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 a meaningful curriculum 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 curriculum 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.

Science and Engineering Practices

1. Asking questions & defining problems
2. Developing & using models
3. Planning & carrying out investigations
4. Analyzing & interpreting data
5. Using mathematics & computational thinking
6. Constructing explanations & designing solutions
7. Engaging in argument from evidence
8. Obtaining, evaluating, & communicating information

Disciplinary Core Ideas

Physical Science
PS 1: Matter & its interactions
PS 2: Motion & stability: Forces & interactions
PS 3: Energy
PS 4: Waves & their applications in technologies for information transfer

Life Sciences
LS 1: From molecules to organisms: structures & processes
LS 2: Ecosystems: Interactions, energy, & dynamics
LS 3: Heredity: Inheritance & variation of traits
LS 4: Biological evaluation: Unity & diversity

Earth & Space Sciences
ESS 1: Earth's place in the universe
ESS 2: Earth's systems
ESS 3: Earth & human activity

Engineering, Technology, & the Application of Science
ETS 1: Engineering design
ETS 2: Links among engineering, technology, science, & society

Crosscutting Concepts

1. Patterns
2. Cause & effect
3. Scale, proportion, & quantity
4. Systems & system models
5. Energy & matter
6. Structure & function
7. Stability & change

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 defines 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.

Physical World Concepts Quarter 1 Curriculum Map Quarter 1 Curriculum Map Feedback Survey			
Quarter 1	Quarter 2	Quarter 3	Quarter 4
Unit 1 Motion and Stability: Forces and Interaction	Unit 2 Energy	Unit 3 Waves and Their Applications in Technologies for Information Transfer	Unit 4 Matter and Its Interactions
9 weeks	9 weeks	9 weeks	9 weeks

UNIT 1: Motion and Stability: Forces and Interaction [9 weeks]			
Overarching Question(s)			
How can one explain and predict interactions between objects and within systems of objects?			
Unit, Lesson	**Lesson Length**	**Essential Question**	**Vocabulary**
Unit 1 Motion and Stability: Forces and Interaction	**5 days**	● How can understanding various physical properties about motion be useful in understanding everyday occurrences? ● What variables can you manipulate to affect the movement of objects?	Frame of reference, distance, displacement, speed, average velocity, instantaneous velocity, acceleration

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI PS2: Motion and Stability: Forces and Interactions **Standard** **PWC.S2.2** Explore characteristics of rectilinear motion and create distance-time graphs and velocity-time graphs. Science standards reference guide https://www.tn.gov/content/dam/tn/education/standards/sci/sci_standards_reference.pdf **Explanation** Discussions should lead students to differentiate between scalar and vector properties and appropriate uses for each. In eighth grade, standard 8.PS2.3 provides limited exposure to the different approaches to modeling the motion of an object. At that time, the focus was on creating the representations. It is not appropriate to use some of these representations to develop basic kinematic expressions. Students should not be able to explain and translate between models that include the motion of multiple objects on the same graph. It is also appropriate to introduce the concepts of derivatives (slopes of tangents) and	**Learning Outcomes** ● Explore characteristics of rectilinear motion and create distance-time graphs and velocity-time graphs. ● Analyze vector diagrams **Phenomenon** When you stretch out a spring and release it, the spring goes back and forth between being compressed and being stretched out.	**Curricular Resources** **Engage** Acceleration in One Dimension **Explore** Graphing of Motion Position-Time Graphs Velocity-Time Graphs Free Fall and the Acceleration of Gravity **Explain** **Elaborate** **Evaluate** **Textbook** **No textbook adopted for this course**

integrals (areas under curves) to aid in the process transforming between representations. **Misconceptions** Many students may have difficulty understanding that the magnitude of a displacement is the length of the straight-line path between two points rather than the distance travelled. Point out that although the odometer on a car shows that it has been driven 5 mi, the displacement may have been 0 mi. **Science and Engineering Practice** 1. Asking questions and defining problems 2. Developing and using models **Cross Cutting Concepts** 2.Cause and Effect		

Physical World Concepts Quarter 1 Curriculum Map Quarter 1 Curriculum Map Feedback			
Quarter 1	Quarter 2	Quarter 3	Quarter 4
Unit 1 **Motion and Stability: Forces and Interaction**	Unit 2 Energy	Unit 3 Waves and Their Applications in Technologies for Information Transfer	Unit 4 Matter and Its Interactions
9 weeks	9 weeks	9 weeks	9 weeks

