PHYSICAL SCIENCE	
Motion and Stability: Forces and Interactions	Kindergarten
SCRIPTURE	
God is our refuge and our strength, an ever-present help in distress Psalms 46:2	
STANDARD	
S. 1. Exploring God's beautiful world through his creations, plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object. S. 2. After utilizing our God given gifts and creations as tools, analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or pull.	
EXAMPLES	
Parables, Scripture, Literature, Saints	
ESSENTIAL QUESTIONS	
Using our God given physical abilities, what would happen to an object if we push or pull it harder? Softer?	
VOCABULARY TERMS	
push, pull, force, strength, motion	

<u>Parables</u>

The Parable of the Mustard Seed

-Mark 4:30-32, Matthew 13:31-32, Luke 13:18-19

The Parable of the Lost Sheep-Luke 15:4-7

<u>Scriptures</u>

Story of Creation (Genesis 1:1-2;4) (Genesis 2:6-25)

Retell or illustrate the Birth of Jesus (Luke 18:15-17)

Annunciation (Luke 1:28-38)

Guardian Angels (Luke 1:26-36)

Literature

And Everyone Shouted, "Pull!": A First Look at Forces and Motion (First Look: Science) by Claire Llewellyn

Move It!: Motion, Forces and You (Primary Physical Science) by Adrienne Mason and Claudia Dávila

Motion: Push and Pull, Fast and Slow (Amazing Science)by Darlene R. Stille and Sheree Boyd

The Golden Press Children's Bible

Peter Rabbit, Tom Kitten, Benjamin Bunny and others

Aesop's Fables by Jerry Pinkney

Saints

St. Nicholas (sleigh)

Mary, Mother of God

St. Michael

St. Gabriel

Activities

S.1-The Way of the Cross- Discussing the Stations of the Cross, have students pull a wagon or laundry basket with a jump rope tied to it with several books in it role playing Jesus pulling the Cross. Ask students to push the books keeping in mind what Jesus endured. Ask which needed more force or strength.

S.2-Domino Design- Pass out three different biblical map designs with a designated start and stop spot with three X's that the dominoes have to pass through. As a team, have students discuss how they will design a solution for their domino fall. Have them set up and practice it before trying a different map.

PHYSICAL SCIENCE	
Energy	Kindergarten
SCRIPTURE	
God said: Let there be light, and there was light Genesis 1:3	
STANDARD	
S. 1. God created light, investigate the effect of sunlight on the Earth's surface of sand, soil, rocks, and water. S. 2. Living out God's calling and protecting the Earth, use tools and materials to design and build a structure that will reduce the warming effect of sunlight on variations of the Earth's surface.	
EXAMPLES	
Parables, Scripture, Literature, Saints	
ESSENTIAL QUESTIONS	
How does sunlight warm the Earth's surface?	
VOCABULARY	
effect, sunlight, observations, data, collect, comparison	

<u>Parables</u>

Houses Built on Rock and Sand (Luke 6:47-49)

The Sower (Matthew 13: 1-9)

<u>Scripture</u>

Story of Creation (Genesis 1:1-2;4) (Genesis 2:6-25)

<u>Literature</u>

Jump Into Science: Sand Paperback by Prager

Ricky, the Rock that Couldn't Roll by Jay Miletsky

<u>Aesop's Fables</u> by Jerry Pinkney

Wonder Book for Boys and Girls

The Bears of Hemlock Mountain

<u>Saints</u>

St. Nicholas (sleigh)

Mary, Mother of God

St. Michael

St. Gabriel

Activities

S.1- Effect of Sunlight on Earth's surface- Using six small containers such as small pottery plant holders or cups, fill them with soil, plants, ice, sand, rocks, and water. Have students feel all of the examples of the Earth's surface with one finger observing the shape and temperature of each. Record in science notebooks their observations. Place a heat lamp (artificial sun) over the examples of the Earth's surface for the entire school day. Have students feel each example at the end of the day and discuss and record their observations. Did any of the examples change? Did any of them feel differently? If so, how?

Place a piece of white and black piece of paper outside on a warm sunny day for the school day. Have students feel before and after in hopes that the black paper is a lot warmer than the white paper. Explain to the students that the white paper reflects the sunlight, while black paper absorbs sunlight and is warmer. Discuss how why this is important to know and how this affects the Earth's surface.

S.2- Parking Garage- Give each group a toy car, stacking cubes, popsicle sticks, tape, legos, white paper and black paper. Tell the students that they have been hired to engineer and design a garage to protect an antique car that cannot be in sunlight. Help guide the students in making the decision to the best color of paper to use and designing a garage that allows no sunlight in touching the car. Allow the students to work together and explain when the time is up, the teacher will come around with a flashlight (artificial sunlight) to test their design with the classroom lights off. It is helpful to move the sunlight in the direction the sun would rise and set to help students get a real life visual. If time allows, discuss how the structure could be improved and allow students to make edits.

LIFE SCIENCE	
From Molecules to Organisms: Structures and Process.	Kindergarten
SCRIPTURE	
Are not two sparrows sold for a small coin? Yet not one of them falls to the ground without your Father's knowledge Matthew 10:29	
STANDARD	
S. 1. Describing the relationships, underlying order and meaning in God's creation of living things, use observations to describe patterns of what plants and animals (including humans) need to survive.	

EXAMPLES
Parables, Scripture, Literature, Saints
ESSENTIAL QUESTIONS
How does our Creator want us to take care of plants, animals and humans?
Vocabulary
observe, habitat, life, media, patterns, scientific questions, plants, survive, animals, humans

Parables

The Parable of the Mustard Seed

Mark 4:30-32, Matthew 13:31-32, Luke 13:18-19

The Parable of the Lost Sheep-Luke 15:4-7

Scripture

Story of Creation (Genesis 1:1-2;4) (Genesis 2:6-25)

Retell or illustrate the Birth of Jesus (Luke 18:15-17)

Annunciation (Luke 1:28-38)

Guardian Angels (Luke 1:26-36)

Literature

Noah's Ark (Caldecott Honor Book) by Jerry Pinkney

Goodnight, Ark by Laura Sassi and Jane Chapman
Noah's Ark (Little Golden Book) by Barbara Shook Hazen and Mircea Catusanu
The Story of PIng

Tim to the Rescue

Aesop's Fables by Jerry Pinkney

Saints

St. Nicholas

Mary, Mother of God

St. Michael

St. Gabriel

Activities

S.1- After discussing examples of the evident beauty of God's creation of plants, animals and humans differ from what they need to survive, have each student bring in a small shoe box and ask for donations of small figurines of a certain habitat, for example, Grasslands, Tundra, Rainforest, or Prairie. Provide construction paper, tissue paper, animal figurines, cotton balls, or anything that would be suitable for the habitat of your choice. Explain to the students that they will make a miniature model of God's creation of the habitat explaining that they will need plants, animals and humans in their model and what they need to survive; food, water, shelter and clothing.

EARTH AND SPACE SCIENCE	
Earth's Systems	Kindergarten
SCRIPTURE	
All the days of the Earth, seedtime and Harvest and cold and heat, summer and winter, and day and night shall not cease Genesis 8:22	
STANDARD	
S. 1. Using the Gift of our senses, use and share observations of local weather conditions to describe patterns over time. S. 2. Understanding God's relationship with man and nature, observe plants and animals (including humans), how can they change the environment to meet their needs? Construct an argument supported by evidence.	
EXAMPLES	
Parables, Scripture, Literature, Saints	
ESSENTIAL QUESTIONS	
Knowing God created weather for a purpose, describe the purpose of having rain, snow, sunlight, clouds and patterns in the weather?	
VOCABULARY	
describe, weather, sunlight, wind, rain, snow, temperature, cloudiness, patterns, measurable	

<u>Parables</u>

Jesus Calms the Storm- Matthew 8:23-27

The Man Who Prayed about Weather-1 Kings 17-28

<u>Scripture</u>

Story of Creation (Genesis 1:1-2;4) (Genesis 2:6-25)

Archangels: Michael and Gabriel (Lk 1:26-36)

Christmas (Luke 2:1-20)

<u>Literature</u>

<u>Aesop's Fables</u> by Jerry Pinkney
Ant and the Grasshopper
The Tortoise and the Hare
THe Mouse and the Lion

Peter Rabbit, Tom Kitten, Benjamin Bunny and others

The Story of Ferdinand the Bull (Leaf)

Activities

S1) Everyday in circle time, discuss and chart the weather in terms of different types of weather and temperature changes each day. Also, chart the weather in the morning and afternoon, explaining that typically the sunlight warms the Earth throughout the day and when the energy of God's creation of the sun sets, the temperatures lower. Discuss patterns in weekly and seasonal differences as well.

Students can also fill in a weather journal to help visualize and illustrate the weather changes. There are free examples if searched in Teachers Pay Teachers.

S2) Discuss habitats of animals and how they use materials from God's Earth to help them survive. You could use a groundhog as an example in February and discuss Groundhog Day. Have students draw or make a model of where a groundhog lives and changes the environment to create complex burrow systems. They are herbivores and vegetation and sometimes insects. They increase their consumption to accumulate fat for reserve to hibernate for the winter. All of these discussions can be geared around how God created the world so that all living things would have what they need in their environment around them to survive.

EARTH AND SPACE SCIENCE	
Earth and Human Activity	Kindergarten
SCRIPTURE	
Then God said: Let us make human beings in our image, after our own likeness. Let them have dominion over the fish of the sea, the birds of the air, the tame animals, all the animals, and all the creatures that crawl of the Earth Genesis 1:26	
STANDARD	
S. 1. Understanding God's purpose and order in the world, construct a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live. S. 2. Utilizing our God-given knowledge, ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather.	

S. 3. Explain the processes of conversation, preservation, overconsumption, and stewardship in relation to caring for what God has given us, discover how to reduce the impact of humans on the land, water, air, and/or other living things in the environment.
EXAMPLES
Parables, Scripture, Literature, Saints
ESSENTIAL QUESTIONS
How can you obtain information about the weather to protect all of God's creations of animals, humans, plants and the land?
VOCABULARY
weather, sunlight, cloudiness, wind, temperature, rain, snow, measurable, patterns, describe, record, severe, moderate, fair

Parables

The Parable of the Mustard Seed

Mark 4:30-32, Matthew 13:31-32, Luke 13:18-19

The Parable of the Lost Sheep-Luke 15:4-7

The Parable of the sheep, gate and shepherd- John 10:1-5, 7-18

Scriptures

Story of Creation (Genesis 1:1-2;4) (Genesis 2:6-25)

Retell or illustrate the Birth of Jesus (Luke 18:15-17)

Annunciation (Luke 1:28-38)

Guardian Angels (Luke 1:26-36

Literature

Oh Say Can You Say What's the Weather Today?: All About Weather (Cat in the Hat's Learning Library) Hardcover by Tish Rabe and Illustrated by Aristides Ruides

"WOW! Weather!" by Paul Deanno and Illustrated by Toby Mikle

Katy and the Big Snow by Virgina Lee Burton

Noah's Ark (Caldecott Honor Book) by Jerry Pinkney

Saints

St. Nicholas

Mary, Mother of God

St. Michael

St. Gabriel

Activities

S1-Continuing discussion of daily weather, it is important for students to understand the vocabulary severe, moderate, and fair. Explaining how seasons manifest His wisdom, glory and purpose explaining these terms focusing on winter and spring. This can be explained in terms of Kindergarten language.

Severe=when the weather is unsafe to go outside. For example-Thunderstorm with lightning, blizzards, extremely low or high temperatures, Tornadoes or natural disasters

Moderate- Cloudy, raining with no lightning, windy, students might need a jacket or umbrella, snowing lightly

Fair-Sunny with temperatures comfortable to go outside without a jacket, Partly Cloudy

S2) Discuss how we can be good stewards to help protect God's Earth by reducing, reusing and recycling. Bring in a variety of items such as soda cans, milk jugs, newspapers, paper clips, old toys, etc. Have three boxes labeled with Reduce, Reuse, Recycle and have students have a class sort of these items. There are worksheets for continued practice of cut, paste and sort if searched.

PHYSICAL SCIENCE	
Waves and their Applications in Technologies for Information Transfer	First Grade

SCRIPTURE

The eye is the lamp of the body. If your eyes are healthy, your whole body will be full of light. But if your eyes are unhealthy, your whole body will be full of darkness. If then the light within you is darkness, how great is that darkness! Matthew 6:22-23

STANDARD

S. 1. Make observations using our God given senses to provide evidence that vibrating materials can
make sound and objects can be seen only when illuminated and .

S. 2.Plan and conduct an investigation using our God given senses to determine the effect of placing objects made with different materials in the path of a beam of light.

S. 3. Using tools and materials from our natural universe evident in God's creation, design and build a device that uses light or sound to solve the problem of communicating over a distance.

EXAMPLES

Parables

The Parables of Jesus: The Body's Lamp
-Matthew 6:22-23, Luke 11:34-36

The Parables of Jesus: The Lamp on a stand
-Matthew 5:14-15, Luke 8:16, 11:33

Literature:

Sound: Loud, soft, high, and low by Natalie Rosinsky: Non-fiction book that breaks down the concepts of sound and how sound travels for young learners. The author also addresses pitch, sound waves, and other facts.

Oscar and the moth: A book about light and dark by Geoff Waring: As Oscar the kitten watches the sun set one evening, he has lots of questions about light and dark. Who better than Moth to help out? Moth shows how sources of light are as different as the sun, stars, fireflies, streetlights, and airplanes, and also explains how shadows are made and why darkness comes at night. Includes lesson summaries!

Sounds All Around (Let's-Read-and-Find-Out Science 1) by Wendy Pfeffer

Saints:

Albertus Magnus- Patron Saint of Natural Sciences

ESSENTIAL QUESTIONS

How does science and technology impact God's people?

We are each called to let our light shine for all to see. What kinds of things block the Light of God from shining on us?

VOCABULARY TERMS

Sound, volume, vibrate, pitch, speed, sound wave, frequency, light, opaque, transparent, translucent, reflect, refract

ACTIVITIES

The Science of the String Phone-

Students will work in teams as they build a set of telephones and then figure out how they work. Start the lesson by demonstrating how to build a set of phones. Speaking into the cup creates sound waves which are converted into vibrations at the bottom of the cup. The vibrations travel along the string and are converted back into sound waves at the other end so your friend can hear what you said. Sound travels through the air but it travels even better through solids such as your cup and string, allowing you to hear sounds that might be too far away when traveling through the air.

Materials: Each team of kids will need two paper cups, a pencil, and 40 inches of cotton string.

LIFE SCIENCE

From Molecules to Organisms: Structures and Processes — First Grade

SCRIPTURE

"How varied are your works, Lord! In wisdom you have made them all; the earth is full of your creatures. There is the sea, great and wide! It teems with countless beings, living things both large and small." (Psalm 104: 24-25)

STANDARD

S. 1. Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.

S. 2. Read texts and use media to determine patterns in behavior of parent and offspring that help offspring survive.

EXAMPLES

Parables:

The Parable of the Sower and four types of soil

-Matthew 13:3-8, 18-23, Mark 4:3-8, 14-20, Luke 8:5-8,11-15

The Parable of the Mustard Seed

-Mark 4:30-32, Matthew 13:31-32, Luke 13:18-19

Literature:

Stellaluna by Janell Cannon: A fruit bat is separated from her mother and has to survive with a family of birds, mimicking the behavior of this different species.

Mothers are like that by Carol Carrick: Describes mothers of all species, from a chicken guarding an egg-filled nest to a woman tucking her baby into bed at night. The text is tender without being sappy, its comforting descriptions anchored by the title refrain: "Mother keeps her babies clean,/ and close,/ and safe from harm./ She can find them in a crowd./ Mothers are like that."

Saints:

Saint Peter

Mary, Mother of God

Saint Michael Saint Gabriel
ESSENTIAL QUESTIONS

1. Describe the relationships, elements, underlying order, harmony, and meaning in God's creation.

2. What patterns can we develop in our lives to help plants, animals and others, especially the poor, to survive?

VOCABULARY TERMS
Plants, animals, survive, grow, habitat, life, offspring, parent
ACTIVITIES

Penguin's Egg Activity:

Before you begin your activity, take a moment to read *A Mother's Journey* by Sandra Markle.

