CONNECTED/21st Century Learning	Global Perspective:	Communication Skills/Characteristics of Successful Learners
Technology • SMART Board • Digital Data Analysis • Personal Electronic Devices	• Seasonal differences	• Small Group Collaborative Work (Thinking Interdependently) • Claims and Evidence • Transferring Knowledge to New Situations • Act Responsibly in Lab Setting • Self-Advocacy with Challenging Concepts • Thinking Flexibly • Taking Responsible Risks in the Inquiry Process

Scientific and Engineering Practices

Asking questions and defining problems in 6–8 builds on K–5 experiences and progresses to specifying relationships between variables, and clarifying arguments and models.

Ask questions

- that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information.
- to identify and/or clarify evidence and/or the premise(s) of an argument.
- to clarify and/or refine a model, an explanation, or an engineering problem.
- that require sufficient and appropriate empirical evidence to answer.
- that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles.
- that challenge the premise(s) of an argument or the interpretation of a data set.

Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions.

Developing and Using Models: Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

Evaluate limitations of a model for a proposed object or tool.

Develop or modify a model—based on evidence – to match what happens if a variable or component of a system is changed.

Use and/or develop a model of simple systems with uncertain and less predictable factors.

Develop and/or revise a model to show the relationships among variables, including those that are not observable but predict observable phenomena.

Develop and/or use a model to predict and/or describe phenomena.

Develop a model to describe unobservable mechanisms.

Develop and/or use a model to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales.

Planning and carrying out investigations in 6-8 builds on K-5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or solutions.

Conduct an investigation and/or evaluate and/or revise the experimental design to produce data to serve as the basis for evidence that meet the goals of the investigation.

Evaluate the accuracy of various methods for collecting data.

Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions.

Collect data about the performance of a proposed object, tool, process or system under a range of conditions.

Analyzing and Interpreting Data: Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

Construct, analyze, and/or interpret graphical displays of data and/or large data sets to identify linear and nonlinear relationships.

Use graphical displays (e.g., maps, charts, graphs, and/or tables) of large data sets to identify temporal and spatial relationships.

Distinguish between causal and correlational relationships in data.

Analyze and interpret data to provide evidence for phenomena.

Consider limitations of data analysis (e.g., measurement error), and/or seek to improve precision and accuracy of data with better technological tools and methods (e.g., multiple trials).

Analyze and interpret data to determine similarities and differences in findings.

Analyze data to define an optimal operational range for a proposed object, tool, process or system that best meets criteria for success.

Mathematical and computational thinking in 6–8 builds on K–5 experiences and progresses to identifying patterns in large data sets and using mathematical concepts to support explanations and arguments.

Use mathematical representations to describe and/or support scientific conclusions and design solutions.

Create algorithms (a series of ordered steps) to solve a problem.

Apply mathematical concepts and/or processes (e.g., ratio, rate, percent, basic operations, simple algebra) to scientific and engineering questions and problems.

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

Construct an explanation that includes qualitative or quantitative relationships between variables that predict(s) and/or describe(s) phenomena.

Construct an explanation using models or representations.

Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Apply scientific ideas, principles, and/or evidence to construct, revise and/or use an explanation for real-world phenomena, examples, or events.

Apply scientific ideas or principles to design, construct, and/or test a design of an object, tool, process or system.

Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).

Respectfully provide and receive critiques about one's explanations, procedures, models, and questions by citing relevant evidence and posing and responding to questions that elicit pertinent elaboration and detail.

Obtaining, evaluating, and communicating information in 6–8 builds on K–5 experiences and progresses to evaluating the merit and validity of ideas and methods.

Critically read scientific texts adapted for classroom use to determine the central ideas and/or obtain scientific and/or technical information to describe patterns in and/or evidence about the natural and designed world(s).

Integrate qualitative and/or quantitative scientific and/or technical information in written text with that contained in media and visual displays to clarify claims and findings.

Gather, read, and synthesize information from multiple appropriate sources.

Communicate scientific and/or technical information (e.g. about a proposed object, tool, process, system) in writing and/or through oral presentations.

