SCIENCE AND TECHNOLOGY

The world around us continues to change and be changed at a rapid pace. Science and Technology provide us with tools to understand the changes, as well as knowledge and processes to address the challenges. To be successful in this global society, students must access, understand, and evaluate current information and tools related to science and technology.

The study of science includes processes and a body of knowledge. Processes are the ways scientists investigate and communicate about the natural world. The body of knowledge includes concepts, principles, facts, laws, and theories about the way the world around us works. Technology includes the study of tools and the process of technological design. It is a partner to science.

Science and technology merge in the pursuit of solutions to problems that require the application of scientific understanding and product design. Solving technological problems demands scientific knowledge while modern technologies make it possible to discover new scientific knowledge. In a world shaped by science and technology, it is important for students to learn how science and technology connect with demands of society and the knowledge of all content areas.

Helping students develop curiosity and excitement for science and technology while they gain essential knowledge and skills is best achieved by actively engaging learners in multiple experiences that increase their ability to be critical thinkers and problem solvers. Standard A describes the four themes that connect the ideas in Standards D and E. Standards D and E describe performance indicators that encompass the subject matter conventionally referred to as life, physical, earth, and space science. It is essential that the understanding of these themes be developed in the context of the knowledge related to life, physical, earth, and space science. Standard B describes the processes of scientific inquiry and technological design and Standard C describes the enterprises of science and technology and their connection to society. Standards B and C, like Standard A, should always be embedded throughout the curriculum and integrated with the ideas of Standards D and E, rather than taught separately. Students should be able to understand and solve complex problems that require the integration of knowledge. Accordingly, schools must create learning experiences that require the application of knowledge and processes in the context of authentic, integrated problems.

Unifying Themes - The proposed revised standards begin with a focus on four themes of science and technology: systems, models, scale, and constancy and change. These themes can provide teachers and students with a scaffold on which to develop the details of the standards. National standards documents identify themes as critical knowledge for students in the 21st century.

The Technological Design Process and Scientific Inquiry - The proposed revised standards for Science and Technology define both the student skills of scientific inquiry and the student skills of technological design. The inclusion of scientific inquiry, the development of a coherent section on the technological design and the inclusion of a standard on Scientific and Technological Enterprise highlights importance of developing student understandings of the unique characteristics of and relationships between science and technology. The Scientific and Technological Enterprise outlines key understandings about the relationships among science, technology and society and underscores the role of citizens in the decision making process related to science and technology.

OUTLINE OF SCIENCE AND TECHNOLOGY STANDARDS AND PERFORMANCE INDICATORS

A. Unifying Themes
    1. Systems
    2. Models
    3. Constancy and Change
    4. Scale
B. The Skills and Traits of Scientific Inquiry and Technological Design
    1. Skills and Traits of Scientific Inquiry
    2. Skills and Traits of Technological Design
C. The Scientific and Technological Enterprise
    1. Understandings of Inquiry
    2. Understandings About Science and Technology
    3. Science, Technology, and Society
    4. History and Nature of Science
D. The Physical Setting
    1. Universe and Solar System
    2. Earth
    3. Matter and Energy
    4. Force and Motion
E. The Living Environment
    1. Biodiversity
    2. Ecosystems
    3. Cells
    4. Heredity and Reproduction
    5. Evolution

A. Unifying Themes: Students apply the principles of systems, models, constancy and change, and scale in science and technology.

	PK – 2 *PERFORMANCE INDICATOR*	3-5 *PERFORMANCE INDICATOR*	6-8 *PERFORMANCE INDICATOR*	9-Diploma *PERFORMANCE INDICATOR*
A1 Systems	Students recognize that parts work together, and make up whole human-made and natural objects. a. Explain that most human-made and natural objects are made of parts that when put together, can do things they could not do separately.	Students explain interactions between parts that make up a whole human-made and natural thing. a. Give examples that show how individual parts of organisms, ecosystems or human-made structures can influence one another. b. Explain that things including organism, ecosystems or human-made structures may not work as well, or at all, if a part is missing broken, worn out, mismatched or misconnected.	Students describe principles of systems in human-made and natural things and processes. a. Explain how individual parts working together can do more than each part individually in such systems as an organism, Earth systems, solar system or human-made structures. b. Explain how the output of one part of the system, including waste products from manufacturing or organisms, can become the input of another part of a system. c. Explain that systems are nested and one system may be thought of as containing subsystems as well as being a subsystem of a larger system.	Students apply an understanding of systems to explain and analyze human-made and natural phenomena. a. Analyze a system using principles including boundaries, subsystems, inputs, outputs, feedback, or the system's relation to other systems, to explain phenomena, and design solutions to a problem. b. Explain how it may not always be possible to predict the impact of changing some part of a human-made or natural system.

