

Pequea Valley School District
STEM

Unit 1: Nature of Science

Course: STEM 9 Conceptual Physics

Grade: 9

Planning the Focus Based on the Desired Result

What do you want all students to know, understand and do by the end of the unit?

Unit Essential Question(s)

- How and why does the scientific method contribute to society? Explain using a historical example

Keystone Eligible Content/PA Core Standard

3.1.12.A Apply concepts of systems, subsystems, feedback and control to solve complex technological problems.

3.1.12.B Apply concepts of models as a method to predict and understand science and technology.

3.1.12.C Assess and apply patterns in science and technology.

Pacing: Approximate number of class sessions per unit

- 16 days

Tier 3 Vocabulary (Content specific vocabulary)

Theory, Law, Hypothesis, Fact, Belief, Physics, Science, Technology, Math, Model, Control, Variable, Independent Variable, Dependent Variable, Constant, Derived Unit, SI, Units

Know - What do students need to **know** in order to be able to do and understand? *List concepts, such as facts, formulas, key vocabulary and knowledge “nuggets”.*

- The parts of the scientific method
- The differences between theories, laws, hypotheses, facts
- The purposes of variables and controls in an experiment
- The SI system units

Understand - What do students need to **understand**? What is the **big idea**? *List broad concepts or “big ideas” in a statement of enduring understanding.*

- How science and technology are related
- How science and math are related
- How to construct a valid experiment
- Why scientists use the SI system of units

- Why scientists use units
- How to construct and analyze a graph

Learning Outcome - What do students need to be able to **accomplish** by the unit's end? *List skills and competencies.*

Learners will be able to identify the independent and dependent variables in an experiment.

Learners will be able to identify the constants and controls in an experiment.

Learners will be able to describe the similarities and differences between theories, hypotheses, laws, and facts.

Learners will be able to describe the differences between the common usage and scientific usage of theories, hypotheses, laws, and facts.

Learners will develop a valid experiment to test a characteristic of the CNC routing machine.

Learners will be able to analyze and create graphs in respect to their experiments.

Assessments:

- Nature of Science Formative Assessment
- CNC Lab Report
- Quiz
- Test

Software/Resources:

- Schoology
- CNC Router
- Google Drive
- EdPuzzle

**Pequea Valley School District
STEM Department**

Unit: Deck Modeling

Course: STEM 9 Conceptual Physics

Grade: 9

**Planning the Focus Based on the Desired Result
What do you want all students to know, understand and do by the end of the unit?**

Unit Essential Question(s)

How do engineers determine the safety of a deck structure or concrete?

Keystone Eligible Content/PA Core Standard

3.1.12.A Apply concepts of systems, subsystems, feedback and control to solve complex technological problems.

3.1.12.B Apply concepts of models as a method to predict and understand science and technology.

3.1.12.C Assess and apply patterns in science and technology.

3.1.12.D Analyze scale as a way of relating concepts and ideas to one another by some measure.

Pacing: Approximate number of class sessions per unit

12

Tier 3 Vocabulary (Content specific vocabulary)

force, pressure, area, Pascal, p.s.i., live load, dead load, data analysis, scale model, proportions, Newtons

Know - What do students need to **know** in order to be able to do and understand? List concepts, such as facts, formulas, key vocabulary and knowledge nuggets .

- How to calculate Area
- How to calculate Pressure
- Units for Force, Pressure, and Area
- How to set up a proportion
- How to communicate with others

Understand - What do students need to **understand**? What is the **big idea**? List broad concepts or big ideas in a statement of enduring understanding.

- How to use a proportion to create a scale model
- How to evaluate the safety of a deck using live load and dead load calculations
- How Force, Pressure, and Area relate to each other

Learning Outcome - What do students need to be able to **accomplish** by the unit's end? List skills and competencies.

Learners will be able to calculate Pressure, given Force and Area.

Learners will be able to calculate Area, given Pressure and Force.

Learners will be able to calculate Force, given Pressure and Area.

Learners will be able to evaluate the safety of a deck structure.

Learners will be able to communicate the evidence of the safety of their deck through a presentation.

Assessments:

- Word Problems
- Play-Doh Lab

Software/Resources:

- Schoology
- Google Drive
- EdPuzzle
- Lowe's Deck Designer

**Pequea Valley School District
STEM Department**

Unit: Concrete Testing

Course: STEM 9 Conceptual Physics

Grade: 9

Planning the Focus Based on the Desired Result

What do you want all students to know, understand and do by the end of the unit?

