EARTH AND SPACE SCIENCE
Earth's Place in the Universe
Faith supporting Reason • God is the creator of all matter • There is a sense of order, balance, and symmetry in God's universe • Just as physical laws exist within our universe, we cannot exist without laws in our spiritual or moral sense. • God has a personal relationship with each individual that transcends time and space
Catholics making contribution to the topic • Fr. Robert Spitzer – Current authority on the origin of the universe from a Catholic perspective. New 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 Franc • 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
Science outcomes 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. (MS-ESS1-1) 2. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. (MS-ESS1-2) 3. Analyze and interpret data to determine scale properties of objects in the solar system. (MS-ESS1-3)
Engineering - Experiments - Extension Activities • National Geographic Video Story of the Earth section 1 shows the age of the earth • Walking the Solar System audio tour by Union Station, Starts at 13th and Baltimore, 1 to 10 billion scale model • NASA.gov Lesson Title: Gravity Games, integrates a series of activities designed to demonstrate gravity's role in recreation • Field Trip Ideas: Kansas Cosmosphere in Hutchison, KS and Powell Observatory in Louisburg, KS • Video: Mission 1: Newton in Space, video illustrates how simple experiments, in space and on Earth, can be used to investigate Newton's three laws of motion
Crosscutting Concepts • Religion- Fr. Robert Spitzer – Current authority on the origin of the universe from a Catholic perspective. New Book: *New Proofs for the Existence of God: Contributions of Contemporary Physics and Philosophies* • ELA- Cite specific textual evidence from the Bible and other scientific texts to support the Catholic perspective of the origin of the universe • Math- Calculations for weight on different planets, ratios for scale models,

- P.E.- Solar System walk to a scaled model of solar system
- Social Studies- Timeline of the universe

Resources:

- Books: *New Proofs for the Existence of God: Contributions of Contemporary Physics and Philosophies* by: Fr. Robert Spitzer, *Seashell on the Mountain Top* by Alan Cutler, *A Day Without Yesterday* by Georges Lemaitre
- Apps: Planet Earth 3D: structure and rotation of the earth, discusses moon and stars, NASA Science: A Journey of Discovery, Night Sky
- Websites: Hubblesite.org, www.kidsastronomy.com information about the universe in student terminology, nationalgeographic.com
- Bible verses: All matter was created Gen 2:1-2, Gravity is the result of the word of God Heb 11:3, Gravity/ holding things together Col 1:15-17, End of the Universe 2 Peter 3:8-12, Mat 24:29, Mark 13:31, Praise all things Psl 148
- Video Series: Fr. Robert Spitzer and Magis Center: Videos on God and modern physics http://www.magisreasonfaith.org/in_the_beginning.html
- Catholic Scientists http://en.wikipedia.org/wiki/List_of_Catholic_scientists http://en.wikipedia.org/wiki/List_of_Roman_Catholic_cleric%E2%80%93scientists

Key content 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,

EARTH AND SPACE SCIENCE
Earth's Systems
Faith supporting Reason • Just as reconciliation and purgatory help cleans and heal our soul, the Earth's natural processes are also necessary for renewal • The Lord has control over all the elements • Even though natural disasters can cause pain and suffering, we must experience suffering to become closer to Christ
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
Science outcomes 1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. (MS-ESS2-1) 2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. (MS-ESS2-2) 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. (MS-ESS1-4) 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. (MS-ESS2-3) 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. (MS-ESS2-4) 6. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. (MS-ESS2-5) 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. (MS-ESS2-6)
Engineering - Experiments - Extension 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 • Day at the K- weather related sports event at Kauffman Stadium
Crosscutting Concepts • Religion- Research biblical natural disasters (Noah's flood, earthquake when Jesus died) • ELA- Write and perform a weather forecast and regional climate • Math- Reading thermometers and barometers, converting temperatures from Fahrenheit to Celsius, reading station map

- P.E.- Build and fly kites or parachutes
- Social Studies- Research historical natural disasters and their effects on the human populations in those areas

Resources:

- Books: CK-12 Earth Science for Middle School by CK-12, online book http://www.platetectonics.com/book, CPOscience.com for Middle School Earth Science
- Apps: Just Science, helps explore science behind climate change, included news articles and links, Ancient Earth: Breakup of Pangea,
- Websites: webs.cmich.edu/resgl/ resource for Earth processes , crh.noaa.gov/iwx daily weather maps of the USA, earthsciweek.org classroom activity involving earth science, nationalgeographic.com photo gallery for info on weathering and erosion
- Bible verses: End of Earth Is 40:8, Weather Lk 8: 24-25, Water Cycle Psl 135:7, Jer 51:16, Healing from Natural Disasters Deu 31:8 or Ecc 3:1-8
- Video Series: nationalgeographickids.com forces of nature videos,
- Catholic Scientists http://en.wikipedia.org/wiki/List_of_Catholic_scientists http://en.wikipedia.org/wiki/List_of_Roman_Catholic_cleric%E2%80%93scientists

Key content 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 wave, S wave, surface waves, Richter scale, Mercalli Scale precipitation, condensation, transpiration, evaporation

EARTH AND SPACE SCIENCE
Earth and Human Activity
Faith supporting Reason • Respect God's creation because all people are created with minds and the gift of reason • God provides us with all we need to survive. We must appreciate, care for, and protect these gifts though conservation, preservation and stewardship of natural resources
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
Science outcomes 1. Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. (MS-ESS3-1) 2. Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. (MS-ESS3-2) 3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. (MS-ESS3-3) 4. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. (MS-ESS3-4) 5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century. (MS-ESS3-5)
Engineering - Experiments - Extension Activities • Design a compost fed garden • Field Trip: Discovery Center through the MO Department of Conservation • Renewable Energy: build/ design solar ovens • Calculate waste generated by weighing trash generated at lunch time
Crosscutting Concepts • Religion- Community service focusing on sharing the corporal works of mercy to those in need, parable plays talking about giving/ using talents to help distribute wealth to others, • ELA- The Giving Tree by Shel Silverstein , • Math- Calculating and graphing population density, price increases on agriculture (food) and distribution charts • P.E.- Relay race demonstrating the conservation of water- goal is to transfer the correct amount of total earth water (fresh/salt) into the amount that is drinkable, fresh water • Social Studies- Collect and compare data on natural resource distribution and human populations, supply and demand
Resources: • Books: *Theological Foundations for Environmental Ethics: Reconstructing Patristic & Medieval Concepts by* Dr. Jame Schaefer, Article: Ethics and the Environment: Towards Oneness in Life, *10 Commandments of the Environment* by Bishop Giampaolo • Apps: Sustainability: encourages social responsibility, Drip Detective: calculates the amount of water and money being wasted every day, week, month and year based on your current water bill • Websites: conservation.catholic.org, catholicecology.blogspot.org

• Bible verses: Human taking care of the Earth Psl 65:9, Corporal Works of Mercy Mat 25:31-46, 1 John 3:17 • Video: http://video.nationalgeographic.com/video/alternative-energy • Catholic Scientists http://en.wikipedia.org/wiki/List_of_Catholic_scientists http://en.wikipedia.org/wiki/List_of_Roman_Catholic_cleric%E2%80%93scientists
Key content vocabulary: renewable and nonrenewable resources, mineral, groundwater, conservation, greenhouse gases, global warming, natural hazards, population density