Saskatchewan Catholic Schools Curriculum Permeation

REVEALING CHRIST IN ALL WE TEACH

SCIENCE 6

2010

"Revealing Christ In All We Teach"

A Curriculum Permeation initiative of the Saskatchewan Catholic School Boards Association

Introduction:

"The Gospel spirit should be evident in a Christian way of thought and life which permeates all facets of the educational climate. Prime responsibility for creating this unique Christian school climate rests with the teachers, as individuals and as a community." *(The Religious Dimension of Education in a Catholic School, 1988 #25 -26.)*

Teachers in Saskatchewan are mandated by the Ministry of Education to implement provincial curricula. Teachers in Saskatchewan Catholic Schools are further charged to utilize the "Revealing Christ in All We Teach" resources to permeate the Ministry curriculum with the Catholic world view.

Our Catholic schools seek to create a learning environment that reflects the identity and character of the Catholic Church. In each of our Catholic schools throughout Saskatchewan, we strive to become learning environments in which the uniqueness of our Catholic faith is expressed in all we do.

We believe that teaching in our Catholic schools is a ministry in which all are called to witness their faith. The teaching that occurs within our Catholic schools ought to reflect more than the content and objectives of the provincial curricula. In addition to these core fundamentals, we are called to infuse our Catholic beliefs and values in all subject areas.

In an ever-increasing secular world in which religious beliefs are dismissed, we must take up the challenge to see that the teaching of our Catholic values and beliefs are not limited to Religion and Christian Ethics classes alone, but are taught across the entire curricula. Our Catholic faith must permeate all subject areas! This undertaking is critical to the distinctiveness of Catholic education in Saskatchewan.

As Catholic educators, how do we permeate our Catholic teachings across the curricula? How do we, for example, discuss our church's teachings on respect for the environment in science classes? How do we promote social justice in our studies of the humanities? How do we critique literary works through the eyes of our faith? In biology, how do we promote the sanctity of all human life, indeed, all of creation?

At the direction of the Saskatchewan Catholic School Boards Association, the following resource has been produced to assist teachers in the permeation of our Catholic faith across the curricula. A number of dedicated Catholic teachers in Saskatchewan have contributed to this resource by developing and sharing a variety of activities, lessons, and units for this purpose.

Please note: Teachers are invited to submit feedback and/or suggestions for additional faith permeation ideas to their Religious Education coordinator/consultant.

Contents

Saskatchewan Catholic Schools Curriculum

Gr. 6 Science - Faith Permeation Essential Connections

Unit Theme: Diversity of Living Things

The Saskatchewan Science Curriculum calls for students to grow in knowledge, skills and attitudes according to the goals of Education in Saskatchewan, which include "Spiritual Development." This proposed unit will help students develop the "wonder and awe" to which we are called in the face of creation, as well as a sense of "Stewardship" that is our responsibility. This first section deals with Life Science: "Diversity of Living Things" and will help students achieve the following Outcomes of the provincial Gr. 6 Science Curriculum: DL 6.1, DL 6.2, DL 6.3, DL 6.4 and DL 6.5.

NOTE: All highlighted/shaded areas indicate faith permeation.

Catholic Faith Focus for Learning:

God created the universe, keeps it in existence and is the author of all life. We see something of the beauty, power and wisdom of God in the great diversity and order of created life. Human beings, beyond other creatures, were created in the "image and likeness of God," -- we have awareness and freedom. We are called to study and understand creation, to express thanks, wonder and awe, and to cooperate with God in bringing about the Kingdom. We are not to use Creation or abuse it in any way we wish without reference to God's plan. Original Sin broke the harmony of creation, and ecological problems of today can be linked to this.

Catholic Faith Big Ideas (answers to the essential questions):

Students will understand that …

- God created the universe to "show forth and communicate his goodness, truth and beauty." Life is a miracle.
- The great variety of living things on earth and their myriad relationships speak to us about the transcendence of God who is Trinity – Father, Son and Holy Spirit in intimate relationship.

- We are a part of creation. We cannot create life, nor destroy it or alter unless we do so in harmony with God's plan. If any species becomes extinct all life is impoverished. Our role and place as humans in the hierarchy of creation is to "subdue" or "have dominion over" nature, but as "stewards" of God, not as absolute masters. We need to keep our humility and "wonder" in the face of creation. E.g. the awe inspired in microorganisms, complex biological functions, extreme life. There is inherent goodness in all life, even species we consider bothersome or dangerous.
- We place often blind "faith" in scientists to tell us about things which we cannot see. (ex. Cell functions, microbes) Our faith in God is mostly based on things we cannot see, and yet believe.
- All creation will share in the joy of heaven, not just people. (Romans 8)
- Faith and science are not always mutually exclusive, for example in healing illness, but they are different.

Catholic Faith Essential Skills:

Students will be able to:

- Express wonder and awe in the face of creation.
- Compare an atheistic view of the universe as random particle interactions to a Catholic view of creation as the handiwork of a loving God.
- Recognize some ethical aspects of certain scientific endeavours like genetic engineering, cloning, stem cell research, biological warfare, nuclear energy and others.

Catholic Faith Essential Questions:

- Why did God create the universe?
- What does creation and the diversity of life tell us about God?
- What is the role of human beings in creation?

Description of Culminating Assessment Task – Integrating Catholic Faith (end of unit assessment):

Divide students into groups of three or four. Each team will choose a position either for or against one of the topics in Appendix H. Note that the Church is not always *against*, but will sometimes be *for* or *against* depending on how the activity is pursued. Each card has a few points to get them started. Have them research the topic, giving time to consult also their parents or other adults, and if possible their parish priest, a pastoral associate or youth worker. Although some of the topics are a bit advanced for Grade 6 students, most should be able to grasp the main lines of the issues. If your class is ready, you may want to have them do debates, for and against, or you may want to stick to presentations to the entire class, and after each discuss with the class who made a better case and how does it fit with what we learned about Catholic teaching on stewardship and respect for life. Assessment should focus not so much on debating skills or

fancy props, but on the quality of the research and the understanding of the science and grasp of Catholic values displayed by students.

Additional Resources: (See details in Appendix A)

Catechism of the Catholic Church: 320, 337, 339, 340, 341

Compendium of the Catechism of the Catholic Church: 53, 54, 71,

Born of the Spirit, Grade 6, Theme 15-16; Theme 20

Fully Alive, Grade 6, Theme 1; Theme 5
Scripture: (New Revised Standard Version)

Catholic Ethics and Science links

Outcomes:

DL6.1: Recognize, describe, and appreciate the diversity of living things in local and other ecosystems, and explore related careers.
DL6.2: Examine how humans organize understanding of the diversity of living things.
DL6.3: Analyze the characteristics and behaviours of vertebrates (i.e., mammals, birds, reptiles, amphibians, and fish) and invertebrates.
DL6.4: Examine and describe structures and behaviours that help:
- individual living organisms survive in their environments in the short term
- species of living organisms adapt to their environments in the long term.

DL6.5: Assess effects of micro-organisms on past and present society, and contributions of science and technology to human understanding of micro-organisms.

Lesson 1:

Outcome DL6.1: Recognize, describe, and appreciate the diversity of living things in local and other ecosystems, and explore related careers.

Indicators:

a. State the characteristics that define all living things (e.g., are made up of one or more cells, require energy for life processes, respond to stimuli in their environment, and have the ability to reproduce).

b. Observe and document the diversity of living things in their local habitat through journaling, a nature walk, sketching, drawing, photographing, video recording, or other means.

c. Show respect for other people, living things, and the environment when observing ecosystems.

d. Document the diversity of living things in different terrestrial and aquatic habitats (e.g., grasslands, forests, tundra, deserts, rivers, ponds, and oceans) using print, video, and/or on-line resources.

e. Analyze how First Nations and Métis art and storytelling highlight movement and/or behaviour of living things and reflect a worldview that values all living things.

f. Identify examples of science and technology-related careers and workplaces which require an understanding of the diversity of living things (e.g., naturalist, zoo keeper, palaeontologist, and wildlife biologist).

Faith Permeation Ideas:

- God created the universe and is the author of all life. Studying the diversity and complexity of life inspires awe, wonder, respect and gratitude. We are called to care for creation according to God's plan – that all creation live in harmony. Have students choose an ecology quote from the Internet, transfer it to a poster paper, and draw an appropriate scene.
- Whenever possible in teaching this unit, use the word "creation" instead of "nature." Try to include vocabulary like "miracle, mystery, wonder, awe, gratitude" rather than "control, manipulate, examine, dissect," and be willing to admit that science does not understand ALL there is to know about creation – there is still much that is mysterious and only theoretical.
- Do a nature walk. Ask students to be attentive to sights, sounds, touch sensations and smells around them. When you return, discuss with students what they experienced with their different senses and how they felt. Some of the experiences may be positive ("I saw a Canada Goose!) or negative (The broken branch was rotting.) Draw out the spiritual dimension as well as scientific.
- Do a Google search for some ecology quotes. Have students discuss a quote in small groups to determine what it means and how it might apply in your home, school or community. Perhaps have each group make a poster to express the meaning or implications.
- Use the Catholic Ecology Quiz: (see Appendix B)
  http://www.funtrivia.com/playquiz/quiz135054f77f98.html

Lesson 2:

Outcome DL6.2: Examine how humans organize understanding of the diversity of living things.

Indicators:

a. Construct and use a classification system to organize living things into groups and subgroups according to student-developed criteria.
b. Consider personal observations and ideas as well as those of others (including differing worldviews) when constructing classification systems by asking questions, sharing stories, and responding to classmates' classification systems.
c. Demonstrate how different classification systems can be used to classify the same set of objects and explain how humans develop and refine classification systems to meet specific needs.
d. Explore local First Nations and Métis methods of organizing understanding of living things (e.g., two-legged, four-legged, winged-ones, swimmers, trees, and grasses) and the criteria underlying that understanding (e.g., where animals are found, how animals move, and the uses of plants).
e. Describe how aspects of First Nations and Métis worldviews (e.g., holistic, interconnectedness, valuing of place-based knowledge) shape their systems of organizing understanding of living things.
f. Illustrate the diversity of living things on Earth by constructing a visual representation (e.g., poster, mobile, slide show, and web page) showing examples from each kingdom of the five kingdom taxonomic model: monera, protists, fungi, plants, and animals.
g. Use appropriate scientific terminology to communicate ideas about the diversity of living things (e.g., biotic, abiotic, kingdom, phylum, monera, protist, fungi, plant, animal, vertebrate, and invertebrate).
h. Critique the use of biological classification systems to aid scientific understanding of living things rather than relying on common, local, or personally chosen names.

Faith Permeation Ideas:

- Human beings share Creation with all creatures, yet we are set apart from other creatures in that we are created in the "image and likeness of God." (Genesis 1:27) Our place in creation is to "be fruitful and multiply" as well as to "subdue" nature, (Genesis 1:28) not as "despots" but as "stewards" - caring for and keeping the balance intended by the Creator. (see Appendix D: Common Declaration of John Paul II and Bartholomew I, and Appendix E: John-Paul II weekly address)
    - Solomon in the Old Testament tells us precisely how this trust is to be exercised:
        "God of my fathers and Lord of mercy, who has made all things by your word, and by your wisdom has formed man, to have dominion over the creatures you have made, and rule the world in holiness and righteousness... give me the wisdom that sits by thy throne..".(Wisdom 9:14)
- Compare the First Nations perspective on the hierarchy of creation (see Appendix C) with the European model. In the European (based on the biblical) worldview, humanity would

be placed directly below God. What implications does this have regarding our relationship with the rest of nature or how we treat plants, animals, ecosystems, resources? Might we be more humble if we recognized, as in the First Nations model, that every creature depends on those above for existence?

Lesson 3:

Outcome DL6.3: Analyze the characteristics and behaviours of vertebrates (i.e., mammals, birds, reptiles, amphibians, and fish) and invertebrates.

Indicators:

a. Identify characteristics of vertebrates and invertebrates and classify animals as vertebrates or invertebrates from drawings, videos, pictures, lists, and/or personal observations.

b. Compare and represent characteristics and behaviours (e.g., body shape, body description, method of respiration, method of reproduction, method of movement, and method of feeding) of student-selected examples of vertebrates.

c. Compare and represent characteristics and behaviours (e.g., body shape, body description, method of respiration, method of reproduction, method of movement, and method of feeding) of student-selected examples of invertebrates (e.g.,
arthropods, annelids, cnidarids, echinoderms, molluscs, and nematodes).

d. Propose questions for inquiry that arise from personal investigations of characteristics and behaviours of animals.

e. Suggest reasons why current biological classification systems for living things are based on structural (internal)
characteristics rather than solely on physical appearance or behaviour.

Faith Permeation Ideas:

- We are called to wonder in the face of God's creation. Read all or part of the "Canticle of the Sun." (Appendix F) You might also use the hymn "All Things Bright and Beautiful" (Appendix G) as a poem, or sing it if possible (A link to the midi tune appears in the appendix.) Discuss the attitude towards creation in these prayer-poems. Note especially that even death is praised rather than feared in St. Francis's canticle. Have students write a similar prayer or poem in praise of creation.
- Fish as a Christian Symbol: Early Christians, fearing persecution, sometimes marked their doors or the dirt near their house with a secret Christian symbol so that others might know theirs was a Christian home. The simple double arc represented a fish or "Ichthus" in Greek (ΙΧΘΥΣ). The initials of the word Ichthus are also used as a Christian acronym of the following Greek words:

  I=Jesus
  Ch=Christ
  Th=Theou (God's)
  U=Uios (Son)
  S=Soter (Savior)

  Using the Ichthus acronym IChThUS means "Jesus Christ, God's Son, Savior".

- Why do Catholics eat fish only on Fridays and days of abstinence from meat (Ash Wednesday and Good Friday)? Partly, it is a penance asked by the Church to commemorate the day of the Crucifixion. Fish is allowed because of the symbolism mentioned above, and also because Our Lord cooked fish for His Apostles after His Resurrection, and most of these men were fisherman. After He established His Church, these fishermen became "fishers of people" for the Kingdom of God.
- Did you know that the Catholic practice of abstaining from meat on Friday was the reason for the creation of McDonald's Filet-o-Fish sandwich? Because hamburger sales dropped off noticeably on Fridays, the owner of the franchise in Cincinnati introduced the new offering, and sales picked up again.

Faith Permeation Resources:

- (see appendices A, F, G)

Lesson 4:

Outcome DL6.4: Examine and describe structures and behaviours that help:

- individual living organisms survive in their environments in the short term
- species of living organisms adapt to their environments in the long term.

Indicators

a. Propose questions to investigate related to the structures and behaviours that help organisms survive in their environments (e.g., "What advantage are different beaks for birds?", "Why do owls turn their heads to look sideways?", "Why do rabbits change color at different times of the year?", "Why do caribou migrate?", "Why do ground squirrels hibernate?").

b. Show interest and curiosity in learning about organisms' adaptations to different environments by journaling, participating in a nature walk, or sharing science-related information about adaptations (gathered from print or video resources or personal experience) with classmates.

c. Describe examples of structures and behaviours, including seasonal changes, which help living things survive in their environments during the lifetime of the organism.

d. Describe examples of adaptations to structures and behaviours (e.g., flippers, webbed feet, night-time vision, wide wings, camouflage coloring, migration, and hibernation) that have enabled living things to adapt to their environments in the long term.

e. Explain how scientists use fossils and the fossil record as a source of information to identify changes or diversity in species over long periods of time.

f. Suggest reasons why specific species of organisms have or might become endangered or extinct.

g. Gather information from a variety of sources (e.g., Elder, traditional knowledge keeper, naturalist, textbook, non-fiction book, museum display, encyclopaedia, and website) to answer student-generated questions about the structural and behavioural adaptations of organisms.

h. Compare closely related animals that live in different parts of the world and propose explanations for any differences in their structures and behaviours.

i. Research the advantages of particular structures or behaviours of organisms that suit different environments (e.g., how different bird beaks are best suited to obtain different types of food, how different types of foot structure are best suited for different environments).

j. Suggest reasons to explain how results of similar and repeated studies of the adaptations of organisms may vary and suggest possible explanations for variations (e.g., independent studies may reveal different responses by polar bears to temperature changes or pollution).

Faith Permeation Ideas:

- Change in species and populations is a natural part of God's plan. Evolution of species is a naturally occurring phenomenon as species respond and adapt to their environment. Even extinction is a natural part of the evolutionary process, but it is not the place of human beings to deliberately or accidentally cause these extinctions.

