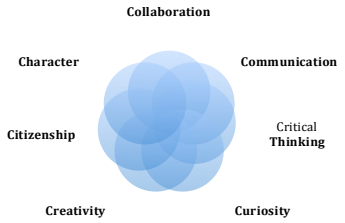
Region 14 Schools
Inspiring Excellence

Content Area: Science	Course: AP Physics	Grade Level: 11-12
	**R14 The Seven Cs of Learning** 	

Unit Titles	Length of Unit
• Kinematics	5 - 6 Weeks
• Newton's Laws of Motion	3 - 4 Weeks
• Circular Motion and Gravity	2 - 3 Weeks
• Work, Energy and Power	3 - 4 Weeks
• Momentum	2 - 3 Weeks
• Rotational Motion	4 - 5 Weeks
• Waves and Simple Harmonic Motion	3 - 4 Weeks
• Electricity and DC Circuits	2 - 3 Weeks
• Heat	2 - 3 Weeks

Strands	Course Level Expectations
Big Idea 1	• Students will understand that objects and systems have properties such as mass and charge. Systems may have internal structure.
Big Idea 2	• Students will understand fields existing in space can be used to explain interactions.
Big Idea 3	• Students will understand the interactions of an object with other objects can be described by forces.
Big Idea 4	• Students will understand interactions between systems can result in changes in those systems.
Big Ideas 5	• Students will understand that changes that occur as a result of interactions are constrained by conservation laws.
Big Idea 6	• Students will understand that waves can transfer energy and momentum from one location to another without the permanent transfer of mass and serve as a mathematical model for the description of other phenomena.

* Course expectations based the course outlines from the College Board. For more information visit: https://apcentral.collegeboard.org/pdf/cbscs-science-standards-2009.pdf?course=ap-physics-1

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Unit Title	Kinematics	Length of Unit	5 - 6 Weeks

Inquiry Questions **(Engaging & Debatable)**	• What must a person know about an object in order to predict its future position or velocity or both?
Standards*	**Big Idea** 3 & 4 **Learning Objectives:** 3A, 3.A.1.1, 3.A.1.2, 3.A.1.3, 3.A.1, 4.A, 4.A.1.1, 4.A1
Unit Strands & Concepts	• Displacement, • Distance • Velocity and acceleration • Projectile motion
Key Vocabulary	Displacement, distance, velocity, speed, acceleration, vector, scalar

*Standards and enduring understandings are based on College Board's AP Physics 1 course description.
For more information visit: https://secure-media.collegeboard.org/digitalServices/pdf/ap/ap-physics-1-course-and-exam-description.pdf

Unit Title	Kinematics	Length of Unit	5 - 6 Weeks

Critical Content: **My students will Know…**	**Key Skills:** **My students will be able to (Do)…**
• That motion can be described using such quantities as position, displacement, distance, velocity, speed, and acceleration • That displacement, velocity and acceleration are vectors • That displacement is change in position. Velocity is the rate of change of position. Acceleration is the rate of change of velocity. Changes in each property are expressed by subtracting initial values from final values • That a choice of reference frame determines the direction and the magnitude of each of these quantities.	• Express the motion of an object using narrative, mathematical, and graphical representations. • Design and experimental investigation of the motion of an object. • Analyze experimental data describing the motion of an object and is able to express the results of the analysis using narrative, mathematical, and graphical representations.

Assessments:	• Lab Reports • Motion in one dimension formative Assessment • Kinematics Summative Assessment
Teacher Resources:	Unit implementation Guide, *Physics* Walker 3rd edition AP Physics 1 Inquiry-Based Lab Investigations, Department Lab Report rubric, Phet simulations (online)

Unit Title	Newton's Laws of Motion	Length of Unit	3 - 4 Weeks

Inquiry Questions (Engaging & Debatable)	• What is the cause and effect relationship between force and mass, force and acceleration? • What is the interaction between objects and forces that act on each other?
Standards*	**Big Idea 1,2,3, & 4** **Learning Objectives:** 1.A, 1.A.1, 1.A.5.1, 1.A.5, 1.C, I.C.1.1, 1.C.1, 1.C.3.1, 1.C.3, 2.B, 2.B.1.1, 2.B.1, 3.A, 3.A.2.1, 3.A.2, 3.A.3.1, 3.A.3.2, 3.A.3.3, 3.A.4.1, 3.A.3, 3.A.4, 3.B, 3.B.1.1, 3.B.1.2, 3.B.1.3, 3.B.2.1, 3.B1, 3.B.2, 3.C, 3. C.4.1, 3.C.4.2, 3.C.4, 4.A, 4.A.1.1, 4.A.2.2, 4.A.2
Unit Strands & Concepts	• Mass, force, and weight, • Action force and reaction force • Frictional force, normal force •
Key Vocabulary	Mass, force, friction, weight and free body diagram