1. Discuss the story with the students:What was hard about being a penguin parent? *(cold, snow, predators, having to transfer the egg are just a few ideas)*
2. What helps the penguin parents? *(working together)*
3. Start by turning your students into emperor penguins:
    - Each participant will put on flippers/slippers to make them waddle like a penguin. Teacher tip: Large pieces of cardboard rubber banded to shoes make quick, cheap flippers!
    - Have all participants place a standard size pillow in front of their bodies and wrap rope to tie the pillow around them. These will be their penguin bellies.
4. Arrange students into pairs. Distribute one soft ball or toy to be used as the egg per pair.
5. Have one student from each pair go to the beginning line of the activity space, and the other partner to the end line of the activity space so that each partner pair is facing each other in two parallel lines. Teacher tip: If your class is too large to all line up at once, or if you don't have enough costume supplies to go around, split your class into two groups. One group will do the penguin activity while the other cheers them on, and then switch.
6. Have each student balance the "egg" on top of their feet. Once their egg is placed, their arms will remain by their sides.
7. If desired, you can use an electric fan or assign a student to fan a large piece of posterboard at the "penguins" to create the harsh wind penguins must face. Teacher tip: This can be a good way for a physically disabled or injured student to participate.
8. At your signal, students waddle towards each other while keeping the egg precariously perched on their feet.
9. Now, here is the tricky part! Once the partners meet in the middle, they will pass the egg to their partner's feet, without using your hands or letting the egg touch the ground. If the egg touches the ground and stays there, it will freeze and won't survive.
10. Once the egg is transferred, partners part ways and walk back to their respective ends.
11. This is not easy! Let students practice and keep trying for as long as is reasonable. Be sure to leave other waiting penguins enough time to also play.

Materials: soft ball or toy to resemble a penguin egg standard size pillows (1 per student if possible), rope or string flippers or slippers (1 set per student if possible)painter's tape or masking tape, thick blankets or pieces of egg crate foam, book: *A Mother's Journey* by Sandra Markle

LIFE SCIENCE
Heredity: Inheritance and Variation of Traits — First Grade
SCRIPTURE
Then God said, "Let Us make man in Our image, according to Our likeness; and let them rule over the fish of the sea and over the birds of the sky and over the cattle and over all the earth, and over every creeping thing that creeps on the earth." (Genesis 1:26)
STANDARD
S. 1. Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents.
EXAMPLES
Parables: The Prodigal Son -Luke 15:11-32 The Mustard Seed -Matthew 13:31-32, Mark 4:30-32, Luke 13:18-19 Literature: *Mama cat has three kittens* by Denise Fleming*:* Using her own cats as models, Denise Fleming has captured the moods, expressions, and the antics of a mother cat and her kittens. But there is a rebel in every crowd, and Boris is sure to charm readers who will recognize themselves in his contrary ways. *Edward the emu* by Sheena Knowles: Tired of his life as an emu, Edward decides to try being something else for a change. He tries swimming with the seals. He spends a day lounging with the lions. He even does a stint slithering with the snakes. But Edward soon discovers that being an emu may be the best thing after all. And so he returns to his pen, only to find a big surprise awaiting him. Saints: Saint Francis of Assisi- Patron Saint of Animals and Ecology
ESSENTIAL QUESTIONS

Explain how creation is an outward sign of God's love and goodness and, therefore, is "sacramental" in nature.

VOCABULARY TERMS
Life cycle, hereditary, traits, genes, adapt, genetics, community
ACTIVITIES

Students will create life cycles of a local plant and animal and understand the cyclical process of nature.

1. Using the plant and animal worksheets, either provided or created, have students match vocab words with the images they believe they represent.

2. In small groups have students share out. What are some differences?What are some similarities?

3. As a large group go through each species. Make students end with the right order and right vocab pairing. Highlight the differences of plant versus animal's life cycles. Ask students to articulate this.

4. Go outside and have each child find a plant or animal. Have them draw or describe it. What stage of life is it at? How can you tell?

5. Go back inside and ask students to fill in the blanks with the species they found. Draw or write the rest of its lifecycle. They can ask for help, work in small groups or use other resources.

Materials: • One plant and one animal life cycle vocab and image.

EARTH AND SPACE SCIENCE
Earth's Place in the Universe — First Grade
SCRIPTURE
He took him outside and said, "Look up at the sky and count the stars—if indeed you can count them." Then he said to him, "So shall your offspring be."(Genesis 15: 5)
STANDARD
S. 1. Establish an understanding of God's place and love for his creations of our planet. Use observations of the sun, moon, and stars to describe patterns that can be predicted. S. 2. Observing God's creations at different times of the year to relate the amount of daylight to the time of year.
EXAMPLES
<u>Parables:</u> Parable of the Workers in the Vineyard -Matthew 20:1-16 Parable of the Watchful Servants -Luke 12:35-40 <u>Scripture:</u> Story of Creation -Genesis 1:1-2,4 -Genesis 2:6-25 Return of the Son of Man -Matthew 24:29 <u>Literature</u>: *Kitten's first full moon.* By Kevin Henkes: Tells the story of a kitten who thinks the moon is a bowl of milk. *Sun bread.* By Elisa Kleven: Winter's gray chill has set in and everyone misses the sun-especially the baker. So she decides to bring some warmth to the town by making sun bread. And as the bread bakes, rising hot and delicious, everyone comes out to share in its goodness. Everyone, including the sun itself. <u>Saints</u>:

Saint Francis of Assisi- Patron Saint of Animals and Ecology Saint Dominic- Patron Saint of Astronomers
ESSENTIAL QUESTIONS

What is our role as caretakers of all God's creations and of our planet Earth, and how can we identify and describe ways to treat it with respect?

VOCABULARY TERMS
Sun, moon, stars, earth, day, night, phases, planet
ACTIVITIES

Oreo Cookie Moon Phases: /Downloads/Oreo-Cookie-Moon-Phases.pdf

Students will recreate the lunar phases using the frosting from Oreo® cookies. (Round cream cheese crackers can also be used if cookies are not an option.)

1. Invite the students to describe what the Moon looks like, and how it changes shapes.

2. Explain to the students that they will be using Oreo® cookies to draw the phases and to put them into order. Demonstrate how to twist and open a cookie so that the frosting is all on one side. Which side looks like the Full Moon? Which side looks like the New Moon?

3. Pass out 6 cookies, a paper towel, a plastic spoon or knife, and a copy of the student handout to each student.. Each cookie should be able to make two Moon phases, but some will break, and some of the frosting will go "missing."

4. Invite the students to twist their cookies open and scrape the Oreo® cookies to illustrate Moon phases, and ask them to arrange cookies on the poster in order.

5. Check on the students' progress and invite them to clean up by eating their work!

Materials: Oreo Cookies, Paper Towel, Plastic spoon or knife

PHYSICAL SCIENCE

Matter and its Interactions — Second Grade

SCRIPTURE

By faith we understand that the universe was ordered by the word of God, so that what is visible came into being through the invisible.* Hebrews 11:3

STANDARD

S. 1. Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.
S. 2. Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.
S. 3. Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.
S. 4. Construct an argument with evidence that some changes caused by heating and cooling can be revered and some cannot.

EXAMPLES

What the World is Made Of? By Kathleen Weidner Zoehfeld
Change It by Adrienne Mason
Catholics making contributions to this topic: Alessandro Volta, Charles Coulomb, William Thompson Kelvin, Henri Victor Regnault

ESSENTIAL QUESTIONS

1. Define matter?
2. Name and describe the three states of matter?
3. How can properties of matter be changed?
4. Can the changes of matter be reversed?
5. How can an object be disassembled and made into a new object?

VOCABULARY TERMS

1. Solid
2. Liquid
3. Gas
4. Classify
5. Observable
6. Evidence
7. Color
8. Texture
9. Hardness
10. Flexibility

ACTIVITIES

1. AlkaSeltzer Tablet
    a. Give every student a small cup of water.
    b. Give every student an AlkaSeltzer tablet.
    c. Asks students to predict what is going to happen when they drop the tablet into the water.

d. Tell the students to drop the tablet into the water and observe what happens.
e. As they are observing, have students put their hand over the cup to feel the gas.
f. Have students illustrate what happened in the activity.

2. States of Matter Collage
    a. Give each student a large piece of construction paper.
    b. Tell the students to fold the paper into three columns.
    c. Label each column - Solid, Liquid, Gas.
    d. Provide students with magazines and have them cut out pictures representing the three states of matter and glue them to their construction paper.
3. Culminating Activity - Rootbeer Floats
    a. Rootbeer is the liquid
    b. Ice Cream is the solid
    c. Add them together and you have a gas.

LIFE SCIENCE

Ecosystems: Interactions, Energy, and Dynamics — Second Grade

SCRIPTURE

And so it happened, the earth brought forth vegetation: every kind of plant that bears seed and every kind of fruit tree that bears fruit with its seed in it. God saw that it was good. **Genesis 1:12**

STANDARD

S. 1. Plan and conduct an investigation to determine if plants need sunlight and water to grow.

S. 2. Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.

EXAMPLES

The Reason for a Flower by Ruth Heller

The Tiny Seed by Eric Carle

Catholics making contributions: Isaac Newton, James Britten, Stephan Endlicher, Antione Laurent de Jussieu, Pierre Duhem

ESSENTIAL QUESTIONS

1. Why do plants need sunlight to grow?
2. Why do plants need water to grow?
3. Would a plant survive if you withheld sunlight and only gave the plant water?

VOCABULARY

1. Pollinate
2. Disperse
3. Investigation
4. Mimic

ACTIVITIES

1. Sunflower Seed Investigation
    a. Place students in groups of three
    b. Provide each group with a cup filled with dirt and sunflower seeds
    c. Instruct students to plant the seed in the cup and water it.
    d. Allow groups to choose where they would like to place their plant in the classroom. Ensure students place their plant in different locations depending on sunlight.
    e. Tell students they will be recording in their Science journal the growth of their plant every week in class.
    f. At the end of the investigation, each group must present to the class their findings and explain the reason for the growth or lack of growth of their plant.
2. Watch the following video about the Parable of the Mustard Seed. .https://www.youtube.com/watch?v=sYmRj3s6JLE Have students write a three sentence reflection about how they can live the parable in the classroom and at home.

LIFE SCIENCE	
Biological Evolution: Unity and Diversity	Second Grade

SCRIPTURE

Then God said: Let the earth bring forth every kind of living creature: tame animals, crawling things, and every kind of wild animal. And so it happened. Genesis 1:11

STANDARD

S. 1. Make observations of plants and animals to compare the diversity of life in different habitats.

EXAMPLES

https://kids.sandiegozoo.org/

Catholics making contributions to this topic: Gregor Mendel, Leonardo da Vinci, Paula Gonzalez, Jean-Baptiste Lamarck

ESSENTIAL QUESTIONS

1. Where do different kinds of living things live on land and in water?

VOCABULARY

1. Diversity
2. Habitat
3. Compare
4. Contrast

ACTIVITIES

1. Using https://kids.sandiegozoo.org/ have students observe three different animals and their habitats. Use a Venn diagram to compare and contrast their habitats.
2. Give students a large piece of construction paper and several magazines. Fold the paper in two (hotdog style) and label on side “habitat” and the other “non-habitat.” Students find three pictures from magazines to glue under each heading. In groups of four, students take turns explaining why they chose each picture.

EARTH AND SPACE SCIENCE	
Earth's Place in the Universe	Second Grade
SCRIPTURE	
You fixed the earth on its foundation, so it can never be shaken. Psalms 104:5	
STANDARD	
S. 1. Use information from several sources to provide evidence that Earth events can occur quickly or slowly.	
EXAMPLES	
The Next Time You See the Moon by Emily Morgan Catholics making contributions to the topic: Gaspard-Gustave Coriolis, Giovanni Domenica Gassini, Leonardo da Vinci, Nicholas Copernicus and Johannes Kepler	
ESSENTIAL QUESTIONS	
1. Why is it important to find information from more than one source when studying Earth's events?	
VOCABULARY	
1. Space 2. Planet 3. Earth	
ACTIVITIES	
1. Students create booklets about the different places they could visit in space. Allow them to share with the class. 2. Students observe the night sky for three evenings and record what they observed. Give each student a dark piece of construction paper and white crayons or chalk. Students should fold the paper into three sections and label each - Observation 1, 2, 3. Students should draw what they observed each night, and write a one sentence description.	

EARTH AND SPACE SCIENCE	
Earth's Systems	Second Grade

SCRIPTURE

During the fourth watch of the night, he came toward the, walking on the sea. When the disciples saw him walking on the sea they were terrified. "It is a ghost," they said, and they cried in fear. At once, Jesus spoke to them, "Take courage, it is I; do not be afraid." Matthew 14:25-27

STANDARD

S. 1. Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.

S. 2. Develop a model to represent the shapes and kinds of land and bodies of water in the area.

S. 3. Obtain information to identify where water is found on Earth and that it can be solid or liquid.

EXAMPLES

Catholics making contributions to this topic: Gaspard-Gustave Coriolis, Giovanni Domenica Gassini, Leonardo da Vinci, Nicholas Copernicus and Johannes Kepler

ESSENTIAL QUESTIONS

1. What structures hold back water?
2. How are mountains created?
3. What causes erosion?
4. Name the types of bodies of water in your city/state.

VOCABULARY

1. Bodies of Water
2. Solid
3. Liquid
4. Erosion

ACTIVITIES

1. https://betterlesson.com/lesson/635808/how-are-mountains-made
2. https://betterlesson.com/lesson/637182/using-skittles-to-learn-about-weathering-and-erosion

ENGINEERING	
Engineering Design	Second Grade

SCRIPTURE

God created mankind in his own image, in the image of God he created him; male and female he created them. Genesis 1:27

STANDARD

S. 1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

S. 2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

S. 3. Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

EXAMPLES

The Most Magnificent Thing by Ashley Spires

ESSENTIAL QUESTIONS

1. Why is it important to make observations before deciding to make changes?

VOCABULARY

1. Gather
2. Problem
3. Engineering
4. Design
5. Teamwork

ACTIVITIES

1. Index Card Structure/Spaghetti Structure - Place students in groups of three. Give half the class index cards and tape, and the other half spaghetti and styrofoam pieces. Tell the students to make a structure at least two feet high that will hold two books (you choose the books). Utilizing a Venn diagram, students should compare and contrast the weaknesses and strengths of the structures.
2. Paper Airplane Design - Provide students with paper to create a paper airplane. The goal is to create an airplane that will fly the farthest. Students should draw their design first, and then create their airplane. Allow each student two flights. Suggestion: Students can fly planes in the hallway. Have a measuring tape set up and have students record flight distance. Students can make a graph of the flights.

PHYSICAL SCIENCE

Motion and Stability: Forces and Interactions — Third Grade

SCRIPTURE

David put his hand into the bag and took out a stone, hurled it with the sling, and struck the Philistine on the forehead. The stone embedded itself in his brow, and he fell on his face to the ground.
S.1-S.2 1 Samuel 17: 49

Draw near to God, and He will draw near to you.
S.3-James 5:8

STANDARD

S. 1. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object, acknowledging that God is the first and ultimate 'mover' of all creation.

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.

S. 2. Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.

a. Examples of motion with a predictable pattern could include a child swinging on 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.

S.3. Just as God draws us closer to him, determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.

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 paper clips, 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 the 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.

S.4. Define a simple design problem that can be solved by applying scientific ideas about magnets, acknowledging that they are naturally found in the world God has created.

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.

EXAMPLES

Alessandro Volta – Catholic scientist who worked with static electricity (1775) and invented an early electrochemical cell battery (1800)

ESSENTIAL QUESTIONS

- What causes an object to be put in motion?
- What causes an object's motion to stop?
- How does gravity affect the object?
- How did God first set us in 'motion' and how does he continue to affect us?

VOCABULARY TERMS

- Balance
- Unbalance

- Repelling force
- Attracting force
- Pattern

ACTIVITIES

S.1-S.2 Challenge students to design and create their own slingshot (using consumables:plastic cups, balloons, pom pom balls) Have students aim at small paper cut out of Goliath as a way to see how the momentum and force behind David's stone defeated Goliath, though it was an unbalanced force.

S.3-S.4-ENGINEERING-Challenge students to move an object through a maze on a poster board without touching it. They should be able to explain what they did, and why it worked. Use concepts of attractive force to move an object through a maze by placing something magnetic (or paperclip toy car) on the maze and pulling it through the path with a magnet placed below the 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.
For the "object," stick an image of a sheep to the magnetic item.
When the magnet *pulls (attractive force)* the sheep through the maze it shows us how Jesus leads us to Heaven. When the magnet *pushes/repels* the sheep us away backwards in the maze it shows us how sin takes us away from God. But ultimately we need Christ to bring us back and lead us through the maze.

LIFE SCIENCE

From Molecules to Organisms: Structures and Processes THIRD GRADE

SCRIPTURE

One generation departs and another generation comes, but the world forever stays.
Ecclesiastes 1:3-11

There is an appointed time for everything...A time to give birth, and a time to die; a time to plant, and a time to uproot the plant.
Ecclesiastes 3:1-8

STANDARD

S. 1. Develop models to describe that organisms in God's creation have unique and diverse life-cycles, and all have in common birth, reproduction, and death.

a. The changes that organisms in God's creation (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 production.

EXAMPLES

Francesco Redi was an Italian physician and poet. He is called "the founder of experimental biology" He was the first person to challenge the theory of spontaneous generation by demonstrating that maggots come from eggs of flies. He continued his experiments by capturing the maggots and waiting for them to metamorphose, which they did, becoming flies.

Stephan Endlicher (1804–1849) – botanist who formulated a major system of plant classification

ESSENTIAL QUESTIONS

- Where do specific living organisms (plants or animals) come from?
- How do certain living organisms (plants or animals) grow?
- Why did God make so many plants and animals in such different ways?

