

PHYSICAL SCIENCE	
Motion and Stability: Forces and Interactions	
Faith Seeking Understanding	
<ul style="list-style-type: none"> • James 5:8 “Draw near to God, and He will draw near to you.” 	
Catholics making contribution to the topic	
<ul style="list-style-type: none"> • Alessandro Volta – Catholic scientist who worked with static electricity (1775) and invented an early electrochemical cell battery (1800) 	
Science outcomes	
<ol style="list-style-type: none"> 1. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object. <ol style="list-style-type: none"> a. Examples could include an unbalanced force on one side of a ball can make it start moving; and, balanced forces pushing on a box from both sides will not produce any motion at all. Assessment does not include quantitative force size, only qualitative and relative. Gravity is being addressed as a force that pulls objects down. 2. Make observations and/or measurements of an object’s motion to provide evidence that a pattern can be used to predict future motion. <ol style="list-style-type: none"> a. Examples of motion with a predictable pattern could include a child swinging in a swing, a ball rolling back and forth in a bowl, and two children on a see-saw. Assessment does not include technical terms such as period and frequency. 3. Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other. <ol style="list-style-type: none"> a. Examples of an electric force could include the force could include the force on hair from an electrically charged balloon and the electrical forces between a charged rod and pieces of paper; examples of magnetic force could include the force between two permanent magnets, the force between an electromagnet and steel paperclips, and the force exerted by one magnet versus the force exerted by two magnets. Examples of cause and effect relationships could include how the distance between objects affects strength of the force and how the orientation of magnets affects the direction of the magnetic force. Assessment is limited to forces produced by objects that can be manipulated by students, and electrical interactions are limited to static electricity. <ol style="list-style-type: none"> i. Relate actions of magnets to God and His people. God is like a strong magnet, drawing us toward Himself. (James 5:8) 4. Define a simple design problem that can be solved by applying scientific ideas about magnets. <ol style="list-style-type: none"> a. Examples of problems could include constructing a latch to keep a door shut and creating a device to keep two moving objects from touching each other. 	
Engineering - Experiments - Extension Activities	
<ul style="list-style-type: none"> • Activity: Challenge students to move an object through the maze without touching it. They should be able to explain what they did, and why it worked. <ul style="list-style-type: none"> ○ Use concepts of attractive force to move an object through a maze by placing a magnet (or paperclip) on the maze and pulling it through the path with a magnet placed below the cardstock-paper maze. ○ Use concepts of repelling force to move an object through a maze by using two magnets with similar poles facing one another, and “pushing” the secondary magnet along the path with the first magnet, without actually touching them together. 	
Crosscutting Concepts	
<ul style="list-style-type: none"> • Religion- 	

- ELA-cause/effect, compare/contrast, use patterns to make predictions
- Math- reason abstractly, use appropriate tools strategically
- P.E.-explain motion of balls and recess equipment
- Social Studies-
- Other

Resources

- balloons
- paperclips
- magnets – bar magnets recommended, N and S marked on the magnets
- copy of “Magnet Maze” on cardstock *See Appendix

LIFE SCIENCE
From Molecules to Organisms: Structures and Processes
Faith Seeking Understanding <ul style="list-style-type: none"> • Sacraments of the Church support us in faith throughout our lives
Catholics making contribution to the topic <ul style="list-style-type: none"> •
Science outcomes <ol style="list-style-type: none"> 1. Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death. <ol style="list-style-type: none"> a. Changes organisms (plants and animals) go through during their life form a pattern. Assessment of plant life cycles is limited to those of flowering plants. Does not include details of human reproduction. b. Sacraments of Christian Initiation mirror this cycle. “The faithful are born anew by Baptism, strengthened by the sacrament of Confirmation, and receive in the Eucharist the food of eternal life. They receive in increasing measure the treasures of the divine life.” – CCC 1212 <i>Baptism = birth; Eucharist & Reconciliation = growth & maturity; Matrimony = reproduction; Anointing of the Sick = death</i>
Engineering - Experiments - Extension Activities <ul style="list-style-type: none"> • Students will work in cooperative groups to research and diagram common life cycles of animals and flowering plants. (examples: chickens, frogs, butterflies, rabbits, fish, flowers) Classroom discussion should compare similarities (birth, growth, reproduction, death) and contrast (various types of birth & growth – eggs or not, metamorphosis phase or not, etc.) among the organisms.
Crosscutting Concepts <ul style="list-style-type: none"> • Religion- Sacraments of Christian Initiation • ELA- create & read charts and diagrams; compare & contrast • Math- • P.E.- • Social Studies- • Other
Resources <ul style="list-style-type: none"> • research materials for plant and animal life cycles • visual display-making materials

LIFE SCIENCE

Ecosystems: Interactions, Energy and Dynamics

Faith Seeking Understanding

- Body of Christ (Church) supports the growth and salvation of all members
- Romans 12:4-5 (individuals are given different gifts for the good of all)

Catholics making contribution to the topic

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Science outcomes

1. Construct an argument that some animals form groups that help members survive.
 - a. Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size.

Engineering - Experiments - Extension Activities

- Given video examples of group animal behavior (such as buffalo protecting young, bees/ants cooperating in a colony, gophers “look out”, wolves “babysitting”, Canadian geese rotating point & supporting injured member) students will identify animal behaviors that are cooperative and contribute to group survival.

Crosscutting Concepts

- Religion- Romans 12:4-5 (individuals are given different gifts for the good of all)
- ELA-
- Math-
- P.E.-
- Social Studies-
- Other – Music “We are Many Parts” by Marty Haugen

Resources

- video examples of animals working cooperatively in groups to survive (obtain food, defend themselves, cope with changes)

LIFE SCIENCE
Heredity: Inheritance and Variation of Traits
Faith Seeking Understanding <ul style="list-style-type: none"> • God created humans in His own image (Genesis 1:27) • “Seed that Falls on Good Ground” parable (Mark 4:1-8)
Catholics making contribution to the topic <ul style="list-style-type: none"> • Catholic monk (Gregor Mendel) studied the traits that are passed on to pea plants
Science outcomes <ol style="list-style-type: none"> 1. Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms. <ol style="list-style-type: none"> a. Patterns are the similarities and differences in traits shared between offspring and their parents, or among siblings. Emphasis is on organisms other than humans. (does not include genetics mechanisms of inheritance and prediction of traits; is limited to only non-human examples) <ol style="list-style-type: none"> i. sample activity could include analyzing a picture of a litter of kittens to find common traits and individual differences 2. Use evidence to support the explanation that traits can be influenced by the environment. <ol style="list-style-type: none"> a. Examples of the environment affecting a trait could include normally tall plants grown with insufficient water are stunted; and a pet dog that is given too much food and little exercise may become overweight <ol style="list-style-type: none"> i. “Seed that Falls on Good Ground” parable (Mark 4:1-8)
Engineering - Experiments - Extension Activities <ul style="list-style-type: none"> • Inquiry – design an experiment to test the effects of environment on the growth of a plant from seeds. (ex. grass seeds in 3 cups, given different types of soil/ground covering OR different amounts of water) *See “Engineering Design” for more complete description.
Crosscutting Concepts <ul style="list-style-type: none"> • Religion- Stewardship of the environment (Genesis & 7th Commandment) • ELA- • Math- graph seed growth (any one of these: height, number of sprouts, or first day of sprouting) • P.E.- • Social Studies- • Other
Resources <ul style="list-style-type: none"> • Bible • seeds (any kind, radishes sprout fast, grass is easy but takes awhile to sprout) • soil of differing types (sand, dirt, rocky) • cups

LIFE SCIENCE
Biological Evolution: Unity and Diversity
Faith Seeking Understanding <ul style="list-style-type: none"> Creation story (Genesis 1:1-27) – be sure to clarify with our students that Catholic teaching views this not as a history – not as 7, 24-hour days – but as a message of God’s lovingly creating all things according to His divine plan
Catholics making contribution to the topic <ul style="list-style-type: none"> Coronado discovered the Grand Canyon (Catholic Spanish explorer) which contains fossil records
Science outcomes <ol style="list-style-type: none"> Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago. <ol style="list-style-type: none"> Examples of data could include type, size, and distributions of fossil organisms. Examples of fossils and environments could include marine fossils found on dry land, tropical plant fossils found in Arctic areas, and fossils of extinct organisms. (Does not include identification of specific fossils or present plants and animals. Is limited to major fossil types and relative ages.) <ol style="list-style-type: none"> Kansas connection: Sternberg Museum “fish within a fish”, limestone in this area contains fossil evidence of mollusks and marine life Genesis 1:1-27 Creation story – God created all things, in an organized way. The beauty of creation reflects the infinite beauty of the Creator. Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing. <ol style="list-style-type: none"> Examples of cause-effect relationships could be plants that have larger thorns than other plants may be less likely to be eaten by predators; and animals that have better camouflage coloration than other animals may be more likely to survive and therefore more likely to leave offspring. <ol style="list-style-type: none"> Activity: Inquiry First: Have each student cut several “moth shapes” out of white paper and newsprint. Scatter all of them –whole class combined- on newspaper and have the students make a tally-chart of how many you see of each type in 15 seconds. Explanation: When an environment became polluted with smoke, and the tree-trunks darkened, certain coloration traits helped some moths survive because predators couldn’t see them to eat them. This caused an increase in grey moths, and a reduction in white moths Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all. <ol style="list-style-type: none"> Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other. In our spiritual environment, we need to create a “culture of life” so that everyone can grow. Jesus gives us instructions for living as a joyful Christian (some examples are the 10 Commandments and the two “Great Commandments” – love of God and love of neighbor). Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change. <ol style="list-style-type: none"> Examples of environmental changes could include changes in land characteristics, water distribution, temperature, food, and other organisms. It is limited to a single environmental change, and does not include the greenhouse effect or climate change.

i. Optional activity – view and discuss “How Wolves Change Rivers”

Engineering - Experiments - Extension Activities

- see activities embedded within the outcomes descriptions

Crosscutting Concepts

- Religion- God created the world in love, and with a divine plan
- ELA- cause/effect, support with evidence
- Math- graphing (tally chart, bar or picto-graphs)
- P.E.-
- Social Studies- urban, suburban, rural – environment pollution in urban areas
- Other

Resources

- Bible
- newspaper
- white paper
- scissors
- story of the moths
- internet video “How Wolves Change Rivers” by SustainableMan <http://sustainableman.org/how-wolves-change-rivers/>
- (optional) article about fossil records NOT substantiating macro-evolutionary theories <http://www.catholiceducation.org/articles/science/sc0042.html>

EARTH AND SPACE SCIENCE	
Earth's Systems	
Faith Seeking Understanding	
<ul style="list-style-type: none"> • Christian Virtues: sharing our gifts with others CCC 1942, 1948 (solidarity with others, those affected by climates that are difficult to live in need help from those in more hospitable climates) • James 2:15 (do good works, share with others) 	
Catholics making contribution to the topic	
<ul style="list-style-type: none"> • José Antonio de Alzate y Ramírez was a Mexican priest who was one of the earliest reliable observers of Mexican meteorology. (21 November 1737 – 2 February 1799) 	
Science outcomes	
<ol style="list-style-type: none"> 1. Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. <ol style="list-style-type: none"> a. Examples of data could include average temperature, precipitation, and wind direction. Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change. 2. Obtain and combine information to describe climates in different regions of the world. <ol style="list-style-type: none"> a. Utilize internet or almanac resources to research in small groups a particular country or region served by Catholic Relief Services's annual Lenten Rice Bowl. Prepare a presentation for the class that includes that area's climate. 	
Engineering - Experiments - Extension Activities	
<ul style="list-style-type: none"> • Using graphs, display information about typical weather conditions for an area. This data should be divided according to the four seasons. 	
Crosscutting Concepts	
<ul style="list-style-type: none"> • Religion-solidarity with the needy • ELA-research and create a visual presentation • Math-graphs • P.E.-games played in different regions/countries • Social Studies-regions, map skills • Other 	
Resources	
<ul style="list-style-type: none"> • weather.com (historical weather data) 	

EARTH AND SPACE SCIENCE	
Earth and Human Activity	
Faith Seeking Understanding	
<ul style="list-style-type: none"> • Mark 4:35-40, Luke 8:22-25, or Matthew 8: 23-27 (Jesus Calms the Storm) 	
Catholics making contribution to the topic	
<ul style="list-style-type: none"> • Prokop Divis a theologian and natural scientist of Czechoslovakia who invented the first grounded lightning rod 	
Science outcomes	
<ol style="list-style-type: none"> 1. Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard. <ol style="list-style-type: none"> a. Examples of design solutions to weather-related hazards could include barriers to prevent flooding, wind resistant roofs, tornado-safety locations, and lightning rods. 	
Engineering - Experiments - Extension Activities	
<ul style="list-style-type: none"> • Identify your school building's features that are designed to manage weather hazards (examples: tornado-safety procedures & locations, how rainwater is managed, winter-storm weather plans, etc.) • Discuss/model what would happen without these features. • Discuss/model what changes you would make to improve your building's features. Critique the value of these changes. Explain why they would or would not be helpful. 	
Crosscutting Concepts	
<ul style="list-style-type: none"> • Religion-Catholic Relief Services natural disaster responses; most church buildings have a lightning rod incorporated into the external cross; God gives humans creative talents to solve problems, but we also rely on Him for protection • ELA-cause/effect • Math-use data to predict and track severe weather events • P.E.- • Social Studies-regions, climate • Other 	
Resources:	
<ul style="list-style-type: none"> • weather.com 	

ENGINEERING

Engineering Design

Faith Seeking Understanding

- God created humans in His own image (Genesis 1:27)
- “Seed that Falls on Good Ground” parable (Mark 4:1-8)

Catholics making contribution to the topic

- Catholic monk (Gregor Mendel) studied the traits that are passed on to pea plants

Science outcomes

1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Engineering - Experiments - Extension Activities

- Use experiment from “Heredity: Inheritance and Variation of Traits” outcome.
- Define the design problem (either differing water amounts to simulate different environments, or differing types of soil/ground covering to simulate different environments). Define “success” criteria – plants that grow to a certain height, live for a certain amount of time, etc. Define the constraints for your project (probably mostly related to time).
- Have students design 1 “control” and at least 2 different “variable” plant containers to grow their plants. The variables should focus on the design problem.
- Carry out the experiment to see which design solution best meets the criteria for success. Identify any “failure points” and be able to suggest changes that could be made to improve the design.

Crosscutting Concepts

- Religion- Stewardship of the environment (Genesis & 7th Commandment)
- ELA-
- Math- graph seed growth (any one of these: height, number of sprouts, or first day of sprouting)
- P.E.-
- Social Studies-
- Other

Resources

- Bible
- seeds (any kind, radishes sprout fast, grass is easy but takes a while to sprout)
- soil of differing types (sand, dirt, rocky) or measuring tools for differing water amounts
- cups/containers for plants