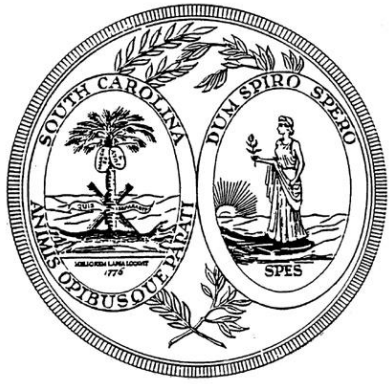
South Carolina Academic Standards and Performance Indicators for Science 2014



Instructional Unit Resource

5th Grade

South Carolina Academic Standards and Performance Indicators for Science 2014
Fifth Grade Science Instructional Unit Resource

As support for implementing the *South Carolina Academic Standards and Performance Indicators for Science 2014*, the standards for Fifth Grade have been grouped into possible units. In the Overview of Units below, the titles for those possible units are listed in columns. Refer to the Overview document to note these unit titles and how Standards, Conceptual Understandings, Performance Indicators, Science and Engineering Practices, and Crosscutting Concepts align. Following the Overview of Units, an Instructional Unit document is provided that delivers guidance and possible resources in teaching our new *South Carolina Academic Standards and Performance Indicators for Science 2014*. The purpose of this document is to provide guidance as to how all the standards in this grade may be grouped into units and how those units might look. Since this document is merely guidance, districts should implement the standards in a manner that addresses the district curriculum and the needs of students. This document is a living document and instructional leaders from around the state will continuously update and expand these resource documents. These documents will be released throughout the 2016-2017 school year with the intentionality of staying ahead of instruction. Teachers should also note that links to the Standards document, A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas, the SEP Support Document, and the Support Document 2.0 are embedded throughout the Instructional Unit format for reference.

Acknowledgments

Jean Baptiste Massieu, famous deaf educator, made a statement that is now considered a French proverb. “Gratitude is the memory of the heart. Indeed, appreciation comes when you feel grateful from the depths of your heart. The head keeps an account of all the benefits you received and gave. But the heart records the feelings of appreciation, humility, and generosity that one feels when someone showers you with kindness.” It is with sincere appreciation that we humbly acknowledge the dedication, hard work and generosity of time provided by teachers and instructional leaders across the state that have made and are continuing to make the Instructional Unit Resources possible.

Grade 5 Overview of Units

Unit 1		Unit 2		Unit 3		Unit 4
PHYSICAL SCIENCE: MATTER AND MIXTURES		EARTH SCIENCE: CHANGES IN LANDFORMS AND OCEANS		LIFE SCIENCE: INTERDEPENDENT RELATIONSHIPS		PHYSICAL SCIENCE: FORCES AND MOTIONS
Standard		**Standard**		**Standard**		**Standard**
5.P.2		5.E.3		5.L.4		5.P.5
Conceptual Understanding		**Conceptual Understanding**		**Conceptual Understanding**		**Conceptual Understanding**
5.P.2.A	5.P.2B	5.E.3A	5.E.3B	5.L.4A	5.L.4B	5.P.5A
Performance Indicators		**Performance Indicators**		**Performance Indicators**		**Performance Indicators**
5.P.2.A.1 5.P.2.A.2	5.P.2B.1 5.P.2B.2 5.P.2B.3 5.P.2B.4 5.P.2B.5 5.P.2B.6	5.E.3A.1 5.E.3A.2	5.E.3B.1 5.E.3B.2 5.E.3B.3 5.E.3B.4	5.L.4A.1 5.L.4A.2	5.L.4B.1 5.L.4B.2 5.L.4B.3 5.L.4B.4	5.P.5A.1 5.P.5A.2 5.P.5A.3 5.P.5A.4 5.P.5A.5
***Science and Engineering Practices**		***Science and Engineering Practices**		***Science and Engineering Practices**		***Science and Engineering Practices**
5.S.1A.2 5.S.1A.3 5.S.1A.4 5.S.1A.6 5.S.1A.7 5.S.1A.8		5.S.1A.1 5.S.1A.2 5.S.1A.4 5.S.1A.6 5.S.1A.8 5.S.1B.1		5.S.1A.2 5.S.1A.4 5.S.1A.6 5.S.1A.7 5.S.1A.8		5.S.1A.1 5.S.1A.2 5.S.1A.3 5.S.1A.4 5.S.1A.5 5.S.1B.1
***Crosscutting Concepts**		***Crosscutting Concepts**		***Crosscutting Concepts**		***Crosscutting Concepts**
2,4,5,7		1,2,3,4,7		1,2,5		2,3,4,7