VOCABULARY TERMS

- Life-cycle
- Organism

- Birth
- Death
- Reproduction

ACTIVITIES

Following Redi's example as an 'experimenter in biology,' give students one or two mealworms in a container to observe once a week for several weeks. Students should observe how this enclosed creature change over time and changed from larva to pupa to adult (beetle)
https://i.pinimg.com/originals/86/60/92/86609214b1aaec7c147ee0597a831991.png
http://ourmealworms.weebly.com/uploads/4/6/2/9/46297011/1422992292.png
Students can keep an observation journal and record what they observe about their mealworm once a week (or more).

LIFE SCIENCE

Ecosystems: Interactions, Energy, and Dynamics. THIRD GRADE

SCRIPTURE

Indeed, the parts of the body that seem to be weaker are all the more necessary
1 Corinthians 12:12-26

STANDARD

S. 1. Construct an argument that some animals in God's creation 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 in different functions and vary dramatically in size.

EXAMPLES

The saints are a great example of how one individual can influence many.

Saint Therese and her 'Little Way'

Bartolomeo Eustachi-was one of the founders of the science of human anatomy.

ESSENTIAL QUESTIONS

- How is a part essential for the whole?
- How does one member help/hurt an entire group?
- How do I play a part in the community?
- How do we see that God made each person to be important and one of a kind?

VOCABULARY TERMS

- Member
- Group
- Survive

ACTIVITIES

Roll out butcher paper and trace a student's body. Cut the body tracing off the roll and lay it out on a table. Remind the students that we are all part of the Body of Christ and we all have different talents and skills. Brainstorm all the skills, talents, and tasks that are performed in the Body of Christ, the Church. Students should write them down as they think of them, spreading them throughout the traced body. Label the paper, "The Body of Christ" and allow students to sign their names. Hang it up!

This activity will help students see how each part of their body is essential to who they are, and each one has a unique and important job. If a part of you body fails (your heart, a limb) it can affect you as a whole.

Similarly, YOU (the member) are an essential part of the body of Christ (the group) and YOU have a unique and important job to help the church to grow and thrive.

LIFE SCIENCE

Heredity: Inheritance and Variation of Traits. THIRD GRADE

SCRIPTURE

Does not scripture say that the Messiah will be of David's family and come from Bethlehem, the village where David lived?
John 7:42

STANDARD

S. 1. Analyze and interpret data to provide evidence that plants and animals within God's creation have traits inherited from parents and that variation of these traits exists in a group or similar organisms.

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)

S. 2. Use evidence to support the explanation that traits of organisms within God's Creation can be influenced by their environment.

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.

EXAMPLES

Antoine Laurent de Jussieu was a French botanist, notable as the first to publish a natural classification of flowering plants; much of his system remains in use today. His classification was based on an extended unpublished work by his uncle, the botanist Bernard de Jussieu.

ESSENTIAL QUESTIONS

- How does each person inherit the traits that they have?
- Where do our physical traits and interests come from?
- Do I see my own traits in my parents?
- What traits did Jesus inherit from his Mother and from God the Father?

VOCABULARY TERMS

- Inherited
- Trait
- Random Variation
- Parent
- Offspring

ACTIVITIES

S. 1 Using the family tree of Joseph, the Foster Father of Jesus and Mary, the Mother of God, have students analyze this family tree (https://lightnercrew.files.wordpress.com/2013/07/houseofdavid.jpg) and show them that Jesus' lineage goes all the way back to King David. This visual aid will help students to understand how Jesus is both the King of Heaven *and* on Earth because he is the Son of God as well as a member of a line of 'royalty'.

Read the book "The One and Only Me" and have students match the offspring with the parent and discuss the traits found in both parent and offspring. Students may also create their own 'My Hereditary Tree'. Students will list their inherited and learned traits that they received from their parents and display what is unique about us and why. https://i.pinimg.com/564x/ef/16/71/ef1671ab115425652f1e28eb51bb8d9b.jpg

S. 2 Referring to Biological Evolution: Unity and Diversity - the activity on planting seeds in different grounds can also be used here.

LIFE SCIENCE	
Biological Evolution: Unity and Diversity	THIRD GRADE

SCRIPTURE

The Parable of the Sower-*The seed falling on rocky ground refers to someone who hears the word and at once receives it with joy. But since they have no root, they last only a short time. When trouble or persecution comes because of the word, they quickly fall away. The seed falling among the thorns refers to someone who hears the word, but the worries of this life and the deceitfulness of wealth choke the word, making it unfruitful. But the seed falling on good soil refers to someone who hears the word and understands it. This is the one who produces a crop, yielding a hundred, sixty or thirty times what was sown.*
Matthew 13: 20-23

Do not be conformed to this world, but be transformed by the renewal of your mind, that by testing you may discern what is the will of God, what is good and acceptable and perfect.
Romans 12:2

STANDARD

S. 1. Analyze and interpret data from fossils to provide evidence of the organisms in God's creation and the environments in which they lived long ago.
S. 2. 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.
S. 3. Construct an argument with evidence that in a particular habitat some organisms in God's creation can survive well, some survive less well, and some cannot survive at all.
S. 4. Make a claim about the merits of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

EXAMPLES

Coronado discovered the Grand Canyon (Catholic Spanish explorer) which contains fossil records
Joachim Barrand-For ten years (1840–1850) he made a detailed study of these rocks, engaging workmen specially to collect fossils, and in this way he obtained upwards of 3500 species of graptolites, brachiopoda, mollusca, trilobites and fishes.

ESSENTIAL QUESTIONS

- What elements of the environment make survival easier or harder?
- How do animals 'learn' to survive when their environment changes?
- Where do we see this in God's creation?

VOCABULARY TERMS

- Survive
- Adapt
- Environmental Changes
- Advantage
- Disadvantage

ACTIVITIES

S.1 Using images of shark teeth, leaf imprints, scorpion imprints, turtle shells, fish bones, etc. have students determine the type of fossils and the type of environment where the creature lived. Students should be able to explain their answers. This activity will help students to see and appreciate the vast variety in God's creation and how each organism serves its own purpose.

S.2 Place students into groups of five. Allow students to select one student in each group to represent a less-skilled gatherer of food. The less-skilled gatherer will only be allowed to pick up as much pasta as he or she can grasp with their thumb and forefinger. The remaining students in the group represent highly skilled food gatherers. They will be allowed to pick up as much pasta as they can using their entire hand. On your signal, allow the students to walk across the room and gather their pasta (food) in the appropriate manner (either whole-hand, or thumb and finger). Have students record the amount of food they were able to collect on their own in their journal. Direct students to combine all of the food gathered by the members of their group into a single pile, divide it equally among the members of the group. Have students discuss the following: Do you think skilled hunters are always successful in getting food? What do you predict would happen to the most skilled and successful hunter if injured? Without the group, what would happen to the less-skilled hunters? (from STEMSCOPEDIA)

S.3 Read Matthew 13. Have students predict what would happen to a seed if it were planted on hard ground, thorny ground, or in rich soil. Then have students "plant" seeds in these environments and observe for a few weeks. Students should record observations and explain why some seeds were fruitful and why some were not. Also, they could answer the following question: What does 'rich soil' mean for our faith and what does 'stony/thorny' ground mean for our faith?

EARTH AND SPACE SCIENCE	
Earth's Systems	Third Grade

SCRIPTURE

There is an appointed time for everything...A time to give birth, and a time to die; a time to plant, and a time to uproot the plant.
Ecclesiastes 3:1-8

As long as the earth endures, seedtime and harvest, cold and heat, summer and winter, day and night will never cease.
Genesis 8:22

For as the rain and the snow come down from heaven and do not return there but water the earth, making it bring forth and sprout, giving seed to the sower and bread to the eater, so shall my words be that goes out from my mouth; it shall not return to me empty, but it shall accomplish that which I purpose, and shall succeed in the thing for which I sent it.
Isaiah 55:10-11

STANDARD

S. 1. Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.

a. Examples of data could include average temperature, precipitation, and wind direction. Assessment of graphical displays is limited to pictographs and bar graphs.

S. 2. Obtain and combine information to describe climates in different regions of the world that God has created.

EXAMPLES

Antoine Laurent de Jussieu was a French botanist, notable as the first to publish a natural classification of flowering plants; much of his system remains in use today. His classification was based on an extended unpublished work by his uncle, the botanist Bernard de Jussieu.

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)

ESSENTIAL QUESTIONS

- Why do certain regions of our country/our world have different weather patterns and climates?
- What patterns do we see in regional climate?
- What is the weather and climate like where I live?
- What could be a reason that God designed our world in this way?

VOCABULARY TERMS

- Data
- Weather
- Climate
- Seasons
- Regions

ACTIVITIES

S. 1 As a class, conduct research on the different regions of our country and the different weather patterns and crops that are found in the Northeast, Midwest, South, and West (dividing as you see fit for your Geography curriculum). Create a large scale map of the USA. Using 3D materials or simply art supplies to display these weather/climate patterns and crops grown in the region. Hang it on the wall!
http://hansengeorge.blogspot.com/2013/10/world-studies-regions-project.html?m=1

S.2 Tell students they are travel agents specializing in teacher vacation packages providing information to help teachers choose their ideal destination based on climate. (online sources may be used such as https://weather.com/). Divide students into groups. Give students a list of major cities to choose as a destination. Students research climate and create brochures, infomercials, dioramas, posters, slideshows of their destination.
https://cdn.acceleratelearning.com/system/part_type_image/images/129864/normal/Weather_and_Climate_color.png?1465930814

EARTH AND SPACE SCIENCE

Earth and Human Activity — Third Grade

SCRIPTURE

They came to Jesus and woke Him up, saying, "Master, Master, we are perishing!" And He got up and rebuked the wind and the surging waves, and they stopped, and it became calm. And He said to them, "Where is your faith?" They were fearful and amazed, saying to one another, "Who then is this, that He commands even the winds and the water, and they obey Him?"
Luke 8:24-25

The Story of Noah -Genesis 5:32-10:1->through end of story

STANDARD

S. 1. Make a claim about the merits of a design solution that reduces the impacts of a weather-related hazards.

EXAMPLES

Prokop Divis-theologian and natural scientist of Czechoslovakia who invented the 1st grounded lightning rod

ESSENTIAL QUESTIONS

- What can we do to prepare for weather hazards?

- What can we do to recover after a weather hazard?
- Can we protect ourselves from weather hazards without always getting a miracle from God?
- How can we help and serve our neighbor in times of hazard?

VOCABULARY TERMS

- Weather
- Climate
- Hazard
- Impact

ACTIVITIES

Have students imagine what it would be like if the story of Noah had happened today. Besides building the ark, what else could Noah have done to protect his family and the animals from the flood? Students will create their own flood barriers! Tell them the weather forecast is for heavy flooding in the area. You need to build a flood barrier or flood resistant shelter to keep the family safe! Students must design a shelter with the available supplies (cardboard, tape, pipe cleaner, tp roll, cotton ball, plastic lid. etc.) that is resistant to flooding. The shelter will be tested with water in a pan to see if the design was effective as a flood barrier. They can experiment with materials to see if they can protect Noah and the animals. Trial and error will lead them to revise and change their model. https://www.teacherspayteachers.com/Product/Weather-Hazard-STEM-Flood-Barrier-Challenge-2240222

ENGINEERING

Engineering Design THIRD GRADE

SCRIPTURE

God created man in His own image
Genesis 1:27

The Story of Noah -Genesis 5:32-10:1->through end of story

STANDARD

S. 1. Define a simple design problem reflecting a need or a want for God's people that includes specified criteria for success and constraints on materials, time, or cost.
S. 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 while maintaining respect for the design in which creation is already set.
S. 3. Following the model of God being the original engineer, 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.

EXAMPLES

Jonathan Lunine (1959–) – planetary scientist at the forefront of research into planet formation, evolution, and habitability; serves as vice-president of the Society of Catholic Scientists

Wilhelm Heinrich Waagen (1841–1900) – geologist and paleontologist who provided the first example of evolution described from the geologic record, after studying Jurassic ammonites

ESSENTIAL QUESTIONS

- What is the difference between a want and a need?
- What is success?
- When you are building something, how do you know when it is ready/complete?
- How did God know when he was 'done' creating the World and everything was ready?

- What needs exist on Earth that were solved in the creation story? Ex. birds need the sky, fish need the sea-time to work (day), and time to rest (night).
- How does God allow us to participate in his creation?

VOCABULARY TERMS

- Criteria
- Problem
- Solution
- Variables
- Prototype
- Want
- Need

ACTIVITIES

S. 1 Students will read the Creation Story then play a game where students must list all comparing and contrasting traits between Adam and the animals he named. In the end, students will be able to see that Eve has the most in common with Adam which is why she is a perfect partner for him! They think alike, they look alike, they communicate in the same way, and so they are able to 'meet the criteria' and need of the other person. Students can also create an expandable creation story book, and discuss how each part of creation fills a need and solves a problem that could happen in the world (light and dark, sea and land, etc…) Discuss how God could have made the world in any way (prototypes) but chose to do it this way because it was the best way! https://craftingthewordofgod.com/2013/10/17/in-the-beginning-bookmark/

S.1, S.2, S.3 Project encompassing all: Mechanical engineers research, design, develop, and test tools, engines, and all kinds of mechanical devices. Give students the scenario that they must create a 'river course' which Noah's arc (a toy car with a picture of an arc attached to it) will travel through during the flood (it will resemble a racetrack). They must design a water maze that can move the 'arc' around in 30 seconds or less using the force of magnetism. Tell the students that they are going to be mechanical engineers for a day, designing and creating a way to move a toy 'arc' around a track using the force of magnetism. Students design and construct a 'racetrack' that uses magnetism to make the car move. The racetrack must be constructed from one piece of poster board. You may guide the 'arc' without actually touching it. The toy 'arc' must go around the track using magnetic force without the guiding magnet directly touching it. The arc must change directions three or more times while moving from one side of the poster board to the other. Prompt the students to list the steps of their plan and design for the challenge in a journal. Students could tape a washer to the bottom of the arc and hold a magnet below the poster board to guide it through the course without touching the magnet to the car. Students need to explain how their solution will solve the problem. Students must have sufficient evidence to support their design. Invite other students/groups to ask questions. (based on a Stemscopes Exploration lesson)

PHYSICAL SCIENCE

Energy — Fourth Grade

SCRIPTURE

"On his journey, as he was nearing Damascus, a light from the sky suddenly flashed around him. He fell to the ground and heard a voice saying to him, 'Saul, Saul, why are you persecuting me?'" Acts 9:3-4

STANDARD

Always searching for truth, beauty, and goodness in God's creation:

S. 1. Use evidence to construct an explanation relating the speed of an object to the energy of that object. (Assessment does not include quantitative measurements of changes in the speed of an object or on any precise quantitative definition of energy.)

S. 2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents. (Assessments don't include quantitative measurements of energy.)

S. 3. Ask questions and predict outcomes about the changes in energy that occur when objects collide.

S. 4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

EXAMPLES

Giovanni di Casali Franciscan friar who provided graphical analysis of the motion of accelerated bodies,

ESSENTIAL QUESTIONS

1. What is the Law of Conservation of Mass and Energy?
2. What effect does changing the speed of an object have on the energy the that object possesses?
3. What forces can impact the speed of an object?
4. What are some examples from the Bible in which God uses heat, electricity, sound, or light to move or change objects?

VOCABULARY TERMS

1. Velocity
2. Acceleration
3. Inertia
4. Momentum
5. Friction

ACTIVITIES

S.1. Baseball bat and ball

- Students should hit baseballs (tennis balls/wiffle balls) thrown at different speeds. Students should predict how the speed of the pitch impacts the distance the ball is hit. Measure the distance each travels.

S.2. Dark cloth/White cloth with thermometers

- Put a thermometer in a black glove and a second thermometer in a white glove. Let them sit in the sun and record the temperature at regular intervals. Discuss the impact of this information on clothing choices in the winter and summer.

S.3. Marbles

- Students should design a ramp system inside a shoe box that slow a marble down (but not stop it). As the marble exits the ramp system, it will strike a second marble. Measure the distance the second travels.

S.4. Circuits

- Students should design a circuit that accomplishes a task (light a light bulb, run a small fan, sound an alarm)

PHYSICAL SCIENCE

Waves and their Applications in Technologies for Information Transfer — Fourth Grade

SCRIPTURE

"Then I heard something like the sound of a great multitude or the sound of rushing water or mighty peels of thunder as they said, Alleluia! The LORD has established His reign, (our) God, the almighty." Revelations 19:6

STANDARD

Always searching for truth, beauty, and goodness in God's creation:

S. 1. Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.

a. Examples of models could include diagrams, analogies, and physical models using rope to illustrate wavelength and amplitude of waves. Assessment does not include interference effects, electromagnetic waves, non-periodic waves, or quantitative models of amplitude and wavelength.

S. 2. Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.

a. Assessment does not include knowledge of specific colors reflected and seen, the cellular mechanisms of vision, or how the retina works.

