New York Intermediate Science Grades 5 - 8

MIDDLE SCHOOL SCIENCE	BOARDWORKS MIDDLE SCHOOL SCIENCE PRESENTATION
Standard 4 - Living Environment	
Key idea 1 - Living things are both similar to and different from each other and from nonliving things.	
performance indicator 1.1 - Compare and contrast the parts of plants, animals, and one-celled organisms.	
1.1a Living things are composed of cells. Cells provide structure and carry on major functions to sustain life. Cells are usually microscopic in size.	Animal and Plant Cells Looking at Cells
1.1b The way in which cells function is similar in all living things. Cells grow and divide, producing more cells. Cells take in nutrients, which they use to provide energy for the work that cells do and to make the materials that a cell or an organism needs.	Animal and Plant Cells Where Do Cells Come From? Releasing Energy
1.1c Most cells have cell membranes, genetic material, and cytoplasm. Some cells have a cell wall and/or chloroplasts. Many cells have a nucleus.	Animal and Plant Cells
1.1d Some organisms are single cells; others, including humans, are multicellular.	Animal and Plant Cells Cells to Organisms
1.1e Cells are organized for more effective functioning in multicellular organisms. Levels of organization for structure and function of a multicellular organism include cells, tissues, organs, and organ systems.	Cells to Organisms
1.1f Many plants have roots, stems, leaves, and reproductive structures. These organized groups of tissues are responsible for a plant's life activities.	Leaves and Glucose Roots and Water
1.1g Multicellular animals often have similar organs and specialized systems for carrying out major life activities.	Cells to Organisms
1.1h Living things are classified by shared characteristics on the cellular and organism level. In classifying organisms, biologists consider details of internal and external structures. Biological classification systems are arranged from general (kingdom) to specific (species).	Classifying Organisms
performance indicator 1.2 - Explain the functioning of the major human organ systems and their interactions.	

1.2a Each system is composed of organs and tissues which perform specific functions and interact with each other, e.g., digestion, gas exchange, excretion, circulation, locomotion, control, coordination, reproduction, and protection from disease.	Cells to Organisms Digestion Human Sex Cells and Systems Respiration and the Circulatory System The Respiratory System The Nervous System The Endocrine System The Musculoskeletal System Fighting Disease
1.2b Tissues, organs, and organ systems help to provide all cells with nutrients, oxygen, and waste removal.	Cells to Organisms Respiration and the Circulatory System The Respiratory System Digestion
1.2c The digestive system consists of organs that are responsible for the mechanical and chemical breakdown of food. The breakdown process results in molecules that can be absorbed and transported to cells.	Cells to Organisms Digestion Chemical Digestion
1.2d During respiration, cells use oxygen to release the energy stored in food. The respiratory system supplies oxygen and removes carbon dioxide (gas exchange).	Releasing Energy Respiration and the Circulatory System The Respiratory System
1.2e The excretory system functions in the disposal of dissolved waste molecules, the elimination of liquid and gaseous wastes, and the removal of excess heat energy.	Cells to Organisms
1.2f The circulatory system moves substances to and from cells, where they are needed or produced, responding to changing demands.	Cells to Organisms Respiration and the Circulatory System
1.2g Locomotion, necessary to escape danger, obtain food and shelter, and reproduce, is accomplished by the interaction of the skeletal and muscular systems, and coordinated by the nervous system.	The Musculoskeletal System The Nervous System
1.2h The nervous and endocrine systems interact to control and coordinate the body's responses to changes in the environment, and to regulate growth, development, and reproduction. Hormones are chemicals produced by the endocrine system; hormones regulate many body functions.	The Nervous System The Endocrine System
1.2i The male and female reproductive systems are responsible for producing sex cells necessary for the production of offspring.	Human Sex Cells and Systems
1.2j Disease breaks down the structures or functions of an organism. Some diseases are the result of failures of the system. Other diseases are the result of damage by infection from other organisms (germ theory). Specialized cells protect the body from infectious disease. The chemicals they produce identify and destroy microbes that enter the body.	Fighting Disease How Microbes Cause Disease Human Behavior What Are Microbes?
Key idea 2 - Organisms inherit genetic information in a variety of ways that result in continuity of structure and function between parents and offspring.	