Faith Permeation Resources:

Some background material:

- Note the list of Catholic Scientists in this area (Appendix I). This list only includes Catholics, but many scientists are and were believers in God, and this had an effect on their work. Charles Darwin was an Anglican minister, and a man of faith all his life. (see, for example, an article from the Faraday Institute for Science and Religion: *http://www.st-edmunds.cam.ac.uk/faraday/Issues.php* This same site has also an excellent paper on the Ethics of Genetic Modification.)

Lesson 5:

Outcome DL6.5: Assess effects of micro-organisms on past and present society, and contributions of science and technology to human understanding of micro-organisms.

Indicators:

a. Choose and correctly use appropriate tools (e.g., magnifying glasses, optical microscopes, and video microscopes) to study living organisms that cannot be seen with the naked eye.

b. Observe and represent, using words and diagrams, characteristics of micro-organisms obtained from student- or teacher-collected water samples (e.g., bottled water, tap water, rain barrel, pond, creek, slough, and river water).

c. Explain how micro-organisms meet their basic needs, including moving around and obtaining food, water, and oxygen.

d. Design and conduct an investigation of the factors that influence how quickly micro-organisms break down organic matter (e.g., build a composter in a 2L plastic bottle and vary conditions such as the amount of water, soil, light, and combinations of waste products).

e. Compare cultural, historical, and scientific understandings and explanations of disease, including First Nations and Métis understandings and the contributions of scientists such as John Snow and Louis Pasteur to the germ theory.

f. Critique representations or depictions of micro-organisms in a variety of texts (e.g., science fiction, cartoons, movies, music, and poetry).
g. Discuss positive and negative impacts of micro-organisms for humans (e.g., food production and spoilage, fermentation, pasteurization, water and sewage treatment, human digestion, composting, disease spread and prevention, and biological warfare).

Faith Permeation Ideas:

- Many problems caused by microorganisms (diseases, rashes) or physical disabilities (ex. Epilepsy) were once explained by evil spirits or as punishment for sin. Today we understand much better the causes of these phenomena. Some people faith as challenged or disproved by science, assuming that science will one day explain EVERYTHING in creation. Yet the two are not mutually exclusive. Despite the advance of scientific knowledge, there is still a place for spiritual help in healing illness.
    - See for example the article "Can Prayer Heal People" which "found that there was indeed a significant difference in the quality of recovery among patients who received prayer." *http://www.howstuffworks.com/prayer-healing1.htm*
    - Another example, "My Faith Helped Me Fight Cancer" in Catholic Digest, May 2009, p. 46

  Read either of these articles (or at least excerpts) to your students. Ask them: Have you ever prayed for someone who was ill? What was the effect on yourself? On the person you prayed for? What do we do if prayer seems to go unanswered? (Note that Jesus also prayed to be delivered from the cross, but finished with "not my will but yours be done." (Luke 22:42)
  If the topic comes up, it might be important to note that the Church still teaches that there are demons working evil in the world. In fact, every diocese has a designated exorcist. Much misinformation, fear and fiction surrounds this topic, so it might be best simply to use the information in paragraph 74 from the Compendium (below) and if you feel it helpful, use or teach the Prayer to St, Michael the Archangel. (below)
- Should governments pay for medical research so that corporations aren't tempted to alter the results to obtain what they want, or use the results for sheer profit?
- How is Louis Pasteur a good role model for a Catholic scientist? (See Appendix I)

Faith Permeation Resources:

- Compendium of the Catechism of the Catholic Church
    - 29. **Why is there no contradiction between faith and science?**
        - Though faith is above reason, there can never be a contradiction between faith and science because both originate in God. It is God himself who gives to us the light both of reason and of faith.
        - "I believe, in order to understand; and I understand, the better to believe." (Saint Augustine)
    - 74. **What was the fall of the angels?**
        - This expression indicates that Satan and the other demons, about which Sacred Scripture and the Tradition of the Church speak, were angels, created good by God. They were, however, transformed into evil because with a free and irrevocable choice they rejected God and his Kingdom,

thus giving rise to the existence of hell. They try to associate human beings with their revolt against God. However, God has wrought in Christ a sure victory over the Evil One.

- There are many articles about the role of faith in healing. See, for example, "My Faith Helped Me Fight Cancer" in Catholic Digest, May 2009, p. 46
- **PRAYER TO SAINT MICHAEL THE ARCHANGEL**

  St. Michael the Archangel,
  defend us in battle.
  Be our safeguard against the wickedness and snares of the Devil.
  May God rebuke him, we humbly pray,
  and do thou, O Prince of the heavenly hosts,
  by the power of God,
  cast into hell Satan, and all the evil spirits,
  who prowl about the world
  seeking the ruin of souls. Amen

Teacher Catholic Faith Integrations Reflections What have I learned about teaching this unit?	
Subject: Gr. 6 Science	**Unit: Diversity of Living Things**

What permeation ideas worked well in this unit?

How well did the permeation prompts engage the students?

Describe how the faith permeation prompts helped your students to grow in understanding the Catholic faith.

As a teacher, describe how the faith permeation prompts helped you to grow in understanding the Catholic faith.

It would have been good to have...

If I adapted / modified this unit I would...

General Comment:

Appendix A - Additional Resources

Catechism of the Catholic Church:

- **337** God himself created the visible world in all its richness, diversity and order.

- **339** *Each creature possesses its own particular goodness and perfection*. For each one of the works of the "six days" it is said: "And God saw that it was good." "By the very nature of creation, material being is endowed with its own stability, truth and excellence, its own order and laws."[208] Each of the various creatures, willed in its own being, reflects in its own way a ray of God's infinite wisdom and goodness. Man must therefore respect the particular goodness of every creature, to avoid any disordered use of things which would be in contempt of the Creator and would bring disastrous consequences for human beings and their environment.
- **340** God wills the *interdependence of creatures*. 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.
- **341** The *beauty of the universe*: 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 created the universe and keeps it in existence by his Word, the Son "upholding the universe by his word of power" (*Heb* 1:3), and by his Creator Spirit, the giver of life.

Compendium of the Catechism of the Catholic Church:

- **29. Why is there no contradiction between faith and science?**
- Though faith is above reason, there can never be a contradiction between faith and science because both originate in God. It is God himself who gives to us the light both of reason and of faith.
    - *"I believe, in order to understand; and I understand, the better to believe."* (Saint Augustine)

- **53. Why was the world created?**
- The world was created for the glory of God who wished to show forth and communicate his goodness, truth and beauty. The ultimate end of creation is that God, in Christ, might be "all in all" (1 Corinthians 15:28) for his glory and for our happiness.

- *"The glory of God is man fully alive; moreover man's life is the vision of God." (Saint Irenaeus*)

- **54. How did God create the universe?**
  - God created the universe freely with wisdom and love. The world is not the result of any necessity, nor of blind fate, nor of chance. God created "out of nothing" (*ex nihilo*) (2 *Maccabees* 7:28) a world which is ordered and good and which he infinitely transcends. God preserves his creation in being and sustains it, giving it the capacity to act and leading it toward its fulfillment through his Son and the Holy Spirit.
- **62. What does Sacred Scripture teach about the creation of the visible world?**
  - Through the account of the "six days" of creation Sacred Scripture teaches us the value of the created world and its purpose, namely, to praise God and to serve humanity. Every single thing owes its very existence to God from whom it receives its goodness and perfection, its proper laws and its proper place in the universe.

- …[Man and woman] are likewise called to subdue the earth as "stewards" of God.

- **What does the seventh commandment require?**
  - The seventh commandment requires respect for the goods of others … and respect for the integrity of creation by the prudent and moderate use of the mineral, vegetable, and animal resources of the universe with special attention to those species which are in danger of extinction.

- **What attitude should people have toward animals?**
  - People must treat animals with kindness as creatures of God and avoid both excessive love for them and an indiscriminate use of them especially by scientific experiments that go beyond reasonable limits and entail needless suffering for the animals.

<u>Born of the Spirit</u>, Grade 6

Theme 15-16 – call to justice ("people of justice and of the Kingdom)
Theme 20 – fasting "appreciating all food as a gift from God" (our use of creation)

<u>Fully Alive</u>, Grade 6

Theme 1: Created and Loved by God
Topic 1 – What it means to be created and loved by God
Topic 2 – Appreciate complexity and mystery of each person
Topic 4 – Other people nurture our growth.
Topic 5 – We can be life-giving to others.

Theme 5 : Living in the World
Topic 1: influencing and being influenced by others

Topic 2: Values
Topic 3: Our impact on the physical and social environment

Patron Saint of ecology and ecologists: St. Francis of Assisi

Scripture: (New Revised Standard Version)

- Genesis 1:28: God blessed them, and God said to them, 'Be fruitful and multiply, and fill the earth and subdue it; and have dominion over the fish of the sea and over the birds of the air and over every living thing that moves upon the earth.'

- Romans 8:19-21: For the creation waits with eager longing for the revealing of the children of God; for the creation was subjected to futility, not of its own will but by the will of the one who subjected it, in hope that the creation itself will be set free from its bondage to decay and will obtain the freedom of the glory of the children of God.

- Wisdom 9: 1-6, 9-11:

Solomon's Prayer for Wisdom:
'O God of my ancestors and Lord of mercy, who have made all things by your word, and by your wisdom have formed humankind to have dominion over the creatures you have made, and rule the world in holiness and righteousness, and pronounce judgement in uprightness of soul, give me the wisdom that sits by your throne, and do not reject me from among your servants. For I am your servant, the son of your servant-girl, a man who is weak and short-lived, with little understanding of judgement and laws; for even one who is perfect among human beings will be regarded as nothing without the wisdom that comes from you.
…
With you is wisdom, she who knows your works and was present when you made the world; she understands what is pleasing in your sight and what is right according to your commandments. Send her forth from the holy heavens, and from the throne of your glory send her, that she may labour at my side, and that I may learn what is pleasing to you. For she knows and understands all things, and she will guide me wisely in my actions and guard me with her glory.

- Psalm 96:11-12:
  Let the heavens be glad, and let the earth rejoice;
  let the sea roar, and all that fills it;
  let the field exult, and everything in it.
  Then shall all the trees of the forest sing for joy
- Psalm 8:3-8:
  When I look at your heavens, the work of your fingers,
  the moon and the stars that you have established;
  what are human beings that you are mindful of them,
  mortals that you care for them?
  Yet you have made them a little lower than God,
  and crowned them with glory and honour.

You have given them dominion over the works of your hands;
you have put all things under their feet,
all sheep and oxen,
and also the beasts of the field,
the birds of the air, and the fish of the sea,
whatever passes along the paths of the seas.

God our Father,
open our eyes to see your hand at work
in the splendor of creation
in the beauty of human life.
Touched by your hand, our world is holy.
Help us to cherish the gifts that surround us,
to share your blessings with our brothers and sisters,
and to experience the joy of life in your presence.
We ask this through Christ our Lord. Amen.

(Prayer for the 17th Sunday in Ordinary time.)

Catholic Ethics and Science:

- Bioethics and Reproductive Technologies - NCCBUSCC - Pro-Life Activities
- BioSpin - Why Adult Stem Cell Research Successes Get Downplayed by the Media Wesley J. Smith - CERC
- Cloning: A Catholic Moral Evaluation - Sr. Terese Auer, OSF
- Cloning and Catholic Ethics - St. Anthony Messenger
- "Cloning: Legal, Medical, Ethical, and Social Issues" - Testimony of Cardinal William Keeler Archbishop of Baltimore on behalf of the Committee for Pro-Life Activities, National Conference of Catholic Bishops - Subcommittee on Health and Environment, House Commerce Committee - February 12, 1998
- Cloning: When word games kill - by Dianne N. Irving, M.A., Ph.D. Professor of Philosophy Dominican House of Studies
- Dangers of Genetic Manipulation - Pope John Paul II, 1983
- Declaration by the Pontificate Council for the Family regarding "Embryonic Reduction"
- Declaration on the Production and the Scientific and Therapeutic Use of Human Embyos
- Ethical, Legal and Social Issues in Science
- First cloned human embryo revealed - BBC News
- Human Cloning: Religious and Ethical Aspects
- Human Embryo Bioslavery: The Eugenicists - Suzanne Rini, 1994
- I Appeal to the World's Scientific Authorities: Halt the Production of Human Embryos! - Pope John Paul II, 1996
- "Evolution, not intelligent design, is fundamental Catholic teaching", based on a lecture by Father George V. Coyne, director of the Vatican Observatory, on www.catholic.org
- wonderful faith and ecology quotes from the Scarborough Missions Calendar, 2009

Appendix B: The Catholic Church and Ecology

(Excerpted from "FunTrivia.com, the World's Largest Trivia Website"

Crafted by rialto88, used with permission)

"On 1st January 1990 Pope John Paul II issued a message to the world about ecology. This is a short quiz about how the Catholic Church views ecological issues."

Name: _____

1. In 1979 Pope John Paul II created a patron saint of those who promote ecology. Who is this heavenly Patron?
   - Saint Cuthbert
   - Saint Cosmas
   - Saint Kevin
   - Saint Francis of Assisi

2. In his message of 1990 the Pope referred to the ecological crisis in the world as a "moral problem."
   - True
   - False

3. The Pope says that God saw all His creation as "very good". Where does this concept originate from?
   - Abraham
   - the teaching of Jesus Christ
   - the Biblical Book of Genesis
   - Noah

4. Is it true to say that according to Pope John Paul II the Bible teaches that God entrusted the whole of creation to mankind?
   - Yes
   - No

5. What is the origin of the word "ecology" as used in common parlance and by the Pope in his message in 1990?
   - from the Greek word "oikos" meaning "to stop exploitation"
   - from the Greek word "oikos" meaning "house"
   - from the Latin word "oikus" meaning "to be unselfish"
   - from the Latin word "oikus" meaning "caretaker"

6. The Pope reminds us that the Second Vatican Council said "God destined the earth and all it contains for the use of _____".

- people of religious belief
- Himself
- every individual and all peoples
- industrialized western societies

7. Again, in his message the Pope says that "Modern society will find no solution to the ecological problem unless it takes a serious look at its _____".

- lifestyle
- motorcars
- televisions
- religious beliefs

8. The Pope also says that "the aesthetic value of creation cannot be overlooked". What does the word "aesthetic" mean?

- belonging to the appreciation of the worldly
- belonging to the appreciation of profit
- belonging to the appreciation of God
- belonging to the appreciation of the beautiful

9. The Pope continues that "Today the ecological crisis has assumed such proportions as to be the responsibility of _____".

- everyone
- God
- big business
- Green activists

10. Is it correct to say that Pope John Paul II has travelled about the world far more in his time as Pontiff than any previous Pope?

- Yes
- No

Answers:

1. Saint Francis of Assisi
cf. Apostolic Letter Inter Sanctos; AAS 71 (1979), 1509f. The Pope in his message of 1990 says said that St. Francis gave striking witness that "when we are at peace with God we are better able to devote ourselves to building up that peace with all creation which is inseparable from peace among all peoples".

2. True
He firstly refers to the "indiscriminate application of advances in science and technology". Here he is speaking of the harmful long-term effects of this indiscriminate use and its effect on other parts of our planet and future generations. He goes on to speak of the depletion of the ozone layer and the "greenhouse" effect" having reached crisis proportions. His most profound worry is the lack of respect for life, including production taking precedence over workers and the environment. Biological research is raised as an area of deep concern.

3. the Biblical Book of Genesis
Having made all of creation and human life "God saw all the things that He had made, and they were very good" (Genesis 1:31). Thus the Pope calls on people to respect and support this goodness.

4. y
Please see Genesis 1:28-30 for an account of this stewardship of the earth as it is now seen.

5. from the Greek word "oikos" meaning "house"
Ecology is a science that developed from the study of the interrelation between various parts of a wider unit or whole.

6. every individual and all peoples
The reference here is Gaudiam et Spes, 69. This enhances his message of looking after all parts of our planet and not just our own short-term needs - and also looking after future generations.

7. lifestyle
Here the Pope is referring to consumerism. He calls for "simplicity, moderation and discipline" and also refers to a "spirit of sacrifice".
He says that "an education in ecological responsibility is urgent".

8. belonging to the appreciation of the beautiful
The Pope says in conclusion of this matter that "The relationship between a good aesthetic education and the maintenance of a healthy environment cannot be overlooked".

