Instructor: **Ryan Moore** School: **Kalkaska Middle School**

Subject: **8th Grade Science** Grade(s): **8**

Instructional Materials: **Text: Holt Science and Technology**

Month	Topics	Activities & Assessments	CCR & CCW	MCF Benchmarks, or Grade Level Content Expectations (GLCEs)
September	**P2.1 Position — Time** An object's position can be measured and graphed as a function of time. An object's speed can be calculated and graphed as a function of time. **P2.2 Velocity — Time** The motion of an object can be described by its position and velocity as functions of time and by its average speed and average acceleration during intervals of time.	Speed Lab: Measuring student's speed and acceleration.		**P2.1A** Calculate the average speed of an object using the change of position and elapsed time. **P2.1B** Represent the velocities for linear and circular motion using motion diagrams (arrows on strobe pictures). **P2.1C** Create line graphs using measured values of position and elapsed time. **P2.1D** Describe and analyze the motion that a position-time graph represents, given the graph. **P2.1E** Describe and classify various motions in a plane as one dimensional, two dimensional, circular, or periodic. **P2.1F** Distinguish between rotation and revolution and describe and contrast the two speeds of an object like the Earth. **P2.2A** Distinguish between the variables of distance, displacement, speed, velocity, and acceleration. **P2.2B** Use the change of speed and elapsed time to calculate the average acceleration for linear motion. **P2.2C** Describe and analyze the motion that a velocity-time graph represents, given the graph. **P2.2D** State that uniform circular motion involves acceleration without a change in speed.

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October	**P3.1 Basic Forces in Nature** Objects can interact with each other by “direct contact” (e.g., pushes or pulls, friction) or at a distance (e.g., gravity, electromagnetism, nuclear). **P3.2 Net Forces** Forces have magnitude and direction. The net force on an object is the sum of all the forces acting on the object. Objects change their speed and/or direction only when a net force is applied. If the net force on an object is zero, there is no change in motion (Newton’s First Law).	Impacting Lab.		**P3.1A** Identify the force(s) acting between objects in “direct contact” or at a distance. **P3.2A** Identify the magnitude and direction of everyday forces (e.g., wind, tension in ropes, pushes and pulls, weight). **P3.2B** Compare work done in different situations. **P3.2C** Calculate the net force acting on an object.

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November	**P3.3 Newton's Third Law** Whenever one object exerts a force on another object, a force equal in magnitude and opposite in direction is exerted back on the first object. **P3.4 Forces and Acceleration** The change of speed and/or direction (acceleration) of an object is proportional to the net force and inversely proportional to the mass of the object. The acceleration and net force are always in the same direction. **P3.6 Gravitational Interactions** Gravitation is a universal attractive force that a mass exerts on every other mass. The strength of the gravitational force between two masses is proportional to the masses and inversely proportional to the square of the distance between them.	Newton Scooters		**P3.3A** Identify the action and reaction force from examples of forces in everyday situations (e.g., book on a table, walking across the floor, pushing open a door). **P3.4A** Predict the change in motion of an object acted on by several forces. **P3.4B** Identify forces acting on objects moving with constant velocity (e.g., cars on a highway). **P3.4C** Solve problems involving force, mass, and acceleration in linear motion (Newton's second law). **P3.4D** Identify the force(s) acting on objects moving with uniform circular motion (e.g., a car on a circular track, satellites in orbit). **P3.6A** Explain earth-moon interactions (orbital motion) in terms of forces. **P3.6B** Predict how the gravitational force between objects changes when the distance between them changes. **P3.6C** Explain how your weight on Earth could be different from your weight on another planet.