UNIT 1: Motion and Stability: Forces and Interaction [9 weeks]			
Overarching Question(s)			
How can one explain and predict interactions between objects and within systems of objects?			
Unit, Lesson	**Lesson Length**	**Essential Question**	**Vocabulary**
Unit 1 **Motion and Stability: Forces and Interaction**	**5 days**	• How can understanding various physical properties about motion be useful in understanding everyday occurrences? • What variables can you manipulate to affect the movement of objects?	Frame of reference, distance, displacement, speed, average velocity, instantaneous velocity, acceleration
Standards and Related Background Information		**Instructional Focus**	**Instructional Resources**
DCI PS2: Motion and Stability: Forces and Interactions		**Learning Outcomes**	**Curricular Resources** **Engage**

Standard **PWC.PS2.1** Investigate, measure, calculate, and analyze the relationship among position, displacement, velocity, acceleration, and time**.** https://www.tn.gov/content/dam/tn/education/standards/sci/sci_standards_reference.pdf **Explanation** Discussions should lead students to differentiate between scalar and vector properties and appropriate uses for each. In eighth grade, standard 8.PS2.3 provides limited exposure to the different approaches to modeling the motion of an object. At that time, the focus was on creating the representations. It is not appropriate to use some of these representations to develop basic kinematic expressions. Students should not be able to explain and translate between models that include the motion of multiple objects on the same graph. It is also appropriate to introduce the concepts of derivatives (slopes of tangents) and integrals (areas under curves) to aid in the process transforming between representations. **Misconceptions** 1. Velocity is another name of speed. 2. To have acceleration for a moving body its velocity should be increased 3. Displacement is the total distance traveled by an object **Science and Engineering Practice** 3. Planning and Carrying Out Investigations **Cross Cutting Concepts** 4.Scale, Proportion, and Quantity	• Investigate, measure, and calculate position, displacement, and time. velocity and acceleration. **Phenomenon** Motion: https://www.ngssphenomena.com/new-gallery-1/41na4f0lnigidena81kqjwk4ge2un2 Free fall: https://www.ngssphenomena.com/new-gallery-1/3mw481bgv3bag2zbo39y97d6yyjezf	Acceleration in One Dimension **Explore** Discovery Lab: Motion Bungee Jump Accelerations **Explain** **Elaborate** **Evaluate** **Textbook** **No textbook adopted for this course**

Physical World Concepts Quarter 1 Curriculum Map Quarter 1 Curriculum Map Feedback			
Quarter 1	Quarter 2	Quarter 3	Quarter 4

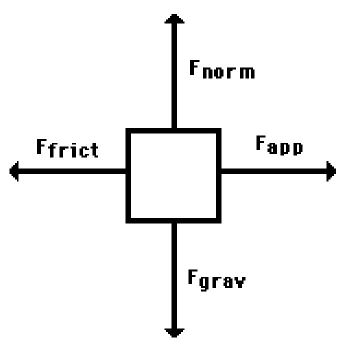
Unit 1 **Motion and Stability: Forces and Interaction**	Unit 2 Energy	Unit 3 Waves and Their Applications in Technologies for Information Transfer	Unit 4 Matter and Its Interactions
9 weeks	9 weeks	9 weeks	9 weeks

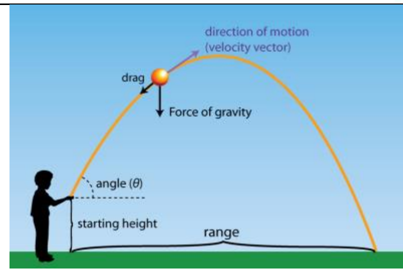
UNIT 1: Motion and Stability: Forces and Interaction [9 weeks]

Overarching Question(s)

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

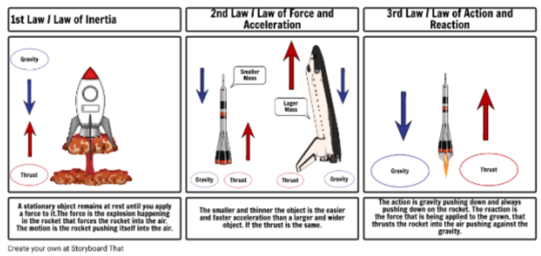
Unit, Lesson	Lesson Length	Essential Question	Vocabulary
Unit 1 Motion and Stability: Forces and Interaction	**5 days**	• When is the vertical component of a vector used? • When is the horizontal component of a vector used? • What component of a projectile's motion has the greatest effect on its height, or its range of motion? • Which will hit the ground first: an object shot from a cannon, or the same object allowed to fall straight down?	Frame of reference, distance, displacement, speed, average velocity, instantaneous velocity, acceleration