**Teachers have the discretion to enhance the selected SEP's and CCCs.*

Unit Title
Physical Science: Forces and Motions
Standard http://ed.sc.gov/scdoe/assets/file/agency/ccr/Standards-Learning/documents/South_Carolina_Academic_Standards_and_Performance_Indicators_for_Science_2014.pdf
5.P.5 The student will demonstrate an understanding of the factors that affect the motion of an object.

Conceptual Understanding
5.P.5A The motion of an object can be described in terms of its position, direction, and speed. The rate and motion of an object is determined by multiple factors.
New Academic Vocabulary **Some students may need extra support with the following academic vocabulary in order to understand what they are being asked to understand and do. Teaching these terms in an instructional context is recommended rather than teaching the words in isolation. A great time to deliver explicit instruction for the terms would be during the modeling process. Ultimately, the student should be able to use the academic vocabulary in conversation with peers and teachers. These terms are pulled from the essential knowledge portion of the Support Doc 2.0 (http://ed.sc.gov/instruction/standards-learning/science/support-documents-and-resources/) and further inquiry into the terms can be found there.**

Inertia	Mass	Magnetism	Force	Gravity	Force
Gravity	Friction	Position	Direction	Speed	Balanced Forces
Unbalanced forces	Acceleration	Deceleration	Texture	Surface	Rough surface
Smooth surface	Weight	Lubrication	Rate	Motion	

Performance Indicators **Text highlighted below in *orange* and *italicized/underlined* shows connections to SEP's.**
5.P.5A.1 *Use mathematical and computational thinking* to describe and predict the motion of an object (including position, direction, and speed). 5.P.5A.2 *Develop and use models* to explain how the amount or type of force (contact and non-contact) affects the motion of an object. 5.P.5A.3 *Plan and conduct* controlled scientific investigations to test the effects of balanced and unbalanced forces on the rate and direction of motion of objects. 5.P.5A.4 *Analyze and interpret* data to describe how a change of force, a change in mass, or friction affects the motion of an object. 5.P.5A.5 *Design and test* possible devices or solutions that reduce the effects of friction on the motion of an object.

***Science and Engineering Practices**

Support for the guidance, overviews of grade level progressions, and explicit details of each SEP can found in the Science and Engineering Support Doc (http://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf). It is important that teachers realize that the nine science and engineering practices are not intended to be used in isolation. Even if a performance indicator for a given standard only lists one of the practices as a performance expectation, scientists and engineers do not use these practices in isolation, but rather as part of an overall sequence of practice. When educators design the learning for their students, it is important that they see how a given performance expectation fits into the broader context of the other science and engineering practices. This will allow teachers to provide comprehensive, authentic learning experiences through which students will develop and demonstrate a deep understanding of scientific concepts.

5.S.1A.1 Ask questions to (1) generate hypotheses for scientific investigations or (2) refine models, explanations, or designs.

5.S.1A.2 Develop and use models to (1) understand or represent phenomena, processes, and relationships; (2) test devices or solutions; or (3) communicate ideas to others.

