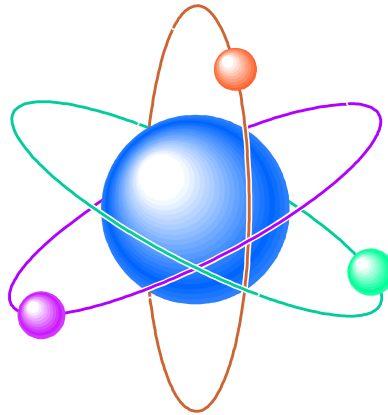


# CURRICULUM GUIDELINES

## SCIENCE

(Revised August, 2001)



*Diocese of Covington  
Department of Catholic Education*

## LETTER FROM LARRY

## INTRODUCTION

*The terms and circumstances of human existence can be expected to change radically during the next human life span. Science, mathematics and technology will be at the center of this change – causing it, shaping it, responding to it. Therefore, they will be essential to the education of today’s students for tomorrow’s world.*

## DIOCESAN PHILOSOPHY

Science instruction within the Catholic school should be permeated with the vision of faith that encourages students to appreciate, with wonder and joy, the world and the universe, and enjoy their environment. A purpose of scientific study is to come to value our world and develop a sense of respect for that world entrusted to us, God’s earthly stewards. This view identifies individuals as participants in this ongoing creation, personally responsible for the well-being of self, others and the environment. Students then are charged with the task of cooperating with others and with God in bringing all things to unity and perfection in Christ.

The education of the student in the natural sciences takes into consideration individual needs and capabilities as well as provision for the development of scientific knowledge and skill. The development of Christian values and attitudes assures continued growth in the student’s knowledge and appreciation of the complexity of God’s creation.

## **DIRECTIONS FOR THE DIOCESAN SCIENCE PROGRAM**

The Science Program for the Diocese of Covington will:

- begin in preschool, continue throughout formal education and include a range of related electives at the secondary level
- depend on innovative teachers, broadly prepared in science, mathematics and technology
- expect high standards of performance in an atmosphere that promotes learning
- involve students in scientific inquiry
- demonstrate the interrelation of science, mathematics, technology, and the arts
- emphasize the physically experiential and developmental approach that may require an increase in time, personnel and materials, both in the school setting and in the local community
- assess student progress through a variety of methods
- provide a foundation which will enable students to become life-long learners
- provide opportunities for acquiring skills and concepts that apply beyond the classroom
- prepare students to integrate scientific principles into decision-making
- reflect the intellectual and historical development that has led to contemporary science
- enable students to understand and discuss ethical issues relating to science

## **BELIEFS ABOUT LEARNERS AND LEARNING EXPECTATIONS**

### **BELIEFS:**

- All students have an innate curiosity about their world.
- All students can learn.
- Students have different learning styles.
- All students learn primarily through experience, observation and association.
- Students can realize their God-given potential.
- Students thrive in a positive learning environment.
- Students assimilate that which is relevant and experienced.
- Students learn to “do science” with guidance of an adult and in cooperation with peers.

### **LEARNING EXPECTATIONS**

All students, regardless of gender, cultural or ethnic background, physical or learning disabilities, aspirations or interest and motivation in science, will:

- develop an appreciation and respect for creation
- be led to cultivate a love for science
- learn the nature of science
- value the history of science
- become skilled in problem-solving methods
- develop higher-order thinking skills
- appreciate the values of teamwork
- relate science to personal/social perspectives
- see the importance of technology in daily living
- understand and experience technology’s use in aiding scientific discovery
- develop a respect for resources, both local and global
- develop research skills
- learn laboratory skills and safety guidelines

## **SCIENCE LEARNING OBJECTIVES – 8 CATEGORIES**

- Science as Inquiry
- Physical Science
- Life Science
- Earth and Space Science
- Science and Technology
- Science and Social Perspectives
- History and Nature of Science
- Unifying Concepts and Processes

### **SCIENCE AS INQUIRY**

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Inquiry is a step beyond “science as a process”, in which students learn skills, such as observing, inferring and experimenting. Engaging students in inquiry serves five essential functions:

It assists in the development of understanding of scientific concepts.

It helps students “know how we know” in science.

It develops an understanding of the nature of science.

It develops the skills necessary to become independent inquirers about the natural world.

It develops the dispositions to use the skills, abilities, and habits of mind associated with science.

Science as inquiry is a basic and controlling principle in the ultimate organization of and activities in students’ science education. The ideas presented under “Inquiry” highlight the ability to conduct inquiry and develop understandings about scientific inquiry. Students in every domain of science should have the opportunity to sue scientific inquiry and develop the ability to think and act in ways associated with the processes of inquiry, including asking questions, planning and conducting an investigation, using appropriate tools and techniques, thinking critically and logically about the relationships between evidence and explanations, constructing and analyzing alternative explanations, and communicating scientific arguments.

### **PHYSICAL SCIENCE, LIFE SCIENCE, AND EARTH AND SPACE SCIENCE**

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The objectives for physical science, life science and Earth and space science describe the content of three widely accepted divisions of scientific disciplines. Science subject matter focuses on the fundamental knowledge, and on science concepts, principles, theories and models that are important for all students to know, understand and use.

## **SCIENCE AND TECHNOLOGY**

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The Science and technology objectives establish useful connections between the natural and the designed worlds, and provide students with opportunities to develop decision-making abilities. They are not standards for technology education. These objectives emphasize abilities associated with the process of design and fundamental understanding about the enterprise of science and its various linkages with technology.

## **SCIENCE AND SOCIAL PERSPECTIVES**

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An important purpose of science education is to give students a means to understand and act on personal and social issues. The science and social perspectives objectives will help the students develop the perspectives will help the students develop the decision-making skills to accomplish that.

## **HISTORY AND NATURE OF SCIENCE**

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In learning science it is essential to understand that science reflects its history and is an ongoing, changing enterprise. The history and nature of science category recommend the use of history in school science programs to clarify different aspects of scientific inquiry, the human aspects of science, and the role science has played in the development of various cultures.

## **UNIFYING CONCEPTS**

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This group of objectives describes the integrative schemes that will bring together students' many experiences in science education. These can be the focus of instruction but should be linked to the other concept standards and objectives. In the early grades, instruction should establish the meaning and use of unifying concepts and processes. At the upper grades, this category should facilitate and enhance the learning of scientific ideas and principles by providing students with a "big picture" of scientific ideas.

***TAKEN FROM:***

Science Content Standards  
The National Science Standards

# **KINDERGARTEN - LEARNING OBJECTIVES**

## **SCIENCE AS INQUIRY**

The Learner Will:

- observe and describe objects by size, shape, color and texture
- understand the basics of investigating and questioning to solve simple problems
- discuss findings in large groups
- begin recording class findings on simple charts
- begin to use non-standard units of measurement to compare lengths and heights of objects

## **PHYSICAL SCIENCE**

The Learner Will:

- observe states of matter: water, ice, etc.
- describe objects by size, weight, shape, color, texture, temperature, manufactured or natural
- compare objects by using a simple balance
- classify objects based on materials – plastic, wood, metal and glass
- understand positional terms: above, beside, under, etc.
- observe magnets attract and repel certain kinds of metals
- discriminate between hot and cold substances

## **LIFE SCIENCE**

The Learner Will:

- observe that plants and animals have basic needs: air, water, food
- name plant parts: root, stem, leaf, flower
- describe that animals have different body coverings: fur/hair, rough/scales, smooth, feathers
- discuss that people have and use five basic senses to learn about the environment
- observe plants and animals' life cycles
- observe that some animals do not change much from birth to adult. Others change completely (frog, butterfly)
- discuss that animals live in different habitats – water, land, desert, etc.

## **EARTH AND SPACE SCIENCE**

The Learner Will:

- discover that the Earth is made up of land and water
- discover that fossils provide evidence of past lives
- discuss dinosaur life
- observe that the sun provides heat and light
- observe that the Moon, Stars, Clouds are also in the sky and follow a pattern to determine day/night
- observe and chart daily weather changes
- show seasonal changes and how they effect us

## **SCIENCE AND TECHNOLOGY**

The Learner Will:

- begin to understand how science and technology are related

## **SCIENCE AND SOCIAL PERSPECTIVES**

The Learner Will:

- learn and use safety rules for home, school and public places
- practice personal care habits – dental health, washing, grooming, cover mouth when sneeze, etc.
- recognize the importance of eating good foods for good health
- study the importance of recycling to save resources
- recognize personal responsibility in caring for environment – air, water, soil ... not littering, etc.
- discuss how people are alike and different

## **HISTORY AND NATURE OF SCIENCE**

The Learner Will:

- discuss that people choose different areas of science as a career

## **UNIFYING CONCEPTS**

The Learner Will:

- identify simple patterns: make representations, and extend patterns
- begin to recognize simple – cause effect relationships
- make simple predictions
- recognize that a globe is a model of earth
- recognize maps are models of land area
- use simple charts to graph changes over time
- observe changes in plant growth, ice melting, seasonal changes
- sequence simple events
- assemble, describe, take apart, and reassemble constructions using interlocking blocks, Legos, etc

## **GRADE 1 - LEARNING OBJECTIVES**

### **SCIENCE AS INQUIRY**

The Learner Will:

- observe, describe, and classify objects and events in their environment
- use standard measuring instruments (rulers, magnifiers, balances, and thermometers) to gather information and measure objects
- begin recording individual findings on simple charts

### **PHYSICAL SCIENCE**

The Learner Will:

- group objects (solid, liquid, gas) by observation and comparison
- observe and describe changes due to temperature and time
- identify simple machines
- differentiate between sounds of objects
- observe light reflection
- demonstrate that magnets attract/repel each other and certain metals
- group and classify objects that are magnetic

### **LIFE SCIENCE**

The Learner Will:

- show what plants and animals need for growth
- classify living and non-living organisms
- investigate the life cycles of plants and animals
- describe the five senses and the body parts associated with them
- discuss how humans and other organisms mature physically, mentally and socially

### **EARTH AND SPACE SCIENCE**

The Learner Will:

- distinguish between landform, air and water
- observe and classify rocks according to size, shape, color and texture
- observe the seasons and characteristics of each
- observe weather; relating it to air, wind and temperature and moisture
- be introduced to conservation and how to keep the earth safe and clean
- observe and read about sun, moon and stars

### **SCIENCE AND TECHNOLOGY**

The Learner Will:

- begin to use technology to investigate science

## **SCIENCE AND SOCIAL PERSPECTIVES**

The Learner Will:

- read and participate in programs that include dental health, fire and personal safety and drug prevention
- know the basic food groups and tell why the body needs them
- students will read about and observe the effects of pollution and conservation

## **HISTORY AND NATURE OF SCIENCE**

The Learner Will:

- read and be read stories and books about scientists and scientific discoveries
- compare life with and without scientific discoveries
- make predictions about future and scientific discoveries

## **UNIFYING CONCEPTS**

In addition to concepts learned at previous grades, the Learner Will:

- write factual and inventive stories about topics studied (e.g., a flower is living because)
- read and explain a simple classroom chart or graph
- begin to work in small groups solving simple problems

## **GRADE 2 – LEARNING OBJECTIVES**

### **SCIENCE AS INQUIRY**

The Learner Will:

- be able to draw pictures that show at least some of the attributes (size, shape, color, texture, etc.) of the thing being described
- be able to use simple equipment (hand lenses, rulers, scissors, clamps, hammers, screwdrivers)
- begin to qualify data by measuring the length in whole units of objects having straight edges
- begin to collect, organize, record, and discuss data as a small group

### **PHYSICAL SCIENCE**

The Learner Will:

- describe objects orally and written by their composition and their physical properties (color, size, weight, texture, flexibility, etc.)
- demonstrate that things move in different ways such as straight, zig-zag, round and round, back and forth
- show that an object is moved by a push or pull
- demonstrate how sounds are made
- show how light can be divided into a spectrum
- be introduced to the basics of electrical currents and observe that circuits require a complete loop
- test the strength of magnetic force
- observe that heat or cold can change basic matter, such as water, from one state to another

### **LIFE SCIENCE**

The Learner Will:

- show by drawing and writing that organisms have basic needs
- explain that organisms can only survive in environments which meet their needs
- sequence animal and plant life cycles
- be introduced to habitat and how the environment affects homes for people and animals
- discuss and demonstrate knowledge of the importance of saving endangered plants/animals
- discuss that humans and other organisms have senses that help them learn
- be introduced to the food chain

## **EARTH AND SPACE SCIENCE**

The Learner Will:

- compare and contrast natural objects and those manufactured
- begin to show awareness of soil and its uses
- discuss differences between salt water and fresh water and some organisms that live in each
- demonstrate knowledge of rocks (rock layers, classifying rocks, and fossils)
- observe climate and show how properties of air effect weather
- understand the relationship between light and shadows
- understand the movement of the Earth and planets

## **SCIENCE AND TECHNOLOGY**

The Learner Will:

- understand how inventions and tools were created to help solve problems
- continue to use various technology to investigate science

## **SCIENCE AND SOCIAL PERSPECTIVES**

The Learner Will:

- demonstrate knowledge of safety rules for home and school
- show by writing, drawing how health food, exercise and rest are important to people
- understand the importance of personal hygiene
- show awareness that people are born into some groups and choose to join others
- discuss how change in environment can be good, bad, or neutral

## **HISTORY AND NATURE OF SCIENCE**

The Learner Will:

- examine contributions of science in areas of career opportunities
- explore scientists and the careers of scientists

## **UNIFYING CONCEPTS**

In addition to concepts learned at previous grades, the Learner Will:

- make something out of paper, cardboard, wood, plastic, metal or existing objects that can actually be used to perform a task
- develop ability to interpret line, bar, and pictographs
- work in small groups to develop skills necessary to investigate a problem, propose a solution, and evaluate the solution and its effect on the original problem

## **GRADE 3 – LEARNING OBJECTIVES**

### **SCIENCE AS INQUIRY**

The Learner Will:

- Begin to inquire about objects, organisms, and events in the environment
- continue to use numerical data in describing and comparing objects and events
- be able to write simple instructions that others can follow in carrying out a procedure
- use sketches to aid in explaining procedures or ideas
- continue collecting, organizing, recording, and discussing data in small groups
- learn that scientists ask questions about the results of other scientists' work

### **PHYSICAL SCIENCE**

The Learner Will:

- understand how natural and manufactured objects are used to solve problems
- demonstrate states of matter and write observations
- observe and create simple models that demonstrate change in state of matter
- demonstrate speed and direction of motion caused by forces
- create and demonstrate simple machines
- understand that position/motion is changed by pull/push and degree of change is directly proportional to strength of push/pull
- demonstrate that the rate of vibration determines pitch

### **LIFE SCIENCE**

The Learner Will:

- draw and write about different environments
- show that distinct environments support the life of different types of organisms
- discuss how plants and animals have different structures which serve different functions in growth, survival and reproduction
- discuss how many characteristics of an organism are inherited from the parent
- show how the environment of an organism influences development
- discuss the roles of organisms in the various habitats: (producers, consumers, scavengers, decomposers)
- show the importance of conservation of habitats
- discuss how people affect the environment both beneficially and negatively
- be introduced to body systems.

### **EARTH AND SPACE SCIENCE**

The Learner Will:

- demonstrate knowledge of surface changes on Earth: (erosion, weathering, volcanoes, glaciers)
- demonstrate why it is important to conserve and protect natural resources
- understand that coal, oil, and gas are used for energy
- understand earth's history through investigation of dinosaurs
- demonstrate measurement of temperature, humidity, precipitation and air pressure
- discuss weather prediction as a science
- demonstrate knowledge that the sun and the planets make up the solar system
- understand that an eclipse takes place when the earth or moon passes into the other's shadow
- understand and explain the water cycle

## **SCIENCE AND TECHNOLOGY**

The Learner Will:

- Study how science and technology have improved transportation, health, sanitation, and communication in areas of the world
- discuss the value of an invention
- begin to use technology independently to investigate and solve problems

## **SCIENCE AND SOCIAL PERSPECTIVES**

The Learner Will:

- Demonstrate by picture, writing, and oral presentation, the importance of balanced diet; drugs/poisons; care of body
- Examine the relationship between natural resources and populations
- Participate in recycling efforts with understanding

## **HISTORY AND NATURE OF SCIENCE**

The Learner Will:

- Further gain awareness of science and career possibilities
- Demonstrate by presentation either written or oral the contributions of scientists past and present

## **UNIFYING CONCEPTS**

In addition to concepts learned at previous grades, the Learner Will:

- further develop ability to make models to demonstrate a concept being studied
- keep a notebook detailing observations and discoveries
- use appropriate terms in writing and discussing area of study
- measure and mix dry ingredients, and liquid materials in designated amounts using reasonable safety
- use graphs to record data
- demonstrate cooperative group problem solving techniques when given a simple problem (comparing two different types of string)

## Grade 4 – LEARNING OBJECTIVES

### SCIENCE AS INQUIRY

The Learner Will:

- Inquire about objects, organisms, and events in the environment
- Plan and conduct investigations using scientific processes, concepts and vocabulary
- Use more complex equipment and tools to gather data and extend the senses
- Use data to present a reasonable explanation
- Communicate investigations and explanations via the written and/or spoken word
- Understand that scientific investigations involve the comparison of their answers with what scientists already know about the world

### PHYSICAL SCIENCE

The Learner Will:

- Note observable properties of matter
- Discover that objects are made up of one or more materials and can be described by the properties of those materials
- Demonstrate that heat or cold can change matter from one state to another
- Describe object's motion by noting its position over time
- Observe that light travels in a straight line, can be reflected, refracted and absorbed
- Produce heat by burning, rubbing, mixing
- Show that heat can move from object to object – conduction
- Demonstrate that electricity in currents can produce light, heat, sounds and magnetic effects

### LIFE SCIENCE

The Learner Will:

- Observe that a variety of organisms' behaviors are influenced by internal cues, (hunger), external cues, (environment change)
- Expand their knowledge of life cycles of plants and animals
- Develop terminology for use in discussing heredity: distinguish between inherited characteristics and those influenced by environment
- Demonstrate the different food chains (all animals depend on plants)
- Introduce vertebrate classification
- Introduce ecosystems and build one model of an ecosystem
- Discuss major ways environment affects organisms' patterns of behavior: kinds and numbers of other organisms present; availability of food and resources
- Show that all organisms including humans cause detrimental or beneficial changes in their living environment
- Observe and discuss that humans depend on both their natural and constructed environment
- Identify respiratory, muscular, and skeletal systems of the human body and state their functions

## **EARTH AND SPACE SCIENCE**

The Learner Will:

- Demonstrate the use of natural resources: building materials, fuel sources, growing plants for food
- Describe the effects of changing in Earth's surface: erosion, volcanoes, earthquakes
- Develop scientific understanding of fossils as evidence of early plants, animals and environment, and how conditions have changed over time
- Describe properties, locations, and patterns of movement and change of objects in the sky (Sun, moon, planets, etc.)
- Observe, record and predict patterns of weather
- Understand earth's materials are solids, water, and gases
- Know the properties and uses of minerals and rocks
- Understand the destructive forces of erosion
- Diagram and explain the rock cycle
- Differentiate layers of soil; rock and decomposed materials

## **SCIENCE AND TECHNOLOGY**

The Learner Will:

- Discover that scientists and engineers use a variety of technologies to solve problems
- Demonstrate the ability to use a variety of technology for scientific investigations and presentations

## **SCIENCE AND SOCIAL PERSPECTIVES**

The Learner Will:

- Explain that safety and security are basic human needs
- Practice responsibility for various aspects of their own health: avoid communicable diseases
- Examine further the relationship between health and nutrition
- Recognize that different substances: alcohol, tobacco and drugs can be harmful
- Develop an appreciation and awareness of non-material resources: quiet places, beauty, security, safety
- Appreciate how environmental changes affect survival and quality of life
- Explain that environmental change can be natural or influenced by humans; (good, neutral or bad)
- Demonstrate awareness of the +/- effects of science and technological advances on society
- Recognize that Science and Technology are not available, to the same extent, to all people

## **HISTORY AND NATURE OF SCIENCE**

The Learner Will:

- Read and study about women and men who engaged in science and technology
- Recognize that science and technology has steadily increased in complexity
- Read and study literature on people who have made scientific contributions throughout history
- Recognize although much about nature has been learned, there is much more to be discovered
- Recognize careers in science continue to attract people
- Discuss that people have analyzed problems and their solutions in an effort to avoid new problems
- Read and study various careers in science

## **UNIFYING CONCEPTS**

In addition to concepts learned at previous grades, the Learner Will:

- Identify a simple problem, describe it and propose a possible solution
- Increase ability to use evidence, observations and data, on which to base scientific explanations
- Recognize that although most things change, there are some properties of objects and processes which do not change

# **GRADE 5 – LEARNING OBJECTIVES**

## **SCIENCE AS INQUIRY**

The Learner Will:

- Develop the ability of scientific inquiry
- Design an investigation
- Recognize the relationship between explanation and evidence
- Produce an oral and written report that represents the results of inquiry
- Organize and communicate data with graphs and written reports
- Produce accurate measurements using various tools
- Develop descriptions, explorations, predictions and models
- Review and analyze scientific investigations

## **PHYSICAL SCIENCE**

The Learner Will:

- Identify characteristics of substances: ex. Density, boiling point, compounds, and mixtures
- See that energy exists in many forms including heat, light, chemical, nuclear, mechanical and electrical
- Describe and demonstrate the motion of an object by its position, direction of motion and speed
- Learn that the motion of an object can be described by its position, directions of motion and speed
- Understand the Laws of Motion including forces and friction
- Introduce the structure of atoms
- Introduce the Periodic Table
- Compare and evaluate simple and compound machines
- Explain the difference between circuits
- Compare how conductors and insulators affect electric current

## **LIFE SCIENCE**

The Learner Will:

- Increase awareness of the diversity of life through direct observation and use of various media
- Appreciate the interdependence of organisms and their environment
- Identify factors whereby human beings can effect the quality of life (pollution, conservation, recycling)
- Differentiate between learned and inherited characteristics and role of genes in inheritance
- Compare and contrast the different ecosystems
- Identify eye and ear of the human body and tell their functions
- Understand basic human reproduction
- Introduce invertebrate classification

## **EARTH AND SPACE SCIENCE**

The Learner Will:

- Understand the earth's geologic changes over time
- Understand and model the relationship of the earth to the entire solar system
- Explain the motions of the solar system as they relate to days, years, lunar phases
- Understand the sun as the major source of energy that contributes to plant growth, wind, ocean currents, water cycle and seasons
- Recognize gravity causes the motion of the solar system

## **SCIENCE AND TECHNOLOGY**

The Learner Will:

- Develop abilities of technical design
- Develop an understanding of science and technology
- Continue to demonstrate the ability to use a more advanced variety of technology for scientific investigation and presentations

## **SCIENCE AND SOCIAL PERSPECTIVE**

The Learner Will:

- Recognize need for regular exercise
- Understand the risks of tobacco use and possible long-term detrimental effects of smoking and chewing tobacco
- Understand the risks of drug and alcohol use and that use can lead to addiction
- Become aware of environmental substances that are harmful to human beings
- Understand the risks of natural hazards; floods, fires, tornadoes, etc.
- Know that technology influences society through its products and processes
- Appreciate that the cultural backgrounds and beliefs of different groups can affect the criteria for a suitable product
- Understand that people of many different cultures have made, and continue to make, contributions to science and technology
- Realize that a person's gender, race or national origin should not influence the acceptance or rejection of the contribution to science or technology
- Demonstrate respect for life

## **HISTORY AND NATURE OF SCIENCE**

The Learner Will:

- Study the contributions of various cultures and individuals to the development of modern scientific thought

## **UNIFYING CONCEPTS**

In addition to concepts learned at previous grades, the Learner Will:

- Develop an understanding of order and organization
- Develop the ability to provide evidence, models and explanations
- Identify some examples of constancy, change and balance across the science curriculum
- Give examples of form and function in the natural world

## **GRADE 6 - LEARNING OBJECTIVES**

### **SCIENCE AS INQUIRY**

The Learner Will:

- identify and refine questions that can be answered through scientific investigations combined with scientific information.
- use appropriate equipment (e.g., binoculars), tools (e.g., beakers), techniques (e.g. ordering), technology (e.g., calculators), and mathematics in scientific investigations.
- use evidence (e.g., orderings, organizations), logic, and scientific knowledge to develop scientific explanations.
- design and conduct different kinds of scientific investigations to answer different kinds of questions.
- communicate (e.g., speak, write) designs, procedures, and results of scientific investigations.
- review and analyze scientific investigations and explanations of other students.

### **PHYSICAL SCIENCE**

The Learner Will:

- investigate structure and function of the atom
- examine and classify elements of the periodic table
- differentiate the characteristic properties between elements, compounds, mixtures and solutions
- show how energy is released in a chemical reaction in the forms of heat, light, electrical and mechanical energy
- investigate natural resources as sources of energy

### **LIFE SCIENCE**

The Learner Will:

- increase awareness of biodiversity through direct observation and use of various media and technology
- identify factors whereby human beings can effect the quality of life (pollution, conservation, recycling)
- investigate how plants and animals obtain and use resources, grow, reproduce, and maintain stable internal conditions. Examine the regulation of an organism's internal environment.
- analyze internal or environmental stimuli and organisms' behavioral responses. Explore how organisms' behavior changes through adaptation.
- Compare and contrast populations in an ecosystem and determine existing interrelationships and functions
- investigate energy flow in ecosystems( decomposers, producers, consumers)
- investigate factors (e.g., resources, light, water) that affect the number of organisms an ecosystem can support.
- examine the circulatory and digestive systems of the human body
- Compare and contrast invertebrates and vertebrates

## **EARTH AND SPACE SCIENCE**

The Learner Will:

- model the basic structure of the earth (eg., crust, mantle, core)
- demonstrate the movement of plates, causing earthquakes, volcanoes, etc.
- understand the earth's processes are similar to those of the past (eg., Geologic time)
- recognize the destructive forces of ocean pollution on the marine ecosystem
- understand the effects of the ocean on weather and climate
- identify resources from the ocean
- know the contents and property of ocean water
- explain the sun as the major source of energy that contributes to plant growth, wind, ocean currents, water cycle and seasons
- identify components of the atmosphere and related weather patterns and climates
- model the solar system (e.g., structure, number of planets) and its components (e.g., planets, moons, asteroids).
- model motion (e.g., orbits) of astronomical objects (e.g., planets, constellations, galaxies) to explain phenomena such as days, years, and eclipses.
- recognize that gravitational forces cause motion in the solar system.

# **GRADE 7 - LEARNING OBJECTIVES**

## **SCIENCE AS INQUIRY**

The Learner Will:

- identify and refine questions that can be answered through scientific investigations combined with scientific information.
- use appropriate equipment (e.g., spring scales), tools (e.g., microscopes), techniques (e.g., measuring), technology (e.g., computers), and mathematics in scientific investigations.
- use evidence (e.g., measurements), logic, and scientific knowledge to develop scientific explanations.
- design and conduct different kinds of scientific investigations to answer different kinds of questions.
- communicate (e.g., write) designs, procedures, and results of scientific investigations.
- review and analyze scientific investigations and explanations of other students.

## **PHYSICAL SCIENCE**

Properties and Changes in Matter

The Learner Will:

- investigate characteristic properties (e.g., density) of substances using the periodic table.
- examine chemical reactions between substances, recognize that the total mass remains the same, and that substances are categorized by how they react.
- recognize that elements do not break down during normal laboratory reactions and how elements combine to produce compounds.

## **LIFE SCIENCE**

Diversity and Adaptations of Organisms

The Learner Will:

- investigate unity among organisms.
- investigate biological adaptation and extinction (eg., evolution, natural selection and Darwin).
- demonstrate an understanding of classification systems of living organisms
- use taxonomy keys to identify various organisms
- identify various microorganisms – virus, bacteria, monerans, protists and explain their function in an ecosystem

## Cell Structure and Function

The Learner Will:

- identify basic cell structures and explain their processes
- observe and explain cell processes; mitosis, meiosis, photosynthesis, respiration

## Human Body

The Learner Will:

- determine specific threats to the immune system
- investigate structure (e.g., cells, tissues, organs) and function (e.g., growth, muscular function, digestion) of body systems

## **EARTH AND SPACE SCIENCE**

### Structure of the Earth System

The Learner Will:

- model Earth's layers.
- demonstrate the rock cycle (e.g., weathered rocks produce soil, weathered rocks are often recrystallized into new rock) and examine characteristics of soils.

### Earth's History

The Learner Will:

- examine Earth's processes (e.g., erosion, deposition) and catastrophes (e.g., asteroid impact).
- examine evidence (e.g., fossils) for changes in life and environmental conditions.

## **GRADE 8 - LEARNING OBJECTIVES**

### **SCIENCE AS INQUIRY**

The Learner Will:

- identify and refine questions that can be answered through scientific investigations combined with scientific information.
- use appropriate equipment (e.g., barometers), tools (e.g., meter sticks), techniques (e.g., computer skills), technology (e.g., computers), and mathematics in scientific investigations.
- use evidence (e.g., computer models), logic, and scientific knowledge to develop scientific explanations.
- design and conduct different kinds of scientific investigations to answer different kinds of questions.
- communicate (e.g., write, graph) designs, procedures, and results of scientific investigations.
- review and analyze scientific investigations and explanations of other students.

### **PHYSICAL SCIENCE**

The Learner Will:

- analyze properties (e.g., boiling point, solubility) and changes of properties in matter.
- measure and represent (e.g., graph) forces on objects and motions (e.g., constant speed, changing speed) of objects
- investigate transfer of energy (e.g., heat, light, electricity, mechanical motion, sound).

### **LIFE SCIENCE**

The Learner Will:

- analyze reproduction (e.g., asexual, sexual) and heredity (e.g., genetic information, inherited traits).
- analyze regulation (changing physiological activities) and behavior (a set of responses).
- investigate and analyze populations and ecosystems.
- analyze diversity and adaptations (e.g., changes in structure, behaviors, or physiology).

### **EARTH AND SPACE SCIENCE**

The Learner Will:

- investigate the interrelationships between the structures of the Earth system (e.g., lithosphere, rock cycle, water cycle, weather, climate).
- analyze Earth's history (e.g., Earth processes, catastrophes, evidence for changes).

## **Grades 6-7-8**

### **SCIENCE AND TECHNOLOGY**

The Learner Will:

- examine the interaction between science and technology.
- use technology to recognize how science is used to understand changes in populations, issues related to resources, and changes in environment
- describe the effects of science and technology (e.g., television, computers) on society
- use scientific inquiry and conceptual understandings to design technological solutions (e.g., zippers, ballpoint pens) to problems
- examine the role of science and technology to explain and predict natural events (e.g., floods, earthquakes, volcanoes).
- recognize that science is a process that generates conceptual understandings and solves problems.

### **SCIENCE AND SOCIAL PERSPECTIVES**

The Learner Will:

- demonstrate respect for life
- recognize need for regular exercise
- understand the risks of tobacco use, the influence of short-term social and psychological factors and possible long-term detrimental effects of smoking and chewing tobacco
- appreciate the interdependence of organisms and their environment
- understand the individual and societal risks of drug and alcohol use and
- identify and become aware of environmental substances that are harmful to human beings
- understand the effects of natural hazards; floods, fires, tornadoes, etc. on society
- know that technology influences society through its products and processes
- scientists have ethical codes for prior knowledge and consent by participants in research projects
- understand the difference between scientific and other questions and what science and technology can reasonably contribute to society – for example, new technologies decrease some risks and increase others
- realize the cumulative ecological and economic effects of pollution
- identify factors whereby human beings can effect the quality of life (pollution, conservation, recycling)

## **HISTORY AND NATURE OF SCIENCE**

The Learner Will:

- continue to study the contributions of various cultures to the development of modern scientific thought
- continue to investigate the contributions of individuals who have contributed to scientific discovery and knowledge
- explore the importance of scientific discoveries in world history (e.g., new drugs, weapons, transportation).
- become aware of the role of science and engineering in modern society and possible career choices that may be open to them

## **UNIFYING CONCEPTS**

In addition to concepts learned at previous grades, the Learner Will:

- develop an understanding of order and organization
- develop the ability to provide evidence, models and explanations
- continue to identify and give examples of constancy and change across the science curriculum
- state some evidence of evolution and equilibrium
- give and analyze examples of form and function in the natural world

# HIGH SCHOOL

## SCIENCE AS INQUIRY

The Learner Will:

