Schools Science Vision

chools' 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 i ss sufficient knowledge of science and engineering to engage in discussions; are able to learn and apply scientific and technological information in t e skills such as critical thinking, problem solving, and communication to enter careers of their choice, while having access to connections to science

Shelby County Schools has employed The Tennessee Academic Standards for Science to craft a meaningful curriculum that is innovative and provid ities that extend beyond mastery of basic scientific principles.

by County Schools Board of Education adopted a set of ambitious, yet attainable goals for school and student performance. The District is committe ed in our strategic plan, Destination 2025. In order to achieve these ambitious goals, we must collectively work to provide our students with high qu n. 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 c the Tennessee Science Standards Reference. Tennessee Academic Standards for Science are rooted in the knowledge and skills that students nee tudy or careers. While the academic standards establish desired learning outcomes, the curriculum provides instructional planning designed to help The curriculum maps contain components to ensure that instruction focuses students toward college and career readiness. Educators will use this g admap for curriculum and instruction. The sequence of learning is strategically positioned so that necessary foundational skills are spiraled in order of the standards.

al is to ensure our students graduate ready for college and career. Being College and Career Ready entails, many aspects of teaching and learning. their scientific learning in the classroom and beyond. These valuable experiences include students being facilitators of their own learning through pr ally. The Science and Engineering Practices are valuable tools used by students to engage in understanding how scientific knowledge develops. Th "processes and proficiencies" with longstanding importance in science education. The science maps contain components to ensure that instruction ding how science and engineering can contribute to meeting many of the major challenges that confront society today. The maps are centered arou Tennessee Academic Standards for Science, Science and Engineering Practices, Disciplinary Core Ideas, Crosscutting Concepts, and Phenomena

Academic Standards for Science were developed using the National Research Council's 2012 publication, A Framework for K-12 Science Education 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 ab ing concepts and solving mathematical formulae. Practicing science had become prescribed lab situations with predetermined outcomes. The frame l approach to science education that capitalizes on a child's natural curiosity. The Science Framework for K-12 Science Education provides the blue fective science practices. The *Framework* expresses a vision in science education that requires students to operate at the nexus of three dimensions neering Practices, Crosscutting Concepts, and Disciplinary Core Ideas. The *Framework* identified a small number of disciplinary core ideas that all s ing depth and sophistication, from Kindergarten through grade twelve. Key to the vision expressed in the *Framework* is for students to learn these di xt of science and engineering practices. The importance of combining Science and Engineering Practices, Crosscutting Concepts and Disciplinary C *nework* as follows:

erformance expectations that are aligned to the framework must take into account that students cannot fully understand scientific and engineering ide ractices of inquiry and the discourses by which such ideas are developed and refined. At the same time, they cannot learn or show competence in p pecific content. (NRC Framework, 2012, p. 218)

kills and dispositions to use scientific and engineering practices needed to further their learning and to solve problems, students need to experience i ultiple practices in developing a particular core idea and apply each practice in the context of multiple core ideas. We use the term "practices" instea nasize that engaging in scientific investigation requires not only skill but also knowledge that is specific to each practice. Students in grades K-12 sho er each grade band. Crosscutting concepts have application across all domains of science. As such, they are a way of linking the different domains cepts have value because they provide students with connections and intellectual tools that are related across the differing areas of disciplinary cont ation of practices and their understanding of core ideas. There are seven crosscutting concepts that bridge disciplinary boundaries, uniting core ide ce and engineering. Their purpose is to help students deepen their understanding of the disciplinary core ideas and develop a coherent and scientifi

t to support effective planning and instruction to rigorous standards. It is *not* meant to replace teacher planning, prescribe pacing or instructional pra ely "cover the curriculum," but rather to "uncover" it by developing students' deep understanding of the content and mastery of the standards. Teach bout and intentionally align the learning target (standards and objectives), topic, text(s), task, and needs (and assessment) of the learners are best-p bout how to support student learning toward such mastery. Teachers are therefore expected--with the support of their colleagues, coaches, leaders, --to exercise their professional judgment aligned to our shared vision of effective instruction, the Teacher Effectiveness Measure (TEM) and related ver, while the framework allows for flexibility and encourages each teacher/teacher team to make it their own, our expectations for student learning a nust ensure all of our children have access to rigor—high-quality teaching and learning to grade level specific standards, including purposeful suppor j 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

