Science Curriculum Guidelines

August 2011

Archdiocese of San Francisco

SCIENCE CURRICULUM

TABLE OF CONTENTS

INTRODUCTION

A committee of educators from the schools of the Archdiocese of San Francisco revised the Science Guidelines in order to align them with the current *Science Framework for California Public Schools: Kindergarten through Grade Twelve*. The committee also prioritized the standards, in order to guide science educators as to which of the standards are foundational standards which will ensure the continuity of the science curriculum across the grades.

Science is an integral part of a well-rounded Catholic education that prepares students to become contributing members of our global society. Religious overtones are integrated into scientific study in order for students to make ethical and moral decisions about challenging social issues. Catholic values are introduced (I), developed (D), and expanded (E) in the science content throughout the grades, providing students with a sense of connectedness between science and religion.

For each grade level, these Science Guidelines provide science educators with California grade level standards, bolded foundational standards, suggested working vocabulary, sample procedures, sample assessments, sample resources, and the correlation to Catholic values. Religious overtones in the primary, intermediate, and middle grades are also given, to stress the importance of incorporating religion into the science curriculum. A chart of Grade-to-Grade Crossover Standards is available in an appendix, to demonstrate the continuity of concepts taught throughout all grade levels. A list of suggested fieldtrips throughout the San Francisco Bay Area is also available in an appendix.

The foundational standards selected by the committee represent the core concepts, principles, skills, and theories of science that are essential to creating a comprehensive science education. While it is important that all standards are taught, it is essential that the foundational standards are emphasized because they provide the framework of the students' scientific understanding.

Science Committee

Lynne Dowdy
St. Brendan School

Bernice Tonegato-Jarrell
Saint Gabriel

Melissa Matheson
Saint Matthew

Jean Scott
Our Lady of Loretto

Shelly White
Saint Thomas More

Dr. Nina Russo
Department of Catholic Schools

Philosophy

As science educators in the elementary Catholic Schools of the Archdiocese of San Francisco:

- We appreciate and respect the wonders of God's creation and seek to integrate scientific knowledge with the teachings of the Catholic Church.

- We acknowledge that science is an integral part of the whole curriculum in which the students utilize applicable skills from all disciplines.

- We foster scientific literacy in all students, which is essential in our increasingly complex world. This foundation encourages students to become actively involved with challenging global issues.

- We promote life-long learning for all students by inspiring a sense of discovery and curiosity.

- We embrace our responsibility to instill in students a moral Christian obligation to exercise good judgment, by becoming conscientious stewards of our world.

- We incorporate the use of technology and electronic resources as a integral component of student learning in science.

Goals

We recognize that science is a core academic subject with an allotted share of instructional time and resources, and that there must be careful and deliberate articulation of the Archdiocesan Guidelines across grade levels. In order for students to succeed in meeting the Archdiocesan and California State Science Standards, we provide the following goals:

- Promote scientific inquiry and enthusiasm for science by motivating students to investigate the natural world in an atmosphere of curiosity, open-mindedness, integrity, and patience.

- Utilize Archdiocesan Guidelines as well as additional curriculum strategies/resources to incorporate science across multiple disciplines.

- Introduce all students, starting in the primary grades, to scientific vocabulary and methods, in order to provide them with the essential knowledge necessary to understand and to apply scientific concepts.

- Challenge students to become active problem solvers, to differentiate fact from fiction, and to develop critical reading and thinking skills.

- Create a student-centered environment that encourages exploration and application of scientific processes. Methodologies may include hands-on experiences, cooperative learning, experimentation, inquiry-based activities, and appropriate use of technological resources.

- Evaluate student performance using a variety of assessments, including those with appropriate modifications and accommodations for differentiated learners.

- Empower students with the skills necessary to make educated and ethical decisions concerning their own lives and their local and global communities.

CATHOLIC VALUES INTEGRATED INTO SCIENCE CONTENT

	K	1	2	3	4	5	6	7	8
Students will be able to demonstrate stewardship imbued with Catholic values in the care of local and global environments.	I	D	D	D	D	E	E	E	E
Students will be able to identify the relationships between the roles of science, technology, and Catholic ethics in the global community.		I	D	D	D	D	E	E	E
Students will be able to compare/describe life from the fossil record with modern life forms and discuss Biblical implications.			I	D	D	D	E	E	E
Students will be able to relate concepts of heredity and reproduction to Catholic teaching.			I	D	D	D	D	E	E
Students will be able to discuss the theory of evolution in the context of Catholic teaching about the origin of life.					I	D	D	E	E
Students will be able to work cooperatively, and respect each other's ideas, roles, and abilities.	I	I	I	I	D	D	E	E	E

LEGEND: I = Introduce D = Develop E = Expand/Enrich/Extend

RELIGIOUS OVERTONES IN PRIMARY (K-3) GRADE SCIENCE

The wonder of the beauty of all God's creation is expanded upon through facilitated discovery and taught content. Investigation and simple experimentation play a large role in the discovery that only a Divine Being could create such beauty and keep it in a process of natural order. As students observe the unfolding of the cyclical rhythm of life, they can see God's continual work within the world today. Students also discover that each creature that God has created possesses its own particular goodness and perfection.

Stewardship is a concept that is introduced in simple terms on the kindergarten level and is developed through the primary grades, encompassing everything from the local level to our global community. Through the wonder of creation comes the realization that we are all responsible for the well-being of God's world. "Since all that God created reflects in its own way a ray of God's infinite wisdom and goodness, man must therefore respect the particular goodness of every creature." (Catechism of the Catholic Church 2 #339)

KINDERGARTEN

In order to ensure continuity and mastery throughout the K-8 science curriculum, all standards need to be taught. These standards emphasize the critical components of the science content for this particular grade.

Physical Sciences

Standard 1: Properties of materials can be observed, measured, and predicted. As a basis for understanding this concept, students will:

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

Suggested Concepts and Working Vocabulary

attribute	category	characteristics	color	flexibility
magnetic	property	size	texture	weight

Sample Procedure for Standard 1a

Provide each table of four students with common objects: scissors, books, baskets, paper clips, sweatshirts. Elicit observations and descriptions. Create categories based on physical attributes (e.g., color, shape, texture, size, weight). Develop charts of the categories. Segregate objects by moving them to particular parts of the table. Draw or list objects in the chart.

Sample Assessments

1) Use attribute blocks as an introductory and culminating activity.

2) Add new objects, as discovered, to the chart of attributes.

Resources

See page 27

Life Sciences

Standard 2: Different types of plants and animals inhabit the earth. As a basis for understanding this concept, students will:

a. know how to observe and describe similarities and differences in the appearance and behavior of plants and animals (e.g., seed-bearing plants, birds, fish, insects).
b. know stories sometimes give plants and animals attributes they do not possess.
c. know how to identify major structures of common plants and animals (e.g., stems, leaves, roots, arms, wings, legs).

Suggested Concepts and Working Vocabulary

camouflage	carnivore	extinction	gills	habitat
herbivore	mammal			

Sample Procedure for Standards 2a and 2c

Direct students to look for similarities and differences among marine animals in the Bay Area, and make models of specific marine animals.

Sample Assessment

Place models of species in correct habitat.

Resources

See page 27

Earth Sciences

Standard 3: Earth is composed of land, air, and water. As a basis for understanding this concept, students will:

a. know characteristics of mountains, rivers, oceans, valleys, deserts, and local landforms.
b. know changes in weather occur from day to day and across seasons, affecting Earth and its inhabitants.
c. know how to identify resources from Earth that are used in everyday life and understand that many resources can be conserved.

Suggested Concepts and Working Vocabulary

climate	energy	environment	fog	graph
ice	predict	rain	recycle	reflect
snow	weather	wind		

Sample Procedure for Standard 3b

Keep weather calendar throughout the year. Plot daily weather, using symbols.

Sample Assessment

Use data to make graph of rainy, foggy, and sunny days.

Resources

See Page 27

Investigation and Experimentation

Standard 4: Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:

a. **observe common objects by using the five senses.**
b. **describe the properties of common objects.**
c. **describe the relative position of objects by using one reference (e.g., above or below).**
d. **compare and sort common objects by one physical attribute (e.g., color, shape, texture, size, weight).**
e. **communicate observations orally and through drawings.**

Catholic Values

- Students will be able to demonstrate stewardship imbued with Catholic values in the care of local and global environments. (I)

- Students will be able to work cooperatively, and respect each other's ideas, roles, and abilities. (I)

LEGEND I = Introduce D = Develop E – Expand/Enrich/Extend

GRADE ONE

In order to ensure continuity and mastery throughout the K-8 science curriculum, all standards need to be taught. These standards emphasize the critical components of the science content for this particular grade.

Physical Sciences

Standard 1: Materials come in different forms (states), including solids, liquids, and gases. As a basis for understanding this concept, students will:

a. **know solids, liquids, and gases have different properties.**
b. **know the properties of substances can change when the substances are mixed, cooled, or heated.**

Suggested Concepts and Working Vocabulary

atom	attributes	centigrade	characteristics	experiment
Fahrenheit	gas	investigation	liquid	opaque
solid	translucent	transparent		

Sample Procedures for Standards 1a and 1b

1) Model states of matter with six students as atoms.
   - Solid - Join hands with feet touching to simulate lack of motion within a solid.
   - Liquid - Walk in a line with hands on shoulders of person in front, to simulate the fluidity of a liquid.
   - Gas - Have "atoms" move apart to simulate the range of motion in a gas.

2) Elicit examples of solids, liquids, and gases.

3) Using clear containers filled with substances representing the three states of a particular material, have students match each with an appropriate paper thermometer.

Sample Assessment

Draw pictures that show how atoms of solids, liquids, and gases act.

Resources

See page 27

Life Sciences

Standard 2: Plants and animals meet their needs in different ways. As a basis for understanding this concept, students will:

a. know different plants and animals inhabit different kinds of environments and have external features that help them thrive in different kinds of places.
b. know both plants and animals need water, animals need food, and plants need light.
c. know animals eat plants or other animals for food and may also use plants or even other animals for shelter and nesting.
d. know how to infer what animals eat from the shape of their teeth (e.g., sharp teeth: eats meat; flat teeth: eats plants).
e. know roots are associated with the intake of water and soil nutrients, and green leaves are associated with making food from sunlight.

Suggested Concepts and Working Vocabulary

data	external	food chain	fossil	internal
nutrient				

Sample Procedure for Standards 2a and 2e

Examine and describe different types of leaves using the senses. Record observations and data with drawings and words.

Sample Assessment

Share observations with the class.

Resources

See page 27

Earth Sciences

Standard 3: Weather can be observed, measured, and described. As a basis for understanding this concept, students will:

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

Suggested Concepts and Working Vocabulary

air pressure pollution temperature weather wind

Sample Procedure for Standard 3a

Construct and use a wind vane and a barometer to measure weather conditions. Draw conclusions based on the data.

Sample Assessments

1) Observe weather instruments.
2) Make bar graphs of windy and non-windy days for a week.
3) Chart changes in air pressure for one week.

Resources

See page 27

Investigation and Experimentation

Standard 4: Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:

a. **draw pictures that portray some features of the thing being described.**
b. **record observations and data with pictures, numbers, or written statements.**
c. **record observations on a bar graph.**
d. **describe the relative position of objects by using two references (e.g., above and next to, below and left of).**
e. **make new observations when discrepancies exist between two descriptions of the same object or phenomenon.**

Catholic Values

- Students will be able to demonstrate stewardship imbued with Catholic values in the care of local and global environments. (D)
- Students will be able to identify the relationships between the roles of science, technology, and Catholic ethics in the global community. (I)
- Students will be able to work cooperatively & respect each other's ideas, roles, and abilities. (I)

LEGEND: I = Introduce D = Develop E = Expand/Enrich/Extend

GRADE TWO

In order to ensure continuity and mastery throughout the K-8 science curriculum, all standards need to be taught. These standards emphasize the critical components of the science content for this particular grade.

Physical Sciences

Standard 1: The motion of objects can be observed and measured. As a basis for understanding this concept, students will:

a. **know the position of an object can be described by locating it in relation to another object or to the background.**
b. **know an object's motion can be described by recording the change in position of the object over time.**
c. **know the way to change how something is moving is by giving it a push or a pull. The size of the change is related to the strength, or the amount of force, of the push or pull.**
d. **know tools and machines are used to apply pushes and pulls (forces) to make things move.**
e. **know objects fall to the ground unless something holds them up.**
f. **know magnets can be used to make some objects move without being touched.**
g. **know sound is made by vibrating objects and can be described by its pitch and volume.**

Suggested Concepts and Working Vocabulary

attract	force	friction	gravity	magnetic
pitch	repel	vibration	volume	

Sample Procedure for Standard 1f

Provide magnets and assorted coins and clips. Check for magnetic property in all items. Chart the findings.

Sample Assessment

Predict whether a stapler is magnetic and explain the basis for the prediction. Test the hypothesis. Draw a conclusion.

Resources

See Page 28

Life Sciences

Standard 2: Plants and animals have predictable life cycles. As a basis for understanding this concept, students will:

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

Suggested Concepts and Working Vocabulary

antenna	chrysalis	germination	insect	invertebrate
larva	metamorphosis	proboscis	pupa	reproduce
thorax	vertebrates	variation		

Sample Procedures for Standard 2b

1) Color a large poster of a butterfly.

2) Study the metamorphosis of a butterfly through pictures and text. Name the life stages of a butterfly.

Sample Assessment

Color a diagram of a butterfly. Label the body parts.