	PK – 2 *PERFORMANCE INDICATOR*	3-5 *PERFORMANCE INDICATOR*	6-8 *PERFORMANCE INDICATOR*	9-Diploma *PERFORMANCE INDICATOR*
A2 Models	Students identify models and the objects they represent to learn about their features. a. Describe ways in which toys and pictures are like the real things they model. b. Use a model as a tool to describe something about the motion of objects or the features of plants and animals.	Students use models to represent objects, processes, and events from the physical setting, the living environment and the technological world. a. Represent the features of a real object, event, or process using models including geometric figures, number sequences, graphs, diagrams, sketches, maps, or three-dimensional figures, and note ways in which those representations do not match all features of the originals.	Students compare advantages and disadvantages of models to examine a variety of real-world phenomena from the physical setting, the living environment and the technological world. a. Compare different types of models (such as physical, conceptual, and mathematical) that can be used to represent the same thing including chemical reactions, motion, or cells in order to match the purpose and complexity of a model to its use. b. Make changes to models, and suggest how those changes may affect the real thing.	Students evaluate the effectiveness of a model by comparing its predictions to actual observations from the physical setting, the living environment and the technological world.

	PK – 2 *PERFORMANCE INDICATOR*	3-5 *PERFORMANCE INDICATOR*	6-8 *PERFORMANCE INDICATOR*	9-Diploma *PERFORMANCE INDICATOR*
A3 Constancy and Change	Students observe that in the physical setting, the living environment, and the technological world some things change over time and some things stay the same. a. Describe the size, weight, color, or movement of things over varying lengths of time, and note other qualities that change or remain the same.	Students identify basic patterns of change in the physical setting, the living environment and the technological world. a. Recognize patterns of change—including steady, repetitive, irregular or apparently unpredictable change. b. Make tables or graphs to represent changes.	Students recognize how patterns of change vary in physical, biological, and technological systems. a. Give examples of systems including ecosystems, Earth systems and technologies that appear to be unchanging, even though things are happening to them, and identify any feedback mechanisms that may be modifying the changes. b. Describe rates of change and cyclic patterns using appropriate grade level mathematics.	Students identify examples of phenomena that result from varying types and rates of change in physical, biological, and technological systems with and without counterbalances.
A4 Scale	Students observe differences in scale. a. Compare significantly different sizes, weights, ages, and speeds of objects.	Students use mathematics to describe scale for human-made and natural things. a. Measure things to compare sizes, speeds, times, distances, and weights. b. Use fractions and multiples to make comparisons of scale.	Students use scale to describe objects, phenomena, or processes related to Earth, space, matter, and mechanical and living systems. a. Describe how some things change or work differently at different scales. b. Use proportions, averages, and ranges to describe small and large extremes	Students apply understanding of scale to explain phenomena in physical, biological, and technological systems. a. Give examples of how large changes of scale may change how physical and biological systems work. b. Mathematically represent large magnitudes of scale.

			of scale.	

B. The Skills and Traits of Scientific Inquiry and Technological Design: Students plan, conduct, analyze data from and communicate results of in-depth scientific investigations and use a systematic process, tools, equipment, and a variety of materials to create a technological design producing a solution or product to meet a specified need.