ssion

elementary science experience, students can observe and measure phenomena using appropriate tools. They are able to organize objects and idea single properties and later by multiple properties. They can create and interpret graphs and models that explain phenomena. Students can keep no observations and identify simple patterns. They are able to design and conduct investigations, analyze results, and communicate the results to oth ty, interest and enjoyment of the scientific world view, scientific inquiry, and the scientific enterprise into middle school.

middle school science experience, students can discover relationships by making observations and by the systematic gathering of data. They can i d arguments. Their focus has shifted from the general to the specific and from the simple to the complex. They use scientific information to make w vation of the natural world. They recognize that there are both negative and positive implications to new technologies.

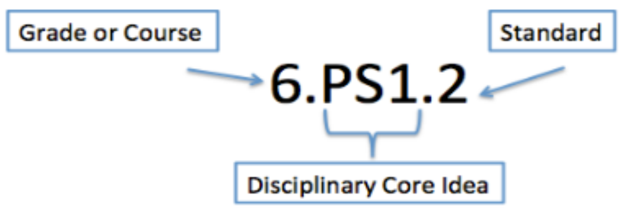
ate, former students should be literate in science, understand key science ideas, aware that science and technology are interdependent human ente
itations, familiar with the natural world and recognizes both its diversity and unity, and able to apply scientific knowledge and ways of thinking for ind

Standards

Level/Course Overview: An overview that describes that specific content and themes for each grade level or high school course.

nary Core Idea: Scientific and foundational ideas that permeate all grades and connect common themes that bridge scientific disciplines.

rd: Statements of what students can do to demonstrate knowledge of the conceptual understanding. Each performance indicator includes a specific
eering practice paired with the content knowledge and skills that students should demonstrate to meet the grade level or high school course standar



nce Curriculum Maps

de to help teachers and their support providers (e.g., coaches, leaders) on their path to effective, college and career ready (CCR) aligned instruction

tion 2025. It is a resource for organizing instruction around the Tennessee Academic Standards for Science, which defines what to teach and what
de level. The map is designed to reinforce the grade/course-specific standards and content (scope) and provides *suggested* sequencing, pacing, tim
. 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 te
lity materials (though they may both select from and/or supplement those included here) and have more time to plan, teach, assess, and reflect with
ove practice and best meet the needs of their students.

t to support effective planning and instruction to rigorous standards. It is *not* meant to replace teacher planning, prescribe pacing or instructional pra
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g across the content areas.

SCS Physical World Concepts Curriculum Map

Unit 1 Stability: Forces and nteraction	Unit 2 Energy	Unit 3 Waves and Their Applications in Technologies for Information Transfer	Unit 4 Matter and Its Ir
9 weeks	9 weeks	9 weeks	9 week

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

Question(s)

move?

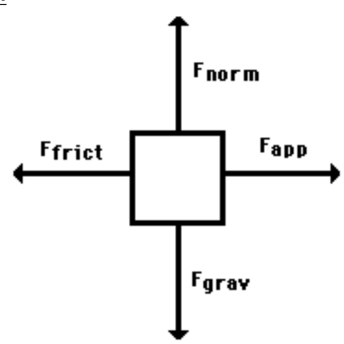
planations, Misconceptions th [5 days]	Learning Outcomes/Phenomena (Anchor, Driving)	3-Dimensional Instructional Approach (SEPs and CCCs) *Suggestions	Vocabulary and Cu
Stability: Forces and Interac characteristics of rectiline phs and velocity-time grap ay have difficulty at the magnitude of a he length of the straight- n two points rather than elled. Point out that meter on a car shows that 5 mi, the displacement mi.	**Essential Questions** • 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? **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.	**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** 1.Pattern 2.Cause and Effect 3.Systems and System Models 4.Scale, Proportion, and Quantity	**Vocabulary** Frame of reference, displacement, speed instantaneous veloci **Curricular Materials** Animation: https://my.hrw.com/nce/hss2017/tn/gr9-12/hmd_phy_97813matedphysics/p02_C Virtual simulation: https://www.thephysics/Programs/Labs/ab/index.html Lab: Position-Time Graph Velocity-Time Graph Free Fall and the Acc

