

## **Science**

### **Grades 7-8**

#### **Program Goal:**

Students will develop a curiosity for and an understanding of our universe, including a sense of stewardship toward God's creation and dwindling natural resources. They will develop critical and independent thinking skills and a knowledge base which will enable them to solve (scientific) problems and to create new and ethical solutions for the future of our world.

#### **Grade Level Goal:**

##### **Seventh Grade:**

In seventh grade, students will expand their knowledge base of life, physical and earth science. They will use this knowledge to explore their curiosity of science and to develop critical thinking skills.

##### **Eighth Grade:**

In eighth grade, students will apply their knowledge of life, earth, and physical science using an ethical perspective. They will evaluate the impact of human activities and determine appropriate solutions for these situations.

#### **Program Goal Objectives:**

##### **Scientific Curiosity:**

1. The learner will generate scientific questions about the world based on observations.
2. The learner will design scientific investigations.
3. The learner will conduct scientific investigations.

4. The learner will use tools and equipment to provide consistency in an investigation.
5. The learner will obtain information through a variety of sources.

### **Stewardship:**

1. The learner will explain how science is the study of *God's* creation.
2. The learner will recognize the delicate balance of the earth's ecosystem and the need to maintain that balance as *God* created it.
3. The learner will describe their responsibility to conserve the limited natural resources of the earth and investigate the human effect on the earth.

### **Problem Solving/Critical Thinking:**

1. The learner will design and conduct scientific investigations that use appropriate tools, equipment and measurement devices in an investigation.
2. The learner will analyze and draw conclusions from measurement, data, observations, graphing and calculations.
3. The learner will evaluate the strengths and weaknesses of claims, arguments or data.
4. The learner will read, organize and analyze data.
5. The learner will write and follow step-by-step procedures.
6. The learner will describe limitations in personal knowledge.
7. The learner will evaluate validity of claims, arguments and data.

### **Ethical Perspective:**

1. The learner will evaluate current life science technology and formulate an opinion based on his or her knowledge of the Catholic Faith.

2. The learner will develop a lifelong awareness of both the potential and limitations of research and technology.
3. The learner will identify the social and moral implications of genetic research and technology.
4. The learner will investigate the implications of human activities and their affect on the environment.
5. The learner will evaluate energy consumption in terms of renewable and non-renewable resources.
6. The learner will investigate alternate energy sources and their risks and benefits for society.
7. The learner will evaluate his or her role in making responsible environmental decisions.
8. The learner will evaluate contemporary evolutionary theories in relation to Catholic Doctrine.

## **Content Criteria:**

### **Earth Science:**

1. The learner will describe and identify the history, structure and composition of earth's features and the forces that change it over time.
  - a. The learner will describe and identify surface features using maps.
  - b. The learner will compare and contrast the composition of rocks and minerals.
  - c. The learner will explain how rocks and fossils are used to determine the age and geological history of the earth.
  - d. The learner will explain how rocks are broken down to form soil.
  - e. The learner will explain the effect of industrial technology on the earth's surface.
  - f. The learner will use the theory of plate tectonics to explain the features of the earth's surface.
2. The learner will investigate and describe what makes up weather and explain what causes the different weather patterns.

- a. The learner will explain patterns of changing weather and demonstrate how they are measured.
- b. The learner will interpret weather patterns using various data in order to make predictions.
3. The learner will describe the water cycle and analyze the impact on life on earth.
  - a. The learner will trace the path of water through the water cycle.
  - b. The learner will describe the various forms that water takes on the earth's surface and conditions under which they exist.
  - c. The learner will analyze the critical nature of the water cycle upon life on earth.
4. The learner will describe the composition of the atmosphere and the forces within the atmosphere that affect weather patterns and analyze the effect of human interaction on the weather.
  - a. The learner will describe the composition of the atmosphere.
  - b. The learner will explain the impact of human activities on the atmosphere and describe its effect on human health.

## **Life Science:**

1. The learner will explore the relationships between different ecosystems and classify the living things they contain. (interact, change over time and how they are related.)
  - a. The learner will identify components of an ecosystem and describe energy flow in a particular ecosystem, examine the ecological relationships among species and how the relationships among species change over time.
  - b. The learner will compare and contrast relationships between different ecosystems- habitat, populations, carrying capacity, endangered species and extinction, human impact.
2. The learner will discover the structure of different cells.
  - a. The learner will diagram the components of plant and animal cells and explain the functions of these components.
  - b. The learner will compare and contrast plant and animal cells.