Unit Essential Question(s)

Why is materials testing important to our society's infrastructure and how do companies go about doing it?

Keystone Eligible Content/PA Core Standard

- 3.1.12.A** Apply concepts of systems, subsystems, feedback and control to solve complex technological problems.
- 3.1.12.B** Apply concepts of models as a method to predict and understand science and technology.
- 3.1.12.C** Assess and apply patterns in science and technology.
- 3.4.10.C** Distinguish among the principles of force and motion

Pacing: Approximate number of class sessions per unit

5

Tier 3 Vocabulary (Content specific vocabulary)

force, pressure, area, p.s.i., Pascal, data analysis, cure rate

Know - What do students need to **know** in order to be able to do and understand? *List concepts, such as facts, formulas, key vocabulary and knowledge "nuggets".*

- How to calculate Area
- How to calculate Pressure
- Units for Force, Pressure, and Area
- How to communicate with others
- How to make a graph
- How to operate a materials tester

Understand - What do students need to **understand**? What is the **big idea**? *List broad concepts or "big ideas" in a statement of enduring understanding.*

- How Force, Pressure, and Area relate to each other
- How the cure rate of concrete changes over time
- The methods of gathering data
- How to analyze large collections of data

Learning Outcome - What do students need to be able to **accomplish** by the unit's end? *List skills and competencies.*

Learners will be able to design an experiment to discover the cure rate of concrete.

Learners will be able to communicate their experimental setup and results through a lab report.

Learners will be able to analyze a collection of data, create graphs with that data, and come to a conclusion regarding cure rate of concrete.

Assessments:

- Lab Report
- Lab Result Analysis

Software/Resources:

- Schoology
- Google Drive
- EdPuzzle
- Materials Tester

**Pequea Valley School District
STEM Department**

Unit: Simple Machines and Slow Car

Course: STEM 9 Conceptual Physics

Grade: 9

Planning the Focus Based on the Desired Result

What do you want all students to know, understand and do by the end of the unit?

Unit Essential Question(s)

How do safety engineers use systems of equations in their tests?
How do simple machines make our lives easier?
How can math and science be used to accurately predict the future?

Keystone Eligible Content/PA Core Standard

3.1.12.A Apply concepts of systems, subsystems, feedback and control to solve complex technological problems.
3.1.12.B Apply concepts of models as a method to predict and understand science and technology.
3.1.12.C Assess and apply patterns in science and technology.
3.4.10.C Distinguish among the principles of force and motion

Pacing: Approximate number of class sessions per unit

22 days

Tier 3 Vocabulary (Content specific vocabulary)

work, power, Joule, Watt, machine, mechanical advantage, effort arm, effort force, fulcrum, resistance arm, resistance force efficiency, compound machine, pulley, wheel and axle, inclined plane, screw, wedge, lever, horsepower, kilowatt-hour, rate, speed, velocity, distance, displacement, time, instantaneous speed, average speed, constant speed, relative and slope.

Know - What do students need to **know** in order to be able to do and understand? *List concepts, such as facts, formulas, key vocabulary and knowledge “nuggets”.*

- How to calculate speed and velocity
- How to find the slope of a line
- The conditions necessary for work to be done
- How to calculate work
- The six simple machines
- How to calculate mechanical advantage
- How power is calculated
- How to find the efficiency of a machine

Understand - What do students need to **understand**? What is the **big idea**? *List broad concepts or “big ideas” in a statement of enduring understanding.*

- The difference between work and power

- The applications and uses of power
- How simple machines are used to make work easier
- The difference between speed and velocity
- How math can be applied to a physical situation in order to make predictions
- How the slope and y-intercept of a graph relate to the motion of an object

Learning Outcome - What do students need to be able to **accomplish** by the unit's end? *List skills and competencies.*

Learners will be able predict when and where two cars will collide using linear systems of equations.

Learners will be able to measure and calculate their work and power in climbing a set of stairs.

Learners will be evaluate the efficiency of a machine.