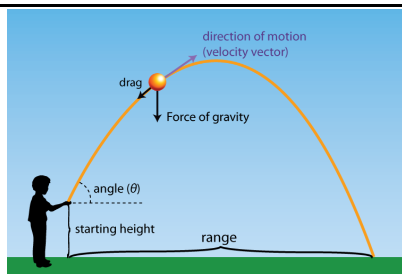
...planations, Misconceptions ...th [5 days]	Learning Outcomes/Phenomena (Anchor, Driving)	3-Dimensional Instructional Approach (SEPs and CCCs) *Suggestions	Vocabulary and Curricular M...
Stability: Forces and Interac... ...tigate, measure, calculate, a... ...ng position, displacement, v... ...is another name of speed. ...acceleration for a moving ...velocity should be ...d ...ment is the total distance ...by an object	**Essential Questions** • 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? **Learning Outcomes** 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	**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** 1.Pattern 2.Cause and Effect 3.Systems and System Models 4.Scale, Proportion, and Quantity	**Vocabulary** Frame of reference, distance, di... speed, average velocity, instanta... velocity, acceleration **Curricular Materials** Animation:https://my.hrw.com/.../science/hss2017/tn/gr9-12/hmd_phy_9781328833716_... physics/p02_02as153/index.htm... Motion Lab: https://my.hrw.com/content/hr... ss2017/tn/gr9-12/hmd_phy_9781328833716_... ages/teacher/data/chap02/hssp... Acceleration Lab: https://my.hrw.com/content/hr... ss2017/tn/gr9-12/hmd_phy_9781328833716_... ages/teacher/data/chap02/hssp... warelab.pdf

...uestion(s)

...he laws that govern two-dimensional motion be calculated and expressed?

...planations, Misconceptions ...th [5 days]	Learning Outcomes/Phenomena (Anchor, Driving)	3-Dimensional Instructional Approach (SEPs and	Vocabulary and Curricu...

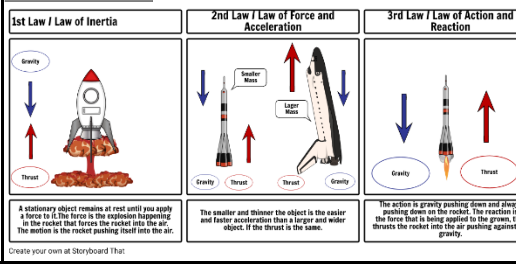
		CCCs) *Suggestions	
Stability: Forces and rstand that the two- rement of an object can be mbination of its ertical components of rominence of angles he x-axis, students may onception that the x vector is always calculated function. This ay be corrected by using board in which the angles m the y-axis.	**Essential Questions** • 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? **Learning Outcomes** • Given various examples of quantities, categorize them as scalar or vector quantities. • Investigate projectile motion. **Phenomenon** 	**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** 1.Pattern 2.Cause and Effect 3.Systems and System Models 4.Scale, Proportion, and Quantity	**Vocabulary** Frame of reference, dist displacement, speed, av velocity, instantaneous acceleration, free fall **Curricular Materials** Lab: Projectile Motion

Question(s)

ct an objects continued motion, change in motion, or stability?

