Shelby County Schools Science Vision

Shelby County Schools' vision of science education is to ensure that from early childhood to the end of the 12th grade, all students have heightened curiosity and an increased wonder of science; possess sufficient knowledge of science and engineering to engage in discussions; are able to learn and apply scientific and technological information in their everyday lives; and have the skills such as critical thinking, problem solving, and communication to enter careers of their choice, while having access to connections to science, engineering, and technology.

To achieve this, Shelby County Schools has employed The Tennessee Academic Standards for Science to craft meaningful curricula that is innovative and provide a myriad of learning opportunities that extend beyond mastery of basic scientific principles.

Introduction

In 2014, the Shelby County Schools Board of Education adopted a set of ambitious, yet attainable goals for school and student performance. The District is committed to these goals, as further described in our strategic plan, Destination 2025. In order to achieve these ambitious goals, we must collectively work to provide our students with high quality standards aligned instruction. The Tennessee Academic Standards for Science provide a common set of expectations for what students will know and be able to do at the end of each grade, can be located in the Tennessee Science Standards Reference. Tennessee Academic Standards for Science are rooted in the knowledge and skills that students need to succeed in post-secondary study or careers. While the academic standards establish desired learning outcomes, the curricula provides instructional planning designed to help students reach these outcomes. The curriculum maps contain components to ensure that instruction focuses students toward college and career readiness. Educators will use this guide and the standards as a roadmap for curriculum and instruction. The sequence of learning is strategically positioned so that necessary foundational skills are spiraled in order to facilitate student mastery of the standards.

Our collective goal is to ensure our students graduate ready for college and career. Being College and Career Ready entails, many aspects of teaching and learning. We want our students to apply their scientific learning in the classroom and beyond. These valuable experiences include students being facilitators of their own learning through problem solving and thinking critically. The Science and Engineering Practices are valuable tools used by students to engage in understanding how scientific knowledge develops.These practices rest on important "processes and proficiencies" with longstanding importance in science education. The science maps contain components to ensure that instruction focuses students toward understanding how science and engineering can contribute to meeting many of the major challenges that confront society today. The maps are centered around five basic components: the Tennessee Academic Standards for Science, Science and Engineering Practices, Disciplinary Core Ideas, Crosscutting Concepts, and Phenomena.