Unit: CHEMISTRY (Properties of Matter & Mixtures, Compounds, and Elements) Essential Question: What is our universe made of?		
CROSS-CUTTING CONCEPTS: Cause and Effect - Cause and effect relationships may be used to predict phenomena in natural or designed systems. Scale, Proportion, and Quantity - Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. Structure and Function - Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. Energy and Matter - Matter is conserved because atoms are conserved in physical and chemical processes. The transfer of energy can be tracked as energy flows through a designed or natural system.		
SCIENCE VOCABULARY: matter, mass/weight, volume, density, particles, boiling point, melting point, phase changes, condensation, freezing point, evaporation, sublimation, vaporization, atom, mixtures, compounds, elements, periodic table, group/family, period, physical properties/changes, chemical properties/changes, solutions, pure substances, solids, liquids, gas, plasma ACADEMIC VOCABULARY: claim, evidence, structure, transformation, properties		
District Grade Level Summative Assessment 1: Application: Demonstrate knowledge and understanding of concepts covered in the Properties of Matter Unit Performance Task: Design and conduct a scientific procedure to determine the identity of an unknown substance. District Grade Level Summative Assessment 2: Application: Demonstrate knowledge and understanding of concepts covered in the Mixtures, Compounds & Elements Unit Performance Task: Determine placement of elements on the periodic table based upon their physical and chemical characteristics. Support placement with evidence and knowledge of neighboring elements.		
GUIDING QUESTIONS: 1. How can you distinguish one substance from another? 2. How do the building blocks of matter help explain the diversity of materials that exist in the world? 3. What are substances made from and how does their structure affect their properties?		
Engineering, Technology, and Applications of Science 1.B: Developing Possible Solutions A solution needs to be tested, and then modified on the basis of the test results, in order to improve it.		
Next Generation Science Standards Performance Expectations	**Disciplinary Core ideas**	**Skills and Knowledge**
Students who demonstrate understanding can: MS-PS1-1. Develop models to describe the atomic composition of simple molecules and extended	Connected NGSS Disciplinary Core Ideas: Grade 5 Standards: PS1.A: Structure and Properties of Matter	Formative Understandings and Skills ● Compare positions, movements, and relationships of particles in different

structures. MS-PS1-2 Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. MS-PS1-3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society. MS-PS1-5. Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved. MS-PS1-6. Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.* MS-PS3-4. Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.	-Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects. -The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. -Measurements of a variety of properties can be used to identify materials. (Boundary: At this grade level (5th grade), mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.) Grade 5 Standards: PS1.B: Chemical Reactions -When two or more different substances are mixed, a new substance with different properties may be formed. -No matter what reaction or change in properties occurs, the total weight of the substances does not change. (Boundary: Mass and weight are not distinguished at this grade level.) ____ PS1.A: Structure and Properties of Matter -Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. -Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. -Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. -In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations. -Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals).	phases of matter, depending on temperature and pressure ● Understand that solids may be formed with molecules or a crystalline structure ● Explain how temperature is a measurement of kinetic energy ● Give an example of Law of Conservation of Mass ● Explain how mass is conserved when matter changes form (i.e., solid to liquid) ● Use characteristic properties to identify substances (density, behavior in water, behavior when heated, solubility, boiling point, melting point) ● Identify pure substances using their characteristic properties ● Identify physical and chemical properties ● Identify physical and chemical changes ● Describe chemical reactions (Chemical equations to show regrouping of atoms) ● Explain examples of chemical reactions that release energy and others that store energy (exo- and endo- thermic) ● Analyze the different properties of new substances ● Understand that atoms are the smallest unit of matter ● Understand that atoms can combine in various ways to form substances ● Apply understanding of the organization of the Periodic Table based on characteristic properties

	-The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (PS1.B: Chemical Reactions -Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. -The total number of each type of atom is conserved, and thus the mass does not change. -Some chemical reactions release energy, others store energy. PS3.A: Definitions of Energy -Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present.	

Unit: ASTRONOMY (Sun, Earth, Moon & Planetary Systems) Essential Questions: What is the universe? What are the effects of the features and forces in the *planetary system?*
CROSSCUTTING CONCEPTS: *Patterns* Patterns can be used to identify cause-and-effect relationships. *Scale, Proportion, and Quantity* Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. *Systems and System Models* Models can be used to represent systems and their interactions.
SCIENCE VOCABULARY: tides, gravity, orbit, rotation, revolution, eclipses, galaxy, universe, energy, phases of the moon, asteroids, diameter ACADEMIC VOCABULARY: motion, force, patterns, structure
District Grade Level Summative Assessments: Summative Assessment 1: Demonstrate knowledge and understanding of concepts covered in the Researching the Sun-Earth-Moon Unit Summative Assessment 2:

Demonstrate knowledge and understanding of concepts covered in the Exploring Planetary Systems Unit
GUIDING QUESTIONS: 1. What forces and processes govern motion, matter and structure in the universe? 2. What role does the sun play? What is Earth's relationship to other objects in our solar system and beyond? (Universal address)
Interdependence of Science, Engineering, and Technology Engineering advances have led to important discoveries in virtually every field of science and scientific discoveries have led to the development of entire industries and engineered systems.