	PK – 2 *PERFORMANCE INDICATOR*	3-5 *PERFORMANCE INDICATOR*	6-8 *PERFORMANCE INDICATOR*	9-Diploma *PERFORMANCE INDICATOR*
B1 Skills and Traits of Scientific Inquiry	Students plan, conduct, and communicate results of simple investigations. a. Ask questions and make observations about objects, organisms, and events in the environment. b. Plan and safely conduct a simple investigation to answer questions. c. Use simple instruments with basic units of measurement to gather data and extend the senses. d. Know what constitutes evidence used for constructing a	Students plan, conduct, analyze data from and communicate results of investigations, including fair tests. a. Pose investigable questions and seek answers from reliable sources of scientific information and their own investigations. b. Plan and safely conduct an investigation including simple experiments that involve a fair test. c. Use simple equipment, tools, and appropriate metric units of measurement to gather data and extend the senses. d. Use data to construct and support a reasonable explanation.	Students plan, conduct, analyze data from, and communicate results of investigations, including simple experiments. a. Identify questions that can be answered through scientific investigations. b. Design and safely conduct scientific investigations including controlled experiments. c. Use appropriate tools, metric units and techniques to gather, analyze, and interpret data. d. Use mathematics to ask questions; gather, organize, and present data; and structure convincing explanations. e. Use logic and critical reasoning to develop descriptions, explanations,	Students methodically plan, conduct, analyze data from, and communicate results of in-depth scientific investigations, including experiments guided by a testable hypothesis. a. Identify questions, concepts, and testable hypotheses that guide scientific investigations. b. Design and safely conduct methodical scientific investigations, including controlled experiments. Use statistics to analyze and interpret results. c. Formulate and revise scientific investigations and models using logic and evidence. d. Use a variety of tools and technologies to improve investigations and

	reasonable explanation. e. Use writing, speaking, and drawing to communicate investigations and explanations.	e. Communicate, critique, and analyze own scientific work and the work of other students.	predictions, and models using evidence. f. Recognize alternative explanations and predictions. g. Communicate scientific procedures and explanations.	communications. e. Recognize and analyze alternative explanations and models using scientific criteria. f. Communicate and defend scientific ideas.
B2 Skills and Traits of Technological Design	Students use a simple design process, and basic tools and materials to solve a problem or create a product. a. Describe a design problem in students' own words. b. Propose a way to build something or get something to work better. c. Use suitable tools, materials, safe techniques, and measurements to implement a proposed solution to a design problem. d. Judge how well a product or design solved a problem. e. Present a design or solution to a	Students use a design process, simple tools, and a variety of materials to solve a problem or create a product, recognizing the constraints that need to be considered. a. Identify and explain a simple design problem, task, and solution related to the problem. b. Propose a solution to a design problem that recognizes constraints such as cost, materials, time, space, or safety. c. Use appropriate tools, materials, safe techniques, and quantitative measurements to implement a proposed solution to a design problem. d. Balance simple constraints in carrying out	Students use a systematic process, tools, equipment, and a variety of materials to design and produce a solution or product to meet a specified need, using established criteria. a. Identify appropriate problems for technological design. b. Design a solution or product. c. Communicate a proposed design using drawings and simple models. d. Implement a proposed design. e. Evaluate a completed design or product. f. Suggest improvements for their own and others' designs and try out proposed modifications. g. Communicate the process of technological design, including a review and	Students use a systematic process, tools and techniques, and a variety of materials to design and produce a solution or product that meets new needs or improves existing designs. a. Identify new problems or a current design in need of improvement. b. Generate alternative design solutions. c. Select the design that best meets established criteria. d. Use models and simulations as prototypes in the design planning process. e. Implement the proposed design solution. f. Evaluate the solution to a design problem and the consequences of that solution. g. Communicate the problem, process, and solution to a design problem.

	problem, using oral, written, or pictorial means of communication.	a proposed solution to a design problem. e. Evaluate own design results as well as those of others, using established criteria in their evaluations. f. Modify designs based on results of evaluations. g. Use oral, written, and pictorial means of communication to present the process and result of a design problem.	description of the completed design or product.	

C. <u>The Scientific and Technological Enterprise:</u> Students understand the history and nature of scientific knowledge and technology, the processes of inquiry and technological design, and the impacts science and technology have on society and the environment.

	PK – 2 *PERFORMANCE INDICATOR*	3-5 *PERFORMANCE INDICATOR*	6-8 *PERFORMANCE INDICATOR*	9-Diploma *PERFORMANCE INDICATOR*
C1 Understandings of Inquiry	Students describe the use of questions, and accurate communication in scientists' work. a. Describe how scientific investigations involve asking and answering a question. b. Point out the importance of describing things and investigations accurately so others	Students describe how scientific investigations result in explanations that are communicated to other scientists. a. Describe how scientists develop explanations based on observations, evidence and knowledge of the natural world. b. Describe how scientists make their explanations public.	Students describe how scientists use varied and systematic approaches to investigations that may lead to further investigations. a. Explain how the type of question informs the type of investigation. b. Explain why it is important to identify and control variables, and replicate trials in experiments. c. Describe how scientists' analysis of findings can	Students describe key aspects of scientific investigations: that they are guided by scientific principles and knowledge; that they are performed to test ideas and that they are communicated and defended publicly. a. Describe how hypotheses as well as past and present knowledge guide and influence scientific investigations. b. Describe how scientists defend their evidence and

	can learn about them or repeat them.		lead to new investigations.	explanations using logical arguments and verifiable results.
C2 Understandings About Science and Technology	Students recognize that people have always engaged in science and technology, and that there is a difference between the natural and designed worlds. a. Recognize that people have always had problems and invented tools and ways of doing things to solve problems. b. Distinguish between objects that occur in nature and objects that have been made by people.	Students describe why people use science and technology, and how scientists and engineers work. a. Describe how scientists seek to answer questions and explain the natural world, while engineers seek solutions to problems through the design and production of products.	Students recognize the differences between scientific inquiry and technological design. a. Compare and contrast the processes of scientific inquiry and technological design. b. Explain how constraints and consequences relate to scientific inquiry and technological design.	Students explain how the relationship between the research and knowledge of scientists and, the design process and products of engineers influences the advancement of ideas and designs. a. Provide an example that shows how science advances with the introduction of new technologies and how solving technological problems often impacts new scientific knowledge. b. Provide examples of how creativity, imagination, and a good knowledge base are required to advance scientific ideas and technological design. c. Give examples of how technological solutions to problems sometimes create new problems.
C3 Science, Technology, and Society	No performance indicator. Although no performance indicators are stated students	Students identify and describe the influences of science and technology on people and the environment.	Students describe the relationship of science and technology in addressing personal and societal	Students describe the role of science and technology in creating and solving contemporary issues and

	are expected to have instructional experiences that describe influences of science and technology on their own lives.	a. Explain how science and technology can help people make safe and healthy decisions. b. Give examples of changes in the environment caused by natural or human-made influences. c. Identify that natural resources are limited, and conserving them, decreasing their use and using renewable resources is important.	challenges. a. Identify the challenges to society that science and technology can help address including population, natural hazards, sustainability, personal health, and environmental quality. b. Identify personal choices that can either positively or negatively impact society in such areas as population, ecosystem sustainability, personal health and environmental quality. c. Describe how science and technology are used to address societal concerns related to environmental quality and personal health and safety. d. Identify the factors that influence the development and use of science and technology.	challenges. a. Explain how science and technology influence the *carrying capacity* and sustainability of the planet. b. Explain how ethical, societal, political, economic, and cultural factors influence personal health, safety and the quality of the environment. c. Explain how ethical, societal, political, economic, religious, and cultural factors influence the development and use of science and technology.
C4 History and Nature of Science	No performance indicator. Although no performance indicators are stated students are expected to have instructional experiences that	No performance indicator. Although no performance indicators are stated students are expected to have instructional experiences that	Students describe how science advances knowledge through the scientists involved, the ways they think about their work and that of others, and through historical examples.	Students describe the human dimensions and traditions of science, the nature of scientific knowledge, and historical episodes in science that impacted science and society.

	describe how people use science in their lives.	describe how science helps us understand the natural world.	a. Describe how women and men of various backgrounds, working in teams or alone but communicating extensively with others, engage in science, engineering and related fields. b. Describe a breakthrough from the history of science that contributes to our current understanding of science. c. Describe the basis for understanding science as a human endeavor that generates explanations based on verifiable evidence and why it is subject to change when new evidence does not match existing explanations.	a. Describe the ethical traditions in science including peer review, truthful reporting, and making results public. b. Select one of the major episodes in the history of science and describe how the scientific knowledge changed over time, and the important effects on science and technology. c. Give examples of how societal, cultural, and personal beliefs and ways of viewing the world could bias scientists. d. Provide examples of criteria that distinguish scientific explanations from pseudoscientific ones.