3. The learner will explain how cells grow, develop and reproduce and how they function within an organism.
  - a. The learner will construct a model demonstrating cell division and reproduction.
  - b. The learner will explain how cells use and store energy.
4. The learner will describe similarities and differences between single cell and multi-cell organisms.
  - a. The learner will compare and contrast single cell organisms with multi-cellular organisms.
5. The learner will compare and classify organism into major groups based on their structure.
  - a. The learner will identify the six taxonomic kingdoms.
  - b. The learner will describe the characteristics of each of the six kingdoms.
  - c. The learner will recognize basic characteristics and categorize organisms into one of six kingdoms.
6. The learner will observe how plants obtain and use energy and how they grow and develop.
  - a. The learner will provide evidence that plants make and store food.
  - b. The learner will describe the life cycle of a flowering plant.
7. The learner will observe how traits are passed from one generation to the next.
  - a. The learner will describe how characteristics of living things are passed on from generations, illustrating how heredity environment may influence and determine the characteristics of an organism.
8. The learner will describe scientific evidence and theory pertaining to evolution.
  - a. The learner will explain how new traits develop and become established in a population.
  - b. The learner will identify the causes of extinction and the introduction of new species.

## Physical Science:

1. The learner will measure, describe, and classify types of matter and the changes they undergo.
  - a. The learner will describe and compare objects in terms of mass, volume, and density.
  - b. The learner will explain when length, mass, weight, density, area, volume, or temperature are appropriate to describe the properties of an object or substance.
  - c. The learner will compare and contrast atoms and molecules.
  - d. The learner will classify substances as elements, compounds, or mixtures.
  - e. The learner will describe the arrangement and motions of molecules in solids, liquids and gases.
  - f. The learner will describe common physical changes in matter: evaporation, condensation, sublimation, thermal expansion and contraction.
  - g. The learner will describe common chemical changes in terms of properties of reactants and products.
  - h. The learner will explain how mass is conserved in physical and chemical changes.
2. The learner will identify, describe and classify types of energy and the transformations they undergo.
  - a. The learner will describe common energy transformations in everyday situations.
  - b. The learner will describe energy and the many common forms it takes.
  - c. The learner will classify the common forms of energy.
3. The learner will describe how and why objects move as they do.
  - a. The learner will describe relative motion.
  - b. The learner will relate motion of objects to unbalanced forces.
  - c. The learner will describe the contrasting forces exerted by magnets, electrically charged objects, and gravity.
  - d. The learner will use electric currents to create magnetic fields, and explain applications of this principle.
  - e. The learner will design strategies for moving objects by application of forces, including the use of simple machines.

4. The learner will compare and contrast mechanical waves and electromagnetic waves.
  - a. The learner will explain how sound travels through different media.
  - b. The learner will explain how echoes occur and how they are used.
  - c. The learner will explain how light is required to see objects.
  - d. The learner will describe ways in which light interacts with matter.
  - e. The learner will describe the motions of pendulums and vibrating objects.
  - f. The learner will explain how mechanical and electromagnetic waves transfer energy.
  - g. The learner will compare and contrast the various characteristics of waves.

## Space:

1. The learner will explain how technology and scientific inquiry help us learn about the universe.
  - a. The learner will compare and contrast telescopes.
  - b. The learner will describe history of space exploration.
  - c. The learner will explore current technological developments concerning the study of space.
2. The learner will compare and contrast the earth and sun with other planets and star systems.
  - a. The learner will illustrate characteristics of earth and other planets in terms of supporting life.
  - b. The learner will describe the life cycle of stars and classify our own sun.
3. The learner will explain how we learn about the universe and how science uses theories and evidence to explain the origin of the universe.
  - a. The learner will explain how the solar system formed.

4. The learner will explain motions and forces that act upon the solar system.
  - a. The learner will illustrate orbits and rotations of objects in space.
  - b. The learner will prove that gravity is a force that affects our universe.
5. The learner will explain observations made in the day and night sky.
  - a. The learner will demonstrate perceived and actual movement of the moon, planets and constellations.
6. The learner will explain how stars and planetary systems form and how stars produce energy.
  - a. The learner will name the processes of a star's formation.
  - b. The learner will summarize the concepts of fusion and radiation.

