Indiana's Academic Standards 2010 ICP	Indiana's Academic Standards 2016 ICP
ICP.1.1 Measure the motion of objects to understand the relationships among distance, velocity and acceleration. Develop deeper understanding through graphical analysis of the time dependence of acceleration, velocity and distance.	**ICP.1.1** Develop graphical, mathematical, and pictorial representations (such as a motion map) that describe the relationship between the clock reading (time) and position of an object moving at a constant velocity and apply those representations to qualitatively and quantitatively describe the motion of an object.
	ICP.1.2 Describe the slope of the graphical representation of position vs. clock reading (time) in terms of the velocity of the object moving in one dimension.
	ICP.1.4 Distinguish between the terms "speed," "velocity," "average speed," and "average velocity" and determine the value of any of these measurements given either a graphical or mathematical representation.
	ICP.2.2 Describe the differences between average velocity and instantaneous velocity and be able to determine either quantity given a graph of position vs clock reading (time).
ICP.1.2 Describe and apply Newton's three laws of motion. By experimentation, determine the relationships among the variables in Newton's laws and how all three laws relate mass, acceleration and force as a triad of proportional variables, leading to the definitions of momentum and energy.	**ICP.2.1** Develop graphical, mathematical, and pictorial representations (such as a motion map) that describe the relationship between the clock reading (time) and velocity of an object moving at a constant acceleration and apply those representations to qualitatively and quantitatively describe the motion of an object in terms of its change in position or velocity.

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	ICP.3.1 Develop pictorial and graphical representations which show that a single external applied force changes the velocity of an object, and that when no force acts, the velocity of an object remains constant.
ICP.1.3 Describe how Newton's Law of Universal Gravitation and the laws of motion together explain the motions of objects on earth and of the moon, planets and stars.	
ICP.1.4 Describe the kinetic and potential energies of macroscopic objects and use measurements to develop an understanding of these forms of energy.	**ICP.3.7** Develop pictorial and graphical representations which show that when two objects interact, the forces occur in pairs according to Newton's third law and that the change in motion of each object is dependent on the mass of each object.
	ICP.4.2 Identify forms of energy present in a system (kinetic, gravitational, elastic, etc.), and pictorially represent the distribution of energies, such as using pie or bar charts.
ICP2.1 Identify properties of objects that vibrate by using Newton's laws to understand the motion. Understand that vibrating objects can give rise to mechanical waves.	
ICP.2.2 Identify properties of waves (e.g., frequency, wavelength, amplitude, energy and wave speed).	**ICP.9.2** Develop and apply a simple mathematical model regarding the relationship among frequency, wavelength, and speed of waves in a medium as well.

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ICP2.3 Describe how energy is propagated by waves without the transfer of mass using examples such as water waves, earthquakes and sound waves.	**ICP.9.1** Develop qualitative particle models of mechanical waves and explain the relationship of the particles and their interactions in transverse and longitudinal waves, as well as, how waves appear in nature as in water waves and tsunamis, ground waves in earth quakes, and sound waves.
ICP.2.4 Apply the properties of waves to wave phenomena like reflection, refraction, transmission of energy and loss of energy.	**ICP.9.3** Qualitatively describe the reflection and transmission of a mechanical wave at either a fixed or free boundary or interface.
ICP.3.1 Describe how we use macroscopic properties of matter to model microscopic processes.	
ICP.3.2 Study the characteristics of solids, liquids and gases and their changes of state. Interpret them in terms of a molecular model which describes their energies and motions.	**ICP.5.6** Describe and demonstrate how the kinetic theory can be extended to describe the properties of liquids and solids by introducing attractive forces between the particles.
	ICP.6.7 Describe how both density and molecular structure are applicable in distinguishing the properties of gases from those of liquids and solids.
ICP3.3 Understand how thermal energy (the microscopic motions of the atoms, molecules or both) is related to the macroscopic concept of temperature. Examine the differences in these concepts by measuring the temperature changes and determining specific heat capacity of water as it is heated or cooled.	**ICP.5.3** At the particle level, describe the relationship between temperature and the average kinetic energy of particles in the system and describe how a thermometer measures the temperature of a system.
	ICP.5.4 Distinguish "temperature" from "thermal energy," compare and contrast the Fahrenheit, Celsius, and Kelvin temperature scales, and convert temperatures between them.
ICP.3.4 Understand how the microscopic kinetic molecular theory explains observations of macroscopic gas behavior in terms of temperature, volume, pressure and the number of particles (using	**ICP.5.2** Describe the assumptions used to develop the kinetic theory of gasses.

