Elizabethtown Area School District

AP Physics 1

Course Number:	335A	Length of Course:	2 marking periods
Grade Level:	11-12	Total Clock Hours:	
Length of Period:	80 minutes	Date Written:	Course adopted 2014/2015
Periods/Week:	5 periods/week	Written By:	David Cherry
Credits (if app.):	1.0	Weighting: 1.2	

Prerequisite: Calculus

Course Description:

This weighted course covers topics in mechanics, rotational motion, electrostatics, electric circuits, and waves that are included in introductory college physics courses. The course will also allow students to explore these topics in a laboratory setting, with the emphasis on solving calculus based physics problems. This course would be beneficial for those who plan to major in physics, mathematics, chemistry or engineering in college. Upon successful completion of this course students may choose to take the Advanced Placement Physics I exam. Students scoring three or above may receive college credit from participating colleges or universities.

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I. Overall Course/Grade Level Standards

Students will know and be able to do the following as a result of taking this course.

A. The student will be able to discuss the meaning and significance of the basic principles of physics.

B. The student will be able to analyze technical problems, organize technical information, create a labeled sketch, develop a logical approach to problem solving, arrive at a solution, and ascertain the reasonableness of the solution.

C. The student will be able to interpret graphs (graphs constructed on paper and Microsoft Excel), and will be able to correctly present laboratory and classroom data in a graphical format.

D. The student will be able to synthesize new approaches to problems by considering skills, knowledge, and experiences gained in prior units of study or other courses.

E. The student will be able to collect, statistically analyze, and interpret data taken from computers, mechanical, or electrical equipment in the laboratory, as well as prepare written lab reports detailing important points of the lab and the significance of the results.

F. The student will recognize the role of the computer as a data collection and analysis instrument in the modern laboratory setting.

G. The student will know how to analyze and make predictions concerning the position, speed, and acceleration of objects, particularly the special case of constant acceleration and objects in free fall (motion in one dimension).

H. The student will know how to analyze the motion of objects in two dimensions (projectile motion, uniform circular motion, simple harmonic motion).

I. The student will know how to resolve vectors, and how to perform vector operations such as dot product and cross product.

J. The student will be able to determine forces in physical systems and construct free body diagrams.

K. The student will know how to apply Newton's laws of motion to friction and non-friction situations, how to use the law of universal gravitation, and when to apply the impulse momentum theorem.

L. The student will know how and when to apply conservation principles (conservation of energy, conservation of charge, conservation of nucleons, conservation of mechanical energy, and conservation of momentum).

M. The student will know how to calculate, work, power, kinetic energy, and potential energy, and understand the relationship between work and energy (work-kinetic energy theorem).

N. The student will know the basic principles of rotational motion and rolling motion.

O. The student will know how to analyze problems in electrostatics in different coordinate systems and electrical circuits (using Kirchhoff's voltage and current laws).

P. Students know how to use Ohm's laws and how to calculate equivalent resistances for basic resistive circuits as well as draw and interpret basic schematic diagrams.

Q. The student will know the properties of sound waves and mechanical waves including the Doppler effect and conditions for complete destructive and constructive interference.

R. The student will know the properties of light waves and the electromagnetic spectrum, including the nature of color and the dual nature of light.

S. The students will know the basic characteristics of optical systems, reflection, refraction and interference of light, and be able to predict image characteristics mathematically or through construction of ray diagrams.

T. The student will know the basic vocabulary of each physics discipline including fundamental SI units, variables, and equations.