performance indicator 2.1 - Describe sexual and asexual mechanisms for passing genetic materials from generation to generation.	
2.1a Hereditary information is contained in genes. Genes are composed of DNA that makes up the chromosomes of cells.	Causes of Variation
2.1b Each gene carries a single unit of information. A single inherited trait of an individual can be determined by one pair or by many pairs of genes. A human cell contains thousands of different genes.	Genes and Alleles Causes of Variation
2.1c Each human cell contains a copy of all the genes needed to produce a human being.	Causes of Variation
2.1d In asexual reproduction, all the genes come from a single parent. Asexually produced offspring are genetically identical to the parent.	Types of Reproduction
2.1e In sexual reproduction typically half of the genes come from each parent. Sexually produced offspring are not identical to either parent.	Causes of Variation Types of Variation
performance indicator 2.2 - Describe simple mechanisms related to the inheritance of some physical traits in offspring.	
2.2a In all organisms, genetic traits are passed on from generation to generation.	Causes of Variation Types of Variation
2.2b Some genes are dominant and some are recessive. Some traits are inherited by mechanisms other than dominance and recessiveness.	Genes and Alleles Inheritance
2.2c The probability of traits being expressed can be determined using models of genetic inheritance. Some models of prediction are pedigree charts and Punnett squares.	Inheritance Gregor Mendel
Key idea 3 - Individual organisms and species change over time.	
performance indicator 3.1 - Describe sources of variation in organisms and their structures and relate the variations to survival.	
3.1a The processes of sexual reproduction and mutation have given rise to a variety of traits within a species.	Causes of Variation Types of Variation
3.1b Changes in environmental conditions can affect the survival of individual organisms with a particular trait. Small differences between parents and offspring can accumulate in successive generations so that descendants are very different from their ancestors. Individual organisms with certain traits are more likely to survive and have offspring than individuals without those traits.	Evolution
3.1c Human activities such as selective breeding and advances in genetic engineering may affect the variations of species.	Selecting Characteristics
performance indicator 3.2 - Describe factors responsible for competition within species and the significance of that competition.	
3.2a In all environments, organisms with similar needs may compete with one another for resources.	Competition Growing Plants

3.2b Extinction of a species occurs when the environment changes and the adaptive characteristics of a species are insufficient to permit its survival. Extinction of species is common. Fossils are evidence that a great variety of species existed in the past.	Environmental Change Evolution
3.2c Many thousands of layers of sedimentary rock provide evidence for the long history of Earth and for the long history of changing lifeforms whose remains are found in the rocks. Recently deposited rock layers are more likely to contain fossils resembling existing species.	Sedimentary Rocks Evolution
3.2d Although the time needed for change in a species is usually great, some species of insects and bacteria have undergone significant change in just a few years.	Evolution
Key idea 4 - The continuity of life is sustained through reproduction and development.	
performance indicator 4.1 - Observe and describe the variations in reproductive patterns of organisms, including asexual and sexual reproduction.	
4.1a Some organisms reproduce asexually. Other organisms reproduce sexually. Some organisms can reproduce both sexually and asexually.	Types of Reproduction
4.1b There are many methods of asexual reproduction, including division of a cell into two cells, or separation of part of an animal or plant from the parent, resulting in the growth of another individual.	Types of Reproduction
4.1c Methods of sexual reproduction depend upon the species. All methods involve the merging of sex cells to begin the development of a new individual. In many species, including plants and humans, eggs and sperm are produced.	Human Sex Cells and Systems
4.1d Fertilization and/or development in organisms may be internal or external.	Human Sex Cells and Systems Embryo Development and Birth
performance indicator 4.2 - Explain the role of sperm and egg cells in sexual reproduction.	
4.2a The male sex cell is the sperm. The female sex cell is the egg. The fertilization of an egg by a sperm results in a fertilized egg.	Human Sex Cells and Systems
4.2b In sexual reproduction, sperm and egg each carry one-half of the genetic information for the new individual. Therefore, the fertilized egg contains genetic information from each parent.	Human Sex Cells and Systems Causes of Variation
performance indicator 4.3 - Observe and describe developmental patterns in selected plants and animals (e.g., insects, frogs, humans, seed-bearing plants).	
4.3a Multicellular organisms exhibit complex changes in development, which begin after fertilization. The fertilized egg undergoes numerous cellular divisions that will result in a multicellular organism, with each cell having identical genetic information.	Embryo Development and Birth Causes of Variation
4.3b In humans, the fertilized egg grows into tissue which develops into organs and organ systems before birth.	Causes of Variation Embryo Development and Birth
4.3c Various body structures and functions change as an organism goes through its life cycle.	Puberty
4.3d Patterns of development vary among animals. In some species the young resemble the adult, while in others they do not. Some insects and amphibians undergo metamorphosis as they mature.	–

