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.

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Physics Quarter 1 Curriculum Map

Quarter 1 [Curriculum Map Feedback Survey]

Quarter 1			Quarter 2			Quarter 3			Quarter 4		
Unit 1 One Dimensional Kinematics	Unit 2 Two Dimensional Kinematic	Unit 3 Forces	Unit 4 Work and Energy	Unit 5 Momentum	Unit 6 Circular Motion and Gravitation	Unit 7 Heat Energy and Thermo.	Unit 8 Electric Forces, Fields and Energy	Unit 9 Capacitors, Resistors and Circuits	Unit 10 Waves and Sound	Unit 11 Light and Light Behaviors	Unit 12 Nuclear Physics
3 weeks	2 weeks	4 weeks	3 weeks	3 weeks	3 weeks	2 weeks	4 weeks	3 weeks	3 weeks	4 weeks	2 weeks

UNIT 1: One Dimensional Kinematics [3 weeks]

Overarching Question(s)

How can one explain and predict interactions between objects and within systems of objects?
How can one predict an object's continued motion, changes in motion, or stability?

Unit, Lesson	Lesson Length	Essential Question	Vocabulary
Unit 1 One Dimensional Kinematics	**3 weeks**	<u>**Essential Questions**</u> • 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, free fall

Standards and Related Background Information	Instructional Focus	Instructional Resources

DCI PS2: Motion and Stability: Forces and Interactions **Standard(s)** PHYS.PS2.1 Investigate and evaluate the graphical and mathematical relationship (using either manual graphing or computers) of one -dimensional kinematic parameters (distance, displacement, speed, velocity, acceleration) with respect to an object's position, direction of motion, and time. PHYS.PS2.2 Algebraically solve problems involving constant velocity and constant acceleration in one -dimension. **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	**Learning Outcomes** • Solve motion and conceptual problems regarding velocity, acceleration, and displacement algebraically. • Given various examples of quantities, categorize them as scalar or vector quantities. **Suggested Phenomenon** Free Fall Graphic When you stretch out a spring and release it, the spring goes back and forth between being compressed and being stretched out. Motion Graphic	**Curricular Materials** **Engage** Acceleration Lab: Bungee Jump Accelerations **Demonstration:** ● Displacement – TE pg. 40 ● Acceleration – TE p. 49 ● Constant Acceleration – TE pg. 50 **Explore** **Virtual Lab:** Acceleration of Gravity: Explore the relationship among position, velocity, and acceleration for a free-falling body. **Explain** Classroom Practice: Average Velocity and Displacement; TE/SE pg. 42 Classroom Practice: Acceleration; TE/SE pg. 47 Classroom Practice: Displacement with Constant Acceleration; TE/SE pgs. 51-53 Classroom Practice: Final Velocity After Any Displacement; TE/SE pgs. 55-56 **Elaborate** **Evaluate** Conceptual Challenge; TE/SE pg. 39 Conceptual Challenge; TE/SE pg.43 Section 1 Formative Assessment; TE/SE pg. 45

transforming between representations. Students can use the models they have developed in PHYS.PS2.1 to evaluate systems. For a system to undergo constant acceleration, the net force on the object must be constant throughout the problem. Algebraic problem solving should be extended to include proportional reasoning, beyond simple manipulation of variables. **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. • Many students believe that the average speed is always the average of the starting and ending speeds as discussed in the Tips and Tricks on this student page. Use counterexamples to address this misconception. **Suggested Science and Engineering Practice** **Using Mathematics and computational thinking** *Students can apply and test computational" "models for the function of a device.* **Suggested Cross Cutting Concepts** **Scale, Proportion, and Quantity**		Conceptual Challenge; TE/SE pg. 48 Section 2 Formative Assessment **Textbook** HMH Physics – Motion in One Dimension - Chapter 2 **Additional Resources:** **Web Resource:** HMD Science Explore: Ch. 2 Motion in One Dimension **Graphing Calculator:** TI-83/84 Graphing Calculator Activity Guide Sheet: Motion in One Dimension ACT & SAT TN ACT Information & Resources SAT Connections SAT Practice from Khan Academy

Students use proportional relationships to predict how changing one property will affect another in a system.		