Resources

See page 28

Earth Sciences

Standard 3: Earth is made of materials that have distinct properties and provide resources for human activities. As a basis for understanding this concept, students will:

a. know how to compare the physical properties of different kinds of rocks and know that rock is composed of different combinations of minerals.
b. know smaller rocks come from the breakage and weathering of larger rocks.
c. know that soil is made partly from weathered rock and partly from organic materials and that soils differ in their color, texture, capacity to retain water, and ability to support the growth of many kinds of plants.
d. know that fossils provide evidence about the plants and animals that lived long ago and that scientists learn about the past history of Earth by studying fossils.
e. know rock, water, plants, and soil provide many resources, including food, fuel, and building materials, that humans use.

Suggested Concepts and Working Vocabulary

cast	fossil	geology	igneous	metamorphic
mold	paleontology	resource	sedimentary rock	silt
trace fossil	weathering			

Sample Procedures for Standard 3d

1) Show different types of fossils.

2) Make a plaster cast and a mold. Compare and discuss the differences between a cast and a mold.

3) Use puzzle pieces to model the assembly of fossil pieces.

Sample Assessment

Put disarticulated chicken wings in an envelope. Have students assemble the bones in their correct positions.

Resources

See Page 28

Investigation and Experimentation

Standard 4: Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:

a. **make predictions based on observed patterns and not random guessing.**
b. **measure length, weight, temperature, and liquid volume with appropriate tools and express those measurements in standard metric system units.**
c. **compare and sort common objects according to two or more physical attributes (e.g., color, shape, texture, size, weight).**
d. **write or draw descriptions of a sequence of steps, events, and observations.**
e. **construct bar graphs to record data, using appropriately labeled axes.**
f. **use magnifiers or microscopes to observe and draw descriptions of small objects or small features of objects.**
g. **follow oral instructions for a scientific investigation.**

Catholic Values

- Students will be able to demonstrate stewardship imbued with Catholic values in the care of local and global environments. (D)
- Students will be able to identify the relationships between the roles of science, technology, and
- Catholic ethics in the global community. (D)
- Students will be able to compare/describe life from the fossil record with modern life forms and discuss Biblical implications. (I)
- Students will be able to relate concepts of heredity and reproduction to Catholic teaching. (I)
- Students will be able to work cooperatively, and respect each other's ideas, roles, and abilities.(I)

LEGEND: I = Introduce D = Develop E = Expand

GRADE THREE

In order to ensure continuity and mastery throughout the K-8 science curriculum, all standards need to be taught. These standards emphasize the critical components of the science content for this particular grade.

Physical Sciences

Standard 1: Energy and matter have multiple forms and can be changed from one form to another. As a basis for understanding this concept, students will:

a. know energy comes from the Sun to Earth in the form of light.
b. know sources of stored energy take many forms, such as food, fuel, and batteries.
c. know machines and living things convert stored energy to motion and heat.
d. know energy can be carried from one place to another by waves, such as water waves and sound waves, by electric current, and by moving objects.
e. know matter has three forms: solid, liquid, and gas.
f. know evaporation and melting are changes that occur when the objects are heated.
g. know that when two or more substances are combined, a new substance may be formed with properties that are different from those of the original materials.
h. know all matter is made of small particles called atoms, too small to see with the naked eye.
i. know people once thought that earth, wind, fire, and water were the basic elements that made up all matter. Science experiments show that there are more than 100 different types of atoms, which are presented on the periodic table of the elements.

Suggested Concepts and Working Vocabulary

atom compare energy kinetic periodic table potential

Sample Procedures for Standard 1c

Create a pendulum using a paper plate, straw, string, life saver, and play dough. (www.education.com)

Sample Assessment

Explain and give examples of types of energy.

Resources

See Page 28

Standard 2: Light has a source and travels in a direction. As a basis for understanding this concept, students will:

a. know sunlight can be blocked to create shadows.
b. know light is reflected from mirrors and other surfaces.
c. know the color of light striking an object affects the way the object is seen.
d. know an object is seen when light traveling from the object enters the eye.

Suggested Concepts and Working Vocabulary

absorption reflection refraction shadow

Life Sciences

Standard 3: Adaptations in physical structure or behavior may improve an organism's chance for survival. As a basis for understanding this concept, students will:

a. **know plants and animals have structures that serve different functions in growth, survival, and reproduction.**
b. **know examples of diverse life forms in different environments, such as oceans, deserts, tundra, forests, grasslands, and wetlands.**
c. **know living things cause changes in the environment in which they live: some of these changes are detrimental to the organism or other organisms, and some are beneficial.**
d. **know when the environment changes, some plants and animals survive and reproduce; others die or move to new locations.**
e. **know that some kinds of organisms that once lived on Earth have completely disappeared and that some of those resembled others that are alive today.**

Suggested Concepts and Working Vocabulary

adaptation	algae	bacteria	biome	camouflage
consumer	decomposer	extinct	fossil	fungus
lichen	migration	organism	predator	prey
producer	succulent			

Sample Procedures for Standards 3a and 3b

1) Elicit examples of what behaviors help survival.

2) Elicit examples of plant and animal structures that aid survival, e.g., in cacti and other succulents in the desert; in zebra or lion in grasslands.

3) Play a camouflage game using colored circles on large multicolored background.

Sample Assessments

1) Make a bar graph using data obtained in the camouflage game.

2) Analyze data to develop a logical conclusion.

Resources

See page 28

Earth Sciences

Standard 4: Objects in the sky move in regular and predictable patterns. As a basis for understanding this concept, students will:

a. know the patterns of stars stay the same, although they appear to move across the sky nightly, and different stars can be seen in different seasons.
b. know the way in which the Moon's appearance changes during the four-week lunar cycle.
c. know telescopes magnify the appearance of some distant objects in the sky, including the Moon and the planets. The number of stars that can be seen through telescopes is dramatically greater than the number that can be seen by the unaided eye.
d. know that Earth is one of several planets that orbit the Sun and that the Moon orbits Earth.
e. know the position of the Sun in the sky changes during the course of the day and from season to season.

Suggested Concepts and Working Vocabulary

axis	constellation	crescent	eclipse	ellipse
moon	North Star	orbit	phase	revolve
revolution	rotation	satellite	solar and lunar	telescope

Sample Procedures for Standard 4b

1) Create a moon journal.

2) Create a planisphere.

Sample Assessments

1) Describe in a journal what the lunar phases tell us about the location of the Earth, Moon, and Sun.

Resources

See page 28

Investigation and Experimentation

Standard 5: Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:

a. repeat observations to improve accuracy and know that the results of similar scientific investigations seldom turn out exactly the same because of differences in the things being investigated, methods being used, or uncertainty in the observation.

b. differentiate evidence from opinion and know that scientists do not rely on claims or conclusions unless they are backed by observations that can be confirmed.

c. use numerical data in describing and comparing objects, events, and measurements.

d. predict the outcome of a simple investigation and compare the result with the prediction.

e. collect data in an investigation and analyze those data to develop a logical conclusion.

CatholicValues

- Students will be able to demonstrate stewardship imbued with Catholic values in the care of local and global environments. (D)
- Students will be able to identify the relationships between the roles of science, technology, and Catholic ethics in the global community. (D)
- Students will be able to compare/describe life from the fossil record with modern life forms and discuss Biblical implications. (D)
- Students will be able to relate concepts of heredity and reproduction to Catholic teaching. (D)
- Students will be able to work cooperatively, and respect each other's ideas, roles, and abilities. (I)

LEGEND: I = Introduce D = Develop E = Expand

RESOURCES KINDERGARTEN

Physical Science

- Physics for Every Kid, by Janice Van Cleave (1999) "Super Science"
- Scholastic Magazine www.**scholastic**.com/superscience
- TOPS Learning Systems "TopScience" http://topscience.org/
- www.EnchantedLearning.com

Life Science

- Marine Mammal Center, Marin Headlands, www.marinemammalcenter.org/science
- Aquarium of the Bay, 415.623.5376, www.aquariumofthebay.org/
- California academy of Sciences, Discovery Tide Pool, 414.379.8000, wwwcalacademy.org
- GEMS, 510.642.5132, lhsgems.org

RESOURCES GRADE ONE

Physical Science

- http://www.ctnba.org/
- Physics for Every Kid, by Janice Van Cleave
- The Magic School Bus – Science Explorations – Joanna Cole
- www.enchantedlearning.com

Life Science

- Bears, EYEWITNESS (Video)
- Dairy Council of California – www.mealsmatter.org
- GEMS (Great Explorations in Math and Science), Lawrence Hall of Science 510.642.5132, www.lawrencehallofscience.org/gems/
- http://www.ctnba.org/
- http://www.2scholastic.com/browsw/learn.jsp
- Insects, EYEWITNESS (Video)
- Inside the Human Body, The Magic School Buss Series (DVD)
- Marine Mammal Center, Marin Headlands, www.marinemammalcenter.org/science

Earth Science

- 1001 Facts About Earth, Scholastic
- Earth Science for Every Kid, by Janice Van Cleave

- Pacific Gas & Electric Company, www.pge.com.safety and www.pge.com.energenics
- Recycle Rex, Disney Educational (Video) http://dep.disney.go.com/educational/store

RESOURCES GRADE TWO

Physical Science

- Bill Nye the Science Guy: http://bullnye.com (for kids, teachers, home demos)
- Enchanted Learning.com
- Forces Make Things Move (Let's-Read-and-Find-Out Science), by Kimberly Brubaker Bradley
- http://www.ctnba.org/
- Pushing and Pulling, by Gary Gibson
- Science with Magnets, by Helen Edom

Life Science

- Cool Science for Kids – http://www.hhmiorg/coolscience/coolscience/index.html
- Dairy Council of Californa – www.mealsmatter.org
- Enchantedlearning.com
- From Caterpillar to Butterfly (Let's-Read-and-Find-Out Science), by Deborah Heiligman
- From Tadpole to Frog (Let's-Read-and-Find-Out Science), by Wendy Pfeffer
- "Ranger Rick" Magazine, National Wildlife Federation, http://www.nwf.org/kids/

Earth Science

- Earth Science Explorer – http://www.cotf.edu/ete/modules/msese/elevator.html
- Fossils Tell of Long Ago (Let's-Read-and-Find-Out Series), by Aliki
- The Magic School Bus Inside the Earth, by Joanna Cole
- The Fossil Book (Wonders of Creation), by Gary Parker and Mary Parker
- http://www.pge.com/safety
- http://www.pge.com/energenics

RESOURCES GRADE THREE

Physical Science

- Light and Color, by Gary Gibson
- San Francisco Exploratorium and website: http://www.exploratorium.edu
- Snackbook, from the Exploratorium http://www.exploratorium.edu/snacks/

Life Science

- Insects, EYEWITNESS (Video)
- What If Sharks, by Steve Parker
- Deserts, EYEWITNESS (Video)

Earth Science

- http://www.science.sjsu.edu/scied/375/nasaames.html
- What If the Earth, by Steve Parker
- The Magic School Bus Series (DVD)

RELIGIOUS OVERTONES IN INTERMEDIATE (4-5) GRADE SCIENCE

In the intermediate grades, science takes on a more complex aspect. Although the beauty of God's creation is still the foundation, natural processes of life are seen to be the planned thoughtfulness of God. Even in the natural order of things, the Physical, Life, and Earth Sciences show that all of God's creation works in perfect harmony. "Students explore the fact that creatures exist only in dependence on each other, to complete each other, in the service of each other." (Catechism of the Catholic Church 2 #340)

How creation changes through evolution again shows that God is still with us, guiding our ever-changing world. The biblical story of creation is put into the context of today in exhibiting that God's beauty is still unfolding into ultimate perfection in spite of evil (Catechism of the Catholic Church 2 #310).

The concept of stewardship is again emphasized, pointing out our role in caring for creation and using all of what God gave us. Therefore, ecological concerns are addressed within this context of stewardship. As caretakers of the Earth, students have the responsibility of learning to use and protect our resources in ways that will benefit future generations.

GRADE FOUR

In order to ensure continuity and mastery throughout the K-8 science curriculum, all standards need to be taught. The foundational content standards for this grade are indicated in bold. These core standards emphasize the critical components of the science content for this particular grade.

Physical Sciences

Standard 1: Electricity and magnetism are related effects that have many useful applications in everyday life. As a basis for understanding this concept, students will:

- **a. know how to design and build simple series and parallel circuits by using components such as wires, batteries, and bulbs.**
- **b. know how to build a simple compass and use it to detect magnetic effects, including Earth's magnetic field.**
- **c. know electric currents produce magnetic fields and know how to build a simple electromagnet.**
- d. know the role of electromagnets in the construction of electric motors, electric generators, and simple devices, such as doorbells and earphones. e. know electrically charged objects attract or repel each other.
- **f. know that magnets have two poles (north and south) and that like poles repel each other while unlike poles attract each other.**
- g. know electrical energy can be converted to heat, light, and motion.

Suggested Concepts and Working Vocabulary

attraction	battery	circuit	closed path	conductor
electric charges	circuit	current	electrode	insulator
magnetic field	parallel circuit	repulsion	resistance	series circuit
static electricity	voltage	Watt		

Sample Procedures for Standard 1a

1) Diagram series and parallel circuits.
2) Build series and parallel circuits.
3) Construct an electric game board, with a science theme.
4) Build a simple telegraph, and use Morse code to send messages.

Sample Assessments

1) Demonstrate, display, and explain closed and open paths.
2) Make working models of series and parallel circuits. Interrupt the series and parallel circuits, and explain the results.

Resources

See Page 45

Life Sciences

Standard 2: All organisms need energy and matter to live and grow. As a basis for understanding this concept, students will:

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

Standard 3: Living organisms depend on one another and on their environment for survival. As a basis for understanding this concept, students will:

a. know ecosystems can be characterized by their living and nonliving components.
b. know that in any particular environment, some kinds of plants and animals survive well, some survive less well, and some cannot survive at all.
c. know many plants depend on animals for pollination and seed dispersal, and animals depend on plants for food and shelter.
d. know that most microorganisms do not cause disease and that many are beneficial.