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II. Content

Major Areas of Study

Unit	Estimated Time	Materials
1. Newtonian Mechanics		Textbook, Prepared Notes, PASCO Science Workshop 750 Computer Interfaces and Probes, Computers, Prepared Problems, Free Response Problems, Mechanics Lab Equipment, College Board Released MC Exams
2. Electricity		Textbook, Prepared Notes, PASCO Science Workshop 750 Computer Interfaces and Probes, Computers, Prepared Problems, Free Response Problems, Electricity and Magnetism Lab Equipment, College Board Released MC Exams
3. Waves and Optics		Textbook, Prepared Notes, PASCO Science Workshop 750 Computer Interfaces and Probes, Computers, Prepared Problems, Free Response Problems, Waves and Optics Lab Equipment, College Board Released MC Exams

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Name of Course: AP Physics 1
Name of Unit: Newtonian Mechanics

Essential Question: How does the universe, and everything in it, move?

Unit Objectives	Priority	Aligned to Course Standard	Aligned to PA Standard
A. Kinematics **1.** Vectors **a)** Students will be able to identify all quantities in Newtonian mechanics as either a vector or a scalar quantity. **b)** Students will be able to resolve a displacement, velocity, or acceleration vector into its vector components. **c)** Students will be able to perform vector addition (graphically and mathematically), vector dot product (work, power), and vector cross product (torque). Students will be able to recognize that the dot product of two vectors is a scalar and the cross product of two vectors is a vector. **d)** Students will be able to utilize unit vector notation in an orthogonal coordinate system. **2.** Motion in One Dimension **a)** Students will be able to understand the mathematical relationships among position, velocity, and acceleration for an object (treated as a point particle) moving in a straight line. **b)** Students will be able to understand the graphical interrelationship between a position vs. time graph, velocity vs. time graph, and an acceleration vs. time graph for constant acceleration. Students will be able to identify the slope of a tangent line on a position vs. time graph as instantaneous velocity, slope of a line on a velocity vs. time graph as acceleration. Students will be able to calculate the area under a velocity vs. time graph as change in position, and the area under an acceleration graph as change in velocity. Students will be able to sketch each graph. **c)** Given a mathematical equation of position vs. time, velocity vs. time, or acceleration vs. time, students will be able to either differentiate or integrate the expression to obtain the other two functions as a function of time (includes finding minimums, maximums, and zeros). **d)** Students will be able to utilize the five equations for constant acceleration to solve free response problems (X and Y directions—derive Y from X-dir.). **e)** Students will be able to describe qualitatively, with the aid of graphs, the acceleration, velocity, and displacement of an object when it is released from rest or is projected vertically upward or downward with a specified initial velocity. **3.** Motion in Two Dimensions **a)** Students will gain a full understanding of independence of motion in the X and Y directions. **b)** Students will be able to identify the horizontal acceleration of a projectile to be zero, and the vertical acceleration of a projectile to be 9.8 m/s^2 downward.	E	V I H G F E D C B A	3.1.12B 3.1.12C 3.1.12D 3.2.12A 3.2.12B 3.2.12C 3.2.12D 3.4.12C 3.4.10C 3.7.12B

