Catholic Elementary and Middle School

SCIENCE

STANDARDS

2010

Archdiocese of Portland in Oregon

Science Curriculum

Preschool through Grade 8

The Department of Catholic Schools extends sincere appreciation to the members of the Archdiocesan Science Curriculum Committee who contributed their professional expertise and invested many hours of valuable time bringing these student outcomes into reality. We also express deep gratitude to our principals for the sacrifices made in order to release teachers to do this very important work. We pray that our gratitude to all involved may be realized by the implementation of the new science content standards.

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Archdiocesan Science Philosophy

Creation reflects the power and wisdom of God as evidenced in the complexity and order of the scientific world. We are committed to fostering respect, stewardship, and appreciation of God's creation. A strong science background inspires a sense of wonder through inquiry, discovery, and exploration as we learn about God's world around us. Nurturing and developing a deeper appreciation and understanding of the complexities and interrelationships in nature are vital for promoting a foundation for lifelong curiosity and success for all learners. We, in partnership with families, are committed to building the scientific knowledge of our students so they become leaders who will solve problems in our world and advance humanity in the context of our Catholic Faith.

Archdiocesan Science Goals for Teaching and Learning

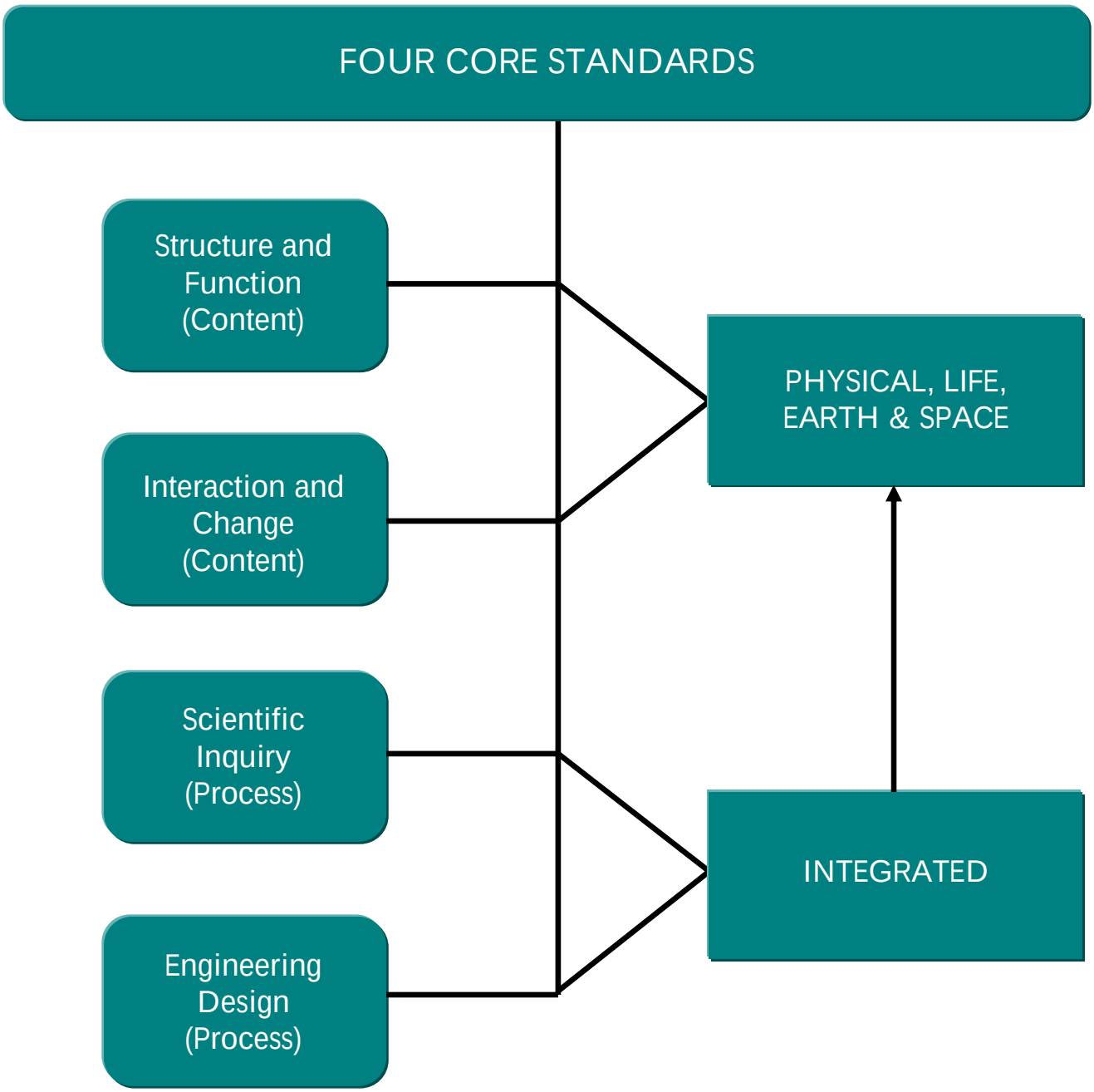
As science educators in the Catholic Schools of the Archdiocese of Portland, we understand that students learn in a variety of ways. We provide opportunities for learners to:

- Think critically about scientific topics that may impact their own lives in the context of the Catholic Faith.
- Use scientific inquiry that is consistent with love and respect for God's creation.
- Compete globally in science, math, and technology.
- Demonstrate a deep conceptual understanding and appreciation of scientific principles and how the world works.
- Act as responsible stewards of the Earth.
- Demonstrate scientific inquiry, use of evidence, critical thinking, making connections, and communication using appropriate scientific vocabulary.
- Utilize technology effectively and appropriately in science.

As science educators we will:

- Analyze formative and summative assessments to guide instruction and learning.
- Motivate learners through hands-on investigations, so that all students experience success.
- Provide a rigorous science curriculum in a student-centered environment that stimulates curiosity, interest, and enjoyment in science while accommodating for diverse needs and learning styles.