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI PS2: Motion and Stability: Forces and Interactions **Standard** **PWC.PS2.6** Understand that the two-dimensional movement of an object can be explained as a combination of its horizontal and vertical components of motion. https://www.tn.gov/content/dam/tn/education/standards/sci/sci_standards_reference.pdf **Explanation** Discussions should lead students to differentiate between scalar and vector properties and appropriate uses for each. In eighth grade, standard 8.PS2.3 provides limited exposure to the different approaches to modeling the motion of an object. At that time, the focus was on creating the representations. It is not appropriate to use some of these representations to develop basic kinematic expressions. Students should not be able to	**Learning Outcomes** • Given various examples of quantities, categorize them as scalar or vector quantities. • Investigate projectile motion. **Phenomenon** 	**Curricular Resources** **Engage** **Explore** Projectile Motion **Explain** **Elaborate** **Evaluate** **Textbook** **No textbook adopted for this course**

explain and translate between models that include the motion of multiple objects on the same graph. It is also appropriate to introduce the concepts of derivatives (slopes of tangents) and integrals (areas under curves) to aid in the process transforming between representations. **Misconceptions** Because of the prominence of angles measured from the x-axis, students may develop the misconception that the x component of a vector is always calculated using the cosine function. This misconception may be corrected by using examples on the board in which the angles are measured from the y-axis. **Science and Engineering Practice** 5. Using Mathematics and computational thinking **Cross Cutting Concepts** 4.Scale, Proportion, and Quantity		

Physical World Concepts Quarter 1 Curriculum Map Quarter 1 Curriculum Map Feedback			
Quarter 1	Quarter 2	Quarter 3	Quarter 4
Unit 1 **Motion and Stability: Forces and Interaction**	Unit 2 Energy	Unit 3 Waves and Their Applications in Technologies for Information Transfer	Unit 4 Matter and Its Interactions
9 weeks	9 weeks	9 weeks	9 weeks

UNIT 1: Motion and Stability: Forces and Interaction [9 weeks]			
Overarching Question(s)			
How can one explain and predict interactions between objects and within systems of objects?			
Unit, Lesson	**Lesson Length**	**Essential Question**	**Vocabulary**
Unit 1 **Motion and Stability: Forces and Interaction**	**5 days**	• How can we use forces and the Laws of Motion to understand motion of objects? • How does describing motion allow us to make predictions about real-life phenomena? • How and why can we use initial conditions and knowledge of Newton's Laws to predict an object's motion?	Force, inertia, net force, equilibrium, weight

Standards and Related Background Information	Instructional Focus	Instructional Resources
<u>DCI</u> PS2: Motion and Stability: Forces and Interactions **<u>Standard</u>** **PWC.PS2.3** Explain how Newton's first law applies to objects at rest and objects moving at a constant velocity. **PWC.PS2.4** Using Newton's second law, analyze the relationship among the net force acting on a body, the mass of the body, and the resulting acceleration through mathematical and graph **PWC.PS2.5** Apply Newton'**s law** https://www.tn.gov/content/dam/tn/education/standards/sci/sci_standards_reference.pdf **<u>Misconceptions</u>** 1. Stationary object has no inertia. 2. Inertia is independent of mass. 3. If an object is not moving, there is no force acting on it. 4. Everything that moves will eventually come to a stop. Rest is the "natural" state of all objects. An object is hard to push because it is heavy. **<u>Science and Engineering Practice</u>** 4. Analyzing and Interpreting Data 5. Using Mathematics and computational thinking **<u>Cross Cutting Concepts</u>** 7. Scale, Proportion, and Quantity	**<u>Learning Outcomes</u>** • Analyze and apply Newton's three laws of motion. **<u>Phenomenon</u>** 	**<u>Curricular Resources</u>** **<u>Engage</u>** **<u>Explore</u>** Newton's First Law of Motion Newton's Second Law of Motion Newton's Third Law of Motion **<u>Explain</u>** **<u>Elaborate</u>** **<u>Evaluate</u>** **<u>Textbook</u>** **No textbook adopted for this course**