c) Students will be able to utilize equations from motion in one dimension to solve problems in motion in two dimensions. **d)** Students will be able to combine equations from motion in one dimension to obtain expressions for range, total time in air, and maximum height of a projectile (horizontal and angled projection). **e)** Students should understand the general motion of a particle in two dimensions so that, given functions x(t) and y(t) which describe this motion, they can determine the components, magnitude, and direction of the particle's velocity and acceleration as functions of time. **f)** Students will be able to identify and sketch graphs of position vs. time, velocity vs. time, and acceleration vs. time for projectile motion (both X and Y directions).			
B) Newton's Laws **1.** First Law (Law of Inertia) **a)** Students will be able to analyze situations in which a particle remains at rest (static equilibrium), or moves with a constant velocity in a straight line, under the influence of several forces. **b)** Students will understand the idea of an inertial frame of reference and a non-inertial frame of reference. **2.** Second Law (**F** = m**A**) **a)** Students will be able to calculate, for a body moving in one direction, the velocity change that results when a constant force acts over a specified time interval. **b)** Students will be able to utilize Newton's Second Law in the impulse momentum form. **(1)** Students will be able to relate impulse to the change in linear momentum and the average force acting on a body. **(2)** Students will be able to identify the area under a force vs. time graph as the impulse. **c)** Students will be able to analyze situations in which an object moves with a specified acceleration under the influence of one or more forces so they can determine the magnitude and direction of the net force, or one of the forces that makes up the net force in situations such as: **(1)** Motion in the X and Y-direction with constant acceleration. **(2)** Motion in a horizontal circle. **(3)** Motion in a vertical circle. **d)** Students will be able to draw complete free-body diagrams for objects that are in static equilibrium and objects that are accelerating. **(1)** Students will be able to draw and accurately label a free-body diagram showing all real forces that act on the object. **(2)** From an accurately labeled free-body diagram students will be able to write down vector summation equations along appropriate coordinate axes (X, Y, radial, tangential, or rotated). **(3)** Students will be able to identify the center of mass of symmetrically shaped objects of uniform density, or locate the center of mass of a system consisting of two symmetrically shaped bodies. **e)** Students will be able to apply Newton's Second Law to objects that are undergoing terminal velocity. **3.** Static and Kinetic Frictional Considerations **a)** Students should have an understanding of the relative magnitude of coefficients of friction and understand their significance. **b)** Students will be able to write down a relationship between the normal and frictional forces on a surface (horizontal or on a ramp). **c)** Students will be able to analyze situations in which a body slides down a	E	V K J F E D C B A	3.1.12B 3.1.12D 3.2.12A 3.2.12B 3.2.12C 3.2.12D 3.4.12C 3.4.10C 3.7.12B

rough inclined plane or is pulled or pushed across a rough surface. **d)** Students will be able to analyze static friction situations to determine under what circumstances a body will undergo slippage, or to calculate the magnitude of the force of static friction. **4.** Third Law (Law of Action/Reaction) **a)** Students should understand how to apply Newton's Third Law so that for a given force they can identify the body on which the reaction force acts and state the magnitude and direction of this reaction force. **b)** Students will understand that action and reaction forces will not produce identical accelerations unless the bodies are of equal mass. **5.** Systems of Two or More Bodies (Coupled Systems) **a)** Students should be able to apply Newton's Laws in analyzing the force between the two bodies that accelerate together along a horizontal or vertical line, or objects coupled on a ramp. **b)** Students will be able to analyze the motion of a system of two bodies coupled together with a string. **c)** Students will be able to understand the forces involved in a large-scale system, such as planetary bodies coupled by gravitational forces. This analysis includes treating the objects as if they are point masses.			
C. Work, Energy, and Power **1.** Work **a)** Students will be able to calculate the work done by a constant force on an object that undergoes a specified displacement. **b)** Students will relate the work done by a force to the area under a graph of force vs. position, and calculate this work in cases where the force is a linear and non-linear function of position (in this case by integration of function). **c)** Students will be able to calculate work as the dot product of the constant force and displacement vectors. **d)** Students will be able to calculate the work done by a variable force (such as a spring force) by integrating the function (for spring $F = -kx$). **2.** Kinetic Energy, Work-Kinetic Energy Theorem **a)** Students will be able to calculate the kinetic energy of an object. **b)** Students will be able to use the work-kinetic energy theorem to calculate the change in kinetic energy or speed that results from performing a specified amount of work on an object. **c)** Students will be able to calculate the work performed by the net force on a body that undergoes a specified change in speed or kinetic energy. **d)** Students will be able to determine the change in a body's kinetic energy and speed that results from the application of specified forces, or to determine the force that is required in order to bring an object to rest in a specified distance. **3.** Conservative Forces and Potential Energy **a)** Students should be able to identify forces as either conservative or non-conservative (mainly frictional forces). **b)** Students will be able to calculate the gravitational potential energy of an object in a uniform gravitational field. **c)** Students will understand that work done by a conservative force is equal to the negative of the change in potential energy. **d)** Students will be able to calculate elastic potential energy. **e)** Students should be able to express the gravitational potential energy of a rigid body in terms of the position of its center of mass. **4.** Conservation of Mechanical Energy, Conservation of Energy **a)** Students will be able to apply conservation of mechanical energy to situations where only conservative forces are present.	E	V M L F E D C B A	3.1.12B 3.1.12D 3.1.12E 3.2.12A 3.2.12B 3.2.12C 3.2.12D 3.4.12A 3.4.12C 3.4.10B 3.4.10C 3.7.12B