December	**P4.1 Energy Transfer** Moving objects and waves transfer energy from one location to another. They also transfer energy to objects during interactions (e.g., sunlight transfers energy to the ground when it warms the ground; sunlight also transfers energy from the Sun to the Earth). **P4.2 Energy Transformation** Energy is often transformed from one form to another. The amount of energy before a transformation is equal to the amount of energy after the transformation. In most energy transformations, some energy is converted to thermal energy. **P4.3 Kinetic and Potential Energy** Moving objects have kinetic energy. Objects experiencing a force may have potential energy due to their relative positions (e.g., lifting an object or stretching a spring, energy stored in chemical bonds). Conversions between kinetic and gravitational potential energy are common in moving objects. In frictionless systems, the decrease in gravitational potential energy is equal to the increase in kinetic energy or vice versa.	Examining energy transformations in household appliances. Application to rollercoasters	**Article:** Electric Car Article – Identifying arguments for and against the development of electric cars. **Article:** “One Day Your Pants May power Your iPod.”	**P4.1A** Account for and represent energy into and out of systems using energy transfer diagrams. **P4.1B** Explain instances of energy transfer by waves and objects in everyday activities (e.g., why the ground gets warm during the day, how you hear a distant sound, why it hurts when you are hit by a baseball). **P4.2A** Account for and represent energy transfer and transformation in complex processes (interactions). **P4.2B** Name devices that transform specific types of energy into other types (e.g., a device that transforms electricity into motion). **P4.2C** Explain how energy is conserved in common systems (e.g., light incident on a transparent material, light incident on a leaf, mechanical energy in a collision). **P4.2D** Explain why all the stored energy in gasoline does not transform to mechanical energy of a vehicle. **P4.3A** Identify the form of energy in given situations (e.g., moving objects, stretched springs, rocks on cliffs, energy in food). **P4.3B** Describe the transformation between potential and kinetic energy in simple mechanical systems (e.g., pendulums, roller coasters, ski lifts). **P4.3C** Explain why all mechanical systems require an external energy source to maintain their motion.

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January	**C2.2 Molecules in Motion** Molecules that compose matter are in constant motion (translational, rotational, vibrational). Energy may be transferred from one object to another during collisions between molecules. **C3.3 Heating Impacts** Heating increases the kinetic (translational, rotational, and vibrational) energy of the atoms composing elements and the molecules or ions composing compounds. As the kinetic (translational) energy of the atoms, molecules, or ions increases, the temperature of the matter increases. Heating a sample of a crystalline solid increases the kinetic (vibrational) energy of the atoms, molecules, or ions. When the kinetic (vibrational) energy becomes great enough, the crystalline structure breaks down, and the solid melts.			**C2.2A** Describe conduction in terms of molecules bumping into each other to transfer energy. Explain why there is better conduction in solids and liquids than gases. **C2.2B** Describe the various states of matter in terms of the motion and arrangement of the molecules (atoms) making up the substance. **C3.3A** Describe how heat is conducted in a solid. **C3.3B** Describe melting on a molecular level.

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January	**C4.3 Properties of Substances** Differences in the physical and chemical properties of substances are explained by the arrangement of the atoms, ions, or molecules of the substances and by the strength of the forces of attraction between the atoms, ions, or molecules. **C4.8 Atomic Structure** Electrons, protons, and neutrons are parts of the atom and have measurable properties, including mass and, in the case of protons and electrons, charge. The nuclei of atoms are composed of protons and neutrons. A kind of force that is only evident at nuclear distances holds the particles of the nucleus together against the electrical repulsion between the protons.	Atomic Model/Timeline		**C4.3A** Recognize that substances that are solid at room temperature have stronger attractive forces than liquids at room temperature, which have stronger attractive forces than gases at room temperature. **C4.3B** Recognize that solids have a more ordered, regular arrangement of their particles than liquids and that liquids are more ordered than gases. **C4.8A** Identify the location, relative mass, and charge for electrons, protons, and neutrons. **C4.8B** Describe the atom as mostly empty space with an extremely small, dense nucleus consisting of the protons and neutrons and an electron cloud surrounding the nucleus. **C4.8C** Recognize that protons repel each other and that a strong force needs to be present to keep the nucleus intact. **C4.8D** Give the number of electrons and protons present if the fluoride ion has a -1 charge.