Next Generation Science Standards Performance Expectations	Disciplinary Core ideas	Skills and Knowledge
Grade 5 Performance Expectation: 5-ESS1-1. Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from Earth. Grade 5 Performance Expectation: 5-ESS1-2. Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. MS-PS2-4. Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. MS-ESS1-1. Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons. MS-ESS1-2. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. MS-ESS1-3. Analyze and interpret data to determine scale properties of objects in the	Grade 5 Standards: PS2.B: Types of Interactions The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center. (5-PS2-1) **Extend to all planets for grade 6** Grade 5 Standards: ESS1.A: The Universe and its Stars The sun is a star that appears larger and brighter than other stars because it is closer. Stars range greatly in their distance from Earth. (5-ESS1-1) Grade 5 Standards: ESS1.B: Earth and the Solar System The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the sun, moon, and stars at different times of the day, month, and year. (5-ESS1-2) ESS1.A: The Universe and Its Stars -Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. -Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. ESS1.B: Earth and the Solar System -The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them.	Formative Understandings and Skills • Understand that the Sun, Earth, and Moon comprise a system • Understand that the sun is a star that appears larger and brighter because it is closer than other stars, which have various distances from earth • Distinguish between rotation and revolution • Explain why we have night and day • Analyze data about shadows to draw conclusions about Sun's apparent motion • Model and compare seasonal shadows • Understand relationship of Earth's revolutions to the angle of the Sun's rays • Explain why we have different seasons and how they differ for different parts of the world • Model how the positions of the sun, moon, and stars change throughout the day, month, and year • Describe the cyclical pattern of the lunar phases • Model how solar and lunar eclipses occur based on the tilt of the moon's orbit • Understand that the earth and solar system are a part of one of many galaxies, the Milky Way

solar system.	-This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year. -The solar system appears to have formed from a disk of dust and gas, drawn together by gravity.	● Explain how our solar system appears to have formed from a disk of dust and gas drawn together by gravity ● Understand that planets, moons, and asteroids are held in orbit by gravitational pull ● Analyze how a planet's mass and radius affects surface gravity ● Use scale model to represent planets

Unit: Light Energy (Nature of Light & Optics)

Essential Questions: What is energy? What is the nature of light?

CROSSCUTTING CONCEPTS:

Scale, Proportion, and Quantity
Proportional relationships (e.g. speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes.

Systems and System Models
Models can be used to represent systems and their interactions – such as inputs, processes, and outputs – and energy and matter flows within systems.

Energy and Matter
Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion).

SCIENCE VOCABULARY: energy transformation, Law of Conservation, electromagnetic spectrum, reflection, refraction, angle of incidence, angle of reflection, convex, concave, ultraviolet, infrared, wave, particle, wavelength, frequency, amplitude, optical fiber, total internal reflection, transmission, code, receiver, transmitter
ACADEMIC VOCABULARY: evidence, claim, support, argue, defend, analyze, justify, system, interaction, relationship,

District Grade Level Summative Assessments:

Summative Assessment 1: Demonstrate knowledge and understanding of concepts covered in the Researching the Nature of Light Unit
Summative Assessment 2: Demonstrate knowledge and understanding of concepts covered in the Exploring Optical Systems Unit

GUIDING QUESTIONS:

1. How can we investigate the transfer of energy within and between systems? Why is it important?
2. What are the characteristic properties and behaviors of waves?
3. Is light a wave or a particle or both? Support your claim with evidence
4. How do we use instruments that transmit and detect light to extend our senses?
5. How does the media (air, water, vacuum) affect the behavior of light?
6. What is the electromagnetic spectrum?
7. How can we apply our understanding of light to a design problem?

Influence of Science, Engineering, and Technology on Society and the Natural World Technologies extend the measurement, exploration, modeling, and computational capacity of scientific investigations.		
Next Generation Science Standards Performance Expectations	**Disciplinary Core ideas**	**Skills and Knowledge**
MS-PS4-1. Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave. MS-PS4-2. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. MS-PS4-3. Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.	Grade 4 Standard: PS3.B: Conservation of Energy and Energy Transfer Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced. Light also transfers energy from place to place. PS3.A: Definitions of Energy -Motion energy is properly called kinetic energy -A system of objects may also contain stored (potential) energy, depending on their relative positions. PS4.A: Wave Properties -A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. PS4.B: Electromagnetic Radiation -When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light. -The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends. -A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. -However, because light can travel through space, it cannot be a matter wave, like sound or water waves. PS4.C: Information Technologies and Instrumentation -Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information.	Formative Understandings and Skills ● Understand that light is one of the forms of energy ● Identify energy transformations ● Distinguish between kinetic and potential energy ● Understand that light travels in waves, which have a specific wavelength, frequency, and amplitude ● Compare the ways light interacts with objects (reflected, absorbed, or transmitted through the object) ● Show how light travels in straight lines on a path which can bend ● Apply a wave model to explain the brightness, color, and frequency of light ● Compare types of waves (light vs. sound or water) based on their ability to travel through space ● Explain how light wave pulses can be used to encode and transmit information through fiber optics