## **Scope and Sequence:**

### **EARTH SCIENCE:**

#### **I. Geosphere**

- A. Earth features
  1. Mountains
    - a. Ranges
    - b. Volcanoes
  2. Plains
  3. Plateaus
  4. Deserts
- B. Glacial features
  1. Moraines
- C. How features change
  1. Erosion
  2. Weathering
  3. Decomposition
- D. Earth materials
  1. Rocks and minerals
    - a.) Composition
    - b.) Location

- c.) Formation
  - 2. Soil formation
    - a.) Clay
    - b.) Silt
    - c.) Sand
- E. Earth Layers
  - 1. Tectonics
  - 2. Crust, Mantle, Core
    - a.) Composition
    - b.) Characteristics
- F. Earth History
  - 1. Fossils
  - 2. Geologic eras
  - 3. Plate tectonics
- G. Forces for change
  - 1. How features change
    - a.) Earthquakes
    - b.) Volcanoes
    - c.) Sea floor spreading
    - d.) Plate tectonics
    - e.) Erosion
      - 1.) Erosion
      - 2.) Decomposition
      - 3.) Weathering
  - 2. Effect of Human activity

## II. Hydrosphere

- A. Features
  - 1. Lakes
    - a.) Reservoirs
  - 2. Rivers
  - 3. Oceans
  - 4. Ground Water
    - Aquifer
  - 5. Snow
  - 6. Glaciers

7. Ice caps
8. Wetlands
- B. Composition
  1. Water types
    - a. Fresh water
    - b. Salt water
    - c. Brackish
  2. Properties of water
    - a. Boiling point/freezing point
    - b. Density
    - c. Elements
    - d. Surface tension
- C. Water Cycle
  1. Evaporation
  2. Precipitation
  3. Condensation
  4. Transpiration
  5. On-going, closed system
  6. Sublimation
  7. Impact on life
- D. Forces of Change
  1. Drought
  2. Global warming
  3. Waves and tides
  4. Current
  5. Human impact
    - a. Dams
    - b. Pollution
    - c. Filtration

### **III. Atmosphere**

- A. Composition
  1. Layers
    - a.) Stratosphere
    - b.) Mesosphere
    - c.) Thermosphere

- d.) Exosphere
- e.) Troposphere
- f.) Ionosphere
- 2. Characteristics
  - a.) Oxygen
  - b.) Nitrogen
  - c.) Carbon dioxide
  - d.) Density
  - e.) Water vapor
- B. Weather Components
  - 1. Climate
    - a.) Atmosphere conditions
      - 1.) Temp
      - 2.) Precipitation
      - 3.) Wind (direction and speed)
      - 4.) Pressure
        - a. Low
        - b. High
    - b.) Air masses
      - 1. Fronts
    - c.) Measurement tools
      - 1. Thermometer
      - 2. Barometer (pressure)
      - 3. Psychrometer (relative humidity)
      - 4. Hydrometer (regular humidity)
      - 5. Rain gauge
      - 6. Anemometer (wind)
      - 7. Cloud chart
    - d.) Interpreting/forecasting
      - 1.) Satellite images
      - 2.) Observations and measurements
      - 3.) Warnings and watches
        - a.) NWS
        - b.) AWIPS
        - c.) NOAA
  - 2. Forces that effect weather
    - a.) Wind

- b.) Jet Stream
  - c.) Trade winds
  - d.) Westerlies
  - e.) Natural phenomenon
    - 1.) Volcanoes
    - 2.) Fires
    - 3.) Lake effect
    - 4.) El Nino, El Nina
  - f.) Axis of earth
  - g.) Gravity
  - h.) Atmospheric pressure
  - i.) Heat transfer
    - 1.) Convection
    - 2.) Conduction
    - 3.) Radiation
3. Human impact:
- a.) Effects of human activities:
    - 1.) Transportation
    - 2.) Industry
    - 3.) Green house effect
    - 4.) Deforestation
    - 5.) Destroying the ozone layer
  - b.) Health
    - 1.) Disease
      - a. Asthma
      - b. Allergies
      - c. Cancer
  - c.) Drought/flooding
  - d.) Acid rain
  - e.) Smog
4. Conditions

# SPACE

## I. Technology

- A. Telescopes
  - 1. Refracting
  - 2. Reflecting
  - 3. Radio
  - 4. Hubble
- B. History of space exploration
  - 1. Scientists (Copernicus, Galileo, Brache)
  - 2. Rockets and satellites
  - 3. Space programs
    - a. NASA
    - b. Explorations of the solar system
    - c. Human exploration
- C. Current Technological Developments
  - 1. Space stations
  - 2. Space Shuttle Program
  - 3. Satellites
    - a. Weather
    - b. Communication
    - c. National defense
  - 4. Computers
    - a. Collecting and interpreting data from deep space

