

Wallenpaupack Area School District Planned Course Curriculum Guide

Science

Physics II

Course Description:

Physics II continues the study of physics with laboratory experiences. The course is a survey of fluid mechanics, thermodynamics, waves, sound, light, optics, electricity, magnetism, and modern atomic and subatomic physics. The course uses the mathematics of algebra, geometry, and some trigonometry.

Initial Creation Date and Revision Dates:

This curriculum was initially completed in the Fall of 2025 by Ryan Neenan. Completion Date:

Textbook Resource:

Physics, Serway & Faughn. © 2012 by Holt McDougal

Unit Breakdown (90 Days of 84 Minute Blocks):

- 1) Kinetic Molecular Theory and Fluid Mechanics (~6 days)
- 2) Thermodynamics (~10 days)
- 3) Waves and Sound (~10 Days)
- 4) Light, Reflection, and Color (~10 days)
- 5) Refraction, Diffraction, and Interference (~10 days)
- 6) Electrostatics and Electric Energy (~8 days)
- 7) Current and Circuits (~10 days)
- 8) Magnetism and Magnetic Induction (~10 days)
- 9) Atomic and Subatomic Physics* (~10 days)

* This unit may be shortened based on lack of time due to snow/other interruptions
Any remaining days are devoted to the Final Exam and Exam Review

Wallenpaupack Area School District Curriculum	
COURSE: Physics II	GRADE/S: 11-12
UNIT 1: Kinetic Molecular Theory and Fluid Mechanics	TIMEFRAME: ~6 Days

PA STEELS:

3.2.6-8.B

Develop a model that predicts and describes changes in the particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

3.2.6-8.O

Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

3.2.9-12.I

Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

3.2.6-8.H

Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

UNIT OBJECTIVES:

Students will be able to:

- 1) Describe the model of Kinetic Theory of Gases.
- 2) Define the general ideas of Pressure, Volume, and Temperature.
- 3) State the relationship between temperature and energy.
- 4) Define the idea of a fluid
- 5) Solve for the pressure of a fluid.
- 6) Compare pressures in different units
- 7) Analyze how pressure changes with depth of a fluid.
- 8) Explain Pascal's Law.
- 9) Evaluate the idea of Buoyant Forces with prior understanding of forces.
- 10) Explain Archimedes's Principle
- 11) Calculate the Buoyant force on objects in different situations.
- 12) Summarize the properties of fluid dynamics, including laminar vs. turbulent flow and the concept of ideal fluid flow.
- 13) Evaluate the velocity of fluid flow using the Continuity of Flow equation
- 14) Explain Bernoulli's Principle, and use Bernoulli's Equation to solve for various variables
- 15) Predict the concept of Toricellis's Law.
- 16) Compare and contrast the ideas of lift and drag.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

1. Direct Instruction and Group Discussions on content
2. Lab activity on buoyant force.
3. Class demonstrations of Bernoulli's Principle and Fluid Flow.
4. Computer Simulations/Online Videos
5. Worksheets on Pressure, Buoyant Force, and Bernoulli's Equation

ASSESSMENTS:

1. Formative assessment from teacher observation and checks.
2. Summative quiz at the end of chapters/unit
3. Lab Activities

DIFFERENTIATED INSTRUCTION (Acceleration/Enrichment):

- Due to the varied level of experience in prior math and science classes, students may need DI on basic algebra concepts and/or unit conversions. Prior knowledge from Physics I may need to be reviewed and extra practice may be given for DI. Worksheets/quizzes may be modified to show learning goals. One on one instruction or extra practice may be used if necessary.
- Enrichment problems that employ more difficult problems (college level, where appropriate math levels are available) may be given.

RESOURCES (Technology Based Resources, Text Resources, etc.):

- Physics, (Serway/Faughn), Chapter 8
- Physics for Scientists and Engineers (Serway/Jewett), Chapter 14
- PASCO Hardware and Software
- General Lab Equipment

KEY VOCABULARY:

Fluid, pressure, area, volume, temperature, pascal, Pascal's Law, barometer, absolute pressure, gauge pressure, buoyancy, buoyant force, Archimedes's Principle, Continuity of Fluids, laminar flow, turbulent flow, viscosity, ideal fluid, Bernoulli's Principle, Bernoulli's Equation, Toricelli's Law, lift, drag.

