

**Pequea Valley School District
Science**

Unit: Thermodynamics

Course: Physics II

Grade: 10-12

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 we use the transfer of heat to create an engine?

Keystone Eligible Content/PA Core Standard

- 3.4.12.B Apply and analyze energy sources and conversions and their relationship to heat and temperature.
- 3.4.10.A Explain concepts about the structure and properties of matter.
- 3.1.10.B Describe concepts of models as a way to predict and understand science and technology.
- 3.1.10.D Apply scale as a way of relating concepts and ideas to one another by some measure.
- 3.1.10.E Describe patterns of change in nature, physical and man-made systems.

Pacing: Approximate number of class sessions per unit

25 classes

Tier 3 Vocabulary (Content specific vocabulary)

Heat
Temperature
Celsius
Fahrenheit
Kelvin
Internal Energy
Conduction
Convection
radiation
Calorimetry
Latent heat
Phase changes
Heat of fusion/vaporization
Thermal equilibrium
Heat capacity
Joules

Efficiency
Carnot cycle

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

Temperature can be changed by transferring energy to or from a substance.

Thermal equilibrium is the condition when two or more objects reach a common temperature when in contact with each other.

Three methods of heat transfer

Energy moves from objects of higher temperature to objects of lower temperature.

Heat and work can transfer energy to or from a system, changing its internal energy.

Work is defined as the product of gas pressure and the change in the volume of a gas for thermodynamic systems.

Energy is conserved and described by the first law of Thermodynamics.

A cyclic process returns a system to conditions identical to those it had before the process began making the internal energy unchanged.

The second law of thermodynamics states that no machine can transfer all of its absorbed energy by means of work.

The efficiency of a heat engine depends on the amount of energy transferred by heat to and from the engine.

The unit for energy is Joules.

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

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

How to convert different units of temperature.

How to calculate the amount of energy needed to change the temperature of a substance.

How to calculate the amount of energy required to change the phase of a substance.

Calculate the work done on or by a gas.

Relate the pressure and volume of a gas during an isothermal expansion or compression.

Relate the pressure and temperature of a gas during constant-volume heating or cooling, or the volume and temperature during constant-pressure heating or cooling.

Calculate the work performed on or by a gas during an expansion or compression at constant pressure.

Understand the process of adiabatic expansion or compression of a gas.

Identify or sketch on a PV diagram the curves that represent each gas process.
Compute the efficiency of a heat engine.

Literature:

Software/Resources:

Pequea Valley School District
Science

Unit: Light Waves

Course: Physics II

Grade: 10-12

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):

What is visible light and how does it travel and interact with materials around it?

Keystone Eligible Content/PA Core Standard

- 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.
- 3.2.12.B Evaluate experimental information for appropriateness and adherence to relevant science processes.
- 3.4.12.C Apply the principles of motion and force.

Pacing: Approximate number of class sessions per unit

35

Tier 3 Vocabulary (Content specific vocabulary)

Electromagnetic waves
Radiowaves
Microwaves
Infrared waves
Visible light
Ultraviolet light
Xrays
Gamma rays
Real and virtual images
Angle of incidence
Angle of reflection and refraction
Concave
Convex
Polarization
Object and image distance

Magnification
Focal length
Radius of curvature
Specular
diffuse
Refraction
Critical angle
Dispersion
Index of refraction
Lens
Total internal reflection
Medium
Parallel ray
Central ray
Focal ray

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

Identify the components of the electromagnetic spectrum

Calculate the frequency and wavelength of electromagnetic radiation

Law of reflection for flat mirrors

Mirror equation

Snell’s Law

Thin lens equation

Calculate the magnification of lenses.

Atmospheric conditions that cause refraction.

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

Light has a finite speed.

Inverse square law

How images are formed from a flat mirror.
Difference between real and virtual images
How to draw ray diagrams for flat and curved mirrors.
How to use the mirror equation to calculate distances and focal lengths for a mirror.
How additive colors affect the color of light.
How pigments affect the color of reflected light.
How polarized light is formed and detected.
When light is refracted.
Identify the direction light will bend when passing from one medium to another.
Whether light will be refracted or undergo total internal reflection

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

Identify the components of the electromagnetic spectrum and relate their frequency and wavelength to the speed of light.
Explain the relationship between distance and brightness for a light source.
Apply laws of reflection to mirrors and use ray diagrams and the mirror equation to determine the image location and characteristics of the image.
Explain how polarized light is formed and detected.
Explain how mirrors can be used in surveillance devices.
Create an operating telescope from two lenses.

Literature:

Software/Resources:

Pequea Valley School District
Science

Unit: Static Electricity

Course: Physics II

Grade: 10-12

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):

What happens at the atomic level to create static electricity?

Keystone Eligible Content/PA Core Standard

3.4.12.A Apply concepts about the structure and properties of matter.