Physical World Concepts Quarter 1 Curriculum Map Quarter 1 Curriculum Map Feedback			
Quarter 1	Quarter 2	Quarter 3	Quarter 4

Unit 1 **Motion and Stability: Forces and Interaction**	Unit 2 Energy	Unit 3 Waves and Their Applications in Technologies for Information Transfer	Unit 4 Matter and Its Interactions
9 weeks	9 weeks	9 weeks	9 weeks

UNIT 1: Motion and Stability: Forces and Interaction [9 weeks]
Overarching Question(s)
How can one explain and predict interactions between objects and within systems of objects?

Unit, Lesson	Lesson Length	Essential Question	Vocabulary
Unit 1 Motion and Stability: Forces and Interaction	**5 days**	• How can an object move at constant speed having changing velocity? • Why does a spinning skater accelerate when his/her arms are brought closer to the body?	Centripetal force, centripetal acceleration, mass, velocity, Radius

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI PS2: Motion and Stability: Forces and Interactions **Standard** **PWC.PS2.7** Analyze the general relationship between net force, acceleration, and motion for an object undergoing uniform circular motion. **PWC.PS2.8** Describe the nature and magnitude of frictional forces. https://www.tn.gov/content/dam/tn/education/standards/sci/sci_standards_reference.pdf **Misconceptions** 1. Centrifugal force is the force acting inward from center on the body in circular motion. 2. Centrifugal force is the force acting inward from center on the body in circular motion 3. An object is hard to push because it is heavy. **Science and Engineering Practice** 3. Planning and Carrying Out Investigations 5. Using Mathematics and computational thinking	**Learning Outcomes** • Evaluate, measure, and analyze circular motion. • Investigate the characteristics of centripetal motion and centripetal acceleration. **Phenomenon** 	**Curricular Resources** **Engage** **Explore** Circular Motion **Explain** **Elaborate** **Evaluate** **Textbook** **No textbook adopted for this course**

Cross Cutting Concepts 7. Scale, Proportion, and Quantity		

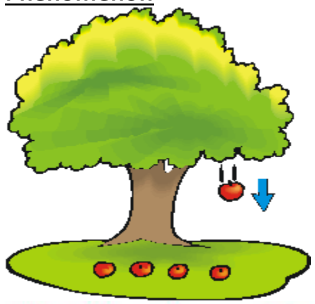
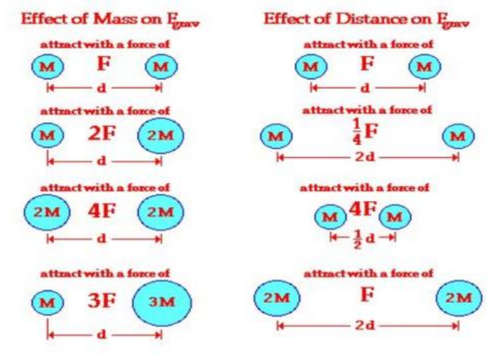
Physical World Concepts Quarter 1 Curriculum Map Quarter 1 Curriculum Map Feedback					
Quarter 1		Quarter 2		Quarter 3	Quarter 4
Unit 1 **Motion and Stability: Forces and Interaction**		Unit 2 Energy		Unit 3 Waves and Their Applications in Technologies for Information Transfer	Unit 4 Matter and Its Interactions
9 weeks		9 weeks		9 weeks	9 weeks
UNIT 1: Motion and Stability: Forces and Interaction [9 weeks]					
Overarching Question(s)					
How can one explain and predict interactions between objects and within systems of objects?					
Unit, Lesson	**Lesson Length**	**Essential Question**		**Vocabulary**	
Unit 1 **Motion and Stability: Forces and Interaction**	**5 days**	**Essential Questions** ● How can an object move at constant speed having changing velocity? ● Why does a spinning skater accelerate when his/her arms are brought closer to the body?		Centripetal force, centripetal acceleration, mass, velocity, Radius	
Standards and Related Background Information		**Instructional Focus**		**Instructional Resources**	
DCI PS2: Motion and Stability: Forces and Interactions **Standard** **PWC.PS2.9** Quantify interactions between objects to show that the total momentum is conserved in both elastic collisions and inelastic collisions. **PWC.PS2.10** Determine the impulse required to produce a change in momentum https://www.tn.gov/content/dam/tn/education/standards/sci/sci_standards_reference.pdf		**Learning Outcomes** • Evaluate the dynamics of systems in motion and collisions including friction, gravity, impulse and momentum, change in momentum and conservation of momentum. **Phenomenon**		**Curricular Resources** **Engage** **Explore** Impulse and Momentum Change Momentum Conservation **Explain** **Elaborate** **Evaluate** **Textbook** **No textbook adopted for this course**	