Assessments:

Work and Power Quiz

Stairs Lab Data Analysis

Lever & Inclined Plane Lab Data Analysis

Work, Power, and Simple Machines Exam

Speed Quiz

Slow Car Collision Data Analysis

Software/Resources:

Schoology

Google Drive

Explore Learning/ Gizmos

GoPro

**Pequea Valley School District
STEM Department**

Unit: Maglev Vehicle

Course: STEM 9 Conceptual Physics

Grade: 9

Planning the Focus Based on the Desired Result
What do you want all students to know, understand and do by the end of the unit?

Unit Essential Question(s)

Why is it important for engineers to describe accelerated motion differently than constant motion?

Keystone Eligible Content/PA Core Standard

- 3.1.12.A** Apply concepts of systems, subsystems, feedback and control to solve complex technological problems.
- 3.1.12.B** Apply concepts of models as a method to predict and understand science and technology.
- 3.1.12.C** Assess and apply patterns in science and technology.
- 3.4.10.C** Distinguish among the principles of force and motion.
- 3.1.10.C** Apply patterns and repeated processes or recurring elements in science and technology.
- 3.1.12.C** Assess and apply patterns in science and technology

Pacing: Approximate number of class sessions per unit

23 days

Tier 3 Vocabulary (Content specific vocabulary)

change in velocity, acceleration, rate, slope, speed, velocity, distance, displacement, time, instantaneous speed, average speed, relative,

Know - What do students need to **know** in order to be able to do and understand? *List concepts, such as facts, formulas, key vocabulary and knowledge “nuggets”.*

How to calculate acceleration

How to find the velocity and starting location from a position versus time graph.

How to determine the acceleration and starting velocity from a velocity versus time graph.

Understand - What do students need to **understand**? What is the **big idea**? *List broad concepts or “big ideas” in a statement of enduring understanding.*

The difference between constant, instantaneous and average speed.

The difference between velocity and acceleration.

What kind of information can be obtained from a velocity vs time and position vs time graph.

The differences between constant velocity and accelerated motion

Learning Outcome - What do students need to be able to **accomplish** by the unit’s end? *List skills and competencies.*

Learners will be able to recreate or interpret an object's motion based on position and velocity graphs.

Assessments:

- Quiz: Speed, Velocity, Acceleration
- Motion Matchup Lab Completion
- Exam: How can motion be described?

Software/Resources:

- Schoology
- Google Drive
- EdPuzzle
- Vernier LabPro & Motion Detectors

**Pequea Valley School District
STEM Department**

Unit: Rocketry & Newton's Laws

Course: STEM 9 Conceptual Physics

Grade: 9

Planning the Focus Based on the Desired Result

What do you want all students to know, understand and do by the end of the unit?

Unit Essential Question(s)

How does an engineer use Newton's Laws to launch and land a rocket?

Keystone Eligible Content/PA Core Standard

3.1.12.A Apply concepts of systems, subsystems, feedback and control to solve complex technological problems.

3.1.12.B Apply concepts of models as a method to predict and understand science and technology.

3.1.12.C Assess and apply patterns in science and technology.

3.4.10.C Distinguish among the principles of force and motion.

Pacing: Approximate number of class sessions per unit

8 days

Tier 3 Vocabulary (Content specific vocabulary)

free-fall, gravity, speed, velocity, acceleration, inertia, Newton's First Law of Motion, force, Newton's Second Law of Motion, mass, weight, Newtons, kilograms

Know - What do students need to **know** in order to be able to do and understand? *List concepts, such as facts, formulas, key vocabulary and knowledge "nuggets".*

What inertia is

The difference between mass and weight

How to calculate weight

Conditions necessary for free-fall

How mass, force, and acceleration are measured.

Understand - What do students need to **understand**? What is the **big idea**? *List broad concepts or "big ideas" in a statement of enduring understanding.*

How Force, Mass, and Acceleration of an object are related

How Newton's Laws apply to accelerating objects, such as free-fall balls, rockets, and cars

Learning Outcome - What do students need to be able to **accomplish** by the unit's end? *List skills and competencies.*

Create an experiment that verifies Newton's 2nd Law

Communicate the structure and results of an experiment

Communicate the relationship between Force, Mass, and Acceleration

Assessments:

- Newton's 2nd Law Lab Report
- Quiz: Newton's 1st Law
- Quiz: Newton's 1st and 2nd Laws
- Exam: Newton's 1st and 2nd Laws

Software/Resources:

Schoology

Explore Learning/ Gizmo

Google Drive

Altimeter and ipad

Vernier Motion Sensors