, color, texture, smell, weight).
- Record observations/data about physical properties.
- Identify which materials are best for different uses (e.g., soils for growing plants, sand for the sandbox).

Science processes to be integrated

- Conduct investigations using scientific processes, including observing, describing, comparing, sorting, recording and organizing data, and building explanations.
- Use tools to explore physical properties of materials.

Essential questions

- In what ways can earth materials be described, compared, and sorted?
- In what ways can observations and data be organized?
- How do you know which materials are best suited for different uses?

Written Curriculum

Grade-Span Expectations

ESS1 - The earth and earth materials as we know them today have developed over long periods of time, through continual change processes.

ESS1 (K-4) INQ-1

Given certain earth materials (soils, rocks or minerals) use physical properties to sort, classify, and describe them.

ESS1 (K-2)–1 Students demonstrate an understanding of earth materials by ...

1a describing, comparing, ~~and sorting rocks~~ and soils by similar or different physical properties (e.g., size, shape, color, texture, smell, weight).

1b recording observations/data about physical properties.

ESS1 (K-4) FAF -6

Given information about earth materials explain how their characteristics lend themselves to specific uses

ESS1 (K-2) –6 Students demonstrate an understanding of properties of earth materials by...

6a identifying which materials are best for different uses (e.g., soils for growing plants, sand for the sand box).

Clarifying the Standards

Prior Learning

In kindergarten, students described, compared, and sorted rocks by similar or different physical properties (e.g., size, shape, color, texture, smell, weight), and they used attributes of properties to state why objects are grouped together (e.g., rocks that are shiny or not shiny).

Current Learning

At the developmental level of instruction, first graders demonstrate an understanding of earth materials by describing and comparing soils with similar or different physical properties (e.g., size, shape, color, texture, smell, weight), and they record observations/data about physical properties of soils. When addressing these concepts, students should spend time outside of the school building to collect soil samples. Then, back in the classroom, students should use magnifying lenses to observe soil samples collected. They should look for similarities and differences in color and texture and should separate the various components of each soil sample. Students can then use T-charts and/or Venn diagrams to visually represent their observations after investigating a variety of soil samples. If students do not have the opportunity to collect local soil samples, teachers can use a variety of soils (e.g., potting soil, topsoil, sand) for student observations. Additional activities could include adding water to soil samples, sifting soil samples (to separate components as well as varying particle sizes found in the soil), attempting to build with soil samples, and weighing equal amounts of soil samples.

At the developmental level of instruction, students demonstrate an understanding of properties of earth materials by identifying which materials are best for different uses (e.g., soils for growing plants, sand for the sandbox). They could conduct an investigation to determine which type of soil would support and sustain plant life. (This works best with fast-growing seeds such as grasses, radishes, and beans.) Students could then observe, compare, and record plant growth. In addition, they should also discuss which types of soils are best suited for other everyday uses such as in playgrounds, for art, in building structures, and for landscaping.

Future Learning

In grade 2, students will demonstrate an understanding of earth materials by describing, comparing, and sorting rocks and soils by similar or different physical properties (e.g., size, shape, color, texture, smell, weight). They will record observations/data about physical properties and will use attributes of properties to state why objects are grouped together (e.g., rocks that are shiny or not shiny). Students will demonstrate an understanding of processes and change over time within earth systems by conducting tests on how different soils retain water (e.g., How fast does the water drain through?). They will also demonstrate an understanding of properties of earth materials by identifying which materials are best for different uses (e.g., soils for growing plants, sand for the sandbox).

In grades 3 and 4, students will demonstrate an understanding of earth materials by describing, comparing, and sorting rocks, soils, and minerals by similar or different physical properties (e.g., size, shape, color, texture, smell, weight, temperature, hardness, composition). They will record and analyze observations/data about physical properties (e.g., within a grouping, which characteristics are the same and which are different). Students will cite evidence (e.g., prior knowledge, data) to support why rocks, soil, or minerals are classified/not classified together and will identify the four basic materials of Earth (water, soil, rocks, air). In addition, they will demonstrate an understanding of properties of earth materials by determining and supporting explanations of their uses (e.g., best soils to grow plants, best building material for a specific purpose, determining which rock size best prevents erosion).