Unit Title	Newton's Laws of Motion	Length of Unit	3-4 Weeks

Critical Content: **My students will Know…**	**Key Skills:** **My students will be able to (Do)…**
• That the acceleration of an object is directly proportional to the net force exerted on it and inversely proportional to the mass of the object • That force and acceleration are both vectors, with acceleration in the same direction as the net force. • Tha forces have magnitude and direction. • If one object exerts a force on a second object, the second object always exerts a force of equal magnitude on the first object in the opposite direction. • That even though an object is at rest, there may be forces exerted on that object by other objects. • The difference between conservative and non-conservative forces. • The difference between static friction and kinetic friction.	• Make predictions about the motion of a system based on the fact that acceleration is equal to the change in velocity, and velocity is equal to the change in position per unit time. • Make free body diagrams that describe all the forces acting on an object. • Design an experiment for collecting data to determine the relationship between the net force exerted on an object and its acceleration. • Represent frictional forces, normal forces and weight where appropriate in all his or her models.

Assessments:	• Lab Reports • Formative Assessments • Dynamics Summative Assessment
Teacher Resources:	Unit Implementation Guide, *Physics* Walker 3rd edition, AP Physics 1 Inquiry-Based Lab Investigations, Department Lab Report Rubric, Phet simulations (online)

Unit Title	Circular Motion and Gravity	Length of Unit	2 - 3 Weeks

Inquiry Questions (Engaging & Debatable)	• What happens to the motion of an object when a force is applied in a direction perpendicular to its motion? • Why do the planets go around the sun? • Why does the moon go around the Earth?
Standards*	**Big Idea 1,2,3, & 4** **Learning Objectives:** 1.A, 1.A.1, 1.A.5.1, 1.A.5, 1.C, I.C.1.1, 1.C.1, 1.C.3.1, 1.C.3, 2.A, 2. A.1, 2.B, 2.B.1.1, 2.B.1, 2.B.2, 2.B.2.1, 2.B.2.2, 3.A, 3.A.1.2, 3.A.1.3, 3.A.2.1, 3.A.2, 3.A.3.1, 3.A.3.2, 3.A.3.3, 3.A.4.1, 3.A.3, 3.A.4, 3.B, 3.B.1.1, 3.B.1.2, 3.B.1.3, 3.B.2.1, 3.B1, 3.B.2, 3.C, 3.C.2.2, 3.C.2, 3.C.4.1, 3.C.4.2, 3.C.4, 3.G, 3.G.1.1, 3.G.1, 4.A, 4.A.1.1, 4.A.2.2, 4.A.2
Unit Strands & Concepts	• Mass • Force • Centripetal force
Key Vocabulary	Mass, force, centripetal acceleration, centripetal force, revolution, period

Unit Title	Circular Motion and Gravity	Length of Unit	2 - 3 Weeks

Critical Content: **My students will Know…**	**Key Skills:** **My students will be able to (Do)…**
• That a gravitational field ***g*** at the location of an object with mass ***m*** causes a gravitational force of magnitude ***mg*** to be exerted on the object in the direction of the field. • That on Earth, the gravitational force is called weight • That the gravitational field at a point in space is measured by dividing the gravitational force exerted by the field on a test object at the point by the mass of the test object and has the same direction as the force. • That near the Earth's surface, all objects fall with the same acceleration regardless of their mass. • That the gravitational field caused by a spherically symmetric object is radial and , outside the object, varies as the inverse square of the radial distance from the center of that object. • That the centripetal force acting on an object acts perpendicular to the direction of travel. • That the centripetal force is the force that maintains circular motion. • That circular acceleration is equal to square of the linear speed of an object divided by the radius of the circle (or portion of the circle) the object is traveling along.	• Use Newton's law of gravitation to calculate the gravitational force the two object exert on each other and use that force in contexts other than orbital motion. • Calculate the centripetal acceleration • Calculate the centripetal force • Calculate the gravitational force between two masses • Create and use free-body diagrams to analyze physical situations, solve problems with motion qualitatively and quantitatively.

Assessments:	• Lab Reports, Formative Assessments, Circular Motion and Gravity Unit Assessment
Teacher Resources:	Unit implementation Guide, *Physics* Walker 3rd edition, AP Physics 1 Inquiry-Based Lab Investigations Lab equipment, Department Lab Report rubric, Phet simulations (available online)

Unit Title	Work, Energy and Power	Length of Unit	3 - 4 weeks

Inquiry Questions (Engaging & Debatable)	● What happens when work is applied to a mass system? ● What does the statement mean that energy cannot be created or destroyed? ● What are different forms energy can take? ● What is the relationship between energy and power?
Standards*	**Big Idea 3,4, & 5** **Learning Objectives:** 3.E, 3.E.1.1, 3.E.1.2, 3.E.1.3, 3.E.1.4, 3.E.1, 4.C, 4.C.1.1, 4.C.1.2, 4.C.2.2, 4.C.2, 5.A, 5.A.1, 5.A.2.1, 5.A.2, 5.A.3, 5.B, 5.B.1.1, 5.B.1.2, 5.B.1, 5.B.2.1, 5.B.2, 5.B.3.1, 5.B.3.2, 5.B.3.3, 5.B.4.1, 5.B.4.2, 5.B.5.1, 5.B.5.2, 5.B.5.3, 5.B.5.5, 5.D.1.1, 5.D.1, 5.D.1.2, 5.D.1.3, 5.D.1.4, 5.D.1.5, 5.D.2.1, 5.D.2.3
Unit Strands & Concepts	• Work • Conservative forces, field forces, contact forces • Mechanical advantage • Kinetic and potential energy, mechanical energy • Power
Key Vocabulary	Work, simple machines, kinetic energy, potential energy, power

Unit Title	Work, Energy and Power	Length of Unit	3 - 4 weeks

Critical Content: **My students will Know…**	**Key Skills:** **My students will be able to (Do)…**
• That the change in kinetic energy of an object depends on the force exerted on the object and on the displacement of the object during the interval that the force is exerted. • That the magnitude of the change in the kinetic energy is the product of the magnitude of the displacement and of the magnitude of the component of force parallel or antiparallel to the displacement. • That the energy of a system includes its kinetic energy, potential energy, and microscopic internal. Examples include gravitational potential energy, elastic potential energy, and kinetic energy. • That the component of the net force exerted o an object perpendicular to the direction of the displacement of the object can change the direction of an object without changing its kinetic energy. • That mechanical energy (the sum of kinetic and potential energies) is transferred into or out of a system such that a component of the force is parallel to its displacement. The process through which the energy is transferred is call work. • If the force is constant during a given displacement, then the work done is the product of the displacement and the component of the force parallel or antiparallel to the displacement. • Hooke's Law	• Calculate the net work applied to system • Calculate the mechanical advantage of a simple machine • Apply the law of conservation of energy to a closed system • Calculate kinetic energy • Calculate gravitational potential energy • Calculate the elastic potential energy • Calculate power • Make predictions about the changes in kinetic energy of an object based on considerations of the direction of the net force on the object as the object moves. • Apply mathematical routines to determine the changes in kinetic energy given the forces on the object and the displacement of the object. • Predict changes in the total energy of a system due to changes in position and speed of onsets or frictional interactions within the system.

Assessments:	• Lab Reports, Formative Assessment, Circular Motion and Gravity Assessment
Teacher Resources:	Unit implementation Guide, *Physics* Walker 3rd edition, AP Physics 1 Inquiry-Based Lab Investigations, Department Lab Report rubric, Phet simulations (available online)

Unit Title	Momentum	Length of Unit	2 - 3 weeks

Inquiry Questions (Engaging & Debatable)	● What happens to the momentum of a system when the particles in the system collide? ● What causes the momentum of a system to change?
Standards	**Big Idea 3,4, & 5** **Learning Objectives**: 3.D, 3.D.1.1, 3.D.2.1, 3.D.2.2, 3.D.2.3, 3.D.2.4, 3.D.1, 3.D.2, 4.B, 4.B.1.1, 4.B.1.2, 4.B.1 4.B.2.1, 4.B.2, 4.B.2.2, 5.A, 5.A.1, 5.A.2.1, 5.A.2, 5.D.1.1, 5.D.1, 5.D.1.2, 5.D.1.3, 5.D.1.4, 5.D.1.5, 5.D.2.1, 5.D.2.2, 5.D.2.3, 5.D.2.5, 5.D.3.1, 5.D.3
Unit Strands & Concepts	• Momentum • Elastic and inelastic collisions • Conservation of momentum • Impulse
Key Vocabulary	Momentum, impulse, elastic, inelastic, velocity, phenomena

Unit Title	Momentum	Length of Unit	2 - 3 weeks

Critical Content: **My students will Know…**	**Key Skills:** **My students will be able to (Do)…**
• The change in momentum of an object is a vector in the direction of the net force exerted on the object. • The change in momentum of an object occurs over a time interval. • The change in momentum of an object depends on the impulse, which is the product of the average force and the time interval during which the interaction occurred. • That in a collision between objects, linear momentum is conserved. In an elastic collision, kinetic energy is the same before and after. • When objects in a system collide, the velocity of the center of mass of the system will not change unless an external force is exerted on the system	• Calculate the momentum of an object and of a system of objects. • Calculate the impulse applied to an object. • Justify the selection of routines for the calculation of the relationships between changes in momentum of an object, average force, impulse, and time of interaction. • Calculate the change in linear momentum of a two-object system with constant mass in linear motion from a representation of the system (data, graphs, etc.). • Perform analysis on data presented as a force-time graph and predict the change in momentum of a system. • Make qualitative predictions about natural phenomena based on conservation of linear momentum and restoration of kinetic energy in elastic collisions.

Assessments:	• Lab Reports, Formative Assessment, Unit Summative Assessment
Teacher Resources:	Unit implementation Guide, *Physics* Walker 3rd edition, AP Physics 1 Inquiry-Based Lab Investigations Lab equipment, Department Lab Report rubric, Phet simulations (available online)

Unit Title	Rotational Motion	Length of Unit	4 - 5 weeks

Inquiry Questions (Engaging & Debatable)	• What causes an object to go around a point? • What causes a rotating object to increase its angular velocity?
Standards	**Big Idea 3,4, & 5** **Learning Objectives**: 3.A, 3.A.1.1, 3.A.1, 3.F, 3.F.1.1, 3.F.1.2, 4.B, 4.B.1.1, 4.B.1.2, 4.B.1, 4.B.2.1, 4.B.2, 4.B.2.2, 5.A, 5.A.1, 5.A.2.1, 5.A.2, 5.D.1.1, 5.D.1, 5.D.1.2, 5.D.1.3, 5.D.1.4, 5.D.1.5, 5.D.2.1, 5.D.2.2, 5.D.2.3, 5.D.2.5, 5.D.3.1, 5.D.3
Unit Strands & Concepts	• Rotational kinematics • Rotational dynamics • Radians, angular velocity, angular acceleration • Moment of inertia • Rotational kinetic energy • Angular momentum, conservation of angular momentum
Key Vocabulary	Radians, angular velocity and acceleration, torque, moment of inertia, revolve and rotate.

Unit Title	Rotational Motion	Length of Unit	4 - 5 weeks

Critical Content: **My students will Know…**	**Key Skills:** **My students will be able to (Do)…**
• An observer in a particular reference frame can describe the motion of an object using such quantities as position, displacement, distance, velocity, speed and acceleration. For rotational motion, there are analogous quantities such as angular position, angular velocity, and angular acceleration. • That torque, angular velocity, angular acceleration and angular momentum are vector quantities and the direction of the vectors is governed by the right hand rule. • That only the force component perpendicular to the line connecting the axis of rotation and the point of application of the force results in a torque about the axis. • The lever arm is the perpendicular distance from the axis of rotation or revolution to the line of application of the force. And the magnitude of the torque is the product of the magnitude of the lever arm and the magnitude of the force. • The presence of a net torque along any axis will cause a rigid system to change its rotational motion or an object to change its rotational motion about the axis. • The angular acceleration of an object or rigid system can be calculated from the net torque and the rotational inertia of the object or rigid system. • Qualitatively what factors affect rotational inertia, for example why a hoop has more rotational inertia than a puck of the same mass and radius.	• Use representations of the relationship between force and torque. • Estimate the torque on an object caused by various forces in comparison to other situations. • Calculate torques on a two-dimensional system in static equilibrium, by examining a representation or model (such as a diagram or physical construction.) • Make predictions about the change in the angular velocity about an axis for an object when forces exerted on the object cause a torque about that axis. • Make calculations of quantities related to the angular momentum of a system when the net external torque on the system is zero.

Assessments:	• Lab Reports, Unit Formative Assessments, Summative Assessment
Teacher Resources:	Unit implementation Guide, *Physics* Walker 3rd edition, AP Physics 1 Inquiry-Based Lab Investigations, Lab equipment Department Lab Report rubric, Phet simulations (available online)

Unit Title	Simple Harmonic Motion, Waves and Sound	Length of Unit	3 - 4 weeks

Inquiry Questions (Engaging & Debatable)	• What determines the period of simple harmonic oscillators? • What are the characteristics of waves and how do they differ from the motion of objects? • What is resonance?
Standards	**Big Idea 3,4, & 5** **Learning Objectives**: 3.A, 3.A.1.1, 3.A.1, 3.F, 3.F.1.1, 3.F.1.2, 4.B, 4.B.1.1, 4.B.1.2, 4.B.1, 4.B.2.1, 4.B.2, 4.B.2.2, 5.A, 5.A.1, 5.A.2.1, 5.A.2, 5.D.1.1, 5.D.1, 5.D.1.2, 5.D.1.3, 5.D.1.4, 5.D.1.5, 5.D.2.1, 5.D.2.2, 5.D.2.3, 5.D.2.5, 5.D.3.1, 5.D.3
Unit Strands & Concepts	• Harmonic motion, • Frequency, wavelength, • Constructive and destructive interference, • Standing waves, • Doppler effect, beats
Key Vocabulary	pendulum, harmonic motion, frequency, wavelength, doppler effect, beat

Unit Title	Simple Harmonic Motion, Waves and Sound	Length of Unit	2 - 3 weeks

Critical Content: **My students will Know…**	**Key Skills:** **My students will be able to (Do)…**
• Restoring forces can result in oscillatory motion. When a linear restoring force is exerted on an object displaced from an equilibrium position, the object will undergo a special type of motion called simple harmonic motion. Examples include gravitational force exerted by the Earth on a simple pendulum and mass-spring oscillator. • A system with internal structure can have internal energy, and changes in a system's internal structure can result in changes in internal energy. • A system with internal structure can have potential energy. Potential energy exists within a system if the objects within that system interact with conservative forces. • That changes in the internal structure can result in changes in potential energy. Examples include mass-spring oscillators and objects falling in a gravitational field (i.e. pendula) • The internal energy of a system includes kinetic energy of the objects that make up the system and the potential energy of the configuration of the objects that make up the system. • That since energy is constant in a closed system, changes in a system's potential energy can result in changes to the system's kinetic energy. • Waves can propagate via different oscillation modes such as transverse and longitudinal • That for propagation, mechanical waves require a medium. • That for periodic waves or simple oscillators, the period is the repeat time of the wave or oscillation. The frequency is the number of repetitions of the wave or oscillation per unit time. • That for period waves, the wavelength is the ratio of the speed of the wave	• Predict which properties determine the motion of a simple harmonic oscillator and what the dependence of the motion is on those properties. • Construct a qualitative and/or a quantitative explanation of oscillatory behavior given evidence of a restoring force. • Make quantitative calculations of the internal potential energy of a system from a description or diagram of that system. • Calculate changes in kinetic energy and potential energy of a system, using information from representations of that system. • Describe representations of transverse and longitudinal waves. • Describe sound in terms of transfer of energy and momentum in a medium and relate the concepts to everyday examples. • Use graphical representation of a periodic mechanical wave to determine the amplitude of the wave. • Use graphical representation of a periodic mechanical wave to determine the wavelength of the wave.

over the frequency. • Two or more wave pulses can interact in such a way as to produce amplitude variations in the resultant wave. When two pulses cross, they travel through each other; they do not bounce off each other. Where the pulses overlap, the resulting displacement can be determined by adding the displacements of two pulses. This is call superposition. • Standing waves are the result of the addition of incident and reflected waves that are confined to a region and have nodes and antinodes. Examples include waves on a fixed length of string and sound waves in both closed and open tubes.	• Predict properties of standing waves that result from the addition of incident and reflected waves that are confined to a region and have nodes and antinodes. • Use a visual representation to explain how waves of slightly different frequency give rise to the phenomenon of beats.

Assessments:	• Lab Reporting and Unit Summative Assessment
Teacher Resources:	Unit implementation Guide, *Physics* Walker 3rd edition, AP Physics 1 Inquiry-Based Lab Investigations Lab equipment, Department Lab Report rubric, Phet simulations (available online)

Unit Title	Electricity and Simple DC Circuits	Length of Unit	2 - 3 weeks

Inquiry Questions (Engaging & Debatable)	• What causes static electricity? • What factors affect the resistance of a material? • What is the relationship between voltage and current? • What is the relationship between power, voltage and current? • How does the arrangement of resistors affect the voltage and current in a circuit?
Standards	**Big Idea 1, 3, & 5** **Learning Objectives:** 1.B.1, 1.B.1.1, 1.B2.1, 1.B.3.1; 1.B.3, 1.E, 1.E.2.1, 3.C., 3.C.2.1, 3.C.2, 3.C.2.2, 5.A., 5.A.2.1, 5.A.2, 5.B.2; 5.B.9, 5.B.9.2, 5.B.9.3, 5.C. 5.C.3.1, 5.C.3, 5.C.3.2, 5.C.3.3
Unit Strands & Concepts	• Voltage, current, Ohm's Law • Electric charge • Simple series and parallel circuits • Electric power
Key Vocabulary	Voltage, current, resistance, resistivity, series and parallel, direct current, alternating current

Unit Title	Electricity and Simple DC Circuits	Length of Unit	2 - 3 weeks

Critical Content: My students will Know…	**Key Skills: My students will be able to (Do)…**
• Electric charge is conserved. The net charge of a system is equal to the sum of the charges of all the objects in the system. • Electric current is the movement of charge through a conductor. • That a circuit is a closed loop of electrical current. • Like-charged objects and systems repel, and unlike charged objects and systems attract. • That electric force results from the interaction of one object that has an electric charge with another object that has an electric charge. • Matter has a property called resistivity and it depends on the matters molecular and atomic structure. • The electric potential difference across a resistor is given by the product of the current and the resistance. • The rate at which energy is transferred (power) from a resistor is equal to the product of the electric potential difference across the resistor and the current through the resistor. • The fundamental variables used in analyzing electricity • What induces and what inhibits the movement of charge from one location to another	• Make predictions, using the conservation of electric charge, about the sign and relative quantity of net charge of objects or systems after various charge processes, including conservation of charge in simple circuits. • Apply conservation of electric charge to the comparison of electric current in various segments of an electrical circuit with a single battery and resistors in series and in , at most one parallel branch and predict how those values would change if configurations of the circuit are changed. • Use a description or schematic diagram of an electric circuit to calculate unknown values of current in various segments or branches of the circuit. • Use a description or schematic diagram of an electric circuit to calculate the distribution of voltage in a simple DC circuit. • Use a description or schematic diagram of an electric circuit to calculate the distribution of voltage in a simple DC circuit, calculate unknown values of current in various segments or branches of a circuit that consists of parallel and series components.

Assessments:	• Lab Reports and Summative Assessment
Teacher Resources:	Unit implementation Guide, *Physics* Walker 3rd edition, AP Physics 1 Inquiry-Based Lab Investigations, Department Lab Report rubric, Phet simulations (available online)

Unit Title	Heat	Length of Unit	2 - 3 weeks

Inquiry Questions (Engaging & Debatable)	● What is Zeroth Law and the Second Law of Thermodynamics and how do they impact what we know about energy? ● What is the relationship between temperature and the movement of atoms in an object? ● How is heat transferred and what are important effects?
Standards	**Big Idea 4 & 5** **Learning Objectives**: 4.C.1, 4.C.2.2, 5.B.2, 5.B.4, 5.B.5, 5.B.2.1, 5.B.4.1
Unit Strands & Concepts	• Heat transfer • Heat capacity • Specific heat • Conduction, convection and radiation • Thermal expansion
Key Vocabulary	heat, temperature (Fahrenheit, Celsius and Kelvin), coefficient of linear expansion, coefficient of volume expansion, specific heat, heat capacity

Unit Title	Heat	Length of Unit	2 - 3 weeks

Critical Content: **My students will Know…**	**Key Skills:** **My students will be able to (Do)…**
• How to measure the internal energy of an object. • Thee transfer of thermal energy when two components of different temperature are combined within a closed system adheres to defined routines and mathematical relationships. • The transfer of thermal energy results in a more uniform energy distribution among the components in the system (second law of thermodynamics). • The method by which energy is transmitted from one object to another • The effect of a rising temperature on the length and volume of an object	• Use the properties of matter and the geometry of objects to predict the rate of heat transfer and thermal expansion. • Calculate the specific heat of an object • Calculate the heat capacity of an object.

Assessments:	• Lab Reporting and Summative Assessments
Teacher Resources:	Unit implementation Guide, *Physics* Walker 3rd edition, AP Physics 1 Inquiry-Based Lab Investigations, Department Lab Report rubric, Phet simulations (available online)