4.3e Patterns of development vary among plants. In seed-bearing plants, seeds contain stored food for early development. Their later development into adulthood is characterized by varying patterns of growth from species to species.	–
4.3f As an individual organism ages, various body structures and functions change.	Puberty
performance indicator 4.4 - Observe and describe cell division at the microscopic level and its macroscopic effects.	
4.4a In multicellular organisms, cell division is responsible for growth, maintenance, and repair. In some one-celled organisms, cell division is a method of asexual reproduction.	Where Do Cells Come From? Types of Reproduction
4.4b In one type of cell division, chromosomes are duplicated and then separated into two identical and complete sets to be passed to each of the two resulting cells. In this type of cell division, the hereditary information is identical in all the cells that result.	Types of Reproduction
4.4c Another type of cell division accounts for the production of egg and sperm cells in sexually reproducing organisms. The eggs and sperm resulting from this type of cell division contain one-half of the hereditary information.	Types of Reproduction Causes of Variation
4.4d Cancers are a result of abnormal cell division.	–
Key idea 5 - Organisms maintain a dynamic equilibrium that sustains life.	
performance indicator 5.1 - Compare the way a variety of living specimens carry out basic life functions and maintain dynamic equilibrium.	
5.1a Animals and plants have a great variety of body plans and internal structures that contribute to their ability to maintain a balanced condition.	Adaptations The Nervous System The Endocrine System Leaves and Glucose Roots and Water
5.1b An organism's overall body plan and its environment determine the way that the organism carries out the life processes.	–
5.1c All organisms require energy to survive. The amount of energy needed and the method for obtaining this energy vary among cells. Some cells use oxygen to release the energy stored in food.	Releasing Energy
5.1d The methods for obtaining nutrients vary among organisms. Producers, such as green plants, use light energy to make their food. Consumers, such as animals, take in energy-rich foods.	What is Photosynthesis? Plants as Food Feeding Types Food Chains
5.1e Herbivores obtain energy from plants. Carnivores obtain energy from animals. Omnivores obtain energy from both plants and animals. Decomposers, such as bacteria and fungi, obtain energy by consuming wastes and/or dead organisms.	Feeding Types Food Chains Pyramids of Number and Biomass

