

Science Curriculum – Physical Science

Kindergarten

Overall Essential Skill – Students will use their 5 senses to observe and describe characteristics and changes in non-living and living objects in the world around them

- **Process Skills/Scientific Method** –Children will use the scientific method in our inquiry-based activities in all grade levels and content areas in the science curriculum. Students will observe and describe with their five senses
- **Scientific Technology & Tools**- magnifying glasses, simple scales, safety goggles and measuring tools
- **Content Topics** – Using the appropriate tools, technology, and techniques, students will observe the characteristics and changes in living and non-living objects in the world around them
- **Science Safety**- - Students will follow safety instructions, directions, and use appropriate safety equipment.

Content – Science at the Kindergarten level is at the free-exploration level. Students will use their 5 senses to observe and describe the characteristics and changes in living and non-living objects in the world around them

Students will be exposed to:

- Living things, both plants and animals
- The physical environment, such as rocks, minerals, soil, day and night, puddles, daily weather, musical instruments and water play

Grade One – Properties of Matter

Essential Skills

- **Content Skills**- Students will demonstrate an understanding that cycles are a repeating pattern in living and non-living objects. Students will demonstrate an understanding that properties distinguish one object from another.
- **Process Skills/Scientific Method** –Children will use the scientific method in our inquiry-based activities in all grade levels and content areas in the science curriculum. – Students will use standard/non-standard measurement scales and units and to observe and describe, predict, sort, categorize and record
- **Scientific Technology & Tools** – Students will use appropriate tools, technology, and techniques to gather, analyze, interpret, and share data. (Thermometers, rulers (inch & cm), rain gauges (cm units), magnifying glasses, simple microscopes, balances, computers and safety goggles)
- **Science Safety**- Students will follow safety instructions, directions, and use appropriate safety equipment

Content

- Students will list some observable properties of solids, liquids, and gases
- Students will define matter
- Students will classify substances according to physical properties
- Students will perform an experiment to demonstrate common properties of gases, liquids and solids

Grade Two – Changes: Solids, Liquids & Gases - STC

Essential Skills

- **Content Skills-** Students will demonstrate an understanding that the Earth gets heat and light from the sun and has air, soil and water to sustain life. Students will understand that proper soil conditions are essential for plant growth and survival. Students will understand that plants have life cycles and plant growth is affected by many different variables. Students will expand their understanding of solids, liquids, and gases and how they change.
- **Process Skills/Scientific Method** –Children will use the scientific method in our inquiry-based activities in all grade levels and content areas in the science curriculum. Students will use appropriate measurement units, observe, describe, predict, sort, record, categorize
- **Scientific Technology & Tools** - Students will use appropriate tools, models, technology, and techniques to gather, analyze, interpret, and share data. (Rulers, magnifying glasses, compare old and new technology, computers and safety goggles)
- **Science Safety-** - Students will follow safety instructions, directions, and use appropriate safety equipment.

Content

- Students will define matter
- Students will classify substances according to their physical properties
- Students will perform experiments to demonstrate changes of properties in a gases, liquids and solids
- Students will describe and record how matter is changed through such processes as heating, cooling, mixing, dissolving and separating
- Students will investigate and describe the characteristics of a chemical reaction
- Students will perform and describe experiments which illustrate the difference between physical and chemical changes in substances

Grade Three – Sound - STC

Essential Skills

- **Content Skills-** Students will demonstrate an understanding of the characteristics of vertebrates and their adaptations for survival in various environments. Students will understand the basic characteristics of sound. Students will understand the different properties of rocks and minerals; and how those properties determine their use.
- **Process Skills/Scientific Method** –Children will use the scientific method in our inquiry-based activities in all grade levels and content areas in the science curriculum. Students will use appropriate measurement units, observe, describe, read and create graphs/tables to construct explanations, predict, sort, categorize, record, develop scales, introduce and conduct an experiment isolating one variable
- **Scientific Technology & Tools** – Students will use appropriate tools, technology, and techniques to gather, analyze, interpret, and share data. (computers, rulers, magnifying glasses, microscopes, balance scales, prisms, and safety goggles)
- **Science Safety-** - Students will follow safety instructions, directions, and use appropriate safety equipment.

Content

- Students will produce sounds by causing several types of objects to vibrate

- Students will explore and discuss that sound is changed when it travels through different materials
- Through investigations, students will demonstrate that changes in frequency and amplitude of vibration change the pitch and volume of sound.
- Students will explore, discuss, and explain in their own words, with or without visuals, the effects of sound on living objects in the environment
- Students will demonstrate that sound is produced produced when objects vibrate and cause movement of the nearby environment, in the form of wave motion.