Wallenpaupack Area School District Curriculum	
COURSE: Physics II	GRADE/S: 11-12
UNIT 2: Thermodynamics	TIMEFRAME: ~10 Days

PA STEELS:

3.2.6-8.B

Develop a model that predicts and describes changes in the particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

3.2.6-8.M

Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.

3.2.6-8.N

Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.

3.2.6-8.O

Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

3.2.9-12.R

Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).

UNIT OBJECTIVES:

Students will be able to:

- 1) State the relationship between temperature and internal energy.
- 2) Compare and contrast internal energy with prior knowledge of energy
- 3) Analyze the concept of thermal equilibrium and the 0th law of Thermodynamics
- 4) Relate the idea of thermal expansion to common situations such as a thermometer
- 5) Convert temperatures between various units
- 6) Explain the concept of temperature change in terms of heat.
- 7) List various units besides the joule that can be used to relate heat energy.
- 8) Differentiate between conduction, convection, and radiation.
- 9) Apply the concept of conservation of energy in problems including internal energy.
- 10) Differentiate between specific heat and specific heat capacity
- 11) Calculate for a missing variable in a heat exchange problems using specific and latent heat.
- 12) Compare and contrast latent heat of fusion and latent heat of vaporization.
- 13) Summarize the heating curve of water
- 14) Explain the relationship between heat, work, and internal energy.
- 15) Solve for the work done on or by a gas.
- 16) Differentiate between an isovolumetric, isothermal, and adiabatic process.
- 17) Describe the First Law of Thermodynamics
- 18) Solve for variables using the First Law of Thermodynamics
- 19) Explain the concept of a cyclic process, applying it to concepts like an engine or refrigerator.
- 20) Describe the concept of Entropy and how it is related to the 2nd Law of Thermodynamics.
- 21) Solve for the efficiency of different engines and state the reasons why 100% is impossible.
- 22) Describe the 3rd Law of Thermodynamics and the concept of absolute zero.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

1. Direct Instruction and Group Discussions on content
2. Lab activity on calorimetry and specific heat.
3. Class demonstrations of thermal expansion, specific heat, and thermal equilibrium.
4. Computer Simulations/Online Videos
5. Worksheets on Temperature conversion, conservation of internal energy, Thermal Exchange, and Laws of Thermodynamics.

ASSESSMENTS:

1. Formative assessment from teacher observation and checks.
2. Summative quiz at the end of chapters/unit
3. Lab Activities

DIFFERENTIATED INSTRUCTION (Acceleration/Enrichment):

- Due to the varied level of experience in prior math and science classes, students may need DI on basic algebra concepts and/or unit conversions. Prior knowledge from Physics I may need to be reviewed and extra practice may be given for DI. Worksheets/quizzes may be modified to show learning goals. One on one instruction or extra practice may be used if necessary.
- Enrichment problems that employ more difficult problems (college level, where appropriate math levels are available) may be given.

RESOURCES (Technology Based Resources, Text Resources, etc.):

- Physics, (Serway/Faughn), Chapter 9, 10
- Physics for Scientists and Engineers (Serway/Jewett), Chapter 19-22
- PASCO Hardware and Software
- General Lab Equipment

KEY VOCABULARY:

Temperature, heat, internal energy, thermal equilibrium, thermal expansion, Fahrenheit, Celsius, Kelvin, joule, calorie, BTU, conduction, convection, radiation, heat capacity, specific heat, latent heat, calorimeter, 0th Law of Thermodynamics, Work, isovolumetric, isothermal, adiabatic, 1st Law of Thermodynamics, cyclic process, 2nd Law of Thermodynamics, entropy, efficiency, 3rd Law of Thermodynamics

Wallenpaupack Area School District Curriculum

COURSE: Physics II

GRADE/S: 11-12

UNIT 3: Waves and Sound

TIMEFRAME: ~10 Days

PA STEELS:

3.2.6-8.Q

Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave

3.2.9-12.T

Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.