5.S.1A.3 Plan and conduct controlled scientific investigations to answer questions, test hypotheses and predictions, and develop explanations: (1) formulate scientific questions and testable hypotheses; (2) identify materials, procedures, and variables; (3) select and use appropriate tools or instruments to collect qualitative and quantitative data; and (4) record and represent data in an appropriate form. Use appropriate safety procedures.

5.S.1A.4 Analyze and interpret data from informational texts, observations, measurements, or investigations using a range of methods (such as tabulation or graphing) to (1) reveal patterns and construct meaning or (2) support hypotheses, explanations, claims, or designs.

5.S.1A.5 Use mathematical and computational thinking to (1) express quantitative observations using appropriate metric units; (2) collect and analyze data; or (3) understand patterns, trends, and relationships between variables.

5.5.1B.1 Construct devices or design solutions using scientific knowledge to solve specific problems or needs: (1) ask questions to identify problems or needs, (2) ask questions about the criteria and constraints of the device or solutions, (3) generate and communicate ideas for possible devices or solutions, (4) build and test devices or solutions, (5) determine if the devices or solutions solved the problem and refine the design if needed, and (6) communicate the results.

***Cross Cutting Concepts** **(http://www.nap.edu/read/13165/chapter/8)**

The link above provides support from the Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas (2012). The text in blue and *italicized/underlined* below provides a brief explanation of how the specific content ties to the CCC's.

2. Cause and effect: Mechanism and explanation: The National Research Council (2012) states that "events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts" (p. 84). *An object's position is affected by its direction and speed. Both contact and non-contact forces affect the motion of an object.*

3. Scale, Proportion, and Quantity: The National Research Council (2012) states, "In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance" (p. 84). *The quantity (or strength) of balanced or unbalanced forces affects an object's performance in terms of rate and direction of motion.*

4. Systems and System Models: The National Research Council (2012) states that "defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineering" (p. 84). *Models can be made of systems that will allow for the reduction of friction (for example, wheels added to an object, grease applied in specific locations, etc.).*

7. Stability and Change: The National Research Council (2012) states that "defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineering" (p. 84). For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study. *The force of gravity determines the change in tides. The motion of an object will remain stable or will change depending on the change in force, mass, or friction that is applied to the object.*

**Teachers have the discretion to enhance the selected SEP's and CCC's.*

Prior Knowledge
• 2.P.4 Motion
Subsequent Knowledge
• 8.P.2 Motion

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Possible Instructional Strategies/Lessons
Strategies and lessons that will enable students to master the standard and/or indicator.

- 5.P.5A.1
  - Physical Science: Forces and Motion: (Experiment/Lesson) Students will analyze and collect data involving metric units to describe motion in terms of speed, direction, and position. This resource can be found at http://rpsec.usca.edu/workshops/SISSI/SISSI3-5AikenJune2015/lessons/Gr5ForcesMotionSISSILesson.pdf.

  - Marble Motion: This is an activity that allows the students to observe the path of a marble, record time and distance data, and calculate the average speed. The same will be done for a marble using an incline plane. Then students will graph the results for both parts of the lab. This activity can be found at https://kimberlykludt.wikispaces.com/file/view/Marble+Motion+Lab.pdf.

  - Marble Motion Lab: This is another activity that allows the students to calculate the speed/ momentum of a marble and identify factors that affect its speed using the variable of steepness of the ramp and size of the marble. This activity can be found at http://www.chatham-nj.org/cms/lib/NJ01000518/Centricity/Domain/871/lab_marble%20motion%2014.pdf.

- 5.P.5A.2, 5.P.5A.4
  - Rules of Forces and Motion: This is an experiment/Lesson that shows the effects of mass and friction on speed and motion. This resource can be found at http://www.discoveryeducation.com/teachers/free-lesson-plans/rules-of-forces-and-motion.cfm.

- 5.P.5A.3
  - Balanced and Unbalanced Forces: In these lessons, students will describe events and observations and explain the law that impacts the situation in their own words. This resource can be found at http://physicsed.buffalostate.edu/pubs/PHYx90IndepStudy/RicheltP590Spr07GAstds/Richelt%20IS%20Part%20Two.doc.