b) Students will be able to identify situations in which mechanical energy is converted from one form to another (example: GPE converted to KE) and identify situations in which mechanical energy is, or is not conserved. **c)** Students will be able to amend their conservation of mechanical energy statements to include frictional considerations and non-conservative forces. **d)** Students will be able to apply conservation of energy principles in their analysis of bodies that are moving in a gravitational field. **e)** Students will be able to apply conservation of energy principles in their analysis of bodies that move under the influence of a spring force. **5.** Power **a)** Students will be able to calculate the power required to maintain the motion of a body with constant acceleration such as a body moving on a level surface, a body raised at a constant rate, or a body that is overcoming friction. **b)** Students will be able to calculate the work performed by a force that supplies constant power, or the average power supplied by a force that performs a specified amount of work. **c)** Students will be able to calculate power as the dot product of force and velocity vectors.			
D. Linear Momentum, Conservation of Linear Momentum, Collisions **1.** Students will be able to calculate the linear momentum of an object. **2.** Students will be able to set up and solve conservation of momentum statements for collisions in one-dimensional and two-dimensional situations. **3.** Students will be able to apply conservation of linear momentum to determine the final velocity of one of the objects when two objects that are moving in one or two dimensions collide. **4.** Students will be able to identify a collision as elastic, inelastic, or perfectly inelastic and apply conservation of momentum. Students should be able to give examples of each type of collision. **5.** If a collision is proven to be inelastic, students should be able to calculate the amount of kinetic energy lost as a result of the collision.	E	V L F E D C B A	3.1.12B 3.1.12D 3.2.12A 3.2.12B 3.2.12C 3.2.12D 3.4.12C 3.4.10B 3.4.10C 3.7.12B
E. Circular Motion, and Rotational Systems **1.** Uniform Circular Motion **a)** Students will be able to relate the radius of a circle and the speed or rate of revolution of a particle to the magnitude of its centripetal acceleration. **b)** Students will be able to describe the direction of a particle's velocity, force, and acceleration at any instant during the objects motion. **c)** Students will be able to determine the components of the velocity, force and acceleration vectors at any instant. **2.** Students will be able to recognize the conditions under which the law of conservation of angular momentum is applicable and relate this to rotational systems. **3.** Students will recognize the simple pendulum as an example of non-uniform circular motion, and will be able to identify and calculate the centripetal and tangential components of acceleration. **4.** Torque and Rotational Statics **a)** Students should be able to calculate torque as a vector cross product. **b)** Students should be able to determine the direction of the torque using the right hand rule. **c)** Students should be able to calculate the torque as the product of the force and lever arm. **d)** Students will be able to identify the conditions for translational and rotational equilibrium of a rigid body, angular velocity, and angular acc. **e)** Students will understand and apply the sign conventions for torque. **f)** Students will be able to apply the conditions for translational and static	E	V N H D C B A	3.1.12B 3.1.12D 3.2.12A 3.2.12B 3.2.12C 3.2.12D 3.4.12C 3.7.12B

