SCIENCE 21

SCIENCE FOR THE 21ST CENTURY

UNIT CONCEPTS

Grade K Unit 1

- Comparing involves observing similarities and differences.
- It is important to work carefully and safely when doing science activities.
- Scientists investigate objects by using their senses.
- Scientists record their observations and predictions, and they communicate with others about their investigations.

Grade K Unit 2

- All humans have the same body parts; they include head, shoulders, arms, legs, eyes, ears, knees.
- Individual humans are similar to each other in many ways; they are also different from each other in many ways. Humans can be grouped together by shared characteristics, such as hair color or eye color.
- Sight, sound, smell, taste and touch are the five senses. Eyes are used for sight, ears for sound, noses for smell, tongues for taste, fingers and skin for touch.
- We use our senses to observe and respond to the world around us.

Grade K Unit 3

- Living things are different from non-living things. Living things grow, take in nutrients, breathe, eliminate waste, and die. Non-living things do not do these things.
- Plants and animals have similarities, such as basic needs for water and air. Plants and animals also have differences; plants do not need food and they cannot move. Animals need to eat food and they are able to move.
- Some plants grow from seeds. The roots grow first and then the stem.
- Seeds need water, air and warmth to germinate. Once they germinate, the seedlings need light to continue to grow.
- An animal, such as a newt, needs food, water, air, space and shelter.

Grade K Unit 4

- A mixture is a combination of two or more different substances.
- When solids and liquids are mixed together, some of the mixtures stay together and some of them un-mix (separate).
- Some mixtures can produce a product with unusual properties.
- Color is a property that can be observed with the eyes.
- The primary colors can be mixed to produce new colors.

UNIT CONCEPTS

Grade 1 Unit 1

- By identifying the properties of objects, the objects can be sorted in useful ways.
- Objects can be sorted by shape, size, length, weight, color, texture and function.
- Objects can be placed in serial order on the basis of a given property.
- Describing objects and classifying them are types of investigations that scientists use in their work.
- To do their work effectively, scientists must be organized, they must be able to work collaboratively, they must be good at observing and recording their observations as they answer questions, and they must be good at reporting to others what they have investigated.

Grade 1 Unit 2

- Objects have many observable properties, including size, weight, shape, color, temperature, texture and sink/float.
- Some properties can be observed by using the sense of sight; other properties can be observed using the sense of touch, smell, taste, and hearing.
- Objects can be sorted into groups according to their properties; each group contains objects that are similar with respect to the chosen property.
- Objects are made of one or more materials, such as plastic, wood, and metal. Objects can be described by the properties of the materials from which they are made.
- Tests can be performed to investigate properties that cannot be observed simply through the senses; putting an object into water is a test for floating or sinking.

Grade 1 Unit 3

- Liquids have a definite volume but not a definite shape; they go to the bottom of their container.
- Liquids have a tendency to flow and can be poured from one container to another. They change shape as they flow into a container.
- Solids have a definite shape and a definite volume.
- Gases fill a container and take the shape and volume of the entire container. Gases can't be seen but they take up space and can be 'felt' in a closed container like a balloon.
- Some common materials, such as water, can be changed from one state to another by heating and cooling; heating can change solid water (ice) into liquid water and then into water vapor (a gas).

Grade 1 Unit 4

- All living things have basic needs, such as the need for food, water, air, space and shelter. Non-living things do not have needs.
- The life functions performed by living things include eating, drinking, breathing, growing and moving.
- Each type of animal has specific needs, such as type of food, amount of water and range of temperature.
- A habitat is the place where an animal finds the food, water, shelter and space necessary for it to survive.
- Animals sense and respond to changes in their environment.

UNIT CONCEPTS

Grade 2 Unit 1

- It is important to work carefully and safely when conducting scientific investigations.
- Standard units of measure produce more consistent results than nonstandard units.
- Scientists use tools (simple scientific instruments) that permit the measurement of quantities, such as length, mass, volume, and temperature.
- Simple instruments such as thermometers, rulers, measuring cups and balances provide more information than scientists can obtain by using only their senses.

Grade 2 Unit 2

- Energy is in electric circuits, vibrating and moving objects, chemicals, food, hot objects and sunlight.
- Energy can be changed from one form to another; some examples include electrical energy changing into light energy in a light bulb, chemical energy in food changing into mechanical energy as you move your arm, and changing into light energy in a candle, and mechanical energy changing into sound when a drum is hit.
- Sounds can be produced by vibrating objects and vibrating columns of air.
- Magnets can attract objects made of iron or steel; they can attract through air, through liquids and through solids.
- Light is energy that comes from the sun, and can also come from a light bulb, a candle flame and from lightening. It travels from a source and hits objects; it passes through transparent objects, but not through opaque objects.