  - Balanced or Not: In this lesson, students will collect and record data from different grouping scenarios for tug-of-war to show balanced and unbalanced forces. This lesson can be found at http://www.cpalms.org/Public/PreviewResourceLesson/Preview/76419.

- 5.P.5A.4
  - Friction in Our Lives: This two-period lesson provides students with an understanding of what friction is, how it can be changed, and how it is used in our everyday lives. This lesson includes adaptations, evaluation, and extension suggestions/activities. This lesson can be found at http://www.discoveryeducation.com/teachers/free-lesson-plans/friction-in-our-lives.cfm.

- 5.P.5A.5
  - How to Reduce Friction: This lesson provides a problem and solution with a hands-on activity that will encourage the students to design and test possible solutions that will reduce the effects of friction. The beginning of the document has background information for teachers, but it is not necessary for the students to know this information. The lesson can be found at http://www.education.com/science-fair/article/find-ways-reduce-friction/.

  - Rules of Forces and Motion: This lesson plan allows students to set up an experiment to test motion and friction by using materials such as sand paper, wax paper, pennies, etc. The lesson can be found at http://www.discoveryeducation.com/teachers/free-lesson-plans/rules-of-forces-and-motion.cfm.

  - Getting Your Bearings. This lesson plan allows students to use ball bearings to explore the concept of friction and shows how ball bearings reduce friction. Students learn about different uses for ball bearings, how the design has changed over time to incorporate roller bearings, how to test friction using marbles, and to identify the use of ball bearings in everyday items. This lesson can be found at http://tryengineering.org/lessons/gettingyourbearings.pdf.

Resources

- Science NetLinks: This site provides various lessons that will address indicators from this unit. Students explore ramps to evaluate the results of the effects the different materials used to build the ramps have on the distance and rate at which the car travels. These resources can be found at http://sciencenetlinks.com/search/?csrfmiddlewaretoken=212020952998aae19c95572e05cf5bdf&q=force+and+motion.

- Study Jams by Scholastic: This is an interactive site with quizzes, songs, and slideshows for over 200 subjects. This resource can be found at http://studyjams.scholastic.com/studyjams/jams/science/forces-and-motion/acceleration.htm.

- This is a third grade unit on Forces and Motion, but the lessons and assessments are appropriate for fifth grade level. These resources can be found at http://www.mccracken.kyschools.us/Downloads/FORCES%20INTERACTIONS%203.pdf.

- 5.P.5A.1
  - Motion Graphs: This site includes vocabulary and sample line graphs that can be used to determine the speed and motion of an object. The worksheets/samples can be found at http://camillasenior.homestead.com/motion_graphs.pdf.

- 5.P.5A.2
  - How Forces Affect Motion: This is a student-created video that explains concepts of forces and motion. This resource can be found at: www.youtube.com/watch?v=1-qAhlvwE3Y.

  - Let's Move It, Newton's Laws of Motion: This is a video about Newton's Laws of Motion using the sport of hockey and various other activities to demonstrate the different laws of motion. This resource can be found at https://www.youtube.com/watch?v=JI-AwlBsckQ.

- 5.P.5A.3
  - Balanced and Unbalanced Forces: This is a slideshow/PowerPoint that explains the meanings of balance and unbalanced forces with child-friendly illustrations and explanations. This resource can be found at www.slideshare.net/rickaturner/balanced-and-unbalanced-forces-5408256.

- 5.P.5A.4
  - What is Friction?: This video introduces friction and gives examples of how it affects force and speed. This resource can be found at www.youtube.com/watch?v=C7NPD9W0kro.

  - Friction for Kids: This is a video presents what friction is in a child-friendly manner. This resource can be found at www.youtube.com/watch?v=PNDRIicw4E0 .