5.1f Regulation of an organism's internal environment involves sensing the internal environment and changing physiological activities to keep conditions within the range required for survival. Regulation includes a variety of nervous and hormonal feedback systems.	The Nervous System The Endocrine System
5.1g The survival of an organism depends on its ability to sense and respond to its external environment.	Animal Behavior Types of Animal Behavior Human Behavior
performance indicator 5.2 - Describe the importance of major nutrients, vitamins, and minerals in maintaining health and promoting growth, and explain the need for a constant input of energy for living organisms.	
5.2a Food provides molecules that serve as fuel and building material for all organisms. All living things, including plants, must release energy from their food, using it to carry on their life processes.	Releasing Energy Digestion
5.2b Foods contain a variety of substances, which include carbohydrates, fats, vitamins, proteins, minerals, and water. Each substance is vital to the survival of the organism.	Digestion Chemical Digestion
5.2c Metabolism is the sum of all chemical reactions in an organism. Metabolism can be influenced by hormones, exercise, diet, and aging.	–
5.2d Energy in foods is measured in Calories. The total caloric value of each type of food varies. The number of Calories a person requires varies from person to person.	–
5.2e In order to maintain a balanced state, all organisms have a minimum daily intake of each type of nutrient based on species, size, age, sex, activity, etc. An imbalance in any of the nutrients might result in weight gain, weight loss, or a diseased state.	–
5.2f Contraction of infectious disease, and personal behaviors such as use of toxic substances and some dietary habits, may interfere with one's dynamic equilibrium. During pregnancy these conditions may also affect the development of the child. Some effects of these conditions are immediate; others may not appear for many years.	How Microbes Cause Disease
Key idea 6 - Plants and animals depend on each other and their physical environment.	
performance indicator 6.1 - Describe the flow of energy and matter through food chains and food webs.	
6.1a Energy flows through ecosystems in one direction, usually from the Sun, through producers to consumers and then to decomposers. This process may be visualized with food chains or energy pyramids.	Food Chains Food Webs Pyramids of Number and Biomass
6.1b Food webs identify feeding relationships among producers, consumers, and decomposers in an ecosystem.	Feeding Types Food Chains
6.1c Matter is transferred from one organism to another and between organisms and their physical environment. Water, nitrogen, carbon dioxide, and oxygen are examples of substances cycled between the living and nonliving environment.	The Water Cycle Recycling Nutrients

performance indicator 6.2 - Provide evidence that green plants make food and explain the significance of this process to other organisms.	
6.2a Photosynthesis is carried on by green plants and other organisms containing chlorophyll. In this process, the Sun's energy is converted into and stored as chemical energy in the form of a sugar. The quantity of sugar molecules increases in green plants during photosynthesis in the presence of sunlight.	What is Photosynthesis?
6.2b The major source of atmospheric oxygen is photosynthesis. Carbon dioxide is removed from the atmosphere and oxygen is released during photosynthesis.	What is Photosynthesis?
6.2c Green plants are the producers of food which is used directly or indirectly by consumers.	Feeding Types Food Chains Plants as Food
Key idea 7 - Human decisions and activities have had a profound impact on the physical and living environment.	
performance indicator 7.1 - Describe how living things, including humans, depend upon the living and nonliving environment for their survival.	
7.1a A population consists of all individuals of a species that are found together at a given place and time. Populations living in one place form a community. The community and the physical factors with which it interacts compose an ecosystem.	Habitats
7.1b Given adequate resources and no disease or predators, populations (including humans) increase. Lack of resources, habitat destruction, and other factors such as predation and climate limit the growth of certain populations in the ecosystem.	Food Webs Environmental Change Feeding Types Competition
7.1c In all environments, organisms interact with one another in many ways. Relationships among organisms may be competitive, harmful, or beneficial. Some species have adapted to be dependent upon each other with the result that neither could survive without the other.	Competition Feeding Types Food Chains
7.1d Some microorganisms are essential to the survival of other living things.	Pyramids of Number and Biomass
7.1e The environment may contain dangerous levels of substances (pollutants) that are harmful to organisms. Therefore, the good health of environments and individuals requires the monitoring of soil, air, and water, and taking steps to keep them safe.	Acid Rain The pH Scale
performance indicator 7.2 - Describe the effects of environmental changes on humans and other populations.	
7.2a In ecosystems, balance is the result of interactions between community members and their environment.	–
7.2b The environment may be altered through the activities of organisms. Alterations are sometimes abrupt. Some species may replace others over time, resulting in longterm gradual changes (ecological succession).	–