The New Archdiocesan Science Standards

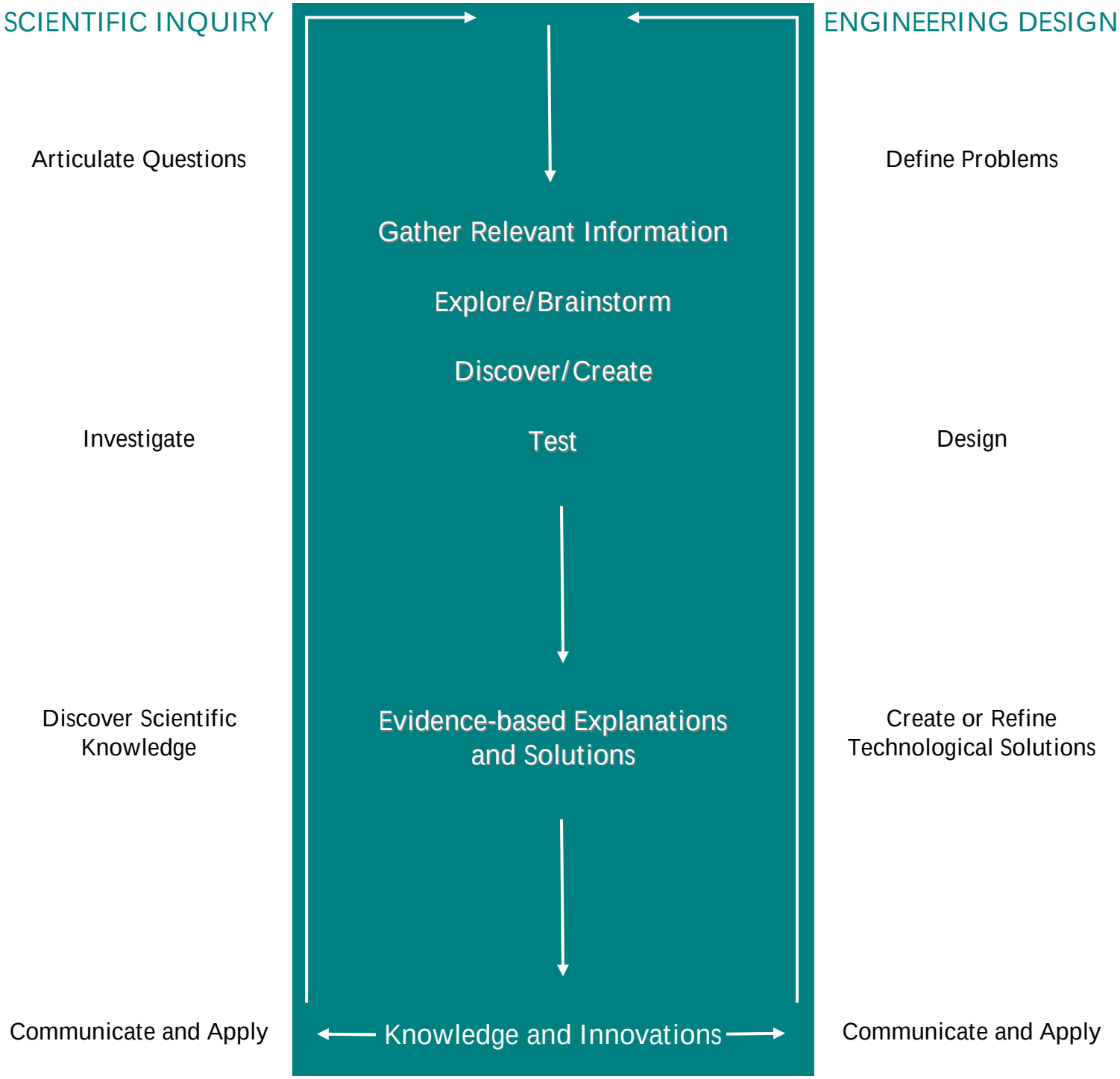


Science Standards Framework

The big ideas organized by science discipline and core strand

	Science Content Knowledge		*Science Process Skills*	
	STRUCTURE AND FUNCTION	**INTERACTION AND CHANGE**	**SCIENTIFIC INQUIRY**	**ENGINEERING DESIGN**
PHYSICAL	Properties of Matter Forms of Energy	Changes in Matter Energy Transfer and Conservation Forces and Motion	Abilities to do Scientific Inquiry Nature, History, and Interaction of Science and Technology	Abilities to do Engineering Design Nature, History, and Interaction of Technology and Science
LIFE	Organization of Living Systems	Matter and Energy Transformations in Living Systems Interdependence Evolution and Diversity		
EARTH AND SPACE	Properties of Earth Materials Objects in the Universe	Matter and Energy Transformations in Earth Systems History of Earth		

Science Processes



Content Standard in Science: Preschool

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication using appropriate scientific vocabulary.

P.1 STRUCTURE AND FUNCTION: *The natural world includes living and non-living things.*

Explore language use to:

P.1P.1	Recognize and identify living and non-living things.
P.1L1.	Recognize traits of plants and animals.
P.1E.1	Observe and discuss the weather.

P.2 INTERACTION AND CHANGE: Living and non-living things change.

P.2P.1	Explore the different ways things move and change.
P.2E.1	Observe and discuss weather changes and seasons.

P.3 SCIENTIFIC INQUIRY: Science explores the natural world through the five senses.

P.3S.1	Conduct hands-on exploration of their world.
P.3S.2	Explore the language of the scientific process.
P.3S.3	Explore and use a variety of science tools.

P.4 ENGINEERING DESIGN: Engineering design is used to design and build things.

P.4D.1	Create structures using materials available in their environment.
P.4D.2	Explore how components of designed structures can be assembled, disassembled, and reassembled.

Content Standard in Science: Kindergarten

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication using appropriate scientific vocabulary.

K.1 STRUCTURE AND FUNCTION: *The natural world includes living and non-living things.*

K.1P.1 Compare and contrast traits of living and properties of non-living things.

K.1L.1 Compare and contrast traits of plants and animals.

K.1E.1 Gather evidence that the sun warms land, air, and water.

K.2 INTERACTION AND CHANGE: *Living and non-living things move.*

K.2P.1 Examine the different ways things move.

K.2E.1 Identify changes in things seen in the sky.

K.3 SCIENTIFIC INQUIRY: Science explores the natural world through observation.

K.3S.1 Explore questions about living and non-living things and events in the natural world.

K.3S.2 Gather information about the natural world using the five senses and scientific tools.

K.4 ENGINEERING DESIGN: *Engineering design is used to design and build things.*

K.4D.1 Create structures using natural or designed materials and simple tools.

K.4D.2 Demonstrate how components of designed structures can be disassembled and reassembled.

Content Standard in Science: Grade 1

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication using appropriate scientific vocabulary.