Physics Quarter 1 Curriculum Map Quarter 1 Curriculum Map Feedback Survey											
Quarter 1			Quarter 2			Quarter 3			Quarter 4		
Unit 1 One Dimensional Kinematics	**Unit 2 Two-Dimensional Kinematics**	Unit 3 Forces	Unit 4 Work and Energy	Unit 5 Momentum	Unit 6 Circular Motion and Gravitation	Unit 7 Heat Energy and Thermo.	Unit 8 Electric Forces, Fields and Energy	Unit 9 Capacitors, Resistors and Circuits	Unit 10 Waves and Sound	Unit 11 Light and Light Behaviors	Unit 12 Nuclear Physics
3 weeks	**2 weeks**	4 weeks	3 weeks	3 weeks	3 weeks	2 weeks	4 weeks	3 weeks	3 weeks	4 weeks	2 weeks

UNIT 2: Two Dimensional Kinematics **[2 weeks]**			
Overarching Question(s)			
How can one predict an object's continued motion, changes in motion, or stability?			
Unit, Lesson	**Lesson Length Length [2 weeks]**	**Essential Question**	**Vocabulary**
Unit 2 Two-Dimensional Kinematics	**2 weeks**	• 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?	Scalar, vector, resultant, components of a vector, projectile motion

		Learning Outcomes • Given various examples of quantities, categorize them as scalar or vector quantities. • Given a projectile launched at an angle, select the correct equation from a list for calculating: the maximum height of travel, time of flight and/or the maximum horizontal distance covered. • Given a scenario where a projectile is being launched at an angle, answer the following conceptual questions.	

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI: PS2: Motion and Stability: Forces and Interactions **Standard** PHYS.PS2.13 Develop a model to predict the range of a two-dimensional projectile based upon its starting height, initial velocity, and angle at which it was launched. **Explanation:** Focus should center on the understanding that horizontal and vertical forces act independently of each other. Students may develop this idea using video capture tools (cells phones, tablets, web cams), which permit frame by frame analysis. Working with an object of known size as reference in frame, students can develop function for motion in the x and y separately. Use of free body	• 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? **Phenomenon** When you stretch out a spring and release it, the spring goes back and forth between being compressed and being stretched out.	**Curricular Materials** **HMH Physics – Two-Dimensional Motion and Vectors - Chapter 3** Animations and Simulations: Projectile Motion: https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/dlo/animatedphysics/p03_03as155/index.html Lab: Projectile motion: https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/teacher/tabpages/teacher/data/chap03/hssp0303t_probewarelab.pdf **Additional Resources:**

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<td>diagrams can be included to permit separate analysis of each component. Related predictions such as maximum height or situations where the launch height is at a different height than the landing/impact location should also be included. A scale model can be created for the motion of a projectile using strings of varying lengths to affix washers along a meter stick at equal intervals. With such a model, tradeoffs between height and distance can be observed as the initial launch angle is varied.

<u>Misconceptions</u>
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.
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.
<u>Science and Engineering Practice</u>
1. Asking questions and defining problems
2. Developing and using models
3. Planning and Carrying Out Investigations
4. Analyzing and Interpreting Data
5. Using Mathematics and computational thinking
6. Constructing explanations and designing solutions</td>
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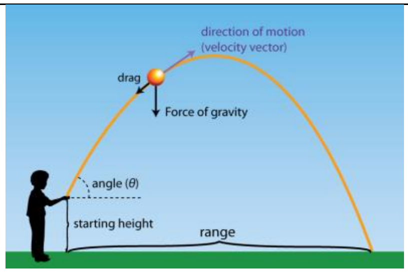

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<td><u>ACT & SAT</u>
<u>TN ACT Information & Resources</u>
<u>SAT Connections</u>
<u>SAT Practice from Khan Academy</u></td>
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7. Engaging in Argument from Evidence 8. Obtaining, evaluating, and communicating information **Cross Cutting Concepts** 1.Pattern 2.Cause and Effect 3.Systems and System Models 4.Scale, Proportion, and Quantity		

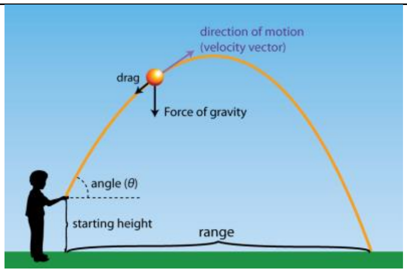
Physics Quarter 1 Curriculum Map Quarter 1 Curriculum Map Feedback Survey											
Unit 1 One Dimensional Kinematics	Unit 2 Two Dimensional Kinematic	Unit 3 Forces	Unit 4 Work and Energy	Unit 5 Momentum	Unit 6 Circular Motion and Gravitation	Unit 7 Heat Energy and Thermo.	Unit 8 Electric Forces, Fields and Energy	Unit 9 Capacitors, Resistors and Circuits	Unit 10 Waves and Sound	Unit 11 Light and Light Behaviors	Unit 12 Nuclear Physics

3 weeks	2 weeks	4 weeks	3 weeks	3 weeks	3 weeks	2 weeks	4 weeks	3 weeks	3 weeks	4 weeks	2 weeks

UNIT 3: Forces **[4 weeks]**			
Overarching Question(s)			
What underlying forces explain the variety of interactions observed?			
Unit, Lesson	**Lesson Length** **Length [4 weeks]**	**Essential Question**	**Vocabulary**
Unit 3 Forces	**2 weeks**	**Essential Questions** ● 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? **Learning Outcomes** ● Given Newton's laws of motion, analyze scenarios related to inertia, force, and action-reaction. ● Given various examples of quantities, categorize them as scalar or vector quantities. ● Given the static and kinetic friction coefficients (μs and μk); select the appropriate coefficient of	**Vocabulary** Force, inertia, net force, equilibrium, weight, normal force, static force, kinetic friction, coefficient of friction **Curricular Materials** **HMH Physics – Forces and the Laws of Motion - Chapter 4** Animations and Simulations: Force: https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/dlo/animatedphysics/p04_03as17/index.html Friction: https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/dlo/animatedphysics/p04_04as156/index.html Lab: Force and Changes in Motion:

		friction and calculate the force necessary to move the object. ● Select the correct vector diagram to illustrate all forces on an object affected by gravity, friction and an applied force. ● Given an inclined plane, the required coefficient of friction and an object of a specific mass, select the appropriate trigonometry functions to determine whether the object will slide down the plane or not. ● Explain the relationship between the motion of an object and the net external force acting on the object.	https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/teacher/tabpages/teacher/data/chap04/hssp0401t_quicklab.pdf **Additional Resources:** **ACT & SAT** TN ACT Information & Resources SAT Connections SAT Practice from Khan Academy

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI PS2: Motion and Stability: Forces and Interactions **Standard** PHYS.PS2.4 Use **free-body diagrams** to illustrate the contact and non-contact forces acting on an object. Use the diagrams in combination with graphical or component-based vector analysis and with Newton's first and second laws to predict the position of the object on which the forces act in a constant **net force** scenario. **Explanation**	• 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? **Phenomenon** When you stretch out a spring and release it, the spring goes back and forth between being compressed and being stretched out.	**Curricular Materials** **HMH Physics – Motion in One Dimension - Chapter 2** Acceleration Lab: https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/teacher/tabpages/teacher/data/chap02/hssp0202t_probewarelab.pdf

The concept of net force and Newton's laws have been introduced in 8.PS2.3 and 8.PS2.4. At that time, free-body diagrams are introduced as a tool to represent the forces acting on an object. In further developing the use of free-body diagrams, it is now appropriate to include vectors that must be evaluated to parallel and perpendicular components. This includes objects on inclined planes as well as projectile motion as addressed in PHYS.PS2.13 **Misconceptions** 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. **Science and Engineering Practice** 1. Asking questions and defining problems 2. Developing and using models 3. Planning and Carrying Out Investigations 4. Analyzing and Interpreting Data 5. Using Mathematics and computational thinking 6. Constructing explanations and designing solutions 7. Engaging in Argument from Evidence 8. Obtaining, evaluating, and communicating information **Cross Cutting Concepts** Patterns Structure and Function		

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3 weeks	2 weeks	4 weeks	3 weeks	3 weeks	3 weeks	2 weeks	4 weeks	3 weeks	3 weeks	4 weeks	2 weeks

UNIT 3: Forces [4 weeks]

Overarching Question(s)

What underlying forces explain the variety of interactions observed?