Grade 2 Unit 3

- Many plants have a life cycle that begins with the germination of a seed. Seeds need water, air, and warmth to germinate. Roots grow first and then the stem; the seedlings need light to grow and thrive.
- Different kinds of plants have different life spans - the time from development to death of the plant. An animal's life span, the time from birth to death of the animal, is also different for different kinds of animals.
- Some plants can be propagated using bulbs. Bulbs contain stored food for the plant.
- Animals need food, water and air to grow, stay healthy and thrive. They can only survive in an environment in which these needs are met.
- All animals require a suitable habitat to grow and thrive. Habitat requirements may include salt/fresh water, temperature, appropriate food, light, humidity.
- Animals sense their environment and respond to stimuli, such as light/dark, warm/cold, touch, or noise.

Grade 2 Unit 4

- The length of daylight and average daily temperatures vary with the seasons. This affects the decisions people make, such as what clothing they will wear.
- The appearance of the Moon changes as it moves around the earth; the phases of the moon repeat in a cyclic pattern each month.
- Animals have behaviors and physical adaptations that enable them to survive through the seasonal changes in their environment.
- As the sun moves through the sky each day, the length and position of shadows change. A sundial can be used to determine the approximate time of day by the position of the shadow cast by the triangular shaped gnomon.
- Light energy from the sun is converted into heat energy in a solar heater.

UNIT CONCEPTS

Grade 3 Unit 1

- Scientific inquiry involves proposing appropriate questions, making predictions that can be tested, and developing good explanations that are based on evidence from investigations.
- Many plants follow a life cycle with distinct stages that begins with growth from a seed and continues to the production of seeds.
- A mature plant produces many seeds, which can each grow into another plant. Often, the seeds are transported to another location, by a plant's own mechanism, by the wind or by animal dispersal.
- Plants have structures, such as roots, stems, leaves and flowers that enable the plant to carry out its life functions.

Grade 3 Unit 2

- A complete electric circuit is required for electricity to be converted into light and heat.
- A complete circuit can be constructed in more than one way using the same materials (i.e. series circuit and parallel circuit). These circuits have different properties.
- Some materials conduct electricity and are called conductors; others do not conduct electricity and are called insulators.
- A battery provides the chemical energy that is converted into electrical energy in a circuit.

Grade 3 Unit 3

- Some common substances, such as water, can be changed from one state to another by heating and cooling.
- Water in its three states moves from one place on earth to another in a continuous cycle called the water cycle. The water cycle includes the processes of evaporation, condensation, precipitation and the movement of water over and into the ground.
- One common weather phenomenon is precipitation, which can be in the form of rain, sleet, snow or hail.
- Clouds are made of condensed water vapor in the form of drops of liquid or crystals of ice. Rain falls from clouds when the drops of water become too heavy to stay suspended in the sky and are pulled toward the earth by gravity.

Grade 3 Unit 4

- All animals need food, water, and air to survive.
- All animals go through a life cycle. The stages of the life cycle differ for different types of animals; food is necessary for the growth of the animal in every stage.
- Some organisms, such as butterflies, undergo changes early in their development in which the developing organism looks very different from the adult. The offspring of other organisms, such as humans, have features that are similar to the mature adult.
- All the living and nonliving parts of the environment in which an animal lives, including other animals, plants, climate, water, and air, affect the life of that animal.
- Some animals use camouflage to protect themselves and survive in their environment.

UNIT CONCEPTS

Grade 4 Unit 1

- The process of scientific inquiry includes observing of natural phenomena, conducting investigations to answer questions, analyzing results of investigations, developing explanations and hypotheses, and sharing the findings with others.
- Scientists develop explanations of natural phenomena using evidence from their investigations and what scientists already known about the world.
- Scientists investigate questions and proposed explanations using a controlled experiment or 'fair test', an experiment in which all the variables are kept the same, except the variable that is being investigated.
- Scientists use tools such as thermometers, rulers, graduated cylinders and balances to measure quantities, such as length, mass, volume, and temperature. These simple scientific instruments provide more information than scientists can obtain by using only their senses.

Grade 4 Unit 2

- Using water, air, and energy from sunlight, plants make the food they need for their life processes; they are producers.
- Animals cannot make their own food and get their food they need for their life processes from the environment by eating plants, animals, or both; they are consumers.
- In a food chain, energy from the sun is transferred from plants to the animals that eat the plants for food, and then to the animals that eat other animals.
- The complex relationships between plants and animals are depicted in food webs, and in food pyramids, showing the flow of energy within an ecosystem.
- The digestive system consists of several organs that work together to break food down into molecules that can be absorbed by the cells.