1.1 STRUCTURE AND FUNCTION: *Living and non-living things have characteristics and properties.*

1.1P.1 Compare and contrast physical properties and composition of objects.

1.1L.1 Compare and contrast traits among individuals within one plant and animal group.

1.1E.1 Examine and describe physical properties of Earth materials.

1.2 INTERACTION AND CHANGE: *Living and non-living things interact.*

1.2P.1 Describe the motion of objects when a force is applied.

1.2L.1 Describe the basic needs of living things.

1.3 SCIENTIFIC INQUIRY: *Science explores the natural world using evidence from observations.*

1.3S.1 Identify and use tools to make careful observations and to answer questions about the natural world.

1.3S.2 Record observations with pictures, numbers, or written statements.

1.3S.3 Describe why recording accurate observations is important in science.

1.4 ENGINEERING DESIGN: *Engineering design is used to design and build things to meet a need.*

1.4D.1 Identify basic tools used in engineering design.

1.4D.2 Demonstrate that designed structures have parts that work together to perform a function.

1.4D.3 Show how tools are used to complete tasks every day.

Content Standard in Science: Grade 2

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication using appropriate scientific vocabulary.

2.1 STRUCTURE AND FUNCTION: *Living and non-living things vary throughout the natural world.*

2.1L.1 Compare and contrast traits and behaviors of plants and animals and the environments where they live.

2.2 INTERACTION AND CHANGE: *Living and non-living things change.*

2.2P.1 Compare and contrast how objects and materials respond to magnetic forces.

2.2L.1 Describe life cycles of living things.

2.2E.1 Observe and record the patterns of apparent movement of the sun and the moon.

2.2E.2 Record and summarize daily and seasonal temperature changes.

2.3 SCIENTIFIC INQUIRY: *Scientific inquiry is a process used to explore the natural world using evidence from observations.*

2.3S.1 Observe, measure, and record properties of objects and substances using simple tools to gather data and extend the senses.

2.3S.2 Make predictions about living and non-living things and events in the environment based on observed patterns.

2.3S.3 Make, describe, and compare observations, and organize recorded data.

2.4 ENGINEERING DESIGN: *Engineering design is used to design and build things to solve problems or address needs.*

2.4D.1 Use tools to construct a simple designed structure out of common objects and materials.

2.4D.2 Work with a team to complete a designed structure that can be shared with others.

2.4D3. Describe an engineering design that is used to solve a problem or address a need.

Content Standard in Science: Grade 3

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication using appropriate scientific vocabulary.

3.1 STRUCTURE AND FUNCTION: *Living and non-living things vary in their characteristics and properties.*

3.1P.1	Compare and contrast the properties of states of matter.
3.1 L.1	Compare and contrast the traits of offspring and parents.
3.1E.1	Identify and describe the characteristics of planets in the solar system.

3.2 INTERACTION AND CHANGE: *Living and non-living things interact with energy and forces.*

3.2P.1	Describe how forces cause changes in an object's position, motion and speed.
3.2L.1	Compare and contrast the life cycles of plants and animals
3.2E.1	Identify Earth as a planet and describe its seasonal weather patterns of precipitation and temperature.

3.3 SCIENTIFIC INQUIRY: *Scientific inquiry is a process used to explore the natural world using evidence from observations and investigations.*

3.3S.1	Plan a simple investigation based on a testable question, hypothesize, match measuring tools to their uses, and collect and record data from a scientific investigation.
3.3S.2	Use the data collected from a scientific investigation to explain the results and draw conclusions.
3.3S.3	Explain why, when a scientific investigation is repeated, similar results are expected.

3.4 ENGINEERING DESIGN: *Engineering design is a process that uses science to solve problems or address needs or aspirations.*

3.4D.1	Identify a problem that can be addressed through engineering design, propose a potential solution, and design a prototype.
3.4D.2	Describe how recent inventions have significantly changed the way people live.
3.4D.3	Describe inventions that enable scientists to observe living and non-living things.

Content Standard in Science: Grade 4

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication using appropriate scientific vocabulary.

4.1 STRUCTURE AND FUNCTION: *Living and non-living things can be classified by their characteristics and properties.*

4.1P.1 Describe and define the properties and forms of energy and how objects vary in the extent to which they absorb, reflect, and conduct energy.

4.1L.1 Compare and contrast characteristics of fossils and living organisms.

4.1E.1 Identify properties, uses, and availability of Earth materials.

4.2 INTERACTION AND CHANGE: *Living and non-living things undergo changes that involve force and energy.*

4.2P.1 Describe physical changes in matter and explain how they occur within the water cycle.

4.2L.1 Describe the interactions of organisms and the environment where they live.

4.2E.1 Compare and contrast the changes in the surface of Earth that are due to slow and rapid processes.

4.2E.2 Explain the water cycle and its relationship to landforms and weather.

4.3 SCIENTIFIC INQUIRY: *Scientific inquiry is a process of investigation through questioning, collecting, describing, and examining evidence to explain natural phenomena and artifacts.*

4.3S.1 Based on observations, identify testable questions, design a scientific investigation, and collect and record data consistent with a planned scientific investigation.

4.3S.2 Summarize the results from a scientific investigation and use the results to respond to the question being tested and to form additional questions.

4.3S.3 Explain that scientific claims about the natural world use evidence that can be confirmed in order to support a logical argument.

4.4 ENGINEERING DESIGN: *Engineering design is using scientific principles to solve problems generated by needs and aspirations.*

4.4D.1 Identify a problem that can be addressed through engineering design using scientific principles.

4.4D.2 Design, construct, and test a prototype of a possible solution to a problem using appropriate tools, materials, and resources.

4.4D.3 Explain how the solution to one problem may create other problems.

Content Standard in Science: Grade 5

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication using appropriate scientific vocabulary.

5.1 STRUCTURE AND FUNCTION: *Living and non-living things are composed of related parts that function together to form systems.*

5.1L.1 Explain that organisms are composed of parts that function together to form a living system.

5.1E.1 Describe the Sun-Earth-Moon system.

5.1E.2 Describe the properties of objects in the solar system.

5.1E.3 Describe and compare the position of the sun within the solar system, galaxy, and universe.

5.2 INTERACTION AND CHANGE: *Force, energy, matter, and organisms interact within living and non-living systems.*

5.2P.1 Describe how friction, gravity, and magnetic forces affect objects on or near Earth.