Grade Four – Food Chemistry - STC

Essential Skills

- Content Skills - Students will demonstrate an understanding of the interactions and interdependence between plants and animals and their habitats in New Hampshire ecosystems. Students will demonstrate an understanding of the interactions between land and water on the planet Earth. Students will explore chemistry in the familiar context of food, and relate nutrients to human health.
- Process Skills/Scientific Method –Children will use the scientific method in our inquiry-based activities in all grade levels and content areas in the science curriculum. Students will use appropriate measurement units and will observe, describe, experiment isolate a variable, pose a question, make a prediction, read and create graphs and tables and create explanations
- Scientific Technology & Tools – Students will use appropriate tools, technology, and techniques to gather, analyze, interpret, and share data. (computers, rulers, magnifying glasses, microscopes, thermometers (F & C), compasses, litmus paper, models and safety goggles)
- Science Safety- - Students will follow safety instructions, directions, and use appropriate safety equipment.

Content

- Students will perform physical and chemical tests to identify the presence of starch, glucose, fats and proteins in common foods
- Students will explain how nutrients are essential to human health
- Students will perform and describe experiments which illustrate physical and chemical changes in substances

Grade Five – Motion & Design - STC

Essential Skills

- Content Skills- Students will develop an understanding of the differences between scientific law and theory through the study of ecology, astronomy and motion and energy
- Process Skills/Scientific Method –Children will use the scientific method in our inquiry-based activities in all grade levels and content areas in the science curriculum. Students will use appropriate measurement units, observe, describe, experiment, isolate a variable, pose a question, make a prediction, read and create graphs and tables, create explanations, compare and estimate very large and small numbers, work in small teams and form own conclusion, make hypothesis, and design experiments to test and seek information for comparing past and present science ideas and theories
- Scientific Technology & Tools – Students will use appropriate tools, technology, and techniques to gather, analyze, interpret, and share data. (computers, rulers,

magnifying glasses, microscopes, thermometers (F & C), stop watches, compasses, telescopes, microscopes, graduated cylinders, pH paper, and safety goggles)

- Science Safety- - Students will follow safety instructions, directions, and use appropriate safety equipment

Content

- Students will observe and describe how one form of energy may be transformed into another
- Students will build and design a device to demonstrate energy transfer
- Students will design a simple experiment or demonstration to show the difference between potential and kinetic energy
- Students will design simple investigations which demonstrate Newton's Three Laws of Motion
- Students will explain the effects of gravity, friction, and acceleration upon moving objects
- Students will explain the effects of gravity and friction upon objects
- Students will construct simple machines (wheel and axle, levers, inclined planes, rope and pulley, wedge and screw) to demonstrate how they make work easier. (not part of kit)

Grade Seven – Physics – Quantities and Qualities of Motion

Essential Skills

Content Skills - Students will demonstrate an understanding of cellular structures and functions. Students will demonstrate an understanding of the laws governing transfer of energy and change in matter.

- Process Skills/Scientific Method - Children will use the scientific method in our inquiry-based activities in all grade levels and content areas in the science curriculum
- Scientific Technology & Tools - Students will use appropriate tools, technology, and techniques to gather, analyze, interpret and share data. (Thermometers, graduated cylinders, rulers (inch & cm), magnifying glasses, simple microscopes, balances, computers and probes, and safety goggles)
- Science Safety - Students will follow safety instructions, directions, and use appropriate safety equipment

Content

- Students will observe and describe objects in motion, including linear, free fall, projectile, circular, and vibrational motion
- Students will explain the 4 states and changes of states of matter, including plasma
- Students will demonstrate through modeling and analogy of Newton's Three Laws of Motion; including momentum
- Students will describe momentum and conduct an experiment to illustrate conservation and transfer of momentum
- Students will explain the causes and controls of motion: force and work
- Students will identify/explain the forms and states of energy (heat, electrical, light, mechanical, and nuclear) transformation of energy, and conservation of energy
- Students will show by examples how types of energy are used for specific purposes
- Students will build or design a device to demonstrate energy transfer and apply the knowledge gained to how energy transfer impacts on the operation of devices