Grade 4 Unit 3

- Mechanical energy can be transferred from one object to another and cause a change in motion, through the use of simple machines.
- Simple machines have a moving part and can do work. They include pulleys, levers and inclined planes.
- Machines cannot change the amount of work for a task, but they can make the work 'easier' by changing the direction or amount of force, or the distance or speed of force required to do the work.
- Machines can be made more efficient by reducing friction between moving parts.

- A lever makes work easier by reducing the amount of force needed, with the force being applied over a greater distance; it takes less force to move an object up an inclined plane, but the smaller force must be applied over a greater distance; a simple pulley changes the direction of an applied force; a compound pulley increases force, but at the expense of distance.

Grade 4 Unit 4

- The properties of rocks are determined by the way they were formed and the minerals in them. The recurring series of events that rocks undergo, over time, that transforms them from one type to another is called the rock cycle.
- Rocks can be sorted and classified as igneous, sedimentary and metamorphic based on their properties. The properties of rocks include color, mineral composition, and texture.
- The earth's outer shell is composed of tectonic plates which move relative to each other and interact at plate boundaries. Plate movement and faults are a cause of earthquakes, volcanoes, and mountain formation.
- Catastrophic events, such as volcanoes and earthquakes, provide information about the earth's interior. Patterns in earthquake locations reveal plate boundaries.
- The wearing away and moving of soil and rock is erosion; the settling of eroded materials is deposition. Chemical weathering is one cause of the wearing away of rock. The flow of water over the land also affects erosion and deposition.

UNIT CONCEPTS

Grade 5 Unit 1

- The process of scientific inquiry includes observing natural phenomena, conducting controlled experiments to test hypotheses, gathering evidence and analyzing data, constructing explanations, and presenting the findings to others.
- In a controlled experiment, the effect of changes in the manipulated variable (independent variable) on another variable (dependent variable) is measured. The investigator must identify all the other possible variables that can affect the manipulated variable and design an experiment in which these are kept constant.
- The decrease in viscosity of a polymer upon addition of water can be investigated using a controlled study.
- Atoms are the smallest particles of a chemical element and molecules are the smallest particles of a compound. Elements combine in many ways to produce compounds.

Grade 5 Unit 2

- The cell theory is a well-tested and accepted explanation of the relationship between cells and living things. It states that all living things are composed of one or more cells, that the cell is the smallest unit having the properties of life, and that all cells are produced from the growth and division of single cells.
- Cells, and some living organisms, are too small to see without a microscope. When magnified, observable structures can be seen in all cells. These structures enable the cell to perform basic functions of life.
- Cells grow and divide, producing more cells for growth and repair. One-celled organisms reproduce by cell division.
- Scientists use a classification system to organize living things into groups based on important biological similarities, so that they are easier to study. Organisms are classified into seven levels, from kingdom (most general) to species (most specific).
- Multicellular organisms have specialized cells, with different shapes and sizes, to carry out the functions of the organism; groups of specialized cells form tissue, groups of tissue form organs, and organs working together form organ systems.
- If there is a failure in a structure or in the functioning of an organism, or if the organism is damaged by infection from another organism, the result is disease.

Grade 5 Unit 3

- Humans have organ systems to carry out functions such as respiration, circulation, movement, control and coordination. These organ systems interact with each other to serve the organism as a whole.
- The tissues and organs of the respiratory system take in oxygen and deliver it to the blood. The respiratory system works together with the heart, blood vessels and blood of the circulatory system to provide oxygen to every cell in the body and to remove carbon dioxide and water, the end products of cellular respiration.
- Interaction between the skeletal system and the muscular system enables movement of the body. This interaction is coordinated by the nervous system.
- Heredity is the passage of instructions for specifying traits of an organism from parents to offspring. Genes are the units of information about heritable traits, and each gene has a particular location on a particular chromosome. All of the heritable bits of information that are necessary to produce a new individual are carried by the DNA molecules that make up the genes.
- Genes occur in pairs and offspring inherit one copy of each gene from each parent. A gene is dominant when its effect on a trait overshadows that of the other gene (recessive) paired with it. This is Mendel's Law of Dominance.
- Punnett squares help to visualize the possible outcomes for inheritance of a trait and can be used to determine the probability of a particular outcome for a trait that is controlled by a single gene. Pedigree charts can track the inheritance of traits from generation to generation.
- Biological adaptations are heritable traits that arise from mutations and help an organism survive and reproduce.