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January/February	**C4.9 Periodic Table** In the periodic table, elements are arranged in order of increasing number of protons (called the atomic number). Vertical groups in the periodic table (families) have similar physical and chemical properties due to the same outer electron structures. **C5.4 Phase Change/Diagrams** Changes of state require a transfer of energy. Water has unusually high-energy changes associated with its changes of state.	Element Test Melting Snow Lab: - observations on state of matter in relation to temperature - graphing results		**C4.9A** Identify elements with similar chemical and physical properties using the periodic table. **C5.4A** Compare the energy required to raise the temperature of one gram of aluminum and one gram of water the same number of degrees. **C5.4B** Measure, plot, and interpret the graph of the temperature versus time of an ice-water mixture, under slow heating, through melting and boiling.

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February	**C3.4 Endothermic and Exothermic Reactions** Chemical interactions either release energy to the environment (exothermic) or absorb energy from the environment (endothermic). **C4.2 Nomenclature** All compounds have unique names that are determined systematically. **C4.10 Neutral Atoms, Ions, and Isotopes** A neutral atom of any element will contain the same number of protons and electrons. Ions are charged particles with an unequal number of protons and electrons. Isotopes are atoms of the same element with different numbers of neutrons and essentially the same chemical and physical properties.			**C3.4A** Use the terms endothermic and exothermic correctly to describe chemical reactions in the laboratory. **C3.4B** Explain why chemical reactions will either release or absorb energy. **C4.2A** Name simple binary compounds using their formulae. **C4.2B** Given the name, write the formula of simple binary compounds. **C4.10A** List the number of protons, neutrons, and electrons for any given ion or isotope. **C4.10B** Recognize that an element always contains the same number of protons.

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February	**C5.2 Chemical Changes** Chemical changes can occur when two substances, elements, or compounds interact and produce one or more different substances whose physical and chemical properties are different from the interacting substances. When substances undergo chemical change, the number of atoms in the reactants is the same as the number of atoms in the products. This can be shown through simple balancing of chemical equations. Mass is conserved when substances undergo chemical change. The total mass of the interacting substances (reactants) is the same as the total mass of the substances produced (products).	Balanced Equation Worksheets & Websites.		**C5.2A** Balance simple chemical equations applying the conservation of matter. **C5.2B** Distinguish between chemical and physical changes in terms of the properties of the reactants and products. **C5.2C** Draw pictures to distinguish the relationships between atoms in physical and chemical changes.

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March	**C5.5 Chemical Bonds Trends** An atom's electron configuration, particularly of the outermost electrons, determines how the atom can interact with other atoms. The interactions between atoms that hold them together in molecules or between oppositely charged ions are called chemical bonds. **C5.7 Acids and Bases** Acids and bases are important classes of chemicals that are recognized by easily observed properties in the laboratory. Acids and bases will neutralize each other. Acid formulas usually begin with hydrogen, and base formulas are a metal with a hydroxide ion. As the pH decreases, a solution becomes more acidic. A difference of one pH unit is a factor of 10 in hydrogen ion concentration.	Acid/Base Test		**C5.5A** Predict if the bonding between two atoms of different elements will be primarily ionic or covalent. **C5.4B** Predict the formula for binary compounds of main group elements. **C5.7A** Recognize formulas for common inorganic acids, carboxylic acids, and bases formed from families I and II. **C5.7B** Predict products of an acid-base neutralization. **C5.7C** Describe tests that can be used to distinguish an acid from a base. **C5.7D** Classify various solutions as acidic or basic, given their pH. **C5.7E** Explain why lakes with limestone or calcium carbonate experience less adverse effects from acid rain than lakes with granite beds

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March	**C5.8 Carbon Chemistry** The chemistry of carbon is important. Carbon atoms can bond to one another in chains, rings, and branching networks to form a variety of structures, including synthetic polymers, oils, and the large molecules essential to life.			**C5.8A** Draw structural formulas for up to ten carbon chains of simple hydrocarbons. **C5.8B** Draw isomers for simple hydrocarbons. **C5.8C** Recognize that proteins, starches, and other large biological molecules are polymers.
April	**P3.7 Electric Charges** Electric force exists between any two charged objects. Oppositely charged objects attract, while objects with like charge repel. The strength of the electric force between two charged objects is proportional to the magnitudes of the charges and inversely proportional to the square of the distance between them (Coulomb's Law).			**P3.7A** Predict how the electric force between charged objects varies when the distance between them and/or the magnitude of charges change. **P3.7B** Explain why acquiring a large excess static charge (e.g., pulling off a wool cap, touching a Van de Graaff generator, combing) affects your hair.

