Standard #: SC.6.P.13.1

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Investigate and describe types of forces including contact forces and forces acting at a distance, such as electrical, magnetic, and gravitational.

Subject Area: Science

Grade: 6

Body of Knowledge: Physical Science

Idea: Level 2: Basic Application of Skills & Concepts

Big Idea: Forces and Changes in Motion - A. It takes energy to change the motion of objects.

Date Adopted or Revised: 02/08

B. Energy change is understood in terms of forces--pushes or pulls.

C. Some forces act through physical contact, while others act at a distance.

Clarification for grades K-5: The target understanding for students in the elementary grades should focus on Big Ideas A, B, and C.

Clarification for grades 6-8: The target understanding for students in grades 6-8 should begin to transition the focus to a more specific definition of forces and changes in motion. Net forces create a change in motion. A change in momentum occurs when a net force is applied to an object over a time interval.

Grades 9-12, Standard 12: Motion - A. Motion can be measured and described qualitatively and quantitatively. Net forces create a change in motion. B. Momentum is conserved under well-defined conditions. A change in momentum occurs when a net force is applied to an object over a time interval.

Content Complexity Rating: Level 2: Basic Application of Skills & Concepts - More Information

Date of Last Rating: 05/08

Status: State Board Approved

Assessed: Yes

TEST ITEM SPECIFICATIONS

Item Type(s): This benchmark may be assessed using: MC item(s)

Also Assesses
SC.6.P.13.2 Explore the Law of Gravity by recognizing that every object exerts gravitational force on every other object and that the force depends on how much mass the objects have and how far apart they are.

SC.8.P.8.2 Differentiate between weight and mass recognizing that weight is the amount of gravitational pull on an object and is distinct from, though proportional to, mass.
Clarification :
Students will identify and/or describe types of forces.

Students will describe the relationship among distance, mass, and gravitational force between any two objects.

Students will differentiate between mass and weight.
Content Limits :
Items assessing gravity will use a conceptual understanding of the Law of Universal Gravitation by keeping either the mass or distance constant.

Items will not assess nuclear forces.

Items will not require the use of formulas or calculations.

Items addressing mass and/or weight will not assess the units of measure for mass and weight.
Stimulus Attributes :
None specified
Response Attributes :
None specified
Prior Knowledge :
Items may require the student to apply science knowledge described in the NGSSS from lower grades. This benchmark requires prerequisite knowledge from SC.5.10.3 and SC.5.P.13.1.

SAMPLE TEST ITEMS (1)

Test Item #: Sample Item 1
Question: Luis rubbed a balloon on his hair and held the balloon next to the wall. He observed the balloon stick to the wall. Which of the following is responsible for the balloon sticking to the wall?
Difficulty: N/A
Type: MC: Multiple Choice

Related Courses

Course Number	Course Title
2002040:	M/J Comprehensive Science 1 (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2002050:	M/J Comprehensive Science 1, Advanced (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2003010:	M/J Physical Science (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2003020:	M/J Physical Science, Advanced (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
7820015:	Access M/J Comprehensive Science 1 (Specifically in versions: 2014 - 2015, 2015 - 2018, 2018 and beyond (current))
2002055:	M/J Comprehensive Science 1 Accelerated Advanced (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2003030:	M/J STEM Physical Science (Specifically in versions: 2015 and beyond (current))

Related Access Points

Independent

Access Points Number	Access Points Title
SC.6.P.13.In.1:	Identify examples of gravitational and contact forces, such as falling objects or push and pull.

Supported

Access Points Number	Access Points Title
SC.6.P.13.Su.1:	Distinguish between pushing and pulling forces (contact) and falling (gravitational force) of an object.

Participatory

Access Points Number	Access Points Title
SC.6.P.13.Pa.1:	Recognize that pushing or pulling makes an object move (contact force).

Related Resources

Original Student Tutorial

Name	Description
Balancing the Machine:	Use models to solve balance problems on a space station in this interactive, math and science tutorial.
Types of Forces:	Examine contact and non-contact forces such as gravity, electrical, and magnetic forces in this interactive tutorial.