UNIT OBJECTIVES:

Students will be able to:

- 1) Describe wave motion in a general sense in terms of a sine wave.
- 2) Differentiate between mechanical and EM waves
- 3) Differentiate between transverse and longitudinal waves.
- 4) Differentiate between crests and troughs, rarefactions and compressions
- 5) Define the ideas of wavelength, period, and frequency.
- 6) Solve for a given variable using the relationship between a wave's speed, frequency and wavelength.
- 7) Describe the relationship between a wave's amplitude and energy.
- 8) Describe the concept of interference and the superposition principle.
- 9) Compare and contrast the ideas of constructive and destructive interference.
- 10) Predict what will happen when two waves interfere in different ways.
- 11) Differentiate between reflection, refraction, and diffraction.
- 12) Describe how a standing wave forms.
- 13) State the relationship between standing waves and nodes and antinodes.
- 14) Describe the basic wave properties of a sound wave
- 15) Calculate the speed of sound in air based on temperature
- 16) Differentiate between frequency and pitch
- 17) Differentiate between amplitude and volume
- 18) Describe the Doppler effect conceptually and solve for the change of frequency using relevant equations
- 19) Differentiate between sound intensity and relative intensity.
- 20) Describe the sonic spectrum in human terms, and summarize the effects of relative sound intensity on human biology.
- 21) Calculate both sound intensity and relative intensity.
- 22) Explain the idea of forced vibrations and resonance using examples.
- 23) Connect the ideas of standing waves to sound using the idea of harmonics.
- 24) Calculate frequencies using the mathematical relationships of different harmonic series
- 25) Describe the nature of beats and how they form.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

1. Direct Instruction and Group Discussions on content
2. Lab activities on Wave Interactions, Standing Waves, and Sound Intensity
3. Class demonstrations of resonance, standing waves, doppler effect.
4. Computer Simulations/Online Videos
5. Worksheets on Wave properties and interactions, doppler effect, sound intensity, and harmonics

ASSESSMENTS:

6. Formative assessment from teacher observation and checks.
7. Summative quiz at the end of chapters/unit
8. Lab Activities

DIFFERENTIATED INSTRUCTION (Acceleration/Enrichment):

- Due to the varied level of experience in prior math and science classes, students may need DI on basic algebra concepts and/or unit conversions. Prior knowledge from Physics I may need to be reviewed and extra practice may be given for DI. Worksheets/quizzes may be modified to show learning goals. One on one instruction or extra practice may be used if necessary.
- Enrichment problems that employ more difficult problems (college level, where appropriate math levels are available) may be given.

RESOURCES (Technology Based Resources, Text Resources, etc.):

- Physics, (Serway/Faughn), Chapter 11, 12
- Physics for Scientists and Engineers (Serway/Jewett), Chapter 16-18
- PASCO Hardware and Software
- General Lab Equipment

KEY VOCABULARY:

Wave, medium, mechanical wave, electromagnetic wave, transverse, longitudinal, crest, trough, rarefaction, compression, wavelength, frequency, period, hertz, superposition principle, interference, reflection, refraction, diffraction, standing wave, node, antinode, pitch, sonic spectrum, Doppler Effect, sound intensity, threshold of hearing, threshold of pain, relative intensity, decibels, resonance, harmonic series, fundamental frequency, timbre, beat

Wallenpaupack Area School District Curriculum	
COURSE: Physics II	GRADE/S: 11-12
UNIT 4: Light, Reflection, and Color	TIMEFRAME: ~10 Days

PA STEELS:

3.2.9-12.V

Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model and that for some situations one model is more useful than the other.

3.2.6-8.R

Develop and use a model to describe how waves are reflected, absorbed, or transmitted through various materials.

3.2.9-12.W

Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.

UNIT OBJECTIVES:

Students will be able to:

- 1) Summarize the historical development of the theory of light, citing specific instances of evidence that changed the theory.
- 2) Describe the Electromagnetic theory
- 3) List the major parts of the EM spectrum, relating them to their relative changes in wavelength, frequency, and energy.
- 4) Differentiate between illuminated and luminous objects, as well transparent, translucent, and opaque.
- 5) Contrast and solve for luminous intensity, luminous flux, and illuminance.
- 6) Differentiate between specular and diffuse reflection
- 7) State the Laws of Reflection
- 8) Interpret and draw ray tracing diagrams of both flat and curved mirrors.
- 9) Differentiate between concave and convex mirrors and between real and virtual images.
- 10) Describe an image created in front of flat and curved mirrors given initial conditions.
- 11) Solve for the properties of an image using equations relating to the focal length of a mirror, the distances of the object and image to the mirror surface, and the heights of the image and object.
- 12) Define curved mirror terminology.
- 13) Explain the working concepts behind reflecting telescopes.
- 14) Describe the concept of color as it relates to light.
- 15) Explain the idea of scattering of light and how it explains the color of the sky and sunsets
- 16) Predict the color seen by using both the addition and subtraction of colored light
- 17) Define the idea of polarization and how it can occur in various ways.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

1. Direct Instruction and Group Discussions on content
2. Lab activities on reflection, polarization, and color
3. Class demonstrations of reflection, illuminance, and polarization
4. Computer Simulations/Online Videos
5. Worksheets on the EM Spectrum, light properties and reflection math.