5.2L.1 Explain the interdependence of plants, animals, and environment, and how adaptation influences survival.

5.2E.1 Explain how the energy from the sun affects Earth's weather, seasons and climate.

5.3 SCIENTIFIC INQUIRY: *Scientific inquiry is a process of investigation based upon science principles and questioning, collecting, describing, and examining evidence to explain natural phenomena and artifacts.*

5.3S.1 Based on observations and science principles, identify questions that can be tested, design an experiment or investigation, and identify appropriate tools. Collect and record data based upon multiple observations, while conducting investigations or experiments to test a scientific question or hypothesis.

5.3S.2 Identify patterns in data that support a reasonable explanation for the results of an investigation or experiment and communicate findings using graphs, charts, maps, models, and oral and written reports.

5.3S.3 Explain the reasons why similar investigations may have different results.

5.4 ENGINEERING DESIGN: *Engineering design is a process of using scientific principles to make modifications in the world in order to meet human needs and aspirations.*

5.4D.1 Using scientific principles, describe a solution to a need or problem given criteria and constraints.

5.4D.2 Design and build a prototype of a proposed engineering solution and identify factors such as cost, safety, appearance, environmental impact, and what will happen if the solution fails.

5.4D.3 Explain that inventions may lead to other inventions, and once an invention exists, people may think of novel ways of using it.

Content Standard in Science: Grade 6

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication using appropriate scientific vocabulary.

6.1 STRUCTURE AND FUNCTION: *Living and non-living systems are organized groups of related parts that function together and have characteristics and properties.*

6.1P.1	Describe physical and chemical properties of matter and how they can be measured.
6.1P.2	Compare and contrast the properties of all forms of energy.
6.1L.1	Compare and contrast the types and components of cells.
6.1L.2	Describe the functions and relative complexity of cells, tissues, organs, and organ systems.
6.1E.1	Describe and compare the properties and composition of the layers of the Earth.

6.2 INTERACTION AND CHANGE: *The related parts within a system interact and change.*

6.2P.1	Describe and compare types and properties of waves and explain how they interact with matter.
6.2P.2	Describe the relationships between: electricity and magnetism, static and current electricity, and series and parallel electrical circuits.
6.2L.1	Describe the relationships and interactions between and among cells, tissues, organs, and organ systems.
6.2L.2	Explain how individual organisms and populations in ecosystem interact and how changes in populations are related to resources.

6.3 SCIENTIFIC INQUIRY: *Scientific inquiry is the investigation of the natural world based on observations and science principles; it includes proposing questions or hypotheses, and developing procedures for questioning, collecting, analyzing, and interpreting accurate and relevant data to produce justifiable evidence-based explanations.*

6.3S.1	Based on observations and science principles, propose questions or hypotheses that can be examined through scientific investigation. Design and conduct an investigation that uses appropriate tools and techniques to collect relevant data.
6.3S.2	Organize and display relevant data, construct an evidence-based explanation of the results of an investigation, and communicate the conclusions.
6.3S.3	Explain why, if more than one variable changes at the same time in an investigation, the outcome of the investigation may not be clearly attributable to any one variable.

6.4 ENGINEERING DESIGN: *Engineering design is a process of identifying needs, defining problems, developing solutions, and evaluating proposed solutions.*

6.4D.1	Define a problem that addresses a need and identify science principles that may be related to possible solutions.
6.4D.2	Design, construct, and test a possible solution to a defined problem using appropriate tools and materials. Evaluate proposed engineering design solutions to the defined problem.
6.4D.3	Describe examples of how engineers have created inventions that address human needs and aspirations.

Content Standard in Science: Grade 7

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication using appropriate scientific vocabulary.

7.1 STRUCTURE AND FUNCTION: *Living and non-living systems are composed of components which affect the characteristics and properties of the system.*

7.1P.1 Explain that all matter is made of atoms, elements are composed of a single kind of atom, and compounds are composed of two or more different elements.

7.1L.1 Compare and contrast sexual and asexual reproduction. Explain why reproduction is essential to the continuation of every species.

7.1L.2 Distinguish between inherited and learned traits; explain how inherited traits are passed from generation to generation; and describe the relationships among phenotype, genotype, chromosomes, and genes.

7.1L.3 Describe the chemical structure of DNA.

7.2 INTERACTION AND CHANGE: *The components and processes within a system interact.*

7.2P.1 Identify and describe types of motion and forces and relate forces quantitatively and qualitatively to the laws of motion and gravitation.

7.2P.2 Describe concepts of fluid dynamics

7.2L.1 Explain how organelles within a cell perform cellular processes and how cells obtain the raw materials for those processes.

7.2L.2 Explain the processes by which plants and animals obtain energy and materials for growth and metabolism.

7.2E.1 Describe and evaluate the environmental and societal effects of obtaining, using, and managing waste of renewable and non-renewable resources.

7.2E.2 Describe the composition of Earth's atmosphere, how it has changed over time, and implications for the future.

7.2E.3 Evaluate natural processes and human activities that affect global environmental change and suggest and evaluate possible solutions to problems.

7.2.E.4 Explain how landforms change over time at various rates in terms of constructive and destructive forces.

7.3 SCIENTIFIC INQUIRY: *Scientific inquiry is the investigation of the natural world based on observations and science principles; it includes proposing questions or hypotheses, and designing procedures for questioning, collecting, analyzing, and interpreting multiple forms of accurate and relevant data to produce justifiable evidence-based explanations.*

7.3S.1 Based on observations and science principles, propose questions or hypotheses that can be examined through scientific investigation. Design and conduct a scientific investigation that uses appropriate tools and techniques to collect relevant data.

7.3S.2 Organize, display, and analyze relevant data; construct an evidence-based explanation of the results of an investigation, and communicate the conclusions including possible sources of error.

7.3S.3 Evaluate the validity of scientific explanations and conclusions based on the amount and quality of the evidence cited.

7.4 ENGINEERING DESIGN: *Engineering design is a process of identifying needs, defining problems, identifying constraints, developing solutions, and evaluating proposed solutions.*

7.4D.1 Define a problem that addresses a need and identify constraints that may be related to possible solutions.

7.4D.2 Design, construct, and test a possible solution using appropriate tools and materials. Evaluate the proposed solution to identify how design constraints are addressed.

7.4D.3 Explain how new scientific knowledge can be used to develop new technologies and how new technologies can be used to generate new scientific knowledge.