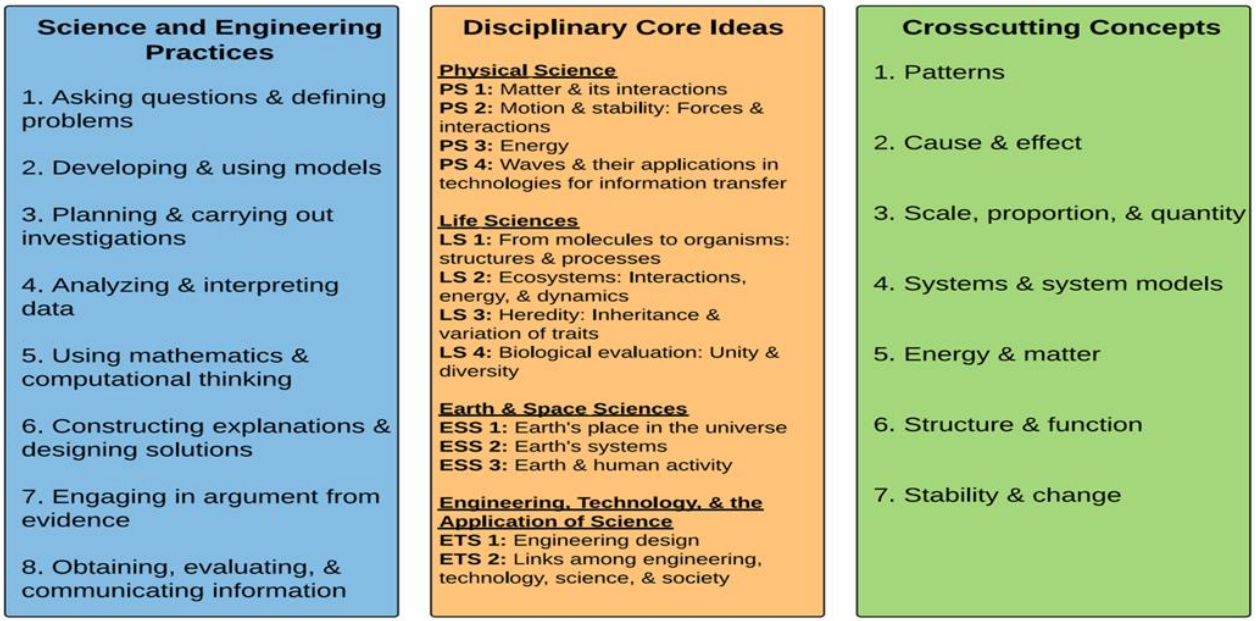
The Tennessee Academic Standards for Science were developed using the National Research Council's 2012 publication, A Framework for K-12 Science Education as their foundation. The framework presents a new model for science instruction that is a stark contrast to what has come to be the norm in science classrooms. Thinking about science had become memorizing concepts and solving mathematical formulae. Practicing science had become prescribed lab situations with predetermined outcomes. The framework proposes a three-dimensional approach to science education that capitalizes on a child's natural curiosity. The Science Framework for K-12 Science Education provides the blueprint for developing the effective science practices. The *Framework* expresses a vision in science education that requires students to operate at the nexus of three dimensions of learning: Science and Engineering Practices, Crosscutting Concepts, and Disciplinary Core Ideas. The *Framework* identified a small number of disciplinary core ideas that all students should learn with increasing depth and sophistication, from Kindergarten through grade twelve. Key to the vision expressed in the *Framework* is for students to learn these disciplinary core ideas in the context of science and engineering practices. The importance of combining Science and Engineering Practices, Crosscutting Concepts and Disciplinary Core Ideas is stated in the *Framework* as follows:

Standards and performance expectations that are aligned to the framework must take into account that students cannot fully understand scientific and engineering ideas without engaging in the practices of inquiry and the discourses by which such ideas are developed and refined. At the same time, they cannot learn or show competence in practices except in the context of specific content. (NRC Framework, 2012, p. 218)

To develop the skills and dispositions to use scientific and engineering practices needed to further their learning and to solve problems, students need to experience instruction in which they use multiple practices in developing a particular core idea and apply each practice in the context of multiple core ideas. We use the term "practices" instead of a term such as "skills" to emphasize that engaging in scientific investigation requires not only skill but also knowledge that is specific to each practice. Students in grades K-12 should engage in all eight practices over each grade band**.** Crosscutting concepts have application across all domains of science. As such, they are a way of linking the different domains of science. Crosscutting concepts have value because they provide students with connections and intellectual tools that are related across the differing areas of disciplinary content and can enrich their application of practices and their understanding of core ideas. There are seven crosscutting concepts that bridge disciplinary boundaries, uniting core ideas throughout the fields of science and engineering. Their purpose is to help students deepen their understanding of the disciplinary core ideas and develop a coherent and scientifically based view of the world.

The map is meant to support effective planning and instruction to rigorous standards. It is *not* meant to replace teacher planning, prescribe pacing or instructional practice. In fact, our goal is not to merely "cover the curriculum," but rather to "uncover" it by developing students' deep understanding of the content and mastery of the standards. Teachers who are knowledgeable about and intentionally align the learning target (standards and objectives), topic, text(s), task, and needs (and assessment) of the learners are best-positioned to make decisions about how to support student learning toward such mastery. Teachers are therefore expected--with the support of their colleagues, coaches, leaders, and other

support providers--to exercise their professional judgment aligned to our shared vision of effective instruction, the Teacher Effectiveness Measure (TEM) and related best practices. However, while the framework allows for flexibility and encourages each teacher/teacher team to make it their own, our expectations for student learning are non-negotiable. We must ensure all of our children have access to rigor—high-quality teaching and learning to grade level specific standards, including purposeful support of literacy and language learning across the content areas.