Lesson Plan

Name	Description
Building a Skyscraper—An Engineering Design Challenge:	This Engineering Design Challenge is intended to help students apply the concepts of contact and non-contact forces as they build structures able to withstand the forces of wind and gravity. It is not intended as an initial introduction to this benchmark.
Did you slow the flow, Joe?:	Students will identify the effects of friction on the falling rates of an object in different liquids using speed calculation. With these calculations, the students will synthesize a cause/effect statement from the results comparing thickness (viscosity) of the liquid and the speed on a falling object.
Does something have to be touching to interact?:	This is a quick lesson on contact and non-contact forces.
Electrical Conductors and Insulators:	Students will identify substances capable of carrying an electric charge and those that do not. Students will be able to identify and diagram the parts of a basic series circuit, though the concepts of series and parallel circuits have not be developed yet.
Hot or cold: Magnets always rock!:	This lesson uses a hands-on-approach to investigate one of the three non-contact forces. Teachers can use this lesson plan to have students explore and investigate how temperature can have an effect on the magnetic strength of a magnet.
Levitation Engineers: Exploring Forces:	Students will explore, observe, and infer about the properties and behaviors of magnets by conducting their own experiments with the magnets and the differences between contact and non-contact forces. Students will plan and design a magnetic levitation device using the engineering design process.
Lightning Strikes! :	In this lesson, students will analyze an informational text that addresses what causes lightning and thunder. The text also outlines ways to stay safe during a lightning storm. This informational text is designed to support reading in the content area. The lesson plan includes a note-taking guide, text-dependent questions, a writing prompt, answer keys, and a writing rubric.
	This lesson focuses on students being able to identify the difference between contact and non-contact forces. This

May the force be with you:	lesson includes a presentation that shows students contact forces and non-contact forces and has students make a booklet to organize information they have learned.
May the neutrally buoyant force be with you !:	• This lesson helps students understand that forces affect motion and that some forces can be manipulated to be balanced or unbalanced with respect to motion. In the lesson, students use their knowledge of types of forces and free body diagrams to do an inquiry activity where they attempt to make a film canister neutrally buoyant in a 10 gal tank full of fresh water. (I have also used 2 L bottles with tops cut off and an empty pie pan to collect spillage.) Students need to predict, observe, and explain along the way as well as collect and record data to help quantify their results. • After the lesson, students apply their new knowledge gained through experiential learning to real life scenarios in an abstract way as a formative assessment.
Paper Route Logic:	The main problem students will need to solve is helping Lily Rae Wridenhoud find a route that will afford her the quickest time, least distance and highest customer satisfaction rating. Students will be given a map of all the streets leading around the neighborhood and customer rating (smiley faces). Students will need to use a ruler to figure out distances as well as decide elevation numbers on the topographic map. Then they will write out the route they have chosen to give Lily, and write a short explanation as to why this is the quickest and least distance traveled. Students will then be asked to look over their findings and be informed that some of the old clients have canceled the paper delivery and a few new paper clients have signed on. Does their new route still fit their findings?
Parachutes For Sale:	The students will be asked to help a company choose a design to market for their new business. The company gives students four prototypes to begin with, but asks the students to create one of their own if they wish to further the research. After choosing one of the models and writing a report to declare their findings and explain their reasoning, students will then be given restrictions to the parachute. They are asked to find a material that is light yet strong, and resistant to tearing and breaking. Students will have to create parachutes using the chosen model but made with different materials to establish the best overall material.
Robots Get a Job:	In this MEA, students will select the robots that are more efficient at doing a certain type of job. They will have to analyze data tables that include force, force units, mass, mass units, and friction.
Static Cling is a Thing:	This is a visual lesson that uses computer simulation and 2 short instructional videos to educate students on electrical force from a distance. It includes a PowerPoint summative test and a rubric for grading the summative.
STEM Roller Coaster Engineering:	Students will investigate and describe different types of forces. They will complete an engineering design to build the fastest roller coaster. Students will use variables (distance and time) that change in relationship to each other to solve a real world problem.
The Amazing Balloon Rocket :	Students will investigate Newton's 3 Laws of Motion as it relates to rocketry by constructing a balloon rocket. They will collect data, calculate velocity of the balloon as it races across the string and calculate velocity and acceleration. Students will construct a Distance-Time graph and a Velocity-Time graph. Students will find the slope of the Distance-Time graph and will explain why this slope represents the velocity of the balloon. Students will further explain why they slope of the Velocity-Time graph represents the acceleration.
The Force IS With You:	A centers-based investigation of contact and action-at-a-distance forces with a performance assessment summative. Students will explore the different types of forces in a group work centers approach. After reviewing the data gathered, students will demonstrate the ability to define where each of these forces can found in the real world. Students will be engaged in cooperation and argumentation to achieve these goals.
The Physics Behind the Fun:	In this lesson, students will analyze an informational text that describes the physics of roller coasters. This informational text is designed to support reading in the content area. The article was written to answer the question, "Why don't I fall out when a roller coaster goes upside down?" The article is an interesting combination of scientific information about physics of roller coasters along with some fun facts. The lesson plan includes text-dependent questions, a writing prompt, answer keys, and a writing rubric.
You've Got to Move It, Move it!:	This STEM lesson is a lesson to be done over 3-4 sessions of 45 minutes, possibly longer for inclusion students who will need more direction. It involves lots of collaboration and the Engineering Design Process. • Define the Problem • Do Background Research • Specify Requirements • Brainstorm Solutions • Choose the Best Solution • Do Development Work • Build a Prototype • Test and Redesign Students will be designing a vessel that needs to travel four feet, with the use of a fan, across two different types of string (fishing line and yarn). They will be expected to draw the design on an engineering page(s) with explicit details, illustrations, with an emphasis on gravity and the forces that are observed (tension, frictional, normal, pull, etc.). The students will be collaborating on the Law of Gravity, forces, and motion and take a short response assessment at the end of the activity.