Suggested Concepts and Working Vocabulary

accommodations	adaptation	bacteria	biome	carnivore
cell	consumer	decomposer	decomposition	dispersal
ecosystem	energy pyramid	food chain	herbivore	inorganic
microorganism	omnivore	organic	organism	photosynthesis
plankton	pollination	predator	prey	producer
protists	scavenger			

Sample Procedures for Standards 2b, 2c, and 3a

1) Collect organic (e.g. popcorn, bread, cotton) and inorganic materials and bury them in twelve centimeters of soil; observe decomposition after three weeks.

2) Dissect an owl pellet.

3) Construct food chains, food webs, and energy pyramids.

Sample Assessments

1) Create a classroom compost. (See Resource List)

2) Identify and classify the bones discovered in the owl pellet.

3) Compare and contrast food chain, food web, and energy pyramid models.

Resources

See page 45

Earth Sciences

Standard 4: The properties of rocks and minerals reflect the processes that formed them. As a basis for understanding this concept, students will:

a. know how to differentiate among igneous, sedimentary, and metamorphic rocks by referring to their properties and methods of formation (the rock cycle).

b. know how to identify common rock-forming minerals (including quartz, calcite feldspar, mica, and hornblende) and ore minerals by using a table of diagnostic properties.

Standard 5: Waves, wind, water, and ice shape and reshape Earth's land surface. As a basis for understanding this concept, students will:

a. know some changes in the Earth are due to slow processes, such as erosion, and some changes are due to rapid processes, such as landslides, volcanic eruptions, and earthquakes.

b. know natural processes, including freezing and thawing and the growth of roots, cause rocks to break down into smaller pieces.

c. know moving water erodes landforms, reshaping the land by taking it away from some places and depositing it as pebbles, sand, silt, and mud in other places (weathering, transport, and deposition).

Suggested Concepts and Working Vocabulary

deposition	earthquake	epicenter	erosion	fault
glacier	igneous	landform	landslide	lava
magma	metamorphic	mineral	moraine	rock cycle
salinity	sedimentary	seismology	tsunami	volcano
weathering				

Sample Procedures for Standards 4a, 5a, and 5c

1) Using mineral/rock collections, have the students classify and identify the minerals and rocks.
2) Students simulate a rock cycle and complete a rock journal.
3) Research and present findings on how glaciers form and what their effects are on landforms. (www.discoverycube.org)
4) Construct models of landslides, volcanoes, earthquakes, tsunamis, and glaciers.
5) Simulate the forces of erosion, weathering, and deposition by using a stream table.

Sample Assessments

1) Using models, predict, test predictions, and discuss the effects of landslides, volcanoes, earthquakes, tsunamis, and glaciers.
2) Describe/explain the effects of erosion, weathering, and deposition.
3) Classify "unknown" minerals and rocks according to specific physical and chemical attributes/properties.

Resources

See page 45

Investigation and Experimentation

Standard 6: Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:

a. differentiate observation from inference (interpretation) and know scientists' explanations come partly from what they observe and partly from how they interpret their observations.
b. measure and estimate the weight, length, or volume of objects.
c. formulate and justify predictions based on cause-and-effect relationships.
d. conduct multiple trials to test a prediction and draw conclusions about the relationships between predictions and results.
e. construct and interpret graphs from measurements.
f. follow a set of written instructions for a scientific investigation.

Catholic Values

- Students will be able to demonstrate stewardship imbued with Catholic values in the care of local and global environments. (D)
- Students will be able to identify the relationships between the roles of science, technology, and Catholic ethics in the global community. (D)
- Students will be able to compare/describe life from the fossil record with modern life forms and discuss Biblical implications. (D)
- Students will be able to relate concepts of heredity and reproduction to Catholic teaching. (D)
- Students will be able to discuss the theory of evolution in the context of Catholic teaching about the origin of life. (I)
- Students will be able to work cooperatively, and respect each other's ideals, roles, and abilities. (I)

LEGEND: I = Introduce D = Develop E = Expand

GRADE FIVE

In order to ensure continuity and mastery throughout the K-8 science curriculum, all standards need to be taught. The foundational content standards for this grade are indicated in bold. These standards emphasize the critical components of the science content for this particular grade.

Physical Sciences

Standard 1: Elements and their combinations account for all the varied types of matter in the world. As a basis for understanding this concept, students will:

- **a. know that during chemical reactions the atoms in the reactants rearrange to form products with different properties.**
- **b. know all matter is made of atoms, which may combine to form molecules.**
- **c. know metals have properties in common, such as high electrical and thermal conductivity. Some metals, such as aluminum (Al), iron (Fe), nickel (Ni), copper (Cu), silver (Ag), and gold (Au), are pure elements; others, such as steel and brass, are composed of a combination of elemental metals.**
- **d. know that each element is made of one kind of atom and that the elements are organized in the periodic table by their chemical properties.**
- e. know scientists have developed instruments that can create discrete images of atoms and molecules that show that the atoms and molecules often occur in well-ordered arrays.
- **f. know differences in chemical and physical properties of substances are used to separate mixtures and identify compounds.**
- **g. know properties of solid, liquid, and gaseous substances, such as sugar ($C_6H_{12}O_6$), water (H_2O), helium (He), oxygen (O_2), nitrogen (N_2), and carbon dioxide (CO_2).**
- h. know living organisms and most materials are composed of just a few elements.
- i. know the common properties of salts, such as sodium chloride (NaCl).

Suggested Concepts and Working Vocabulary

alloys	atomic number	chain reaction	chemical change	chemical symbol
compound	conductivity	electron	freezing point	mass
metal	mixture	molecule	neutron	nonmetal
physical change	property	proton	reaction	

Sample Procedure for Standard 1a

Recall for students that physical changes can be reversed, but chemical changes cannot, because the atoms have been rearranged. Then make "goop": fill half a bucket with white glue, fill remainder with a 5% borax solution. Describe the properties of each ingredient; then describe the properties of the product.

Sample Assessment

Give another example of chemical change. Explain how you know this is a chemical change.

Resources

See page 45

Life Sciences

Standard 2: Plants and animals have structures for respiration, digestion, waste disposal, and transport of materials. As a basis for understanding this concept, students will:

a. know many multi-cellular organisms have specialized structures to support the transport of materials.
b. know how blood circulates through the heart chambers, lungs, and body and how carbon dioxide (CO_2) and oxygen (O_2) are exchanged in the lungs and tissues.
c. know the sequential steps of digestion and the roles of teeth and the mouth, esophagus, stomach, small intestine, large intestine, and colon in the function of the digestive system.
d. know the role of the kidney in removing cellular waste from blood and converting it into urine, which is stored in the bladder.
e. know how sugar, water, and minerals are transported in a vascular plant.
f. know plants use carbon dioxide (CO_2) and energy from sunlight to build molecules of sugar and release oxygen.
g. know plant and animal cells break down sugar to obtain energy, a process resulting in carbon dioxide (CO_2) and water (respiration).

Suggested Concepts and Working Vocabulary

bladder	circulatory	CO_2	colon	digestive
esophagus	excretory	heart chamber	multi-cellular	nervous system
organ system	phloem	photosynthesis	respiratory	skeleton-muscular
unicellular tissue	xylem			

Sample Procedure for Standards 2b, 2c, and 2d

Divide the class into five body systems. Direct each group to present a skit and/or poster presentation of their system.

Sample Assessment

After your group's presentation, answer questions posed by the class and the teacher, to demonstrate your knowledge and understanding of your group's body system.

Resources

See page 45

Earth Sciences

Standard 3: Water on Earth moves between the oceans and land through the processes of evaporation and condensation. As a basis for understanding this concept, students will:

a. know most of Earth's water is present as salt water in the oceans, which cover most of Earth's surface.
b. know when liquid water evaporates, it turns into water vapor in the air and can reappear as a liquid when cooled or as a solid if cooled below the freezing point of water.
c. know water vapor in the air moves from one place to another and can form fog or clouds, which are tiny droplets of water or ice, and can fall to Earth as rain, hail, sleet, or snow.
d. know that the amount of fresh water located in rivers, lakes, underground sources, and glaciers is limited and that its availability can be extended by recycling and decreasing the use of water.
e. know the origin of the water used by their local communities.

Standard 4: Energy from the Sun heats Earth unevenly, causing air movements that result in changing weather patterns. As a basis for understanding this concept, students will:

a. **know uneven heating of Earth causes air movements (convection currents).**
b. **know the influence that the ocean has on the weather and the role that the water cycle plays in weather patterns.**
c. **know the causes and effects of different types of severe weather.**
d. **know how to use weather maps and data to predict local weather and know that weather forecasts depend on many variables.**
e. **know that the Earth's atmosphere exerts a pressure that decreases with distance above Earth's surface and that at any point it exerts this pressure equally in all directions.**

Standard 5: The solar system consists of planets and other bodies that orbit the Sun in predictable paths. As a basis for understanding this concept, students will:

a. **know the Sun, an average star, is the central and largest body in the solar system and is composed primarily of hydrogen and helium.**
b. **know the solar system includes the planet Earth, the Moon, the Sun, eight other planets and their satellites, and smaller objects, such as asteroids and comets.**
c. **know the path of a planet around the Sun is due to the gravitational attraction between the Sun and the planet.**

Suggested Concepts and Working Vocabulary

asteroid	comet	condensation	convection	current
evaporation	glacier	groundwater	hail	inference
planet	point source	precipitation	sleet	solar
satellite	system	water cycle	water vapor	

Sample Procedures for Standards 3b and 3c

1) Demonstrate each part of the water cycle.

2) Have students diagram and annotate a water cycle chart.

Sample Assessment

Use *precipitation*, *condensation*, *evaporation*, and *groundwater* in an expository paragraph about the water cycle.

Resources

See Page 46

Investigation and Experimentation

Standard 6: Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:

a. **classify objects (e.g., rocks, plants, leaves) in accordance with appropriate criteria.**
b. **develop a testable question.**
c. **plan and conduct a simple investigation based on a student-developed question and write instructions others can follow to carry out the procedure.**
d. **identify the dependent and controlled variables in an investigation.**
e. **identify a single independent variable in a scientific investigation and explain how this variable can be used to collect information to answer a question about the results of the experiment.**
f. **select appropriate tools (e.g., thermometers, meter sticks, balances, and graduated cylinders) and make quantitative observations.**
g. **record data by using appropriate graphic representations (including charts, graphs, and labeled diagrams) and make inferences based on those data.**
h. **draw conclusions from scientific evidence and indicate whether further information is needed to support a specific conclusion.**
i. **write a report of an investigation that includes conducting tests, collecting data or examining evidence, and drawing conclusions.**

Suggested Concepts and Working Vocabulary

conclusion	controlled experiment	dependent variable	independent variable
inference	qualitative	quantitative	scientific method

Catholic Values

- Students will be able to demonstrate stewardship imbued with Catholic values in the care of local and global environments. (E)
- Students will be able to identify the relationships between the roles of science, technology, and Catholic ethics in the global community. (D)
- Students will be able to compare/describe life from the fossil record with modern life forms and discuss Biblical implications. (D)
- Students will be able to relate concepts of heredity and reproduction to Catholic teaching. (D)

- Students will be able to discuss the theory of evolution in the context of Catholic teaching about the origin of life. (D)
- Students will be able to work cooperatively, and respect each other's ideas, roles, and abilities.(I)

LEGEND: I = Introduce D = Develop E = Expand

RESOURCES GRADE FOUR

Physical Science

Everyday Science: Real Life Activities, by John M. Scott (1995)
Odyssey Magazine, Cobblestone Press http://www.cobblestonepub.com
San Francisco Exploratorium and website: http://www.exploratorium.edu
Snackbook, from the Exploratorium http://www.exploratorium.edu/snacks/

Life Science

California School Garden Network: www.scgn.org
Dinosaur & Prehistoric Life/Fish & Shark/Amphibian & Reptile/Cat & Dog,
EYEWITNESS (DVD)
The Great Kapok Tree, by Lynne Cherry, Harcourt Brace 1990
The Jungles, EYEWITNESS (Video)

Earth Science

Rocks and Minerals, by Steve Parker and Peter Vessiher
Rocks and Minerals, EYEWITNESS (DVD
Stories in Stone, Lawrence Hall of Science, GEMS series
www.sciencepot.net

RESOURCES GRADE FIVE

Physical Sciences

Exploring the World of Chemistry, by George Burns
Current Science, Weekly Reader Magazine www.**weeklyreader**.com
Science World, Scholastic Magazine www.**scholastic**.com/**scienceworld**
Making Things Change, by Gary Gibson
Scienceworks, Ontario Science Centre

Life Science

Amazing Body, National Geographic (DVD)
Blood and Guts, by Linda Allison
The Body Book, by Sara Stein
The Incredible Machine, National Geographic (Video)

Earth Science

Finite Oceans, Discovery Channel (Video)
Hurricanes and Typhoons, by Jen Green
Letting Swift River Go By, Jane Yolen
Starry Messenger, Galileo Galilei, by Peter Sis

RELIGIOUS OVERTONES IN MIDDLE SCHOOL (Grades 6-8) SCIENCE

In the middle grades, curricular content becomes of prime importance as students continue to increase their scientific literacy. Students explore science topics that relate to the structure and function of organisms, ecology, evolution, and biodiversity. These topics should align with church teachings and should guide the development of the student's moral compass. Reinforcing God's grace and presence teaches students to have the utmost respect for all of God's creatures and creation. This should be demonstrated by their actions and incorporated into their personal belief systems. "Consequently, methodical research in all branches of knowledge, provided it is carried out in a truly scientific manner and does not override moral laws, can never conflict with the faith, because the things of the world and the things of faith derive from the same God. The humble and persevering investigator of the secrets of nature is being led, as it were, by the hand of God in spite of himself, for it is God, the conserver of all things, who made them what they are." x

Students are dynamic in their growth and development. Their personal choices begin to define both who they are and what they are becoming physically, socially, and emotionally. Instilling a sense of health and well-being within students should be integral to the science curriculum. This should establish a foundation for ethical decision-making skills as students become increasingly independent. Students should exercise good judgment as knowledge is put into practice. "The virtue of temperance disposes us to avoid every kind of excess: the abuse of food, alcohol, tobacco, or medicine. Those incur grave guilt who, by drunkenness or love of speed, endanger their own and other's safety on the road, at sea, or in the air." (Catechism of the Catholic Church 2290 Part III)

As students become active members of the world community, it is essential that a connection between faith and science be cultivated. Students constantly challenge and are challenged by the world around them. They become ever more aware of the global diversity of beliefs, opinions, and lifestyles. It is important to cement a foundation in faith so that students are increasingly compassionate and reasonable in their decision-making. "Faith and science: "Though faith is above reason, there can never be any real discrepancy between faith and reason. Since the same God who reveals mysteries and infuses faith has bestowed the light of reason on the human mind, God cannot deny himself, nor can truth ever contradict truth." (Catechism of the Catholic Church 159 Part I)

GRADE SIX
Focus on Earth Science

In order to ensure continuity and mastery throughout the K-8 science curriculum, all standards need to be taught. The foundational content standards for this grade are indicated in bold. These standards emphasize the critical components of the science content for this particular grade.

Earth science includes interconnected fields of study which focus on the solid Earth, the ocean, the atmosphere, and objects in space. Scientific disciplines in Earth science include geology, meteorology, astronomy, oceanography, paleontology, seismology, volcanology, and ecology.

An exploration and understanding of Earth science combines the structural features of the Earth and the rest of the universe, the processes which explain how these structural features arose, and the interrelatedness between the solid Earth, water, and energy. An understanding and appreciation of Earth's structure, composition, processes, cycles, and history are important components as well.

Plate Tectonics and Earth's Structure

Standard 1: Plate tectonics accounts for important features of the Earth's surface and major geologic events. As a basis for understanding this concept, students will know:

- **a. evidence of plate tectonics is derived from the fit of the continents; the location of earthquakes, volcanoes, and mid-ocean ridges; and the distribution of fossils, rock types, and ancient climatic zones.**
- **b. Earth is composed of several layers: a cold, brittle lithosphere; a hot, convecting mantle; and a dense, metallic core.**
- **c. lithospheric plates that are the size of continents and oceans move at rates of centimeters per year in response to movements in the mantle.**
- **d. earthquakes are sudden motions along breaks in the crust called faults, and volcanoes and fissures are locations where magma reaches the surface.**
- **e. major geologic events, such as earthquakes, volcanic eruptions, and mountain building, result from plate motions.**
- **f. how to explain major features of California geology (including mountains, faults, and volcanoes) in terms of plate tectonics.**
- **g. how to determine the epicenter of an earthquake and that the effects of an earthquake on any region vary, depending on the size of the earthquake, the distance from the epicenter, the local geology, and the type of construction in the region.**

Suggested Concepts and Working Vocabulary

- **Plate tectonics**
  continental drift, convection, fit of continents, plate boundaries (converging, diverging, transform), seafloor spreading, subduction

- **Composition of the Earth**
  crust, lithosphere, mantle, inner and outer core

- **Major geological features and their locations relative to plate boundaries**
  faults, mid-ocean ridges, mountain ranges, trenches, volcanoes

- **Earthquakes**
  epicenter, faults (normal; reverse or thrust; strike-slip or transform), focus, magnitude, seismic waves, seismograph, shadow zone

Sample Procedure for Standard 1g

Provide students with seismographic records from three different cities, for the same earthquake. Use S-P time lag to calculate distance of each city from epicenter. Then on a map draw a circle around each city. (Circle should have city in center and should have radius equal to distance between city and epicenter.) Based on overlap of the 3 circles, determine the epicenter.

Sample Assessment

Give students a geologic map of the greater Bay Area (available from http://earthquake.usgs.gov). Assess the students' knowledge of the geologic history of earthquakes in the greater Bay Area and their understanding of the causes and frequency of these quakes.

Resources

See Page 92

Shaping the Earth's Surface

Standard 2: Topography is reshaped by the weathering of rock and soil and by the transportation and deposition of sediment. As a basis for understanding this concept, students will know:

a. water running downhill is the dominant process in shaping the landscape, including California's landscape.
b. rivers and streams are dynamic systems that erode, transport sediment, change course, and flood their banks in natural and recurring patterns.
c. beaches are dynamic systems in which sand is supplied by rivers and moved along the coast by wave action.
d. earthquakes, volcanic eruptions, landslides, and floods change human and wildlife habitats.

Suggested Concepts and Working Vocabulary

- **Topographic maps**
  contour lines, elevation, landforms, relief, scale, topography

- **Flowing water**
  erosion, flood plain, transportation and deposition of sediment, water cycle, watershed, weathering of rock, role of wave action in shoreline deposition and erosion

Sample Procedure for Standard 2b

Use a store-bought stream-table or a deep-sided, plastic paint tray to demonstrate erosion and deposition. Slightly raise one end of the tray by stacking books or blocks under it. Press sand or soil into upper third of tray, leveling the sand with a ruler. Set two long rulers or pieces of wood side-by-side across the top end of the tray, leaving a gap between the rulers. Set a water-filled Styrofoam cup over the cap on the rulers. Have students predict the path of the water channel. Then, to start the water flowing down the "hillside", use a sharp instrument or pencil to poke a hole at the bottom of the cup. Observe and record the action and path of the water on the soil. Observe and record the pattern of the deposited sediment at the edge of the soil.

Sample Assessments

1) To accompany erosion and deposition demonstration: Have students prepare an analysis of the water action, proposing explanations for the specific path of the water stream, the width, and/or the depth. Then have students propose how they could prevent or slow the process of erosion on the simulated "hillside".

2) Scenario: A lumber company wants to cut down all of the trees on a hillside. What would be the effect on the hill and on a nearby river, streams, and watershed? What might happen to the face of the hillside? Could this affect any other plant or animal life? Are there any special directions that should be given to the lumber company to help preserve the hillside?

Resources

See page 92

Heat (Thermal Energy) (Physical Science)

Standard 3: Heat moves in a predictable flow from warmer objects to cooler objects until all the objects are at the same temperature. As a basis for understanding this concept, students will know:

a. energy can be carried from one place to another by heat flow, by waves including water, light, and sound waves, or by moving objects.
b. when fuel is consumed, most of the energy released becomes heat energy.
c. heat flows in solids by conduction (which involves no flow of matter) and in fluids by conduction and by convection (which involves flow of matter).
d. heat energy is also transferred between objects by radiation; radiation can travel through space.

Suggested Concepts and Working Vocabulary

- **Heat**

heat, temperature, thermal energy

- **Transfer of energy**

  conduction, convection, insulation, radiation

Sample Procedure for Standard 3c

Demonstration of convection: Provide students with two jars, one large and the other small enough to fit inside the larger jar with room to spare. Fill the smaller jar with hot, colored water. Cover the jar with a piece of aluminum foil, and secure with a rubber band. Lower the jar into the other jar which had already been filled with cold water. Using a sharp pencil, puncture the aluminum foil. Predict the movement of the hot water. Observe and record the movement of the less dense, hot water as it rises and spreads out in the colder water, in a convection loop. Have the students draw the pattern of movement.

Sample Assessment

Have students conduct investigations on conduction and convection, perhaps focusing on how to prevent energy from transferring to an ice cube. Have students report hypothesis, observations, results, and conclusions.

Resources

See page 92

Energy in the Earth System

Standard 4: Many phenomena on the Earth's surface are affected by the transfer of energy through radiation and convection currents. As a basis for understanding this concept, students will know:

a. the sun is the major source of energy for phenomena on the Earth's surface; it powers winds, ocean currents, and the water cycle.
b. solar energy reaches Earth through radiation, mostly in the form of visible light.
c. heat from Earth's interior reaches the surface primarily through convection.
d. convection currents distribute heat in the atmosphere and oceans.
e. differences in pressure, heat, air movement, and humidity result in changes of weather.

Suggested Concepts and Working Vocabulary

- **Earth**
  convection, magma, pressure, radioactivity

- **Ocean**
  convection, Coriolis effect, deep currents, surface currents

- **Weather**
  atmospheric pressure, convection, Coriolis effect, humidity, wind

- **Climate**
  climate zones, global warming, greenhouse effect, microclimate

Sample Procedure for Standard 4b

Demonstration of the relationship between heat radiation and distance from the source: Place heat source (hot plate, candle, or incandescent light bulb) on a table. Use a thermometer to measure the radiant heat at different distances away from this heat source. Have students draw a line graph of temperature versus distance.

Sample Assessment

Have students produce posters that illustrate how different forms of energy transfer, such as radiation and convection, relate to weather.

Resources

See page 92

Ecology (Life Science)

Standard 5: Organisms in ecosystems exchange energy and nutrients among themselves and with the environment. As a basis for understanding this concept, students will know:

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

Suggested Concepts and Working Vocabulary

- **Ecosystem**

  abiotic factors, community, consumer, decomposer, habitat, niche, population, producer

- **Food web**

  carnivore, chlorophyll, energy pyramid, food chain, food web, herbivore, omnivore, photosynthesis, scavenger

Sample Procedures for Standards 5a and 5e

1) Using a drinking straw, exhale a good quantity of air into a cup of bromothymol blue solution. (The CO_2 should turn the solution greenish-yellow.) Divide the solution into three test tubes. Leave one tube as the control. Put a sprig of Elodea in the second tube. Put a sprig of Elodea in the third tube, and wrap this tube with aluminum foil to prevent any light from entering the tube. Set all three tubes under an indoor direct light source (a lamp) overnight. Examine the tubes the next day. The control tube and the foil-covered tube should remain the same color. The uncovered tube with Elodea should turn back to blue, since the Elodea was able to use the light energy and the CO_2 in photosynthesis.

2) Have the students stand in a circle. Each student represents a different species. Pass a ball of yarn or string among the students, connecting each person to his/her "predator". (The yarn can crisscross among the students.) Each student should hold onto the yarn section until everyone is connected. Then select one student's yarn position and cut the yarn. (This means that the organism met with disaster, and may be near extinction.) Immediately, two other students will be affected because their yarn is no longer connected. Decide which of these two "organisms" has lost its food supply, and then cut their yarn also. Through this activity, students can see the interdependency of living things in the food web.

3) Biomes Power Point presentation – sample instructions and rubric can be found at
   cfbstaff.cfbisd.edu/bramhalla/TCEA/Science/Diomes/BiomeDirections.doc

4) Biome group project – sample instructions and rubric can be found at
   http://pleasanton.k12.ca.us/avhsweb/ogle/Biology/notes/BIOMEGROUPPROJECT.htm

Sample Assessments

1) Have students explain the results of the Elodea/bromothymol activity.

2) Have students construct a food web showing the different feeding levels.

3) Scenario: The American bald eagle is on the endangered species list. What has happened to the food chain as the bald eagle population has decreased?

4) Scenario: A large farming operation has just purchased 100 acres of grassland. They plan to use the acres for farming and want to get rid ot the gophers. What might happen to the other members of the food web if they poison the gophers?

Resources

See Page 92

Resources

Standard 6: Sources of energy and materials differ in amounts, distribution, usefulness, and the time required for their formation. As a basis for understanding this concept, students will know:

a. the utility of energy sources is determined by factors that are involved in converting these sources to useful forms and the consequences of the conversion process.

b. different natural energy and material resources, including air, soil, rocks, minerals, petroleum, fresh water, wildlife, and forests, and how to classify them as renewable or nonrenewable.

c. the natural origin of the materials used to make common objects.

Suggested Concepts and Working Vocabulary

- **Natural resources**
  nonrenewable, renewable

- **Energy resources**
  fossil fuels, geothermal energy, hydroelectric energy, nuclear energy, solar energy, wind energy

Sample Procedures for Standards 6b and 6c

1) Use computer, adding machine tape, or butcher paper to construct a geologic timeline. Show the time when the fossils (which are today's fossil fuels) were first laid down, during the Cambrian Period about 600 million years ago. This will provide a sense of the immense length of time required to form and accumulate fossil fuels.
2) Have the students choose an object: cement, quartz watch, salt, brick, cast iron, or aluminum can. Then have them re-trace the steps and energy required to obtain the required resources and to produce this object from its original mineral source.

Sample Assessments

1) Have students research a fossil fuel used in daily life. Where does this fossil fuel come from? What were the consumption rates of this fuel before and after the Industrial Revolution?

2) Have students research an alternative to the use of fossil fuel, focusing on the pros and cons of this alternative energy source. Then have the students present their research results creatively: poster, skit, PowerPoint presentation, rap song.

Resources

See page 92

Investigation and Experimentation

Standard 7: Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:

a. develop a hypothesis.
b. select and use appropriate tools and technology (including calculators, computers, balances, spring scales, microscopes, and binoculars) to perform tests, collect data, and display data.
c. construct appropriate graphs from data and develop qualitative statements about the relationships between variables.
d. communicate the steps and results from an investigation in written reports and oral presentations.
e. recognize whether evidence is consistent with a proposed explanation.
f. read a topographic map and a geologic map for evidence provided on the maps, and construct and interpret a simple scale map.
g. interpret events by sequence and time from natural phenomena (e.g., relative ages of rocks and intrusions).
h. identify changes in natural phenomena over time without manipulating the phenomena (e.g., a tree limb, a grove of trees, a stream, a hillslope).

Suggested Concepts and Working Vocabulary

- **Scientific method**
  problem, hypothesis, materials, procedures, variable, control, results or data, conclusion

Scientists

- **Continental drift**
  Alfred Wegener
- **Earthquakes**
  Charles Richter

Catholic Values

- Students will be able to demonstrate stewardship imbued with Catholic values in the care of local and global environments. (E)
- Students will be able to identify the relationships between the roles of science, technology, and Catholic ethics in the global community. (E)
- Students will be able to compare/describe life from the fossil record with modern life forms and discuss Biblical implications. (E)
- Students will be able to relate concepts of heredity and reproduction to Catholic teaching. (D)
- Students will be able to discuss the theory of evolution in the context of Catholic teaching about the origin of life. (D)
- Students will be able to work cooperatively, and respect each other's ideas, roles, and abilities.(I)

LEGEND: I = Introduce D = Develop E = Expand

GRADE SEVEN
Focus on Life Science

In order to ensure continuity and mastery throughout the K-8 science curriculum, all standards need to be taught. The foundational content standards for this grade are indicated in bold. These standards emphasize the critical components of the science content for this particular grade.

The structure and organization of all things (living and non-living) develop from the same basic properties of matter and energy: particles joined by energy into atoms, which then bond in predictable patterns as molecules. Some of these molecules became organized into spherical systems in ways that allowed them to duplicate themselves and to lay the foundation for reproduction. This led to the development of the cell, the smallest unit of life.

Genetic information within individuals is chemically decoded and expressed during development. There are approximately 30,000 human genes, which are sections of the long DNA molecules. These genes are expressed in different combinations in different tissues of the body as a result of experience. In this sense, nature and nurture are connected, allowing individuals to grow guided by a combination of genetic inheritance and nurture.

Raw material for evolution by natural selection is continually provided by mutations, a few of which result in variations in a species which allow individuals to better adapt to their environment. The rock record provides evidence of change in living things and in the environment over billions of years.

Cell Biology

Standard 1: All living organisms are composed of cells, from just one to many trillions, whose details usually are visible only through a microscope. As a basis for understanding this concept, students will know:

- **a. cells function similarly in all living organisms.**
- **b. the characteristics that distinguish plant cells from animal cells, including chloroplasts and cell walls.**
- **c. the nucleus is the repository for genetic information in plant and animal cells.**
- **d. mitochondria liberate energy for the work that cells do, and chloroplasts capture sunlight energy for photosynthesis.**
- **e. cells divide to increase their numbers through a process of mitosis, which results in two daughter cells with identical sets of chromosomes.**
- **f. as multicellular organisms develop, their cells differentiate.**

Suggested Concepts and Working Vocabulary

- **Cell structure**
  cell membrane, cytoplasm, nucleus, nuclear membrane, chromosome, mitochondria, cell wall, chloroplasts, vacuole

- **Cellular metabolism**
  respiration, photosynthesis

- **Cellular organisms**
  prokaryote, eukaryote, differentiation

- **Cell division**
  mitosis

Sample Procedures for Standards 1b and 1e

1) After students are familiar with the microscope and how to use it, view prepared slides of plant and animal cells. Have students observe the slides, drawing what they see under the microscope. Students should label the parts of the cell in their drawing. If available, have the students view prepared slides of mitosis as an extension of this activity.

2) Cell webquest – a sample webquest can be found at http://meny.weebly.com/cell-webquest.html

Sample Assessments

1) Identify parts of the cell on a diagram or model.

2) Construct a Venn diagram to demonstrate the similarities and differences between plant and animal cells.

Resources

See page 92

Genetics

Standard 2: A typical cell of any organism contains genetic instructions that specify its traits. Those traits may be modified by environmental influences. As a basis for understanding this concept, students will know:

a. the differences between the life cycles and reproduction methods of sexual and asexual organisms.
b. sexual reproduction produces offspring that inherit half their genes from each parent.
c. an inherited trait can be determined by one or more genes.
d. plant and animal cells contain many thousands of different genes and typically have two copies of every gene. The two copies (or alleles) of the gene may or may not be identical, and one may be dominant in determining the phenotype while the other is recessive.
e. DNA (deoxyribonucleic acid) is the genetic material of living organisms and is located in the chromosomes of each cell.

Suggested Concepts and Working Vocabulary

- **Reproduction**
  asexual reproduction, sexual reproduction, meiosis

- **Inheritance**
  gene, allele, genotype, phenotype, trait, dominant, recessive, probability, Punnett square

- **Genetic material in the cell**
  DNA and its structure, chromosome, genome

Sample Procedures for Standards 2b, 2d, and 2e

1) Family tree of traits: For a particular trait (such as tongue rolling ability, ear lobe attachment, hair on middle segment of finger), have students collect information from as many family members as possible, including at least three generations. Based on the phenotypes, determine the genotype of each individual in the family.

2) Have the students model the process of meiosis: using yarn, create one pair of long chromosomes and one pair of short chromosomes. Use yarn of one color for the "maternal" chromosome in each pair, and use yarn of a different color for the "paternal" chromosome in each pair. Using a paper plate as the cell, have the students manipulate the chromosomes through the phases of meiosis. The resulting cells should each have one long chromosome and one short chromosome, half the number of chromosomes as the original cell.

3) Construct a 3D model of the DNA molecule, using such materials as licorice whips, toothpicks, pipe cleaners, and/or paper clips.

4) Provide pairs of students with color-coded puzzle pieces representing the four nucleotide bases (A,T,G,C). Design the puzzle pieces such that A will only fit with T, and C will only fit with G. Then give the students the sequence of one DNA strand: A A T C G G T A C. Have the students then use the puzzle pieces to build the double-stranded DNA molecule.

Sample Assessments

1) Scenario: A person exhibits the recessive form of a trait. What is the person's genotype? What are the possible genotypes for the parents of this individual? Conversely, if a person exhibits the dominant form of a trait, what is the person's genotype? What are the possible genotypes of the parents?

2) Give the students the base sequence from one DNA strand. Ask them to determine the base sequence of the complementary strand.

Resources

See page 92

Evolution

Standard 3: Biological evolution accounts for the diversity of species developed through gradual processes over many generations. As a basis for understanding this concept, students will know:

a. both genetic variation and environmental factors are causes of evolution and diversity of organisms.
b. the reasoning used by Charles Darwin in reaching his conclusion that natural selection is the mechanism of evolution.
c. how independent lines of evidence from geology, fossils, and comparative anatomy provide the bases for the theory of evolution.
d. how to construct a simple branching diagram to classify living groups of organisms by shared derived characteristics and how to expand the diagram to include fossil organisms.
e. extinction of a species occurs when the environment changes and the adaptive characteristics of a species are insufficient for its survival.

Suggested Concepts and Working Vocabulary

- **Evolution**
  adaptation, mutation, diversity, genetic variation, extinction
- **Mechanism for evolution**
  natural selection, competition, habitat
- **Evidence for evolution**
  fossil record, comparative embryology, comparative anatomy
- **Classification**
  five kingdoms of life, taxonomy, genus, species

Sample Procedure for Standards 3a and 3b

Divide the class into 5 or 6 equally-sized groups, each of which is to be assigned a particular type of "bird beak": drinking straw, clothespin, pencil, skewer, spoon, tweezer. Each member of the group will be given their assigned type of beak to use to pick up "bird food". Scatter food (such as Cheerios, Kix, or cat food) on the ground. Give the "birds" 45 seconds to pick up food with their beak. Have each group count total pieces of food picked up. Which beaks were best adapted to the environment?

Sample Assessment

For the "bird beak" activity: if the food supply remained as it was in the activity, how would the frequency of each beak type in the population change over time? Predict what would happen to the bird population if there was a flood which washed away all the food, leaving sugar water as the only energy source.

Resources

See page 92

Earth and Life History (Earth Science)

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

a. Earth processes today are similar to those that occurred in the past, and slow geologic processes have large cumulative effects over long periods of time.
b. the history of life on Earth has been disrupted by major catastrophic events, such as major volcanic eruptions or the impacts of asteroids.
c. the rock cycle includes the formation of new sediment and rocks, and rocks are often found in layers, with the oldest generally on the bottom.
d. evidence from geologic layers and radioactive dating indicates the Earth is approximately 4.6 billion years old and life on this planet has existed for more than 3 billion years.
e. fossils provide evidence of how life and environmental conditions have hanged.
f. how movements of Earth's continental and oceanic plates through time, with associated changes in climate and geographic connections, have affected the past and present distribution of organisms.
g. how to explain significant developments and extinctions of plant and animal life on the geologic time scale.

Suggested Concepts and Working Vocabulary

- **Geologic processes**
  rock cycle, geologic layers, Theory of Uniformitarianism

- **Geologic time scale**
  age of the Earth, mass extinction, era, period, epoch

- **Fossil and rock dating**
  relative dating, absolute dating, radioactive decay

- **Past and present distribution of living things**
  climate change, plate tectonics

Sample Procedure for Standard 4d and 4g

Have students construct a geologic time line to scale, using the context of a 1000 page book. If page 1 is when the Earth was formed, on what page did the first cell form? On which pages did the dinosaurs live? On which pages would one find the Jurassic Period? On which page did humans arise?

Sample Assessment

Introduce the term *anachronism*. In the context of the geologic time scale, produce hypothetical examples, in which one event is out of historical order. Challenge the student to spot the anachronism, explaining what the proper time sequence in the example should be.

Resources

See page 93

Structure and Function in Living Systems

Standard 5: The anatomy and physiology of plants and animals illustrate the complementary nature of structure and function. As a basis for understanding this concept, students will know:

a. plants and animals have levels of organization for structure and function, including cells, tissues, organs, organ systems, and the whole organism.
b. organ systems function because of the contributions of individual organs, tissues, and cells. The failure of any part can affect the entire system.
c. how bones and muscles work together to provide a structural framework for movement.
d. how the reproductive organs of the human female and male generate eggs and sperm, and how sexual activity may lead to fertilization and pregnancy.
e. the function of the umbilicus and placenta during pregnancy.
f. the structures and processes by which flowering plants generate pollen, ovules seeds, and fruit.
g. how to relate the structures of the eye and ear to their functions.

Suggested Concepts and Working Vocabulary

- **Organ systems**
  anatomy, physiology

- **Animal movement**
  skeleton, skeletal muscles, muscle pairs, joints, tendons, ligaments

- **Sense organs**
  eye: parts of the eye, changing pupil size, color vision
  ear: parts of the ear, hearing, balance

- **Reproduction in humans**
  eggs, embryo, fertilization, fetus, meiosis, menstrual cycle, ovary, parts of the male and female reproductive systems, placenta, sex hormones, sperm, testis, umbilical cord, uterus

- **Reproduction in flowering plants**
  reproductive parts of the flower, pollen, ovule, pollination, fertilization, seed, embryo, fruit, germination

Sample Procedures for Standards 5a, 5b, 5c, 5d, 5f, and 5g

Have students dissect one or more of the following: a flower (such as tiger lily), a seed (such as lima bean), cow eye, and chicken wing. Some more elaborate "virtual" dissections are available online.

Sample Assessment

Have students identify specific parts of a dissected flower or seed, and describe the functions of each identified part.

Resources

See page 93

Physical Principles in Living Systems (Physical Science)

Standard 6: Physical principles underlie biological structures and functions. As a basis for understanding this concept, students will know:

a. visible light is a small band within a very broad electromagnetic spectrum.
b. for an object to be seen, light emitted by or scattered from it must be detected by the eye.
c. light travels in straight lines except when the medium it travels through changes.
d. how simple lenses are used in a magnifying glass, the eye, a camera, a telescope, and a microscope.
e. white light is a mixture of many wavelengths (colors), and that retinal cells react differently to different wavelengths.
f. light can be reflected, refracted, transmitted, and absorbed by matter.
g. the angle of reflection of a light beam is equal to the angle of incidence.
h. how to compare joints in the body (wrist, shoulder, thigh) with structures used in machines and simple devices (hinge, ball-and-socket, and sliding joints).
i. how levers confer mechanical advantage and how the application of this principle applies to the musculoskeletal system.
j. contractions of the heart generate blood pressure, and heart valves prevent backflow of blood in the circulatory system.

Suggested Concepts and Working Vocabulary

- **Electromagnetic spectrum**
  visible light, white light, ultraviolet, infrared

- **Path of light waves**
  reflection, angle of incidence, scattering, refraction, refractive index, absorption

- **Lenses**
  convex lens, concave lens, focal point, magnification

- **Joints, compared to mechanical devices**
  sliding joint, hinge joint, ball-and-socket joint

- **Mechanics of muscles and bones, compared to levers**
  fulcrum, load, resistance, mechanical advantage

- **Blood pressure**
  blood flow through the heart, valves, heart beat, contraction, arterial blood pressure, systolic, diastolic

Sample Procedures for Standards 6c, 6d, and 6f

1) Distribute a concave and a convex lens to each group of four students. Elicit observations about how the shape of the lens affects the image.

2) Ask how many students are nearsighted or farsighted. Sketch what's going on. Ask how corrective lenses could fix the problem. Sketch what's going on. What kind of lens (concave or convex) would enable the image to focus on the retina in a nearsighted person? What about in a farsighted person?
3) EMS webquest – a sample webquest can be found at learn.shorelineschools.org/shorecrest/lchi/documents/ems_webquest.pdf

Sample Assessment

You're the doctor! First of all, Jack can't see the board unless he has a front row seat. Show him the sort of lens you'd prescribe, and explain why. Then, Jill says she can see the board from anywhere in the room, but she gets headaches when she reads and the print gets blurry. Show her the sort of lens you'd prescribe, and explain why.

Resources

See page 93

Investigation and Experimentation

Standard 7: Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:

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

Suggested Concepts and Working Vocabulary

- **Light microscope**
  parts of the microscope, total magnification

Sample Assessment

Have students qualify for a "microscope license" by demonstrating proficiency, and by being able to clearly focus under both low and high power.

Scientists

- **Cell**
  Robert Hooke, Antonie van Leeuwenhoek, Matthias Schleiden, Theodor Schwann

- **Inheritance**
  Gregor Mendel, Rosalind Franklin, Barbara McClintock, James Watson, Francis Crick

- **Evolution**
  Charles Darwin, Alfred Wegener, Luis Alvarez

- **Taxonomy**
  Carolus Linnaeus

Catholic Values

- Students will be able to demonstrate stewardship imbued with Catholic values in the care of local and global environments. (E)
- Students will be able to identify the relationships between the roles of science, technology, and Catholic ethics in the global community. (E)
- Students will be able to compare/describe life from the fossil record with modern life forms and discuss Biblical implications. (E)
- Students will be able to relate concepts of heredity and reproduction to Catholic teaching. (E)
- Students will be able to discuss the theory of evolution in the context of Catholic teaching about the origin of life. (E)
- Students will be able to work cooperatively, and respect each other's ideas, roles, and abilities. (I)

LEGEND I = Introduce D = Develop E – Expand/Enrich/Extend

GRADE EIGHT
Focus on Physical Science

In order to ensure continuity and mastery throughout the K-8 science curriculum, all standards need to be taught. The foundational content standards for this grade are indicated in bold. These standards emphasize the critical components of the science content for this particular grade.

The universe consists of space, time, and energy. Energy is often found in the form of matter. Atoms are the building blocks of matter, and matter makes up our oceans, mountains, the sun, and us. The Big Bang was the creation of the physical universe. Prior to the onset of the Big Bang, matter, space, and time did not exist. There was only energy, contained in an infinitely small point. About 100,000 years after the Big Bang, as the universe continued to expand, the temperature dropped low enough to allow electrons to bind with protons, forming hydrogen atoms (and in some cases helium atoms). Sufficient amounts of this matter coalesced (due to gravitational attraction) and formed stars made up of hydrogen and some helium. As gravity pulled the hydrogen atoms closer and closer together, the temperature increased enough to ignite the hydrogen in fusion. The hydrogen atoms fused together creating helium atoms, with the excess energy being released in the form of light particles and neutrinos. Stars continued to burn in this way through nuclear reactions, creating all the heavier elements up to iron. Supernovae explosions then created the more massive naturally occurring elements.

Interactions of matter (chemistry) are dictated by electromagnetism and thermodynamics, which drive the transfer of electrons to form bonds. Electrical repulsion gives matter substance, while electrical attraction allows stable bonds to form, creating the molecules found in living and nonliving matter. Biological systems contain living organisms which are made of carbon-based molecules, have a way to take in energy (either from the sun or from other life forms), can grow in size, and can reproduce. The first life forms were simple one-molecule structures, such as RNA. Evolution, driven by processes such as natural selection, explains how more complex life forms (such as humans) arose from simpler organisms such as algae.

Motion

Standard 1: The velocity of an object is the rate of change of its position. As a basis for understanding this concept, students will know:

a. position is defined relative to some choice of a standard reference point and a set of reference directions.
b. average speed is the total distance traveled divided by the total time elapsed, and the speed of an object along the path traveled can vary.
c. how to solve problems involving distance, time, and average speed.
d. the velocity of an object must be described by specifying both the direction and the speed of the object.
e. changes in velocity may be due to changes in speed, direction, or both.
f. how to interpret graphs of position versus time and graphs of speed versus time for motion in a single direction.

Suggested Concepts and Working Vocabulary

- **Measurement**
  mass, length, density, weight, displacement, dimensions, International System of Units

- **Motion**
  distance, speed, time, velocity, acceleration, motion, projectile motion, momentum, displacement

Sample Procedures for Standards 1b, 1c, and 1f

1) Have students perform a discovery lab – "Speed" - measuring distance and time. Lay out a course 10 to 20 m long. Break the class into groups of three. Have one student be the timer, one be the test subject, and one record the data. Have the test subject walk the course: first walking, then walking fast, and then running. Perform each experiment three times. Calculate the speed of each individual experiment. Then calculate the average walking, fast-walking and running speeds.

2) Provide a data set of time and distance. Have students plot the data and analyze the graph with regard to speed and slope of the line.

Sample Assessment

Students create a graph from a data chart and/or a word problem. They should correctly identify graph components, label units, and find speed by calculating the slope of the line.

Resources

See Page 93

Forces

Standard 2: Unbalanced forces cause changes in velocity. As a basis for understanding this concept, students will know:

a. a force has both direction and magnitude.
b. when an object is subject to two or more forces at once, the result is the cumulative effect of all the forces.
c. when the forces on an object are balanced, the motion of the object does not change.
d. how to identify separately two or more forces that are acting on a single static object, including gravity, elastic forces due to tension or compression in matter, and friction.
e. when the forces on an object are unbalanced, the object will change its velocity (that is, it will speed up, slow down, or change direction).
f. the greater the mass of an object, the more force is needed to achieve the same rate of change in motion.
g. the role of gravity in forming and maintaining the shapes of planets, stars, and the solar system.

Suggested Concepts and Working Vocabulary

- **Forces**
  force, unbalanced and balanced forces, Newton's Laws, friction, centripetal force, gravity, terminal velocity, weight, newtons

- **Work**
  simple machines (pulley, inclined plane, screw, wheel and axle, wedge, lever), fulcrum, machine, compound machine, joules

- **Energy**
  Law of Conservation of Energy, kinetic and potential energy, nuclear energy, heat (thermal) energy, electrical energy, mechanical energy, chemical energy, wind, solar energy, joules

- **Electricity**
  atoms, electric charge, attraction, repulsion, static electricity, friction, conduction, induction, lightning, voltage, volts, amperes, series circuit, parallel circuit

- **Magnetism**
  poles, magnetic field, magnetic induction, compass, electromagnet, electric motor, generator, fuses

Sample Procedures for Standards 2a and 2b

1) Weigh an object (e.g. block of wood with hook on one end) using a spring scale (0 to 10 newtons). Pull on the object as it is suspended on the scale. Pull until you reach 5 N and 10 N. Estimate what the force would be to pull the object over three different surfaces: lubricated (baby powder or cornstarch); rough surface (carpet or sand paper); smooth, flat surface. Then measure the forces and compare to each other and to the force (due to gravity) of holding the object vertically with the scale. Extension: Repeat using objects of different masses.

2) Roller Coaster Project – Student work in groups to build a roller coaster, then each person writes a report on the science of roller coasters and the process of how their group built one. Provide websites such as the following for research:

http://tiny.cc/pb7iz

http://www.howstuffworks.com/

http://learner.org/eshibits/parkphysics/coaster.html

Sample Assessments

1) Students draw diagrams of examples of Newton's Laws, and then write out each law.

2) Using graphs and data tables, students analyze the relationship of the different variables in Newton's 2nd Law: total force = m x a.

3) Students solve word problems. For example, a baseball player hits a 0.1 kg baseball, which accelerates at a rate of 4000 m/s^2. What is the total force (F) exerted on the ball?
(Answer: $F = (0.1\ kg)(4000\ m/s^2) = 400N.$)

4) Students show forces acting on objects in Free Body Diagrams.

Resources

See page 93

Structure of Matter

Standard 3: Each of the more than 100 elements of matter has distinct properties and a distinct atomic structure. All forms of matter are composed of one or more of these elements. As a basis for understanding this concept, students will know:

a. the structure of the atom and how it is composed of protons, neutrons, and electrons.
b. compounds are formed by combining two or more different elements, and compounds have properties that are different from their constituent elements.
c. atoms and molecules form solids by building up repeating patterns, such as the crystal structure of NaCl or long-chain polymers.
d. the states of matter (solid, liquid, gas) depend on molecular motion.
e. in solids, the atoms are closely locked in position and can only vibrate; in liquids, the atoms and molecules are more loosely connected and can collide with and move past one another; and in gases, the atoms and molecules are free to move independently, colliding frequently.
f. how to use the periodic table to identify elements in simple compounds.

Suggested Concepts and Working Vocabulary

- **Structure of matter**
  atom, electron, neutron, proton, nucleus

- **Classification of matter**
  liquid, solid, gas, chemical change, physical change, boiling point, melting point, freezing point, molecule, element, mixture, compound, heterogeneous mixture, homogeneous mixture

Sample Procedures for Standards 3a, 3d, and 3e

1) Have students write a newspaper article on the discovery of the elements.

2) Have students write a creative story on a day in the life of an atom. The story should describe the journey of an element, such as oxygen, and should include a specific description of the atom.

3) Have students re-enact Rutherford's experiment using a croquet set, cardboard boxes, and a gold sheet (bed sheet). Students should discover that the mallet is the emitter, the balls which the emitter hits are the alpha particles, the black ball behind the sheet is the nucleus (positively charged dense center), and the cardboard boxes surrounding the sheet are the zinc plates.

4) Demonstrate the different phases of matter using moth balls (melt until gas comes off, then quickly quench to solid again). Ask students what is happening during each phase – energy is being added.

Sample Assessments

1) Draw a diagram of an atom which includes the correct number of protons, neutrons, and electrons. The electrons must be in the proper energy shells.

2) Draw the three phases of matter, describing phase, molecular arrangement, molecular movement, and shape.

Resources

See page 93

Earth in the Solar System (Earth Sciences)

Standard 4: The structure and composition of the universe can be learned from the study of stars and galaxies, and their evolution. As a basis for understanding this concept, students will know:

a. galaxies are clusters of billions of stars and may have different shapes.
b. the Sun is one of many stars in the Milky Way galaxy, and stars may differ in size, temperature, and color.
c. how to use astronomical units and light years as measures of distances between theSun, stars, and Earth.
d. stars are the source of light for all bright objects in outer space, and the Moon and planets shine by reflected sunlight, not by their own light.
e. the appearance, general composition, relative position and size, and motion of objects in the solar system, including planets, planetary satellites, comets, and asteroids.

Suggested Concepts and Working Vocabulary

- **Formation of the universe**
  galaxies, big bang theory, gravity, universe, quasars, red shift

- **Stars**
  binary star, giant stars, supergiant stars, white dwarf, neutron stars, parallax, nuclear fusion, nebula, pulsar, black hole, supernova

- **Formation of the solar system**
  rotation, revolution, orbit, asteroid, asteroid belt, meteor, meteorite, meteoroid, comet, satellites

- **Layers of the Sun**
  core, corona, sunspot, solar flare

- **Motion of the planets**
  rotation, revolution, orbit, solar eclipse, lunar eclipse, light-year

Sample Procedures for Standards 4c and 4e

1) Have students mathematically find distances, to scale, between the planets in our solar system. Have them draw them to scale using chalk or using objects to represent the planets. Then have students calculate distances using AU units (given that AU = 1.5×10^{11} m).

2) Have students discover how many light-years away the nearest galaxies are.

Sample Assessments

1) Using a flashlight and a ball, explain why we have seasons. Using a flashlight and two balls, demonstrate an eclipse.
2) Draw a picture to show the differences between meteors, meteorites, and meteoroids.

Resources

See page 93

Reactions

Standard 5: Chemical reactions are processes in which atoms are rearranged into different combinations of molecules. As a basis for understanding this concept, students will know:

- **a. reactant atoms and molecules interact to form products with different chemical properties.**
- **b. the idea of atoms explains the conservation of matter: in chemical reactions the number of atoms stays the same no matter how they are arranged, so their total mass stays the same.**
- **c. chemical reactions usually liberate heat or absorb heat.**
- d. physical processes include freezing and boiling, in which a material changes form with no chemical reaction.
- **e. how to determine whether a solution is acidic, basic or neutral.**

Suggested Concepts and Working Vocabulary

- **Bonding**
  chemical bonding, valence electron, ionic bonding, ionization, covalent bonding, oxidation number, electron pairs

- **Chemical reactions**
  chemical reactions, reactant, product, chemical equation, exothermic reaction, endothermic reaction

- **Nature of solutions**
  concentration, solution, solute, solvent, solubility, saturated solution, unsaturated solution, supersaturation, insoluble, suspension, colloid

- **Acids and bases**
  indicators, acids, bases, pH, neutralization

Sample Procedures for Standards 5a, 5c, and 5e

1) Demonstrate chemical reactions using cold packs or hunter's socks.

2) Use litmus, pH paper and other indicators to test whether a substance is an acid or a base.

3) Have students perform a decomposition lab: test hydrogen peroxide with various reactants including raw meat. (O_2 from raw meat reacts with hydrogen peroxide (H_2O_2) to form H_2O.)

4) Have students perform a discovery lab – "Chemical Reaction in a Ziploc Bag" – using 2 tsp. $CaCl_2$, 1 tsp. baking soda, and 10 ml of phenol red solution in a small vial with screw top (film canister will work also). Place all three substances in a Ziploc bag and seal, keeping phenol red solution capped inside the closed baggie. Then release the phenol red inside the sealed baggie, and watch it mix with other substances, noting reactions that take place.

Sample Assessments

1) Students identify the evidence for chemical reactions when an alka seltzer is dropped into water: reactants/products.

2) Ziploc Bag Lab – Students identify which combination of chemicals in the lab produced the exothermic reaction (calcium chloride and the water in the phenol red solution), and which combination of chemicals in the lab produced the endothermic reaction (baking soda dissolving in water). Students must test their hypothesis.

3) Students successfully measure the pH of known solutions and unknown solutions, labeling each of them as an acid, a base, or a neutral substance.

Resources

See page 93

Chemistry of Living Systems (Life Science)

Standard 6: Principles of chemistry underlie the functioning of biological systems. As a basis for understanding this concept, students will know:

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

Suggested Concepts and Working Vocabulary

- **Chemistry of living systems**

  carbon, organic compounds, molecular formulas, structural formulas, amino acids, lipids, DNA, RNA, nucleic acids, proteins, starch, glucose, carbohydrates, polymers

Sample Procedures for Standards 6a and 6b

1) Have students conduct a Polymer Lab (using 1/4 cup liquid starch, 1/4 cup white glue, a Popsicle stick/stirrer, and a 100 ml beaker filled about 2/3 full of water). Have students add the glue to the starch and stir; then have them reach into the mixture, remove a handful, and form it into a ball; then put ball into the beaker of water and squeeze to remove any unreacted materials; dry it with paper towels; observe and record what happens when they: a) pull apart slowly; b) pull apart quickly; c) bounce.

   Students should consider why two substances formed a solid (carbon bonding); when it acted like a solid (bounced, pulled apart quickly); when it acted like a liquid (pulled apart slowly).

2) Have students make and compare molecular models of organic substances such as proteins, lipids, carbohydrates, and DNA.

Sample Assessments

1) Have students identify the monomer components of a polymer.

2) Have students explain how carbon can form over 6 million different compounds. Students should be specific and give at least 3 examples. Also, have students sketch pictures of the carbon compounds.

3) Have students identify various molecular models of carbon compounds.

Resources

See page 94

Periodic Table

Standard 7: The organization of the periodic table is based on the properties of the elements and reflects the structure of atoms. As a basis for understanding this concept, students will know:

a. how to identify regions corresponding to metals, nonmetals, and inert gases.
b. each element has a specific number of protons in the nucleus (the atomic number), and each isotope of the element has a different but specific number of neutrons in the nucleus.
c. substances can be classified by their properties, including melting temperature, density, hardness, and thermal and electrical conductivity.

Suggested Concepts and Working Vocabulary

- **Periodic Table of Elements**
  chemical symbol, atomic mass, atomic number, atomic mass unit, family, group, period, reactivity

- **Families of elements**
  metals, nonmetals, metalloids, alloys, noble gases

Sample Procedures for Standards 7a, 7b, and 7c

1) Have students perform the "Penny Lab": find the atomic mass of an imaginary element "pennium", of which there are two different isotopes. Count the number of pre-1982 and post-1982 pennies in a sample of 100 pennies. (Do not use 1982 pennies since masses were inconsistent that year.) Find the mass of one pre-1982 penny and of one post-1982 penny. Then multiply the mass of each penny-type times the number of each type in the sample of 100 pennies. Add the two mass totals together to find the total mass of the 100 pennies. Divide the total mass by 100 to determine the average (standard) mass of the element "pennium." This average is like the atomic mass for that element.

2) Graph atomic mass vs. atomic number; compare ionization energies.

3) Color code the first 20 elements to see any relationship changes.

4) Have students observe how many atoms of hydrogen or fluorine, for example, can combine with each element as you go across the chart. Which groups (families) form bonds with the most number of hydrogen or fluorine atoms? Which groups form bonds with the least number of hydrogen or fluorine atoms? Which group does not form a bond with fluorine or hydrogen? Where are most of the solids found on the chart? Most gases found?

5) Classify elements by properties: melting/boiling point, density, hardness, thermal and electrical conductivity.

6) Make a comparison chart showing the differences among the following bonds and give an example of each: a) ionic bonds; b) covalent bonds; c) metallic bonds

Sample Assessments

1) Have students answer the following question: How can you use the mass of an element to determine if it is an isotope?

2) Using the Periodic Table of Elements, indicate the number of protons for each of the following elements:

Lithium	Cesium	Carbon
Silver	Bismuth	Chlorine
Lead	Tungsten	

3) Have students answer the following questions:

Moving from left to right across a period, how do the number of hydrogen atoms and fluorine atoms that combine with the elements vary?

How is the periodic chart like a calendar?

4) Have students use the atomic mass and atomic number to find out how many neutrons are in the nucleus of an atom of a certain element.

Resources

See page 94

Density and Buoyancy

Standard 8: All objects experience a buoyant force when immersed in a fluid. As a basis for understanding this concept, students will know:

- **a. density is mass per unit volume.**
- **b. how to calculate the density of substances (regular and irregular solids, and liquids) from measurements of mass and volume.**
- **c. the buoyant force on an object in a fluid is an upward force equal to the weight of the fluid the object has displaced.**
- d. how to predict whether an object will float or sink.

Suggested Concepts and Working Vocabulary

- **Buoyancy**
  buoyant force, density, fluid, grams per cubic millimeter, volume

- **Volume**

Sample Procedures for Standards 8a, 8b, 8c, and 8d

1) Do a density demo with marbles and salt: fill a beaker 3/4 full with marbles (liken marbles to water molecules). Point out that there are spaces between the marbles. Now add salt to fill in between the marbles. There is now more mass in the same volume. This new "solution" is denser than the regular water (marbles only). This new model represents salt water. Because salt water is denser than regular water, a person floats better in salt water.

2) Demonstration: Push a ball under water and observe the resistance.

3) "Sewer Maggots Lab": Put raisins or lentils in carbonated water or Mountain Dew. Observe movement of raisins/lentils. Explain what is happening using Archimedes Principle and density.

4) "Cartesian Diver Lab", using an eye dropper, 2L bottle, and water: Squeeze filled bottle of water with eye dropper inside; watch dropper fill with water (become more dense) and drop to bottom. Let go of the bottle, and watch water leave the dropper, such that the dropper floats to the top (becomes less dense).

5) Find volume of a regularly and irregularly shaped object: Measure length x width x height for regularly-shaped object. For irregularly-shaped object, use a graduated cylinder containing water. Add the object. The difference between the water level before and after object is added is the volume of the object.

Sample Assessments

1) Explain, in terms of buoyancy, how a submarine can float or sink.

2) Determine the density of a brick which has a mass of 400 grams and a volume of 600 cubic centimeters.

3) The data table below shows the results of an experiment dealing with two liquids, A and B, at room temperature:

Liquid	Trial	Volume (ml)	Mass (g)
A	1	40	48
A	2	60	72
A	3	80	96
B	1	40	32
B	2	60	48
B	3	80	64

Students should construct a graph of the data in the table, using dots for the data points for the liquid A and using x's for the data points for liquid B. Students should use the graph to determine which liquid has the greater density. Students should explain how they arrived at the answer.

Resources

See page 94

Investigation and Experimentation

Standard 9: Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept, and to address the content of the the other three strands, students should develop their own questions and perform investigations. Students will:

a. plan and conduct a scientific investigation to test a hypothesis.
b. evaluate the accuracy and reproducibility of data.
c. distinguish between variable and controlled parameters in a test.
d. recognize the slope of the linear graph as the constant in the relationship $y = kx$ and apply this principle in interpreting graphs constructed from data.
e. construct appropriate graphs from data and develop quantitative statements about the relationships between variables.
f. apply simple mathematical relationships to determine a missing quantity in a mathematic expression, given the two remaining terms (including speed = distance/time, density = mass/volume, force = pressure x area, volume = area x height).
g. distinguish between linear and non-linear relationships on a graph of data.

Scientists

- **Force**
  Isaac Newton, Daniel Bernoulli

- **Buoyancy**
  Archimedes

- **Energy**
  Albert Einstein

- **Periodic Table**
  Dmitri Mendeleev, Henry Moseley

Catholic Values

- Students will be able to demonstrate stewardship imbued with Catholic values in the care of local and global environments. (E)
- Students will be able to identify the relationships between the roles of science, technology, and Catholic ethics in the global community. (E)
- Students will be able to compare/describe life from the fossil record with modern life forms and discuss Biblical implications. (E)
- Students will be able to relate concepts of heredity and reproduction to Catholic teaching. (E)
- Students will be able to discuss the theory of evolution in the context of Catholic teaching about the origin of life. (E)
- Students will be able to work cooperatively & respect each other's ideas, roles, and abilities. (I)

LEGEND: I = Introduce D = Develop E = Expand/Enrich/Extend

RESOURCES GRADE SIX

Plate Tectonics and Earth's Structure

The Dynamic Earth: The Story of Plate Tectonics http://pubs.usgs.gov/gip/dynamic/html
U.S. Geological Survey Earthquake Hazards Program http://earthquake.usgs.gov/

Shaping the Earth's Surface

United States Geological Survey (USGS), 345 Middlefield Rd, Menlo Park, CA 94025 http://www.usgs.gov/
Geography World: http://geographyworldonline.com

Heat (Thermal Energy) (Physical Science)

San Francisco Exploratorium and website: http://www.exploratorium.edu
Snackbook: Exploratorium http://www.exploratorium.edu/snacks/
Demonstration of conduction and convection:
http://www.atmos.washington.edu/2002Q1/101/demos/demo1.htm

Energy in the Earth System

Weather resources and links: http://www.42explore.com/weather.htm

Ecology (Life Science)

Food Webs:
http://academics.uww.edu/cni/webquest/HallOfFame/foodchain/foodchain.htm

Resources

Pacific Gas and Electric Company website: http://www.pge.com

The Lorax, by Dr. Seuss

RESOURCES GRADE SEVEN

Cell Biology

Cells Alive website: http://www.cellsalive.com
Virtual Cell: http://www.ibiblio.org/virtualcell

Genetics

Cells R Us, by Frances R. Balkwill **ISBN:** 0876146361

Evolution

Land of the Kiwi, National Geographic Society (Video)

Beyond Darwin, Discovery Channel (Video)

Earth and Life History (Earth Science)

Dinosaur Hunt, NOVA (Video)
Dating Fossils and Rocks: Scientific Evidence and the Age of the Earth (DVD)

Structure and Function in Living Systems

Wisconsin Fast Plants, www.fastplants.org

Physical Principals in Living Systems (Physical Science)

RESOURCES GRADE EIGHT

Motion

Eyewitness Science: Force and Motion, by Peter Lafferty
Forces and Motion Science Projects, by Simon De Pinna and Chris Fairclough

Forces

Bill Nye's Powerful Forces (Video)
NOVA: Newton's Dark Secrets (2005) (DVD)
Extreme Rollercoasters (DVD)
Physics Days at Paramount's Great America, homepage.mac.com/cbakken/cga
Fear of Physics, www.fearofphysics.com

Structure of Matter

Exploring Chemical Elements and Their Compounds, by David L. Heiserman, Tab Books, 1991
Snackbook, from Exploratorium http://www.exploratorium.edu/snacks/

Earth in the Solar System (Earth Sciences)

Amazing Space: http://amazing-space.stsci.edu
Student for the Exploration and Development of Space (SEDS): http://www.seds.org
NASA Jet Propulsion Laboratory: http://www.jpl.nasa.gov/

Reactions

Exploring Chemical Elements and Their Compounds, by David L. Heiserman, Tab Books, 1991.
The Periodic Kingdom: A Journey into the Land of the Chemical Elements, by P.W. Atkins, Harper Collins, 1997.

Chemistry of Living Systems (Life Science)

Exploring Chemical Elements and Their Compounds, by David L. Heiserman, Tab Books, 1991.
The Periodic Kingdom: A Journey into the Land of the Chemical Elements, by P.W. Atkins, Harper Collins, 1997.

Periodic Table

Exploring Chemical Elements and Their Compounds, by David L. Heiserman, Tab Books, 1991.
The Periodic Kingdom: A Journey into the Land of the Chemical Elements, by P.W. Atkins, Harper Collins, 1997.
Visual Periodical Table: http://www.chemsoc.org/viselements/Pages/periodic_table.html

Density and Buoyancy

Exploring Chemical Elements and Their Compounds, by David L Heiserman, Tab Books, 1991.
The Periodic Kingdom: A Journey into the Land of the Chemical Elements, by P.W. Atkins, Harper Collins, 1997.
Loose in the Lab website: http//www.looseinthelab.com (Resource for purchasing science supplies)

GENERAL RESOURCES GRADES K – 8

Aims

Amazing Space
http://amazing-space.stsci.edu

The Biology Project
http://www.biology.arizona.edu

Brainpop & Brainpop Jr.

CTN

Discovery

Discovery Cube

Exploratorium

Exploratorium Snacks

Gems

Geography World

Hot Chalk
www.lessonplanspage.com/science.htm

Internet 4 Classrooms
www.internet4classrooms.com

Jefferson Lab
jlab.org

NASA

National Geographic

San Jose Tech
www.thetech.org

Science Spot

Science Toy Maker
www.sciencetoymaker.org

UC Berkeley
http://www.ucmp.berkeley.edu

USGS

You Tube

ARCHDIOCESE OF SAN FRANCISCO
DEPARTMENT OF CATHOLIC SCHOOLS

ELEMENTARY SCHEDULES AND TIME ALLOTMENTS

A. School Schedule

1. Length: The school timetable including business, opening and closing exercises, and the required number of minutes of actual classroom instruction must not total less than the number of weekly minutes enumerated on the bottom line of the Weekly Time Allotment Chart.

2. School Hours: The opening and dismissal time for school days are determined at each school after taking into consideration mandatory weekly time requirements for instruction, appropriate recess and lunch periods, faculty meetings, and other local factors. School days should be at least seven hours.

3. Early Dismissal: The weekly schedule may include an early dismissal day for faculty meetings or other local needs. This early dismissal day may not be shorter than a minimum day. The mandatory weekly time requirements for instruction must still be met.

4. Minimum Days: A minimum day includes the following time allotments:

Kindergarten	185 minutes
Grades 1-8	240 minutes

When a school takes a minimum day the recess or lunch period may NOT be counted in the total.