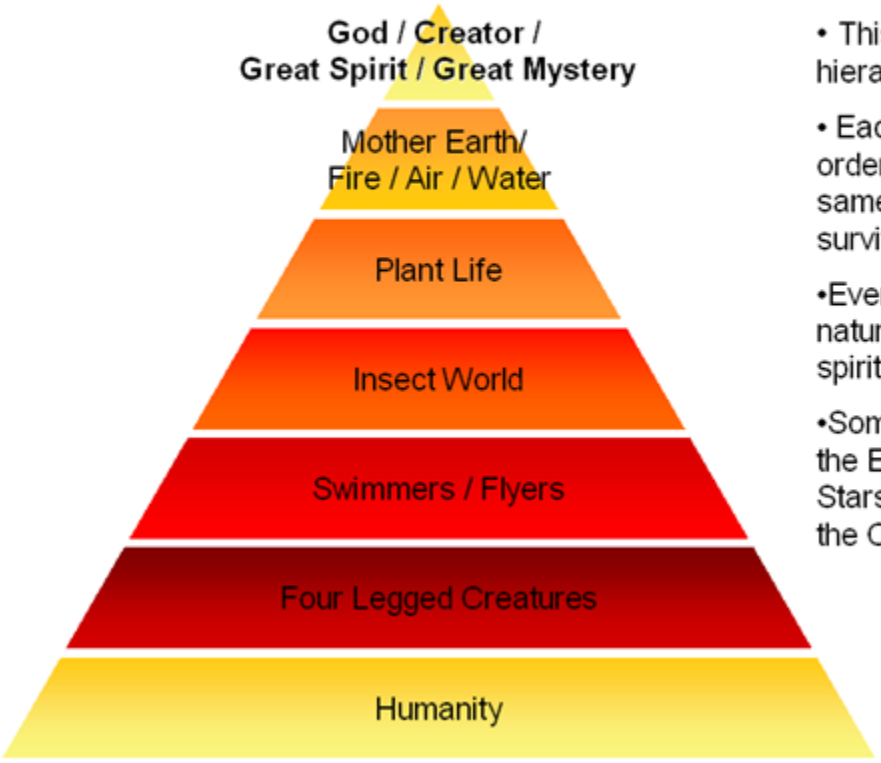
9. everyone
The Pope had also called for a new solidarity particularly between developing nations and highly industrialized nations.

10. y
The Pope has travelled an enormous amount to countries throughout the world and thus is in a special position to speak on world ecology. If you remember the evil attack on him when he was shot and badly injured, his response in recovery has been a saintly answer to such evil.

Appendix C – First Nations

- from Larry McCallum, Greater Saskatoon Catholic Schools
Note: First Nations Spirituality is always expressed with a circle, but a pyramid is used here for the sake of comparison.

Traditional First Nations Spirituality



- This is the circle in hierarchal form
- Each depends on order above or at the same level for survival.
- Everything in the natural world has a spirit.
- Some nations have the Earth, Sun, Moon, Stars at a level next to the Creator

Appendix D – Common Declaration

Common Declaration Of John Paul II And The Ecumenical Patriarch His Holiness Bartholomew I
(10 June 2002)
(http://www.vatican.va/holy_father/john_paul_ii/speeches/2002/june/documents/hf_jp-ii_spe_20020610_venice-declaration_en.html)

> At the centre of the whole of creation, He placed us, human beings, with our inalienable human dignity. Although we share many features with the rest of the living beings, Almighty God went further with us and gave us an immortal soul, the source of self-awareness and freedom, endowments that make us in His image and likeness (cf. *Gen* 1:26-31;2:7). Marked with that resemblance, we have been placed by God in the world in order to cooperate with Him in realizing more and more fully the divine purpose for creation.
>
> At the beginning of history, man and woman sinned by disobeying God and rejecting His design for creation. Among the results of this first sin was the destruction of the original harmony of creation. If we examine carefully the social and environmental crisis which the world community is facing, we must conclude that we are still betraying the mandate God has given us: to be stewards called to collaborate with God in watching over creation in holiness and wisdom.
>
> God has not abandoned the world. It is His will that His design and our hope for it will be realized through our co-operation in restoring its original harmony. In our own time we are witnessing a growth of an *ecological awareness* which needs to be encouraged, so that it will lead to practical programs and initiatives. An awareness of the relationship between God and humankind brings a fuller sense of the importance of the relationship between human beings and the natural environment, which is God's creation and which God entrusted to us to guard with wisdom and love (cf. *Gen* 1:28).
>
> Respect for creation stems from respect for human life and dignity. It is on the basis of our recognition that the world is created by God that we can discern an objective moral order within which to articulate a code of environmental ethics. In this perspective, Christians and all other believers have a specific role to play in proclaiming moral values and in educating people in *ecological awareness*, which is none other than responsibility towards self, towards others, towards creation.…
>
> First, we must regain humility and recognize the limits of our powers, and most importantly, the limits of our knowledge and judgment. We have been making decisions, taking actions and assigning values that are leading us away from the world as it should be, away from the design of God for creation, away from all that is essential for a healthy planet and a healthy commonwealth of people**….**

. To be humble regarding the idea of ownership and to be open to the demands of solidarity. Our mortality and our weakness of judgment together warn us not to take irreversible actions with what we choose to regard as our property during our brief stay on this earth. We have not been entrusted with unlimited power over creation, we are only stewards of the common heritage.

Appendix E – John Paul II

Pope John Paul II, weekly address:

(from L'Osservatore Romano, 24 January 2001, page 11)

The effort to prevent ecological catastrophe was the subject of the Holy Father's catechesis at the General Audience of Wednesday, 17 January. The Pope reminded his listeners that man's lordship over creation is not "absolute, but ministerial: it is a real reflection of the unique and infinite lordship of God. Hence man must exercise it with wisdom and love, sharing in the boundless wisdom and love of God". Here is a translation of the Holy Father's catechesis, which was given in Italian.

1. In the hymn of praise proclaimed a few moments ago (Ps 148:1-5), the Psalmist summons all creatures, calling them by name. Angels, sun, moon, stars and heavens appear on high; 22 things move upon the earth, as many as the letters of the Hebrew alphabet, in order to give an impression of fullness and totality. The believer, in a sense, is "the shepherd of being", that is, the one who leads all beings to God, inviting them to sing an "alleluia" of praise. The Psalm brings us into a sort of cosmic church, whose apse is the heavens and whose aisles are the regions of the world, in which the choir of God's creatures sings his praise.

On the one hand, this vision might represent a lost paradise and, on the other the promised paradise. Not without reason, the horizon of a paradisal universe, which Genesis (chap. 2) put at the very origins of the world, is placed by Isaiah (chap, 11) and the Book of Revelation (chap. 21-22) at the end of history. Thus we see that man's harmony with his fellow beings, with creation and with God is the plan followed by the Creator. This plan was and is continually upset by human sin, which is inspired by an alternative plan depicted in the same Book of Genesis (chap. 3-11), which describes man's progressive conflictual tension with God, with his fellow human beings and even with nature.

Man is called to continue the Creator's work of life

2. The contrast between the two plans emerges clearly in the vocation to which humanity is called, according to the Bible, and in the consequences resulting from its infidelity to this call. The human creature receives a mission to govern creation in order to make all its potential shine. It is a delegation granted at the very origins of creation, when man and woman, who are the "image of God" (Gn 1:27), receive the order to be fruitful and multiply, to fill the earth and subdue it, and to have dominion over the fish of the sea, the birds of the air and every living thing that moves upon the earth (cf. Gn 1:28). St Gregory of Nyssa, one of the three great Cappadocian Fathers, commented: "God made man capable of carrying out his role as king of the earth.... Man was created in the image of the One who governs the universe. Everything demonstrates that from the beginning his nature was marked by royalty.... He is the living image who participates by his dignity in the perfection of the divine archetype" *(De Hominis Opificio,* 4: *PG* 44, 136).

3. Man's lordship, however, is not "absolute, but ministerial: it is a real reflection of the unique and infinite lordship of God. Hence man must exercise it with wisdom and love,

sharing in the boundless wisdom and love of God" *(Evangelium vitae,* n. 52). In biblical language "naming" the creatures (cf. Gn 2:19-20) is the sign of this mission of knowing and transforming created reality. It is not the mission of an absolute and unquestionable master, but of a steward of God's kingdom who is called to continue the Creator's work, a work of life and peace. His task, described the Book of Wisdom, is to rule "the world in holiness and righteousness" (Wis 9:3).

Unfortunately, if we scan the regions of our planet, we immediately see that humanity has disappointed God's expectations. Man, especially in our time, has without hesitation devastated wooded plains and valleys, polluted waters, disfigured the earth's habitat, made the air unbreathable, disturbed the hydro geological and atmospheric systems, turned luxuriant areas into deserts and undertaken forms of unrestrained industrialization, degrading that "flowerbed"—use an image from Dante Alighieri (*Paradiso*, XXII, 151)—which is the earth, our dwelling-place.

4. We must therefore encourage and support the "ecological conversion" which in recent decades has made humanity more sensitive to the catastrophe to which it has been heading. Man is no longer the Creator's "steward", but an autonomous despot, who is finally beginning to understand that he must stop at the edge of the abyss. "Another welcome sign is the growing attention being paid to the quality of life and to ecology, especially in more developed societies, where people's expectations are no longer concentrated so much on problems of survival as on the search for an overall improvement of living conditions" *(Evangelium vitae,* n. 27). At stake, then, is not only a "physical" ecology that is concerned to safeguard the habitat of the various living beings, but also a "human" ecology which makes the existence of creatures more dignified, by protecting the fundamental good of life in all its manifestations and by preparing for future generations an environment more in conformity with the Creator's plan.

The Creator is perceived in the beauty of created things

5. In this rediscovered harmony with nature and with one another, men and women are once again walking in the garden of creation, seeking to make the goods of the earth available to all and not just to a privileged few, as the biblical jubilee suggests (cf. Lv 25:8-13, 23). Among those marvels we find the Creator's voice, transmitted by heaven and earth, by night and day: a language "with no speech nor words; whose voice is not heard" and which can cross all boundaries (cf. Ps 19 [18]:2-5).

The Book of Wisdom, echoed by Paul, celebrates God's presence in the world, recalling that "from the greatness and beauty of created things comes a corresponding perception of their Creator" (Wis 13:5; cf. Rom 1:20). This is also praised in the Jewish tradition of the Hasidim: "Where I wander—You! Where I ponder—You! ... In every trend, at every end, only You, You again, always You!" (M. Buber, *Tales of the Hasidim* [Italian ed., Milan 1979, p. 256]).

Appendix F - Canticle

Canticle of Brother Sun and Sister Moon of St. Francis of Assisi

Most High, all-powerful, all-good Lord, All praise is Yours, all glory, all honour and all blessings.

To you alone, Most High, do they belong, and no mortal lips are worthy to pronounce Your Name.

Praised be You my Lord with all Your creatures,
especially Sir Brother Sun,
Who is the day through whom You give us light.
And he is beautiful and radiant with great splendour,
Of You Most High, he bears the likeness.

Praised be You, my Lord, through Sister Moon and the stars,
In the heavens you have made them bright, precious and fair.

Praised be You, my Lord, through Brothers Wind and Air,
And fair and stormy, all weather's moods,
by which You cherish all that You have made.

Praised be You my Lord through Sister Water,
So useful, humble, precious and pure.

Praised be You my Lord through Brother Fire,
through whom You light the night and he is beautiful and playful and robust and strong.

Praised be You my Lord through our Sister,
Mother Earth
who sustains and governs us,
producing varied fruits with coloured flowers and herbs.
Praise be You my Lord through those who grant pardon for love of You and bear sickness and trial.

Blessed are those who endure in peace, By You Most High, they will be crowned.

Praised be You, my Lord through Sister Death,
from whom no-one living can escape. Woe to those who die in mortal sin! Blessed are they She finds doing Your Will.

No second death can do them harm. Praise and bless my Lord and give Him thanks,
And serve Him with great humility.

Appendix G - All Things Bright and Beautiful

Text: Cecil Frances Alexander
You can hear the music in midi format at:
http://library.timelesstruths.org/music/All_Things_Bright_and_Beautiful/midi/

Refrain:

All things bright and beautiful,
all creatures great and small,
all things wise and wonderful:
the Lord God made them all.

1. Each little flower that opens,
each little bird that sings,
God made their glowing colors,
and made their tiny wings.
(Refrain)

2. The purple-headed mountains,
the river running by,
the sunset and the morning
that brightens up the sky.
(Refrain)

3. The cold wind in the winter,
the pleasant summer sun,
the ripe fruits in the garden:
God made them every one.
(Refrain)

4. God gave us eyes to see them,
and lips that we might tell
how great is God Almighty,
who has made all things well.
(Refrain)

Appendix H – debate topics

Nuclear energy in Saskatchewan – FOR • Nuclear power generation emits relatively low amounts of carbon dioxide (CO2). The emissions of green house gases and therefore the contribution of nuclear power plants to global warming is therefore relatively little. • This technology is readily available, it does not have to be developed first. • It is possible to generate a high amount of electrical energy in one single plant. • Nuclear energy produces clean, cheap electricity 24 hours a day, seven days a week, for up to 30 years once it is running with very little input. • The world's reserves of fossil fuels are running out. There are large reserves of uranium, and new breeder reactors can produce more fuel	**Nuclear energy in Saskatchewan – AGAINST** • The problem of radioactive waste is still an unsolved one. The waste from nuclear energy is extremely dangerous and it has to be carefully looked after for several thousand years (10'000 years according to United States Environmental Protection Agency standards). • High risks:. It is technically impossible to build a plant with 100% security. Accidents and terrorist attacks can still happen, with devastating consequences. • During the operation of nuclear power plants, radioactive waste is produced, which in turn can be used for the production of nuclear weapons. • The production and refining of Uranium for
Cloning or genetic engineered human beings – FOR • cloning parts of humans, like vital organs to be used in transplants, which nullify organ rejection issues. • Give children to people unable to have their own or who lose children at a very young age. • Advance genetic research – help cure genetic defects • Increase human life span	**Cloning genetic engineered Human beings – AGAINST** • Many fertilized embryos ("human beings" in Catholic understanding) are partially developed and then destroyed in the cloning process. • We are "playing God," and reducing the mystery of human life to commodity exchanges. • If a human being is produced to be harvested for organs, what are their rights? • Who decides what traits are best for designer humans? • What is done with "failed" products? • Only the rich could afford it
Using biological warfare – FOR • Far less expensive than conventional or nuclear weapons. • Very easy to deploy – can be done easily without detection. • Can be engineered to spread quickly but with a known antidote.	**Using biological warfare – AGAINST** • May prove to be unstoppable. • Kills indiscriminately military personnel and civilians • Could lead to proliferation of number and variety of attacks and threaten all human life

Genetic Engineering of foods – FOR • Produce higher yielding crops • Grow crops in soil or climates that were not previously possible • Improved concentration of desired nutrients or better appearance and taste • Change characteristics such as frost and pest resistance	**Genetic Engineering of foods – AGAINST** • Loss of biodiversity – if all members of a species are identical, then a new strain of disease or change in conditions could wipe ALL members of that species out very quickly. • Allows for corporate control of seeds and food. • Unforeseen effects on human biology (allergies) and the entire ecosystem (may harm other plants or animals).
Stem Cell Research using embryos – FOR • Embryonic stem cells provide the best cells for this research. • Knowledge gained will be used one day to treat a variety of diseases and impairments which cannot be treated today. • Much human suffering can be avoided by potential applications of this research.	**Stem Cell Research using embryos – AGAINST** • Fertilized embryos are human beings, with the rights that entails. • Using embryos for research destroys the sanctity of life, and treats humans as objects. • Creating a market for aborted babies will only encourage more abortions. • Stem cells from umbilical cords work just as well for the research.
Expanding use of bio-fuels – FOR • Grow our own fuel. • Not have to rely on other countries for petroleum. • Cleaner burning. • No need to wait millions of years for oil to be produced	**Expanding use of bio-fuels – AGAINST** • Land once used to grow food is used instead for fuel, leaving people hungry and driving up food process. • We need to reduce our fuel consumption, not make *more* fuel. • Oil companies may start to control food prices.

Pets – FOR • **They are so adorable!** • **They help us to care for another creature.** • **They keep us company.** • **They protect us.** • **They help seniors live happier and longer.**	**Pets – AGAINST** • **They wake up the neighbors.** • **They scare away wildlife.** • **They destroy property.** • **They use resources that could be helping poor people.**
Steroids for Athletes – FOR • **You win!** • **You get marketing contracts!** • **You feel better about yourself.**	**Steroids for Athletes – AGAINST** • **Health risks** • **Getting kicked out if caught** • **Bad example to youth**
Euthanasia – FOR • **Allows people with no hope of recovery to end their suffering** • **Saves lots of money in end of life care** • **Respects the wishes and dignity of those who ask for it to avoid pain and debilitating illness** • **If legal, then done by professionals** • **"We treat our pets better than our seniors."**	**Euthanasia – AGAINST** • **Still killing a living person, even if they ask** • **Who is designated to do it?** • **Leads to other forms of "mercy" killing for the sake of the living, not the victim – handicapped, depressed, injured at any age** • **We counsel against suicide because it reflects mental instability** • **People may be coerced**

Appendix I – Some Catholic Scientists who worked in the area of Diversity of Life and approached it with the eyes of faith

Copyright Notice: Links embedded in the name of the scientist and the photo point to one of two sources used:
1) Wikipedia, where text is covered under the Creative Commons Attribution/Share-Alike License 3.0.
Images themselves are from the Wikimedia Commons.
2) The Catholic Encyclopaedia Online: http://www.newadvent.org/cathen/ , used with permission.