Content Standard in Science: Grade 8

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication using appropriate scientific vocabulary.

8.1 STRUCTURE AND FUNCTION: *Systems and their components function at various levels of complexity.*

8.1P.1	Describe the atomic model and explain how the types and arrangements of atoms determine the physical and chemical properties of elements and compounds.
8.1P.2	Describe how chemical reactions result from making and breaking of bonds in a process that absorbs or releases energy.
8.1P.3	Explain how the Periodic Table is an organization of elements based upon their physical and chemical properties.
8.1P.4	Explain how the motion and spacing of particles determines states of matter.
8.1L.1	Explain how genetics and anatomical characteristics are used to classify organisms and infer evolutionary relationships.

8.2 INTERACTION AND CHANGE: *Systems interact with other systems.*

8.2P.1	Compare and contrast physical and chemical changes and describe how the law of conservation of mass applies to these changes.
8.2P.2	Explain how energy is transferred, transformed, and conserved.
8.2L.1	Explain how species change through the process of natural selection. Describe evidence for the evolution of species in the context of God's creation.
8.2E.1	Explain how gravity is the force that keeps objects in the solar system in regular and predictable motion and analyze that motion.
8.2E2	Explain the processes of Earth's geosphere and the resulting major geological events.
8.2E.3	Explain the causes of patterns of atmospheric and oceanic movement and the effects on weather and climate.
8.2E.4	Analyze evidence for geologic, climactic, environmental, and life form changes over time.

8.3 SCIENTIFIC INQUIRY: *Scientific inquiry is the investigation of the natural world based on observations and science principles; it includes proposing questions or hypotheses, and designing procedures for questioning, collecting, analyzing, and interpreting multiple forms of accurate and relevant data to produce justifiable evidence-based explanations and new explorations.*

8.3S.1	Based upon observations and science principles, propose questions or hypotheses that can be examined through scientific investigation. Design and conduct a scientific investigation that uses appropriate tools, techniques, independent and dependent variables, and controls to collect relevant data.
8.3S.2	Organize, display, and analyze relevant data, construct an evidence-based explanation of the results of a scientific investigation, and communicate the conclusions including possible sources of error. Suggest new investigations based on analysis of results.
8.3S.3	Explain how scientific explanations and theories evolve as new information becomes available.

8.4 ENGINEERING DESIGN: *Engineering design is a process of identifying needs, defining problems, identifying design criteria and constraints, developing solutions, and evaluating proposed solutions.*

8.4D.1 Define a problem that addresses a need, and using relevant science principles, investigate possible solutions given specified criteria, constraints, priorities, and trade-offs.

8.4D.2 Design, construct, and test a proposed engineering design solution and collect relevant data. Evaluate a proposed design solution in terms of design and performance criteria, constraints, priorities, and trade-offs. Identify possible design improvements.

8.4D.3 Explain how creating a new technology requires considering societal goals, costs, priorities, and trade-offs.

Vertical Articulation of the Big Ideas in the Science Disciplines

This chart shows the grade-by-grade progression of the big ideas and content standards within each science discipline. It outlines a coherent progression in science content from preschool through grade eight.

	PHYSICAL	LIFE	EARTH AND SPACE
P	Properties of Matter: Characteristics of living and non-living things Forces and Motion: Motion and physical change	Organization of Living Systems: Characteristics of plants and animals	Matter and Energy: Weather, weather changes and seasons
K	Properties of Matter: Characteristics of living and non-living things Forces and Motion: Motion	Organization of Living Systems: Characteristics of plants and animals	Objects in the Universe: Objects in sky Matter and Energy: Sun warms land, air, water
1	Properties of Matter: Properties of objects Forces and Motion: Force and motion	Organization of Living Systems: Characteristics of living things Matter and Energy: Needs of living things	Properties of Earth Materials: Properties of Earth materials
2	Forces and Motion: Objects and magnetic forces	Matter and Energy: Describe life cycles Diversity: Variety in living and non-living things	Objects in the Universe: Patterns of change in objects seen in the sky Matter and Energy: Temperature changes
3	Properties of Matter: States of matter Forces and Motion: Position, motion, speed	Matter and Energy: Compare and contrast life cycles Diversity: Characteristics of offspring and parents	Objects in the Universe: Earth as a planet in the solar system Matter and Energy: Seasonal weather changes
4	Forms of Energy: Properties of energy Changes in Matter: Physical changes in the water cycle	Interdependence: Plants, animals, and environment Diversity: Fossils	Properties of Earth Materials: Properties, uses, and availability of Earth materials Matter and Energy: Earth surface changes, water cycle, landforms, and weather
5	Forces and Motion: Effects of friction, gravity, and magnetic forces on objects	Organization of Living Systems: Living things are composed of parts Interdependence: Plants, animals, and environment Diversity: Adaptation and survival	Objects in the Universe: Sun-Earth-Moon in the solar system, galaxy, and universe. Matter and Energy: Sun's energy affects weather, climate, and seasons
6	Properties of Matter: Physical and chemical properties of matter Forms of Energy: Properties of forms of energy and waves Energy Transfer: Electricity, magnetism, waves	Organization of Living Systems: Components, types and complexity of cells, tissues, organs, and organ systems Matter and Energy: Interactions within organisms Interdependence: Organisms, populations, and resources in ecosystems	Objects in the Universe: Properties and composition of layers of the earth Matter and Energy: Water cycle, landforms, and weather moved to fourth grade.
7	Properties of Matter: Atoms, elements, and compounds Forces and Motion: Types of motion and forces and gravitation, fluid dynamics	Matter and Energy: Energy and materials for growth and metabolism of organisms, Evolution and Diversity: Reproduction, life cycles, inherited and learned traits, genes, chromosomes, DNA	History of Earth: Changes in Earth's atmosphere and landforms Matter and Energy: Use of Earth's resources, natural processes, human activities, and global environmental changes
8	Properties of Matter: Atomic model, physical and chemical properties of elements and compounds, Periodic Table Changes in Matter: Physical and chemical changes and conservation of mass, chemical reactions Energy Transfer and Conservation: Conservation of energy	Organization of Living Systems: Classification, internal and external structures, relationships among organisms Evolution and Diversity: Natural selection, evidence for evolution of species in the context of God's creation	History of Earth: Geologic, climatic, environmental and life form changes Matter and Energy: Processes of Earth's atmosphere, oceans, and geosphere, and gravity, motions, and Earth changes

Vertical Articulation of the Core Standards

This chart shows the grade-by-grade progression of the core standards. It outlines a coherent progression in knowledge and skills from preschool through grade eight.

	STRUCTURE & FUNCTION	INTERACTION & CHANGE	SCIENTIFIC INQUIRY	ENGINEERING DESIGN
P	The natural world includes living and non-living things.	Living and non-living things change.	Science explores the natural world through the five senses.	Engineering design is used to design and build things.
K	The natural world includes living and non-living things.	Living and non-living things move.	Science explores the natural world through observation.	Engineering Design is used to design and build things.
1	Living and non-living things have characteristics and properties.	Living and non-living things interact.	Science explores the natural world using evidence from observations.	Engineering Design is used to design and build things to meet a need.
2	Living and non-living things vary throughout the natural world.	Living and non-living things change.	Scientific Inquiry is a process used to explore the natural world using evidence from observations.	Engineering Design is a process used to design and build things to solve problems or address needs.
3	Living and non-living things vary in their characteristics and properties.	Living and non-living things interact with energy and forces.	Scientific Inquiry is a process used to explore the natural world using evidence from observations and investigations.	Engineering Design is a process that uses science to solve problems or address needs or aspirations.
4	Living and non-living things can be classified by their characteristics and properties.	Living and non-living things undergo changes that involve force and energy.	Scientific Inquiry is a process of investigation through questioning, collecting, describing, and examining evidence to explain natural phenomena and artifacts.	Engineering Design is a process of using science principles to solve problems generated by needs and aspirations.
5	Living and non-living things are composed of related parts that function together to form systems.	Force, energy, matter, and organisms interact within living and non-living systems.	Scientific Inquiry is a process of investigation based on science principles and questioning, collecting, describing, and examining evidence to explain natural phenomena and artifacts.	Engineering Design is a process of using science principles to make modifications in the world to meet human needs and aspirations.
6	Living and non-living systems are organized groups of related parts that function together and have characteristic properties.	The related parts within a system interact and change.	Scientific Inquiry is the investigation of the natural world based on observations and science principles that includes proposing questions or hypotheses, and developing procedures for questioning, collecting, analyzing, and interpreting accurate and relevant data to produce justifiable evidence-based explanations.	Engineering design is a process of identifying needs, defining problems, developing solutions, and evaluating proposed solutions.
7	Living and non-living systems are composed of components that affect the defining characteristics and properties of the system.	The components and processes within a system interact.	Scientific Inquiry is the investigation of the natural world based on observations and science principles that includes proposing questions or hypotheses, designing procedures for questioning, collecting, analyzing, and interpreting multiple forms of accurate and relevant data to produce justifiable evidence-based explanations.	Engineering design is a process of identifying needs, defining problems, identifying constraints, developing solutions, and evaluating proposed solutions.
8	Systems and their components function at various levels of complexity.	Systems interact with other systems.	Scientific Inquiry is the investigation of the natural world based on observations and science principles that includes proposing questions or hypotheses and designing procedures for questioning, collecting, analyzing, and interpreting multiple forms of accurate and relevant data to produce justifiable evidence-based explanations and new explorations.	Engineering design is a process of identifying needs, defining problems, identifying design criteria and constraints, developing solutions, and evaluating proposed solutions.

Middle School Physical Science Content Standards

For use by middle schools who wish to teach the science strands as separate subjects.

6.1	Living and non-living systems are organized groups of related parts that function together and have characteristics and properties.
6.1P.1	Describe physical and chemical properties of matter and how they can be measured.
6.1P.2	Compare and contrast the properties of all forms of energy.
6.2	The related parts within a system interact and change.
6.2P.1	Describe and compare types and properties of waves and explain how they interact with matter.
6.2P.2	Describe the relationships between: electricity and magnetism, static and current electricity, and series and parallel electrical circuits.
7.1	Living and non-living systems are composed of components which affect the characteristics and properties of the system.
7.1P.1	Explain that all matter is made of atoms, elements are composed of a single kind of atom, and compounds are composed of two or more different elements.
7.2	The components and processes within a system interact.
7.2P.1	Identify and describe types of motion and forces and relate forces quantitatively and qualitatively to the laws of motion and gravitation.
7.2P.2	Describe concepts of fluid dynamics.
8.1	Systems and their components function at various levels of complexity.
8.1P.1	Describe the atomic model and explain how the types and arrangements of atoms determine the physical and chemical properties of elements and compounds.
8.1P.2	Describe how chemical reactions result from making and breaking of bonds in a process that absorbs or releases energy.
8.1P.3	Explain how the Periodic Table is an organization of elements based on their physical and chemical properties.
8.1P.4	Explain how the motion and spacing of particles determines states of matter.
8.2	Systems interact with other systems.
8.2P.1	Compare and contrast physical and chemical changes and describe how the law of conservation of mass applies to these changes.
8.2P.2	Explain how energy is transferred, transformed, and conserved.

Middle School Life Science Content Standards

For use by middle schools who wish to teach the science strands as separate subjects.

6.1	Living and non-living systems are organized groups of related parts that function together and have characteristics and properties.
6.1L.1	Compare and contrast the types and components of cells
6.2	The related parts within a system interact and change.
6.2L.1	Describe the functions and relative complexity of cells, tissues, organs, and organ systems.
6.2L.2	Explain how individual organisms and populations in an ecosystem interact and how changes in populations are related to resources.
7.1	Living and non-living systems are composed of components which affect the characteristics and properties of the system.
7.1L.1	Compare and contrast sexual and asexual reproduction. Explain why reproduction is essential to the continuation of every species.
7.1L.2	Distinguish between inherited and learned traits, explain how inherited traits are passed from generation to generation, and describe the relationships among phenotype, genotype, chromosomes, and genes.
7.1L.3	Describe the chemical structure of DNA.
7.2	The components and processes within a system interact.
7.2L.1	Explain how organelles within a cell perform cellular processes and how cells obtain the raw materials for those processes.
7.2L.2	Explain the processes by which plants and animals obtain energy and materials for growth and metabolism.
8.1	Systems and their components function at various levels of complexity.
8.1L.1	Explain how genetics and anatomical characteristics are used to classify organisms and infer evolutionary relationships.
8.2	Systems interact with other systems.
8.2L.1	Explain how species change through the process of natural selection. Describe evidence for the evolution of species within the context of God's creation.

Middle School Earth and Space Science Content Standards

For use by middle schools who wish to teach the science strands as separate subjects

6.1	Living and non-living systems are organized groups of related parts that function together and have characteristics and properties.
6.1E.1	Describe and compare the properties and composition of the layers of the Earth.
6.2	The related parts within a system interact and change.
6.2E.1	Explain the water cycle and the relationship to landforms and weather.
7.2	The components and processes within a system interact.
7.2E.1	Describe and evaluate the environmental and societal effects of obtaining, using, and managing waste of renewable and non-renewable resources.
7.2E.2	Describe the composition of Earth's atmosphere, how it has changed over time, and implications for the future.
7.2E.3	Evaluate natural processes and human activities that affect global environmental change and suggest and evaluate possible solutions to problems.
7.2E.4	Explain how landforms change over time at various rates in terms of constructive and destructive forces.
8.2	Systems interact with other systems.
8.2E.1	Explain how gravity is the force that keeps objects in the solar system in regular and predictable motion and analyze that motion.
8.2E.2	Explain the processes of Earth's geosphere and the resulting major geological events.
8.2E.3	Explain the causes of patterns of atmospheric and oceanic movement and the effects on weather and climate.
8.2E.4	Analyze evidence for geologic, climatic, environmental, and life form changes over time.

Middle School Scientific Inquiry Standards

Middle schools who teach physical life, and earth and space strands separately should be certain to integrate these process standards into the content.

6.3	Scientific inquiry is the investigation of the natural world based on observations and science principles that includes proposing questions or hypotheses, and developing procedures for questioning, collecting, analyzing, and interpreting accurate and relevant data to produce justifiable evidence-based explanations.
6.3S.1	Based on observations and science principles, propose questions or hypotheses that can be examined through scientific investigation. Design and conduct an investigation that uses appropriate tools and techniques to collect relevant data.
6.3S.2	Organize and display relevant data, construct an evidence-based explanation of the results of an investigation, and communicate the conclusions.
6.3S.3	Explain why, if more than one variable changes at the same time in an investigation, the outcome of the investigation may not be clearly attributable to any one variable.
7.3	Scientific inquiry is the investigation of the natural world based on observations and science principles that includes proposing questions or hypotheses, designing procedures for questioning, collecting, analyzing, and interpreting multiple forms of accurate and relevant data to produce justifiable evidence-based explanations.
7.3S.1	Based on observations and science principles, propose questions or hypotheses that can be examined through scientific investigation. Design and conduct a scientific investigation that uses appropriate tools and techniques to collect relevant data.
7.3S.2	Organize, display, and analyze relevant data; construct an evidence-based explanation of the results of an investigation, and communicate the conclusions including possible sources of error.
7.3S.3	Evaluate the validity of scientific explanations and conclusions based on the amount and quality of the evidence cited.
8.3	Scientific inquiry is the investigation of the natural world based on observations and science principles that includes proposing questions or hypotheses and designing procedures for questioning, collecting, analyzing, and interpreting multiple forms of accurate and relevant data to produce justifiable evidence-based explanations and new explorations.
8.3S.1	Based upon observations and science principles, propose questions or hypotheses that can be examined through scientific investigation. Design and conduct a scientific investigation that uses appropriate tools, techniques, independent and dependent variables, and controls to collect relevant data.
8.3S.2	Organize, display, and analyze relevant data, construct an evidence-based explanation of the results of a scientific investigation, and communicate the conclusions including possible sources of error. Suggest new investigations based on analysis of results.
8.3S.3	Explain how scientific explanations and theories evolve as new information becomes available.

Middle School Engineering Design Standards

Middle schools who teach physical life, and earth and space strands separately should be certain to integrate these process standards into the content.

6.4	Engineering design is a process of identifying needs, defining problems, developing solutions and evaluating proposed solutions.
6.4D.1	Define a problem that addresses a need and identify science principles that may be related to possible solutions.
6.4D.2	Design, construct, and test a possible solution to a defined problem using appropriate tools and materials. Evaluate proposed engineering design solutions to the defined problem.
6.4D.3	Describe examples of how engineers have created inventions that address human needs and aspirations.
7.4	Engineering design is a process of identifying needs, defining problems, identifying constraints, developing solutions, and evaluating proposed solutions.
7.4D.1	Define a problem that addresses a need and identify constraints that may be related to possible solutions.
7.4D.2	Design, construct, and test a possible solution using appropriate tools and materials. Evaluate proposed solutions to identify how design constraints are addressed.
7.4D.3	Explain how new scientific knowledge can be used to develop new technologies and how new technologies can be used to generate new scientific knowledge.
8.4	Engineering design is a process of identifying needs, defining problems, identifying design criteria and constraints, developing solutions, and evaluating proposed solutions.
8.4D.1	Define a problem that addresses a need, and using relevant science principles, investigate possible solutions given specified criteria, constraints, priorities, and trade-offs.
8.4D.2	Design, construct, and test a proposed solution and collect relevant data. Evaluate a proposed solution in terms of design and performance criteria, constraints, priorities, and trade-offs. Identify possible design improvements.
8.4D.3	Explain how creating a new technology requires considering societal goals, costs, priorities, and trade-offs.

Science Implementation Plan

And Reasons For It

Our Archdiocesan science standards are changing to align with the most current international, national, and state thinking about science. Recent research indicates that science education in the United States is "an inch deep and a mile wide"—just like math. Every adoption and every school has loads of content to teach—but not necessarily a vertical alignment of content or a gradual build up of science knowledge and skills. In other words, "curricula, textbooks, and teaching across the United States are not consistent." -2007 TIMSS (Trends in International Mathematics and Science Study)

We are living in exponential times. More than 3,000 new books are being published every day. More unique information will be generated worldwide this year than in the previous 5,000 years. We must prepare our students for the world of change.
-"Did you know?" Shift Happens http://www.youtube.com/watch?v=ljbI-363A2Q

Our students cannot possibly study every science topic. But they can learn the broad ideas, the processes, and the skills that they will need to learn about and understand every science topic. Current research indicates that science standards should be organized by a small number of big ideas which are essential for all people to understand. We need to have science standards that are "essential, clear, specific, rigorous, and relevant." (-Revised 2008 Washington State Science Standards) Organizing K-12 concepts and abilities by big ideas offers a way to prioritize critical content for students to study and provides a coherent vision of what students should know and be able to do. (-Oregon Science Standards, November, 2009)

In January of 2010, twenty-two Archdiocesan science teachers and five administrators, representing seventeen Catholic elementary schools from ten cities and towns gathered to update our science standards. Our standards were adapted from the 2009 Oregon State Science Standards with permission from the Oregon Department of Education, but preschool standards were added, and the state standards were studied, clarified, revised, and at times, made more rigorous. In keeping with national and international trends, core and curriculum standards and processes have been narrowed, but each grade level will be responsible for ensuring student mastery at that grade level. Over time, students' knowledge and skills will build, preparing them for a rigorous high school science curriculum, for college, and for the 21st century work world.