7.2c Overpopulation by any species impacts the environment due to the increased use of resources. Human activities can bring about environmental degradation through resource acquisition, urban growth, land-use decisions, waste disposal, etc.	Environmental Change Acid Rain
7.2d Since the Industrial Revolution, human activities have resulted in major pollution of air, water, and soil. Pollution has cumulative ecological effects such as acid rain, global warming, or ozone depletion. The survival of living things on our planet depends on the conservation and protection of Earth's resources.	Greenhouse Gases Acid Rain Nonrenewable Energy Resources
Standard 4 - The physical setting	
Key idea 1 - The Earth and celestial phenomena can be described by principles of relative motion and perspective.	
performance indicator 1.1. - Explain daily, monthly, and seasonal changes on Earth.	
1.1a Earth's Sun is an average-sized star. The Sun is more than a million times greater in volume than Earth.	The Solar System
1.1b Other stars are like the Sun but are so far away that they look like points of light. Distances between stars are vast compared to distances within our solar system.	–
1.1c The Sun and the planets that revolve around it are the major bodies in the solar system. Other members include comets, moons, and asteroids. Earth's orbit is nearly circular.	The Solar System
1.1d Gravity is the force that keeps planets in orbit around the Sun and the Moon in orbit around the Earth.	Gravity
1.1e Most objects in the solar system have a regular and predictable motion. These motions explain such phenomena as a day, a year, phases of the Moon, eclipses, tides, meteor showers, and comets.	Days, Years and Seasons The Earth, Moon and Sun
1.1f The latitude/longitude coordinate system and our system of time are based on celestial observations.	–
1.1g Moons are seen by reflected light. Our Moon orbits Earth, while Earth orbits the Sun. The Moon's phases as observed from Earth are the result of seeing different portions of the lighted area of the Moon's surface. The phases repeat in a cyclic pattern in about one month.	The Solar System The Earth, Moon and Sun
1.1h The apparent motions of the Sun, Moon, planets, and stars across the sky can be explained by Earth's rotation and revolution. Earth's rotation causes the length of one day to be approximately 24 hours. This rotation also causes the Sun and Moon to appear to rise along the eastern horizon and to set along the western horizon. Earth's revolution around the Sun defines the length of the year as 365 1/4 days.	Days, Years and Seasons
1.1i The tilt of Earth's axis of rotation and the revolution of Earth around the Sun cause seasons on Earth. The length of daylight varies depending on latitude and season.	Days, Years and Seasons
1.1j The shape of Earth, the other planets, and stars is nearly spherical.	–
Key idea 2 - Many of the phenomena that we observe on Earth involve interactions among components of air, water, and land.	

performance indicator 2.1. - Explain how the atmosphere (air), hydrosphere (water), and lithosphere (land) interact, evolve, and change.	
2.1a Nearly all the atmosphere is confined to a thin shell surrounding Earth. The atmosphere is a mixture of gases, including nitrogen and oxygen with small amounts of water vapor, carbon dioxide, and other trace gases. The atmosphere is stratified into layers, each having distinct properties. Nearly all weather occurs in the lowest layer of the atmosphere.	The Atmosphere
2.1b As altitude increases, air pressure decreases.	The Atmosphere
2.1c The rock at Earth's surface forms a nearly continuous shell around Earth called the lithosphere.	The Structure of the Earth
2.1d The majority of the lithosphere is covered by a relatively thin layer of water called the hydrosphere.	–
2.1e Rocks are composed of minerals. Only a few rock-forming minerals make up most of the rocks of Earth. Minerals are identified on the basis of physical properties such as streak, hardness, and reaction to acid.	Using Rocks
2.1f Fossils are usually found in sedimentary rocks. Fossils can be used to study past climates and environments.	Sedimentary Rocks
2.1g The dynamic processes that wear away Earth's surface include weathering and erosion.	Physical Weathering Biological Weathering Chemical Weathering Erosion, Transportation and Deposition
2.1h The process of weathering breaks down rocks to form sediment. Soil consists of sediment, organic material, water, and air.	Soil
2.1i Erosion is the transport of sediment. Gravity is the driving force behind erosion. Gravity can act directly or through agents such as moving water, wind, and glaciers.	Erosion, Transportation and Deposition
2.1j Water circulates through the atmosphere, lithosphere, and hydrosphere in what is known as the water cycle.	The Water Cycle
performance indicator 2.2 - Describe volcano and earthquake patterns, the rock cycle, and weather and climate changes.	
2.2a The interior of Earth is hot. Heat flow and movement of material within Earth cause sections of Earth's crust to move. This may result in earthquakes, volcanic eruption, and the creation of mountains and ocean basins.	The Structure of the Earth What is Plate Tectonics? Plate Boundaries Earthquakes
2.2b Analysis of earthquake wave data (vibrational disturbances) leads to the conclusion that there are layers within Earth. These layers' the crust, mantle, outer core, and inner core, have distinct properties.	The Structure of the Earth
2.2c Folded, tilted, faulted, and displaced rock layers suggest past crustal movement.	Plate Boundaries
2.2d Continents fitting together like puzzle parts and fossil correlations provided initial evidence that continents were once together.	What is Plate Tectonics?