Pacing: Approximate number of class sessions per unit

20 class periods

Tier 3 Vocabulary (Content specific vocabulary)

electron proton atom polarization insulator conductor friction induction conduction grounding Coulomb's Law
Electrostatic force electric field source charge

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

- The difference between insulators and conductors to explain how and why polarization occurs.
- The grounding process and to explain how it occurs in terms of electron movement.
- The mathematical definition of electric field (force/charge) and to describe the dependence of the electric field strength upon the variables that affect it.

- To understand that all sources of charge create an influence or action upon other objects some distance away and that the electric field concept is used to describe that influence.

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

- How objects become charged by the addition or removal of electrons.
- How an object gets charged through friction, conduction, and induction.
- That objects are charged if there is an imbalance of protons and electrons.
- Understand the convention for electric field direction to identify the electric field direction around a source charge.

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

- Identify the type of charge on an object by observing its interactions with other charged and neutral objects.
- Predict the charge on an object when charged through friction, conduction, or induction.
- To combine Coulomb’s Law equation with Newton’s second law, free-body diagrams and trigonometric functions to analyze physical situations that include interacting charges.
- Calculate the amount of charge on an object if given the number of excess protons or electrons.
- Use Coulomb’s Law equation to make predictions of the effect of alteration in the quantity of charge or the separation distance upon the amount of electrostatic force.
- To use Coulomb’s Law equation to algebraically solve for an unknown quantity (F , d , θ_1 or θ_2).
- To use the electric field equation, Coulomb’s law equation, and Newton’s laws to analyze physical situations that involve electric fields and to solve problems associated with such situations.
- To construct and to interpret electric field line diagrams for isolated charges and for collections of two or more charges.

| |
|--|
| |
| |
| |

Literature:

Software/Resources:

**Pequea Valley School District
Science**

Unit: Current Electricity

Course: Physics II

Grade: 11-12

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 the wiring of a circuit alter the current in and potential difference across each element?
What happens when both types of circuits are combined in a single circuit?

Keystone Eligible Content/PA Core Standard

3.4.10.B Analyze energy sources and transfers of heat.

Pacing: Approximate number of class sessions per unit
30 class periods

Tier 3 Vocabulary (Content specific vocabulary)

Current voltage resistance circuit power potential energy parallel circuit
Series circuit schematic diagram equivalent resistance Ohm's Law
Electric potential voltage drop kilowatt-hour voltmeter ammeter
Resistor LED coulomb

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

Current as the rate of charge flow per second measured in Amperes (Amps)

Voltage is measured in Volts and is the amount of energy in 1 coulomb of charge.

Resistance is measured in Ohms and is defined as slowing of charge.

Conditions which must be met in order for electric current to be established in a circuit.

Ohm's Law relates current, voltage and resistance.

Components of a circuit.

A parallel circuit has more than one path to conduct electricity.

In a parallel circuit, the total current is equal to the sum of the current through each resistor.

In a parallel circuit, the total voltage is the same across each resistor.

As more resistors are added in a parallel circuit, the total resistance decreases.

A series circuit has only one path to conduct electricity.

In a series circuit, the total resistance is equal to the sum of all the resistors.

In a series circuit, the total current is the same throughout each resistor.

In a series circuit, the total voltage is equal to the sum of the voltage across each resistor.

Power is the amount of energy transferred in a given amount of time (1 second) and measured in Joules/second (Watts).

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

Difference between a series and parallel circuit and how to interpret a schematic diagram of both types of circuits.

The relationship between current, voltage, and resistance to solve simple problems.

Electric bills are based on the amount of power consumed.

Current flows in a circuit when there is a voltage difference.

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

Calculate the equivalent resistance in a series, parallel, and combination circuit.

Draw a schematic of simple series, parallel, and combination circuits.

Apply Ohm's Law to simple series, parallel, and combination circuits.

Calculate the power rating of appliances given their voltage and current.

Calculate the cost of running an appliance for a certain amount of time.

Literature:

Software/Resources:

**Pequea Valley School District
Science**

Unit: Electromagnetism

Course: Physics II

Grade: 11-12

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 are magnetism and magnetic fields related to moving charges?

Keystone Eligible Content/PA Core Standard
3.4.10.C

Pacing: Approximate number of class sessions per unit
15 days

Tier 3 Vocabulary (Content specific vocabulary)

Magnetism
Domain
Electron spin
Generator
Motor
Right-hand rule
Commutator
Magnetic flux
Magnetic field
Permanent and temporary magnets
Electromagnetic induction
galvanometer

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

Whether magnets will attract or repel in a given situation.

The orientation of Earth’s magnetic field.

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

Explain magnetism in terms of the domain theory of magnetism.

The difference between the magnetic fields produced by the current in a straight conductor and in a solenoid.

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

Use the right-hand rule to find the direction of the force on a charge moving through a magnetic field.

Determine the strength of a magnetic field given the force on a charge in a magnetic field.

Determine the magnitude and direction of the force on a wire carrying current in a magnetic field.

Literature:

Software/Resources: