

# Science Curriculum Guide Spring 2003

## K-8

**Archdiocese of Oklahoma City**  
Department of Catholic Education

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## **K-12 Science Goals for the Archdiocese of Oklahoma City**

### **Mission Statement**

The science curriculum in the Archdiocese of Oklahoma City prepares students for further study in various scientific disciplines. The students become increasingly aware of their place in creation. Students will learn to integrate scientific knowledge with religious belief. With this knowledge, students will make informed decisions that will affect themselves and the world around them.

### **Goals of the Science Curriculum**

1. We recognize the Church's role in regard to promoting the sacredness of life. Students will learn to respect and value all forms and stages of life. As a commitment to life, preservation, conservation, and restoration of all living things will be emphasized.
2. Students will be encouraged to learn science through a variety of experientially based educational methods. (hands-on activity, technology-based instruments, lab experiments, etc.)
3. Students will learn the concepts, skills, and vocabulary necessary to become scientifically literate.
4. Students will be taught the scientific method and use it at every grade level.
5. Students will develop critical thinking skills for use in scientific inquiry and problem solving.
6. Students will learn to apply scientific knowledge to situations in their own lives and be encouraged to bring moral judgments to scientific thought and practices.
7. Students will understand the relationship and use of technology to scientific discovery and the impact of both on society.
8. Students will be exposed to science related career opportunities.
9. Students will learn the proper use of scientific equipment.
10. Science programs will be developed through a collaborative effort in order to solidify the science program from one level to the next throughout the Archdiocese.

A special thanks is extended to the following individuals for their many hours of work in the formulation of the Science goals and objectives.

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The goals and objectives listed on these pages are basic benchmarks that should be found within the curriculum of every school in the Archdiocese of Oklahoma City. It is the hope of the committee that teachers of science and their administrators will study these goals and objectives in order to evaluate the strength of their present science curriculum. Because every school is independent in the delivery of curriculum, the grade level divisions were made broad in scope to allow for the diversity of thought that exists among us.

The level of mastery is left to the decision of individual schools. An 80% or higher minimum or better mastery level is strongly recommended.

## **ARCHDIOCESAN POLICIES ON CURRICULUM (7150)**

### **7150.1 Curriculum Goals**

The primary goal of the instructional program in our Catholic Schools is to provide those learning experiences which are best for developing the values, attitudes, knowledge, and skills necessary for the student's moral and spiritual, intellectual, social, emotional, and physical development which best support the distinctive mission of Catholic schools.

### **7150.2 Objectives of the Instructional Program**

The instructional program of each school shall be in accord with the local school's educational mission statement and its objectives as well as with the Archdiocesan philosophy, mission statement, goals and curriculum guides.

The curriculum shall meet the Oklahoma State Department of Education requirements, as well as those of the Archdiocese of Oklahoma City, and also any other accrediting agencies, of which the school is a member.

## **The Seven Major Themes of Catholic Social Teaching**

We also advise instructors to incorporate the seven major themes of Catholic Social Teaching in their lessons. Please review science materials, student projects, and this guide to determine which area(s) of the Themes are most appropriate to teach with units of study.

- 1. Life and dignity of the human person**
- 2. A call to family, community, and participation**
- 3. Rights and responsibilities**
- 4. Option for the poor and vulnerable**
- 5. The dignity of work and the rights of workers**
- 6. Solidarity**
- 7. Care for God's creation**

## Kindergarten Science Curriculum

### I. Science as Inquiry

Scientific progress is made by asking meaningful questions, and conducting careful investigations. The student will:

**Columns may be used to record dates lesson is taught**

				A. Observe common objects by using the five senses
				B. Describe the properties of common objects
				C. Describe the relative position of objects by using one Reference (e.g., above or below).
				D. Compare and sort common objects by one physical Attribute (e.g., color, shape, texture, size, weight).
				E. Communicate observations orally and through drawings.

### II. Physical Science

Properties and materials can be observed, measured, and predicted. As a basis for understanding this concept the student will:

				A. Know objects can be described in terms of the materials they are made of (e.g., clay, cloth, paper) and their physical properties (e.g., color, size, shape, weight, texture, flexibility, attraction to magnets, floating, sinking).
				B. Know water can be a liquid, or a solid, and can be made to change back and forth from one form to another.
				C. Know water left in an open container evaporates (goes into the air), but water in a closed container does not.

### III. Life Sciences

Different types of plants and animals inhabit the earth. As a basis for understanding this concept, the student will:

				A. Observe and describe similarities and differences in the appearance and behavior of plants and animals (e.g., seed bearing plants, birds, fish, insects).
				B. Know that stories sometimes give plants and animals attributes they do not really possess.
				C. Identify major structures of common plants and animals, (e.g., stems, leaves, roots, wings, legs).

## Kindergarten Science Curriculum cont.

### IV. Earth and Space Science

Earth is composed of land, air, and water. As a basis for understanding this concept, the student will:

			A. Know characteristics of mountains, rivers, oceans, valleys, deserts, and local landforms.
			B. Know changes in weather occur from day to day, and across seasons, affecting Earth and its inhabitants.
			C. Identify resources from Earth that are used in everyday life and understand that many resources can be conserved.

## FIRST GRADE SCIENCE CURRCULUM

### I. Science As Inquiry

Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept, the student will:

**Columns may be used to record date lesson is taught**

				A. Draw pictures that portray some features of the thing being described.
				B. Record observations and data with pictures, numbers and written statements.
				C. Record observations on a bar graph
				D. Describe the relative position of objects by using two references (e.g., above, and next to, below, and left of).
				E. Make new observations when discrepancies exist between two descriptions of the same object or phenomenon.

### II. Physical Science

Materials come in different forms (states), including solid, liquids, and gases. As a basis for understanding this concept, the student will:

				A. Know solids, liquids, and gases have different properties.
				B. Know the properties of substances can change when the substances are mixed, cooled, or heated.
				C. Identify the major energy sources used today to meet energy needs, and list ways energy is used to meet daily requirements.

### III. Life Science

Plants and animals meet their needs in different ways. As a basis for understanding this concept the student will:

			A. Develop an appreciation for the beauty and sacredness of all life.
			B. Develop a sense of duty to cooperate with and respect nature.
			C. Know different plants and animals inhabit different kinds of environments and have external features to help them thrive in different kinds of places.
			D. Know plants and animals need water, animals need food, and plants need light.
			E. Know animals eat plants or other animals for food, and may also use plants or even other animals for shelter and nesting.
			F. Know how to infer what animals eat from the shapes of their teeth (e.g., sharp teeth: eat meat, flat teeth: eat plants).
			G. Know roots are associated with the intake of water and soil nutrients and green leaves are associated with making food for sunlight.

### IV. Earth Science

Weather can be observed, measured, and described. As a basis for understanding this concept, the student will:

			A. Use simple tools (e.g., thermometer, wind vane), to measure weather conditions and record changes from day to day and across the seasons.
			B. know that weather changes from day to day, but that trends in temperature or of rain or snow tend to be predictable during a season.
			C. Know the sun warms the land, air, and water

## SECOND GRADE SCIENCE CURRICULUM

### I. Science as Inquiry

Scientific progress is made by asking meaningful questions and by conducting careful investigations. As a basis for understanding this concept, the student will:

**Columns may be used to record data lesson is taught**

			A. Make predictions based on observed patterns, and not random guessing.
			B. Measure length, weight, temperature, and liquid volume with appropriate tools, and express those measurements in standard metric system units.
			C. Compare and sort common objects according to two or more physical attributes (e.g., color, shape, texture, size, weight).
			D. Write or draw descriptions of a sequence of steps, events, and observations.
			F. Construct bar graphs to record data, using appropriately labeled axes.
			G. Use magnifiers or microscopes to observe and draw descriptions of small objects or small features of objects.
			H. Follow oral directions for a scientific investigation.

### II. Physical Science

The motion of objects can be observed and measured. As a basis for understanding this concept, the students will:

			A. Know the position of an object can be described by locating it in relation to another object or to the background.
			B. Know an object's motion can be described by locating it in relation to another object in the background.
			C. Know the way to change how something is moving is by giving it a push or a pull. The size of the change is related to the strength, or the amount of the force of the push or pull.
			D. Know tools and machines are used to apply pushes and pulls (force) to make things move.
			E. Know objects fall to the ground unless something holds them up.
			F. Know magnets can be used to make some objects move without being touched.
			G. Know sound is made by vibrating objects and can be described by its pitch and volume.

### III. Life Sciences

Plants and animals have predictable life cycles. As a basis for understanding this concept, the student will:

			A. Know that organisms reproduce offspring of their own kind and that the offspring resemble their parents and one another.
			B. Know the sequential stages of life cycles are different for different animals, such as butterflies, frogs, and mice.
			C. Know many characteristics of an organism are inherited from the parents. Some characteristics are caused or influenced by the environment.
			D. Know there is variation among individuals of one kind within a population.
			E. Know light, gravity, touch, or environmental stress can affect the germination, growth, and development of plants.
			F. Know flowers and fruits are associated with reproduction in plants.

### IV. Earth and Space Sciences

Earth is made of materials that have distinct properties and provide resources for human activities. As a basis for understanding this concept, the student will:

			A. Compare the physical properties of different kinds of rocks and know that rock is composed of different combinations of minerals.
			B. Know smaller rocks come from breakage and weathering of larger rocks.
			C. Know that soil is made partly from weathered rock and partly from organic materials, and that soils differ in their color, texture, capacity to retain water, and ability to support the growth of many kinds of plants.
			D. Know that fossils provide evidence about the plants and animals that lived long ago, and that scientists learn about the past history of earth by studying fossils.
			E. Know rock, water, plants, and soil provide many resources, including food, fuel, and building materials.

## THIRD GRADE SCIENCE CURRICULUM

### I. Science as Inquiry

Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept, the student will:

#### Columns may be used to record date lesson is taught

			A. Make observations using graphs, charts, and pictures.
			B. Collect, classify, describe and compare data.
			C. Predict the outcome of a simple investigation and compare the results.

### II. Physical Science

Energy and matter have multiple forms and can be changed from one form to another. As a basis for understanding this concept, the student will:

			A. Identify the forms of energy and their effect on matter.
			B. Identify how heat energy moves, changes matter, and is measured.
			C. Know machines and living things convert stored energy to motion and heat.
			D. Identify some simple and compound machines that one uses every day and explain how they work.
			E. Know energy can be carried from one place to another by waves, by electric current, by force, and by moving objects.
			F. Describe the properties of the three forms of matter: solid, liquid, and gas.
			G. Know evaporation and melting are changes that occur when objects are heated.
			H. Know that when two or more substances are combined, a new substance may be formed with properties that are different from those of the original materials.

### III. Life Science

Adaptations in physical structure or behavior may improve an organism's chance for survival. As a basis for understanding this concept, the student will:

			A. Know plants and animals have structures that serve different functions in growth, survival and reproduction.
			B. Know when the environment changes, some plants and animals survive and reproduce; others die or move to new locations.
			C. Know living things cause changes in the environment in which they live.
			D. Know that some kinds of organisms that once lived on Earth have completely disappeared and that some of those resembled others that are alive today.
			F. Define the terms food chain, food web, and food pyramid.
			G. Explain how the transfer of disease through water, food, and carriers, is prevented by good health habits.

### IV. Earth and Space Science

Objects in the sky move in regular and predictable patterns. As a basis for understanding this concept, the student will:

			A. Know the patterns of the stars stay the same, although they appear to move across the sky nightly, and different stars can be seen in different seasons.
			B. Know that Earth is one of several planets that orbit the Sun and that the moon orbits the earth.
			C. Explain how the orbiting of the earth around the sun causes differences in length of daylight periods and the seasons.
			D. Identify commonly used resources and describe ways they are used and how they can be conserved.

## FOURTH GRADE SCIENCE CURRICULUM

### I. Science as Inquiry

Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. The student will:

#### Columns may be used to record date lesson is taught

				A. Follow a set of written instructions for a scientific investigation.
				B. Differentiate observation from inference (understand that explanations come partly from what is observed and what is interpreted).
				C. Measure and estimate the weight, length, or volume of objects.
				D. Formulate and justify predictions based on cause-and-effect relationships
				E. Construct and interpret graphs from measurements.

### II. Physical Science

As a basis for understanding electricity and magnetism, the student will:

				A. Know how to design and build simple series and parallel circuits by using components such as wires, batteries, and bulbs.
				B. Know how to build a simple compass and use it to detect magnetic effects including Earth's magnetic field.
				C. Know role of electromagnet and currents in producing magnetic fields, and know how to build a simple electromagnet.
				D. Know the role of electromagnets in the construction of electric motors, electric generators, and simple devices, such as doorbells and earphones.
				E. Understand that electrically charged objects attract or repel each other.
				F. Know that magnets have two poles (north and south) and that like poles repel each other while unlike poles attract each other.
				G. Understand that electrical energy can be converted to heat, light, and motion.

## II. Physical Science cont.

			H. Identify major energy sources today to meet energy needs and know how to increase and conserve energy sources
			I. Identify simple and compound machines and how they work.
			J. Describe the effects of force, motion, and friction on objects.
			K. Define buoyancy and identify an object's center of gravity

## III. Life Sciences

All organisms need energy and matter to live and grow. As a basis for understanding this concept the student will:

			A. Understand that plants are the primary source of matter and energy entering most food chains.
			B. Recognize producers and consumers (herbivores, carnivores, omnivores, and decomposers) are related in food chains and food webs and may compete with each other for resources in an ecosystem.
			C. Know decomposers, including many fungi, insects, and microorganisms, recycle matter from dead plants and animals.

Living organisms depend on one another and on their environment for survival. As a basis for understanding this concept the student will:

			D. Understand that ecosystems can be characterized by their living and nonliving components.
			E. Know that in any particular environment, some kinds of plants and animals survive well, some survive less well, and some cannot survive at all.
			F. Recognize that many plants depend on animals for pollination and seed dispersal, and animals depend on plants for food and shelter.
			G. Understand that most microorganisms do not cause disease and that many are beneficial.

#### IV. Earth Sciences

The properties of rocks and minerals reflect the processes that formed them. As a basis for understanding this concept the student will:

				A. Know how to differentiate among igneous, sedimentary, and metamorphic rocks by referring to their properties and methods of formation (the rock cycle)
				B. Identify common rock forming minerals (including quartz, calcite, feldspar, mica, and hornblende) and ore minerals by using a table of diagnostic properties.

Waves, wind, water, and ice shape and reshape Earth's land surface. As a basis for understanding this concept the student will:

				C. Know some changes in the earth are due to slow processes, such as erosion, and some changes are due to rapid processes, such as landslides, volcanic eruptions, and earthquakes.
				D. Understand some natural processes including freezing and thawing and the growth of roots, cause rocks to break down to smaller pieces.
				E. Recognize land is reshaped by moving water as it takes land from some places and deposits it as pebbles, sand, silt, and mud in other places (weathering, transport, and deposition).

Natural resources are formed by natural processes: As a basis for understanding this concept the student will:

				F. Identify commonly used resources and describe ways they are used and how they can be conserved.
				G. Describe how to recognize and identify fossils and how they are preserved.

## FIFTH GRADE SCIENCE CURRICULUM

### I. Science as Inquiry

Scientific progress is made by asking meaningful questions and conducting careful investigations. To address content in the other three strands, students should develop their own questions and perform investigations. As a basis for understanding this concept the student will:

#### Columns may be used to record date lesson is taught

				A. Classify objects, (e.g., rocks, plants, leaves) in accordance with appropriate criteria.
				B. Develop a testable question.
				C. Plan and conduct a simple investigation based on a student-developed question and write instructions so others can follow and carry out the procedure.
				D. Identify dependent and controlled variables in an investigation.
				E. Identify a single independent variable in a scientific investigation and explain how this variable can be used to collect information and to answer a question about the results of the experiment.
				F. Select appropriate tools (e.g., thermometers, meter sticks, balances, and graduated cylinders) and make quantitative observations.
				G. Record data by using appropriate graphic representations (including charts, graphs, and labeled diagrams), and make inferences based on those data.
				H. Draw conclusions from scientific evidence and indicate whether further information is needed to support a specific conclusion.
				I. Write a report of an investigation that includes conducting tests, collecting data, or examining evidence, and drawing conclusions.

## II. Physical Science

Elements and their combinations account for all the varied types of matter in the world. As a basis for understanding this concept the students will:

			A. Know that during chemical reactions, the atoms in the reactants rearrange to form products with different properties.
			B. Understand all matter is made of atoms, which may combine to form molecules.
			C. Recognize metals have properties in common, such as high electrical and thermal conductivity.
			D. Know that each element is made of one kind of atom and that the elements are organized on the periodic table by their chemical properties.
			F. Describe the differences in chemical and physical properties of substances that are used to separate mixtures and identify compounds.
			G. Describe the common properties of salts, water, helium, oxygen, nitrogen, and carbon dioxide.
			H. Explain light, sound, and energy waves.
			I. Know living organisms and most materials are composed of just a few elements.

An objects motion is affected by many forces. As a basis for understanding this concept, the student will:

			J. Identify Newton's Laws
			K. Define factors that affect motion, such as lift, drag and thrust.

### III. Life Science

Plants and animals have structures for respiration, digestion, waste disposal, and transport of materials. As a basis for understanding this concept, the student will:

			A. Know that multi cellular organisms have specialized structures to support the transport of materials.
			B. Understand how blood circulates through the heart chambers, lungs, and body, and how carbon dioxide (CO <sub>2</sub> ), and how oxygen (O <sub>2</sub> ), are exchanged in the lungs and tissues.
			C. Explain the sequential steps of digestion.
			D. Describe the role of the excretory systems.
			E. Know how sugar, water, and minerals are transported in a vascular plant.
			F. Know that plants use carbon dioxide (CO <sub>2</sub> ) and energy from sunlight to build molecules of sugar and release oxygen.
			G. Understand plant and animal cells break down sugar to obtain energy, a process resulting in carbon dioxide (CO <sub>2</sub> ) and water (respiration).

### IV. Earth Sciences

Water on earth moves between the oceans and land through the processes of evaporation and condensation. As a basis for understanding this concept the student will:

			A. Describe the water cycle.
			B. Know that the amount for fresh water located in rivers, lakes, underground sources, and glaciers is limited and that its availability can be extended by recycling and decreasing the use of water.
			C. Know the origin of water used by their local communities.

#### IV. Earth Sciences cont.

Energy from the sun heats Earth unevenly, causing air movements that result in changing weather patterns. As a basis for understanding this concept, the student will:

			D. Understand uneven heating of the Earth causes air movements called convection currents.
			E. Describe the influence that the ocean has on the weather and the role that the water cycle plays in weather patterns.
			F. Identify the causes and effects of different types of severe weather.
			G. Know how to use weather maps and data to predict local weather and know that weather forecasts depend on variables.
			H. Understand the earth's atmosphere exerts a pressure that decreases with distance above the Earth's surface and that at any point it exerts this pressure equally in all directions.

The solar system consists of planets and other bodies that orbit the sun in predictable paths. As a basis for understanding this concept, the student will:

			I. Know the sun is composed primarily of hydrogen and helium.
			J. Understand the solar system includes the planets and their satellites, the sun, smaller objects, such as asteroids and comets, and man-made objects such as satellites and the space station.
			K. Recognize the path of a planet around the sun is due to the gravitational attraction between the sun and the planet.

**MIDDLE SCHOOL SCIENCE CURRICULUM  
GRADES 6-8**

**I. Physical Science**

**Investigation and Experimentation**

1. Scientific progress is made by asking meaningful questions and conduction of careful investigations. As a basis for understanding this concept and for addressing the content in the other three strands students should develop their own questions and perform investigations. The student will:

**Columns may be used to record date lesson is taught**

			A. Plan and conduct a scientific investigation to test a hypothesis.
			B. Evaluate the accuracy and reproducibility of data.
			C. Distinguish between a variable and controlled parameters in a test.
			D. Recognize the slope in the linear graph as a constant in the relationship $y = kx$ and apply this principle in interpreting graphs constructed from data.
			E. Construct appropriate graphs from data and develop quantitative statements about the relationships between variables.
			F. Apply simple mathematic relationships to determine a missing quantity in a mathematic expression, given the two remaining terms (including speed = distance/time, density = mass/volume, force = pressure x area, volume = area x height).
			G. Distinguish between linear and nonlinear relationships on a graph of data.

## Motion

2. The theories of motion are based on Newton's Laws. As a basis for understanding this concept the student will:

			A. Know how forces are related to motion and work.
			B. Know how energy and work are related.
			C. Calculate average speed by dividing the total distance traveled by the total time elapsed, and understand that the speed of an object along the path traveled can vary.
			D. Understand the velocity of an object must be described by specifying both the direction and the speed of the object.
			E. Recognize changes in velocity may be due to changes in speed, direction, or both and that this is called acceleration.
			F. Understand why a body moving at constant speed can be accelerating and how falling objects accelerate.
			G. Define terminal velocity.
			H. Know momentum and give examples.
			I. Know the universal law of gravitation
			J. Recognize when a state of equilibrium exists.
			K. Know an object's center of gravity.
			L. Demonstrate Newton's laws of motion. <ul style="list-style-type: none"> <li>□ An object will remain at rest or in uniform motion in a straight line unless acted upon by an external, unbalanced force.</li> <li>□ Force equals mass times acceleration</li> <li>□ For every action there is an equal and opposite reaction.</li> </ul>

## Work

3. Work is the product of a force and the parallel distance through which it acts. As a basis for understanding this concept the student will:

			A. Know the formula for work, (work equals force times distance), and can calculate the amount of work done in a given situation.
			B. Know the formula for power, (power equals work divided by time), and can calculate the rate at which work is done.
			C. Know the energy transferred during work and the relationship between work and heat.

## Simple Machines

4. As a basis for understanding this concept the student will:

			A. Understand the simple and compound machines that one uses every day and explain how they work.
			B. Know simple machines change a force.
			C. Compute the mechanical advantage of various machines.
			D. Know mechanical efficiency.

## Aerodynamics

5. Aerodynamics is the branch of mechanics dealing with forces exerted by air or other gases in motion. As a basis for understanding this concept the student will:

			A. Know drag is a retarding force exerted on moving objects and the shape of an object can effect drag (streamline)
			B. Understand lift.

## Density and Buoyancy

6. All objects experience a buoyant force when immersed in a fluid (Archimede's principle). As a basis for understanding this concept the student will:

			A. Know density is mass per unit volume
			B. Calculate the density of substance (regular and irregular solids and liquids) from measurements of mass and volume.
			C. Understand the buoyant force on an object in a fluid is an upward force equal to the weight of the fluid the object has displaced.
			D. Predict whether an object will float or sink.

### Structure of Matter

7. Each of the more than 100 elements of matter has distinct properties and a distinct atomic structure. All forms of matter are composed of one or more of the elements. As a basis for understanding this concept the student will:

			A. Know the structure of the atom and know it is composed of protons, neutrons, and electrons.
			B. Understand that compounds are formed by combining two or more different elements and that compounds have properties that are different from their constituent's elements.
			C. Know atoms and molecules form solids by building up repeating patterns, such as the crystal structure of NaCl or long chain polymers.
			D. Recognize the difference between a solution of colloids and suspensions.
			E. Know soluble and solubility, the amount of solute that will dissolve in a specified volume of a solvent (at a given temperature and pressure) to produce a saturated substance.

### Formulas

8. Chemistry uses many formulas to understand the chemical nature of matter. As a basis for understanding this concept, the student will:

			A. Know and write the chemical symbols for some common elements
			B. Understand what a formula is and what information it contains.
			C. Write the chemical formulas for compounds when given the name.
			D. Write the names of compounds when given the chemical formula.
			E. Write a balanced equation for a chemical reaction.
			F. Name four general types of chemical reactions and describe an example for each (decomposition, single replacement, double replacement, synthesis)
			G. Know oxidation numbers and how to write them in chemical formulas
			H. Know structural formulas and Lewis dot diagrams for various hydrocarbons.

## Reactions

9. Chemical reactions are processes in which atoms are rearranged into different combinations of molecules. As a basis for understanding this concept, the student will:

			A. Understand reactant atoms and molecules interact to form products with different chemical properties.
			B. Know the idea of atoms explains the conservation of matter: In chemical reactions the number of atoms stays the same no matter how they are arranged, so their total mass stays the same.
			C. Understand chemical reactions usually liberate heat or absorb heat (endothermic or exothermic)
			D. Know physical process include freezing and boiling, in which a material changes form with no chemical reaction.
			E. Determine whether a solution is acidic, basic, or neutral and explain the pH scale and how it is used.

## Periodic Table

10. The organization of the periodic table is based on the properties of the elements and reflects the structure of atoms. As a basis for understanding this concept, the student will:

			A. Identify regions corresponding to metals, nonmetal, and inert gases.
			B. Understand each element has a specific number of protons in the nucleus (the atomic number) and each isotope of the element has a different but specific number of neutrons in the nucleus.
			C. Know substances can be classified by their properties, including their melting temperature, density, hardness, and thermal and electrical conductivity.
			D. Use the periodic table to identify elements in simple compounds.

## II. Life Science

1. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and for addressing the content in the other three strands, students should develop their own questions and perform investigations. The student will:

			A. Select and use appropriate tools and technology (including calculators, computers, balances, spring scales, microscopes, and binoculars) to perform tests collect data and display data.
			B. Use a variety of print and electronic resources (including the World Wide Web) to collect information and evidence as part of a research project.
			C. Communicate the logical connection among hypotheses, science concepts, tests conducted, data collected, and conclusions drawn from the scientific evidence.
			D. Construct scale models, maps, and appropriately labeled diagrams to communicate scientific knowledge (e.g. motion of Earth's plates and cell structure)
			E. Communicate the steps and results from and investigation in written reports and oral presentations.

### Classification

2. Classification is used to efficiently study life on Earth. As a basis for understanding this concept the student will:

			A. Know living organisms are given specific names.
			B. Recognize living organisms are given scientific names.
			C. Know the classification system.

## Cell Biology

3. All living organisms are composed of cells, from just one to many trillions, whose details usually are visible only through a microscope. As a basis for understanding this concept, the student will:

			A. Understand cells function similarly in all living organisms.
			B. Know that characteristics that distinguish plant cells, including chloroplasts and cell walls.
			C. Understand the nucleus is the repository for genetic information in plant and animal cells.
			D. Know that mitochondria liberate energy for the work that cells do and that chloroplasts capture sunlight energy for photosynthesis.
			E. Recognize cells divide to increase their numbers through a process of mitosis, which results in two daughter cells with identical sets of chromosomes.
			F. Understand that as multicellular organisms develop, their cells differentiate.
			G. Know diffusion and osmosis

## Chemistry of Living Systems

4. Principles of Chemistry underlie the functioning of biological systems. As a basis for understanding this concept, the student will:

			A. Recognize that carbon, because of its ability to combine in many ways with itself and other elements, has a central role in the chemistry of living organisms.
			B. Know that living organisms are made of molecules consisting largely of carbon, hydrogen, nitrogen, oxygen, phosphorus, and sulfur.
			C. Understand living organisms have many different kinds of molecules, including small ones, such as water and salt, and very large ones, such as carbohydrates, fats, proteins, and DNA.

## Genetics

5. A typical cell of any organism contains genetic instructions that specify its traits. Those traits may be modified by environmental influences. As a basis for understanding this concept the student will:

			A. Know the differences between the life cycles and reproduction methods of sexual and asexual organisms.
			B. Understand sexual reproduction produces offspring that inherit half their genes from each parent.
			C. Know one or more genes can determine an inherited trait.
			D. Know plant and animal cells contain many thousands of different genes. The two copies (or alleles) of the gene may or may not be identical, and one may be dominant in determining the phenotype, while the other is recessive.
			E. Know DNA (deoxyribonucleic acid) is the genetic material of all living organisms and is located in the chromosome of each cell.
			F. Understand why some traits are sex-linked and give examples.
			G. Know the Punnett square is used in demonstrating why sex-linked traits tend to appear more in males than in females.
			H. Understand Mendel's principles of genetic inheritance.