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April	**P4.10 Current Electricity — Circuits** Current electricity is described as movement of charges. It is a particularly useful form of energy because it can be easily transferred from place to place and readily transformed by various devices into other forms of energy (e.g., light, heat, sound, and motion). Electrical current (amperage) in a circuit is determined by the potential difference (voltage) of the power source and the resistance of the loads in the circuit. **P4.4 Wave Characteristics** Waves (mechanical and electromagnetic) are described by their wavelength, amplitude, frequency, and speed.	Circuitry Board		**P4.10A** Describe the energy transformations when electrical energy is produced and transferred to homes and businesses. **P4.10B** Identify common household devices that transform electrical energy to other forms of energy, and describe the type of energy transformation. **P4.10C** Given diagrams of many different possible connections of electric circuit elements, identify complete circuits, open circuits, and short circuits and explain the reasons for the classification. **P4.10D** Discriminate between voltage, resistance, and current as they apply to an electric circuit. **P4.4A** Describe specific mechanical waves (e.g., on a demonstration spring, on the ocean) in terms of wavelength, amplitude, frequency, and speed. **P4.4B** Identify everyday examples of transverse and compression (longitudinal) waves. **P4.4C** Compare and contrast transverse and compression (longitudinal) waves in terms of wavelength, amplitude, and frequency.

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May	**P4.5 Mechanical Wave Propagation** Vibrations in matter initiate mechanical waves (e.g., water waves, sound waves, seismic waves), which may propagate in all directions and decrease in intensity in proportion to the distance squared for a point source. Waves transfer energy from one place to another without transferring mass.	Spring Demonstration		**P4.5A** Identify everyday examples of energy transfer by waves and their sources. **P4.5B** Explain why an object (e.g., fishing bobber) does not move forward as a wave passes under it. **P4.5C** Provide evidence to support the claim that sound is energy transferred by a wave, not energy transferred by particles. **P4.5D** Explain how waves propagate from vibrating sources and why the intensity decreases with the square of the distance from a point source. **P4.5E** Explain why everyone in a classroom can hear one person speaking, but why an amplification system is often used in the rear of a large concert auditorium.

May/June	**P4.6 Electromagnetic Waves** Electromagnetic waves (e.g., radio, microwave, infrared, visible light, ultraviolet, x-ray) are produced by changing the motion (acceleration) of charges or by changing magnetic fields. Electromagnetic waves can travel through matter, but they do not require a material medium. (That is, they also travel through empty space.) All electromagnetic waves move in a vacuum at the speed of light. Types of electromagnetic radiation are distinguished from each other by their wavelength and energy. **P4.8 Wave Behavior — Reflection and Refraction** The laws of reflection and refraction describe the relationships between incident and reflected/refracted waves. **P4.9 Nature of Light** Light interacts with matter by reflection, absorption, or transmission.	Spectroscopes with various forms of light. Light intensity lab.		**P4.6A** Identify the different regions on the electromagnetic spectrum and compare them in terms of wavelength, frequency, and energy. **P4.6B** Explain why radio waves can travel through space, but sound waves cannot. **P4.6C** Explain why there is a delay between the time we send a radio message to astronauts on the moon and when they receive it. **P4.6D** Explain why we see a distant event before we hear it (e.g., lightning before thunder, exploding fireworks before the boom). **P4.8A** Draw ray diagrams to indicate how light reflects off objects or refracts into transparent media. **P4.8B** Predict the path of reflected light from flat, curved, or rough surfaces (e.g., flat and curved mirrors, painted walls, paper). **P4.9A** Identify the principle involved when you see a transparent object (e.g., straw, piece of glass) in a clear liquid. **P4.9B** Explain how various materials reflect, absorb, or transmit light in different ways. **P4.9C** Explain why the image of the Sun appears reddish at sunrise and sunset.