2.2e The Theory of Plate Tectonics explains how the 'solid' lithosphere consists of a series of plates that 'float' on the partially molten section of the mantle. Convection cells within the mantle may be the driving force for the movement of the plates.	What is Plate Tectonics? Plate Boundaries
2.2f Plates may collide, move apart, or slide past one another. Most volcanic activity and mountain building occur at the boundaries of these plates, often resulting in earthquakes.	Plate Boundaries
2.2g Rocks are classified according to their method of formation. The three classes of rocks are sedimentary, metamorphic, and igneous. Most rocks show characteristics that give clues to their formation conditions.	Different Types of Rocks Sedimentary Rocks Metamorphic Rocks Igneous Rocks
2.2h The rock cycle model shows how types of rock or rock material may be transformed from one type of rock to another.	The Rock Cycle
2.2i Weather describes the conditions of the atmosphere at a given location for a short period of time.	Climate Zones What is Weather?
2.2j Climate is the characteristic weather that prevails from season to season and year to year.	Climate Zones
2.2k The uneven heating of Earth's surface is the cause of weather.	What is Weather?
2.2l Air masses form when air remains nearly stationary over a large section of Earth's surface and takes on the conditions of temperature and humidity from that location. Weather conditions at a location are determined primarily by temperature, humidity, and pressure of air masses over that location.	What is Weather?
2.2m Most local weather condition changes are caused by movement of air masses.	What is Weather? Wind and Ocean Currents
2.2n The movement of air masses is determined by prevailing winds and upper air currents.	What is Weather? Wind and Ocean Currents
2.2o Fronts are boundaries between air masses. Precipitation is likely to occur at these boundaries.	What is Weather?
2.2p High-pressure systems generally bring fair weather. Low-pressure systems usually bring cloudy, unstable conditions. The general movement of highs and lows is from west to east across the United States.	What is Weather?
2.2q Hazardous weather conditions include thunderstorms, tornadoes, hurricanes, ice storms, and blizzards. Humans can prepare for and respond to these conditions if given sufficient warning.	Weather Hazards Hurricanes Tornados
2.2r Substances enter the atmosphere naturally and from human activity. Some of these substances include dust from volcanic eruptions and greenhouse gases such as carbon dioxide, methane, and water vapor. These substances can affect weather, climate, and living things.	Greenhouse Gases Environmental Change
Key idea 3 - Matter is made up of particles whose properties determine the observable characteristics of matter and its reactivity.	
performance indicator 3.1 - Observe and describe properties of materials, such as density, conductivity, and solubility.	