found in the home, e.g. home heating systems, refrigerators

- Students will describe or sketch how energy is released when the nuclei of some atoms undergo fission or fusion
- Students will explain quantitatively exchanges of energy within a system, e.g. hot metal in cold water
- Students will explore and identify sources of heat including chemical, mechanical, and absorption of radiation; identify the effect of heat on common substances
- Students will demonstrate an understanding of the difference between heat and temperature
- Students will compare and contrast electric charge and electric current flow
- Students will experiment to determine specific properties of substances that are useful in identification of the substance such as density, strength, tension, and melting point
- Students will identify the electronic nature of all material; electric forces between protons and electrons that hold atoms together (cohesive force that holds an atom together, the bonds between different atoms when compounds form)
- Using magnets, students will investigate and demonstrate magnetic forces
- Students will demonstrate the relationship between electrical and magnetic forces
- Students will construct a series, parallel, and compound circuit, including a simple electrical motor
- Students will measure volts, amps, and ohms as electrical properties; will be introduced to Ohm's Law
- Students will use a prism to separate white light into the visible spectrum and will explain in their own words the principles of refraction
- Students will use a mirror to explain in their own words the principles of reflection
- Students will use opaque objects to explain in their own words the principles of absorption; contrast with transparent and translucent materials
- Students will explain in their own words, with or without visuals, that light travels in a straight line in the form of waves or particles
- Using a variety of objects, students will demonstrate that when light hits an object it can be reflected, absorbed, or it passes through the object
- Students will distinguish among amplitude, wavelength, frequency and velocity of longitudinal and transverse waves (vibrational motion)
- Students will demonstrate an understanding of the electromagnetic spectrum

Grade Eight – Chemistry – Structure and Properties of Matter

Essential Skills

Content Skills - Students will demonstrate an understanding of the interdependence of all life. Students will demonstrate an understanding that all matter has atomic structure that can be transformed.

- **Process Skills/Scientific Method** - Children will use the scientific method in our inquiry-based activities in all grade levels and content areas in the science curriculum
- **Scientific Technology & Tools** - Students will use appropriate tools, technology, and techniques to gather, analyze, interpret and share data. (Thermometers, rulers (inch & CM), magnifying glasses, simple microscopes, balances, computers and safety goggles)
- **Science Safety** - Students will follow safety instructions, directions, and use appropriate safety equipment

Content

- Students will diagram, label, and model various complex atoms including the

seven key elements of living organisms

- Students will explain properties of electrons, protons and neutrons
- Students will distinguish between elements and compounds
- Students will explain how atoms bond to form new compounds
- Students will diagram the flow of a chemical change including endothermic and exothermic reactions
- Students will identify properties and types of solutions
- Students will define matter
- Students will classify substances according to physical and chemical properties
- Students will perform an experiment to demonstrate common properties of gases, liquids and solids
- Students will describe and record how treatments affect substances (such as heating, wetting, bending or combining with other materials)
- Students will perform and describe experiments which illustrate the difference between physical and chemical changes in substances
- Students will understand the organization and use of the Periodical Table
- Students will understand and identify by pH of acids, bases, and salts
- Students will demonstrate understanding and measurement of electrochemical cells

Grade Eleven –

Chemistry

- College prep chemistry as an experimental science emphasizes math application and laboratory activities.
- Students are introduced to quantitative concepts of chemistry and are encouraged to inquire and make accurate observations and valid conclusions.
- Emphasis is on scientific method and appropriate application of inquiry, observations, and inference to solve problems.

Physics

- A Conceptual Physics course requiring working skills in Algebra, Geometry, and Trigonometry.
- The fundamentals of motion, force, energy, work and physical properties of matter including inertia, momentum, gravitational attraction, and specific heat are covered.
- Independent research, formal laboratory reports, and Investigative Challenges are assigned on a regular basis.
- This is suggested for college bound students NOT planning to major in Science or Technology.

Grade Twelve –

Chemistry

- College prep chemistry as an experimental science emphasizes math application and laboratory activities.
- Students are introduced to quantitative concepts of chemistry and are encouraged to inquire and make accurate observations and valid conclusions.
- Emphasis is on scientific method and appropriate application of inquiry, observations, and inference to solve problems.

Chemistry (Advanced)

- College survey course, emphasizing theory and concepts, is designed for students with strong interest in chemistry.
- Students are prepared for the required AP exam, which provides possibility of college credit.
- Laboratory exercises and demonstrations supplement the lecture portion of the course.

Physics

- A Conceptual Physics course requiring working skills in Algebra, Geometry, and Trigonometry.
- The fundamentals of motion, force, energy, work and physical properties of matter including inertia, momentum, gravitational attraction, and specific heat are covered.
- Independent research, formal laboratory reports, and Investigative Challenges are assigned on a regular basis.
- This is suggested for college bound students NOT planning to major in Science or Technology.

Physics (Advanced)

- Advanced Placement level of physics intended for college bound students planning to major in Science or Technology.
- Successful completion of Integrated Mathematics III is a requirement with either Topics in Mathematics or Pre-calculus Mathematics 012 recommended
- This Physics program will provide in depth treatment of motion, force, work, energy, momentum, fluid mechanics, thermodynamics, wave mechanics, sound, light electrostatics, electricity and electronics