equilibrium of a rigid body under the influence of a number of coplanar forces applied at different locations. **g)** Students will be able to calculate the moment of inertia for common shapes, and look up moments of inertias for uncommon shapes in a table.			
F. Oscillatory Motion **1.** General Skills **a)** Students will be able to mathematically analyze spring mass, simple pendulum, physical pendulum, and conical pendulum oscillatory systems. **b)** Students will be able to sketch or identify a graph of displacement vs. time and determine from such a graph the amplitude, period, and frequency of oscillatory motion. **c)** Students will be able to write down and describe each term of the displacement function in the form of $x(t) = A\cos(\omega t + \phi)$. **d)** Students will be able to identify points in the motion where velocity, acceleration, and displacement are zero or achieve maximum positive and negative values for each type of oscillatory motion. **e)** Students will be able to derive an expression for velocity and acceleration as a function of time for oscillatory motion. **f)** Students will be able to understand and apply the relationship between frequency and period. **g)** Students should be able to state how the total energy of an oscillating system depends upon the amplitude of the motion, and identify points in the motion where this energy is all potential or all kinetic. **h)** Students will be able to calculate the kinetic and potential energies of an oscillatory system as functions of time, sketch or identify graphs of these functions, and prove that the sum of kinetic and potential energy is constant. **2.** Spring Mass **a)** Students will be able to derive an expression for the period of oscillation of the spring mass system. **b)** Students will be able to apply the expression for the period of oscillation of the spring mass system. **3.** Simple Pendulum **a)** Students will be able to derive an expression for the period of oscillation of the simple pendulum (using small angle approximation). **b)** Students will be able to apply the expression for the period of oscillation of the simple pendulum system. **c)** Students will know that mass has no effect on the period of a simple pendulum. **4.** Physical Pendulum **a)** Students will be able to derive the expression for the period of oscillation of the physical pendulum system. **b)** Students will be able to apply the expression for the period of oscillation of the physical pendulum system.	E	V H F E D C B A	3.1.12B 3.1.12C 3.1.12D 3.2.12A 3.2.12B 3.2.12C 3.2.12D 3.4.12C 3.7.12B
G. Gravitation **1.** Students will be able to use the law of universal gravitation to determine the force that one spherically symmetric mass exerts on another. **2.** Students will understand the significance of the law of universal gravitation as an important inverse square law. **3.** Students will be able to determine the proper conditions under which the law of universal gravitation is relevant. **4.** Students will be able to determine the strength of the gravitational field at a point outside a spherically symmetric mass. **5.** Students should be able to understand the motion of an object in orbit under the influence of gravitational forces and realize that the motion does not depend	E	V K D C B A	3.1.12C 3.2.12A 3.2.12D 3.4.12C

upon the body's mass. **6.** Students will be able to describe qualitatively how the velocity, period of revolution, and centripetal acceleration depend upon the radius of the orbit.			

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Vocabulary and Unit Essential/Key Questions

Unit: Newtonian Mechanics

Unit Essential Question: How does the universe, and everything in it, move?

Unit Key Questions:

1. How do vector quantities relate to concepts within Newtonian mechanics?
2. What two qualities are necessary for a complete description of a vector quantity?
3. What is a resultant vector?
4. Can an object travel at a constant speed and still accelerate?
5. How does the concept of independence of motion apply to projectile motion?
6. What direction is acceleration directed for objects that move in a circle?
7. How can an object move if there is no net force acting on it?
8. What causes objects to accelerate?
9. Do Newton's Laws apply in a non-inertial frame of reference?
10. Will objects in motion continue in motion?
11. What is a direct measure of an object's inertia?
12. Does the length of a simple pendulum have any effect on its period?
13. Does pendulum-bob mass have any effect upon the period of a simple pendulum?
14. What constants have a role in the period of a spring mass system?
15. How does distance from axis of rotation influence the period of a physical pendulum?
16. How does mass distribution affect rotational inertia?
17. How do conservation of energy principles apply to different collision types?
18. If friction is present, is overall energy conserved?
19. How does friction affect the motion of objects?
20. Will all objects in free-fall accelerate at a rate of 9.8 m/s^2?
21. What factors affect the terminal velocity of an object in free fall?
22. What forces act on astronomical bodies?
23. How is momentum conserved in different collision types?
24. What are the conditions for static equilibrium?
25. What effect does increasing lever arm have on torque?
26. Do the major conservation principles in mechanics apply to rotational dynamics?
27. What does the slope of a line on a position vs. time graph represent?
28. What does the slope of a line on a velocity vs. time graph represent?
29. What does the "area under the curve" on a velocity vs. time graph represent?
30. What does the "area under the curve" on an acceleration vs. time graph represent?
31. What is the time rate of work?
32. What type of energy is associated with an object's state or position?
33. What type of energy is associated with the motion of objects?
34. Do action and reaction forces produce identical accelerations?
35. What direction is the velocity directed for an object undergoing uniform circular motion?
36. What is the relationship between linear and rotational quantities?