Louis Pasteur (1822 - 1895): Inventor of the pasteurization method, a french chemist and microbiologist. He also solved the mysteries of rabies, anthrax, chicken cholera, and silkworm diseases, and contributed to the development of the first vaccines.

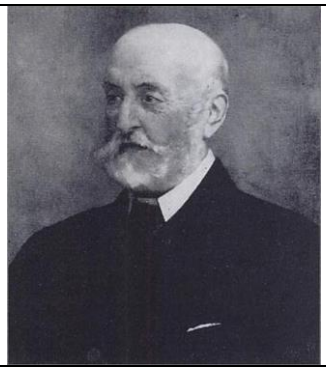
From the Catholic Encyclopaedia online:

Pasteur's faith was as genuine as his science. … he said:

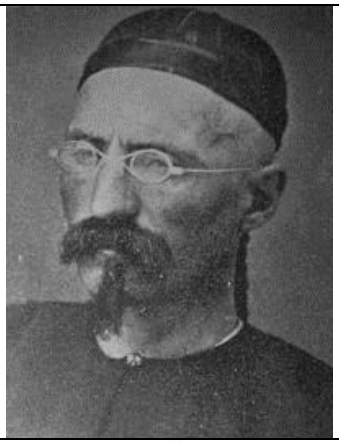
> *Happy the man who bears within him a divinity, an ideal of beauty and obeys it; and ideal of art, and ideal of science, an ideal of country, and ideal of the virtues of the Gospel.*

These words are graven above his tomb in the Institut Pasteur. In his address Pasteur said further "These are the living springs of great thoughts and great actions. Everything grows clear in the reflections from the Infinite". Some of his letters to his children breathe profound simple piety. He declared "The more I know, the more nearly is my faith that of the Breton peasant. Could I but know all, I would have the faith of a Breton peasant woman." What he could not above all understand is the failure of scientists to recognize the demonstration of the existence of the Creator that there is in the world around us. He died with his rosary in his hand, after listening to the life of St. Vincent de Paul which he had asked to have read to him, because he thought that his work like that of St. Vincent would do much to save suffering children.

George Jackson Mivart (1827 - 1900):



A fellow of the Zoological Society of London who did notable work on Insectivora and became involved in controversies with Charles Darwin. He was also a convert Catholicism who taught at the Catholic University of Leuven, and received a Doctor of Philosophy from Pope Pius IX in 1876. By maintaining the creationist theory of the origin of the human soul he attempted to reconcile his evolutionism with the Catholic faith. He broke with the Church near the end of his life, but the judgement was later repealed and his body was moved to a Catholic cemetery.

Armand David (1826–1900): A Catholic missionary to China and member of the Lazarists who considered his religious duties to be his principle concern. He was also a botanist with the author abbreviation **David** and as a zoologist he described several species new to the West. In the midst of his work as a naturalist, Father David did not neglect his missionary labours, and was noted for his careful devotion to his religious duties and for his obedience to every detail of his rules.	
Gregor Mendel (1822-1884): Ordained as an Augustinian priest, he spent most of his years teaching sciences, until he became abbot of his monastery in later life. It was the Augustinians who arranged for Gregor's education at a prestigious university in Vienna and allowed him the time to make the thousands of crosses between carefully selected pea plants in the monastery gardens, and arranged for the construction of a greenhouse to aid in Mendel's experiments. Mendelian genetics underpinned the Green Revolution. This revolution took the world from a food deficit to a food surplus in the 1960's, saving billions of lives.	

Appendix J: Integration with Pearson Saskatchewan Science 6

Saskatchewan Science 6	Suggested integration of faith permeation ideas
UNIT 1: Diversity of Living Things	† See Permeation Lesson 1: Use the word "creation" instead of "nature." Include vocabulary like "miracle, mystery, wonder, awe, gratitude" rather than "control, manipulate, examine, dissect," and be willing to admit that there is still much that is mysterious in science.
LAUNCH: Diversity at the Zoo p.2	† See Permeation Lesson 1: Do a nature walk. Draw out the spiritual dimension as well as scientific. † Use the Catholic Ecology Quiz: (see Appendix B)
1 Living Things p.4	† See Permeation Lesson 1: Life inspires awe, wonder, respect and gratitude. We are called to care for creation according to God's plan.
2 Methods of Classifying p.8	
3 Classifying Living Things p.12	† See Permeation Lesson 2: Human beings are created in the "image and likeness of God." We are to be "stewards."
4 Classifying Trees p.17	
5 Classifying Animals -The Invertebrates p.21	
CAREERS AND PROFILES: p.25	
6 Classifying Arthropods p.26	
7 Investigating an Arthropod -The Mealworm p.30	
8 Classifying Animals -The Vertebrates p.34 ASK A TRADITIONAL KNOWLEDGE KEEPER: p.41	† Compare the First Nations perspective on the hierarchy of creation (see Appendix C) with the European model.
9 All About Fish 42	† See Lesson 3: Fish as an early Christian symbol
10 A Prehistoric Vertebrate p.45	
11 Animal Adaptations p.50	
12 The Perfect Beak p.56	
13 Plant Adaptations p.58	
14 The Key to Classifying p.63	
15 The Microscopic World p.66	
16 The Impact of Micro-organisms p.70	† See Permeation Lesson 5: Faith and Science in healing illness. † What the Church teaches about demons. † Governments and medical research † Louis Pasteur as a good role model for a Catholic scientist? (See Appendix I)
DESIGN PROJECT: Classifying Living Things Around Us p.74	† See Permeation Lesson 3: wonder in the face of God's creation.

Saskatchewan Catholic Schools Curriculum

Gr. 6 Science - Faith Permeation Essential Connections

Unit Theme: Understanding Electricity

The Saskatchewan Science Curriculum calls for students to grow in knowledge, skills and attitudes according to the goals of Education in Saskatchewan, which include "Spiritual Development." This proposed unit will help students develop the "wonder and awe" to which we are called in the face of creation, as well as a sense of "Stewardship" that is our responsibility. This first section deals with Physical Science: "Understanding Electricity" and will help students achieve the following Outcomes of the provincial Gr. 6 Science Curriculum: EL 6.1, EL 6.2 and EL 6.3.

NOTE: All highlighted/shaded areas indicate faith permeation.

Catholic Faith Focus for Learning:

Do we study creation with the goals of better understanding and insight, or is our purpose simply to control and manipulate? There is deep mystery in creation. Although science can predict very accurately *what* will happen in experiments with magnetism and electricity, we still have very little direct knowledge as to *how* and *why* these phenomena occur at the sub-atomic level. We are so ready to take physicists on their word (on *faith*) that something is as they explain it, even though they deal with realms far beyond our ability to examine directly (ex. Quantum states of elemental particles). Yet even a physicist's understanding of the basic structure of nature is purely theoretical – models that more or less correspond to observed results. There are still so many questions and mysteries in science, which our current secular culture tends to ignore.

If we open ourselves to the miraculous and look with the eyes of faith, we can better "see" God in creation, and the boundless beauty and mystery that are there. Electricity is a perfect example of how we can "subdue and master" nature to our use, but at the same time need to respect our limitations (Think of lightning for example!) and understand that God is so far beyond our grasp.

Electricity involves positive or negative charges. A circuit is either on or off. Catholic morality teaches that certain acts are intrinsically right or wrong, "positive" or "negative;" there is no "grey" but only black and white. Yet obviously human actions and interactions are more complicated. Intention, foreknowledge, perception, circumstance, influence – all play a role not only in directing actions but in responsibility. Discerning the morality of an individual case in context is a distinctly Catholic life skill! Many such moral questions arise in the development and application of electronic devices.

Catholic Faith Big Ideas (answers to the essential questions):
Students will understand that …

- The study of physical laws and phenomena should lead us to an appreciation of the mystery of creation and humility in the face of the Creator.
- The purpose of scientific research is not only understanding for the development of technology, but also to bring us to God. Any advances in technology should benefit all people.
- Moral questions arise in the production of electricity as well as in the use and development of electronic devices.

Catholic Faith Essential Skills:
Students will be able to …

- Express wonder and awe in the pursuit of understanding physical forces like electricity and magnetism.
- Indicate an understanding of the process of moral decision making, beginning with the law, then applying it in context.
- Argue for or against the use of various technologies to produce and use electricity from a Catholic perspective. ("stewardship")

Catholic Faith Essential Questions:

- Why do we study the forces of nature?
- What does science teach us about *mystery*?
- What are some moral questions and concerns in the production, development and use of electricity?

Description of Culminating Assessment Task – Integrating Catholic Faith (end of unit assessment):

- A scientist writes the article (excerpt) in Appendix D to explain the sub-atomic world. (Read at least the third paragraph to students, alerting them to the complexity of the language. They are not expected to understand it all.) A believer says simply, "It's a mystery!" Why might neither statement be sufficient? After discussing with a group of classmates, write a paragraph that explains, on the one hand, what parts of the article mentioned refer to mystery, and, on the other hand, what is lacking in the simple statement "It's a mystery!"
- Draw a "circuit" of your life. Begin at God (the "power source") to your conception and growth to where you are now and what future paths might lead you back to the Father. (You might include the notion of vocation to marriage, single life or priesthood/religious life.) Show some choices that you have already made in your life, and where a different choice might have lead, as well as some possible future choices. If you have Microsoft Word you can use the drawing tools – Auto shapes – flowchart and connectors tools.

Additional Resources: See Appendix A

Outcomes: Physical Science – Understanding Electricity (EL)

EL6.1 Assess personal, societal, economic, and environmental impacts of electricity use in Saskatchewan and propose actions to reduce those impacts.
EL6.2 Investigate the characteristics and applications of static electric charges, conductors, insulators, switches, and electromagnetism.
EL6.3 Explain and model the properties of simple series and parallel circuits.

Lesson 1:

Outcome: EL6.1 Assess personal, societal, economic, and environmental impacts of electricity use in Saskatchewan and propose actions to reduce those impacts.

Indicators:

a) Provide examples of the types of energy sources used to provide heat and light to homes in the past and describe ways in which electricity-based technologies have changed the way people work, live, and interact with the environment in Saskatchewan.
b) Describe how electrical energy is generated from hydroelectric, coal, natural gas, nuclear, geothermal, biomass, solar, and wind sources and categorize these resources as renewable or non-renewable.
c) Locate and categorize by type the large-scale electrical energy generation facilities in Saskatchewan and explain how electrical energy is transmitted from those facilities to locations throughout the province.
d) Identify factors that affect electrical energy consumption at home, school, and in the workplace and propose methods of decreasing electrical energy consumption that can help to conserve natural resources and protect the environment.
e) Explain potential dangers of electricity at home, school, and the workplace and suggest ways individuals can minimize those dangers.
f) Research employers and careers related to electrical energy generation, distribution, and conservation in Saskatchewan.

Faith Permeation Ideas:

- Deciding on the environmental impact of generating electricity by various means and using electricity responsibly requires us to be good "stewards" of creation, a topic covered in the unit "Diversity of Life." As with any environmental questions, we must spend time discussing the difference between our needs and our wants. How much of our electrical use and our devices are really needs? Make a list of all the electric or electronic devices you use in an average day (even indirectly if you eat food that was heated, for example). Beside each, place an "N" for "need" or a "W" for "want". What does this tell you about our use of electricity? Picture your day with NO electricity at all. How dependent are you on electricity?
- What is responsible use of electronic devices from a Catholic perspective? As Catholics, we not only need to discuss ethics in the production and conservation of electricity, but the specific devices which use that electricity. For example: What are the ethics of controlling human behavior with technology? Is it moral to implant electronic tracking devices on seniors in nursing homes? On prisoners? On students who misbehave? Who should have access to technology? Should Internet access be restricted for students in schools to research only? Should workers be able to check their emails on the job? Should students be permitted to use cell phones in school? Mp3's? Media? Digital cameras? iPods? Are compact fluorescent light bulbs a good thing if they are adding mercury to our environment? Should aid be given to provide

Internet to communities in developing countries? What should we do with old batteries?

Faith Permeation Resources:

- See unit on "Diversity of Life" and respect for the environment.
- Note that the Patron Saint of Scientists is St. Albert the Great

Lesson 2:

Outcome: EL6.2 Investigate the characteristics and applications of static electric charges, conductors, insulators, switches, and electromagnetism.

Indicators:

a) Conduct investigations to determine the attraction and repulsion of electrostatically charged materials and represent the results of those investigations using drawings, sketches, tables, charts, and/or other representations.
b) Describe how results of similar and repeated investigations into the characteristics of static electric charges (e.g., the rubbing together of different substances) may vary and suggest possible explanations for identified variations.
c) Identify natural and man-made applications of static electric charge and discharge (e.g., lightning, photocopiers, laser printers, air filters, and electrostatic paint sprayers).
d) Pose questions related to the physical properties of conductors, insulators, simple circuits, and electromagnets (e.g., "How can we determine if an unknown material is a conductor or an insulator?", "How does a switch work in a simple electric circuit?", "What materials work best to create an electromagnet?")
e) Make predictions, based on observed patterns of events, related to the physical properties of conductors, insulators, simple circuits, and electromagnets and conduct investigations to test those predictions.
f) Identify appropriate tools, instruments, and materials (e.g., bulbs, batteries, and wires) to use when investigating the properties of conductors, insulators, simple circuits, and electromagnets and use those tools and apparatus in a manner that ensures personal safety and the safety of others.
g) Test the conductivity of a variety of solids and liquids, following a given set of procedures, to identify which materials are conductors and which are insulators, and draw conclusions about the types of materials that work best as conductors and which work best as insulators.
h) Explain the role of switches in electrical circuits.
i) Describe the operation of an electromagnet and contrast magnets and electromagnets.
j) Plan a set of steps to carry out a fair test of a science-related idea related to electromagnets, such as how to increase the strength of an electromagnet.
k) Use evidence gathered through research and observation to answer questions related to the physical properties of conductors, insulators, simple circuits, and electromagnets.
l) Describe the operation of common technologies based on properties of static electricity, current electricity, or electro-magnetism.

Faith Permeation Ideas:

- Working with electricity often elicits child-like wonder from students – seeing a light bulb light up when they properly connect it to a battery is a natural opportunity to

marvel and thrill at the miracle of the physical world. This is an opportunity to re-assert both the beauty and the mystery of creation.

- Electricity is made of electrons, which behave both as particles (with mass) and as waves (pure energy). This is analogous to the teaching of the Church that we human beings are both body (physical) and soul (spiritual). (#69 Compendium of the Catechism of the Catholic Church) What do students understand by their "soul?" How can you nourish your soul?
- Everyone knows how disappointing it is when a device has dead batteries. People also can be spiritually "charged" or spiritually "dead". How can we tell if someone is spiritually alive or not? What makes them different? Who do you know who is spiritually alive? (It is important to underline that only God can judge what is in a person's heart.) See appendix B for information and questions on Catholic scientists who contributed greatly to the study of electricity, but who were also examples of lively faith.

Faith Permeation Resources:

- See quotes in Appendix A; exercise in Appendix B – Catholic Scientists

Lesson 3:

Outcome: EL6.3 Explain and model the properties of simple series and parallel circuits.

Indicators:

a) State the required characteristics of a simple electric circuit (e.g., a source of electrical energy, a closed path to conduct electrical energy, and a load to convert the electrical energy into another form of energy).
b) Compare a variety of electrical pathways by constructing simple circuits.
c) Contrast a closed circuit, open circuit, and short circuit.
d) Propose questions to investigate, and practical problems to solve, related to simple series and parallel circuits (e.g., "What happens when a light bulb is removed from a series or parallel circuit?", "How can I create a simple circuit using only a battery, light bulb, and one wire?", "How are light circuits in a house wired?").
e) Construct and test various combinations of simple electric circuits to determine similarities and differences between series and parallel circuits.
f) Draw electrical circuit diagrams to represent simple series and parallel circuits using appropriate symbols (e.g., battery, conductor, light bulb, motor, and switch).
g) Construct simple circuits to demonstrate how electrical energy can be controlled to produce light, heat, sound, motion, and magnetic effects.
h) Design, construct, and troubleshoot an electrical circuit that meets one or more student-specified criteria.

Faith Permeation Ideas:

- We often think of good as being "positive" and evil as being "negative." Grace and virtue lead us to good acts. Temptation and bad habits to bad acts. Catholic Morality asserts the existence of absolutes – some things are intrinsically ('in themselves") right or wrong, good or evil, "positive" or "negative." (ex. The Ten Commandments give us a beginning.) Yet moral reasoning has to be applied lovingly in each circumstance, and judgment is reserved to God alone. We have both the law, and then the pastoral application of the law.

- Parallel and series circuits, and more especially the pathways in microprocessors, involve electrons moving along a series of connections and "intersections" where "choices" are made to go one way or another, eventually returning to the power source. This is similar to our journey of life. Through a series of free (unlike the electrons) choices, we seek to make our way back to the Father through Jesus in the Spirit.

Faith Permeation Resources:

- For background information, see
    - Compendium of the Catechism of the Catholic Church: 363, 364, 369, 371, 372 on moral decision making (Appendix C) (Not included but possibly useful are 57-58 on the problem of evil)
    - quotes from Ron Rolheiser in Appendix C
- Appendix E has an example of a "life circuit."

Teacher Catholic Faith Integrations Reflections What have I learned about teaching this unit?	
Subject: Gr. 6 Science	**Unit: Understanding Electricity**

What permeation ideas worked well in this unit?

How well did the permeation prompts engage the students?

Describe how the faith permeation prompts helped your students to grow in understanding the Catholic faith.

As a teacher, describe how the faith permeation prompts helped you to grow in understanding the Catholic faith.

It would have been good to have...

If I adapted / modified this unit I would...

General Comment:

Appendix A - Additional Resources

Compendium of the Catechism of the Catholic Church:

29. Why is there no contradiction between faith and science?

Though faith is above reason, there can never be a contradiction between faith and science because both originate in God. It is God himself who gives to us the light both of reason and of faith.

> *"I believe, in order to understand; and I understand, the better to believe."* (Saint Augustine)

53. Why was the world created?

> The world was created for the glory of God who wished to show forth and communicate his goodness, truth and beauty. The ultimate end of creation is that God, in Christ, might be "all in all" (1 Corinthians 15:28) for his glory and for our happiness.
>
> *"The glory of God is man fully alive; moreover man's life is the vision of God." (Saint Irenaeus*)

69. How do the soul and body form a unity in the human being?

The human person is a being at once corporeal and spiritual. In man spirit and matter form one nature. This unity is so profound that, thanks to the spiritual principle which is the soul, the body which is material, becomes a living human body and participates in the dignity of the image of God.

- **Psalm 119:105** Your word is a lamp to my feet and a light to my path.
- **1 John 1.5:** This is the message we have heard from him and proclaim to you, that God is light and in him there is no darkness at all.

Lightning as a sign of God's presence:

- Exodus 19:16: On the morning of the third day there was thunder and lightning, as well as a thick cloud on the mountain, and a blast of a trumpet so loud that all the people who were in the camp trembled.
- Exodus 20:18: When all the people witnessed the thunder and lightning, the sound of the trumpet, and the mountain smoking, they were afraid* and trembled and stood at a distance,
- Psalm 77:18:

> The crash of your thunder was in the whirlwind; your lightnings lit up the world;
> the earth trembled and shook.

Lightning as a sign of God's power:

- 2 Samuel 22.15: He sent out arrows, and scattered them

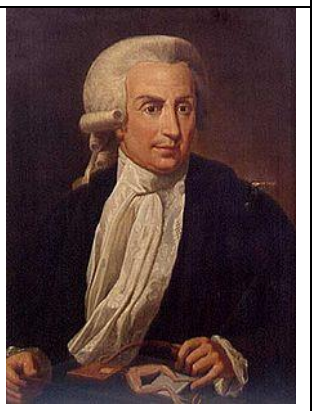
—lightning, and routed them.

- Job 36:32: He covers his hands with the lightning, and commands it to strike the mark.
- Job 37:15: Do you know how God lays his command upon them, and causes the lightning of his cloud to shine?
- Psalm 97:4: His lightnings light up the world; the earth sees and trembles.
- Psalm 135:7:

> He it is who makes the clouds rise at the end of the earth;
> he makes lightnings for the rain
> and brings out the wind from his storehouses.

Appendix B: Some Catholic Scientists in the field of electricity who approached it with the eyes of faith

Copyright Notice: Links embedded in the name of the scientist and the photo point to one of two sources used:
1) Wikipedia, where text is covered under the Creative Commons Attribution/Share-Alike License 3.0. Images themselves are from the Wikimedia Commons.
2) The Catholic Encyclopaedia Online: http://www.newadvent.org/cathen/ , used with permission.

André-Marie Ampere was founder of the science of electrodynamics, and investigator of the laws of electro-magnetism. Trained by the Jesuits, he gives us the unit of electrical current, the "ampere" or "amp." Ampère claimed that "at eighteen years he found three culminating points in his life, his First Communion, the reading of Antoine Leonard Thomas's "Eulogy of Descartes", and the Taking of the Bastille." On the day of his wife's death he wrote two verses from the Psalms, and the prayer, 'O Lord, God of Mercy, unite me in Heaven with those whom you have permitted me to love on earth.' Serious doubts harassed him at times, and made him very unhappy. Then he would take refuge in the reading of the Bible and the Fathers of the Church."	
Léon Foucault invented the first practical electric arc lamp; and made many important contributions in other fields of Science. Although less religious in his youth, Foucault was an active Catholic in his later years.	
Luigi Galvani: one of the pioneers of electricity. Originally, his intention was to study theology and to enter a monastic order, but studied anatomy and physiology instead. He discovered that the muscles of dead frogs twitched when struck by a spark. This was one of the first forays into the study of bioelectricity, a field that still today studies the electrical patterns and signals of the nervous system. Galvani was by nature courageous and religious. He never ended his lessons "without exhorting his hearers and leading them back to the idea of that eternal Providence, which develops, conserves, and circulates life among so many divers beings".	
Allesandro Volta: Trained by the Jesuits, he invented the first, complete galvanic battery; the "volt" is named after him.	

Georg Ohm: (1789 – 1854) was a German physicist. As a high school teacher at a Jesuit school in Cologne, he was able to define the fundamental relationship among voltage, current, and resistance, which represents the true beginning of electrical circuit analysis. The Jesuits funded the sabbatical for him, which resulted in the publication of Ohm's Law.	
Charles-Augustin de Coulomb (1736 –1806) was a French Catholic physicist. He is best known for developing Coulomb's law, the definition of the electrostatic force of attraction and repulsion. The SI unit of charge, the coulomb, was named after him.	

- See also the book: 1000 Years of Catholic Scientists by Jane Meyerhofer

Catholic Scientists in Electricity

Name: _____

1. Which scientist discovered that a frog's leg will twitch when electrical current is applied? _____
2. Four of the scientists have their name used as a unit of measurement for some aspect of electricity. They are: _____, _____, _____ and _____.
3. Who invented the electric arc lamp? _____
4. What term did Galvani use to refer to God at the end of each lecture? _____
5. Who read the Bible and the Church Fathers when having doubts? _____
6. The definition of the electrostatic force of attraction and repulsion is known as _____ .
7. While teaching at a Catholic high school, _____ discovered the fundamental relationship among voltage, current, and resistance.
8. Which Scientist saw their first communion as one of the culminating moments of his life? _____

Answers:
1. Galvani 2. Ampère, Volta, Ohm, Coulomb 3. Foucault 4. Providence 5. Ampère 6. Coulomb's Law 7. Ohm 8. Ampère

Appendix C – Moral decision making

Compendium of the Catechism of the Catholic Church

363: What is freedom?

Freedom implies also the possibility of choosing between good and evil. The choice of evil is an abuse of freedom and leads to the slavery of sin.

364: What is the relationship between freedom and responsibility?

Freedom makes people responsible for their actions to the extent that they are voluntary, even if the imputability and responsibility for an action can be diminished or sometimes cancelled by ignorance, inadvertence, duress, fear, inordinate attachments, or habit.

369: Are there acts which are always illicit?

There are some acts which, in and of themselves, are always illicit by reason of their object (for example, blasphemy, homicide, adultery). Choosing such acts entails a disorder of the will, that is, a moral evil which can never be justified by appealing to the good effects which could possibly result from them.

371: Are the passions morally good or bad?

The passions insofar as they are movements of the sensible appetite are neither good nor bad in themselves. They are good when they contribute to a good action and they are evil in the opposite case. They can be taken up into the virtues or perverted by the vices.

372: What is the moral conscience?

Moral conscience, present in the heart of the person, is a judgment of reason which at the appropriate moment enjoins him to do good and to avoid evil. Thanks to moral conscience, the human person perceives the moral quality of an act to be done or which has already been done, permitting him to assume responsibility for the act. When attentive to moral conscience, the prudent person can hear the voice of God who speaks to him or her.

375. What norms must conscience always follow?

There are three general norms: 1) one may never do evil so that good may result from it; 2) the so-called *Golden Rule*, "Whatever you wish that men would do to you, do so to them" (*Matthew* 7:12); 3) charity always proceeds by way of respect for one's neighbor and his conscience, even though this does not mean accepting as good something that is objectively evil.

416. In what does the natural moral law consist?

The natural law which is inscribed by the Creator on the heart of every person consists in a participation in the wisdom and the goodness of God. It expresses that original moral sense which enables one to discern by reason the good and the bad. It is universal and immutable and determines the basis of the duties and fundamental rights of the person as well as those of the human community and civil law.

Ron Rolheiser: column for 2009-01-04

"Have you ever done something simply on principle, because it was the right thing to do, knowing that you couldn't explain it to anyone, without there even being a good feeling attached to your act?" Karl Rahner wrote that and then added: "If you have done this, you have experienced God, perhaps without knowing it."

Ron Rolheiser: Column for 2008-08-17

Necessity of developing the "heart of a child." The innocence that Jesus glorifies in children is the wholeness of not yet being wounded, of still being able to trust, of not yet having one's heart hardened by sin, wound, and disillusionment. Jesus says as much when he is asked whether divorce is wrong or right. He answers the question not by pronouncing it categorically wrong or right but by giving a deeper reason for its frequency: Divorce happens, Jesus says, because our hearts are no longer as they were "in the beginning", namely, in that pristine time before Adam and Eve sinned and (in terms of our own lives) in the pristine time before we were wounded. In an unwounded heart, in the heart of a child, divorce is not an option. To acquire the heart of a child is therefore to try to move beyond the things that have wounded and hardened us.

Appendix D: Particle Theory and Quantum Mechanics

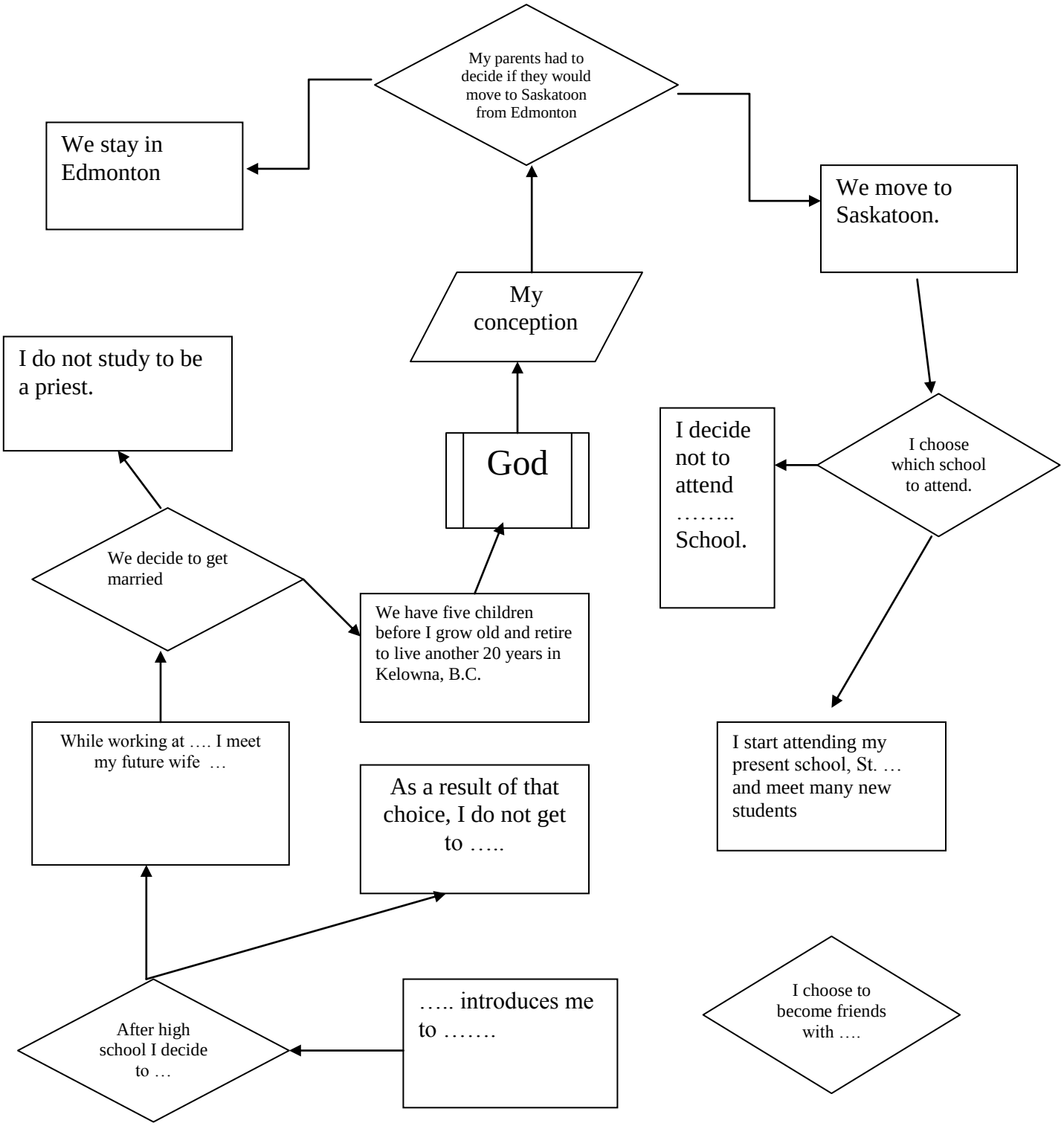
http://en.wikipedia.org/wiki/Particle_physics

Modern particle physics research is focused on subatomic particles, which have less structure than atoms. These include atomic constituents such as electrons, protons, and neutrons (protons and neutrons are actually composite particles, made up of quarks), particles produced by radioactive and scattering processes, such as photons, neutrinos, and muons, as well as a wide range of exotic particles.

Strictly speaking, the term particle is a misnomer because the dynamics of particle physics are governed by quantum mechanics. As such, they exhibit wave-particle duality, displaying particle-like behavior under certain experimental conditions and wave-like behavior in others (more technically they are described by state vectors in a Hilbert space; see quantum field theory). Following the convention of particle physicists, "elementary particles" refer to objects such as electrons and photons, it is well known that these "particles" display wave-like properties as well.

All the particles and their interactions observed to date can almost be described entirely by a quantum field theory called the Standard Model. The Standard Model has 17 species of elementary particles (12 fermions (24 if you count antiparticles separately), 4 vector bosons (5 if you count antiparticles separately), and 1 scalar bosons), which can combine to form composite particles, accounting for the hundreds of other species of particles discovered since the 1960s. The Standard Model has been found to agree with almost all the experimental tests conducted to date. However, most particle physicists believe that it is an incomplete description of nature, and that a more fundamental theory awaits discovery. In recent years, measurements of neutrino mass have provided the first experimental deviations from the Standard Model.

Appendix E – A Catholic's Circuit



Appendix F –Integration with Pearson Saskatchewan Science 6

Saskatchewan Science 6	Suggested integration of faith permeation ideas
1 The Shocking History of Electricity p.84	
2 Static Electricity p.89	† See Lesson 2: Electricity is made of electrons, which behave both as particles and as waves. Human beings are both body and soul.
ASK AN ELDER: Danny Musqua: The Thunderbird and Waskwanehpigan p.95	
3 Making Static Electricity Useful p.96	
4 Where Does Electricity Come From? Renewable Resources p.99	† See Lesson 1: Responsibly generating electricity as "stewards" of creation. (See unit "Diversity of Life.") † How dependent are you on electricity?
5 Non-renewable Resources p.104	
ASK AN EXPERT: Jaclyn Mann	
6 Light Up the Class p.109	† See Lesson 2: Re-assert both the beauty and the mystery of creation † Lesson 3: Catholic Morality asserts the existence of absolutes – some things are intrinsically right or wrong, good or evil, "positive" or "negative. Yet moral reasoning has to be applied lovingly in each circumstance, and judgment is reserved to God alone.
7 Go with the Flow p.112	
8 Key Features of Electrical Circuits p.115	† See Lesson 2: People also be spiritually "charged" or spiritually "dead". See appendix B for information and questions on Catholic scientists who contributed greatly to the study of electricity, but who were also examples of lively faith.
9 Different Needs, Different Circuits p.120	† Lesson 3: Circuit of life.
10 Fixing Electrical Problems p.123	
11 Careers in Electricity p.128	
12 Electricity and Magnets p.130	
13 Electromagnets at work p.134	
14 Electricity -Use it Safely p.140	
15 Talking Around the World -Thanks to Canadians p.143	
16 Conserving Electricity 148	
DESIGN PROJECT: A New Electrical Device p.152 UNIT 2 Summary p.154	See Lesson 1: Responsible use of electronic devices from a Catholic perspective

Saskatchewan Catholic Schools Curriculum

Gr. 6 Science - Faith Permeation Essential Connections

Unit Theme: Principles of Flight

The Saskatchewan Science Curriculum calls for students to grow in knowledge, skills and attitudes according to the goals of Education in Saskatchewan, which include "Spiritual Development." This proposed unit will help students develop the "wonder and awe" to which we are called in the face of creation, as well as a sense of "Stewardship" that is our responsibility. This first section deals with Physical Science: "Principles of Flight" and will help students achieve the following Outcomes of the provincial Gr. 6 Science Curriculum: FL 6.1, FL 6.2 and FL 6.3.

NOTE: All highlighted/shaded areas indicate faith permeation.

Catholic Faith Focus for Learning:

Flight reminds us that we are not made simply for this physical, earthly existence. A "divine spark" within us, calls us to "high" ideals – love, truth, peace, justice -- to move "above" what we see around us. Angels are an order of creation above us, and we usually represent them with wings, for flight is an action that is above our "natural" state. We are made for eternity, and Jesus himself rose up *bodily* into heaven before his disciples.

In our study of flight, we learn of the four forces affecting a flying object. Invisible "forces" affect our faith journey every day as well. We cannot "see" grace, and yet we experience it in the strength, forgiveness and inspiration provided by the Holy Spirit. Temptation is also an invisible "force" drawing us away from God.

Catholic Faith Big Ideas (answers to the essential questions):

Students will understand that …

- We are created for eternity, and a deep sense of that reality lies within our being, urging us to grow beyond what we are. We thirst for that which is beyond us, for greatness, or happiness, love, peace, truth … for God. The desire to fly could be seen as one expression of this desire.
- Just as *invisible* forces act on an object in flight, so *invisible* graces act on us through our Christian journey.
- Virtues are habits of mind and will. They guide our actions and keep our passions in check.

- There is an almost inexpressible beauty in flight – the eagle's soar, the energetic landing of a Canada goose on a clear pond – a beauty that connects us to the inspiration and presence of the Holy Spirit.

Catholic Faith Essential Skills: '

Students will be able to …

- Discover and describe ways they feel called to become more than they are today, and why that is important.
- Explain virtues and grace. Give examples of each.
- Indicate how beauty, for example in aircraft design, reflects God-given talents and gives glory to God.

Catholic Faith Essential Questions:

- In what ways do I feel called to become more than I am right now?
  - What does that tell me about myself and God?
- What "*forces"* (visible and invisible) act on you each day?

Description of Culminating Assessment Task – Integrating Catholic Faith (end of unit assessment):

Write a story about an event where you could (at the time, or looking back) see or sense God's grace ("providence") working in your life. What aspects of the event are "above" the ordinary? What indicated to you that God was present and acting? How does it make you feel? If you can't think of an event for your own life, you could share someone else's story.

Additional Resources: See Appendix A

Outcomes: Physical Science – Principles of Flight (FL)

FL6.1 Examine connections between human fascination with fight and technologies and career
based on the scientific principles of fight.
FL6.2 Investigate how the forces of thrust, drag, lift, and gravity act on living things and constructed devices that fly through the air.
FL6.3 Design a working prototype of a flying object that meets specified performance criteria.

Lesson 1:

Outcome:

FL6.1 Examine connections between human fascination with fight and technologies and career
based on the scientific principles of fight.

Indicators:

a) Observe and describe physical characteristics and adaptations that enable birds (e.g., ravens, hawks, loons, geese, hummingbirds, sandpipers, cranes, and sparrows), insects (e.g., mosquitoes, dragonflies, grasshoppers, bees, wasps, and butterflies), and bats to fly.
b) Show how First Nations and Métis art and storytelling highlight understanding of and respect for birds.

c) Examine the role of inspiration and aesthetic design in the development of flying devices (e.g., initial attempts at trying to fly were based on observations of birds).
d) Research technological problems that had to be overcome to develop devices that fly (e.g., balloons, kites, gliders, airplanes, helicopters, and rockets) and explain how various creative solutions to those problems have resulted in the development of flying devices with different designs.
e) Discuss historical and current contributions of individuals, including Canadians, who have contributed to scientific understanding and technological developments related to fight.
f) Describe examples of traditional and modern technologies developed by First Nations, Métis, and other cultures that are based on principles of fight (e.g., atlatl, bow and arrow, slingshot, catapult, boomerang, and trebuchet).
g) Explain how inventions based on principles of fight have changed the way people work, live, and interact with the environment locally, nationally, and globally (e.g., bush planes in northern Saskatchewan, scheduled airline travel, supply of cargo to remote communities and mine sites, and transoceanic air travel).
h) Describe career opportunities in Canada related to the science and technology of fight.

Faith Permeation Ideas:

- We are meant for more than this physical world, and the development of flight is one result of our natural desire to move beyond our limitations. "In the image of God" we were created, with intellect and free will, as well as the desire to create. Perhaps because we are made "little less than the angels" (Psalm 8:6) we see them as beings naturally capable of flight and seek to imitate them. Ask students, "What do you want to be when you are an adult? Do you have the skills, knowledge, resources to achieve this goal today? How can you get there? What might you have to forego to attain your goal? What is our ultimate goal as Christians? How do we get there? What might we have to give up?

Faith Permeation Resources:

- Ron Rolheiser's article "Facing the Dragon" in Appendix B provides some insight.
- If the students want to learn more about angels, some resources are provided in Appendix D
- The patron Saint of Fliers is Our Lady of Loreto

Lesson 2:

Outcome:

FL6.2 Investigate how the forces of thrust, drag, lift, and gravity act on living things and constructed devices that fly through the air.

Indicators:

a) Diagram how the forces of thrust, drag, lift, and gravity act on living things or devices that fly through the air.
b) Use scientific terminology appropriately (e.g., thrust, drag, lift, and gravity) when communicating ideas about the principles of fight.
c) Generate questions related to the principles of fight and rephrase those questions in a testable form (e.g., rephrase a question such as "Why can some gliders travel farther than others?" to "What effect does wing shape have on the distance a glider can travel?").

d) Describe the role of lift in overcoming gravity and enabling devices or living things to fly.
e) Determine how lift is affected by the shape of a surface by planning and carrying out steps to investigate the effect of wing shape on lift.
f) Describe and represent methods for altering drag in flying devices, such as a bird spreading wings or an airplane employing flaps.
g) Provide examples of how science and technology have been used to solve problems related to drag in devices that fly.
h) Compare the sources of thrust of various constructed flying devices including the propeller, jet engine, and solid or liquid-fuelled rocket.

Faith Permeation Ideas:

- There are four basic forces acting on an object in flight. In our lives, there are also many influences on our decisions, not all of them evident. Grace is an invisible help that we receive from God in the form of consolation, strength or inspiration. The four forces involved in flight could be seen as analogous to the four cardinal virtues: prudence, justice, fortitude, and temperance, which give our lives direction and impetus. Another way to see this is with grace and virtue pulling us in the right direction (upwards and forwards) while temptation and bad habits "pull" us, but in the wrong direction (down and back). Use the diagrams in Appendix E as a comparison and teaching tool. Ask students to draw themselves as if they were flying. Around the picture, list "forces" (i.e. concerns, issues, events, people) that today are lifting them up, pulling them down, dragging them back, pushing (or pulling) them forward.

Faith Permeation Resources:

- Appendix E – four forces and four virtues
- Appendix G – Virtues, fruits and gifts of the Holy Spirit
- Present the topics of virtues, conscience and how we make good choices. Then Use a "moral decision" questionnaire like the one in Appendix F, or an online one:
  http://www.bbc.co.uk/science/humanbody/mind/surveys/morals/
- Though not specifically Catholic or Christian, these surveys give a good idea of what is involved in moral decision making.
- Online printables: (Note that the spaces in links are underscores: _)
  - Gifts of the Holy Spirit Crossword: http://www.catholicmom.com/2007_lesson_plans/gifts_hs_crossword.pdf
  - Fruits of the Holy Spirit Double Puzzle: http://www.catholicmom.com/2007_lesson_plans/fruits_hs_double_puzzle.pdf
  - Corporal and Spiritual Works of Mercy unscramble: http://www.catholicmom.com/2007_lesson_plans/corporal_mercy.pdf

Lesson 3:

Outcome:

FL6.3 Design a working prototype of a flying object that meets specified performance criteria.

Indicators:

a) Assess the characteristics of flying objects (e.g., balloon, kite, glider, airplane, helicopter, and rocket).

b) Construct a prototype of a flying object that meets student-specified performance and aesthetic criteria.
c) Work collaboratively with classmates to define criteria for judging the performance and aesthetics of a prototype of a flying object.
d) Select and carefully use appropriate tools in manipulating materials and in building prototypes.
e) Work collaboratively to collect relevant observations and data to evaluate the performance of a prototype of an object that will fly.
f) Demonstrate and explain the importance of selecting appropriate processes for investigating scientific questions and solving technological problems (e.g., explain why it is important to change one variable while keeping others constant in designing and testing prototypes of flying objects).
g) Analyze personally collected data and suggest improvements to a prototype design.
h) Communicate procedures and results of prototype design, construction, testing, and evaluation in a technical design report.
i) Identify new questions or problems about fight that arise through the prototype design process.
j) Propose designs for futuristic flying devices that meet a particular student-identified need.

Faith Permeation Ideas:

- In the earliest stages of the development of flight, many thought it was "unnatural" for people to fly, and therefore against God's law. (As the classic skeptic states: "If God had wanted us to fly, he would have given us wings!"). Why was flight developed despite these attitudes and beliefs?
- In the design of aircraft for this unit (or any design) more than just function is considered. Aesthetics are also important, not just for marketing, but for its own sake. Beauty ("aesthetics") is one of the marks of the Holy Spirit, and our desire for beauty and harmony is a sign of God's presence in our lives, and provides evidence of the "divine spark" within us. What do you consider "beautiful?" What makes something beautiful? (or ugly?) Is the definition the same for everyone? What does the proverb "Beauty is only skin deep" mean?

Faith Permeation Resources:

Compendium of the Catechism of the Catholic Church

- **3. How is it possible to know God with only the light of human reason?** Starting from creation, that is, from the world and from the human person, through reason alone one can know God with certainty as the origin and end of the universe, as the highest good and as infinite truth and beauty.
- **526. What relationship exists between truth, beauty and sacred art?** The truth is beautiful, *carrying in itself the* splendour of spiritual beauty. *In addition to the expression of the truth in words there are other complementary expressions of the truth, most specifically* in the beauty of artistic works. *These are the* fruit both of the talents given by God and of human effort. *Sacred art* by being true and beautiful should evoke and glorify the mystery of God *made visible in Christ, and lead to the adoration and love of God, the Creator and Savior, who is the surpassing, invisible Beauty of Truth and Love.*

Teacher Catholic Faith Integrations Reflections What have I learned about teaching this unit?	
Subject: Gr. 6 Science	**Unit: Principles of Flight**

What permeation ideas worked well in this unit?

How well did the permeation prompts engage the students?

Describe how the faith permeation prompts helped your students to grow in understanding the Catholic faith.

As a teacher, describe how the faith permeation prompts helped you to grow in understanding the Catholic faith.

It would have been good to have...

If I adapted / modified this unit I would...

General Comment:

Appendix A – Additional Resources

Compendium of the Catechism of the Catholic Church:

29. Why is there no contradiction between faith and science?

Though faith is above reason, there can never be a contradiction between faith and science because both originate in God. It is God himself who gives to us the light both of reason and of faith.

> *"I believe, in order to understand; and I understand, the better to believe."* (Saint Augustine)

67: For what purpose did God create man and woman?

… Only in the mystery of the incarnate Word does the mystery of the human person come into true light. Man and woman are predestined to reproduce the image of the Son of God made Man, who is the perfect "image of the invisible God" (*Colossians* 1:15).

Scripture:

- Genesis 1.20: And God said, 'Let the waters bring forth swarms of living creatures, and let birds fly above the earth across the dome of the sky.'
- Psalm 55.6: And I say, 'O that I had wings like a dove! I would fly away and be at rest;
- Exodus 19.4: You have seen what I did to the Egyptians, and how I bore you on eagles' wings and brought you to myself.
- Exodus 25.20: The cherubim shall spread out their wings above, overshadowing the mercy-seat with their wings.
- 2 Samuel 22.11: He rode on a cherub, and flew; he was seen upon the wings of the wind.
- 2 Chronicles 3.13: The wings of these cherubim extended twenty cubits; *(1 cubit = 45.7 cm, so roughly 9 meters, or a small, single engine aircraft)*
- Psalm 17.8: Guard me as the apple of the eye; hide me in the shadow of your wings,
- Psalm 36.7: How precious is your steadfast love, O God! All people may take refuge in the shadow of your wings.
- Psalm 18.10: He rode on a cherub, and flew; he came swiftly upon the wings of the wind.
- Psalm 55.6: And I say, 'O that I had wings like a dove! I would fly away and be at rest;
- Psalm 63.7: for you have been my help, and in the shadow of your wings I sing for joy.
- Psalm 139.9: If I take the wings of the morning and settle at the farthest limits of the sea,
- Isaiah 40.31:

  > but those who wait for the LORD shall renew their strength, they shall mount up with wings like eagles, they shall run and not be weary, they shall walk and not faint.

- Luke 4:9-12: Then the devil took him to Jerusalem, and placed him on the pinnacle of the temple, saying to him, 'If you are the Son of God, throw yourself down from here, for it is written,
  "He will command his angels concerning you, to protect you", and "On their hands they will bear you up, so that you will not dash your foot against a stone." '
  Jesus answered him, 'It is said, "Do not put the Lord your God to the test." '

- **The ascension:**
  - **Apostles' Creed:** "He ascended into heaven,"
  - **Catechism of the Catholic Church:**

    659: "So then the Lord Jesus, after he had spoken to them, was taken up into heaven, and sat down at the right hand of God."531 (Mk 16:19) Christ's body was glorified at the moment of his Resurrection, as proved by the new and supernatural properties it subsequently and permanently enjoys.
  - **Luke 24:52:** While he was blessing them, he withdrew from them and was carried up into heaven.
  - **Acts 1:9-11:** When he had said this, as they were watching, he was lifted up, and a cloud took him out of their sight. 10While he was going and they were gazing up towards heaven, suddenly two men in white robes stood by them. 11They said, 'Men of Galilee, why do you stand looking up towards heaven? This Jesus, who has been taken up from you into heaven, will come in the same way as you saw him go into heaven.'
- World Catholic Education Day is set always on the Feast of the Ascension (40 days after Easter, i.e. Thursday in the 6th week of Easter Season.)
- "Where I wander—You! Where I ponder—You! ... In every trend, at every end, only You, You again, always You!"

  (M. Buber, *Tales of the Hasidim* [Italian ed., Milan 1979, p. 256]).

Appendix B – Innate call of God

Compendium of the Catechism of the Catholic Church:

2. Why does man have a desire for God?

God himself, in creating man in his own image, has written upon his heart the desire to see him. Even if this desire is often ignored, God never ceases to draw man to himself because only in God will he find and live the fullness of truth and happiness for which he never stops searching. By nature and by vocation, therefore, man is a religious being, capable of entering into communion with God. This intimate and vital bond with God confers on man his fundamental dignity.

Psalm 63:1 O God, you are my God, I seek you,
my soul thirsts for you;
my flesh faints for you,
as in a dry and weary land where there is no water.