planations, Misconceptions th [5 days]	Learning Outcomes/Phenomena (Anchor, Driving)	3-Dimensional Instructional Approach (SEPs and CCCs) *Suggestions	Vocabulary and Curricu
Stability: Forces in how Newton's o objects at rest ng at a constant Newton's second relationship among ng on a body, the , and the resulting ugh mathematical ' Newton'**s law**	**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** Analyze and apply Newton's three laws of motion.	**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** Structure and Function Students apply patterns in structure and function to unfamiliar phenomena.	**Vocabulary** Force, inertia, net force, weight. **Curricular Materials** Lab: Newton's First Law of M Newton's Second Law o Newton's Third Law of N

ry object has no inertia. ; independent of mass. ect is not moving, there is acting on it. ng that moves will lly come to a stop. Rest is ural" state of all objects. :t is hard to push because it .	**Phenomenon** 		

Question(s)

ne laws that govern circular motion be calculated and expressed?

planations, Misconceptions th [5 days]	Learning Outcomes/Phenomena (Anchor, Driving)	3-Dimensional Instructional Approach (SEPs and CCCs) *Suggestions	Vocabulary and Curricu
Stability: Forces and ze the general relationship :e, acceleration, and ject undergoing uniform ibe the nature and :tional forces. gal force is the force acting rom center on the body in motion.	**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? **Learning Outcomes** ● Evaluate, measure, and analyze circular motion. ● Investigate the characteristics of centripetal motion and centripetal acceleration. **Phenomenon**	**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** 1.Cause & Effect 2.Scale, Proportion, and Quantity 3.Constructing explanations and designing solutions	**Vocabulary** Centripetal force, centri acceleration, mass, velo **Curricular Materials** Lab: Circular Motion

gal force is the force acting rom center on the body in motion			

Question(s)

ctors influence the relative motion of objects?

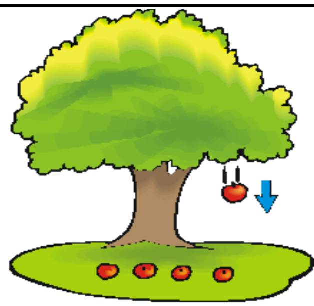
planations, Misconceptions th [5 days]	Learning Outcomes/Phenomena (Anchor, Driving)	3-Dimensional Instructional Approach (SEPs and CCCs) *Suggestions	Vocabulary and Curricu
Stability: Forces and tify interactions between that the total momentum is h elastic collisions and s. ermine the impulse uce a change in	**Essential Questions** • When can momentum be harmful, and when can it be helpful? • When is impulse used rather than momentum? **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**	**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** 1. Stability and Change 2. Energy and Matter 3. Scale, Proportion, and Quantity	**Vocabulary** Momentum, impulse, el inelastic collision **Curricular Materials** Lab: Impulse and Momentun Momentum Conservatic

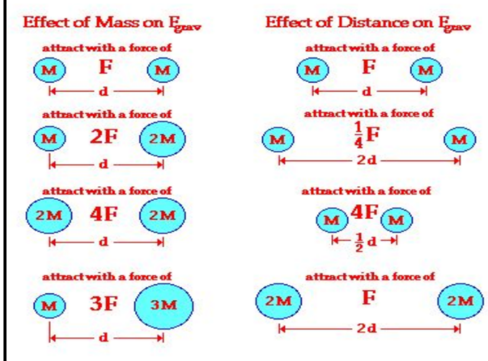
: of conservation of :um applies only to s ıaterials can undergo only ollisions.			

Question(s)

:s gravity pull objects that are sitting still or in motion?

planations, Misconceptions :th [5 days]	Learning Outcomes/Phenomena (Anchor, Driving)	3-Dimensional Instructional Approach (SEPs and CCCs) *Suggestions	Vocabulary and Curricu
Stability: Forces and g the law of universal ict how gravitational force ı the distance between ges or the mass of one nguish between mass and nits. notes size of an object ıot the amount of matter. equal to the weight of the	**Essential Questions** 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? **Learning Outcomes** Use mathematical representations of Newton’s Law of Gravitation and Coulomb’s Law to describe and predict the gravitational and electrostatic forces between objects **Phenomenon**	**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** 1. Stability and Change 2. Energy and Matter 3. Scale, Proportion, and Quantity	**Vocabulary** Mass, weight, gravity, gı potential energy, gravita acceleration **Curricular Materials** Lab: Universal Gravitatic