Critical Vocabulary: acceleration, amplitude, center of mass, centripetal, centripetal force, crest, delta, displacement, dynamic, elastic collision, energy, equilibrium condition, force, frequency, gravitational field, Hooke's law, impulse, inelastic collision, inertia, inertial frame of reference, Joule, kinematics, kinetic energy, kinetic friction, lever arm, mass, momentum, net, Newton, normal force, oscillation, perfectly inelastic collision, period, phase, potential energy, power, projectile, rate, reaction force, resonance, resultant, scalar, speed, static friction, static's, tangential velocity, terminal velocity, torque, trough, vector, velocity, watt, weight, work

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Name of Course: AP Physics 1
Name of Unit: Electricity

Essential Question: How are the basic principles of electricity and magnetism incorporated into products we use in our everyday lives?

Unit Objectives	Priority	Aligned to Course Standard	Aligned to PA Standard
A) Vectors **1.** Students will be able to identify all quantities in electricity and magnetism as either a vector or a scalar quantity. **2.** Students will be able to resolve vectors into their vector components. **3.** Students will be able to perform vector addition (graphically and mathematically), vector dot product, and vector cross product. Students will be able to recognize the dot product of two vectors is a scalar, and the cross product of two vectors is a vector. **4.** Students will be able to utilize unit vector notation, and recognize that vector quantities exist in orthogonal, cylindrical, and spherical coordinate systems.	E	V O I D B A	3.2.12A 3.2.12D
B) Electrostatics **1.** Electric Charge **a)** Students should be able to identify the two types of electric charge. **b)** Students should understand that charges can be isolated. **c)** Students will be able to determine the direction of the force on a charged particle brought near an uncharged or grounded conductor. **d)** Students will be able to describe qualitatively how to charge an object by induction. **2.** Coulomb's Law **a)** Students will be able to understand Coulomb's Law as an important inverse square law. **b)** Students should be able to determine the force that acts between specified point charges, and describe the electric field of an isolated point charge. **c)** Students will be able to use vector addition to determine the electric field produced by two or more point charges (principle of superposition).	E	V Y O D C B A	3.1.12B 3.1.12C 3.2.12A 3.2.12D 3.4.12A 3.4.10C
C) Electric Circuits **1.** Current, Resistance, Voltage, Power **a)** Students should understand that the convention universally adopted for current flow is the movement of positive charges. **b)** Students should understand the definition of electric current. **c)** Students will be able to define conductivity, resistivity, and resistance. **d)** Students will be able to use Ohm's Law to relate current and voltage for a resistor. **e)** Students will be able to describe how the resistance of a resistor depends upon its length and cross sectional area. **f)** Students will be able to apply the relationships for the rate of heat production in a resistor.	E	V P Y O F E D C B A	3.1.12B 3.1.12D 3.1.12E 3.2.12A 3.2.12B 3.2.12C 3.2.12D 3.4.12A 3.4.10B 3.4.10C 3.7.12B