- determine whether a statement is “scientific”
- observe a physical system and formulate a hypothesis about its behavior
- design and carry out experiments to test hypothesis, identifying controlled and experimental variables
- carry out appropriate analysis of experimental results
- critically evaluate conclusions drawn from scientific data
- be able to do background research and design an inquiry about a physical system
- articulate explanations of the behavior of physical systems
- design experiments to test the explanations or test alternative explanations
- select appropriate instrumentation/technology to carry out an investigation and analyze the results
- communicate results of investigations
- formulate questions that can be investigated

## PHYSICAL SCIENCE

The Learner Will:

- a majority of terminology used in any area
- find evidence of the topic in daily life
- do lab work appropriate to topic and use appropriate equipment to carry out laboratory investigations
- be able to write out, as if to teach, one concept in each area
- understand and be able to create and interpret a variety of graphs, spreadsheets, etc.
- apply mathematics to express interpret and analyze the behavior of physical systems
- explain macroscopic properties of matter and physical/chemical phenomena in terms of the atomic model
- articulate the role of energy in physical, chemical and biochemical systems
- be familiar with the fundamental forces and how these determine the state of motion of material objects

## LIFE SCIENCE

The Learner Will:

- identify a variety of life forms—both micro- and macroscopic
- describe some interactions of living with non-living
- describe the balance of nature
- describe the part that chemical and energy changes have in the life processes
- describe some of the techniques used to acquire biology knowledge
- use inquiry in biological investigations
- be knowledgeable about important themes in modern biology: the molecular basis of life and heredity; theories of natural selection and evolution; behavioral biology; ecology and the systems approach to life

## EARTH AND SPACE SCIENCE

The Learner Will:

- work with the fossil record
- use the concept of stratification
- demonstrate an understanding of gravity and “zero” gravity
- demonstrate an understanding of atmosphere and “zero” atmosphere
- understand physical and chemical processes as they apply to the earth system and to cosmology
- understand the physical and chemical methods by which we come to ‘knowledge’ of the history of the earth, the solar system, and the universe
- know the current thinking on the origin of the earth system and of the universe

## **SCIENCE AND TECHNOLOGY**

The Learner Will:

- recognize the differences between science and technology
- recognize the dependence of each on the other
- search the popular literature for evidence of each
- be aware of the goals and limitations of each and the political processes that are at the root of control
- be able to address both positive and negative aspects of technology
- carry out representative design tasks such as are at the heart of applied technology
- understand the basics of risk/benefit analysis

## **SCIENCE AND SOCIAL PERSPECTIVES**

The Learner Will:

- find evidence of the topic in daily life
- discuss some of the ethical issues related to biology and medicine, articulate some of the arguments for both sides and be able to come to a moral Christian stance
- articulate relations of competition for natural resources as well as interdependence between various populations of organisms
- understand cyclical and feedback processes in living systems
- understand potential hazards and positive life choices relating to personal and community health

## **HISTORY AND NATURE OF SCIENCE**

The Learner Will:

- recognize that science is the result of the work of human beings
- be aware of and describe briefly the science timeline with emphasis on periods of greater achievement and change in directions
- recognize the differences between science and technology
- understand how scientists learn from and interact with one another, and build on the ideas of others
- understand that scientific ideas are subject to experimental confirmation and falsification, and that scientific statements are revisable
- be able to describe the process by which 'revolutions' in scientific understanding have come about

## **UNIFYING CONCEPTS**

The Learner Will:

- describe the nature of scientific law
- recognize the ability to predict outcome based on laws
- state instances of the overlapping of physics, chemistry, biology, earth and space science, mathematics, and historical and social perspectives
- show an understanding of the unified theory, of evolution, and of dynamic equilibrium by stating evidence of each
- give examples of the importance of classification and pattern-recognition in science
- give examples of the interrelation of form and function

# Curriculum Guideline Committee

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## Science

**Kathy Kreimborg**

48 Price Avenue  
Erlanger, KY 41018  
St Paul

**Bill Stamm**

442 Glenwood  
Edgeview, KY 41017  
St. Thomas

**Kerry Simkonis**

811 Eastland Drive  
Villa Hills, KY 41017  
St. Henry

**Irene Nichols**

203 Varsity Court  
Crestview Hills, KY 41017  
St. Thomas

**Rita Thiel**

1822 Mt. Vernon Drive  
Ft. Wright, KY 41017  
St. Therese

**Doug Lonneman**

St. Catherine of Siena  
Principal

**Rita Wesseling**

3638 Castlewood Lane  
Cincinnati, OH 45248  
St. Augustine, Covington

**Ray Hildebrand**

Dept. of Catholic Education  
Diocesan Consultant

**Ruth Hubbard**

969 Golden Grove Lane  
Florence, KY 41042  
St. Thomas