Learning Progression

At the end of the elementary science experience, students can observe and measure phenomena using appropriate tools. They are able to organize objects and ideas into broad concepts first by single properties and later by multiple properties. They can create and interpret graphs and models that explain phenomena. Students can keep notebooks to

record sequential observations and identify simple patterns. They are able to design and conduct investigations, analyze results, and communicate the results to others. Students will carry their curiosity, interest and enjoyment of the scientific world view, scientific inquiry, and the scientific enterprise into middle school.

At the end of the middle school science experience, students can discover relationships by making observations and by the systematic gathering of data. They can identify relevant evidence and valid arguments. Their focus has shifted from the general to the specific and from the simple to the complex. They use scientific information to make wise decision related to conservation of the natural world. They recognize that there are both negative and positive implications to new technologies.

As an SCS graduate, former students should be literate in science, understand key science ideas, aware that science and technology are interdependent human enterprises with strengths and limitations, familiar with the natural world and recognizes both its diversity and unity, and able to apply scientific knowledge and ways of thinking for individual and social purposes.

Structure of the Standards

- Grade Level/Course Overview: An overview that describes that specific content and themes for each grade level or high school course.
- Disciplinary Core Idea: Scientific and foundational ideas that permeate all grades and connect common themes that bridge scientific disciplines.
- Standard: Statements of what students can do to demonstrate knowledge of the conceptual understanding. Each performance indicator includes a specific science and engineering practice paired with the content knowledge and skills that students should demonstrate to meet the grade level or high school course standards.

Purpose of Science Curriculum Maps

This map is a guide to help teachers and their support providers (e.g., coaches, leaders) on their path to effective, college and career ready (CCR) aligned instruction and our pursuit of Destination 2025. It is a resource for organizing instruction around the Tennessee Academic Standards for Science, which define what to teach and what students need to learn at each grade level. The map is designed to reinforce the grade/course-specific standards and content (scope) and provides *suggested* sequencing, pacing, time frames, and aligned resources. Our hope is that by curating and organizing a variety of standards-aligned resources, teachers will be able to spend less time wondering what to teach and searching for quality materials (though they may both select from and/or supplement those included here) and have more time to plan, teach, assess, and reflect with colleagues to continuously improve practice and best meet the needs of their students.

The map is meant to support effective planning and instruction to rigorous standards. It is *not* meant to replace teacher planning, prescribe pacing or instructional practice. In fact, our goal is not to merely "cover the curriculum," but rather to "uncover" it by developing students' deep understanding of the content and mastery of the standards. Teachers who are knowledgeable about and intentionally align the learning target (standards and objectives), topic, text(s), task, and needs (and assessment) of the learners are best-positioned to make decisions about how to support student learning toward such mastery. Teachers are therefore expected--with the support of their colleagues, coaches, leaders, and other support providers--to exercise their professional judgment aligned to our shared vision of effective instruction, the Teacher Effectiveness Measure (TEM) and related best practices. However, while the framework allows for flexibility and encourages each teacher/teacher team to make it their own, our expectations for student learning are non-negotiable. We must ensure all of our children have access to rigor—high-quality teaching and learning to grade level specific standards, including purposeful support of literacy and language learning across the content areas.

2nd Grade Quarter 3 Curriculum Map Quarter 3 Curriculum Map Feedback						
Quarter 1			Quarter 2		**Quarter 3**	Quarter 4
Structure and Routine	Unit 1 Living Things	Unit 2 Habitats	Unit 3 Earth's Surface	Unit 4 Earth's Changes	**Unit 5 Forces and Motion**	Unit 6 Sound and Light
1 week	5 weeks	3 weeks	4.5 weeks	4.5	**9 weeks**	9 weeks

UNIT 3: Forces and Motion (9 weeks)

Overarching Question(s)

How can one explain and predict interactions between objects and within systems of objects?