2. Steady-State Direct Current Circuits with Voltage Sources and Resistors Only **a)** Students should be able to identify on a circuit diagram whether a circuit is a series circuit, a parallel circuit, or a series-parallel circuit. **b)** Students will be able to find equivalent resistances of series circuits, parallel circuits, and series-parallel circuits. **c)** Students will be able to determine the ratio of the voltages across resistors connected in series, parallel, or series-parallel. **d)** Students will be able to calculate the voltage, current, and power dissipated for any resistor in a network connected to a voltage source. **e)** Students will be able to design series-parallel circuits that produce a given current and voltage for one specified component, and draw a diagram for the circuit using conventional circuit symbols. **f)** Students will be able to calculate the terminal voltage of a battery of specified EMF and internal resistance from which a known current is flowing. **g)** Students will be able to apply Kirchhoff's rules to direct-current, series series-parallel, and parallel circuits. **h)** Students will be able to apply Kirchhoff's rules to set up and solve systems of simultaneous equations to determine unknown currents. **i)** Students should understand that the resistance of an ammeter is low and the resistance of a voltmeter is high. **j)** Students will be able to demonstrate correct methods of connecting meters (or computer probes) in order to measure voltage or current.			

Unit: **Electricity and Magnetism**

Unit Essential Question: How are the basic principles of electricity and magnetism incorporated into products we use in our everyday lives?

Unit Key Questions:

1. What is the algebraic relationship between voltage, current, and resistance?
2. What is the flow of charge?
3. What is EMF?
4. What device offers resistance to the flow of electrons?
5. How is power calculated in a resistive network?
6. What characterizes a series circuit?
7. What characterizes a parallel circuit?
8. What characterizes a series/parallel circuit?
9. How do resistive devices combine in a series circuit?
10. How do resistive devices combine in a parallel circuit?
11. How do resistive devices combine in a series/parallel circuit?
12. How does current behave in a series circuit?
13. How does current behave in a parallel circuit?
14. How does voltage across resistive devices behave in a series circuit?
15. How does voltage across resistive devices behave in a parallel circuit?
16. How do we break a resistive network down into an equivalent resistance?
17. How is electricity generated and sent to our homes?
18. What are the main types of electric power production in the United States?
19. What type of electricity comes into our homes?
20. What are the two types of electronic circuits?
21. What are the two main branches of study in electronics?
22. What type of circuitry do most of our modern electronic devices use?
23. What is an integrated circuit?
24. What are the three basic building blocks of digital electronic circuitry?
25. How do we apply Kirchhoff's current law to a resistive network?
26. How do we apply Kirchhoff's voltage law to a resistive network?
27. What are the four categories we can classify materials into with regards to their electrical properties?

Critical Vocabulary: alternating current, ampere, analog circuitry, branch, charge, circuit, conductor, coulomb, digital circuitry, direct current, EMF, electron, electric field, electric potential, electrodynamics, electrostatics, equivalent resistance, generator, insulator, integrated circuit, magnetic field, node, Ohm's law, Ohm, parallel circuit, potential, potential difference, power, resistor, semiconductor, series circuit, superconductor, transformer, volt, voltage, watt

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Name of Course: AP Physics 1
Name of Unit: Waves and Optics

Essential Question: How has mankind's curiosity about our solar system and the distant stars led to developments and advancements in the field of optics?

Unit Objectives	Priority	Aligned to Course Standard	Aligned to PA Standard
A) Waves **1.** Wave Motion **a)** Traveling Waves **(1)** Students will be able to sketch and identify graphs that represent traveling waves and determine the amplitude, wavelength, and frequency of a wave from such a graph. **(2)** Students will be able to state and apply the relationship among wavelength, frequency, and velocity of a wave. **(3)** Students will be able to sketch and identify graphs that describe reflection of a wave from the fixed or free end of a string. **(4)** Students will be able to understand what factors determine the speed of waves on a string. **(5)** Students will be able to determine what factors influence the speed of sound in air, solids, and liquids. **b)** Standing Waves **(1)** Students will be able to sketch possible standing wave modes for a stretched string that is fixed at both ends, and determine the amplitude, wavelength, and frequency of such standing waves. **(2)** Students will be able to describe possible standing waves in a pipe or tube that has either open or closed ends, and determine the wavelength and frequency of standing waves. **2.** Doppler Effect **a)** Students will be able to explain the mechanism that gives rise to a frequency shift in both the moving-source and moving observer, and derive an expression for the frequency heard by an observer. **b)** Students will be able to write and apply the equations (with appropriate sign conventions) that describe the moving-source and moving-observer Doppler effect. **3.** Students will be able to use the principle of superposition so they can apply it to traveling waves moving in opposite directions, and describe how a standing wave may be formed by superposition.	E	V R F E D C B A	3.1.12C 3.2.12A 3.2.12C 3.2.12D 3.4.12C 3.4.10C