  - Position and Motion of Objects: This site includes several interactive web lessons/activities for motion. Number 7: "Friction" is directly related to this standard. Once students are finished with "Friction", they can click on the "What's Next?" button. There are two other simulations that relate to this indicator: "Forces in action" and "Forces and movement". It is recommended that you complete these simulations yourself before assigning them to the students. This resource can be found at http://www.learningscience.org/psc1bpositionmotionobjects.htm.

- 5.P.5A.5
  - What is Friction?: This video introduces friction and gives examples of how it affects force and speed. This resource can be found at www.youtube.com/watch?v=C7NPD9W0kro.

  - Fascinating Friction: This is a lesson that relates friction to joints in the human body. While the human body information is not necessary for students to understand, the activity is another model to show what friction is and how it can be reduced. This resource

can be found at https://www.teachengineering.org/activities/view/cub_human_lesson03_activity1.

- 5.P.5A.1-5: These resources cover multiple indicators within this conceptual understanding.
  - 19 Fun Ideas & Resources for Force and Motion: This site has 19 hands-on activities and handouts that help bring the forces and motion concepts alive. This resource can be found at http://www.teachjunkie.com/sciences/19-fun-ideas-resources-force-and-motion/.

  - Force and Motion Facts: This site includes facts about forces, including balanced and unbalanced and contact forces, motion, and friction. The facts can be used for student or teacher information. This resource can be found at http://idahoptv.org/sciencetrek/topics/force_and_motion/facts.cfm.

Sample Formative Assessment Tasks/Questions

Additional sample formative assessment tasks/questions for grade bands are located at the end of each of the SEP Support Doc. (http://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf)

- 5.P.5A.1
  - Motion Graphs: Teachers can use graphs directly from this lesson or modify graphs from this lesson for assessment purposes. The site for the lesson is http://camillasenior.homestead.com/motion_graphs.pdf. A description of the lesson can be found in the "Resources" section above.

- 5.P.5A.2
  - Students participate in the "Roller Coaster Marbles: How Much Height to Loop the Loop?" experiment found at http://www.sciencebuddies.org/science-fair-projects/project_ideas/Phys_p036.shtml#summary. This can be done in groups or as a class. The goal of the experiment is to generate enough force to allow the marble to go through a loop. After the experiment, the students can use the model of the roller coaster to write an explanation about how the amount or type of force affected the motion of the marble. There is a "Make It Your Own" tab that provides variations teachers can use. Other materials could also be used instead of purchasing the foam pipes.

- 5.P.5A.3
  - Jan thinks that the amount of force needed to pull the block depends on the surface texture of the board. The rougher the surface, the more force she will need to pull the block. Debbie thinks that the surface texture does not matter. She thinks that the amount of force needed to pull the block will be the same for each board. Plan an experiment you could conduct to test who is right. Write down the steps you would follow to do your experiment and include a list of the materials you would need for your investigation.

- 5.P.5A.4
  - Car A, Car B, and Car C are at the top of 3 separate inclines of the same length. Car A's incline is covered with ice, car B's incline is covered with sand, and car C's incline is covered with grass. All three car have the same mass. Which car will reach the bottom of the incline first? Why?
  - Car A, Car B, and Car C are at the top of 3 separate inclines of the same length and same surface texture. Car A has a mass of 50 g, Car B has a mass 100g, and Car C has a mass of 150g. Which car will reach the bottom of the incline first? Why?

- 5.P.5A.4
  - Joann bounced a ball five times. She measured how high the ball bounced each time. She recorded her data in the table below. Which bounce was made with the greatest force?

Bounce	Height (ft)
Bounce 1	3
Bounce 2	4
Bounce 3	5
Bounce 4	6
Bounce 5	1

- 5.P.5A.5
  - A student shoots a basketball. Describe the force that drags the ball down as it arches towards the basket?
  - Ashley has to move a box in her room, but it is too heavy to carry or push. What can Ashley do or use to move the box without carrying it? How do you know your method will work?

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