UTICA COMMUNITY SCHOOLS

Course Title: Physical Science

Course Content Expectations:

Physics Concepts

Motion of Objects

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 rotations and revolution and describe and contrast the two speeds of an object like the Earth.

Velocity – Time

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.

Forces & Motion

P3.1A Identify the force(s) acting between objects in “direct contact” or at a distance.

Net Forces

P3.2A Identify the magnitude and directions 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.

Newton's Third Law

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).

Forces & Acceleration

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 2^{nd} 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).

Gravitational Interactions

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.

P3.6C Explain how your weight on Earth could be different from your weight on another planet.

Electric Charges

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 Graff generator, combing) affects your hair.

Forms of Energy and Energy Transformation

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).

Kinetic and Potential Energy

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.

Wave Characteristics

P4.4A Describe specific mechanical waves (e.g., on a demonstration spring, on the ocean) in terms of wavelength, amplitude, and frequency.

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.

Mechanical Wave Propagation

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.

Electromagnetic Waves

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 time 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. lightening before thunder, exploding fireworks before the boom).

Wave Behavior – Reflection & Refraction

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).

Nature of Light

P4.9A Identify the principle involved when you see a transparent object (e.g., straw, a 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.

Current Electricity – Circuits

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.

Nuclear Reactions
P4.12C Explain how stars, including our Sun, produce huge amounts of energy (e.g., visible, infrared, or ultraviolet light).

Chemistry Concepts

Molecules in Motion
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.

Heating Impacts
C3.3A Describe how heat is conducted in a solid.
C3.3B Describe melting on a molecular level.

Nomenclature
C4.2A Name simple binary compounds using their formulae.
C4.2B Given the name, write the formula of simple binary compounds.

Properties of Substances
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.

Atomic Structure
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.

Periodic Table

C4.9A Identify elements with similar chemical and physical properties using the periodic table.

Neutral Atoms, Ions, and Isotopes

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.

Chemical Changes

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.

Phase Change/Diagrams

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.

Chemical Bonds – Trends

C5.5A Predict if the bonding between two atoms of different elements will be primarily ionic or covalent.

C5.5B Predict the formula for binary compounds of main group elements.

Acids and Bases

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-based 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.

Inquiry, Reflection, and Social Implications

P,C1.1A Generate new questions that can be investigated in the laboratory or field.

P,C1.1B Evaluate the uncertainties or validity of scientific conclusions using an understanding of sources of measurement error, the challenges of controlling variables, accuracy of data analysis, logic of argument, logic of experimental design, and/or the dependence on underlying assumptions.

P,C1.1C Conduct scientific investigations using appropriate tools and techniques (e.g., selecting an instrument that measure the desired quantity – length,

volume, weight, time interval, temperature – with the appropriate level of precision).

P,C1.1D Identify patterns in data and relate them to theoretical models.

P,C1.1E Describe a reason for a given conclusion using evidence from an investigation.

Scientific Reflection and Social Implications

P,C1.2A Critique whether or not specific questions can be answered through scientific investigations.

P,C1.2B Identify and critique arguments about personal or societal issues based on scientific evidence.

P,C1.2C Develop an understanding of a scientific concept by accessing information from multiple sources. Evaluate the scientific accuracy and significance of the information.

P,C1.2D Evaluate scientific explanations in a peer review process or discussion format.

P,C1.2E Evaluate the future career and occupational prospects of science fields.