3.1a Substances have characteristic properties. Some of these properties include color, odor, phase at room temperature, density, solubility, heat and electrical conductivity, hardness, and boiling and freezing points.	Changes of Matter The Periodic Table Metals and Nonmetals Metalloids
3.1b Solubility can be affected by the nature of the solute and solvent, temperature, and pressure. The rate of solution can be affected by the size of the particles, stirring, temperature, and the amount of solute already dissolved.	Solutions
3.1c The motion of particles helps to explain the phases (states) of matter as well as changes from one phase to another. The phase in which matter exists depends on the attractive forces among its particles.	Particles in Action Heat and Temperature Changing States
3.1d Gases have neither a determined shape nor a definite volume. Gases assume the shape and volume of a closed container.	Particles in Action
3.1e A liquid has definite volume, but takes the shape of a container.	Particles in Action
3.1f A solid has definite shape and volume. Particles resist a change in position.	Particles in Action
3.1g Characteristic properties can be used to identify different materials, and separate a mixture of substances into its components. For example, iron can be removed from a mixture by means of a magnet. An insoluble substance can be separated from a soluble substance by such processes as filtration, settling, and evaporation.	What is a Mixture? Separating Mixtures Chromatography
3.1h Density can be described as the amount of matter that is in a given amount of space. If two objects have equal volume, but one has more mass, the one with more mass is denser.	–
3.1i Buoyancy is determined by comparative densities.	–
performance indicator 3.2 - Distinguish between chemical and physical changes.	
3.2a During a physical change a substance keeps its chemical composition and properties. Examples of physical changes include freezing, melting, condensation, boiling, evaporation, tearing, and crushing.	Changes of Matter Changing States
3.2b Mixtures are physical combinations of materials and can be separated by physical means.	What is a Mixture?
3.2c During a chemical change, substances react in characteristic ways to form new substances with different physical and chemical properties. Examples of chemical changes include burning of wood, cooking of an egg, rusting of iron, and souring of milk.	Types of Chemical Reactions
3.2d Substances are often placed in categories if they react in similar ways. Examples include metals, nonmetals, and noble gases.	Metals and Nonmetals
3.2e The Law of Conservation of Mass states that during an ordinary chemical reaction matter cannot be created or destroyed. In chemical reactions, the total mass of the reactants equals the total mass of the products.	Conservation of Mass
performance indicator 3.3 - Develop mental models to explain common chemical reactions and changes in states of matter.	

3.3a All matter is made up of atoms. Atoms are far too small to see with a light microscope.	What Are Atoms? Atomic Structure
3.3b Atoms and molecules are perpetually in motion. The greater the temperature, the greater the motion.	Particles in Action Heat and Temperature Changing State
3.3c Atoms may join together in well-defined molecules or may be arranged in regular geometric patterns.	Elements and Compounds Metals and Nonmetals What Are Atoms?
3.3d Interactions among atoms and/or molecules result in chemical reactions.	Elements and Compounds Making Compounds Naming Compounds Types of Chemical Reactions Energy Changes
3.3e The atoms of any one element are different from the atoms of other elements.	What Are Atoms? Elements and Compounds
3.3f There are more than 100 elements. Elements combine in a multitude of ways to produce compounds that account for all living and nonliving substances. Few elements are found in their pure form.	Elements and Compounds
3.3g The periodic table is one useful model for classifying elements. The periodic table can be used to predict properties of elements (metals, nonmetals, noble gases).	The Periodic Table
Key idea 4 - Energy exists in many forms, and when these forms change energy is conserved.	
performance indicator 4.1 - Describe the sources and identify the transformations of energy observed in everyday life.	
4.1a The Sun is a major source of energy for Earth. Other sources of energy include nuclear and geothermal energy.	Nonrenewable Energy Resources Renewable Energy Energy Resources for the Future
4.1b Fossil fuels contain stored solar energy and are considered nonrenewable resources. They are a major source of energy in the United States. Solar energy, wind, moving water, and biomass are some examples of renewable energy resources.	Nonrenewable Energy Resources Renewable Energy Fossil Fuels
4.1c Most activities in everyday life involve one form of energy being transformed into another. For example, the chemical energy in gasoline is transformed into mechanical energy in an automobile engine. Energy, in the form of heat, is almost always one of the products of energy transformations.	What is Energy? Nonrenewable Energy Resources Energy Changes
4.1d Different forms of energy include heat, light, electrical, mechanical, sound, nuclear, and chemical. Energy is transformed in many ways.	What is Energy? What is Sound? What is Light? Energy Changes