ASSESSMENTS:

1. Formative assessment from teacher observation and checks.
2. Summative quiz at the end of chapters/unit
3. Lab Activities

DIFFERENTIATED INSTRUCTION (Acceleration/Enrichment):

- Due to the varied level of experience in prior math and science classes, students may need DI on basic algebra concepts and/or unit conversions. Prior knowledge from Physics I may need to be reviewed and extra practice may be given for DI. Worksheets/quizzes may be modified to show learning goals. One on one instruction or extra practice may be used if necessary.
- Enrichment problems that employ more difficult problems (college level, where appropriate math levels are available) may be given.

RESOURCES (Technology Based Resources, Text Resources, etc.):

- Physics, (Serway/Faughn), Chapter 13
- Physics for Scientists and Engineers (Serway/Jewett), Chapter 35-36
- PASCO Hardware and Software
- General Lab Equipment

KEY VOCABULARY:

Electromagnetic spectrum, radio, microwaves, infrared, visible light, ultraviolet, x-rays, gamma rays, speed of light, electromagnetic theory, luminous, illuminated, transparent, translucent, opaque, luminous intensity, luminous flux, illuminance, candela, lumens, lux, specular reflection, diffused reflection, Laws of Reflection, concave, convex, real image, virtual image, center of curvature, vertex, principal axis, secondary axis, principal focus, focal length, aperture, magnification, spherical aberration, scattering, primary colors, secondary colors, polarization

Wallenpaupack Area School District Curriculum	
COURSE: Physics II	GRADE/S: 11-12
UNIT 5: Refraction, Diffraction, and Interference	TIMEFRAME: ~10 Days

PA STEELS:

3.2.9-12.V

Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model and that for some situations one model is more useful than the other.

3.2.6-8.R

Develop and use a model to describe how waves are reflected, absorbed, or transmitted through various materials.

3.2.9-12.W

Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.

UNIT OBJECTIVES:

Students will be able to:

- 1) Describe the causes of refraction
- 2) State the Laws of Refraction
- 3) Solve for the index of refraction of a given material
- 4) Calculate unknown quantities, including a critical angle, using Snell's Law
- 5) Describe the situation that results in total internal reflection
- 6) Differentiate between a converging lens and a diverging lens
- 7) Compare and contrast the properties of converging and diverging lenses
- 8) Compare and contrast the images formed by mirrors and lenses
- 9) Construct ray diagrams of both converging and diverging lenses
- 10) Apply the math learned with reflection to refraction situation, solving for unknown variables related to the object or image of the object under refraction
- 11) List ways the focal length of a lens can change
- 12) Describe the application of multiple lenses in the human eye, a microscope, and the refracting telescope
- 13) Explain how refraction happens in the atmosphere and its applications
- 14) Recognize the effects of chromatic aberration
- 15) Recall the basic idea of interference
- 16) Differentiate between coherent and incoherent light and it relates to interference
- 17) Discuss Thomas Young's Double Slit experiment and how it explained interference and diffraction
- 18) Describe how interference can happen in thin films
- 19) Diagram how path difference can lead to interference
- 20) Use interference patterns to solve for the wavelength of the light causing them
- 21) Compare and contrast the ideas of interference and diffraction
- 22) Solve problems involving quantities related to a diffraction grating

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

1. Direct Instruction and Group Discussions on content
2. Lab activities on refraction, interference, and diffraction
3. Class demonstrations of refraction, interference, and diffraction
4. Computer Simulations/Online Videos
5. Worksheets on the refraction, interference, and diffraction

ASSESSMENTS:

1. Formative assessment from teacher observation and checks.
2. Summative quiz at the end of chapters/unit
3. Lab Activities

DIFFERENTIATED INSTRUCTION (Acceleration/Enrichment):

- Due to the varied level of experience in prior math and science classes, students may need DI on basic algebra concepts and/or unit conversions. Prior knowledge from Physics I may need to be reviewed and extra practice may be given for DI. Worksheets/quizzes may be modified to show learning goals. One on one instruction or extra practice may be used if necessary.
- Enrichment problems that employ more difficult problems (college level, where appropriate math levels are available) may be given.