## II. Planets and Stars

- A. Characteristics of planets
  - 1. Inner planets
  - 2. Outer planets
- B. Life cycle of stars
  - 1. Star formation
    - a. Production of energy
    - b. Radio waves
    - c. Spectra
  - 2. Classification of stars
    - a. Black holes
    - b. Nebula

3. Sun

**III. Theories**

- A. Fusion and radiation
- B. Solar system formation
  - 1. Big Bang (Quantum, String)
  - 2. Creationism

**IV. Motions and forces**

- A. Orbit
  - 1. Rotation
  - 2. Revolution
  - 3. Tilt
  - 4. Elliptical
  - 5. Eclipses
- B. Gravity

**V. Day and Night sky observations**

- A. Planets
- B. Moons
- C. Comets
- D. Asteroids (meteors, meteorites, meteoroids)
- E. Stars/constellations
- F. Galaxies
  - 1. Spiral
  - 2. Elliptical
- G. Other solar systems
- H. Milky way
- I. Speed of light

## **LIFE SCIENCE**

**I. Ecosystems**

- A. Components
  - 1. Habitat
  - 2. Types of species
  - 3. Climate
- B. Energy flow
  - 1. Food web

2. Food chain
  3. Energy pyramid
  4. Producers/consumers
  - C. Ecological relationships
    1. Competition
    2. Territory
    3. Predator/prey relationship
    4. Parasitism
    5. Colonies/Herd behavior
  - D. Changes over time
    1. Succession
    2. Carry capacity
    3. Human impact
    4. Extinction/endangerment
- II. Cell structure**
- A. Theory
  - B. Components
    1. Animal
      - a. Nucleus
      - b. Cell membrane
      - c. Organelles
    2. Plants
  - C. Functions
    1. Photosynthesis
    2. Respiration
    3. Transpiration
- III. Cell development**
- A. Reproduction and growth
    1. Meiosis
    2. Mitosis
  - B. Organization
    1. Tissues
    2. Organs
    3. Types of cells
  - C. Use and Store energy
    1. Osmosis
    2. Diffusion
    3. Food

4. Molecule
5. Oxygen
6. Carbon dioxide
7. Water

**IV. Single vs. Multi-cells**

- A. Protists
- B. Paramecium
- C. Amoeba
- D. Euglena

**V Classify Organisms**

- J. Taxonomy
  1. Based on Characteristics
  2. Levels
- K. Kingdoms

**VI. Plant**

- A. Food process and production
  1. Photosynthesis
  2. Starch
  3. Sugar
  4. Oxygen
- B. Life cycle of flowering plant
  1. Roots, stems, leaves, flowers, fruits, seeds
  2. Embryo, pollination, ovary, egg cell, germination, fertilization

**VII. Heredity**

- A. How characteristics are based on
  1. Variation
  2. Mutation
  3. Genes
  4. Chromosomes
- B. Environment
  1. Inherited (traits)
  2. Acquired
  3. Genetic manipulation

**VIII. Evolution**

- A. New traits
  1. Adaptations
  2. Survival of fittest (Natural Selection)

3. New species as a result of isolation
- B. Extinction
1. Human impact
  2. Natural selection
  3. Phenomena

## Physical Science

### I. MATTER

- A. Measurable Characteristics Relating to Matter:  
mass, volume, density, weight, length, temperature;  
Units of Metric Measurement/SI Units
- B. Classification of Matter: elements, compounds,  
homogeneous mixtures, heterogeneous mixtures,  
structure of atoms and molecules
- C. States of Matter - the molecular arrangement of  
solids, liquids, gases, plasmas.
- D. The motion of molecules in solids, liquids, gases,  
and plasmas
- E. Changes in Matter:
  1. Physical Changes - evaporation,  
condensation, sublimation, thermal expansion  
and contraction, melting, freezing
  2. Chemical Changes - burning, photosynthesis,  
digestion, corrosion, acid reactions, chemical  
reactions in the home (drain cleaner)
  3. Law of Conservation of Mass - Mass/Weight  
remains constant in closed systems

### II. ENERGY

- A. Energy Classifications
  1. Potential Energy -  $PE = mgh$
  2. Kinetic Energy -  $KE = \frac{1}{2} mv^2$
  3. Einstein's view of energy -  $E = mc^2$