4.1e Energy can be considered to be either kinetic energy, which is the energy of motion, or potential energy, which depends on relative position.	What is Energy?
performance indicator 4.2 - Observe and describe heating and cooling events.	
4.2a Heat moves in predictable ways, flowing from warmer objects to cooler ones, until both reach the same temperature.	Heat and Temperature
4.2b Heat can be transferred through matter by the collisions of atoms and/or molecules (conduction) or through space (radiation). In a liquid or gas, currents will facilitate the transfer of heat (convection).	Conduction and Convection Radiation
4.2c During a phase change, heat energy is absorbed or released. Energy is absorbed when a solid changes to a liquid and when a liquid changes to a gas. Energy is released when a gas changes to a liquid and when a liquid changes to a solid.	Changing State
4.2d Most substances expand when heated and contract when cooled. Water is an exception, expanding when changing to ice.	–
4.2e Temperature affects the solubility of some substances in water.	Solutions
performance indicator 4.3 - Observe and describe energy changes as related to chemical reactions.	
4.3a In chemical reactions, energy is transferred into or out of a system. Light, electricity, or mechanical motion may be involved in such transfers in addition to heat.	Energy Changes What is Energy?
performance indicator 4.4 - Observe and describe the properties of sound, light, magnetism, and electricity.	
4.4a Different forms of electromagnetic energy have different wavelengths. Some examples of electromagnetic energy are microwaves, infrared light, visible light, ultraviolet light, X-rays, and gamma rays.	Electromagnetic Waves
4.4b Light passes through some materials, sometimes refracting in the process. Materials absorb and reflect light, and may transmit light. To see an object, light from that object, emitted by or reflected from it, must enter the eye.	What is Light? Reflection Refraction
4.4c Vibrations in materials set up wave-like disturbances that spread away from the source. Sound waves are an example. Vibrational waves move at different speeds in different materials. Sound cannot travel in a vacuum.	What is Sound? Speed of Sound The Ear and Hearing
4.4d Electrical energy can be produced from a variety of energy sources and can be transformed into almost any other form of energy.	How is Electrical Energy Useful? Energy Efficiency
4.4e Electrical circuits provide a means of transferring electrical energy.	How is Electrical Energy Useful? Energy Transfer in Circuits Parallel Circuits Series Circuits What are Circuits?

4.4f Without touching them, material that has been electrically charged attracts uncharged material, and may either attract or repel other charged material.	–
4.4g Without direct contact, a magnet attracts certain materials and either attracts or repels other magnets. The attractive force of a magnet is greatest at its poles.	Magnetic Materials Magnetic Fields
performance indicator 4.5 - Describe situations that support the principle of conservation of energy.	
4.5a Energy cannot be created or destroyed, but only changed from one form into another.	What is Energy? Energy Transfer in Circuits How is Electrical Energy Useful?
4.5b Energy can change from one form to another, although in the process some energy is always converted to heat. Some systems transform energy with less loss of heat than others.	Energy Efficiency
Key idea 5 - Energy and matter interact through forces that result in changes in motion.	
performance indicator 5.1 - Describe different patterns of motion of objects.	
5.1a The motion of an object is always judged with respect to some other object or point. The idea of absolute motion or rest is misleading.	Distance, Time and Speed
5.1b The motion of an object can be described by its position, direction of motion, and speed.	Distance, Time and Speed
5.1c An object's motion is the result of the combined effect of all forces acting on the object. A moving object that is not subjected to a force will continue to move at a constant speed in a straight line. An object at rest will remain at rest.	What Are Forces?
5.1d Force is directly related to an object's mass and acceleration. The greater the force, the greater the change in motion.	What Are Forces? Calculating Resultant Forces
5.1e For every action there is an equal and opposite reaction.	What Are Forces?
performance indicator 5.2 - Observe, describe, and compare effects of forces (gravity, electric current, and magnetism) on the motion of objects.	
5.2a Every object exerts gravitational force on every other object. Gravitational force depends on how much mass the objects have and on how far apart they are. Gravity is one of the forces acting on orbiting objects and projectiles.	Gravity
5.2b Electric currents and magnets can exert a force on each other.	Electromagnets Uses of Electromagnets
5.2c Machines transfer mechanical energy from one object to another.	Moments Hydraulics
5.2d Friction is a force that opposes motion.	Friction
5.2e A machine can be made more efficient by reducing friction. Some common ways of reducing friction include lubricating or waxing surfaces.	Friction
5.2f Machines can change the direction or amount of force, or the distance or speed of force required to do work.	Moments Hydraulics

5.2g Simple machines include a lever, a pulley, a wheel and axle, and an inclined plane. A complex machine uses a combination of interacting simple machines, e.g., a bicycle.	Moments Hydraulics