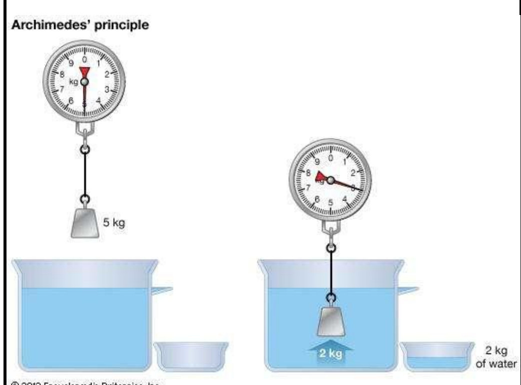




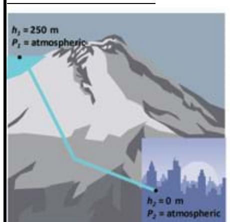
Question(s)

rine stay underwater?

planations, Misconceptions th [5 days]	Learning Outcomes/Phenomena (Anchor, Driving)	3-Dimensional Instructional Approach (SEPs and	Vocabulary and Curricu

		CCCs) *Suggestions	
Stability: Forces and ·esent the force conditions ·stem in equilibrium. ·ugh the use of force ı why objects float or sink and density. ·rimentally investigate the erted on floating and :ts. ce should contain air to s because Water and Oil iscible. :s heaviness a big cube of r floats. or metal objects sink in and volume have no effect ng.	**Essential Questions** What is the relationship between fluid pressure and buoyant force? How can you predict whether an object will sink or float in a liquid? What role does density play in an object's ability to float? **Learning Outcomes** ● Investigate the buoyant force exerted on floating and submerged objects. ● Investigate the apparent weight of an object submerged in a fluid. ● Explain why objects float or sink in terms of force or density. **Phenomenon** 	**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** 1. Stability and Change 2. Energy and Matter 3. Scale, Proportion, and Quantity	**Vocabulary** Mass, weight, apparent sink, buoyant force, hyd Archimedes' Principle **Curricular Materials**

Question(s)
mon effects of ideal fluid flow?

planations, Misconceptions th [5 days]	Learning Outcomes/Phenomena (Anchor, Driving)	3-Dimensional Instructional Approach (SEPs and CCCs) *Suggestions	Vocabulary and Curricu
Stability: Forces and ıonstrate the effects of ple on fluid motion. g out of the hose is at a han the water in the hose.	**<u>Essential Questions</u>** 1. What is Bernoulli's Principle? 2. What are the main parts of an airplane and how do they help a plane achieve flight? **<u>Learning Outcomes</u>** Explain the different parts of an airplane and how the shape of the wing is related to Bernoulli's principle. **<u>Phenomenon</u>**  $\frac{1}{2}\rho v_1^2 + \rho g h_1 + P_1 = \frac{1}{2}\rho v_2^2 + \rho g h_2 + P_2$ The water at the top of the reservoir starts at rest, so v_1 is zero, and the first term drops out. Since the final height (h_2) is also zero, this term drops out, too. Lastly, $P_1 = P_2$, which is atmospheric pressure, so these terms drop out as well. Plugging in the remaining of the known parameters: $\rho_{water}\, g\,(250\text{ m}) = \frac{1}{2}\,\rho_{water}\, v_2^2$ Now the ρ_{water} terms can be cancelled out. Using $g = 9.8\text{ m/s}^2$ and solving for v_2, we have v_2 = sqrt (2*9.8 m/s² * 250 m) v_2 = 70 m/s	**<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. Pattern 2. Cause and Effect 3. Systems and System Models 4. Scale, Proportion, and Quantity	**<u>Vocabulary</u>** Pressure, pascal, fluid, P Principle, Bernoulli's Pri **<u>Curricular Materials</u>** Lab Activity: https://www.teachengi tivities/view/cub_airpla _activity1 http://static.nsta.org/pc 32.pdf Virtual simulation: https://phet.colorado.e ion/fluid-pressure-and-f

SHELBY COUNTY SCHOOLS
SCS
Excellence since 1867