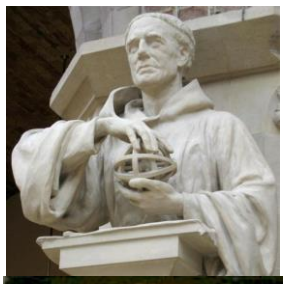
Ron Rolheiser:

- Column for May 31st, 2009 reviews a book by a Canadian writer, Trevor Herriot, Grass, Sky, Song, Promise and Peril in the World of Grassland Birds.
  Referring to the sparrow, he quotes from the book:
  "These small creatures make their stand in the face of great powers transforming their prairie world, living out a yearly drama, a freedom and fidelity to the wind that may escape our awareness even as they sing out to any soul within earshot. The influence of beings as unprepossessing and elusive as grassland birds is something like gravity, a weak though persistent mystery that holds us in place. The heart recognizes such a gentle force, knows that in simply becoming aware of its pull we take a small step towards belonging here ourselves."
- Column for April 26th, 2009 reviews a book by Robert L. Moore, Facing the Dragon: Confronting Personal and Spiritual Grandiosity.
  "Moore asserts, as do our scriptures, that each of us is born with an incurable, innate grandiosity and, because of that, we have larger fantasies and wishes for ourselves than our real life experiences can support. We want, most days, to jump out of our own skins because our lives seem too small for us. But there is an adequate reason: We each have within us the Image and Likeness of God. This is more than just a beautiful icon stamped inside us; it is a fire and an energy that, like God, has no boundaries. We come into this world with the imprint of God stamped in us and that dignity and energy create a godly grandiosity inside us."
  (The article goes on to speak of the humility required to keep this energy in check and avoid its negative possibilities.)

Appendix C – Some Catholic Scientists whose work contributed to Flight

Copyright Notice: Links embedded in the name of the scientist and the photo point to one of two sources used:
1) Wikipedia, where text is covered under the Creative Commons Attribution/Share-Alike License 3.0.
Images themselves are from the Wikimedia Commons.
2) The Catholic Encyclopaedia Online: http://www.newadvent.org/cathen/ , used with permission.

Roger Bacon (c.1214–1294 He was an English philosopher who emphasized empiricism and has been presented as one of the earliest advocates of the modern scientific method. He joined the Franciscan Order around 1240. Bacon was responsible for making the concept of "laws of nature" widespread, and contributed in such areas as mechanics, geography and, most of all, optics.



Jean Buridan (1300–1358): He was a Catholic priest and one of the most influential philosophers of the later Middle Ages. He developed the theory of impetus, which was an important step toward the modern concept of inertia.

Stanley Jaki: (born 1924): Benedictine priest and Distinguished Professor of Physics at Seton Hall University, New Jersey, who won a Templeton Prize and advocates the idea modern science could only have arisen in a Christian society.

Blaise Pascal (1623-1662): was a French mathematician, physicist, and religious philosopher. He made important contributions to the study of fluids, and clarified the concepts of pressure. Pascal also wrote in defense of the scientific method and demonstrated practically that a column of air has weight.

Appendix D - Angels

Compendium of the Catechism of the Catholic Church

59. What did God create?

Sacred Scripture says, "In the beginning, God created the heavens and the earth" (Genesis 1:1). The Church in her profession of faith proclaims that God is the Creator of everything, visible and invisible, of all spiritual and corporeal beings, that is, of angels and of the visible world and, in a special way, of man.

60. Who are the angels?

The angels are purely spiritual creatures, incorporeal, invisible, immortal, and personal beings endowed with intelligence and will. They ceaselessly contemplate God face-to-face and they glorify him. They serve him and are his messengers in the accomplishment of his saving mission to all.

61. In what way are angels present in the life of the Church?

The Church joins with the angels in adoring God, invokes their assistance and commemorates some in her liturgy.

" Beside each believer stands an angel as a protector and shepherd leading him to life." (Saint Basil the Great)

- Catholic Online has some good articles about angels, even each of the nine choirs, as well as prayers:
  http://www.catholic.org/saints/angel.php

- The Catholic Encyclopedia, in a much longer and difficult article, asserts that"

  "The angels are represented throughout the Bible as a body of spiritual beings intermediate between God and men: "You have made him (man) a little less than the angels" (Psalm 8:6). They, equally with man, are created beings;"

  And goes on to discuss the topics: Attendants at God's throne;God's messengers to mankind; Personal guardians; Divine agents governing the world; Hierarchical Organization; The number of angels; The evil angels; Angels in the Bible and other literature

- Bob Williston Song: Little Less than the Angels:
  Refrain:

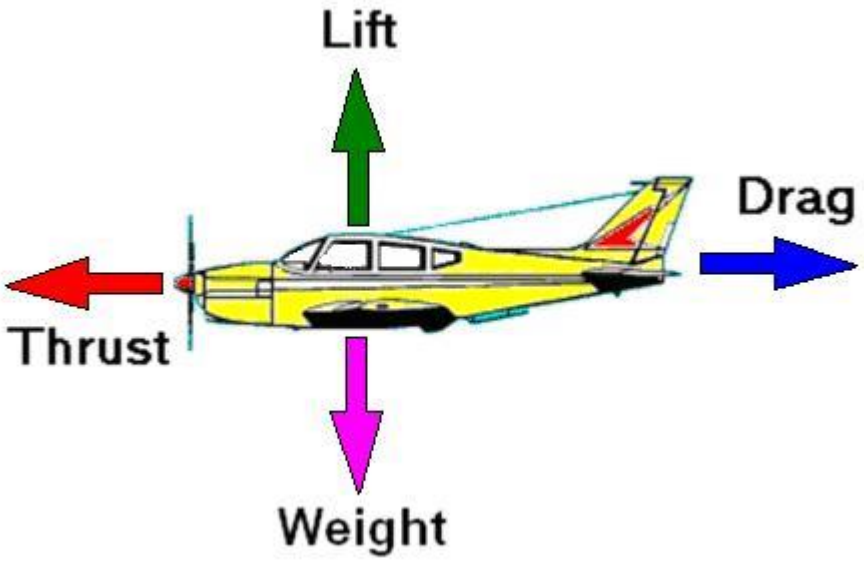
  You were made a little less than the angels.
  You were made to be the best of his shining stars.
  You were made a little less than the angels.
  Be the beauty, the wonder;
  Be the majesty, splendor;
  Be the person that God knows you are.

1. Listen more closely to how you were made,
   A smile from our God's loving heart.
   He crowned you with life
   And showered you with gifts,
   To bring his love to the world.

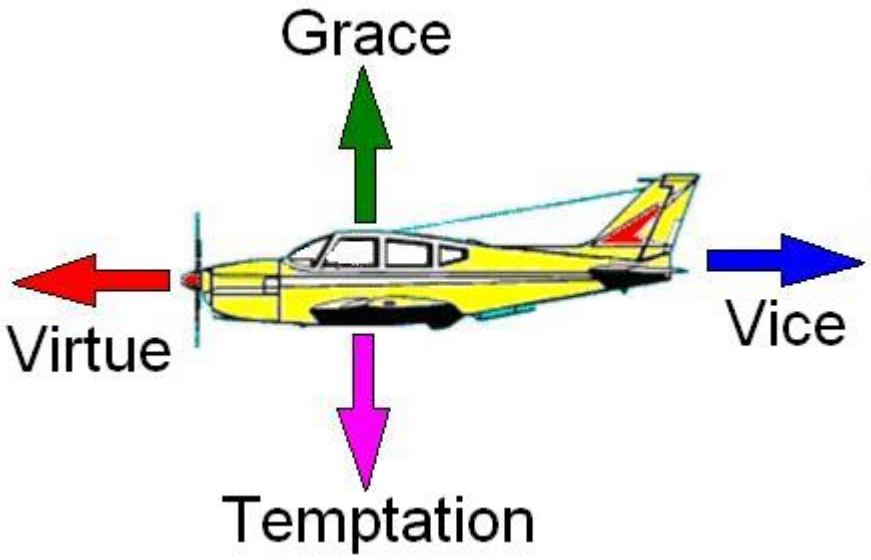
2. Seek out the healing you need in your heart
   And live as a child of God
   He gave you a space and touched you with grace
   To bring his love to the world.

Appendix E – Four Forces

Any discussion of flight presents the four forces acting on an object in flight:

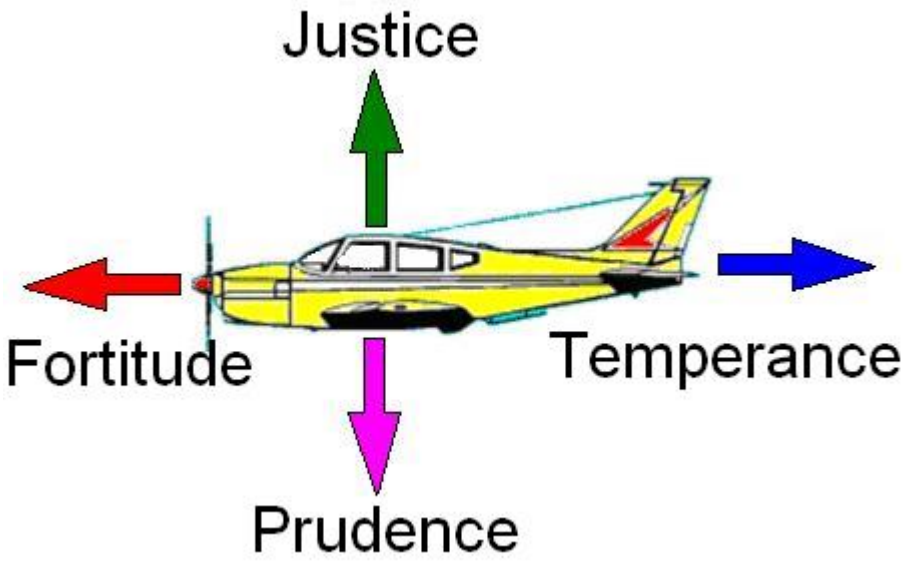


We could relate these analogously to the Catholic teaching on good and bad "forces" in our lives (see below from the Compendium of the Catechism of the Catholic Church):



Grace from the sacraments lifts us up, virtue (good habits) move us forward on our Christian journey. Temptation pulls us down and vice (bad habits) hold us back from making progress.

Or another application of the same image could relate to the four cardinal virtues:



Fortitude gives us strength to move forward, even into challenging situations.
Justice lifts us up to the "higher ground."
Temperance keeps our strong passions and drive in check from running away on us.
Prudence helps keep our "feet on the ground" so we don't try to "fly to high beyond our reach."

Any discussion of the cardinal virtues should also include a mention of the three theological virtues – faith hope and love – as well as the gifts and fruits of the Holy Spirit. It is really **grace** that "lifts us up," but I used justice for the sake of the analogy.

Compendium of the Catechism of the Catholic Church

- **Grace and virtue**
  131: "the risen Christ, the conqueror of sin and death, is the principle of our justification and our Resurrection. It procures for us now the grace of filial adoption which is a real share in the life of the only begotten Son. At the end of time he will raise up our bodies."
  146: Christ communicates his Spirit and the grace of God through the sacraments to all the members of the Church, who thus bear the fruits of the new life of the Spirit. The Holy Spirit is also the Master of prayer.
  224: The sacraments, instituted by Christ and entrusted to the Church, are efficacious signs of grace perceptible to the senses.
  359: We attain beatitude by virtue of the grace of Christ which makes us participants in the divine life. Christ in the Gospel points out to his followers the way that leads to eternal happiness: the beatitudes. The grace of Christ also is operative in every person who, following a correct conscience, seeks and loves the true and the good and avoids evil.
  366: Our freedom is weakened because of original sin. This weakness is intensified because of successive sins. Christ, however, set us free "so that we should remain free" (Galatians 5:1). With his grace, the Holy Spirit leads us to spiritual freedom to make us free co-workers with him in the Church and in the world.
  379: The principal human virtues are called the cardinal virtues, under which all the other virtues are grouped and which are the hinges of a virtuous life. The cardinal virtues are: prudence, justice, fortitude, and temperance. (see also #380-383)

  374. How is a moral conscience formed to be upright and truthful?

An upright and true moral conscience is formed by education and by assimilating the Word of God and the teaching of the Church. It is supported by the gifts of the Holy Spirit and helped by the advice of wise people. Prayer and an examination of conscience can also greatly assist one's moral formation.

375. What norms must conscience always follow?

There are three general norms: 1) one may never do evil so that good may result from it; 2) the so-called Golden Rule, "Whatever you wish that men would do to you, do so to them" (Matthew 7:12); 3) charity always proceeds by way of respect for one's neighbor and his conscience, even though this does not mean accepting as good something that is objectively evil.

377. What is a virtue?

A virtue is an habitual and firm disposition to do the good. "The goal of a virtuous life is to become like God" (Saint Gregory of Nyssa). There are human virtues and theological virtues.

378. What are the human virtues?

The human virtues are habitual and stable perfections of the intellect and will that govern our actions, order our passions and guide our conduct according to reason and faith. They are acquired and strengthened by the repetition of morally good acts and they are purified and elevated by divine grace.

380. What is prudence?

Prudence disposes reason to discern in every circumstance our true good and to choose the right means for achieving it. Prudence guides the other virtues by pointing out their rule and measure.

381. What is justice?

Justice consists in the firm and constant will to give to others their due. Justice toward God is called "the virtue of religion."

382. What is fortitude?

Fortitude assures firmness in difficulties and constancy in the pursuit of the good. It reaches even to the ability of possibly sacrificing one's own life for a just cause.

383. What is temperance?

Temperance moderates the attraction of pleasures, assures the mastery of the will over instincts and provides balance in the use of created goods.

384. What are the theological virtues?

The theological virtues have God himself as their origin, motive and direct object. Infused with sanctifying grace, they bestow on one the capacity to live in a relationship with the Trinity. They are the foundation and the energizing force of the Christian's moral activity and they give life to the human virtues. They are the pledge of the presence and action of the Holy Spirit in the faculties of the human being.

385. What are the theological virtues?

The theological virtues are faith, hope, and charity.

386. What is the virtue of faith?

Faith is the theological virtue by which we believe in God and all that he has revealed to us and that the Church proposes for our belief because God is Truth itself. By faith the human person freely commits himself to God. Therefore, the believer seeks to know and do the will of God because "faith works through charity" (*Galatians* 5:6).

387. What is hope?

Hope is the theological virtue by which we desire and await from God eternal life as our happiness, placing our trust in Christ's promises and relying on the help of the grace of the Holy Spirit to merit it and to persevere to the end of our earthly life.

388. What is charity?

Charity is the theological virtue by which we love God above all things and our neighbor as ourselves for the love of God. Jesus makes charity the new commandment, the fullness of the

law. “It is the bond of perfection” (*Colossians* 3:14) and the foundation of the other virtues to which it gives life, inspiration, and order. Without charity “I am nothing” and “I gain nothing” (*1 Corinthians* 13:1-3).

389. What are the gifts of the Holy Spirit?

The gifts of the Holy Spirit are permanent dispositions which make us docile in following divine inspirations. They are seven: wisdom, understanding, counsel, fortitude, knowledge, piety, and fear of the Lord.

390. What are the fruits of the Holy Spirit?

The *fruits* of the Holy Spirit are perfections formed in us as the first fruits of eternal glory. The tradition of the Church lists twelve of them: charity, joy, peace, patience, kindness, goodness, generosity, gentleness, faithfulness, modesty, self-control, and chastity (*Galatians* 5:22-23, Vulgate).

398. What are vices?

Vices are the opposite of virtues. They are perverse habits which darken the conscience and incline one to evil. The vices can be linked to the seven, so-called, capital sins which are: pride, avarice, envy, anger, lust, gluttony, and sloth or acedia.

596: What does “Lead us not into temptation” mean?

We ask God our Father not to leave us alone and in the power of temptation. We ask the Holy Spirit to help us know how to discern, on the one hand, between a trial that makes us grow in goodness and a temptation that leads to sin and death and, on the other hand, between being tempted and consenting to temptation. This petition unites us to Jesus who overcame temptation by his prayer. It requests the grace of vigilance and of final perseverance.