S. 3. Generate and compare multiple solutions that use patterns to transfer information. a. Examples of solutions could include drums sending coded information through sound waves,singing hymns in Mass using sound waves, using a coordinate grid and directions with off/on for each box representing black and white to send information about a picture, and using Morse code to send text.

EXAMPLES

Augustin-Jean Fresnel was a French civil engineer and physicist whose research in optics led to the almost unanimous acceptance of the wave theory of light

Roger Bacon was an English philosopher and Franciscan friar who placed considerable emphasis on the study of nature through empiricism. He discussed physiology of eyesight, the anatomy of the eye and the brain, light, distance, position, size, direct vision, reflected vision, refraction, mirrors, and lenses.

ESSENTIAL QUESTIONS

1. How does the appearance of a transverse wave (light) differ from a longitudinal wave (sound)?
2. What happens to light when it hits an object?
3. Light and sound waves have similarities and differences, when would light waves be more effective than sound waves and when would sound waves be more effective than light waves?
4. What are some examples of using waves to praise God?

VOCABULARY TERMS

1. Wavelength
2. Amplitude
3. Reflect
4. Absorb
5. Transmit
6. Frequency

ACTIVITIES

S.1.Jump Rope /Spring (Slinky)

- With one student holding each end of the jump rope, simulate a transverse wave.
- Repeat using a spring or slinky to simulate longitudinal waves.

S.2. Diagram Model

- Students should construct diagram models of light reflection, absorption, and transmission using arrows for light rays.

S.3. Morse code

- Using flashlights and morse code, students should send Bible passages to each other across the room.

LIFE SCIENCE

From Molecules to Organisms: Structures and Processes — Fourth Grade

SCRIPTURE

"A good tree does not bear rotten fruit, nor does a rotten tree bear good fruit. For every tree is known by its own fruit. For people do not pick figs from thorn bushes, nor do they gather grapes from brambles." Luke 6:43-44

STANDARD

S. 1. Construct an argument that the plants and animals that God has created have internal and external structures that function to support survival, growth, behavior, and reproduction.

a. Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, and skin. Assessment is limited to macroscopic structures with plant and animal systems.

S. 2. Use a model to describe that animals receive different types of information through their senses, process the information in their brains, and respond to the information in different ways.

a. Emphasis is on systems of information transfer. Assessment does not include the mechanism by which the brain stores and recalls information or the mechanisms of how sensory receptors function.

EXAMPLES

Georges-Louis Leclerc, Comte de Buffon was a French naturalist who explored the struggle for survival in similar environmental conditions in different regions could produce distinct organisms.

ESSENTIAL QUESTIONS

1. What structures help organisms survive in their environments?
2. How do animals use their senses to survive in their environments?
3. God has created a variety of life on our planet, what are some unusual examples of organisms with adaptations?

VOCABULARY TERMS

1. Adaptation
2. Camouflage
3. Exoskeleton
4. Herbivore
5. Carnivore
6. Omnivore
7. Fur
8. Feathers
9. Scales

ACTIVITIES

S.1. Compare and contrast alpine plants with desert plants.

S.1. Your Bird

- Each student should design their own bird. They should draw it and describe it. The bird should have characteristics that allow it to survive and thrive in the environment in which they place it.

S.2. Mystery Boxes

- Place safe items in different boxes. Allow students to smell, listen, and touch (no looking or tasting) to try to determine what each item is.

EARTH AND SPACE SCIENCE	
Earth's Place in the Universe	Fourth Grade

SCRIPTURE

"Then God said: Let the water under the sky be gathered into a single basin, so that the dry land may appear. And so it happened: the water under the sky was gathered into its basin, and the dry land appeared. God called the dry land 'earth,' and the basin of water he called 'sea.' God saw that it was good." Genesis 1:9-10

STANDARD

S. 1. Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes God has directed in a landscape over time.

a. Examples of evidence from patterns could include rock layers with marine shell fossils above rock layers with plant fossils and no shells, indicating a change from land to water over time; and a canyon with different rock layers in the walls and a river in the bottom, indicating that over time a river cut through the rock. Assessment does not include specific knowledge of the mechanism of rock formation or memorization of specific rock formations and layers. Assessment is limited to relative time (first, next, then, later, last).

EXAMPLES

Nicolas Steno was a Danish scientist, a pioneer in geology who became a Catholic bishop in his later years. He questioned explanations for the idea that fossils grew in the ground and explanations of rock formation. His investigations and his subsequent conclusions on fossils and rock formation have led scholars to consider him one of the founders of modern stratigraphy and modern geology

ESSENTIAL QUESTIONS

1. How are fossils formed?
2. What clues has God left us in the layers of rock that tell us about Earth's environment in the past?

VOCABULARY TERMS

1. Fossils
2. Sedimentary
3. Igneous
4. Metamorphic
5. Magma

ACTIVITIES

S.1.Future Fossils

- Students should be shown pictures of various formations (sand dunes, canyons, mountains, etc.) as well as fossils (or shown actual fossils if possible). Then students are asked to explain what fossils a million years from now might show about our world today.

EARTH AND SPACE SCIENCE

Earth's Systems — Fourth Grade

SCRIPTURE

"Mountains fall and crumble, rocks move from their place, And water wears away stone, and floods wash away the soil of the land" Job 14:18-19

STANDARD

S. 1. Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation on God's creation.

a. Examples of variables to test could include angle of slope in the downhill movement of water, amount of vegetation, speed of wind, relative rate of deposition, cycles of freezing and thawing of water, cycles of heating and cooling, and volume of water flow. Assessment is limited to a single form of weathering or erosion.

S. 2. Analyze and interpret data from maps to describe patterns of Earth's features.

a. Maps can include topographic maps of Earth's land and ocean floor, as well as maps of the locations of mountains, continental boundaries, volcanoes, and earthquakes.

EXAMPLES

St. Barbara secretly became Christian. She gazed upon the hills and admired God's creation. She refused to renounce Jesus even after her father had her tortured. She was martyred. She is the patroness of miners.

ESSENTIAL QUESTIONS

1. How can erosion and weathering explain the rock formations we see today?
2. How can erosion be slowed?
3. God's creation is changing overtime through erosion and weathering; when is this a positive and when is it a negative?

VOCABULARY TERMS

1. Erosion
2. Weathering
3. Freezing Cycle
4. Tectonic Plates

ACTIVITIES

S.1. School and Church Grounds

- The students should explore the school and Church campus to find signs of erosion and weathering. They should brainstorm how this can be slowed or halted.

S.1. Dirt box

- Using a box filled evenly with dirt, raise one end and pour water down the middle. Students should describe what they see, Vary the angle of the slope and discuss the impact of the angle change.

S.2. Ring of Fire

- Using maps of continental boundaries, active volcanoes, mountains, and earthquakes, outline the Pacific Ring of Fire.

EARTH AND SPACE SCIENCE

Earth and Human Activity — Fourth Grade

SCRIPTURE

"The wind blows where it wills, and you can hear the sound it makes, but you do not know where it comes from or where it goes; so it is with everyone who is born of the Spirit." John 3:8

STANDARD

S. 1. Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment God created.

a. Examples of renewable energy sources could include wind energy, water behind dams, and sunlight; non-renewable energy resources are fossil fuels, and fissile materials (nuclear fission). Examples of environmental effects could include loss of habitat due to dams, loss of habitat due to surface mining, and air pollution from burning of fossil fuels, water pollution from spilled oil.

S. 2. Generate and compare multiple solutions to reduce the impact of natural Earth processes on humans.

a. Examples of solutions could include designing an earthquake resistant building and improving monitoring of volcanic activity.

EXAMPLES

St. Kateri Tekakwitha is the first Native American to be recognized as a saint by the Catholic Church .She is the patroness of ecology and the environment.

ESSENTIAL QUESTIONS

1. What is the difference between renewable energy resources and fossil fuels?
2. How does the use of fossil fuels impact the environment?
3. As God's stewards of the planet, what can we do to lessen our negative impact on the environment?

VOCABULARY TERMS

1. Fossil fuels
2. Fission
3. Solar
4. Hydroelectric
5. Renewable energy

ACTIVITIES

S.1. Fossil Fuels

- Students should identify fossil fuels that are currently in use and the impact the use of these fuels has on the environment. Students should investigate why fossil fuels are used and how renewable energy could be made more appealing. They should then design a city that uses renewable energy resources.

S.2 Earth Attacks!

- Groups of students should each be given a natural disaster (earthquake, volcanic eruption, flood, hurricane, or tidal wave). They should research how their particular disaster has impacted humans and what humans can do to combat the effects of that disaster. Then they should make sure that their city (from S.1.) is designed to withstand the disaster. Then they should write a prayer for those who have or are suffering through that disaster.

PHYSICAL SCIENCE

Matter and its Interactions FIFTH GRADE

SCRIPTURE

For in him were created all things in heaven and on earth, the visible and the invisible... Colossians 1:16

Through him all things were made; without him nothing was made that has been made. John 1:3

STANDARD

God has created all things, visible and invisible. As we stand in awe of our Creator, we seek to understand Him through his creation.

S. 1. Develop a model to describe that matter is made of particles too small to be seen.

a. Examples of evidence could include adding air to expand a balloon/ball, compressing air in a syringe, dissolving sugar in water, and evaporating salt water.

S. 2. Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of the matter is conserved.

a. Examples of reactions or changes could include phase changes, dissolving, and mixing that form new substances. Assessment does not include distinguishing mass and weight.

S. 3. Make observations and measurements to identify materials based on their properties.

a. Examples of materials to be identified could include baking soda and other powders, metals, minerals, and liquids. Examples of properties could include color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces and solubility; density is not intended as an identifiable property. Assessment does not include density or distinguishing mass and weight.

S. 4. Conduct an investigation to determine whether mixing two or more substances results in new substances.

EXAMPLES

Antoine Laurent Lavoisier - French chemist and lawyer, Lavoisier studied mixtures, compounds, and solutions, with the intent to identify and explain their properties. He was raised in a pious Catholic family and held to his faith throughout his life.

ESSENTIAL QUESTIONS

1. How can one explain the structure, properties and interactions of matter?
2. What makes up all of the things we see around us? How can we observe and measure matter that cannot be seen?
3. What forms can matter take? Does the amount of matter change when it changes form?
4. What properties does matter have? How can we identify matter based on its properties?
5. How do substances interact? Is a new substance always formed?
6. Why do you think that the universe was created so that matter should be conserved?
7. If we cannot see God, what are some ways we can know and feel his presence?

VOCABULARY TERMS
• Matter • Particles • Solid • Liquid • Gas • Properties • Conservation of Matter • Physical Change • Chemical Change • Model • Weight • Measurements • Volume • Density • Temperature • Substances • Solutions • Mixtures
STREAM ACTIVITIES
• Have students create a dance that demonstrates how molecules change during phase changes from solid to liquid to gas. • Create a piece of art that models the spacing of molecules in a solid, liquid and gas. • Make lemonade from mix. Weigh the water and lemonade powder and then weigh the final solution. Was matter conserved? • Conduct "Barf" Bag lab to demonstrate physical and chemical changes. Weigh the bag at the beginning and end to see if matter was conserved during a chemical change. https://www.teacherspayteachers.com/Product/Barf-Bag-Lab-Alcoholic-Fermentation-Activity-1886085 • As Creator of the universe, God has wonderfully designed it with rules and principles that allow us to understand our world. Have students write their own psalm to praise God for how He created matter and how it behaves. For an example see https://scienceandbelief.org/2014/02/27/what-does-christ-have-to-do-with-chemistry/

PHYSICAL SCIENCE

Motion and Stability: Forces and Interactions FIFTH GRADE

SCRIPTURE

He is before all things, and in Him all things hold together. Colossians 1:17

Draw near to God, and He will draw near to you. James 5:8

STANDARD

S. 1. Just as God seeks to draw us to Him, support an argument that the gravitational force exerted by Earth on objects is directed down.

a. Clarification - "down" means toward the center of the Earth.

EXAMPLES

Jean-Felix Picard (1620-1682) was a French Jesuit priest and astronomer. Fr. Picard's achievements include being the first to accurately measure the size of the earth and improvements in scientific instruments that allowed Isaac Newton to develop his theory of universal gravitation.

ESSENTIAL QUESTIONS

1. What is gravity?
2. How can we observe this force?
3. What do we mean when we say that gravity makes things fall down?
4. In what ways does God draw us to him?

VOCABULARY TERMS

- Gravity
- Gravitational Force
- Force
- Interaction
- Speed

STREAM ACTIVITIES

- Build a gravity spinner toy (https://teachbesideme.com/gravity-spinner-toy/) test it without the weights and then add them. Why does the toy only work when it is weighted?
- After learning about gravity have students write a story or create a comic strip about what would happen if Earth suddenly lost gravity. Have students share their stories with classmates and discuss.
- Have a discussion or have students write a reflection on how God draws us to him.

PHYSICAL SCIENCE

Energy FIFTH GRADE

SCRIPTURE

I am the light of the world. Whoever follows me will not walk in darkness, but will have the light of life. John 8:12

God is present as my helper; the Lord sustains my life. Psalm 54:6.

STANDARD

S. 1. As God uses the image of light to represent how He sustains us, use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.

a. Examples of models could include diagrams and flowcharts.

EXAMPLES

Antoine-Laurent de Lavoisier (1743-1794) was a French Catholic scientist known as the "Father of Chemistry," but his work encompassed a number of fields, including biology. His discovery of Oxygen and Hydrogen paved the way for future scientists to discover and explain the process of photosynthesis.

ESSENTIAL QUESTIONS

1. How do plants obtain food?
2. What is the food chain and where does the energy to start the food chain come from?
3. How is a food web different from a food chain?
4. What is the difference between a producer and a consumer?
5. What role do decomposers play in cycling matter through the biosphere?
6. Matter and energy cycle through the food web. What other natural cycles can you identify? Why do you think God set up creation in this way?

VOCABULARY TERMS

- Energy
- Food Web
- Food Chain
- Cycle
- Producer
- Consumer
- Decomposer

STREAM ACTIVITIES

- Using a flow chart model the flow of energy in given meals back to the sun.
    - Science & Math Collaboration: Create varying types of graphs to display the total number of places removed specific food is from its original energy source. Create a poster that illustrates this flow of energy.
- Play the Photosynthesis Song to help students learn about the process. https://www.uwsp.edu/cnr-ap/KEEP/Documents/Activities/Food_Chain_Game.pdf

LIFE SCIENCE	
From Molecules to Organisms: Structures and Processes	FIFTH GRADE
SCRIPTURE	
...The seed is the word of God. Luke 8:11 The Parable of the Sower Mark 4	
STANDARD	
S. 1. Always searching for truth, beauty and goodness in God's creation, support an argument that plants get the materials they need for growth chiefly from air and water. a. Emphasis in on the idea that plant matter comes mostly from air and water, not from the soil.	
EXAMPLES	
James Britten was a Catholic Botanist who was the editor of the "Journal of Botany" in England for 45 years and supported and disseminated research on plants and plant growth.	
ESSENTIAL QUESTIONS	
1. What do plants need to grow? 2. Can you grow a plant without one of these necessities, air, water, soil, sunlight? 3. How is faith like a seed, and what does it need to grow and flourish?	
VOCABULARY TERMS	
● Organism ● Species ● Photosynthesis ● Needs ● Nutrients ● Growth ● Plant Matter ● Waste Matter ● Soil	
STREAM ACTIVITIES	
● Grow plants outside of soil; ○ Science & Math Collaboration: Measure the height of the plant(s) & based on the measurements, convert the height into varying forms of measurements; ○ Science & Math Collaboration: Create varying types of graphs/tables to display the growth changes in students' plant growth.	

LIFE SCIENCE
Ecosystems: Interactions, Energy, and Dynamics FIFTH GRADE
SCRIPTURE
There is an appointed time for everything, and a time for every affair under the heavens. A time to give birth, and a time to die; a time to plant, and a time to uproot the plant. Ecclesiastes 3:1-2.
STANDARD
S. 1. Giving God glory for how He has ordered all things, develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. a. Emphasis is on the idea that matter that is not food (air, water, decomposed materials in soil) is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and the Earth.
EXAMPLES
Annie Chambers Ketchum a Catholic botanist who published *Botany for academies and colleges: consisting of plant development and structure from seaweed to clematis.*
ESSENTIAL QUESTIONS
1. What is the difference between energy and nutrients? 2. Plants get their energy from the sun, where do they get the materials they need for growth and other life processes? 3. How are these materials recycled through an ecosystem? 4. How has God provided for his creatures? How does God provide for us?
VOCABULARY TERMS
● Organism ● Species ● Ecosystem ● Environment ● Matter ● Cycle ● Needs ● Photosynthesis ● Food Chain ● Food Web ● Producer ● Consumer ● Decomposer
STREAM ACTIVITIES
● Listen to & discuss “Turn! Turn! Turn!” by The Byrds. Write a reflection on how the song relates to the idea of energy transfer & our cycle of resources. ● To demonstrate that producers form the base of the food chain and that energy is lost at each level, play the food chain game. https://www.uwsp.edu/cnr-ap/KEEP/Documents/Activities/Food_Chain_Game.pdf

- Design a landscape plan that will house a healthy, balanced ecosystem that includes native plants & animals, found in the same food web.
    - PBL & Math Integration: Draw landscape plans to scale;
    - PBL & ELA Integration: Present landscape plans as timed speeches/presentations;
    - PBL & Art/Engineering Integration: Create a physical prototype of the landscape plan.