RESOURCES (Technology Based Resources, Text Resources, etc.):

- Physics, (Serway/Faughn), Chapter 14-15
- Physics for Scientists and Engineers (Serway/Jewett), Chapter 35-38
- PASCO Hardware and Software
- General Lab Equipment

KEY VOCABULARY:

Optical density, refraction, index of refraction, Snell's Law, total internal reflection, critical angle, converging lens, diverging lens, myopia, hyperopia, compound microscope, refracting telescope, dispersion, chromatic aberration, interference, path difference, double slit experiment, coherent light, diffraction grating, diffraction

Wallenpaupack Area School District Curriculum	
COURSE: Physics II	GRADE/S: 11-12
UNIT 6: Electrostatics and Electric Energy	TIMEFRAME: ~8 Days

PA STEELS:

3.2.9-12.B

Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles

3.2.6-8.H

Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

3.2.6-8.I

Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.

3.2.6-8.K

Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.

3.2.9-12.L

Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.

3.2.6-8.P

Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.

3.2.9-12.S

Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

UNIT OBJECTIVES:

Students will be able to:

- 1) State the basic concept of charge and where it comes from, and how it is moved.
- 2) Differentiate between static electricity and current
- 3) Explain the basic law of electrostatics
- 4) Compare and contrast the forces of gravity and electricity
- 5) Differentiate between charging by contact, charging by induction, and polarization
- 6) Describe the force between two charges, and solve for the force using Coulomb's Law
- 7) Explain the concept of an electric field
- 8) Solve for the strength of an electric field given measured quantities
- 9) Draw the electric field around one or more charges.
- 10) Define electric potential energy
- 11) Compare and contrast gravitational potential energy and electric potential energy
- 12) Differentiate between electric potential energy and potential difference (or voltage)
- 13) Calculate electric potential energy and voltage
- 14) Explain how a typical battery works
- 15) Explain what a capacitor does and how they are constructed
- 16) Solve for the strength of a capacitor

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

1. Direct Instruction and Group Discussions on content
2. Lab activities on electric fields, voltage and capacitance
3. Class demonstrations of electrostatics and voltage
4. Computer Simulations/Online Videos
5. Worksheets on the electric force, electric fields, voltage, and capacitance

ASSESSMENTS:

1. Formative assessment from teacher observation and checks.
2. Summative quiz at the end of chapters/unit
3. Lab Activities

DIFFERENTIATED INSTRUCTION (Acceleration/Enrichment):

- Due to the varied level of experience in prior math and science classes, students may need DI on basic algebra concepts and/or unit conversions. Prior knowledge from Physics I may need to be reviewed and extra practice may be given for DI. Worksheets/quizzes may be modified to show learning goals. One on one instruction or extra practice may be used if necessary.
- Enrichment problems that employ more difficult problems (college level, where appropriate math levels are available) may be given.

RESOURCES (Technology Based Resources, Text Resources, etc.):

- Physics, (Serway/Faughn), Chapter 16-17
- Physics for Scientists and Engineers (Serway/Jewett), Chapter 23, 25-26
- PASCO Hardware and Software
- General Lab Equipment

KEY VOCABULARY:

Charge, static electricity, electron, proton, nucleus, electroscope, basic law of electrostatics, conduction, conductivity, induction, polarization, coulomb, coulomb's constant, electric field, conductor, insulator, electric potential energy, electric potential, electric potential difference, voltage, volt, battery, electromotive force, capacitor, capacitance, farad, dielectric

Wallenpaupack Area School District Curriculum	
COURSE: Physics II	GRADE/S: 11-12
UNIT 7: Current and Circuits	TIMEFRAME: ~10 Days

PA STEELS:

3.2.6-8.I

Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.

3.2.6-8.K

Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.

3.2.6-8.P

Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.