## Evolution

6. Biological evolution accounts for the diversity of species developed through gradual processes over many generations. As a basis for understanding this concept, the student will:

			A. Understand both genetic variation and environmental factors are causes of evolution and diversity of organisms.
			B. Know the reasoning used by Charles Darwin in reaching his conclusion that natural selection is the mechanism of evolution.
			C. Recognize how independent lines of evidence from geology, fossils, and comparative anatomy provide the basis for the theory of evolution.
			D. Construct a simple branching diagram to classify living groups of organisms by shared and derived characteristics and be able to expand the diagram to include fossil organisms.
			E. Understand extinction occurs when the environment changes and that the adaptive characteristics of a species are insufficient for its survival.

## Structure and Function in Living Systems

7. The anatomy and physiology of plants and animals illustrate the complementary nature of structure and function. As a basis for understanding this concept, the student will:

				A. Know plants and animals have levels of organization for structure and function, including cells, tissues, organs, and organ systems, and the whole organisms.
				B. Describe the basic functioning of all organ systems.
				C. Understand organ systems function because of the contributions of individual organs, tissues, and cells. The failure of any part can affect the entire system.
				D. Know the structures and processes by which flowering plants generate pollen, ovules, seeds, and fruit.
				E. Relate the structures of the eye and ear to their functions.
				F. Understand contraction of the heart generates blood pressure and that heart valves prevent backflow of blood in the circulatory system.

## Ecology

8. Organisms and ecosystems exchange energy and nutrients among themselves and with their environments. As a basis for understanding this concept, the student will:

				A. Understand energy entering ecosystems as producers transfer sunlight into chemical energy through photosynthesis and then from organism to organism through food webs.
				B. Know matter is transferred over time from one organism to others in the food web and between organisms and the physical environment.
				C. Know populations of organisms may be categorized by the functions they serve in the ecosystem.
				D. Understand different kinds of organisms may play similar ecological roles in similar biomes.
				E. Know the number and types of organisms an ecosystem can support depends on the resources available and on abiotic factors, such as quantities of light and water, a range of temperatures, and soil composition.

#### IV. Earth Science

##### Investigation and Experimentation

1. Scientific Progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and for addressing the content in the other three strands, students should develop their own questions and perform investigations. The student will:

			A. Develop a hypothesis
			B. Select and use appropriate tools and technology (including calculators, computers, balances, spring scales, microscopes, and binoculars) to perform tests collect data and display data.
			C. Construct appropriate graphs from data and develop qualitative statements about the relationships between variables.
			D. Communicate the steps and results from an investigation in written reports and oral presentations.
			E. Recognize whether evidence is consistent with a proposed explanation.
			F. Read a topographic map and a geologic map for evidence provided on the maps and construct and interpret a simple scale map.
			G. Interpret events by sequence and time from natural phenomena (e.g. the relative ages of rocks and intrusions)
			H. Identify changes in natural phenomena over time without manipulating the phenomena (e.g. a tree limb, a grove of trees, a stream, a hill slope)

## Plate Tectonics and Earth's Structure

2. Plate tectonics accounts for important features of Earth's surface and major geologic events. As a basis for understanding this concept, the student will:

				<p>A. Know evidence of plate tectonics is derived from the fit of the continents:</p> <ul style="list-style-type: none"> <li>• The location of earthquakes, volcanoes, and midocean ridges;</li> <li>• And the distribution of fossils, rock types, and ancient climatic zones</li> </ul>
				<p>B. Recognize the Earth is composed of several layers:</p> <ul style="list-style-type: none"> <li>• a cold, brittle lithosphere</li> <li>• a hot, convecting mantle;</li> <li>• and a dense, metallic core</li> </ul>
				<p>C. Know lithospheric plates the size of continents and oceans move at rates of centimeters per year in response to movement in the mantle.</p>
				<p>D. Understand earthquakes are sudden motions along breaks in the crust called faults and that volcanoes and fissures are locations where magma reaches the surface</p>
				<p>E. Know major geologic events, such as earthquakes, volcanic eruptions, and mountain building, result from plate motions.</p>
				<p>F. Explain major features of Oklahoma geology (including mountains, faults) in terms of plate tectonics.</p>

### Shaping Earth's Surface

3. Topography is reshaped by the weathering of rock and soil and by the transportation and deposition of sediment. As a basis for understanding this concept, the student will:

				A. Know water running downhill is the dominant process in shaping the landscape
				B. Understand rivers and streams are dynamic systems that erode, <ul style="list-style-type: none"> <li>• transport sediment,</li> <li>• change course,</li> <li>• and flood their banks in natural and recurring patterns.</li> </ul>
				C. Recognize beaches are dynamic systems in which the sand is supplied by rivers and moved along the coast by the action of waves.
				D. Know earthquakes, volcanic eruptions, landslides, and floods change human and wildlife habitats.

### Earth and Life History

4. Evidence from rocks allows us to understand the evolution of life on Earth. As a basis for understanding this concept the student will:

				A. Know Earth processes today are similar to those that occurred in the past and slow geologic processes have large cumulative effects over long periods of time.
				B. Understand the history of life on Earth has been disrupted by major catastrophic events, <ul style="list-style-type: none"> <li>• major volcanic eruptions</li> <li>• impacts of asteroids</li> </ul>
				C. Know that the rock cycle includes the formation of new sediment and rocks and that rocks are often found in layers, with the oldest generally on the bottom.

**Earth and Life History cont.**

			D. Know the evidence from geologic layers and radioactive dating indicates Earth is approximately 4.6 billion years old and that life on this planet has existed for more than 3 billion years.
			E. Explain that fossils provide evidence of how life and environmental conditions have changed.
			F. Demonstrate how movements of Earth's continental and oceanic plates through time, with associated changes in climate and geographic connections, have affected the past and present distribution of organisms.
			G. Explain significant developments and extinctions of plant and animal life on the geologic time scale.

**Weather**

5. Many phenomena on Earth's surface are created by weather. As a basis for understanding this concept, the student will:

			A. Explain how weather is related to the changing form and movement of water
			B Describe several factors that influence the weather. <ul style="list-style-type: none"> <li>• solar energy</li> <li>• atmosphere</li> <li>• movement of the Earth</li> <li>• water</li> </ul>
			C. Understand the causes and effects of several kinds of storms.
			D. Use <ul style="list-style-type: none"> <li>• weather maps</li> <li>• weather terms</li> <li>• cause and effect of weather forecasting</li> </ul>
			E. Know weather changes in geographic regions
			F. Describe the layers of the atmosphere and their components.
			G. Recognize the major cloud formations
			H. Understand the factors that affect air masses, and how air masses affect the weather.

## Energy in the Earth's System

6. Many phenomena on the Earth's surface are affected by the transfer of energy through radiation and convection currents. As a basis for understanding this concept, the student will:

				<p>A. Know the sun is the major source of energy for phenomena on Earth's surface</p> <ul style="list-style-type: none"> <li>• it powers winds,</li> <li>• ocean currents,</li> <li>• the water cycle</li> </ul>
				<p>B. Understand solar energy reaches Earth through radiation, mostly in the form of visible light</p>
				<p>C. Know heat from the Earth's interior reaches the surface primarily through convection</p>
				<p>D. Describe differences in</p> <ul style="list-style-type: none"> <li>• pressure,</li> <li>• heat,</li> <li>• air movement,</li> <li>• and humidity result in changes of weather.</li> </ul>

## Resources

7. Sources of energy and materials differ in amounts, distribution, usefulness, and the time required for their formation. As a basis for understanding this concept, the student will:

				<p>A. Understand the utility of energy sources is determined by factors that are involved in converting these sources to useful forms and the consequences of the conversion process.</p> <ul style="list-style-type: none"> <li>• Wind</li> <li>• Geothermal</li> <li>• solarhydroelectric</li> <li>• fossil fuels</li> <li>• nuclear</li> </ul>								
				<p>b. Classify as renewable and nonrenewable different natural energy and material resources.</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">• air</td> <td>soil</td> </tr> <tr> <td>• rocks</td> <td>minerals</td> </tr> <tr> <td>• petroleum</td> <td>fresh water</td> </tr> <tr> <td>• forests</td> <td>wildlife</td> </tr> </table>	• air	soil	• rocks	minerals	• petroleum	fresh water	• forests	wildlife
• air	soil											
• rocks	minerals											
• petroleum	fresh water											
• forests	wildlife											

## Earth in the Solar System

8. The structure and composition of the universe can be learned from studying stars and galaxies and their evolution. As a basis for understanding this concept, the student will:

				A. Know galaxies are clusters of billions of stars and may have different shapes
				B. Understand the Sun is one of many stars in the Milky Way galaxy and that stars may differ in size, temperature, and color.
				C. Use astronomical units and light years as measures of distances between the Sun, stars, and Earth
				D. Know that stars are the source of light for all bright objects in outer space and that the Moon and planets shine by reflected sunlight, not by their own light
				E. Students know the appearance <ul style="list-style-type: none"> <li>• general composition</li> <li>• relative position and size</li> <li>• motion of objects in the solar system <ul style="list-style-type: none"> <li>planets</li> <li>planetary satellites</li> <li>comets</li> <li>asteroids</li> </ul> </li> </ul>