Unit: Waves

Unit Essential Question: How has mankind's curiosity about our solar system and the distant stars led to developments and advancements in the field of optics?

Unit Key Questions:

1. What is reflection?
2. How are images formed in a mirror by the process of reflection?
3. What is refraction?
4. How are images formed in lenses by the process of refraction?
5. What is interference?
6. What is chromatic dispersion?
7. Under what conditions is a real image formed in a mirror?
8. Under what conditions is a virtual image formed in a mirror?
9. What is a real image?
10. What is a virtual image?
11. Under what conditions is a real image formed in a lens?
12. Under what conditions is a virtual image formed in a lens?
13. Where does visible light fall in the electromagnetic spectrum?
14. What wavelengths of light fall in the visible spectrum?
15. What frequencies of light fall in the visible spectrum?
16. What is the vertex of a mirror or lens?
17. What is the radius of curvature of a mirror or lens?
18. What is the focal point of a mirror or lens?
19. How do we perform a ray tracing to locate images for objects in a mirror?
20. How do we perform a ray tracing to locate images for objects in a lens?
21. How do we apply Snell's Law to refracted rays as light passes from one medium to another?
22. What is the speed of light in a vacuum?
23. Does the speed of light vary from one medium to another?
24. How do we define index of refraction?
25. What is the difference between light that is chromatic and light that is monochromatic?
26. What is total internal reflection, and how does this principle apply to modern communications?
27. What is Doppler shift?
28. How does film thickness influence the interference pattern?
29. How does slit spacing change the position of maximum and minimum interference?
30. How is resonance established in a tube or pipe?
31. What conditions are necessary for complete constructive or destructive interference?
32. How does slit spacing in a diffraction grating influence positions of maximums?

Critical Vocabulary: aberration, angle of incidence, angle of reflection, beats, coherent light, converging lens, critical angle, diffraction, diffraction grating, diffuse reflection, dispersion, diverging lens, Doppler effect, electromagnetic spectrum, electromagnetic wave, focal length, focus, frequency, hertz, incoherent light, infrared, interference, laser, lens, longitudinal wave, monochromatic, node, opaque, period, pitch, polarization, real image, reflection, refraction, spectrum, standing wave, total internal reflection, transverse wave, trough, vibration, virtual image, wavelength, white light

Elizabethtown Area School District
III. Course Assessments

Check types of assessments to be used in the teaching of the course.
(Provide examples of each type.)

__X_ Objective Tests/Quizzes
____ Constructed Responses
____ Essays
__X_ Reports
____ Projects
____ Portfolios
__X_ Presentations
__X_ Performance tasks
__X_ Lab Activities
____ Response Journals
____ Logs
__X_ Computer Simulations
____ Research Papers
__X_ Class Participation
__X_ Notetaking
__X_ Daily Assignments
____ Writing Samples
____ ________________

Provide copies of common assessments that will be utilized for all students taking this course. Overall course/grade level standards will be measured by a common course assessment. Unit objectives will be measured on an ongoing basis as needed by the classroom teacher to assess learning and plan for instruction. List common assessements below and recommended date/time frame for administration (at least quarterly).

	Name of Assessment	When given?
1.	Unit Tests	At the conclusion of each major unit
2.	Final Exam	At the conclusion of the course
3.	Lab Reports and Analysis	At the conclusion of a lab