Unit, Lesson	Lesson Length	Essential Question	Vocabulary

	Length [3 weeks]		
Unit 4 Work and Energy	**3 weeks**	**Essential Questions** • 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?	**Vocabulary** Force, inertia, net force, equilibrium, weight, normal force, static force, kinetic friction, coefficient of friction
Standards and Related Background Information		**Instructional Focus**	**Instructional Resources**
DCI PS2: Motion and Stability: Forces and Interactions **Standard** PHYS.PS2.5 Gather evidence to defend the claim of **Newton's first law of motion** by explaining the effect that balanced forces have upon objects that are stationary or are moving at constant velocity. **Explanation** Students should be able to discuss mass as a measurement of the amount of inertia in an object, with a unit of kg. Beginning as early as 5.PS2.3 students have been developing an understanding of gravity. Experiments		**Learning Outcomes** • Given Newton's laws of motion, analyze scenarios related to inertia, force, and action-reaction. • Given various examples of quantities, categorize them as scalar or vector quantities. • Given the static and kinetic friction coefficients (μs and μk); select the appropriate coefficient of friction and calculate the force necessary to move the object. • Select the correct vector diagram to illustrate all forces on an object affected by gravity, friction and an applied force. • Given an inclined plane, the required coefficient of friction and an object of a specific mass, select the appropriate trigonometry functions to determine whether the object will slide down the plane or not.	**Curricular Materials** **HMH Physics – Forces and the Laws of Motion - Chapter 4** Lab: Inertia: https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/teacher/tabpages/teacher/data/chap04/hssp0402t_quicklab.pdf Discovering Newton's Laws: https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/teacher/tabpages/teacher/data/chap04/hssp0400t_lab.pdf Newton's First Law of Motion

determining the rate of acceleration of objects in freefall can be used to determine earth's gravitational field strength which can then be used to develop an object's gravitational mass. A discussion of Hook's Law and subsequent use of a spring with a known spring constant can be used to determine an object's inertial mass **<u>Misconceptions</u>** 1. Stationary object has no inertia. 2. Inertia is independent of mass. 3. Everything that moves, will eventually come to a stop. Rest is the "natural" state of all objects.	• Explain the relationship between the motion of an object and the net external force acting on the object. • **<u>Phenomenon</u>** Inertia: https://www.ngssphenomena.com/sleddinginertia/2017/1/9/1jnskbcm3tssibwe8wcpcw97tzhxpw	**<u>Science and Engineering Practice</u>** 1. Asking questions and defining problems 2. Developing and using models 3. Planning and Carrying Out Investigations 4. Analyzing and Interpreting Data 5. Using Mathematics and computational thinking 6. Constructing explanations and designing solutions 7. Engaging in Argument from Evidence 8. Obtaining, evaluating, and communicating information **<u>Cross Cutting Concepts</u>** 1.Cause and Effect 2.Scale, Proportion, and Quantity 3. Constructing explanations and designing solutions **Additional Resources:** **ACT & SAT** TN ACT Information & Resources SAT Connections SAT Practice from Khan Academy

Curriculum and Instruction- Science			
RESOURCE TOOLKIT			
Quarter 1		**Physics**	
Textbook Resources **HMH Physics – Motion in One Dimension - Chapter 2** **HMH Physics – Forces and the Laws of Motion - Chapter 4**	**DCIs and Standards** **DCI** PS2: Motion and Stability: Forces and Interactions **Standard** PHYS.PS2.2 Algebraically solve problems involving constant velocity and constant acceleration in one -dimension. **DCI** PS2: Motion and Stability: Forces and Interactions **Standard** PHYS.PS2.5 Gather evidence to defend the claim of **Newton's first law of motion** by explaining the effect that balanced forces have upon objects that are stationary or are moving at constant velocity. **DCI:** **PS2: Motion and Stability: Forces and Interactions** **Standard** **PHYS.PS2.13 Develop a model to predict the range of a two-dimensional projectile based upon its starting height, initial velocity, and angle at which it was launched.**	**Videos** Khan Academy Illuminations (NCTM) Discovery Education The Futures Channel The Teaching Channel Teachertube.com Acceleration Lab: https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/teacher/tabpages/teacher/data/chap02/hssp0202t_probewarelab.pdf **Graphing Calculator:** TI-83/84 Graphing Calculator Activity Guide Sheet: Motion in One Dimension: https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/teacher/tabpages/teacher/data/chap02/graphing_calculator/hssp0200t_graphcalc_ti84.pdf **Virtual Lab:** Acceleration of Gravity: Explore the relationship among position, velocity, and acceleration for a free-falling body. https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/nsmedia/polyhedron_virtual_labs/a	**ACT & SAT** TN ACT Information & Resources ACT College & Career Readiness Mathematics Standards SAT Connections SAT Practice from Khan Academy

		cceleration ofgravity/aoghomeframeset.html Web Resource- http://hmdscienceexplore.hmhco.com/physics/ch02/ Animations and Simulations: Projectile Motion: https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/dlo/animatedphysics/p03_03as155/index.html Lab: Projectile motion: https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/teacher/tabpages/teacher/data/chap03/hssp0303t_probewarelab.pdf Inertia: https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/teacher/tabpages/teacher/data/chap04/hssp0402t_quicklab.pdf Discovering Newton's Laws: https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/teacher/tabpages/teacher/data/chap04/hssp0400t_lab.pdf Newton's First Law of Motion	