- B. Forms of Energy
  - 1. Mechanical, heat, sound, light, electrical, magnetic, chemical, food
  - 2. Types of Circuits
  - 3. Electrical Flow
- C. Energy Transformations
  - 1. Law of Conservation of Energy - The total amount of energy remains constant in all transformations.
  - 2. Energy transformations in motors, generators, power plants, light bulbs, appliances, etc.
  - 3. Energy transformation in changing from one physical state of matter to another.
- D. Heat Transfer
- E. Energy Alternatives
  - 1. Renewable and Nonrenewable Resources - Risks/Benefits
  - 2. Geothermal Energy
  - 3. Wind Energy
  - 4. Biomass
  - 5. Nuclear Fusion
  - 6. Nuclear Fission
  - 7. Solar Energy
  - 8. Hydroelectric

### III. FORCES AND MOTION

- A. Types of Forces
  - 1. Push, pull, friction, gravity, magnets, electrical (static electricity)
  - 2. Balanced and unbalanced forces
  - 3. Paired forces - attraction/repulsion, action/reaction
  - 4. Buoyant force

- B. Application of Forces
  - 1. Simple machines - lever, pulley, screw, wheel and axel, wedges
  - 2. Direction change, force advantage, speed and distance advantage
  - 3. Newton's Laws - especially  $F=ma$  (The force on an object is equal to the mass of the object multiplied by the object's acceleration.)
  - 4. Work -  $W=Fd$  (The work done on an object is equal to the force on the object multiplied by the distance it moves.)
- C. Types of Motion
  - 1. Relative Motion
  - 2. Two-Dimensional Motion - up, down curved path.
  - 3. Constant Motion
- D. Quantifying Motion
  - 1. Speed, Direction, Change in Speed, Change in Direction, Acceleration

#### IV. WAVES

- A. Classification of Waves
- B. Mechanical v. Electromagnetic
  - 1. Characteristics of Mechanical Waves
  - 2. Characteristics of Electromagnetic Waves
- C. Types of Waves
  - 1. Sound, Water, Earthquake, Visible Light, X-rays, Gamma rays, Microwaves, Infrared, Radio, etc.
  - 2. General Wave Characteristics/Properties: crests, troughs, wavelength, wave height, amplitude, frequency
  - 3. Motion of Wave
    - a.) Transverse Motion, Longitudinal Motion (Compress ional)
    - b.) How sound waves travel through various media
    - c.) How light waves travel through various media (including the eye)

- d.) The motion of earthquake waves - P waves, S waves, etc.
- e.) The motion of water waves - circular motion as opposed to longitudinal motion
- 4. Wave Interaction with Matter
  - a.) Reflection, Refraction, Diffraction, Constructive Interference, and Destructive Interference
  - b.) Absorption
  - c.) Transmission - transparency, translucence, and opacity

## Instructional Criteria

1. Students will write lab and research reports to demonstrate their understanding of a scientific principle.
2. Students will be able to identify cause and affect relationships in science.
3. Students will recognize the reliability of sources and analyze biases found in various media.
4. Students will use research techniques (internet, periodicals and reference books) to investigate a scientific concept.
5. Students will construct a multi-dimensional project.
6. Students will demonstrate the use of charts, graphs and tables to illustrate scientific data.
7. Students will use maps to analyze the earth's features.
8. Students will develop note taking and outlining skills.
9. Students will demonstrate the ability to use laboratory equipment.
10. Students will experience either an actual or virtual dissection.
11. Students will construct and interpret timelines of people and events in science.
12. Students will apply the use of the metric system in scientific conversions.

## **Text Book Recommendation:**

Glencoe/McGraw Hill - Integrated Science Red, Blue, Green, 15 Book Series

Life (Green): A. Life's Structure and Function - 0-07-825553-8

B. From Bacteria to Plants - 0-07-825560-0

C. Animal Diversity - 0-07-825567-8

D. Human Body Systems - 0-07-825574-0

E. Ecology - 0-07-825588-0

Earth (Red): F. Earth Materials and Processes - 0-07-825531-7

G. The Changing Surface of Earth - 0-07-825538-4

H. The Water Planet - 0-07-825640-2

I. The Air Around You - 0-07-825545-7

J. Astronomy - 0-07-825581-3

Physical (Blue): K. The Nature of Matter 0-07-825524-4

L. Chemistry 0-07-825596-1

M. Motion, Forces, and Energy 0-07-825607-0

N. Electricity and Magnetism 0-07-825619-4

O. Waves, Sound and Light 0-07-825630-5

Rating: 5.0 out of a possible 5.0

Strengths: Supports curriculum, many resource materials, McGraw-Hill is also author of our standardized test.

Weakness: Storage issue