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the mole concept).	**ICP.5.5** Evaluate graphical or pictorial representations that describe the relationship among the volume, temperature, and number of molecules and the pressure exerted by the system to qualitatively and quantitatively describe how changing any of those variables affects the others.
ICP.4.1 Using conservation of energy, calculate the thermal energy released or absorbed by an object and distinguish between exothermic and endothermic changes.	**ICP.5.7** Analyze a heating / cooling curve to describe how adding or removing thermal energy from a system changes the temperature or state of an object and be able to identify the melting and freezing temperatures of the system.
	ICP.4.3 Understand and explain that the total energy in a closed system is conserved.
ICP.4.2 Differentiate among conduction, convection and radiation and identify them as types of energy transfer.	
ICP.4.3 Explain that electrons can absorb energy and can release energy and that electrons in atoms do this at specific energies.	
ICP.4.4 Describe the relationships among velocity, frequency, wavelength and energy in electromagnetic waves. Describe the regions of the electromagnetic spectrum.	**ICP.9.5** Describe and provide examples of how modern technologies use mechanical or electromagnetic waves and their interactions to transmit information.
ICP.4.5 Understand that from diffraction it is known that visible light is an electromagnetic wave.	
ICP.5.1 Recognize and describe physical properties of matter and use them to differentiate between pure substances and mixtures.	**ICP.5.1** Develop pictorial representations which show that matter is made of particles.

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	ICP.6.1 Distinguish between elements, mixtures, and compounds based on their composition and bonds and be able to construct or sketch particle models to represent them.
	ICP.6.2 Develop graphical and mathematical representations to show that mixtures can be made in any proportion and separated based on the properties of the components of the mixture and apply those representations to quantitatively determine the ratio of components.
	ICP.6.3 Cite the evidence that supports the idea that some pure substances are combined of elements in a definite ratio, as for example seen in electrolysis of water.
ICP5.2 Use the periodic table to understand important patterns in properties of elements.	**ICP.6.5** Given a periodic table, understand and describe the significance of column location for the elements by calculation of molar ratios of known compounds.
ICP.5.3 Understand that the atomic number is unique to each element and is the number of protons in the nucleus of the element.	**ICP.6.4** Given the periodic table, determine the atomic mass, atomic number, and charges for any element.
ICP.5.4 Use the concept of the mole to relate number of moles and the mass of a sample of a pure substance of known chemical composition.	**ICP.5.8** Collect and use experimental data to determine the number of items in a sample without actually counting them and qualitatively relate this to Avogadro's hypothesis.
ICP.5.5 Using conservation principles, write and balance chemical equations.	**ICP.7.2** Demonstrate the Law of Conservation of Matter in terms of atoms and mass of substances by balancing equations.

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ICP.5.6 Identify key indicators of a chemical change and classify simple types of chemical reactions. Differentiate among covalent, ionic, hydrogen and Van der Waals bonding. Write formulas for and name compounds of each type.	**ICP.7.1** Pictorially or mathematically represent chemical changes using particle diagrams and chemical equations.
	ICP.7.3 Differentiate the basic types of reactions, for example: synthesis, decomposition, combustion, single replacement, and double replacement.
	ICP.7.4 Using balanced equations and stoichiometric calculations, demonstrate the principle of Conservation of Matter in terms of atoms and mass.
ICP.5.7 Explain that in exothermic chemical reactions chemical energy is converted into other forms such as thermal, electrical, light and sound energy.	
ICP.6.1 Explain that objects that carry a net charge will exert an electric force (attractive or repulsive) on other objects.	
ICP.6.2 Explain that, when charge is transferred from one object to another, the amount lost by one object equals the amount gained by the other, which is consistent with the principal of conservation of charge.	
ICP.6.3 Using the example of electrolysis and its application in batteries, explain the relationship between chemical reactions and electrical energy.	
ICP.6.4 Define and describe the relationships among voltage, current resistance and power in open and closed electrical circuits.	**ICP.8.1** Describe electrical current in terms of the motion of electrons within a device and relate the rate of motion of the electrons to the amount of current measured.