Unit 5: Lesson 1	Lesson Length	Essential Question	Vocabulary
Pushes and Pulls	3 weeks	How do pushes and pulls move an object?	motion, position, force, direction, speed, distance

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI(s) 2.PS2 Motion and Stability: Forces and Interactions **Standard(s)** 2.PS2.1: Analyze the push or the pull that occurs when objects collide or are connected. 2.PS2.2: Evaluate the effects of different strengths and directions of a push or pull on the motion of an object. 2.PS2.3: Recognize the effect of multiple pushes and pulls on an object's movement or non-movement. **Explanation and Support of Standard** 2.PS2.1	**Learning Outcomes** Students will investigate different pushes and pulls and how much force is required to move an object. **Suggested Phenomenon** *Click on the phenomenon picture to view the video.*	**Curricular Resources** Engage Inspire Science TE, pp. 189-190 Be A Scientist Notebook, p. 187 (Phenomenon) Essential Questions, TE p. 190 Explore TE, pp. 190-192 *(LAB)* Be a Scientist Notebook, p. 188, Inquiry Activity: Toy Cars Science Paired Read Aloud/Science File: Queen of the Hill Explain TE, pp. 192-198

When two objects touch, they exert equal pushes or pulls on each another. For example, as we stand on the ground, our weight pushed downward on the ground, but the ground also pushes back on us.

Pushes or pulls will either change the motion of an object, the shape of the object, or a combination of the two changes.

Analysis of the pushes or pulls should include pointing out that a pushes and pulls have both a size and a direction. Evidence for this observation can be collected by placing two bathroom scales between a pair of students and having them push off of one another, or two students pulling backwards on a pair of spring scales. Even in instances where one student may be seated in a rolling chair or on a skateboard the amount of pushing or pulling each student experiences will be equal.

2.PS2.2
The focus of this standard is at looking how a single push or pull affects an object. In specific situations, there are a wide range of effects that pushes or pulls can have on an object, however there are only a small number of patterns for these effects. In some cases, a push or pull can cause an object to move faster, or a push or pull that works against a moving object can cause an object to slow down. If an object is sitting still, a force may cause an object to begin to move. Finally, there are situations where a push or pull changes the direction that an object is heading. It is

Phenomenon Explanation:
Pushes or pulls can change the direction of a moving object.

Be a Scientist notebook, p. 190: Vocabulary
Science Paired Read Aloud/Science File: Pushes and Pulls
Video: Push and Pull
(LAB) Be a Scientist Notebook, p. 191, Inquiry Activity: Push and Pull
Science Paired Read Aloud/Science File: Pushes and Pulls
Digital Interactive: Pushes and Pulls
(LAB) Be a Scientist Notebook, p. 193, Inquiry Activity: Moving Books

Elaborate
TE, p. 199
Digital Interaction: Push and Pull
Be a Scientist Notebook, p. 195: Push and Pull

Evaluate
TE, pp. 200-201
(LAB) Be a Scientist Notebook, p. 196, Performance Task: Pushes and Pulls on a Playground
Video: How Do Pushes and Pulls Move An Object?
eAssessment

Additional Resources
Lesson: What is A Force?
Lesson: Forced to Finish
Video: Force and Motion

possible that a force would change the direction an object is heading without changing its speed. When an object is touching a surface or two surfaces are touching each other, friction may push or pull on the object/surfaces. Friction is pulling on object is resting on a sloped (not level) surface, keeping it from moving. An object is sliding (not rolling) on a surface will be slowed down by friction. 2.PS2.3 This standard may be taught by considering objects that are moving or not moving and looking for patterns in why objects move or remain at rest. When objects experience a single push or pull, they will move. Objects that are at rest are experiencing multiple pushes or pulls at the same time. For example, a ball on Earth will always pulled down by gravity and if there is nothing under the ball, it will fall. However, if that ball is resting on the ground, it experiences a second push from the ground that will prevent the object from falling. Non-movement happens when something experiences more than one *balanced* push or pull, but movement happens when an object is pushed or pulled unequally. *(The falling ball example should be used cautiously since the topic of gravity has not been addressed and gravity is an intangible concept. Friction is considered more tangible because students can see the objects that are touching*		Video: Force and Motion – Bill Nye **ESL Supports and Scaffolds** WIDA Standard 4 To support students in speaking refer to this resource: WIDA Doing and Talking Science When applicable- use Home Language do build vocabulary in concepts. Spanish Cognates Interactive Science Dictionary with visuals Force and motion video **Pre-teach**: contact, forces, negative, outcome **Making predictions (based on investigations) sentence stems:** I think _____ will _____. What I already know about _____ helps me predict that _____.

