

**STATE GOAL 12: Understand the fundamental concepts, principles and interconnections of the life, physical and earth/space sciences.**

**Why This Goal Is Important:** This goal is comprised of key concepts and principles in the life, physical and earth/space sciences that have considerable explanatory and predictive power for scientists and non-scientists alike. These ideas have been thoroughly studied and have stood the test of time. Knowing and being able to apply these concepts, principles and processes help students understand what they observe in nature and through scientific experimentation. A working knowledge of these concepts and principles allows students to relate new subject matter to material previously learned and to create deeper and more meaningful levels of understanding.

**A. Know and apply concepts that explain how living things function, adapt and change.**

<b>EARLY ELEMENTARY</b>	<b>LATE ELEMENTARY</b>	<b>MIDDLE/JUNIOR HIGH SCHOOL</b>	<b>EARLY HIGH SCHOOL</b>	<b>LATE HIGH SCHOOL</b>
<b>12.A.1a</b> Identify and describe the component parts of living things (e.g., birds have feathers; people have bones, blood, hair, skin) and their major functions.	<b>12.A.2a</b> Describe simple life cycles of plants and animals and the similarities and differences in their offspring.	<b>12.A.3a</b> Explain how cells function as “building blocks” of organisms and describe the requirements for cells to live.	<b>12.A.4a</b> Explain how genetic combinations produce visible effects and variations among physical features and cellular functions of organisms.	<b>12.A.5a</b> Explain changes within cells and organisms in response to stimuli and changing environmental conditions (e.g., homeostasis, dormancy).
<b>12.A.1b</b> Categorize living organisms using a variety of observable features (e.g., size, color, shape, backbone).	<b>12.A.2b</b> Categorize features as either inherited or learned (e.g., flower color or eye color is inherited; language is learned).	<b>12.A.3b</b> Compare characteristics of organisms produced from a single parent with those of organisms produced by two parents.	<b>12.A.4b</b> Describe the structures and organization of cells and tissues that underlie basic life functions including nutrition, respiration, cellular transport, biosynthesis and reproduction.	<b>12.A.5b</b> Analyze the transmission of genetic traits, diseases and defects.
		<b>12.A.3c</b> Compare and contrast how different forms and structures reflect different functions (e.g., similarities and differences among animals that fly, walk or swim; structures of plant cells and animal cells).	<b>12.A.4c</b> Describe processes by which organisms change over time using evidence from comparative anatomy and physiology, embryology, the fossil record, genetics and biochemistry.	

**B. Know and apply concepts that describe how living things interact with each other and with their environment.**

<b>EARLY ELEMENTARY</b>	<b>LATE ELEMENTARY</b>	<b>MIDDLE/JUNIOR HIGH SCHOOL</b>	<b>EARLY HIGH SCHOOL</b>	<b>LATE HIGH SCHOOL</b>
<b>12.B.1a</b> Describe and compare characteristics of living things in relationship to their environments.	<b>12.B.2a</b> Describe relationships among various organisms in their environments (e.g., predator/prey, parasite/host, food chains and food webs).	<b>12.B.3a</b> Identify and classify biotic and abiotic factors in an environment that affect population density, habitat and placement of organisms in an energy pyramid.	<b>12.B.4a</b> Compare physical, ecological and behavioral factors that influence interactions and interdependence of organisms.	<b>12.B.5a</b> Analyze and explain biodiversity issues and the causes and effects of extinction.

<b>12.B.1b</b> Describe how living things depend on one another for survival.	<b>12.B.2b</b> Identify physical features of plants and animals that help them live in different environments (e.g., specialized teeth for eating certain foods, thorns for protection, insulation for cold temperature).	<b>12.B.3b</b> Compare and assess features of organisms for their adaptive, competitive and survival potential (e.g., appendages, reproductive rates, camouflage, defensive structures).	<b>12.B.4b</b> Simulate and analyze factors that influence the size and stability of populations within ecosystems (e.g., birth rate, death rate, predation, migration patterns).	<b>12.B.5b</b> Compare and predict how life forms can adapt to changes in the environment by applying concepts of change and constancy (e.g., variations within a population increase the likelihood of survival under new conditions).
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**C. Know and apply concepts that describe properties of matter and energy and the interactions between them.**

<b>EARLY ELEMENTARY</b>	<b>LATE ELEMENTARY</b>	<b>MIDDLE/JUNIOR HIGH SCHOOL</b>	<b>EARLY HIGH SCHOOL</b>	<b>LATE HIGH SCHOOL</b>
<b>12.C.1a</b> Identify and compare sources of energy (e.g., batteries, the sun).	<b>12.C.2a</b> Describe and compare types of energy including light, heat, sound, electrical and mechanical.	<b>12.C.3a</b> Explain interactions of energy with matter including changes of state and conservation of mass and energy.	<b>12.C.4a</b> Use kinetic theory, wave theory, quantum theory and the laws of thermodynamics to explain energy transformations.	<b>12.C.5a</b> Analyze reactions (e.g., nuclear reactions, burning of fuel, decomposition of waste) in natural and man-made energy systems.
<b>12.C.1b</b> Compare large-scale physical properties of matter (e.g., size, shape, color, texture, odor).	<b>12.C.2b</b> Describe and explain the properties of solids, liquids and gases.	<b>12.C.3b</b> Model and describe the chemical and physical characteristics of matter (e.g., atoms, molecules, elements, compounds, mixtures).	<b>12.C.4b</b> Analyze and explain the atomic and nuclear structure of matter.	<b>12.C.5b</b> Analyze the properties of materials (e.g., mass, boiling point, melting point, hardness) in relation to their physical and/or chemical structures.