Teaching Idea

Name	Description
Design a Powerful Bird Wing:	In this hands-on and web interactive project, students design and build a bird wing powerful enough to spin them in an office chair when it is flapped. By modifying the shape, size, and/or materials used in their design based on observations of natural and man-made transportation methods, students will learn about thrust, forces, durability, and energy use.

Perspectives Video: Professional/Enthusiast

Name	Description
Factoring in the Force of Friction:	Race car drivers discuss importance of calculating tire friction before speeding through turns.

Video/Audio/Animation

Name	Description
How to Make your Own Electroscope:	Learn how to build an electroscope to do static electricity experiments
Solar Wind's Effect on Earth:	The Sun produces a solar wind — a continuous flow of charged particles — that can affect us on Earth. It can, for example, disrupt communications, navigation systems, and satellites. Solar activity can also cause power outages, such as the extensive Canadian blackout in 1989. In this video segment adapted from NASA, learn about solar storms and their effects on Earth.

Text Resource

Name	Description
What Causes Thunder and Lightning?:	This informational text resource is designed to support reading in the content area. The text describes what causes lightning and examines the science behind cloud-to-ground lightning strikes. It also discusses what causes thunder and explains why we see the lightning before we hear the thunder. The last section of the text provides important rules about lightning safety and lists ways to stay safe during a lightning storm.
Why Don't I Fall Out When a Roller Coaster Goes Upside Down?:	This informational text resource is designed to support reading in the content area. This short article was written to answer the question, "Why don't I fall out when a roller coaster goes upside down?" The answer to the question results in an interesting article that combines scientific information about the physics of roller coasters, along with some fun facts and photographs.

Student Resources

Name	Description
Balancing the Machine:	Use models to solve balance problems on a space station in this interactive, math and science tutorial.
Solar Wind's Effect on Earth:	The Sun produces a solar wind — a continuous flow of charged particles — that can affect us on Earth. It can, for example, disrupt communications, navigation systems, and satellites. Solar activity can also cause power outages, such as the extensive Canadian blackout in 1989. In this video segment adapted from NASA, learn about solar storms and their effects on Earth.
Types of Forces:	Examine contact and non-contact forces such as gravity, electrical, and magnetic forces in this interactive tutorial.

Parent Resources

Name	Description
Design a Powerful Bird Wing:	In this hands-on and web interactive project, students design and build a bird wing powerful enough to spin them in an office chair when it is flapped. By modifying the shape, size, and/or materials used in their design based on observations of natural and man-made transportation methods, students will learn about thrust, forces, durability, and energy use.