and therefore the source of the friction. A parallel example with friction would be pulling on a rope attached to a box and noting how the pull from the rope and the pull from friction keep the object from moving.) **Suggested Science and Engineering Practice(s)** Analyzing and Interpreting Data Obtaining, Evaluating, and Communicating Information **Suggested Crosscutting Concept(s)** Cause and Effect **Teacher Overview** A force is a push or a pull. Either can move an object or put it into motion. Motion occurs when an object changes position relative to another object. When an object changes position, it has moved a distance. A push moves an object away from the push. A pull moves an object toward the pull. Some pulls are easy to see, such as pulling open a door, and others are more difficult, such as the pull it takes to pick up a grocery bag or backpack. Some objects are kept in motion with both a push and a pull. As a hammer bangs in a nail, it is being pushed down on the nail and then pulled back up to hit the nail again. To change motion, an object requires a push or a pull. A push or a pull can cause an object to start moving, change direction, or stop moving. **Misconceptions**		Because _____, I predict that _____. **Giving evidence stems:** I think _____ is _____ because. I like _____ because _____.

Students may not know that movement is the result of either a push or a pull and that a push or a pull is necessary to make any change in motion. They may also have trouble understanding that stopping an object from moving also involves a force, a push or a pull. To help address possible misconceptions, have students sit in a circle. Have students pass a ball among themselves. Ask students to push or pull the ball gently to pass it to someone else. Use the vocabulary words to explain how the ball travels from student to student. Have them use slow motion to break the actions down into single pushes or pulls. Roll the ball to a student, and ask them to stop the ball with a push or a pull.		

2nd Grade Quarter 3 Curriculum Map Quarter 3 Curriculum Map Feedback						
Quarter 1			Quarter 2		**Quarter 3**	Quarter 4
Structure and Routine	Unit 1 Living Things	Unit 2 Habitats	Unit 3 Earth's Surface	Unit 4 Earth's Changes	**Unit 5 Forces and Motion**	Unit 6 Sound and Light
1 week	5 weeks	3 weeks	4.5 weeks	4.5	**9 weeks**	9 weeks

UNIT 3: Forces and Motion (9 weeks)

Overarching Question(s)

How can one explain and predict interactions between objects and within systems of objects?

Unit 5: Lesson 2	Lesson Length	Essential Question	Vocabulary
Collisions	3 weeks	What happens when objects collide?	collide

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI(s) 2.PS2 Motion and Stability: Forces and Interactions 2.PS3 Energy 2.ETS2 Links Among Engineering, Technology, Science, and Society **Standard(s)** 2.PS2.1: Analyze the push or the pull that occurs when objects collide or are connected. 2.PS2.2: Evaluate the effects of different strengths and directions of a push or pull on the motion of an object. 2.PS2.3: Recognize the effect of multiple pushes and pulls on an object's movement or non-movement.	**Learning Outcomes** Students will investigate how stronger forces can cause bigger changes. **Suggested Phenomenon** *Click on the phenomenon picture to view the video.* 	**Curricular Resources** Engage Inspire Science TE, pp. 203-204 Science in My World, TE p. 199(Phenomenon) Essential Questions, TE p. 204 Explore TE, pp. 204 *(LAB)* Be a Scientist Notebook, p. 200, Inquiry Activity: Cup Collision Science Paired Read Aloud/ Science File: An Amazing Ride Explain TE, pp. 206-211 Be a Scientist notebook, p. 202: Vocabulary