EARTH AND SPACE SCIENCE

Earth's Place in the Universe — FIFTH GRADE

SCRIPTURE

Look up at the sky and count the stars if you can… Genesis 15: 5

O Lord, our Lord… When I see your heavens, the work of your fingers, the moon and stars that you set in place --- What are humans that you are mindful of them, mere mortals that you care for them? ...O Lord, our Lord, How awesome is your name through all the earth! Psalm: 8-10

STANDARD

S. 1. In wonder at the scale of God's universe, support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from Earth.

S. 2. Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.

EXAMPLES

Fr. Georges Lemaître (1894-1966) was a Catholic priest and astronomer from Belgium who was the first to calculate the expansion of the universe, what is now known as Hubble's Law. He also proposed what has become known as the "Big Bang Theory" of the origin of the universe.

ESSENTIAL QUESTIONS

1. How does the sun compare with other stars?
2. Why does the sun appear so different than other stars?
3. How does distance affect a star's appearance?
4. What patterns can we observe as a result of Earth's rotation and its revolution around the sun?
5. What role have the stars played in the story of our faith?

VOCABULARY TERMS

- Apparent Brightness
- Absolute Brightness
- Sun
- Star
- Planet
- Earth
- Moon
- Orbit
- Rotate/Rotation
- Revolve/Revolution
- Axis

STREAM ACTIVITIES

- Students research sundials, then design and build a working sundial. Use the sundial to investigate how shadows change throughout the day. Perhaps have students decorate

their sundials as in this Aztec sundial project. https://www.education.com/activity/article/aztec-sundial/

- Students create a song and dance to demonstrate their understanding of orbit, rotation and revolution.
- Students brainstorm why certain stars appear brighter and test their ideas using flashlights. Ex: https://betterlesson.com/lesson/639839/what-affects-the-brightness-of-star
- Students will create and use a star wheel to show how the night sky changes. Ex: http://highhillhomeschool.blogspot.com/2014/01/astronomy-for-kids-week-1-star-map.html
- Research information on the star that guided the wise men to Bethlehem. What is known about it? Was it a star? What made it so bright?

EARTH AND SPACE SCIENCE	
Earth's Systems	FIFTH GRADE

SCRIPTURE

The Story of Creation Genesis 1: 6-12.

STANDARD

S. 1. Marveling in God's creative genius, develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

a. Examples could include the influence of the ocean on ecosystems, landform shape, and climate; the influence of the atmosphere on landforms and ecosystems through water and climate; and the influence of mountain ranges on winds and clouds in the atmosphere. The geosphere, hydrosphere, atmosphere, and biosphere are each a system.

S. 2. Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.

EXAMPLES

Blessed Niels Stenson - a Danish anatomist and priest, Stenson was known as the "Father of Geology" and was the first to explain petrifications in the earth.

ESSENTIAL QUESTIONS

1. What do we mean by the spheres of the Earth?
2. How do these spheres interact with one another?
3. As part of the biosphere, how are humans interconnected with the rest of creation?
4. How much of Earth's water is fresh water and why is this resource so important?
5. What threats does our fresh water supply face?

VOCABULARY TERMS

- Biosphere
  - Vegetation
- Geosphere
  - Molten Rock
  - Sediments
  - Landform
- Hydrosphere
  - Ocean
  - Glacier
  - Stream
  - Lake
  - Wetlands
  - Freshwater
  - Saltwater
- Atmosphere
  - Climate
  - Weather

STREAM ACTIVITIES
● Take a walk around the school property and have students write down as many things as they can from each sphere. When you return to the classroom have students share what they observed. The psalmist said “This is the day the Lord has made; We will rejoice and be glad in it.” Ask students to share what they saw in nature that made them happy. ● Have students build a terrarium to see how the spheres interact in a closed system. How is water recycled and used?

EARTH AND SPACE SCIENCE
Earth and Human Activity FIFTH GRADE
SCRIPTURE
Thus should one regard us: as servants of Christ and stewards of the mysteries of God. Now it is of course required of stewards that they may be found trustworthy. 1 Corinthians 4:1-2.
STANDARD
S. 1. Knowing that we are stewards of God's creation, obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.
EXAMPLES
St. Kateri Tekakwitha was canonized by Pope Benedict XVI on Oct. 21, 2012. She is the patroness of ecology and the environment, people in exile and Native Americans. St. Francis of Assisi is the patron saint of ecologists.
ESSENTIAL QUESTIONS
1. God has made us stewards of the Earth and its resources. How can we fulfill this responsibility? 2. How can science help us to learn about the environment and provide solutions to help us protect it?
VOCABULARY TERMS
● Industry ● Agriculture ● Conservation ● Resources ● Communities ● Environment
STREAM ACTIVITIES
● Research carbon footprints and create a poster or PSA to teach others how to reduce their carbon footprint. ● Have students plan an Earth Day activity that incorporates the idea of stewardship of the Earth. ● Students research the effects of oil spills and design and test different methods of clean up. Ex: http://scienceafterschool.blogspot.com/2012/07/oil-spill-connecting-stem-activities-to.html

ENGINEERING	
Engineering Design	FIFTH GRADE

SCRIPTURE

Thus says God, the Lord, who created the heavens and stretched them out, who spread out the earth and what comes from it, who gives breath to the people upon it. Isaiah 42:5

For we are what he has made us, created in Christ Jesus for good works, which God prepared beforehand to be our way of life. Ephesians 2:10

STANDARD

Inspired by the Creator of the Universe:

S. 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.

S. 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

S. 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.

EXAMPLES

St. Patrick is the patron saint of engineers. He brought Roman building techniques to Ireland such as the use of lime mortar and arches to Ireland which were used to build churches.

ESSENTIAL QUESTIONS

1. How do engineers identify problems and design and test solutions?
2. What constraints do engineers have to work with when designing a project?
3. What can we learn from nature about good design? Why is God the Great Designer?

VOCABULARY TERMS

- Engineering design cycle
- Brainstorm
- Plan
- Collaborate
- Evaluate
- Modify
- Specifications
- Budget
- Variables
- Prototype
- Model

STREAM ACTIVITIES

- Initiate monthly STREAM days with an engineering challenge tied to curriculum or to the season. Ex: https://frugalfun4boys.com/awesome-stem-challenges/ Make sure students have time to analyze their prototype and make and test refinements to their original designs.
- Give groups a "budget" for supplies for a STREAM challenge so they must plan to use materials efficiently.

- Give a STREAM challenge and have students (or different groups) test and compare independent variables.
- Look at examples of good design in nature and how that can be applied to solve human design problems.
- Learn about St. Patrick's contributions to building churches in Ireland. Have students build an arch using sugar cubes and glue.

EARTH AND SPACE SCIENCE
Earth's Place in the Universe **MIDDLE SCHOOL**
SCRIPTURE
At the beginning, O Lord, you established the earth, and the heavens are the works of your hands. Heb. 1:10
STANDARD
S. 1 Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons. Recognize that just as physical laws exist within our universe, we cannot exist without laws in our spiritual or moral sense. (MS-ESS1-1) S. 2. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system and relate the way gravity draws objects together to the way our hearts are drawn toward the Lord, the center of our lives. (MS-ESS1-2) S. 3. Analyze and interpret data to determine scale properties of objects in the solar system. Understand that God transcends the limits of time and space, and seeks a personal relationship with each individual person. (MS-ESS1-3)
EXAMPLES
Catholic Scientists/Saints, Catechism, Scripture
ESSENTIAL QUESTIONS
S.1, 2 How do gravity and inertia work together to cause cyclical motions within the universe? S.1 What effects do these motions have on what we observe from Earth? S.3 How is the solar system organized?
ESSENTIAL VOCABULARY
rotation, axis, revolution, orbit, ellipse, seasons, axial tilt, lunar phase, planetary system, asteroid, meteoroid, comet, astronomical unit, eclipses of the sun and moon, tides, terrestrial vs. gaseous planet formation
STREAM ACTIVITIES
● NASA.gov Lesson Title: Gravity Games, integrates a series of activities designed to demonstrate gravity's role in recreation

EARTH AND SPACE SCIENCE	
Earth's Systems	Middle School
SCRIPTURE	
Heaven and earth will pass away, but my words will not pass away. Mt. 25:35 *Send forth your spirit, they are created and you renew the face of the earth.* Psalms 104:30	
STANDARD	
S.1 Just as reconciliation and purgatory help cleanse and heal our souls, the Earth's natural processes are also necessary for renewal. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. (MS-ESS2-1) S.2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. While discussing weathering and erosion, relate it to the New Testament admonition to "build your house on rock, not on sand"; that we need a firm foundation in Christ to withstand the effects of external forces on our spiritual stability. (MS-ESS2-2) S.3. Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history. Understand that Genesis's "seven days of creation" is meant to be read as a metaphor, not as a literal scientific explanation. (MS-ESS1-4) S.4. Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions. This aligns with "divine providence", which states that the universe is "in a state of journeying" and is disposed toward perfection according to God's plan for creation. (MS-ESS2-3) S.5. Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity. Relate this to the probability that water molecules we interact with today were present in Jesus's baptism at the Jordan River, at the wedding feast at Cana, in the storm on the Sea of Galilee, etc. (MS-ESS2-4) S.6. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. Relate this to the storms described in the New Testament when Jesus calmed the sea, and when he walked on water. (MS-ESS2-5) S.7. Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. Apply this to explain the difference between the climate in Galilee and Jerusalem described in the New Testament and our climate in Kansas. (MS-ESS2-6)	
EXAMPLES	
Catholic Scientists/Saints, Catechism, Scripture	
ESSENTIAL QUESTIONS	
S.1, 5, 6, 7 How do materials and energy cycle through the Earth System? S.2, 3, 4 What evidence is there of historical changes in the earth's surface, and how do we see those changes continuing to occur in modern times?	

S.6, 7 What effects on weather and climate do the motion and interactions of air masses, uneven heating, the water cycle, and rotation of the Earth cause?

ESSENTIAL VOCABULARY

Celsius, convection currents, air pressure, wind, warm/cold fronts, air mass, dew point, humidity, wind chill, air occluded front, stationary front, turbulence, updraft, downdraft, plate tectonics, boundaries, divergent, transform fault, mid-ocean ridge, rift, sea floor spreading, continental shelf, trench, igneous, metamorphic, sedimentary, earthquake, focus, epicenter, P waves, S waves, surface waves, Richter scale, Mercalli Scale, precipitation, condensation, transpiration, evaporation

STREAM ACTIVITIES

- Construct Earthquake-Proof Buildings on discoveryeducation.com or Earthquake in the Classroom on techengineering.org
- Mini-terrarium or terraqua column to demonstrate water cycle. Video record (or present live in front of the class) a "weather report" explaining how heat and gravity power the water cycle, and relate it to the weather that will be experienced in various parts of the terrarium.

EARTH AND SPACE SCIENCE

Earth and Human Activity — Middle School

SCRIPTURE

There was a strong and violent wind rending the mountains and crushing rocks before the Lord - but the Lord was not in the wind; after the wind, an earthquake - but the Lord was not in the earthquake; after the earthquake, fire - but the Lord was not in the fire; after the fire, a light silent sound. 1 Kings 19: 11-12

STANDARD

S.1 Construct a scientific explanation based on evidence for how the uneven distribution of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. Compare the Jordan River of 2000 years ago, where Jesus was baptized by John, to its current state. (MS-ESS3-1)

S.2. Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. Understand that, while natural disasters can cause distress to humans, they are not direct punishments sent by God, but can become opportunities for us to grow closer to Christ through suffering. (MS-ESS3-2)

S.3. As God's stewards of the earth, apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. (MS-ESS3-3)

S.4. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. Understand that God's command to "be fruitful and multiply" also came with the responsibility to care for creation and ensure resources for future generations. (MS-ESS3-4)

S.5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century. (MS-ESS3-5)
EXAMPLES
Catholic Scientists/Saints, Catechism, Scripture
ESSENTIAL QUESTIONS
S.1 Why are Earth's mineral, energy, and groundwater resources unevenly distributed? S.2 How can we use patterns in natural hazards to predict future catastrophic events, and our God-given ingenuity to mitigate their effects? S.3, 4, 5 What impact do humans have on the environment, and how can we reduce the negative effects of human actions and also positively impact Earth's natural resources and systems?
ESSENTIAL VOCABULARY
renewable and nonrenewable resources, mineral, groundwater, conservation, greenhouse gases, global warming, natural hazards, population density
STREAM ACTIVITIES
● Calculate waste generated by weighing trash generated at lunch time; figure out what percentage of that waste could be recycled or composted by having one school day during which lunch trash is sorted into 3 trash cans (compost, recycling, waste). Present the results graphically to the school community. ● Survey your school grounds for signs of erosion. Discuss potential solutions. Formulate a plan to solve these problems, and possibly correct them as a service project.

Earth's Place in the Universe

Scriptures:

- *You made the moon to mark the seasons, the sun that knows the hour of its setting. You bring darkness and night falls...* Psalms 104:19-20
- Re. eclipses: *At noon darkness came over the whole land until three in the afternoon.* Mark 15:33 The Death of Jesus

Catechism of the Catholic Church:

- *The beauty of the universe*: **341** The order and harmony of the created world results from the diversity of beings and from the relationships which exist among them. Man discovers them progressively as the laws of nature. They call forth the admiration of scholars. The beauty of creation reflects the infinite beauty of the Creator and ought to inspire the respect and submission of man's intellect and will.

- *God creates an ordered and good world:* **299** Because God creates through wisdom, his creation is ordered: "You have arranged all things by measure and number and

weight."[151] The universe, created in and by the eternal Word, the "image of the invisible God", is destined for and addressed to man, himself created in the "image of God" and called to a personal relationship with God.[152] Our human understanding, which shares in the light of the divine intellect, can understand what God tells us by means of his creation, though not without great effort and only in a spirit of humility and respect before the Creator and his work.[153] Because creation comes forth from God's goodness, it shares in that goodness - "And God saw that it was good. . . very good"[154]- for God willed creation as a gift addressed to man, an inheritance destined for and entrusted to him. On many occasions the Church has had to defend the goodness of creation, including that of the physical world

- **CCC 290** In the beginning God created the heavens and the earth":[128] three things are affirmed in these first words of Scripture: the eternal God gave a beginning to all that exists outside of himself; he alone is Creator (the verb "create" - Hebrew *bara* - always has God for its subject). The totality of what exists (expressed by the formula "the heavens and the earth") depends on the One who gives it being.

- **291** "In the beginning was the Word. . . and the Word was God. . . all things were created through him, and without him was not anything made that was made."[129] The New Testament reveals that God created everything by the eternal Word, his beloved Son. In him "all things were created, in heaven and on earth.. . all things were created through him and for him. He is before all things, and in him all things hold together."[130] The Church's faith likewise confesses the creative action of the Holy Spirit, the "giver of life", "the Creator Spirit" (*Veni, Creator Spiritus*), the "source of every good"

- **CCC 294** The glory of God consists in the realization of this manifestation and communication of his goodness, for which the world was created. God made us "to be his sons through Jesus Christ, according to the purpose of his will, *to the praise of his glorious grace*",[138] for "the glory of God is man fully alive; moreover man's life is the vision of God: if God's revelation through creation has already obtained life for all the beings that dwell on earth, how much more will the Word's manifestation of the Father obtain life for those who see God."[139] The ultimate purpose of creation is that God "who is the creator of all things may at last become "all in all", thus simultaneously assuring his own glory and our beatitude

- *God transcends creation and is present to it.* **CCC 300** God is infinitely greater than all his works: "You have set your glory above the heavens."[156] Indeed, God's "greatness is unsearchable".[157] But because he is the free and sovereign Creator, the first cause of all that exists, God is present to his creatures' innermost being: '' in him we live and move and have our being."[158] In the words of St. Augustine, God is "higher than my highest and more inward than my innermost self".[159]

Catholics making contribution to the topic:

- Fr. Robert Spitzer – Current authority on the origin of the universe from a Catholic perspective. Book: *New Proofs for the Existence of God: Contributions of Contemporary Physics and Philosophies*
- Giuseppe Piazzi (1746–1826) – Theatine priest who discovered the asteroid Ceres and did important work cataloguing stars
- Jean Picard (1620–1682) – French priest and father of modern astronomy in France
- Nicolas-Claude Fabri de Peiresc (1580–1637) – Discovered the Orion Nebula
- Nicole Oresme (c.1320–1382) – 14th century bishop who theorized the daily rotation of the earth on its axis
- Christopher Clavius (1538–1612) – Jesuit who was the main architect of the Gregorian calendar
- Nicolaus Copernicus (1473–1543) – First person to formulate a comprehensive heliocentric cosmology
- Fr. Georges Lemaitre- discoverer of the Big Bang Theory
- Nicolas Louis de Lacaille (1713–1762) – French astronomer noted for cataloguing stars, nebulous objects, and constellations

Earth's Systems

Scriptures:

- *Have you entered the storehouses of the snow, and seen the storehouses of the hail Which I have reserved for times of distress, for a day of war and battle? What is the way to the parting of the winds, where the east wind spreads over the earth? Who has laid out a channel for the downpour and a path for the thunderstorm. To bring rain to uninhabited land, the unpeopled wilderness; To drench the desolate wasteland till the desert blooms with verdure? Has the rain a father? Who has begotten the drops of dew? Out of whose womb comes the ice, and who gives the hoarfrost its birth in the skies, when the waters lie covered as though with stone that holds captive the surface of the deep? Have you tied cords to the Pleiades,* or loosened the bonds of Orion? Can you bring forth the Mazzaroth in their season, or guide the Bear with her children?*
  Do you know the ordinances of the heavens; can you put into effect their plan on the earth? Can you raise your voice to the clouds, for them to cover you with a deluge of waters? Can you send forth the lightning on their way, so that they say to you, "Here we are"? Who gives wisdom to the ibis, and gives the rooster understanding? Who counts the clouds with wisdom? Who tilts the water jars of heaven so that the dust of earth is fused into a mass and its clods stick together? Job 38: 22-38

- *Whose hand holds the depths of the earth, who owns the tops of the mountains. The sea and dry land belong to God, who made them, formed them by hand.* Ps 95:4-5

Catechism of the Catholic Church:

- 282-Catechesis on creation is of major importance. It concerns the very foundations of human and Christian life: for it makes explicit the response of the Christian faith to the basic questions that men of all times have asked themselves: 'Where do we come from..Where does everything that exists come from and where is it going?

- **CCC 293**-Scripture and tradition never ceases to teach and celebrate this fundamental truth: 'The world was made for the glory of God.' St. Bonaventure explains that God created all things 'not to increase His glory, but to show it forth and to communicate it, for God has no other reason for creating than His love and goodness: 'Creatures came into existence when the key of love opened His hand.'

- **CCC 302**-Creation has its own goodness and proper perfection, but it did not spring forth complete from the hands of the Creator. The universe was created 'in a state of journeying' toward an ultimate perfection yet to be attained, to which God has destined it. We call 'divine providence' the dispositions by which God guides His creation towards this perfection:
    - By His providence God protects and governs all things which He has made, 'reaching mightily from one end of the earth to the other, and ordering all things as well.'

Catholics making contribution to the topic:

- Georgius Agricola (1494–1555) – Father of mineralogy
- Nicolas Steno (1638–1686) – Bishop, and father of stratigraphy
- Mario J. Molina (1943–present) - Mexican chemist and one of the precursors to the discovery of the Antarctic ozone hole (1995 Nobel Prize in Chemistry).
- José María Algué (1856–1930) – Priest and meteorologist who invented the barocyclonometer
- Jean Baptiste Julien d'Omalius d'Halloy (1783–1875) – One of the pioneers of modern geology

- Theodoric of Freiberg (c.1250–c.1310) – Gave the first geometrical analysis of the rainbow
- Evangelista Torricelli (1608–1647) – Inventor of the barometer
- Abraham Ortelius (1527–1598) – Created the first modern atlas and theorized on continental drift
- Nicholas Steno (1638-1686) - Convert to Catholicism, Bishop, Father of Geology, anatomist, Dutch born
    - Text support: THE SEASHELL ON THE MOUNTAINTOP: A Story of Science, Sainthood, and the Humble Genius Who Discovered a New History of the Earth, ***Alan Cutler, Author***

Earth and Human Activity

Scriptures:

- *The LORD God then took the man and settled him in the garden of Eden, to cultivate and care for it.* Genesis 2:15
- *The one who forms mountains and creates winds, and declares to mortals their thoughts; Who makes dawn into darkness and strides upon the heights of the earth, the LORD, the God of hosts, is his name!* Amos 4:13

Catechism of the Catholic Church:

- **CCC 295** We believe that God created the world according to his wisdom.[141] It is not the product of any necessity whatever, nor of blind fate or chance. We believe that it proceeds from God's free will; he wanted to make his creatures share in his being, wisdom and goodness: "For you created all things, and by your will they existed and were created."[142] Therefore the Psalmist exclaims: "O LORD, how manifold are your works! In wisdom you have made them all"; and "The LORD is good to all, and his compassion is over all that he has made.

- **CCC 299** Because God creates through wisdom, his creation is ordered: "You have arranged all things by measure and number and weight."[151] The universe, created in and by the eternal Word, the "image of the invisible God", is destined for and addressed to man, himself created in the "image of God" and called to a personal relationship with God.[152] Our human understanding, which shares in the light of the divine intellect, can understand what God tells us by means of his creation, though not without great effort and only in a spirit of humility and respect before the Creator and his work.[153] Because creation comes forth from God's goodness, it shares in that goodness - "And God saw that it was good. . . very good"[154]- for God willed creation as a gift addressed to man, an

inheritance destined for and entrusted to him. On many occasions the Church has had to defend the goodness of creation, including that of the physical world.

- **CCC 2415** The seventh commandment enjoins respect for the integrity of creation. Animals, like plants and inanimate beings, are by nature destined for the common good of past, present, and future humanity.[195] Use of the mineral, vegetable, and animal resources of the universe cannot be divorced from respect for moral imperatives. Man's dominion over inanimate and other living beings granted by the Creator is not absolute; it is limited by concern for the quality of life of his neighbor, including generations to come; it requires a religious respect for the integrity of creation.[196]

Catholics making contribution to the topic:

- Dr. James Schaefer, Marquette University, reminds us of our Christian heritage
- Sr. Marjorie Keenan, RSHM author of the book *Ethics and the Environment: Towards Oneness in Life*
- Thomas Berry (1914-2009)- eco-theologian author of *A Great Work*
- Saint Kateri Tekakwitha (1656 – 1680) Known for being a good steward of the Earth, patron saint of the environment and ecology
- Wangari Maathai (1940-2011) - founder of the Green Belt Movement, 2004 Nobel Prize Peace Prize winner for her work in Kenya as an environmental and social/political activist

ENGINEERING DESIGN
Engineering Design **MIDDLE SCHOOL**
SCRIPTURE
Everyone who listens to these words of mine and acts on them will be like a wise man who built his house on rock. The rain fell, the floods came, and the winds blew and buffeted the house. But it did not collapse; it had been set solidly on rock. And everyone who listens to these words of mine but does not act on them will be like a fool who built his house on sand. Matthew 7:24-27
STANDARD
S.1. Using the scientific model put forth by St. Albertus Magnus, define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. Solutions should take into account Catholic social teaching, which calls us to consider the needs of others before our own, and the "preferential option" for the poor and vulnerable. (MS-ETS1-1) S.2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. Also consider in this the moral responsibility that just because it is possible, it does not mean it is right. (MS-ETS1-2) S.3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success, all while weighing the impact on the environment and society. (MS-ETS1-3) S.4. Develop a model to generate data for repetitive testing and modification of a proposed object, tool, or process such that an optimal design can be achieved, just as we are cooperating with God's divine plan in our life to reach the ultimate good He has promised, which requires continual growth, modification, and practice in virtue. (MS-ETS1-4)
EXAMPLES
Catholic Scientists/Saints, Catechism, Scripture
ESSENTIAL QUESTIONS
1. What is the scientific method and how do you apply it to a problem? 2 and 3. How do you determine which design model is the best to solve the problem, but also morally responsible. 4. What is the importance of collecting and analyzing data? Why is it necessary to conduct repetitive testing?
ESSENTIAL VOCABULARY
Scientific method, inquiry, design problem, hypothesis, controls, independent and dependent variables, systematic process, observation, analysis, evidence, validity, reliability, metric system, communicate results
STREAM ACTIVITIES

- Build bridges in teams using the engineering process. Include materials limits, design restrictions and a specific task. The aesthetics of the bridge is essential in the design.
- Build stained glass (or synthetic or similar type art) windows depicting scenes from the Bible. Utilize tissue paper mod-podged onto glass jars; tissue paper on waxed paper; crayon lines to create borders, and then water color paints to fill in the colors; etc. to create the stained-glass window appearance. To relate to math/engineering, create design parameters & constraints related to the required/allowed geometric shapes, number of colors available, or limit the resources available to complete the task. You could also require that it fit within a specific shape or proportions that would match your own church's windows - requiring the students to first measure the church windows, possibly using proportional ratios when direct measurement is not possible.
- Design a simple compound machine that can carry out a function of a repeated task that can be used to collect data.
- Design and build a catapult, use the invention to complete an accuracy task. Research the Catholic Church in the middle ages and the use of weapons of war.
- Design a slingshot and add an accuracy task. Integrate the story of David and Goliath, discussing potential energy and kinetic energy.
- Construct a boat that will carry the most mass. This activity should require a budget with limited materials. Discuss the scripture Luke 5:4-11 - Jesus sends his apostles back out after a night of unsuccessful fishing. They catch so much on the second try that the boats are in danger of sinking. Also relate to Noah and the building of the ark (Genesis 6:14-16) in which God gives Noah his construction design parameters.

Engineering Design

Scriptures:

- *Jesus said to them, "Did you never read in the scriptures: 'The stone that the builders rejected has become the cornerstone; by the Lord has this been done, and it is wonderful in our eyes'?43* Therefore, I say to you, the kingdom of God will be taken away from you and given to a people that will produce its fruit.44[* The one who falls on this stone will be dashed to pieces; and it will crush anyone on whom it falls.]"* Matthew 21:42-44

- *The stone the builders rejected has become the cornerstone.* Psalm 118:22

- *Come now, let us set things right, says the LORD: Though your sins be like scarlet, they may become white as snow; Though they be red like crimson, they may become white as wool.* Isaiah 1:18

- *Faith is the realization of what is hoped for and evidence of things not seen. Because of it the ancients were well attested. By faith we understand that the universe was ordered by the word of God so that what is visible came into being through the invisible.* Hebrews 11:1-3

- *Fear of the LORD is the beginning of knowledge; fools despise wisdom and discipline.* Proverbs 1: 7

Catechism of the Catholic Church:

- **159** *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." "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."

- 426 …"To catechize is "to reveal in the Person of Christ the whole of God's eternal design reaching fulfillment in that Person.

Catholics making contribution to the topic:

- St. Albertus Magnus (1200-1280) - observed nature scientifically, and defended the compatibility of faith and reason, implementing scientific practices based on Aristotle
- Fr. Roger Bacon (1219-1292) - medieval monk who formalized the scientific method
- Jules Henri Poincare (1854-1912)- engineer
- William of Ockham (c.1288–c.1348) – Franciscan Friar known for Ockham's Razor
- Pope Francis (1936-present) Chemical engineer
- Johannes Gutenberg (1398-1468) Inventor of the printing press

Resources

Books: Introducing Engineering to K-12 Students by ASME,

Engineering Your Future by Great Lakes Press

Apps: Roller Coaster Design, Ratventure, Monorail

"How the Catholic Church Built Western Civilization" by Thomas Woods

Websites:

http://www.pbs.org/wgbh/buildingbig/bridge/,

https://www.unionstation.org/science-pioneers

Video: http://www.pbs.org/wgbh/buildingbig/bridge/
http://www.engineering.com/Videos/tabid/4624/Default.aspx Catholic Scientists
http://en.wikipedia.org/wiki/List_of_Catholic_scientists
http://en.wikipedia.org/wiki/List_of_Roman_Catholic_cleric%E2%80%93scientists

LIFE SCIENCE	
From Molecules to Organisms: Structures and Processes	**MIDDLE SCHOOL**
SCRIPTURE	
You formed my inmost being; you knit me in my mother's womb. I praise you, because I am wonderfully made; wonderful are your works! Ps 139:13-14	
STANDARD	
S.1. Conduct an investigation exploring the order of God's creation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells. (MS-LS1-1) S.2 Just as we are all one body, though many parts with respect to the Church,develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function. (MS-LS1-2) S.3. Every part of a system works more successfully when it carries out its intended purpose, just as we are fulfilled when we carry out God's purpose in our lives. Use arguments supported by evidence for how the body is a system of interacting subsystems composed of groups of cells working together for the same purpose. (MS-LSI-3) S.4. God's creation provides evidence of order; use an argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively. (MS-LSI-4) S.5. Through observation of the beautifully created Earth and our natural surroundings, construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. (MS-LSI-5) S.6. Knowing the perfectly beautiful balance of all God's creation, construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. (MS-LSI-6) S.7. Understanding the Law of Conservation of Energy, understand that God created all energy in the beginning and unique relationships among all organisms, develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism. (MS-LSI-7) S. 8.Just as God knew you before he formed you, gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories. (MS-LSI-8)	
EXAMPLES	
Catholic Scientists/Saints, Catechism, Scripture	
ESSENTIAL QUESTIONS	
S.1 What is the basis of cell theory and how does it define the function of cells? S.2 How do you construct a model of cell to accurately display the function of the organelles?	

S.3 How are cells, tissues, organs and organ systems support each other in an organism?
S.4 How does the environment and the network of organisms within the environment allow for successful survival? (Students should consider how behaviors like nest building, herding of young or bright plumes of mates allow for successful survival and opportunities to reproduce. Students should also understand that animals facilitate the fertilization of plants.)
S.5 How does the availability of local environmental conditions impact animal growth? (Students should understand that local environmental conditions impact animal growth. Consider drought and availability of resources, along with fertilizer and the abundance of resources available.)
S.6 Knowing God created plants before animals, how do the waste products of plants allow for the necessary components for animal life? (Students should understand that the waste products of photosynthesis are the essential components necessary for human/animal life.)
S.7 How does digestion allow for the release of energy? (Students should understand that when chemical bonds are broken during digestion energy is released.)

ESSENTIAL VOCABULARY

organelles, nucleus, nucleolus, nuclear membrane, chromosome, chromatin, cytoplasm, mitochondria, smooth endoplasmic reticulation, rough endoplasmic reticulation, golgi body, ribosomes, DNA, RNA, organ, system, tissue, cell wall, cell membrane, chloroplast, centriole, mitosis, meiosis, adaptation, organism, unicellular, multicellular, plants, animals, human body systems, circulatory, immune, respiratory, endocrine, integumentary, skeletal, muscular, digestive, excretory, reproductive, nervous, hygiene, diet, nutrition, exercise, photosynthesis, cell respiration,

STREAM ACTIVITIES

- Build a model of the plant and animal cells https://sciencespot.net/Media/constructionzone.pdf
- Microscope observation of unicellular organisms, cheek samples and cells undergoing Mitosis
- Build diagrams of Mitosis and Meiosis using pasta noodles and string
- Photosynthesis Virtual Lab: Color of the light vs. the growth of plants http://www.glencoe.com/sites/common_assets/science/virtual_labs/LS12/LS12.html
- Photosynthesis Lab: Photosynthetic rate: Bubbles as a function of CO_2, light
- Dissection to relate to human body systems
- Photosynthesis and respiration lab with water plants and bromothymol blue indicator solution to support the idea that plants cells undergo both respiration and photosynthesis.
- The Organ Trail - https://sciencespot.net/Media/organtrail.pdf
- The Human Body Quest - https://sciencespot.net/Pages/kdzeagles.html

LIFE SCIENCE	
Ecosystems: Interactions, Energy,and Dynamics	Middle School
SCRIPTURE	
If, then, you truly listen to my commandments which I give you today, loving and serving the LORD, your God, with your whole heart and your whole being, I will give the seasonal rain to your land, the early rain and the late rain, that you may have your grain, wine and oil to gather in; and I will bring forth grass in your fields for your animals. Thus you may eat and be satisfied. Dt 11:13-15	
STANDARD	
S.1. God gave man intelligence and reason and the responsibility to care for and understand the ordered world. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. (MS-LS2-1) S.2. God himself created the visible world in all its richness, diversity and order. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. (MS-LS2-2) S.3. After discussing ecological spirituality, develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem which show the harmony of the created world. (MS-LS2-3) S.4. Construct an argument supported by empirical evidence that show how changes to physical or biological components of an ecosystem affect populations. Discuss man's place in creation and the responsibility of man to care for the environment. (MS-LS2-4) S.5. Man has a unique role in caring for creation, using this knowledge, evaluate competing design solutions for maintaining biodiversity and ecosystem services. (MS-LS2-5)	
EXAMPLES	
Catholic Scientists/Saints, Catechism, Scripture	
ESSENTIAL QUESTIONS	
S.1 How does the presence, and abundance or deficiency, of natural resources determine the success of all organisms in that ecosystem? S.2 Why is it important to observe and predict patterns in our ordered world? S.3 Why is the sun the source of all energy and why does each level of consumers have only 1/10th of the available energy of the consumer/producer level below? (Use the energy pyramid to support this claim as well as the statement that there will always be more producers than consumers in an ecosystem.) S.4 Why would a small change in an ecosystems cause a much larger change within another part of the ecosystem? S.5 How does the diversity of organisms and the relationship among them allow for order and harmony of the world?	
ESSENTIAL VOCABULARY	

ecosystem, habitat, biotic, abiotic, producer, consumer, decomposer, scavenger, kingdom, phylum, class, order, family, genus, species, extinction, adaptation, biodiversity, symbiosis, commensalism, parasitism, mutualism, energy pyramid, food chain, food web, natural resources, population, community, population density, succession, limiting factor
STREAM ACTIVITIES
• Water filtering activity epa.gov http://water.epa.gov/learn/kids/drinkingwater/teachers_4- 8.cfm • Construct a food web to show the cycling of energy through an ecosystem. https://ngss.nsta.org/Resource.aspx?ResourceID=1094 • Research bald eagles and make a powerpoint outlining solutions to extinction, including possible habitat changes. https://sciencespot.net/Pages/kdzeagles.html

LIFE SCIENCE
Heredity: Inheritance and Variation of Traits — Middle School
SCRIPTURE
His divine power has bestowed on us everything that makes for life and devotion, through the knowledge of him who called us by His own glory and power. Through these, he has bestowed on us the precious and very great promises, so that through them you may come to share in the divine nature, after escaping from the corruption that is in the world. 2Pt 1:3-4
STANDARD
S.1. God created the world according to His wisdom and not by fate or chance. He created all in goodness and order as a sign of Him. Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism. (MS-LS3-1) S.2. Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation, since God wills the interdependence of creatures and their countless diversities to exist in dependence with one another. (MS-LS3-2)
EXAMPLES
Catholic Scientists/Saints, Catechism, Scripture
ESSENTIAL QUESTIONS
S.1 How does a change in the DNA sequence or protein production result in a harmful, beneficial or neutral effect in the structure or function of an organism? (Consider that all human organisms descended from Adam and Eve, so all humans have a common relation. After the great flood, man was not obedient to God and we have the story of Babel and the confusion of languages and distinctions between humans became apparent as regional traits became dominant. All of these changes and distinctions are related to chromosomes and patterns of inheritance.) S.2 Why does the process of meiosis result in an exact replication of DNA?
ESSENTIAL VOCABULARY
dominant, recessive, Punnett square, genotype, phenotype, allele, heterozygous, homozygous, codominance, blood type, karyotype, pedigree, autosomal, sex-linked, probability, DNA, chromosome, gene, asexual and sexual reproduction, adaptation, heredity, mutation, biological diversity, natural selection, artificial selection, selective breeding, genetic engineering, cloning
STREAM ACTIVITIES
• Create a 3D model of the double helix DNA strand • DNA Replication: Paper Clip Activity- use colorful paper clips to represent base pairs to demonstrate DNA replication • DNA keychains https://sciencespot.net/Media/Genetics_DNAKeychainGuide.pdf • Virtual lab on transcribing and translating DNA http://learn.genetics.utah.edu/content/molecules/transcribe/ • Virtual lab on gel electrophoresis http://learn.genetics.utah.edu/content/labs/gel/

- Virtual lab comparing the reproduction cycles of normal cells and cancer cells http://www.mhhe.com/biosci/genbio/virtual_labs/BL_23/BL_23.html
- Punnett Square practice calculating probability of inheriting traits.

LIFE SCIENCE	
Biological Evolution: Unity and Diversity	Middle School
SCRIPTURE	
For everything created by God is good, and nothing is to be rejected when received with thanksgiving, for it is made holy by the invocation of God in prayer. 1 Tim 4:4	
STANDARD	
S.1.Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms physically throughout the history of life on Earth under the assumption that natural laws operate today as in the past; however, the human spiritual soul is not the product of evolution but is created directly by God and conferred into the human body at the moment of conception. (MS-LS4-1) S.2. Understanding the aim of scientific research is the search for truth, which ultimately leads to God, apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships. (MSLS4-2) S.3. Understanding God's divine design, analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy. (MS-LS4-3) S.4. The natural world is created through divine design. This means that God does not "intervene" in nature, rather nature responds as it was created and ordered to respond. Use this knowledge to construct an explanation based on evidence that describes how genetic variations of traits in a population increase some organism's probability of surviving and reproducing in a specific environment.. (MS-LS4- 4) S.5. Understanding that humans were created with an intellect, gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired physical traits in organisms. (Consider the moral obligations of a Catholic with this section.) (MS-LS4-5) S.6. Understanding that nature is ordered in a way that leads to truth, use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific physical traits in populations over time. (MS-LS4-6)	
EXAMPLES	
Catholic Scientists/Saints, Catechism, Scripture	
ESSENTIAL QUESTIONS	
S.1 How do patterns in the fossil record support evolution of organisms today?	

S.2 How do similarities of modern organisms and evidence from the fossil record support evolutionary relationships? S.3 How does similar embryological development across various species support the idea of common ancestors and evolution? S.4 and S.6 How does mathematics support natural selection and the increase or decrease in physical traits over time? S.5 How does technology used by humans influence the inheritance of desired physical traits in organisms?
ESSENTIAL VOCABULARY
adaptation, natural selection, heredity, mutation, biological diversity, artificial selection, evolutionary trees, Darwin's Theory, extinction, fossil record, embryo, anatomy, conception
STREAM ACTIVITIES
• Research how an environment affected the natural selection of a species: compare how the jack rabbit in the desert is different than the cottontail in Kansas • NOVA Guess the Embryo game helps show similarities in embryonic development across species: http://www.pbs.org/wgbh/nova/evolution/guess-embryo.html • Argumentation of fossils http://scienceandliteracy.org/sites/scienceandliteracy.org/files/presentation/MS_SG-Supporting_Claims_with_Evidence-Fossils.pdf

From Molecules to Organisms: Structures and Processes

Scriptures:

- Gen 1:26, Then God said: Let us make human beings in our image, after our likeness. Let them have dominion over the fish of the sea, the birds of the air, the tame animals, all the wild animals, and all the creatures that crawl on the earth.

  Gen 1:28 God blessed them and God said to them: Be fertile and multiply; fill the earth and subdue it. Have dominion over the fish of the sea, the birds of the air, and all the living things that crawl on the earth.

- Gen 2:15 The LORD God then took the man and settled him in the garden of Eden, to cultivate and care for it.

- Col 1:16 For in him were created all things in heaven and on earth, the visible and the invisible, whether thrones or dominions or principalities or powers; all things were created through him and for him.

- Eph 4:16 from whom the whole body, joined and held together by every supporting ligament, with the proper functioning of each part, brings about the body's growth and builds itself up in love.

- 1Cor 12:12-26 As a body is one though it has many parts, and all the parts of the body, though many, are one body, so also Christ. For in one Spirit we were all baptized into one body, whether Jews or Greeks, slaves or free persons, and we were all given to drink of one Spirit. Now the body is not a single part, but many. If a foot should say, “Because I am not a hand I do not belong to the body,” it does not for this reason belong any less to the body. Or if an ear should say, “Because I am not an eye I do not belong to the body,” it does not for this reason belong any less to the body. If the whole body were an eye, where would the hearing be? If the whole body were hearing, where would the sense of smell be? But as it is, God placed the parts, each one of them, in the body as he intended. If they were all one part, where would the body be? But as it is, there are many parts, yet one body. The eye cannot say to the hand, “I do not need you,” nor again the head to the feet, “I do not need you.”Indeed, the parts of the body that seem to be weaker are all the more necessary,23and those parts of the body that we consider less honorable we surround with greater honor, and our less presentable parts are treated with greater propriety, whereas our more presentable parts do not need this. But God has so constructed the body as to give greater honor to a part that is without it, so that there may be no division in the body, but that the parts may have the same concern for one another. If [one] part suffers, all the parts suffer with it; if one part is honored, all the parts share its joy

Catechism of the Catholic Church:

- **364** The human body shares in the dignity of "the image of God": it is a human body precisely because it is animated by a spiritual soul, and it is the whole human person that is intended to become, in the body of Christ, a temple of the Spirit:[232]
    - Man, though made of body and soul, is a unity. Through his very bodily condition he sums up in himself the elements of the material world. Through him they are thus brought to their highest perfection and can raise their voice in praise freely given to the Creator. For this reason man may not despise his bodily life. Rather he is obliged to regard his body as good and to hold it in honor since God has created it and will raise it up on the last day. [233]
- **365** The unity of soul and body is so profound that one has to consider the soul to be the "form" of the body:[234] i.e., it is because of its spiritual soul that the body made of matter becomes a living, human body; spirit and matter, in man, are not two natures united, but rather their union forms a single nature.
- USCCB Ecological Spirituality http://www.usccb.org/issues-and-action/human-life-and-dignity/environment/an-ecological-spirituality.cfm

Catholics making contribution to the topic:

- Albertus Magnus (c.1206–1280) – Patron saint of natural sciences
- Giovanni Alfonso Borelli (1608–1679) – Often referred to as the father of modern biomechanics
- Mateo Realdo Colombo (1516–1559) – Discovered the pulmonary circuit, which paved the way for Harvey's discovery of circulation
- Louis Pasteur (1822–1895) – Father of bacteriology
- Theodor Schwann (1810–1882) – Founder of the theory of the cellular structure of animal organisms
- Johannes Peter Müller (1801–1858) – Founder of modern physiology
- Leonardo Da Vinci (1492- 1519) As an artist, he quickly became master of topographic anatomy, drawing many studies of muscles, tendons and other visible anatomical features.
- Fr. Damien of Molok'ai (1840-1889) Catholic priest who won recognition for his ministry in the Kingdom of Hawai'i to people with leprosy
- Andreas Vesalius (1514–1564) – Father of modern human anatomy
- Francesco Redi (1626–1697) – His experiments with maggots were a major step in overturning the idea of spontaneous generation

Ecosystems: Interactions, Energy, and Dynamics

Scriptures:

- Gen 1:26, Then God said: Let us make human beings in our image, after our likeness. Let them have dominion over the fish of the sea, the birds of the air, the tame animals, all the wild animals, and all the creatures that crawl on the earth.

  Gen 1:28 God blessed them and God said to them: Be fertile and multiply; fill the earth and subdue it. Have dominion over the fish of the sea, the birds of the air, and all the living things that crawl on the earth.

- Gen 2:15 The LORD God then took the man and settled him in the garden of Eden, to cultivate and care for it.

- Col 1:16 For in him* were created all things in heaven and on earth, the visible and the invisible, whether thrones or dominions or principalities or powers; all things were created through him and for him.

- Eph 4:16 from whom the whole body, joined and held together by every supporting ligament, with the proper functioning of each part, brings about the body's growth and builds itself up in love.

Catechism of the Catholic Church:

- God wills the *interdependence of creatures*.
    - **340** The sun and the moon, the cedar and the little flower, the eagle and the sparrow: the spectacle of their countless diversities and inequalities tells us that no creature is self-sufficient. Creatures exist only in dependence on each other, to complete each other, in the service of each other.

- Forest Fire and Purgatory - As students explore ecosystems and the value of forest fire to allow for new life and purging away of disease, just as purgatory offers the same for the soul of a human person. St. Catherine of Genoa
    - **1030** All who die in God's grace and friendship, but still imperfectly purified, are indeed assured of their eternal salvation; but after death they undergo purification, so as to achieve the holiness necessary to enter the joy of heaven.
    - **1031** The Church gives the name *Purgatory* to this final purification of the elect, which is entirely different from the punishment of the damned.[606] The Church formulated her doctrine of faith on Purgatory especially at the Councils of Florence and Trent. The tradition of the Church, by reference to certain texts of Scripture, speaks of a cleansing fire:[607] As for certain lesser faults, we must believe that, before the Final Judgment, there is a purifying fire. He who is truth says that whoever utters blasphemy against the Holy Spirit will be pardoned neither in this age nor in the age to come. From this sentence we understand that certain offenses can be forgiven in this age, but certain others in the age to come.[608]
    - **1032** This teaching is also based on the practice of prayer for the dead, already mentioned in Sacred Scripture: "Therefore [Judas Maccabeus] made atonement for the dead, that they might be delivered from their sin."[609] From the beginning the Church has honored the memory of the dead and offered prayers in suffrage for them, above all the Eucharistic sacrifice, so that, thus purified, they may attain the beatific vision of God.[610] The Church also commends almsgiving, indulgences, and works of penance undertaken on behalf of the dead:

Catholics making contribution to the topic:

- Antoine Laurent de Jussieu (1748–1836) – The first to propose a natural classification of flowering plants
- St. Kateri Tekakwitha (1656-1680) model ecologist
- St. Francis of Assisi (1182-1226) He is known as the patron saint of animals, the environment
- St. John Paul II (1920-2005) wrote encyclicals on ecological thoughts
- Pierre André Latreille (1762–1833) – Pioneer in entomology

Heredity: Inheritance and Variation in Organisms

Scriptures:

- Genesis Chapter 25
    - Isaac entreated the LORD on behalf of his wife, since she was sterile. The LORD heard his entreaty, and his wife Rebekah became pregnant. But the children jostled each other in the womb so much that she exclaimed, “If it is like this, why go on living!” She went to consult the LORD,23and the LORD answered her: Two nations are in your womb, two peoples are separating while still within you; But one will be stronger than the other, and the older will serve the younger. When the time of her delivery came, there were twins in her womb. The first to emerge was reddish,and his whole body was like a hairy mantle; so they named him Esau.26Next his brother came out, gripping Esau’s heel;* so he was named Jacob. Isaac was sixty years old when they were born.

- Genesis Chapter 11:1-9

    - The whole world had the same language and the same words. When they were migrating from the east, they came to a valley in the land of Shinar and settled there. They said to one another, “Come, let us mold bricks and harden them with fire.” They used bricks for stone and bitumen for mortar. Then they said, “Come, let us build ourselves a city and a tower with its top in the sky and so make a name for ourselves; otherwise we shall be scattered all over the earth.” The LORD came down to see the city and the tower that the people had built. Then the LORD said: If now, while they are one people and all have the same language, they have started to do this, nothing they presume to do will be out of their reach. Come, let us go down and there confuse their language, so that no one will understand the speech of another. So the LORD scattered them from there over all the earth, and they stopped building the city. That is why it was called Babel, because there the LORD confused the speech of all the world. From there the LORD scattered them over all the earth.

Catechism of the Catholic Church:

- **302** Creation has its own goodness and proper perfection, but it did not spring forth complete from the hands of the Creator. The universe was created "in a state of journeying" (*in statu viae*) toward an ultimate perfection yet to be attained, to which God has destined it. We call "divine providence" the dispositions by which God guides his creation toward this perfection:
- **1700** The dignity of the human person is rooted in his creation in the image and likeness of God (*article 1*); it is fulfilled in his vocation to divine beatitude

Catholics making contribution to the topic:

- Jérôme Lejeune (1926–1994) – Pediatrician and geneticist, best known for his discovery of the link of diseases to chromosome abnormalities
- Gregor Mendel (1822–1884) – Father of genetics
- Marcello Malpighi (1628–1694) – Father of comparative physiology

Biological Evolution: Unity and Diversity

Scriptures:

- James 2: 1-4 My brothers, show no partiality as you adhere to the faith in our glorious Lord Jesus Christ. For if a man with gold rings on his fingers and in fine clothes comes into your assembly, and a poor person in shabby clothes also comes in, and you pay attention to the one wearing the fine clothes and say, “Sit here, please,” while you say to the poor one, “Stand there,” or “Sit at my feet,” have you not made distinctions among yourselves and become judges with evil designs?

- Gen 1:26 Then God said: Let us make human beings in our image, after our likeness. Let them have dominion over the fish of the sea, the birds of the air, the tame animals, all the wild animals, and all the creatures that crawl on the earth.

  Gen 1:28 God blessed them and God said to them: Be fertile and multiply; fill the earth and subdue it. Have dominion over the fish of the sea, the birds of the air, and all the living things that crawl on the earth.

- Gen 1:11-12 Then God said: Let the earth bring forth vegetation: every kind of plant that bears seed and every kind of fruit tree on earth that bears fruit with its seed in it. And so it happened:12the earth brought forth vegetation: every kind of plant that bears seed and every kind of fruit tree that bears fruit with its seed in it. God saw that it was good

- Gen 2:15 The LORD God then took the man and settled him in the garden of Eden, to cultivate and care for it.

- Col 1:16 For in him were created all things in heaven and on earth, the visible and the invisible, whether thrones or dominions or principalities or powers; all things were created through him and for him.

- Eph 4:16 from whom the whole body, joined and held together by every supporting ligament, with the proper functioning of each part, brings about the body's growth and builds itself up in love.

Catechism:

- **356** Of all visible creatures only man is "able to know and love his creator".[219] He is "the only creature on earth that God has willed for its own sake",[220] and he alone is called to share, by knowledge and love, in God's own life. It was for this end that he was created, and this is the fundamental reason for his dignity:
- **358** God created everything for man,[222] but man in turn was created to serve and love God and to offer all creation back to him:
- Dominican Friars http://www.thomisticevolution.org/

Catholics making contribution to the topic:

- St. Thomas Aquinas *Summa Theologiae*
- Jean-Baptiste Lamarck (1744–1829) – French naturalist, biologist and academic whose theories on evolution preceded those of Darwin
- Wilhelm Heinrich Waagen (1841–1900) – Geologist and paleontologist
- Johann Joachim Winckelmann (1717–1768) – One of the founders of scientific archaeology
- Pope Pius the XII (1875-1958) Confirmed no intrinsic conflict between evolution and Christianity
- Fr. Robert Spitzer (Current) New Proofs from the Existence of God
- Gregor Mendel (1822–1884) – Father of genetics
- Cardinal Christoph Schönborn-(1945- present) writer on Church's stance on evolution
- Nicholas Steno (1638-1686) - Convert to Catholicism, Bishop, Father of Geology,anatomist, Dutch born
    - Text support: THE SEASHELL ON THE MOUNTAINTOP: A Story of Science, Sainthood, and the Humble Genius Who Discovered a New History of the Earth, ***Alan Cutler, Author***

PHYSICAL SCIENCE
Matter and Its Interactions **MIDDLE SCHOOL**
SCRIPTURE
In the beginning, when God-created the heavens and the earth, and the earth was a formless wasteland, and darkness covered the abyss. Gen 1: 1-2
STANDARD
S. 1. Understanding that God created all matter in the beginning, develop a model to describe the atomic composition of simple molecules and extended structures. (MSPS1-1) S. 2. Reflecting on how God is at work in our hearts to bring about a change, analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. (MS-PS1-2) S. 3 Knowing God has called us to care for the Earth, and knowing our responsibility due to our unique place in creation, gather and make sense of information to describe that synthetic materials come from natural resources and impact society. (MS-PS1-3) S. 4. Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed, just as God's energy is at work producing a change in us when we are open to cooperating with his divine plan. (MS-PS1-4) S. 5. Understanding that all things were created by God *ex nihilo*, develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved. (MS-PS1-5) S. 6. Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes. Discuss how this relates to the way that the apostles absorbed the spiritual energy of the Holy Spirit when it descended upon them as tongues of fire in the Upper Room. (MS-PS1-6)
EXAMPLES
Catholic Scientists/Saints, Catechism, Scripture
ESSENTIAL QUESTIONS
1. How do simple molecules bond to create more complex structures? 2. What observations can be made to determine if a chemical reaction has occurred? 3. How do synthetic materials, which come from natural resources, impact our society? 4. How does an increase or decrease in thermal energy impact particle motion? 5. How do the reactants and products compare before and after a chemical reaction? 6. What types of devices release or absorb thermal energy using a chemical process?
ESSENTIAL VOCABULARY
atoms, matter, elements, molecule, compounds, mixtures, protons, neutrons, electrons, nucleus, states of matter, solid, liquid, gas, plasma, boiling point, melting point, freezing point, sublimation, condensation, evaporation, periodic table, group, periods ,atomic number, atomic mass, atomic structure, nonmetal, metals, covalent bond, ionic bond, electron shell, valence electrons, law of conservation of matter, symbols, yields, subscript, co-efficient,

balanced equation, catalyst, inhibitor, endothermic, exothermic, synthesis, decomposition, single replacement, double replacement, combustion, acid-base reaction, solubility, Ph paper, acid, base, hydroxide ion, hydronium ion, blue litmus, red litmus, indicator strip
STREAM ACTIVITIES
● Mystery pH lab: given various liquids and pH indicator strips determine pH, possible purpose of the solution and try to correctly identify the solution ● Mystery density lab: given different liquid solutions determine which has a greater density ● Adopt an element - https://sciencespot.net/Media/adtelempjt.pdf ● Playing with polymers - https://sciencespot.net/Media/playpolyrecipe08.pdf

PHYSICAL SCIENCE	
Motion and Stability: Forces and Interactions	MIDDLE SCHOOL

SCRIPTURE

And he is before all things, and in him all things hold together. Colossians 1:17

STANDARD

S.1. Understanding that God set all things in motion, apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects. (MS-PS2-1)

S.2. Understanding that all of creation is in perfect balance, plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. (MS-PS2-2)

S.3. Understanding that all aspects of God's creation were planned and act as they were created to act, apply scientific inquiry to determine the factors that affect the strength of electric and magnetic forces. (MS-PS2-3)

S.4. Just as all things are held together through Christ who strengthens us, construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. (MS-PS2-4)

S.5. Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact. These forces are similar to the way our souls are invisibly drawn to union with God. (MS-PS2-5)

EXAMPLES

Catholic Scientists/Saints, Catechism, Scripture

ESSENTIAL QUESTIONS

1. and 2 How can Newton's Laws explain and predict a change in motion or stability of an object or the interaction of objects?
3. What factors affect the strength of electric and magnetic forces?
4. How does the mass of an object affect its gravitational force?
5. Why are some physical systems more stable than others?

ESSENTIAL VOCABULARY

metric measurement, mass, grams, liters, meters, density, volume, temperature, Celsius, Newton's First, Second, and Third Law of motion, inertia, friction, motion, reference point, speed, velocity, momentum, acceleration, deceleration, gravity, weight, force, balanced and unbalanced forces, newtons, work, Joules, power, watts, Potential Energy, Kinetic Energy

STREAM ACTIVITIES

- Magnetic Forces: Build a simple nail electromagnet and study how electric currents create magnetic fields.
- Newton's Laws: Assessment- Given a ball, the student will demonstrate all three of Newton's Laws of motion,
- Marble madness competition to construct a marble track to decrease the speed of a marble given certain parameters

- Rubber Band Lab- https://www.scientificamerican.com/article/bring-science-home-rubber-bands-energy/

PHYSICAL SCIENCE	
Energy	MIDDLE SCHOOL
SCRIPTURE	
Then God said, 'Let there be light,' and there was light. Gen 1:3	
STANDARD	
S.1. Understanding the perfect balance of all forces of objects created by God in the beginning, construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and the speed of an object. (MS-PS3-1) S.2. Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. Our potential, God says, is like the mustard seed. To human appearance, it is tiny, but God tells us that through His grace, our faith can grow "to the largest of plants" that gives shelter to others. (MS-PS3-2) S.3. Investigating St. Albertus Magnus and the scientific method, apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer. (MS-PS3-3) S.4. Plan an investigation to determine the relationships among God's creation of a good and ordered world to show energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample. (MS-PS3-4) S.5. Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object, just as we were created to allow the transforming energy of the Holy Spirit to act on and sanctify our life. (MS-PS3-5)	
EXAMPLES	
Catholic Scientists/Saints, Catechism, Scripture	
ESSENTIAL QUESTIONS	
1. How does an object's mass and speed impact its kinetic energy? 2. What is the relationship between objects' interactions and their respective potential energies? 3. What type of device can minimize or maximize thermal energy transfer? 4. How does a change in temperature indicate a thermal energy transfer? 5. How is energy transferred between objects or systems?	
ESSENTIAL VOCABULARY	
Conduction, convection, radiation, Conservation of energy, potential and kinetic energy, mass, speed, acceleration, thermal energy, energy transfer, types of energy, heat, temperature, Celsius, fusion, fission	
STREAM ACTIVITIES	

- Thermal Energy Transfer: build/ design solar ovens or ice cube insulators
- Transfer of energy: build/design a roller coaster demonstrating kinetic and potential energy, marble madness competition to construct a marble track to decrease the speed of a marble given certain parameters,
- charge a plastic grocery bag to create potential energy that transfers to kinetic when a hand is placed near.

PHYSICAL SCIENCE
Waves and Their Applications in Technologies for Information Transfer **MIDDLE SCHOOL**
SCRIPTURE
The men were amazed and asked, "What kind of man is this? Even the winds and the waves obey him! Matthew 8:23
STANDARD
S.1. Just as the Holy Spirit is a force at work in our hearts, and our openness to God's will allow for greater movement in us, use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave. (MS-PS4-1) S.2.Develop and use a model to describe that waves are absorbed, reflected, or transmitted through various materials, just as through our openness to God's will, we are able to absorb his Word, reflect his goodness in our actions, and transmit his love to others. (MS-PS4-2) S.3. Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals, understanding that God gave to man an intellect and ability to reason with logic. (MS-PS4-3)
EXAMPLES
Catholic Scientists/Saints, Catechism, Scripture
ESSENTIAL QUESTIONS
1. What are the characteristics and properties of waves? 2. How do waves behave when reflected, absorbed or transmitted through different materials? 3. How are digitized signals different from analog signals?
ESSENTIAL VOCABULARY
wave, amplitude, crests, troughs, types of waves, reflected, absorbed, transmitted, refracted, compression, analog signals, encode, transmit, Doppler, electricity, magnetism, vibration, spectrum, conductor, insulator, pole
STREAM ACTIVITIES
● Using a slinky, rope and dominos demonstrate different wave patterns ● Use the example of popcorn transforming from a kernel when introduced to a radio wave ● Investigate how water can refract light waves and change the perception of an object's location ● Use prisms to explore what makes up light waves ● Demonstrate the Doppler effect by listening to a sound in motion

Matter and Its Interactions

Scriptures:

- *In the beginning was the Word, and the Word was with God, and the Word was God. He was in the beginning with God. All things came to be through him, and without him nothing came to be. What came to be through him was life, and this life was the light of the human race; the light shines in the darkness, and the darkness has not overcome it.* John 1:1-5
- *By faith we understand that the universe was ordered by the word of God, so that what is visible came into being through the invisible.* Heb 11:3
- *When the time for Pentecost was fulfilled, they were all in one place together. And suddenly there came from the sky a noise like a strong driving wind, and it filled the entire house in which they were. Then there appeared to them tongues as of fire, which parted and came to rest on each one of them. And they were all filled with the holy Spirit and began to speak in different tongues, as the Spirit enabled them to proclaim.* Acts 2:1-4 **(Relate the radical change in the apostles' characteristics - fearful and hiding in the Upper Room, to going out and boldly proclaiming the gospel - after the Holy Spirit has entered them, to the way that chemical changes cause a change in the substance and characteristics of matter.)**

Catechism of the Catholic Church:

- **CCC 298** Since God could create everything out of nothing, he can also, through the Holy Spirit, give spiritual life to sinners by creating a pure heart in them,[148] and bodily life to the dead through the Resurrection. God "gives life to the dead and calls into existence the things that do not exist."[149] And since God was able to make light shine in darkness by his Word, he can also give the light of faith to those who do not yet know him.
- **CCC 293** Scripture and Tradition never ceases to teach and celebrate this fundamental truth: "The world was made for the glory of God."[134] St. Bonaventure explains that God created all things "not to increase his glory, but to show it forth and to communicate it",[135] for God has no other reason for creating than his love and goodness: "Creatures came into existence when the key of love opened his hand."[136] The First Vatican Council explains:

  This one, true God, of his own goodness and "almighty power", not for increasing his own beatitude, nor for attaining his perfection, but in order to manifest this perfection through the benefits which he bestows on creatures, with absolute freedom of counsel "and from the beginning of time, made out of nothing both orders of creatures, the spiritual and the corporeal. . ."[137]

Catholics making contribution to the topic:

- Fr. Robert Spitzer (1952- present) – Current authority on the origin of the universe from a Catholic perspective. Book: *New Proofs for the Existence of God: Contributions of Contemporary Physics and Philosophies*
- Jean-Baptiste Dumas (1800–1884) – Chemist who established new values for the atomic mass of thirty elements
- Henri Becquerel (1852–1908) – Awarded the Nobel Prize in physics for his co-discovery of radioactivity
- Fibonacci (c.1170–c.1250) – Popularized Hindu-Arabic numerals in Europe and discovered the Fibonacci sequence
- Fr. Georges Lemaitre (1894-1966) - discoverer of the Big Bang Theory
- Pope Francis (1936-present) Chemical engineer

Motion and Stability: Forces and Interactions

Scriptures:

- *No one can come to me unless the Father who sent me draw him* John 6:44
- *Jesus, aware at once that power had gone out from him, turned around in the crowd and asked, "Who has touched my clothes?"* Mark 5:30

Catechism of the Catholic Church:

- **296** We believe that God needs no pre-existent thing or any help in order to create, nor is creation any sort of necessary emanation from the divine substance.[144] God creates freely "out of nothing".
- **821** Certain things are required in order to respond adequately to this call:
  - a permanent *renewal* of the Church in greater fidelity to her vocation; such renewal is the **driving-force** of the **movement toward unity**; (bolded emphasis added to relate to science standards)

Catholics making contribution to the topic:

- André-Marie Ampère (1775–1836) – One of the main discoverers of electromagnetism
- Galileo Galilei (1564–1642) – Father of modern science
- Giovanni Battista Riccioli(1598 –1671) was an Italian astronomer and a Catholic priest in the Jesuit order. He is known, among other things, for his experiments with pendulums and with falling bodies, for his discussion of 126 arguments concerning the motion of the Earth, and for introducing the current scheme of lunar nomenclature.

- Bonaventura Cavalieri (1598–1647) – Mathematician known for his work in optics and motion, calculus, and for introducing logarithms to Italy
- Jean Buridan (c.1300–after 1358) – French priest who developed the theory of impetus, the first step toward the modern concept of inertia
- Francesco Lana de Terzi (1631–1687) – Jesuit priest who has been called the father of aeronautics
- Pierre-Simon Laplace (1749–1827) – Famed mathematician and astronomer who has been called the "Newton of France"

Energy

Scriptures:

- Therefore, if anyone is in Christ, he is a new creation. The old has passed away; behold, the new has come. All this is from God, who through Christ. 2 Corinthians 5:17

Catechism of the Catholic Church:

- CCC 295-We believe that God created the world according to his wisdom.[141] It is not the product of any necessity whatever, nor of blind fate or chance. We believe that it proceeds from God's free will; he wanted to make his creatures share in his being, wisdom and goodness: "For you created all things, and by your will they existed and were created."[142] Therefore the Psalmist exclaims: "O LORD, how manifold are your works! In wisdom you have made them all"; and "The LORD is good to all, and his compassion is over all that he has made."[143]
- CCC 299-Because God creates through wisdom, his creation is ordered: "You have arranged all things by measure and number and weight."[151] The universe, created in and by the eternal Word, the "image of the invisible God", is destined for and addressed to man, himself created in the "image of God" and called to a personal relationship with God.[152] Our human understanding, which shares in the light of the divine intellect, can understand what God tells us by means of his creation, though not without great effort and only in a spirit of humility and respect before the Creator and his work.[153] Because creation comes forth from God's goodness, it shares in that goodness - "And God saw that it was good. . . very good"[154]- for God willed creation as a gift addressed to man, an inheritance destined for and entrusted to him. On many occasions the Church has had to defend the goodness of creation, including that of the physical world.[155]

Catholics making contribution to the topic:

- Eugenio Barsanti (1821–1864) – Piarist who is the possible inventor of the internal combustion engine
- Andrew Gordon (Benedictine) (1712–1751) – Benedictine monk, physicist, and inventor who made the first electric motor
- John Polanyi (1929–) – Canadian chemist who won the 1986 Nobel Prize for his research in chemical kinetics

Waves and Their Applications in Technologies for Information Transfer:

Scriptures:

- So God created the great creatures of the sea and every living thing with which the water teems and that moves about in it, according to their kinds, and every winged bird according to its kind. And God saw that it was good. Genesis 1:21
- Then God said, “Let us make mankind in our image, in our likeness, so that they may rule over the fish in the sea and the birds in the sky, over the livestock and all the wild animals, and over all the creatures that move along the ground.” Genesis 1:23
- “You rule over the surging sea; when its waves mount up, you still them.” Psalm 89:9

Catechism of the Catholic Church:

- CCC 2493 Within modern society the communications media play a major role in information, cultural promotion, and formation. This role is increasing, as a result of technological progress, the extent and diversity of the news transmitted, and the influence exercised on public opinion.

Catholics making contribution to the topic:

- Francesco Maria Grimaldi (1618–1663) – Jesuit who discovered the diffraction of light
- Étienne-Louis Malus (1775–1812) – Discovered the polarization of light
- Guglielmo Marconi (1874–1937) – Father of long-distance radio transmission
- Christopher Clavius (1538–1612) – Jesuit who was the main architect of the Gregorian calendar
- René Descartes (1596–1650) – Father of modern philosophy and analytic geometry
- Giuseppe Mercalli (1850–1914) – Priest, volcanologist, and director of the Vesuvius Observatory who is best remembered today for his Mercalli scale for measuring earthquakes which is still in use
- Marin Mersenne (1588–1648) – Minim philosopher, mathematician, and music theorist who is often referred to as the "father of acoustics"

- Jozef Murgaš (1864–1929) – Priest who contributed to wireless telegraphy and help develop mobile communications and wireless transmission of information and human voice
- Saint Lucy (283–304) - Saint of light