The following minimum days are authorized by the Superintendent. When these authorized minimum days occur the weekly time allotments are waived. The list which follows is very specific and does not include regular faculty meetings:

- The first two days of school
- The day preceding the Thanksgiving and the Christmas holidays
- Holy Thursday
- The last two days of the school year
- A maximum of five days at the end of a quarter if parent-teacher conferences are held and the parents of every child are seen (maximum – 10 days per year)
- A monthly staff development day as designated by county

Permission is granted to include, on the school calendar, any of the minimum days listed above in accordance with local needs and circumstances. There is no obligation to include all of them.

B. Time Allotments

1. The number of minutes specified is the minimum allotted for each subject at each grade level. Additional time for each subject is left to the discretion of the principal in light of local needs.

2. In certain situations where team teaching, departmentalization, facilities, or other local issues impact the instructional program, adjustments may be made in individual subjects except religion to accommodate scheduling as long as the total weekly time requirements for instruction are retained.

3. In keeping with the primary purpose of our Catholic schools, religion must be taught on a daily basis. Schools must meet the minimum weekly time requirement for instruction in religion. Family life is blocked with religion.

4. English, composition, literature, reading, spelling, and handwriting are blocked together on the Weekly Time Allotment Chart. Distribution of minutes for each language arts subject may be left to the discretion of the local principal in light of local needs.

5. Science, health, and safety are blocked together on the Weekly Time Allotment Chart to encourage integration.

6. Cross curricular integration is strongly recommended. Where subjects are integrated, the total weekly time requirements for instruction must remain the same (e.g., K: 850 minutes, 1-3: 1,500 minutes, 4-8: 1,600 minutes)

7. In addition to the computer education time, technology will be integrated into the regular classroom instruction across the curriculum.

8. If additional subjects are offered, instructional minutes must be added (e.g., foreign language).

DEPARTMENT OF CATHOLIC SCHOOLS

ARCHDIOCESE OF SAN FRANCISCO

WEEKLY TIME ALLOTMENT CHART
Departmentalized

	Kindergarten	**Grades 1 – 2**	**Grade 3-5**	**Grades 6 - 8**
	Minutes	Minutes	Minutes	Minutes
Religion/Family Life				225
Mathematics				225
Language Arts English Composition Literature Reading Spelling Handwriting				540
History/Social Science				225
Science Health Safety				225
Physical Education				60
Fine Arts Art Music Drama				60
Computer Education				40
Instructional Total Weekly				**1600**

The recommended length of a school day is seven hours. In addition to instructional time, schools need to add adequate time for opening and closing exercises, lunch, recess, and time for students to change classes.

DEPARTMENT OF CATHOLIC SCHOOLS

ARCHDIOCESE OF SAN FRANCISCO

WEEKLY TIME ALLOTMENT CHART

	Kindergarten	**Grades 1 – 2**	**Grade 3**	**Grades 4 - 8**
	Minutes	Minutes	Minutes	Minutes
Religion/Family Life	100	150	150	200
Mathematics	100	200	200	250
Language Arts English Composition Literature Reading Spelling Handwriting	350	850	790	600
History/Social Science	50	60	90	200
Science Health Safety	30	60	90	200
Physical Education	100	60	60	60
Fine Arts Art Music Drama	100	90	90	60
Computer Education	20	30	30	30
Instructional Total Weekly	**850**	**1500**	**1500**	**1600**

The recommended length of a school day is seven hours. In addition to instructional time, schools need to add adequate time for opening and closing exercises, lunch, recess, and time for students to change classes.

ADDENDUM

ENVIRONMENTAL EDUCATION CONTACT SHEET

San Francisco recreation and Park Department Youth Stewardship Program	415.831.6330 x200
Insect Discovery Lab – Visits classrooms promoting the importance of conservation throught hands-on activities with insects. Contact Norm Gershenz - www://www.savenature.org/bugzoo.html	415.648.3392
Cal Academy of Sciences –Education Programs for grades 3-12 in ecology, habitat, biodiversity, geology; tours and classroom visits. www.calacademy.org	415.379.8000
The Crissy Field Center – Self-guided walks, staff-led workshop, and science labs. – http://www.crissyfield.org	415.561.3000
The Headlands Institute – Overnight (3-5 days) environmental education programs in the Marin Headlands. Contact Shannon Murray http://www.yni.org/educator/edu.html	415.332.5771 x28
Literacy for Environmental Justice – Environmental education programs emphasizing community environmental health, justice, and your empowerment. http://www.lejyouth.org	415.282.6840
Josephine Randall Jr. Museum – Love animal museum, science exhibits, local history, hikes. www.randallmuseum.org	415.554.9600
The "Wild In The City" Map – Shows vegetation and animal distribution of San Francisco before modern development. Call Nancy Morita	415.459.6915
Water Pollution Prevention Program – Contact Tommy Moala, Assistant General Manager, Acting for Wastewater Enterprise	415.554.2465
Friends of the Urban Forest – City tree planting program and curriculum. Contact Nancy Strahan www.fuf.net	415.561.6890 x108
San Francisco Botanical Garden – Self guided and docent guided walks of the gardens, youth programs. Contact Annette Huddle www.sfbotanicalgarden.org	415.661.1316 x307

Updated October 2008

SAN FRANCISCO SCIENCE FIELD TRIPS

American Heart Association
120 Montgomery Street, Suite 1650
San Francisco, CA 94104
(415) 433-2273

California Academy of Sciences
875 Howard Street
San Francisco, CA 94103
(415) 750-7145

Exploratorium
3601 Lyon Street
San Francisco, CA 94123
(415) 561-0317
Tactile Dome (415) 561-0308

Friends of Parks and Recreation
501 Stanyan Street - McLaren Lodge
San Francisco, CA 94117
(415) 750-5105

Golden Gate National Recreation Area
Fort Mason, Building 201
San Francisco, CA 94123
(415) 561-4700

Includes:	Fort Point:	(415) 561-4395
		(415) 556-1693
	Alcatraz	(415) 981-7625
	Fort Funston	(415) 239-2366
	Crissy Field	(415) 561-7690
	Presidio of SF	(415) 776-2388

Gulf of the Farallones
National Marine Sanctuary
The Presidio - 991 Marine Drive
San Francisco, CA 94129
(415) 561-6625

Oceanside Water Treatment Plant
(Water Pollution Control Plant)
3500 Great Highway
San Francisco, CA 94116
(415) 242-2200

Josephine Randall Junior Museum
199 Museum Way
San Francisco, CA 94114
(415) 554-9604

San Francisco League of Urban Farmers (SLUG)
2088 Oakdale Avenue
San Francisco, CA 94124
(415) 285-7584

S.F. Recycling and Disposal
501 Tunnel Ave
San Francisco, CA 94134
(415) 330-1400

Strybing Arboretum
9th Avenue and Lincoln Way
San Francisco, CA 94122
(415) 661-0668

Aquarium of the Bay
Embarcadero and Beach Streets
Next to Pier 39
San Francisco, CA 94133
(415) 623-5300

Zeum
221 4th Street
San Francisco, 94103
(415) 820-3320

San Francisco Zoo
1 Zoo Road
San Francisco, CA 94132
(415) 753-7080

Zoomobile
1 Zoo Road
San Francisco, CA 94132
(415) 753-7073

NORTH BAY SCIENCE FIELD TRIPS

Marine Mammal Center
(The Whale Bus)
Marin Headlands
1065 Fort Cronkhite
Sausalito, CA 94965
(415) 289-7330

EAST BAY SCIENCE FIELD TRIPS

Black Diamond Mines
5175 Somersville Road
Antioch, CA 94509
(510) 757-2620

Chabot Space and Science Center
10,000 Skyline Boulevard
Oakland, CA 94619
(510) 336-7300

Coyote Hills Regional Park
8000 Patterson Ranch Road
Fremont, CA 94536
(510) 795-9385

Crab Cove Marine Reserve
1252 McKay Avenue
Alameda, CA 94501
(510) 521-6887

Hall of Health
2230 Shattuck Avenue
Berkeley, CA 4704
(510) 549-1564

Heather Farm Garden Center
1540 Marchbanks Drive
Walnut Creek, CA 94598
(925) 947-1678

Lawrence Hall of Science
University of California at Berkeley
Berkeley, CA 94720
(510) 642-5134

Marine World Africa, USA
Marine World Parkway
Vallejo, CA 94589
(707) 644-4000

Oakland Museum
1000 Oak Street
Oakland, CA 94607
(510) 238-3514

San Francisco Bay
National Wildlife Refuge
P.O. Box 524
Newark, CA 94560
(510) 792-0222

Save the Bay
Save the San Francisco Bay Association
1600 Broadway, Suite 300
Oakland, CA 94612
(510) 452-9261

Sulphur Creek Nature Center
1801 D Street
Hayward, CA 94541
(510) 881-6747

Tilden Nature Area
Berkeley, CA 94708
(510) 525-2233

University of California
Botanical Garden
200 Centennial Drive
Berkeley, CA 94720
(510) 642-3343

University of California
Paleontology Museum
Valley Life Science Building
Berkeley, CA 94720
(510) 642-1821

SOUTH BAY SCIENCE FIELD TRIPS

Año Nuevo State Reserve
New Years Creek Road
Pescadero, CA 94060
(650) 879-2025

Coyote Point Museum
1651 Coyote Point Drive
San Mateo, CA 94401
(650) 342-7755

Great America
2401 Agnew Road
Santa Clara, CA 95054
(408) 988-1776

James V. Fitzgerald Marine Reserve
P.O. Box 451
Moss Beach, CA 94038
(415) 728-3584

Marine Science Institute
500 Discovery Parkway
(check website for directions!)
Redwood City, CA 94063
(650) 364-2760

Monterey Bay Aquarium
886 Cannery Row
Monterey, CA 93940
(831) 648-4888

NASA/Ames Research Center
Education Program
Moffett Field, CA 94035
(650) 604-6497

Pinnacles National Monument
National Park System
Paicines, CA 95043
(831) 389-4485

Recyclery and Garbage Museum
1601 Dixon Landing Road
Milpitas, CA 95035
(408) 262-1401

Sanborn Discovery Center
(Youth Science Institute)
16055 Sanborn Road
Saratoga, CA 95070
(408) 867-6940

San Bruno Mountain Watch
P.O. Box AO
Brisbane, CA 94005
(415) 467-6631

San Jose Tech Museum of Innovation
201 So. Market Street
San Jose, CA 95113-2008
(408) 294-8324

Santa Cruz Beach Boardwalk
400 Beach Street
Santa Cruz, CA 95060
(831) 460-3342

Wildlife Associates
P.O. Box 3098
Half Moon Bay, CA 94019
(650) 712-0800

Youth Science Institute
296 Garden Hill Drive
Los Gatos, CA 95032
(408) 356-4945

Physical Science Grade-to-Grade Crossover Standards

	Motion, Speed, Velocity	**Forces**	**Matter**	**Chemical Reactions**	**Periodic Table**	**Density / Buoyancy**	**Physical Principles of Living Systems (7th Physical Science)**	**Heat/ Thermal Energy (6th Physical Science)**
8th	8th (1. a-f)	8th (2. a-g)	8th (3. a-f)	8th (5. a-e)	8th (7. a-c)	8th (8. a-d)		
7th							7th (6. a-j)	
6th								6th (3. a-d)
5th		1.ef	5th (1. b, d-i)	5th (1. a)	5th (1. c)			
4th		4th (l.e.f)						4th (lg)
3rd			3rd (1. e, g, h)	3rd (1. f)				
2nd	2nd (1. a-c)	2nd (1. c-e)						
1st			1st (1. a-b)					
K			K (1. a-c)					

	K	**1st**	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**	**8th**
Motion			X						X
Forces			X		X				X
Matter	X	X		X		X			X
Chemical Reactions				X		X			X
Periodic Table						X			X
Density/Buoyancy									X
Physical Principles of Living Systems								X	
Heat/Thermal Energy					X		X		

Life Science Grade-to-Grade Crossover Standards

	Cell Biology	**Genetics**	**Evolution**	**Structure / Function of Living Systems**	**Chemistry of Living Systems (8th Life Science)**	**Ecology (6th Life Science)**
8th					8th (6. a-c)	
7th	7th (1. a-f)	7th (2. a-e)	7th (3. a-e)	7th (5. a-g)		
6th						6th (5. a-e)
5th	5th (2. a)			5th (2. b-g)	5th (1. h)	
4th						4th (2 a-c, 3.a-d)
3rd			3rd (3. d-e)	3rd (3. a)		3rd (3. b-c)
2nd		2nd (2. a-d)		2nd (2. f)		
1st				1st (2. d-e)		1st (2. a-c)
K				K (2. c)		

	K	**1st**	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**	**8th**
Cell Biology						X		X	
Genetics			X					X	
Evolution				X				X	
Structure/Function	X	X	X	X		X		X	
Chemistry of Life						X			X
Ecology		X		X	X		X		

Earth Science Grade-to-Grade Crossover Standards

	Plate Tectonics, Earth Structure	**Shaping Earth's Surface**	**Energy in the Earth System**	**Earth/Life History (7th Earth**	**Solar System (8th Earth**	**Resources**
8th					8th (4. a-e)	
7th				7th (4. a-g)		
6th	6th (1. a-g)	6th (2. a-d)	6th (4. a-e)			6th (6. a-c)
5th					5th (5. a-c)	
4th		4th (5. a-c)				
3rd			3rd (1. a-d, 2.a-d)		3rd (4. a-e)	
2nd		2nd (3. b)		2nd (3. a-d)		2nd (3. e)
1st			1st (3. c)			
K		K (3. a)				K (3. c)

	K	**1st**	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**	**8t**
Plate Tectonics							X		
Shaping Earth's Surface	X		X		X		X		
Energy in Earth System		X		X			X		
Earth/Life History			X					X	
Solar System				X		X			X
Resources	X		X				X		