3.2.9-12.S

Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

UNIT OBJECTIVES:

Students will be able to:

- 1) Differentiate between current and static electricity
- 2) State the mathematical definition of current
- 3) Explain the convention to define the direction of current
- 4) Describe the role of resistance in a circuit
- 5) Solve for a missing variable using Ohm's Law
- 6) List factors that can affect the resistance of an object, wire, or the human body
- 7) Differentiate between AC and DC current
- 8) Solve for the electric power of a circuit
- 9) Draw diagrams of basic circuits
- 10) List the symbols used to represent different components of a circuit
- 11) Differentiate between a closed, opened, and short circuit
- 12) Compare and contrast the concept of a series and parallel circuit
- 13) State the resistance of a resistor by using the color code system
- 14) Solve for voltages, currents, and resistances in a series, parallel, and complex circuit
- 15) Accurately use a multimeter to measure voltages, current, and resistances in series, parallel, and complex circuits.
- 16) Predict what will happen to the system when a component of the circuit is altered
- 17) State Kirchoff's Laws

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

1. Direct Instruction and Group Discussions on content
2. Lab activities on circuits
3. Class demonstrations of current and resistance
4. Computer Simulations/Online Videos
5. Worksheets on the Ohm's Law and circuits

ASSESSMENTS:

1. Formative assessment from teacher observation and checks.
2. Summative quiz at the end of chapters/unit
3. Lab Activities

DIFFERENTIATED INSTRUCTION (Acceleration/Enrichment):

- Due to the varied level of experience in prior math and science classes, students may need DI on basic algebra concepts and/or unit conversions. Prior knowledge from Physics I may need to be reviewed and extra practice may be given for DI. Worksheets/quizzes may be modified to show learning goals. One on one instruction or extra practice may be used if necessary.
- Enrichment problems that employ more difficult problems (college level, where appropriate math levels are available) may be given.

RESOURCES (Technology Based Resources, Text Resources, etc.):

- Physics, (Serway/Faughn), Chapter 17-18
- Physics for Scientists and Engineers (Serway/Jewett), Chapter 27-28
- PASCO Hardware and Software
- General Lab Equipment

KEY VOCABULARY:

Electric current, ampere, conventional current, resistance, ohm, Ohm's Law, potentiometer, electric power, direct current, alternating current, schematic diagram, load, closed circuit, open circuit, short circuit, series, parallel, multimeter, Kirchoff's Laws

Wallenpaupack Area School District Curriculum	
COURSE: Physics II	GRADE/S: 11-12
UNIT 8: Magnetism and Magnetic Induction	TIMEFRAME: ~10 Days

PA STEELS:

3.2.6-8.I

Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.

3.2.6-8.K

Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.

3.2.9-12.S

Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

3.2.9-12.M

Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.

UNIT OBJECTIVES:

Students will be able to:

- 1) Discuss the early scientific thought on magnetism
- 2) Differentiate between ferromagnetic, diamagnetic, and paramagnetic materials.
- 3) Explain the domain theory of magnetism
- 4) Describe induced magnification
- 5) State the basic law of magnetic force
- 6) Explain the concept of a magnetic field.
- 7) Solve for the strength of a magnetic field
- 8) Draw lines around a given magnetic object
- 9) Discuss the magnetic field around the Earth
- 10) Explain the concept of electromagnetism
- 11) Describe what a solenoid is
- 12) Describe the shape and direction of a magnetic field around a straight conductor, a solenoid, or a particle with the appropriate Right Hand Rules
- 13) Solve for the force on a particle that is moving in a magnetic field and the force on a current carrying wire in a magnetic field
- 14) Discuss Faraday's experiments with EM induction, stating the three ways an emf can be induced.
- 15) Calculate an induced emf from a magnetic field using Faraday's Law.
- 16) Explain the meaning of Lenz's Law
- 17) Describe how a generator and a motor work
- 18) Explain the idea of mutual inductance
- 19) Compare and contrast induced AC and DC current and voltages
- 20) Describe how a transformer works

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

1. Direct Instruction and Group Discussions on content
2. Lab activities on magnetic induction
3. Class demonstrations of magnetism and magnetic force
4. Computer Simulations/Online Videos
5. Worksheets on the magnetic force, magnetic fields, and induction

ASSESSMENTS:

1. Formative assessment from teacher observation and checks.
2. Summative quiz at the end of chapters/unit
3. Lab Activities

DIFFERENTIATED INSTRUCTION (Acceleration/Enrichment):

- Due to the varied level of experience in prior math and science classes, students may need DI on basic algebra concepts and/or unit conversions. Prior knowledge from Physics I may need to be reviewed and extra practice may be given for DI. Worksheets/quizzes may be modified to show learning goals. One on one instruction or extra practice may be used if necessary.
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RESOURCES (Technology Based Resources, Text Resources, etc.):