2.PS3.1: Demonstrate how a stronger push or pull makes things go faster and how faster speeds during a collision can cause a bigger change in the shape of colliding objects. 2.ETS2.1: Use appropriate tools to make observations, record data, and refine design ideas. **Explanation and Support of Standard** 2.PS2.1 When two objects touch, they exert equal pushes or pulls on each another. For example, as we stand on the ground, our weight pushed downward on the ground, but the ground also pushes back on us. Pushes or pulls will either change the motion of an object, the shape of the object, or a combination of the two changes. Analysis of the pushes or pulls should include pointing out that a pushes and pulls have both a size and a direction. Evidence for this observation can be collected by placing two bathroom scales between a pair of students and having them push off of one another, or two students pulling backwards on a pair of spring scales. Even in instances where one student may be seated in a rolling chair or on a skateboard the amount of pushing or pulling each student experiences will be equal. 2.PS2.2	**Demolition** Phenomenon Explanation: Collision occurs any time two objects come together and hit each other.	Science Paired Read Aloud/Science File: When Things Collide Video: When Objects Collide *(LAB)* Be a Scientist Notebook, p. 204 Inquiry Activity: Marbles Collide Science Paired Read Aloud/Science File: When Things Collide <u>Elaborate</u> TE, p. 212 Be a Scientist Notebook, p. 207: Changing Forces <u>Evaluate</u> TE, pp. 213-215 *(LAB)* Be a Scientist Notebook, p. 208, Performance Task: Building Demolition eAssessment **Additional Resources** Lesson: Pushing and Pulling on The Playground Lesson: Exploring Force and Motion Lesson: Ramp It Up! Video: Energy Transfer & Collisions Video: Newton's First Law of Motion **ESL Supports and Scaffolds** WIDA Standard 4

The focus of this standard is at looking how a single push or pull affects an object. In specific situations, there are a wide range of effects that pushes or pulls can have on an object, however there are only a small number of patterns for these effects. In some cases, a push or pull can cause an object to move faster, or a push or pull that works against a moving object can cause an object to slow down. If an object is sitting still, a force may cause an object to begin to move. Finally, there are situations where a push or pull changes the direction that an object is heading. It is possible that a force would change the direction an object is heading without changing its speed. When an object is touching a surface or two surfaces are touching each other, friction may push or pull on the object/surfaces. Friction is pulling on object is resting on a sloped (not level) surface, keeping it from moving. An object is sliding (not rolling) on a surface will be slowed down by friction. 2.PS2.3 This standard may be taught by considering objects that are moving or not moving and looking for patterns in why objects move or remain at rest. When objects experience a single push or pull, they will move. Objects that are at rest are experiencing multiple pushes or pulls at the same time. For example, a ball on Earth will always pulled down by gravity and if there is nothing under the ball, it will fall. However, if that ball is resting on the		To support students in speaking refer to this resource: WIDA Doing and Talking Science When applicable- use Home Language do build vocabulary in concepts. Spanish Cognates Interactive Science Dictionary with visuals Force and motion video Pre-teach: contact, forces, negative, outcome Making predictions (based on investigations) sentence stems: I think _____ will _____. What I already know about _____ helps me predict that _____. Because _____, I predict that _____.

ground, it experiences a second push from the ground that will prevent the object from falling. Non-movement happens when something experiences more than one *balanced* push or pull, but movement happens when an object is pushed or pulled unequally. *(The falling ball example should be used cautiously since the topic of gravity has not been addressed and gravity is an intangible concept. Friction is considered more tangible because students can see the objects that are touching and therefore the source of the friction. A parallel example with friction would be pulling on a rope attached to a box and noting how the pull from the rope and the pull from friction keep the object from moving.)* 2.PS3.1 Pushes and pulls change the motion of objects (2.PS2) and objects going faster cause bigger changes to the shapes of objects during collisions. The big-picture goal for this entire component idea is to see that forces are a way that energy can be transferred. Objects can be dropped onto soft pillows, observing the difference how the shape of the pillow changes as the object is dropped from greater heights. It should be made clear to students that dropping from a greater height means more speed. Here the falling object pushes/pulls on the pillow to change its shape.		