Grade 5 Unit 4

- In physical changes, substances retain their characteristic properties, while in chemical changes, new substances are formed; in all changes, mass and energy are conserved.
- During photosynthesis, green plants use energy from the Sun to convert carbon dioxide and water into sugar and oxygen. The stored chemical energy in sugar is then transformed by plants into all the products they need for growth and metabolism; the oxygen is used by all organisms for cellular respiration.
- Animals cannot make their own food and they get the food they need by eating plants or by eating other animals that have eaten plants; the energy from the food is used for all their life processes.
- Model ecosystems, consisting of populations of several species in their suitable habitats, help us to observe the complex relationships between living organisms and their environment and they illustrate the flow of energy between plants and animals.

- There is a limit to the number of organisms in a food chain, due to the energy used by organisms for life processes and the loss of heat to the environment. The energy available for each successive consumer is only a tiny fraction of the energy which the primary consumer obtained from plants, the producers. This is itself a tiny fraction of the total energy from sunlight that is available to plants.
- Interactions between air, water, land and solar radiation determine local weather conditions and climate.

UNIT CONCEPTS

Grade 6 Unit 1

- Solving a problem through engineering design involves asking questions, using group discussions for brainstorming and generating ideas, investigating ideas by constructing and modifying models and designs, and testing a design or product to find the best solution.
- The process of scientific inquiry includes observing natural phenomena, conducting controlled experiments to test hypotheses, gathering evidence and analyzing data, constructing explanations, using models, and presenting the findings to others.
- In a controlled experiment, the effect of changes in the manipulated variable (independent variable) on another variable (dependent variable) is measured. The investigator must identify all the other possible variables that can affect the manipulated variable and design an experiment in which these are kept constant.

Grade 6 Unit 2

- Energy is a property of many substances. Energy is in chemicals, electric circuits, moving objects, batteries, hot objects, and food. Energy can be transformed from one form into another, but it is conserved (neither created nor destroyed) in all transformations.
- Objects can have energy in only two ways: kinetic or potential. Kinetic energy is in moving objects; potential energy is 'stored' energy that depends on the relative position of objects that attract or repel each other. Magnets, bonds in chemicals, and objects subject to the force of gravity all have potential energy.
- *C*hemical energy in a battery can be transformed into electrical energy, and electrical energy can be transformed into light, heat, sound, and chemical energy. Magnetism is produced by an electric current moving though a wire.
- Magnets attract and repel each other and this can be used to create motion. Like gravity, magnetism is a force that can act on an object without coming into contact with it.

Grade 6 Unit 3

- Most objects in our solar system including planets, comets, and moons, follow a regular and cyclical pattern of motion. This explains such celestial phenomena as a day, a year, phases of the moon, and eclipses.
- The relative motion of the Sun, the moon, the planets and the stars around the Earth is the result of the rotation of the Earth on its axis and its revolution around the Sun.

- The Earth's coordinate system of latitude and longitude is based on the Earth's rotation and observations of the Sun and stars.
- The Sun is the major source of energy for the Earth. Seasons are the result of the tilt of the Earth's axis of rotation and the changing length of the day, which cause variations in the amount of the Sun's energy hitting different areas on the surface of the Earth.
- All the objects in our solar system are visible only by reflected light from the Sun. As the Moon orbits around the Earth, we see different views of the Moon's sunlit side, which results in a cyclical pattern of phases.
- A lens is a transparent object with a curved surface that refracts light and produces an image by focusing the light. Convex lenses are used in telescopes, as well as in magnifying lenses, cameras, microscopes. Telescopes collect and focus more light than the human eye can collect on its own and allows us to see objects in the universe that cannot be seen with the unaided eye.

Grade 6 Unit 4

- Food chains of producers, consumers and decomposers, have many alternate routes through which energy can flow in an ecosystem, creating integrated, complex food webs. An energy transfer pyramid shows the amount of energy that moves from one feeding level to another in a food web.
- Population growth factors and population reduction factors for many organisms affect the dynamic balance in ecosystems. Biotic factors, which include all the living things in an ecosystem, can enhance the growth of a population or reduce its growth. Abiotic factors, which include all the non-living factors that affect living things, can enhance the growth of a population or reduce its growth.
- Limiting factors, that prevent a population from continuing to increase, include limitations in food, water, and habitable space, the presence of predators and climate.
- Human activities damage the environment in many ways – by draining wetlands, destroying wildlife habitats, expanding population into rural areas, decreasing species diversity, polluting water through waste disposal and polluting the air through incineration and the use of fossil fuels.
- A pollutant is anything that can harm living organisms when too much of it is released into an ecosystem, creating an unfavorable abiotic environment. Pollution can affect the stability of an ecosystem, killing wildlife and causing human health problems. It is important for humans to reduce, reuse, and recycle to minimize environmental deterioration.