- Physics, (Serway/Faughn), Chapter 19-20
- Physics for Scientists and Engineers (Serway/Jewett), Chapter 29-33
- PASCO Hardware and Software
- General Lab Equipment

KEY VOCABULARY:

Magnetism, ferromagnetic, domain theory of magnetism, induced magnetism, magnetic force, magnetic flux, weber, magnetic flux density, magnetic field, tesla, magnetic declination, magnetosphere, electromagnetism, solenoid, 1st Right Hand Rule, 2nd Right Hand Rule, 3rd Right Hand Rule, electromagnetic induction, Lenz's Law, Faraday's Law, generator, motor, inductance, transformer

Wallenpaupack Area School District Curriculum	
COURSE: Physics II	GRADE/S: 11-12
UNIT 9: Atomic and Subatomic Physics	TIMEFRAME: ~10 Days

PA STEELS:

3.2.9-12.H

Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.

3.2.9-12.N

Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

3.2.9-12.O

Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known

UNIT OBJECTIVES:

Students will be able to:

- 1) Analyze the role of blackbody radiation and the ultraviolet catastrophe in the theory of energy quantization and quantum mechanics.
- 2) Calculate the energy of different frequencies using Planck's Equation
- 3) Use Planck's Equation to explain Einstein's Photoelectric Effect and calculate different variables involved in a photoelectric effect interaction.
- 4) Explain the significance of the Compton Effect and how it supports the photon theory of light
- 5) Compare the early models of the atom.
- 6) Contrast Emission and Absorption Spectra.
- 7) Connect the idea of Spectra and how it explains the Model of the Atom
- 8) Derive the connection between Planck's Equation, Einstein's Energy Equation, and the de Broglie wavelength equation.
- 9) Describe the Uncertainty Principle and how it explains the electron cloud.
- 10) Describe the composition of the nucleus and the role the strong force plays in its composition.
- 11) Solve for the binding energy of a nucleus.
- 12) Differentiate between alpha, beta, and gamma decay.
- 13) Solve for the half-life of different elements
- 14) Differentiate between fission and fusion
- 15) Review the Standard Model.
- 16) Identify the mediating field particles of the four fundamental forces.
- 17) Differentiate between leptons, hadrons, mesons, baryons, and quarks.
- 18) Compare and contrast antimatter with normal matter, and dark energy to normal energy.
- 19) Evaluate the validity of the Standard Model.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

1. Direct Instruction and Group Discussions on content
2. Class demonstrations of atomic spectra
3. Computer Simulations/Online Videos
4. Worksheets on Plank's Equation, Photoelectric Effect, Atomic Spectra, Half Life, and Nuclear Decay

ASSESSMENTS:

1. Formative assessment from teacher observation and checks.
2. Summative quiz at the end of chapters/unit
3. Lab Activities

DIFFERENTIATED INSTRUCTION (Acceleration/Enrichment):

- Due to the varied level of experience in prior math and science classes, students may need DI on basic algebra concepts and/or unit conversions. Prior knowledge from Physics I may need to be reviewed and extra practice may be given for DI. Worksheets/quizzes may be modified to show learning goals. One on one instruction or extra practice may be used if necessary.
- Enrichment problems that employ more difficult problems (college level, where appropriate math levels are available) may be given.

RESOURCES (Technology Based Resources, Text Resources, etc.):

- Physics, (Serway/Faughn), Chapter 21-22
- Physics for Scientists and Engineers (Serway/Jewett), Chapter 39-46
- PASCO Hardware and Software
- General Lab Equipment

KEY VOCABULARY:

Blackbody Radiation, Ultraviolet Catastrophe, Plank's Constant, Plank's Equation, Quantum Mechanics, Photon, quantization, photoelectric effect, work function, Compton Shift, Einstein's Energy Equation, atomic spectra, nucleus, proton, electron, neutron, emission, absorption, The Bohr Model, de Broglie Wavelength, Uncertainty Principle, electron cloud, isotope, strong force, binding energy, nuclear decay (alpha, beta, gamma), radiation, radioactivity, neutrino, becquerel, half-life, decay constant, fission, fusion, standard model, gluon, W Boson, Z Boson, graviton, lepton, hadron, meson, baryon, quark, antimatter, dark energy