Additional Findings

Children come to school aware that Earth's surface is composed of rocks, soils, water, and living organisms, but a closer look helps them identify many additional properties of earth materials. By carefully observing and describing the properties of many rocks, children begin to see that some rocks are made of a single substance, but most are made of several substances. In later grades, the substances can be identified as minerals. Understanding rocks and minerals should not be extended to the study of the source of the rocks (e.g., sedimentary, igneous, metamorphic) because the origin of rocks and minerals has little meaning to young children. Playgrounds and nearby vacant lots and parks are convenient study sites to observe a variety of earth materials. As students collect rocks and observe vegetation, they become aware that soil varies from place to place in its color, texture, and reaction to water. By planting seeds in a variety of soil samples, they can compare the effect of different soils on plant growth. (*National Science Education Standards*, p. 130)

The emphasis in grades K–4 should be on developing observation and description skills and the explanations based on observations. Younger children should be encouraged to talk about and draw what they see and think. Children in grades K–4 should learn that earth materials include rocks, soils, and water. These varied materials have different physical properties, which make them useful in different ways (e.g., as building materials, as sources of fuel, for growing the plants used as food). In addition, earth materials provide many of the resources that humans use. Soils have properties of color and texture,

capacity to retain water, and ability to support the growth of many kinds of plants, including those in the food supply. (*National Science Education Standards*, p.134)

In grades K–2, students should be actively involved in exploring phenomena that interest them both in and out of class. These investigations should be fun and exciting, opening the door to even more things to explore. An important part of students’ exploration is telling others what they see, what they think, and what it makes them wonder about, because students can learn about things through careful observation. In addition, children should have lots of time to talk about what they observe. Describing things as accurately as possible is important in science because it enables students to compare their observations with those of others. (*Benchmarks for Science Literacy*, p. 10)

Teaching geological facts about how Earth changes serves little purpose in the primary years. Students may hold the view that the world was always as it is now. Young children need to focus on becoming familiar with objects in their immediate surroundings, including rocks, soils, and organisms. (*Benchmarks for Science Literacy*, p. 72)

Young children should have many experiences in working with different kinds of materials, identifying and composing their properties and figuring out their suitability for different purposes. By the end of grade 2, students should know that some kinds of materials are better than others for making a particular thing. Materials that are better in some ways (e.g., stronger, more abundant) may be worse in other ways (e.g., heavier, difficult to cut). Tools can be used to help make things, and some materials can be used over and over again. (*Benchmarks for Science Literacy*, p. 188) Students should also know that objects can be described in terms of materials of which they are made and their physical properties. (*Benchmarks*, p. 76)

One common misconception young children have when learning about earth materials is that soil is “just dirt” or “any stuff from the ground.” Most children agree that soil is a medium that is useful for plant growth. They are aware that there are living organisms in the soil, and these were assumed to be “eating the soil.” For the most part, children seem to be largely unaware of the role, as well as the identity, of living organisms in soil. In some cases, children distinguished *dirt* from *soil* by saying that “soil has more goodness in it.” (*Making Sense of Secondary Science*, p. 114)

Notes About Resources and Materials

Books

- Cole, Joanna. *The Magic School Bus Inside the Earth*
- Cole, Joanna. *The Magic School Bus Plants a Seed*
- Cronin, Doreen. *The Diary of a Worm*
- Gurney, Beth. *Sand And Soil (Rocks, Minerals, and Resources)*
- Siddals, Mary McKenna. *Compost Stew*
- Rosinsky, Natalie M. *Dirt: The Scoop on Soil*
- Bial, Raymond. *A Handful of Dirt*
- Tomecek, Steve. *Jump into Science: Dirt*

- Pfeffer, Wendy. *Wiggling Worms at Work*
- Koontz, Robin. *Composting: Nature's Recyclers*
- Ditchfield, Christin. *Soil*
- Himmelman, John. *An Earthworm's Life*
- Glaser, Linda. *Wonderful Worms*
- Aloian, Molly. *Different Kinds of Soil (Everybody Digs Soil)*
- Kalman, Bobbie. *Life Cycle of an Earthworm*

Videos

- The Magic School Bus series
- Earth Science: Rock 'N Learn (2008)

Websites

- www.brainpopjr.com/science/land/soil/grownups.weml
- <http://school.discoveryeducation.com/schooladventures/soil> (Discovery Education)
- <http://www.42explore.com/rocks.htm>
- www.atozteacherstuff.com
- www.teachersdomain.org
- www.scienceppst.com
- www.fossweb.com (various science units covered)

Lesson Plans

- www.uen.org/Lessonplan/preview.cgi?LPid=28147