D. <u>The Physical Setting:</u> Students understand the universal nature of matter, energy, force and motion, and identify how these relationships are exhibited in Earth Systems, in the solar system and throughout the universe.

	PK – 2 *PERFORMANCE INDICATOR*	3-5 *PERFORMANCE INDICATOR*	6-8 *PERFORMANCE INDICATOR*	9-Diploma *PERFORMANCE INDICATOR*
D1 Universe and Solar System	Students describe the movement of objects across the sky, as seen from the Earth.	Students describe the positions and apparent motions of different objects in and beyond our solar system,	Students explain the movements, and describe the location, composition, and characteristics of our solar system and vast	Students explain the physical formation and changing nature of our universe and solar system, and how our past and

	a. Describe how the sun and moon seem to move across the sky. b. Describe the changes in the appearance of the moon from day to day.	and how these objects can be viewed from Earth. a. Show the locations of the sun, earth, moon, and planets and their orbits. b. Observe and report on observations that the sun appears to move across the sky in the same way every day, but its path changes slowly over the seasons. c. Recognize that the sun is a star and similar to other stars in the universe.	universe, including planets, the sun, and galaxies. a. Describe the different kinds of objects in the solar system including planets, sun, moons, asteroids and comets. b. Explain the motions that cause days, years, phases of the moon and eclipses. c. Describe the location of our solar system in its galaxy as well as the existence of other galaxies made up of stars and planets.	present knowledge of the universe and solar system developed. a. Explain why the unit of light years can be used to describe relative distances to objects in the universe. b. Explain the role of gravity in forming and maintaining planets, stars, and the solar system. c. Outline the age, origin and process of formation of the universe as currently understood by science.
D2 Earth	Students describe Earth's weather and surface materials and the different ways they change. a. Explain that the Sun warms the air, water and land. b. Describe the way in which weather changes over months. c. Describe what happens to water left in an open	Students describe the properties of Earth's materials, the processes that change them, and cycles that affect the Earth. a. Explain the effects of the rotation of Earth on the day/night cycle, and how that cycle affects local temperature. b. Describe the various forms water takes in the	Students discuss the various cycles, physical and biological forces and processes, position in space, energy transformations, and human actions that affect short-term and long-term changes to the Earth. a. Recognize that in temperate regions the sun rises higher in the sky during the summer than in the winter, and explain this in relation	Students analyze the biological, physical, energy, and human interactions that shape and alter Earth Systems. a. Explain how solar radiation, ocean currents, and atmospheric conditions influence the habitability of life on Earth. b. Describe factors that

	container compared to water left in a closed container.	air and how that relates to weather. c. Explain how wind, waves, water, and ice reshape the surface of Earth. d. Describe the kinds of material that form rocks and soil. e. Recognize that the sun is the source of Earth's heat and light energy.	to change in the path of the sun and the tilt of Earth's rotational axis relative to the plane of its yearly orbit around the Sun. b. Describe Earth Systems – biosphere, atmosphere, hydrosphere and lithosphere – including some of the cycles and interactions such as water moving among and between them, rocks forming and transforming, and weather formation. c. Give several reasons why the climate is different in different regions of the Earth. d. Discuss the importance and limitations of Earth's resources. e. Describe the effect of gravity on objects on Earth. f. Give examples of both abrupt changes and slow changes in Earth Systems.	influence plate tectonics. c. Describe biological and geophysical influences on the origin and changing nature of Earth Systems. d. Describe human influences on the changing Earth Systems.
D3 Matter and Energy	Students use observable characteristics to describe objects and materials and changes to physical properties of materials. a. Describe objects in terms of	Students describe properties of objects and materials before and after they undergo a change or interaction. a. Describe the relation of the weight of an object	Students describe physical and chemical properties of matter, interactions and changes in matter, and transfer of energy through matter. a. Describe that all matter is	Students describe the structure, behavior, and interactions of matter at the atomic level and the relationship between matter and energy. a. Describe the structure of

	what they are made of and their physical properties. b. Describe changes in properties of materials when mixed, *heated*, frozen, or cut.	and the sum of the weight of its parts. b. Illustrate how many different substances can be made from a small number of basic ingredients by using a description of the properties of original materials and the new material formed. c. Describe what happens when an object or process gives off *heat* and is near a cool object. d. Describe how the *heating* and cooling of water and other materials can change the properties of the materials. e. Explain that the properties of a material may change but the total amount of material remains the same.	made up of atoms and distinguish between/among elements, atoms, and molecules. b. Describe how physical characteristics of elements and types of reactions they undergo have been used to create the Periodic Table. c. Describe the difference between physical and chemical change. d. Explain the relationship of the motion of atoms and molecules to the states of matter for gases, liquids and solids. e. Explain that atoms can be packed together in large arrays that compose all substances including compounds mixtures and solutions. f. Explain that some characteristics of matter including density, boiling point, solubility, are not dependent on the amount of matter present and other characteristics are. g. Use the idea of atoms to explain the conservation of matter. h. Describe several different types of energy forms	atoms in terms of neutrons, protons and electrons. b. Describe how the number and arrangement of atoms in a molecule determines a molecule's properties, including the types of bonds it makes with other molecules and its mass. c. Describe how light is emitted and absorbed by atoms changing energy levels, the results of which can be used to identify a substance. d. Describe factors that affect the rate of chemical reactions. e. Describe nuclear reactions and the energy they release. f. Explain the relationship between kinetic and potential energy. g. Describe that in energy transformations the total amount of energy remains the same but because of inefficiencies heat is usually produced which diffuses by radiation or conduction into cooler places, causing a loss of

			including heat energy, chemical energy, and mechanical energy. i. Use examples of energy transformations from one form to another to explain that energy cannot be created or destroyed j. Explain that *heat* is transferred from one object to another by conduction, convection and/or radiation. k. Describe the properties of solar radiation and its interaction with objects on Earth.	useful energy. h. Describe radioactive decay and half-life. i. Explain the nuclear fusion process that causes stars to produce huge quantities of energy. j. Describe the relationship between *heat*, and *temperature* in terms of the actions of atoms, molecules, and ions.
D4 Force and Motion	Students describe how objects move in different ways. a. Describe different ways things move and what it takes to start an object moving or to keep objects moving. b. Give examples of things that make sound by vibrating.	Students summarize how various forces affect the motion of objects. a. Predict the effect of a given force on the motion of an object. b. Describe the relationship between how fast things move and how long it takes them to go a certain distance. c. Give examples of how gravity, magnets, and electrically charged materials push and pull objects.	Students describe the force of gravity, the motion of objects and the nature of energy in light and waves. a. Describe the kind of motion that sound, earthquake and light waves have in common, and how their motions are different. b. Explain the relationship between visible light, the electromagnetic spectrum and sight. c. Explain how the gravitational force between any two objects would change if the distance	Students understand that the laws of forces and motion are the same across the universe. a. Describe the intellectual developments that have led to our present understanding of the universe structure and motion. b. Describe Newton's concept of gravity, using the motion of galaxies, stars, planets, moons, comets, and various events on Earth as examples. c. Describe the contribution

			between them changed or their mass changed. d. Explain that electric currents and magnets can exert force on each other. e. Describe the effects of different types of force on an object and how unbalanced forces will cause changes in the speed or direction.	of Newton to our understanding of force and motion, and give examples of his three laws of motion. d. Explain the ideas of relative motion and frame of reference. e. Describe some of the conceptual considerations in modern technologies that are based on the interplay of magnetic and electric forces.

E. <u>The Living Environment:</u> Students understand that cells are the basic unit of life, that all life as we know it has evolved through genetic transfer and natural selection to create a great diversity of organisms, and that these organisms create interdependent webs through which matter and energy flow. Students understand their similarities and differences, as humans, to other organisms and their interconnections to these interdependent webs.

	PK – 2 *PERFORMANCE INDICATOR*	3-5 *PERFORMANCE INDICATOR*	6-8 *PERFORMANCE INDICATOR*	9-Diploma *PERFORMANCE INDICATOR*
E1 Biodiversity	Students describe similarities and differences in the observable behaviors, features, and needs of plants and animals. a. Describe similarities and differences in the way plants and animals look and the	Students compare living things based on their behaviors, external features, and environmental needs. a. Describe how living things can be sorted in many ways, depending on which features or behaviors are used to sort them.	Students differentiate among organisms based on biological characteristics, and identify patterns of similarity. a. Compare physical characteristics that differentiate organisms into plants that use sunlight to make their own food, animals that consume	Students analyze the evidence for relatedness among and within diverse populations of organisms, and the importance of biodiversity. a. Explain how the variation in structure and behavior of a population of organisms may influence the likelihood that some

	things that they do. b. Describe some features of plants and animals that help them live in different environments. c. Describe how organisms change during their lifetime.	b. Describe the changes in external features of organism during their life cycles.	energy rich food, and microscopic organisms that cannot be easily classified as either. b. Explain that biologists use internal and external anatomical features to determine relatedness among organisms and to form the basis for classification systems. c. Give the definition of a species for organisms that combine genetic information. d. Explain that external and internal structures of animals and plants contribute to the variety of ways organisms are able to find food and reproduce.	members of the species will have adaptations that allow them to survive in a changing environment. b. Describe the role of DNA sequences in determining the degree of kinship among organisms and the identification of species.
E2 Ecosystems	Students understand how plants and animals depend on each other and the environment they live in. a. Explain that animals use plants and other animals for food, shelter and nesting. b. Compare different animals and plants that live in different parts of the world.	Students describe ways organisms depend upon, interact within, and change the living and nonliving environment as well as ways the environment affects organisms, biomes, and ecosystems. a. Explain how changes in an organism's habitat can influence its survival.	Students examine how the characteristics of the physical, non-living (abiotic) environment, the types and behaviors of living (biotic) organisms, and the flow of matter and energy affect organisms and the ecosystem of which they are part. a. List various kinds of resources within different biomes for which organisms may need to compete.	Students analyze the interactions, cycles, and factors that affect short and long-term ecosystem stability and change. a. Explain why ecosystems can be reasonably stable over hundreds or thousands of years, even though populations may fluctuate. b. Explain dynamic

		b. Describe that organisms all over the Earth are living, dying, decaying and new organisms are being produced by the old ones. c. Describe some of the ways in which organisms depend on one another. d. Explain how the food of most animals can be traced back to plants and how the animal uses food for energy and repair.	b. State the main ways in which two types of organisms may interact including competition, predator/prey, producer/consumer/decomposer, parasitism, mutualism, and state the positive and negative consequences such interactions have. c. Describe the source and flow of energy in the two major food webs, terrestrial and marine. d. Describe how matter and energy change from one form to another in living things and physical environment. e. Explain that the total amount of matter in the environment stays the same as its form and location change.	equilibrium in ecosystems and some factors that can, in the long run, lead to change in the normal pattern of cyclic fluctuations. c. Explain the concept of *carrying capacity* and list factors that determine the amount of life that any environment can support. d. Describe how energy and the chemical elements that make up molecules are transformed in ecosystems, and how they obey basic conservation laws, and explain the crucial role of photosynthesis.
E3 Cells	Students describe parts and wholes of living things, their basic needs, and the structures and processes that help them stay alive. a. List some things that are so small we cannot see them	Students describe how living things are made up of one or more cells and the ways cells help organisms meet their basic needs. a. Give examples of organisms that consist of a single cell and organisms that are	Students describe the hierarchy of organization and function in organisms, and the similarities and differences in structure, function, and needs among and within organisms. a. Describe the basic functions of organisms carried out within cells including the	Students describe structure and function of cells at the intracellular and molecular level including differentiation to form systems, interactions between cells and their environment, and the impact of cellular processes and changes on individuals. a. Describe the similarities

	without using magnifying lenses. b. List the basic things that most organisms need to survive, no matter what their size.	made of a collection of cells. b. Compare how needs of living things are met in single-celled and multi-celled organisms.	extracting of energy from food and the elimination of wastes. b. Explain the relationship among cells, tissues, organs, and organ systems. c. Compare the structures, systems and interactions that allow single-celled organisms and multi-celled plants and animals, including humans, to defend themselves, acquire and use energy, self-regulate, reproduce, and coordinate movement. d. Explain that all living things are composed of cells from just one to millions.	and differences in the basic functions of cell membranes and of the specialized parts within cells that allow them to transport materials, capture and release energy, build proteins, dispose of waste, communicate and move. b. Describe the relation between DNA, protein molecules and amino acids in carrying out the work of cells and how this is similar among all organisms. c. Describe the interactions that lead to cell growth and division (mitosis) and allow new cells to carry the same information as the original cell (meiosis). d. Describe ways in which cells can malfunction and put an organism at risk. e. Describe the role of regulation and the processes that maintain an internal environment amidst changes in the external environment. f. Describe the process of metabolism that allows a few key biomolecules to

				provide cells with necessary materials to perform their functions. g. Describe how cells differentiate to form specialized systems for carrying out life functions.
E4 Heredity and Reproduction	Students describe the cycle of birth, development, and death in different organisms and the ways in which organisms resemble their parents. a. Give examples of how organisms are like their parents and not like them.	Students describe the length and stages of development in humans and other organisms, characteristics of organisms, and the reasons why organisms differ from or are similar to their parents. a. Name some likenesses between children and parents that are inherited, and some that are not.	Students describe the general characteristics and mechanisms of reproduction and heredity in organisms, including humans, and ways in which organisms are affected by their genetic traits. a. Explain that sexual reproduction includes fertilization that results in the inclusion of genetic information from each parent and determines the inherited traits that are a part of every cell. b. Identify some of the risks to the healthy development of an embryo including mother's diet, lifestyle and hygiene. c. Describe asexual reproduction as a process by which all genetic information comes from one parent and determines the inherited traits that are a part of every cell.	Students examine the role of DNA in transferring traits from generation to generation, in differentiating cells and in evolving new species. a. Explain some of the effects of the sorting and recombination of genes in sexual reproduction. b. Describe that genes are segments of DNA that contain instructions for the cells including information that leads to the differentiation of cells and results in varied cell functions in the organism and DNA. c. Explain the possible causes and effects of gene mutations.

	PK-2 *PERFORMANCE INDICATORS*	3-5 *PERFORMANCE INDICATORS*	6-8 *PERFORMANCE INDICATORS*	9-Diploma *PERFORMANCE INDICATORS*
E5 Evolution	Students describe similarities and differences between present day and past organisms that helped them live in their environment. a. Describe some organisms' features that allow them to live in places others cannot. b. Explain how some kinds of organisms that once lived on earth have completely disappeared, although they were something like others that are alive today.	Students describe the fossil evidence and present explanations that help us understand why there are differences among and between present and past organisms. a. Explain advantages and disadvantages of some individuals of the same kind being different in their characteristics and behavior. b. Compare fossils to one another and to living organisms according to their similarities and differences.	Students describe the evidence that evolution occurs over many generations, allowing species to acquire many of their unique characteristics or adaptations. a. Explain how the layers of sedimentary rock and their contained fossils provide evidence for the long history of Earth and for the long history of changing life. b. Describe how small differences between parents and offspring can lead to descendants who are very different from their ancestors. c. Describe how variations in the behavior and traits of an offspring may permit some of them to survive a changing environment. d. Explain that new varieties of cultivated plants and domestic animals can be developed through genetic modification.	Students describe the interactions between species, populations and environments that lead to natural selection and evolution. a. Describe the basic idea of biological evolution, citing evidence from the fossil record and evidence based on the observation of similarities within the diversity of existing organisms. b. Describe the origins of life and how the concept of natural selection provides a mechanism for evolution that can be advantageous or disadvantageous to the next generation. c. Explain why some organism may have characteristics that have no apparent survival or reproduction advantage. d. Relate structural and behavioral adaptations of an organism to its survival in the environment.