<u>Misconceptions</u> ● Principle of conservation of momentum applies only to collisions ● Elastic materials can undergo only elastic collisions. **<u>Science and Engineering Practices</u>** 6. Constructing explanations and designing solutions 7. Engaging in Argument from Evidence **<u>Cross Cutting Concepts</u>** 2. Energy and Matter		

Physical World Concepts Quarter 1 Curriculum Map Quarter 1 Curriculum Map Feedback			
Quarter 1	Quarter 2	Quarter 3	Quarter 4
Unit 1 **Motion and Stability: Forces and Interaction**	Unit 2 Energy	Unit 3 Waves and Their Applications in Technologies for Information Transfer	Unit 4 Matter and Its Interactions
9 weeks	9 weeks	9 weeks	9 weeks

UNIT 1: Motion and Stability: Forces and Interaction [9 weeks]			
Overarching Question(s)			
How can one explain and predict interactions between objects and within systems of objects?			
Unit, Lesson	**Lesson Length**	**Essential Question**	**Vocabulary**
Unit 1 **Motion and Stability: Forces and Interaction**	**5 days**	● What direction does gravity pull? ● If an object is rolling down a ramp is gravity still pulling on the object? If so in what direction? ● Does gravity affect everything on earth? ● Does every object have a gravitational pull? ● What has a greater effect: differing masses between two masses, or the distance between masses?	Mass, weight, gravity, gravitational potential energy, gravitational acceleration

Standards and Related Background Information	**Instructional Focus**	**Instructional Resources**
<u>DCI</u> PS2: Motion and Stability: Forces and Interactions **<u>Standard</u>**	**<u>Learning Outcomes</u>** • Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects	**<u>Curricular Resources</u>** **<u>Engage</u>** **<u>Explore</u>** <u>Universal Gravitation</u>

PWC.PS2.11 Using the law of universal gravitation, predict how gravitational force will change when the distance between two masses changes or the mass of one object changes. **PWC.PS2.12** Distinguish between mass and weight using SI units. https://www.tn.gov/content/dam/tn/education/standards/sci/sci_standards_reference.pdf **Misconceptions** 1. Mass denotes size of an object 2. Mass is not the amount of matter. 3. Mass is equal to the weight of the body. **Science and Engineering Practice** 5. Using Mathematics and computational thinking **Cross Cutting Concepts** 7. Scale, Proportion, and Quantity	**Phenomenon**  	**Explain** **Elaborate** **Evaluate** **Textbook** **No textbook adopted for this course**

No textbook for this subject		
RESOURCE TOOLKIT		
Quarter 1 Physical World Concept		
DCIs PS2: Motion and Stability: Forces and Interactions **Standard(s)** PWC.PS2.2 PWC.PS2.1 PWC.PS2.6 PWC.PS2.3 PWC.PS2.4 PWC.PS2.5 PWC.PS2.7 PWC.PS2.8 PWC.PS2.9 PWC.PS2.11 PWC.PS2.12	**Websites/ Videos** Animation: https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/dlo/animatedphysics/p02_02as153/index.html Virtual simulation: https://www.thephysicsaviary.com/Physics/Programs/Labs/GraphingOfMotionLab/index.html Lab: Position-Time Graphs Velocity-Time Graphs Free Fall and the Acceleration of Gravity https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/teacher/tabpages/teacher/data/chap02/hssp0202t_probewarelab.pdf Lab: Projectile Motion Newton's First Law of Motion Newton's Second Law of Motion Newton's Third Law of Motion Circular Motion Impulse and Momentum Change Momentum Conservation Universal Gravitation	**Additional Resources** **ACT & SAT** TN ACT Information & Resources ACT College & Career Readiness Mathematics Standards SAT Connections SAT Practice from Khan Academy Khan Academy Illuminations (NCTM) Discovery Education The Futures Channel The Teaching Channel Teachertube.com