Our planned implementation timeline is listed on the next page.

Implementation Timeline

March 12, 2010	The new Science Standards will be introduced and distributed to principals.
Spring, 2010	All teachers will receive a copy and will discuss the changes.
August 27, 2010	A teacher in-service will be held in Eugene. Teachers will learn more about the standards and implementation plan at a general session and will participate in grade level work sessions.
August 30, 2010	A teacher in-service will be held in Portland. Teachers will learn more about the new standards and their implementation at a general session and will participate in grade level work sessions.
2010-11	All elementary schools will complete a science in-depth study in science following the new WCEA 2010 ISL protocol. This study will include a study of students' current performance in science. Teachers at each school will create school curriculum maps, listing which topics and skills will be taught under the grade level standards and how student learning will be assessed. Dialogue will occur within each school to ensure that topics are not missed or duplicated across the grade levels. Science curriculum maps may be completed during 2010-11 or in 2011-12.
Spring, 2011	Schools will not be required to purchase new science adoptions. However, schools should inventory their science print and electronic resources and also their science equipment and, if resources allow, any needed new materials should be selected and purchased for use in 2011-12.
June, 2011	Science in-depth studies and curriculum maps will be submitted to office of the Archdiocesan Director of Instructional Services and Accreditation.
2011-2012	Schools will fully implement the new science standards and will assess students' learning effectively. Middle School programs may choose to teach 6th, 7th, and 8th grade science following the integrated curriculum on pp. 16-20 or they may teach physical, life, and earth and space content in separate years using pp 23-27 as a planning guide.

Our new science standards should be taught in a hands-on, experiential manner in contexts that promote the processes of:

- Scientific Inquiry
- Use of Evidence
- Critical Thinking
- Making Connections
- Communication Using Scientific Vocabulary

It is our hope that these science changes will prepare all of our students well for the future.

Archdiocesan Science Resources

California State Science Standards
http://www.cde.ca.gov/be/st/ss/documents/sciencestnd.pdf

Curriculum Coherence: An Examination of US Mathematics and Science Content Standards from an International Perspective Schmidt, Wang, and McKnight, 2005
www.eric.ed.gov/ERICWebPortal/recordDetail?accno=EJ719587

Hawaii Preschool Content Standards, 2004
http://www.goodbeginnings.org/pdf/SchoolReadiness/HPCS2004.pdf

Indiana State Science Standards http://dc.doe.in.gov/Standards/AcademicStandards/index.shtml

National Assessment of Educational Progress (NAEP), 2009 Science Assessment Framework
http://www.nagb.org/publications/frameworks/science-09.pdf

National Science Education Standards (NSES): National Research Council, 2006
http://www.nap.edu/openbook.php?record_id=4962

Oregon Science Standards, 2009
http://www.ode.state.or.us/teachlearn/real/standards/sbd.aspx

Oregon State Standards: Standards by Design. Real Site contains standards by grade and also resources.
http://www.ode.state.or.us/teachlearn/real/standards/sbd.aspx

Programme for International Student Assessment (PISA) Assessing Scientific, Reading, and Mathematical Literacy 2006 Framework: Organization for Economic Cooperation and Development
http://www.pisa.oecd.org/document/33/0,3343,en_32252351_32236191_37462369_1_1_1_1,00.html

Project 2061: Benchmarks Online: American Association for the Advancement of Science, 2009 http://www.project2061.org/publications/bsl/online/index.php

Ready, Set, Science! (National Research Council, 2007)
http://www.nap.edu/catalog.php?record_id=11882#toc

Science Digital Library: http://nsdl.org/

Singapore Science Standards http://www.moe.gov.sg/cpdd/syllabuses.htm

Splash, Flash, Crank, Slide, Alive!: National Science Teachers' Association, 2008
http://www.nsta.org/store/bestsellers.aspx?type=Books

Taking Science to School (National Research Council, 2007)
http://www.nap.edu/catalog.php?record_id=11625

The Quest for a Coherent School Science Curriculum: The Need for an Organizing Principle (2002, Schmidt) http://ustimss.msu.edu/coherentscience.pdf

The Thomas B. Fordham Institute: The State of State Science Standards, 2005
http://www.edexcellence.net/detail/news.cfm?news_id=352

Trends in International Mathematics and Science Study (TIMMS); 2007
http://timss.bc.edu/TIMSS2007/frameworks.html

Washington State Science Standards
http://www.k12.wa.us/Science/pubdocs/WAScienceStandards.pdf

Curriculum Map

Grade _____ **Subject** _____

MONTH	ESSENTIAL QUESTIONS Broad overriding question(s) to be answered in this unit.	CONTENT What topics? (Nouns)	SKILLS What will students know and be able to do? (Verbs)	ASSESSMENT How will their learning be measured and evaluated?
AUGUST				
SEPTEMBER				
OCTOBER				

Curriculum Map

Grade _____ Subject _____

MONTH	ESSENTIAL QUESTIONS Broad overriding question(s) to be answered in this unit.	CONTENT What topics? (Nouns)	SKILLS What will students know and be able to do? (Verbs)	ASSESSMENT How will their learning be measured and evaluated?
NOVEMBER				
DECEMBER				
JANUARY				

Curriculum Map

Grade _____ Subject _____

MONTH	ESSENTIAL QUESTIONS Broad overriding question(s) to be answered in this unit.	CONTENT What topics? (Nouns)	SKILLS What will students know and be able to do? (Verbs)	ASSESSMENT How will their learning be measured and evaluated?
FEBRUARY				
MARCH				
APRIL				

Curriculum Map

Grade _____ Subject _____

MONTH	ESSENTIAL QUESTIONS Broad overriding question(s) to be answered in this unit.	CONTENT What topics? (Nouns)	SKILLS What will students know and be able to do? (Verbs)	ASSESSMENT How will their learning be measured and evaluated?
MAY				
JUNE				