**D. Know and apply concepts that describe force and motion and the principles that explain them.**

<b>EARLY ELEMENTARY</b>	<b>LATE ELEMENTARY</b>	<b>MIDDLE/JUNIOR HIGH SCHOOL</b>	<b>EARLY HIGH SCHOOL</b>	<b>LATE HIGH SCHOOL</b>
<b>12.D.1a</b> Identify examples of motion (e.g., moving in a straight line, vibrating, rotating).	<b>12.D.2a</b> Explain constant, variable and periodic motions.	<b>12.D.3a</b> Explain and demonstrate how forces affect motion (e.g., action/reaction, equilibrium conditions, free-falling objects).	<b>12.D.4a</b> Explain and predict motions in inertial and accelerated frames of reference.	<b>12.D.5a</b> Analyze factors that influence the relative motion of an object (e.g., friction, wind shear, cross currents, potential differences).
<b>12.D.1b</b> Identify observable forces in nature (e.g., pushes, pulls, gravity, magnetism).	<b>12.D.2b</b> Demonstrate and explain ways that forces cause actions and reactions (e.g., magnets attracting and repelling; objects falling, rolling and bouncing).	<b>12.D.3b</b> Explain the factors that affect the gravitational forces on objects (e.g., changes in mass, distance).	<b>12.D.4b</b> Describe the effects of electromagnetic and nuclear forces including atomic and molecular bonding, capacitance and nuclear reactions.	<b>12.D.5b</b> Analyze the effects of gravitational, electromagnetic and nuclear forces on a physical system.

**E. Know and apply concepts that describe the features and processes of the Earth and its resources.**

<b>EARLY ELEMENTARY</b>	<b>LATE ELEMENTARY</b>	<b>MIDDLE/JUNIOR HIGH SCHOOL</b>	<b>EARLY HIGH SCHOOL</b>	<b>LATE HIGH SCHOOL</b>
<b>12.E.1a</b> Identify components and describe diverse features of the Earth's land, water and atmospheric systems.	<b>12.E.2a</b> Identify and explain natural cycles of the Earth's land, water and atmospheric systems (e.g., rock cycle, water cycle, weather patterns).	<b>12.E.3a</b> Analyze and explain large-scale dynamic forces, events and processes that affect the Earth's land, water and atmospheric systems (e.g., jetstream, hurricanes, plate tectonics).	<b>12.E.4a</b> Explain how external and internal energy sources drive Earth processes (e.g., solar energy drives weather patterns; internal heat drives plate tectonics).	<b>12.E.5</b> Analyze the processes involved in naturally occurring short-term and long-term Earth events (e.g., floods, ice ages, temperature, sea-level fluctuations).
<b>12.E.1b</b> Identify and describe patterns of weather and seasonal change.	<b>12.E.2b</b> Describe and explain short-term and long-term interactions of the Earth's components (e.g., earthquakes, types of erosion).	<b>12.E.3b</b> Describe interactions between solid earth, oceans, atmosphere and organisms that have resulted in ongoing changes of Earth (e.g., erosion, El Nino).	<b>12.E.4b</b> Describe how rock sequences and fossil remains are used to interpret the age and changes in the Earth.	
<b>12.E.1c</b> Identify renewable and nonrenewable natural resources.	<b>12.E.2c</b> Identify and classify recyclable materials.	<b>12.E.3c</b> Evaluate the biodegradability of renewable and nonrenewable natural resources.		

**F. Know and apply concepts that explain the composition and structure of the universe and Earth's place in it.**

<b>EARLY ELEMENTARY</b>	<b>LATE ELEMENTARY</b>	<b>MIDDLE/JUNIOR HIGH SCHOOL</b>	<b>EARLY HIGH SCHOOL</b>	<b>LATE HIGH SCHOOL</b>
<b>12.F.1a</b> Identify and describe characteristics of the sun, Earth and moon as familiar objects in the solar system.	<b>12.F.2a</b> Identify and explain natural cycles and patterns in the solar system (e.g., order of the planets; moon phases; seasons as related to Earth's tilt, one's latitude, and where Earth is in its yearly orbit around the sun).	<b>12.F.3a</b> Simulate, analyze and explain the effects of gravitational force in the solar system (e.g., orbital shape and speed, tides, spherical shape of the planets and moons).	<b>12.F.4a</b> Explain theories, past and present, for changes observed in the universe.	<b>12.F.5a</b> Compare the processes involved in the life cycle of stars (e.g., gravitational collapse, thermonuclear fusion, nova) and evaluate the supporting evidence.
<b>12.F.1b</b> Identify daily, seasonal and annual patterns related to the Earth's rotation and revolution.	<b>12.F.2b</b> Explain the apparent motion of the sun and stars.	<b>12.F.3b</b> Describe the organization and physical characteristics of the solar system (e.g., sun, planets, satellites, asteroids, comets).	<b>12.F.4b</b> Describe and compare the chemical and physical characteristics of galaxies and objects within galaxies (e.g., pulsars, nebulae, black holes, dark matter, stars).	<b>12.F.5b</b> Describe the size and age of the universe and evaluate the supporting evidence (e.g., red-shift, Hubble's constant).
	<b>12.F.2c</b> Identify easily recognizable star patterns (e.g., the Big Dipper, constellations).	<b>12.F.3c</b> Compare and contrast the sun as a star with other objects in the Milky Way Galaxy (e.g., nebulae, dust clouds, stars, black holes).		