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	ICP.8.2 Describe the relationship among voltage, current, and resistance for an electrical system consisting of a single voltage source and a single device.
ICP.6.5 Describe the current-flow differences in parallel and series circuits.	
ICP.6.6 Explain that some objects, called magnets, exert magnetic forces with no direct contact**.**	**ICP.8.3** Describe on a macroscopic scale how any distribution of magnetic materials (e.g. iron filings, ferrofluid, etc.) aligns with the magnetic field created by a simple magnet.
ICP.6.7 Using the examples of motors and generators, explain that electrical energy can be transformed into mechanical energy and vice versa.	
ICP.7.1 Demonstrate how historical models and experiments supported the development of our current understanding of the atom and its nucleus.	**ICP.10.1** Describe and compare/contrast the atomic models suggested by Rutherford and Bohr.
ICP.7.2 Differentiate among protons, neutrons and electrons and determine the number of these subatomic particles in each atom.	
ICP.7.3 Understand that the stability of nuclei depend on their numbers of neutrons and protons.	**ICP.10.2** Describe the model of the atomic nucleus and explain how the nucleus stays together in spite of the repulsion between protons.
ICP.7.4 Understand that fission results from large, less stable nuclei decomposing to form smaller, more stable nuclei.	**ICP.10.3** Develop and apply simple qualitative models or sketches of the atomic nucleus that illustrate nuclear structures before and after undergoing fusion, fission, or radioactive decay.
ICP.7.5 Understand that fusion results from two smaller nuclei combining to form one larger nucleus.	**ICP.10.4** Distinguish between fusion, fission, and radioactivity and qualitatively compare the amount of energy released in these processes.

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ICP.7.6 Understand that the energy radiated from the sun derives from the fusion process.	
ICP.7.7 Describe the various forms of emission that are typical of radioactive decay.	
ICP.7.8 Relate the fission process to the human development and use of the fission process in war (uncontrolled) and in peace (controlled).	**ICP.10.5** Explain the potential applications and possible consequences as the result of nuclear processes such as the generation of energy at nuclear power plants, including the potential damage that radioactivity can cause to biological tissues.
ICP.8.1 Describe how energy needs have changed throughout history and how energy needs are met in modern society.	
ICP.8.2 Describe the benefits and risks of the development of non-renewable forms of energy such as coal, oil, natural gas and uranium fission sources.	
ICP.8.3 Describe the benefits and risks of the development of renewable forms of energy such as solar energy, wind-energy, geothermal energy, fusion energy and biofuels.	
ICP.8.4 Describe how efficient use of renewable and non-renewable energy sources is essential to maintaining an acceptable environment.	
ICP.8.5 Describe how the availability of energy resources is essential to the development of an economically viable society.	
ICP.8.6 Contrast the dependence on and use of energy and other natural resources in the economies of industrial nations, of developing nations and of undeveloped nations.	
ICP.8.7 Describe the energy needs of a modern urban city. Compare and contrast these needs with those of a modern rural community.	

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	ICP.1.3 Distinguish between the terms "distance" and "displacement", and determine the value of either given a graphical or mathematical representation of position vs. clock reading (time).
	ICP.2.3 For an object thrown vertically, qualitatively describe or quantitatively determine the velocity and acceleration at various positions during its motion.
	ICP.3.2 Construct force diagrams and combine forces to determine the equivalent single net force acting on the object when more than one force is acting on the object.
	ICP.3.3 Distinguish between forces acting on a body and forces exerted by the body. Categorize forces as contact forces, friction, or action at a distance (field) forces.
	ICP.3.4 Develop pictorial and graphical representations which show that a non-zero net force on an object results in an acceleration of the object and that the acceleration of an object of constant mass is proportional to the total force acting on it, and inversely proportional to its mass for a constant applied total force.
	ICP.3.5 Qualitatively describe and quantitatively determine the magnitude and direction of forces from observing the motion of an object of known mass.

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	ICP.3.6 Qualitatively describe and quantitatively determine the acceleration of an object of known mass from observing the forces acting on that object.
	ICP.4.1 Define energy as a quantity that can be represented as being within a system that is distinct from the remainder of the universe and is measured in Joules.
	ICP.4.4 Qualitatively and quantitatively analyze various scenarios to describe how energy may be transferred into or out of a system by doing work through an external force or adding or removing heat.
	ICP.6.6 Develop graphical and mathematical representations that describe the relationship between volume and mass of an object, describe the slope in terms of the object's density, and apply those representations to qualitatively and quantitatively determine the mass or volume of any object.
	ICP.9.4 Describe how interacting waves produce different phenomena than singular waves in a medium(e.g. periodic changes in volume of sound or resonance)