Pull-back cars or pop-up toys could be used to create different strengths of pushes or pulls and observe that objects go faster as the push or pull created by a spring gets stronger. *At this grade, discussions of energy, by name, are not appropriate due to the abstract complexity of energy.* *As part of the 2.PS2 set of standards, students have spent a significant amount of time investigating pushes/pulls and how they work. This standard is not focused on the nature of pushes and pulls, but rather on energy.* 2.ETS2.1 The field of engineering produces tools that can be used to make standardized units. Standard units allow scientists to more easily understand work done by other scientists. The second grade Measurement and Data domain for math now includes the use of some standard units of measure. The length of an object, or distance an object travels can be measured using standard units of inches, feet, yards, centimeters, or meters (2.MD.A.3). In support of 2.MSA.4, part of the design of a student test/investigation should involve students selecting and justifying the units of measurement used in an investigation.		

Examples might include design/building challenges where students can capture and record data to be used in the refinement of a design based on the performance of the object under a student designed test. **Suggested Science and Engineering Practice(s)** Developing and Using Models **Suggested Crosscutting Concept(s)** Cause and Effect **Teacher Overview** Newton's First Law of Motion states that every object in a state of uniform motion tends to remain in that state of motion unless an external force is applied to it. A force is a push or pull. According to Newton's First Law, an object in motion will remain in motion until another force acts on it. Speeding up, slowing down, stopping, starting, and changing direction are all changes in motion. In the case of a ball pushed along the floor, the force of a pull (friction with the floor) slows the ball until it comes to rest. A collision with another object can also change its motion. When two marbles in motion collide, both will change direction, change speed, or even stop. The stronger the force of a push or pull, the greater the change in speed of the objects. **Misconceptions** Students may think that the word collision always has a negative outcome, such as injury from a car collision or when they fall and their body hits the ground. Help		

students understand that in science a collision is any time two objects come together, such as hands hitting one another in a high five. That is a collision. Some collisions are beneficial and prevent accidents, such as a running shoe colliding with the ground to stop the runner or a cyclist pushing on the brakes to stop the bike from moving. Students may need more examples to help them understand collisions are any two objects hitting each other, which can have both benefits and detriments.		

2nd Grade Quarter 3 Curriculum Map Quarter 3 Curriculum Map Feedback						
Quarter 1			Quarter 2		**Quarter 3**	Quarter 4
Structure and Routine	Unit 1 Living Things	Unit 2 Habitats	Unit 3 Earth's Surface	Unit 4 Earth's Changes	**Unit 5 Forces and Motion**	Unit 6 Sound and Light
1 week	5 weeks	3 weeks	4.5 weeks	4.5	**9 weeks**	9 weeks

UNIT 3: Earth's Surface (weeks)			
Overarching Question(s)			
How can one explain and predict interactions between objects and within systems of objects?			
Unit 5: Lesson 3	**Lesson Length**	**Essential Question**	**Vocabulary**
Gravity and Friction	3 weeks	How do forces affect motion?	friction, gravity
Standards and Related Background Information		**Instructional Focus**	**Instructional Resources**
DCI(s) 2.PS3 Energy 2.ETS2 Links Among Engineering, Technology, Science, and Society **Standard(s)** 2.PS3.2: Make observations and conduct experiments to provide evidence that friction produces heat and reduces or increases the motion of an object. 2.ETS2.1: Use appropriate tools to make observations, record data, and refine design ideas. **Explanation and Support of Standard** 2.PS3.2		**Learning Outcomes** Students will investigate how friction changes the motion of an object and produces heat. **Suggested Phenomenon** *Click on the phenomenon picture to view the video.*	Engage Inspire Science TE, pp. 217-218 Be A Scientist Notebook, p. 213 (Phenomenon) Essential Questions, TE p. 218 Explore TE, pp. 218-220 *(LAB)* Be a Scientist Notebook, p. 214, Inquiry Activity: Force Affects the Way Objects Move Online Science Paired Read Aloud: Carlos's Skateboard Explain TE, pp. 220-225 Be a Scientist notebook, p. 216: Vocabulary

This standard provides a more concrete example of how a push or pull changes the energy of a system and bundles well with standards 2.PS2.2 and 2.PS3.1. From 2.PS2.2, students should have connected that friction is one type of a push or pull. Standard 2.PS3.1 conveys that pushes or pulls change the motion (energy) of an object. This standard bridges the two by connecting that the motion of the object is reduced and as a result heat is created. Connecting this idea to systems, we can say that when friction acts on an object, the motion of the object is reduced and the heat that is produced as a result leaves the system. Given that this standard originates from a component idea focused on application, a design task may be appropriate. Engineering challenges associated with this standard might ask students to minimize the effects of friction, or evaluate two similar devices that have varying degrees of effectiveness due to frictional losses. Examples may also include investigating how changes to an object's motion correlate with surfaces warming or cooling. This can be demonstrated when a student rubs his/her hands together and observes how his/her hands warm up. 2.ETS2.1 The field of engineering produces tools that can be used to make standardized units. Standard units allow scientists to more easily understand work done by other scientists. The second grade Measurement and Data domain for math now includes the use of some standard units of measure. The length of an object, or distance an object travels can be measured using standard units of inches,	 Phenomenon Explanation: When a batter hits a baseball, he exerts a force on the ball, which causes it to move in the direction of the force.	Science Paired Read Aloud/Science File: Gravity and Friction *(LAB)* Be a Scientist Notebook, p. 217, Inquiry Activity: Friction Affects Motion Science Paired Read Aloud/Science File: Using Friction Video: Friction Effects <u>Elaborate</u> TE, p. 225 Digital Interaction: Forces in Baseball *(LAB)* Be a Scientist Notebook, p. 221: Forces in Baseball <u>Evaluate</u> TE, pp. 226-227 *(LAB)* Be a Scientist Notebook, p. 222, Performance Task: Forces on a Playground eAssessment **Additional Resources** Lesson: Cars and Ramps By *NBCT Melissa Collins* Lesson: Forces and Friction Lesson: Surface Surfers Video: Gravity Compilation Video: What is Friction? Video: Physics – What is Friction? **ESL Supports and Scaffolds**

feet, yards, centimeters, or meters (2.MD.A.3). In support of 2.MSA.4, part of the design of a student test/investigation should involve students selecting and justifying the units of measurement used in an investigation. Examples might include design/building challenges where students can capture and record data to be used in the refinement of a design based on the performance of the object under a student designed test. **Suggested Science and Engineering Practice(s)** Planning and Carrying Out Controlled Investigations **Suggested Crosscutting Concept(s)** Cause and Effect **Teacher Overview** Motion is caused by a force acting on an object. When forces are balanced, an object's motion does not change. When forces are unbalanced, an object's motion will change: it may begin to move, stop, speed up or slow down, or change direction. A force is a push or pull. Gravity and Friction are both examples of forces that can affect motion. Newton's First Law of Motion states: every object in a state of uniform motion tends to remain in that state of motion unless an external force is applied to it.. Speeding up, slowing down, stopping, starting, and changing direction are all changes in motion. In the case of a ball pushed along the floor, the force of a pull (friction with the floor) slows the ball until it comes to rest.		WIDA Doing and Talking Science When applicable- use Home Language do build vocabulary in concepts. Spanish Cognates Interactive Science Dictionary with visuals Force and motion video Friction and motion video **Pre-teach**: contact, forces, negative, outcome **Cause and effect sentence stems:** The _____ had _____ so _____. Due to the fact that I pulled_____, _____decided to _____.

Misconceptions Students may have the misconception that if a force is acting on an object, the object must move. However, balanced forces act together on an object without changing its motion. Students may believe that the forces that affect motion, like collision, are visible. They may not understand that there are forces we cannot see, like gravity and friction, that can affect motion. Students also may think that a constant force is needed to keep an object moving at a constant speed, rather than just an initial pushing force, for example.		