Appendix F: Moral Foundations Questionnaire

Name" _____
(Cf. Grade 6 Health – Decision making)
http://faculty.virginia.edu/haidtlab/MFQ41_item_key.doc
Part 1. When you decide whether something is right or wrong, to what extent are the following considerations relevant to your thinking? Please rate each statement using this scale:

[0] = not at all relevant (Has nothing to do with my judgments of right and wrong)
[1] = not very relevant
[2] = slightly relevant
[3] = somewhat relevant
[4] = very relevant
[5] = extremely relevant (One of the most important factors when I judge right and wrong)

_____Whether or not someone suffered emotionally

_____Whether or not some people were treated differently than others

_____Whether or not someone's action showed love for his or her country

_____Whether or not someone showed a lack of respect for authority

_____Whether or not someone violated standards of purity and decency

_____Whether or not someone was good at math

_____Whether or not someone cared for someone weak or vulnerable

_____Whether or not someone acted unfairly

_____Whether or not someone did something to betray his or her group

_____Whether or not someone conformed to the traditions of society

_____Whether or not someone did something disgusting

_____Whether or not someone was cruel

_____Whether or not someone was denied his or her rights

_____Whether or not someone showed a lack of loyalty

_____Whether or not an action caused chaos or disorder

_____Whether or not someone acted in a way that God would approve of

Part 2. Please read the following sentences and indicate your agreement or disagreement:

[0]	[1]	[2]	[3]	[4]	[5]
Strongly disagree	Moderately disagree	Slightly disagree	Slightly agree	Moderately agree	Strongly agree

_____Compassion for those who are suffering is the most crucial virtue.

_____When the government makes laws, the number one principle should be ensuring that everyone is treated fairly.

_____I am proud of my country's history.

_____Respect for authority is something all children need to learn.

_____People should not do things that are disgusting, even if no one is harmed.

_____It is better to do good than to do bad.

_____One of the worst things a person could do is hurt a defenseless animal.

_____Justice is the most important requirement for a society.

_____People should be loyal to their family members, even when they have done something wrong.

_____Men and women each have different roles to play in society.

_____I would call some acts wrong on the grounds that they are unnatural.

_____It can never be right to kill a human being.

_____ I think it's morally wrong that rich children inherit a lot of money while poor children inherit nothing.

_____ It is more important to be a team player than to express oneself.

_____ If I were a soldier and disagreed with my commanding officer's orders, I would obey anyway because that is my duty.

_____ Chastity is an important and valuable virtue.

_____ The Bible is important in how I make decisions.

_____ Church teaching is important in how I make decisions

The Moral Foundations Questionnaire (full version, July 2008) by Jesse Graham, Jonathan Haidt, and Brian Nosek. For more information about Moral Foundations Theory and scoring this form, see: www.MoralFoundations.org

Appendix G: Virtues and Holy Spirit Word Search

NAME:_____ **DATE:**_____

Virtues, gifts and fruits of the Holy Spirit

T	Z	N	F	E	K	L	N	U	V	K	J	E	J	H	B	D	O	X	V
D	S	Z	R	D	I	I	G	A	Z	E	T	C	Y	O	Y	S	U	N	X
J	E	B	V	U	N	O	R	D	Q	S	R	N	D	P	T	R	K	Y	X
B	L	K	C	T	D	N	O	M	P	U	T	A	K	E	E	Z	X	R	H
C	F	N	Y	I	N	Y	N	G	E	N	E	R	O	S	I	T	Y	C	B
H	C	O	U	T	E	C	N	E	R	E	V	E	R	L	P	T	S	P	K
A	O	W	Q	R	S	K	Z	T	A	M	B	P	H	F	A	S	A	T	I
S	N	L	S	O	S	O	H	T	D	G	O	M	X	U	E	T	J	U	K
T	T	E	F	F	Q	C	P	T	P	L	N	E	U	N	I	K	X	N	M
I	R	D	N	I	R	Y	B	K	U	G	X	T	E	E	R	C	F	D	H
T	O	G	Q	L	C	H	A	R	I	T	Y	L	N	I	L	H	F	E	U
Y	L	E	Z	B	O	R	E	N	J	E	T	C	W	B	U	R	X	R	J
N	S	F	A	I	T	H	F	U	L	N	E	S	S	Z	B	F	H	S	Z
W	L	X	X	O	U	D	S	M	E	F	C	G	R	N	V	A	T	T	F
I	O	Y	U	Z	D	T	X	G	F	W	O	U	K	R	V	T	I	A	A
S	M	J	R	E	I	N	T	A	P	R	U	D	E	N	C	E	L	N	I
D	Z	R	T	C	L	K	B	N	E	M	N	J	D	J	G	M	X	D	T
O	J	D	E	A	C	C	Q	G	W	X	S	Q	G	Z	O	Y	H	I	H
M	P	K	U	E	J	C	X	V	I	U	E	A	O	I	D	Y	C	N	S
D	D	F	E	P	O	A	Q	P	B	Z	L	A	I	F	B	Q	F	G	S

The three theological virtues:
faith
hope
charity

The four cardinal virtues:
prudence
justice
fortitude
temperance

The seven gifts of the holy spirit:
wisdom
understanding
counsel
fortitude
knowledge
piety
reverence

The twelve fruits of the holy spirit:
charity
joy
peace
patience
kindness
goodness
generosity
gentleness
faithfulness
modesty
self-control
chastity

Appendix H – Integration with Pearson Saskatchewan Science 6

Saskatchewan Science 6 (Pearson)	Suggested integration of faith permeation ideas
LAUNCH: Connecting Flights p.158	
1 Freedom to Fly p.160	† See Lesson 1: Flight is one result of our natural desire to move beyond our limitations.
ASK AN ELDER: Stewart Prosper: The Winged Ones p.166	
2 Ancient Technologies p.167	† See Lesson 3: In the earliest stages of flight, many thought it was "unnatural" for people to fly, and therefore against God's law.
3 Around the World: Fascination with Flight p.171	
4 Liftoff p.176	
5 Flying Canadians p.180	
CAREERS AND PROFILES: Bob Stallard: Chief Pilot Northern Air Operations p.185	
6 Air in Motion p.186	
7 UP Lifting Theories p.194	
8 Takeoff p.198	
9 Moving Faster, Slower, Up, and Down p.200	† See Lesson 2: The four basic forces acting on an object in flight are like the influences on our decisions.
10 The Four Forces of Flight p.204	
CAREERS AND PROFILES: Heather Knox: First Officer p.208	
11 Payload liftoff p.209	
12 Flight Just Above the Ground: The Hovercraft p.212	
ASK AN EXPERT: James Rolston: Hovercraft Operator p.215	
DESIGN PROJECT: Make It Go p.216	† See Lesson 3: Beauty ("aesthetics") is one of the marks of the Holy Spirit.
UNIT 3 Summary p.220	
UNIT 3 Review p.221	

Saskatchewan Catholic Schools Curriculum

Gr. 6 Science - Faith Permeation Essential Connections

Unit Theme: Our Solar System

This proposed unit deals with Earth and Space Science: Our Solar System. The use of this unit will help students achieve the following Outcomes of the provincial Gr. 6 Science Curriculum: SS 6.1, SS 6.2 and SS 6.3.

NOTE: All highlighted/shaded areas indicate faith permeation.

Catholic Faith Focus for Learning:

God created the heavens and the earth, and orders them by his plan, keeping all things in existence. Space speaks to us of the majesty and transcendence of God. Science is really the "study of Creation." The purpose of science is not only to have power over nature, but to understand the world around us, "to ponder and to wonder," to lead us in a form of contemplation back to the Creator. God who existed eternally before the universe, keeps it in existence, and will bring the entire creation to share in the redemption of Christ after the final judgement. The Church's role is to be Christ's presence in the world until then, sanctifying and leading with authority. We approach the study of Space with faith and humility, to improve our knowledge and benefit all people.

Catholic Faith Big Ideas (answers to the essential questions):

Students will understand that …

- Studying space can bring us to God.
- Just as Astronomy or any area of science has an ultimate regulating body. the Church needs an ultimate authority on earth,
- Astrology and divination, or any form of knowledge or control based on the stars and planets is contrary to the Church's teaching and can lead to serious problems, hoaxes or fears.
- Space belongs to everyone. We explore it to expand our knowledge, and to benefit all people, not for exploitation or for military or economic advantage.

Catholic Faith Essential Skills:

Students will be able to:

- Show an understanding and appreciation of the characteristics of the Solar System (and universe) and what that tells us about eternity and God, the Creator.
- Express an understanding of the need for and structure of authority in the Church.
- Discuss the conflict of astrology with Catholic teaching.

Catholic Faith Essential Questions:

- What do the characteristics of the universe tell us about God who created it?
- Why do we study and explore space?
- Who owns space?

Description of Culminating Assessment Task – Integrating Catholic Faith (end of unit assessment):

- Do one or more of the activities in Appendix D, E and F regarding scales for time and size. Have students write a poem or story or simply a paragraph to express their *feelings* about God and humanity and our place in creation when they did the activity, and when they are reminded that God loves *each one of us, personally,* with an infinite love, so that he was willing to send his Son to die for *me!*

Additional Resources: See Appendix A

Outcomes: Earth and Space Science – Our Solar System (SS)

- SS6.1 Research and represent the physical characteristics of the major components of the solar system, including the sun, planets, moons, asteroids, and comets.
- SS6.2 Assess the efficacy of various methods of representing and interpreting astronomical phenomena, including phases, eclipses, and seasons.
- SS6.3 Evaluate past, current, and possible future contributions of space exploration programs, including space probes and human spaceflight, which support living and working in the inner solar system.

Lesson 1:

Outcome: SS6.1 Research and represent the physical characteristics of the major components of the solar system, including the sun, planets, moons, asteroids, and comets.

Indicators

a) Use a variety of sources and technologies to gather and compile pertinent information about the physical characteristics of the major components of the solar system.
b) Analyze historical and current technological developments that have enabled human observation of the major components of the solar system.
c) Construct a timeline of Canadian and worldwide research efforts related to understanding the major components of the solar system.
d) Evaluate the validity and usefulness of different sources of information about the physical characteristics of the solar system.
e) Use star charts and astronomy guides to investigate the night sky, including constellations, and record observations using notes in point form, data tables, simple diagrams, and/or charts.
f) Describe objects in the heavens, as indicated through First Nations and Métis art and stories or by Elders or traditional knowledge keepers.
g) Create scale-distance and/or scale-size models to represent the major components of the solar system.

h) Evaluate the usefulness and accuracy of scale-distance and scale-size models of the major components of the solar system.
i) Explain how evidence is continually questioned in order to validate scientific knowledge about the solar system.

Faith Permeation Ideas:

- Awareness of the vast distances and time spans involved give us a glimpse of God's eternal nature and majesty. Our earth is only an infinitesimal speck in the solar system, which in turn is a minute speck in the Milky Way Galaxy, which is only one of trillions scattered in the "known" universe. The 10,000 year span of humanity is a tiny speck on the scale of 15 billion years in the age of the universe. Use Appendix F to present to students a sense of how small we are in the Universe. What does this make you feel or think? What does it tell us about God who was there before the Big Bang?
- In the summer of 2006, the International Astronomical Union (IAU) voted to change the status of Pluto from a planet to a "dwarf planet" or "planetoid" following the discovery that there are many other similar bodies in the Kuiper Belt. A new definition of "planet" had thus to be agreed upon. There are countless references to the controversy over Pluto. See for example: *http://news.nationalgeographic.com/news/2006/08/060824-pluto-planet.html*

  In the Church, a final authority is also needed to define doctrine and resolve controversy. This is the role of the Magisterium which forms one of three authority pillars in the Church, along with Scripture and Tradition. Tell students you want them to survey as many people as they can in the next day asking "Is Pluto a planet?" and (if they answer "No") "Do you think it should be?" What did you discover? What information is necessary for people to answer the second question? Is this the type of issue that should be decided by a vote? Why or why not?

- The popular cliché holds that Science and Religion were often at odds in history, and, Church authorities sought to control or overrule science, especially in astronomy and cosmology. The most famous examples are probably Galileo and Darwin. Yet, as shown throughout these permeation guides, we see a constant interaction and even agreement of Science and Religion in history and still today -- people of science working with a strong and lively faith. See Catholic Scientists Appendix B. Copy or discuss this with students. Then use the crossword based on these scientists found in Appendix I. (Only the last names are used in the crossword.)
- Although Science fiction is often assumed to be inherently hostile to religion, some of the best and most effective Sci-fi has not only found a place to mention faith, but has allowed it to become an integral part of the plot and characters. Write an essay or prepare a presentation for the class regarding the place of religion/faith in a science fiction series or movie. Use examples of faith issues and elements from the story (or episodes) and explain how this relates to what we have learned about the Catholic Church and astronomy. One episode of the original Star Trek, for example, "Bread and Circuses" has a group of people persecuted for worshipping the "Sun" but at the end, it is discovered they are worshipping not the "Sun" in the sky, but the "Son" of God! Some other possibilities:
  - T.V. Series: Star Trek (and any of the spin-offs), Babylon V (has some excellent episodes on religion in the future on a multi-race space station), Battlestar Gallactica (caution: some mature content), Doctor Who, Firefly (caution: some mature content)
  - Movies: Star Trek, Star Wars, Contact, Stargate, Avatar

Faith Permeation Resources:

- Appendix A – Catechism #340, 341, 344 and the Compendium #3, #54 especially, as well as the Scripture quotes and other sources
- Patron Saint of Astronomers: *St. Dominic*
- For background information on Church authority, see Compendium #16 and 17 in Appendix A
- For background information on the conflict between Science and Faith, see Appendix H.

Lesson 2:

Outcome:

SS6.2 Assess the efficacy of various methods of representing and interpreting astronomical phenomena, including phases, eclipses, and seasons.

Indicators

a) Examine how people of different cultures, including First Nations, have recorded (e.g., medicine wheel, Mayan calendar, Stonehenge, pyramids) and used understandings of astronomical phenomena (e.g., positions of the stars and/or planets) to solve practical problems such as the appropriate time to plant and harvest crops, to support navigation on land and water, or to foretell significant events through stories and legends.
b) Examine ways in which humans have represented understanding of or interest in astronomical phenomena through music, dance, drama, visual art, or stories.
c) Demonstrate the importance of selecting appropriate processes for investigating scientific questions and solving technological problems by explaining why astronomy is considered a part of science but astrology is not.
d) Propose personal explanations for the causes of seasons, phases, and eclipses.
e) Demonstrate how Earth's rotation causes the day and night cycle and how Earth's 23.5° tilt and revolution around the sun causes the yearly cycle of seasons.
f) Propose explanations for how the yearly cycle of seasons might differ if Earth's axis were not tilted.
g) Consider alternate models of seasons and explanations for those models (e.g., the six-season model of the Woodland Cree, the rainy and dry seasons of some tropical and subtropical regions).
h) Model the relative positions of the sun, Earth, and moon to demonstrate moon phases and lunar and solar eclipses.
i) Propose questions related to astronomical phenomena to investigate using models and simulations, such as "Do other planets exhibit phases?", "How would seasons on Earth differ if Earth were not tilted?", "How would patterns of eclipses change if the sun, Earth, or moon were different diameters or positioned at different locations?".

Faith Permeation Ideas:

- Many have suggested that the exact positioning of the earth from the sun – far enough that water doesn't boil away, but close enough to have liquid water – as well as the presence and movement of the moon – creating tides – and a host of other factors are all signs of the hand of God in Creation, for if any of these were not exactly right, earth could not sustain life. For an excellent classroom activity and booklet – free download --

on astrobiology and life on earth, see *http://nai.arc.nasa.gov/library/downloads/Astrobiology-Educator-Guide-2007.pdf*

- The movement of the earth and other planets in space provides the basis for our measurement of secular time as well as the Liturgical Year. For example, Easter is the first Sunday after the first full moon after the vernal equinox. (See Appendix C – the Liturgical Year) Have students make a list of the dates for Easter over a 10-year period and compare it to the full moons before Easter for the same time period.
    - The date of Christ's birth is often based on calculations of a lunar eclipse (4 BC) See for example *http://www.ewtn.com/library/scriptur/chrdat.txt* Note that Christmas, unlike Easter, does not always fall on a Sunday, but rather on December 25th, as January 1st is always the Feast of Mary, Mother of God. The day for Christmas does affect the date for the Feast of Holy Family (Sunday after Christmas, but omitted if Christmas is on a Sunday), Epiphany (12th day of Christmas or January 6th, but moved to the first Sunday after January 2nd in Canada) and the Feast of the Baptism of the Lord (Sunday after Epiphany unless January 6th is on a Sunday in which case it is omitted).
    - A comet is often associated with the Star of Bethlehem (5 BC): "Astronomical and historical evidence suggests that the Star of Bethlehem was a comet which was visible in 5 BC, and described in ancient Chinese records. A comet uniquely fits the description in Matthew of a star which newly appeared, travelled slowly through the sky against the star background and stood over Bethlehem. It is proposed that a remarkable sequence of three astronomical events stimulated the journey of Magi: the triple conjunction of Saturn and Jupiter in 7 BC; the massing of the three planets Saturn, Jupiter and Mars in 6 BC; and finally the appearance in 5 BC of the star of Bethlehem, a comet initially in Capricornus." Humphreys, C. J. , University of Cambridge, Quarterly Journal of the Royal Astronomical Society, 1991, vol. 32, no4, pp. 389-407
- Astrology and divination, (any form of knowledge with the intent to control others based on the stars and planets) is not science, and is also contrary to the Church's teaching. Poor science and the search for thrills can lead to hoaxes like the 2012 doomsday predictions. For an excellent article on the 2012 doomsday hoax by an astrobiologist, see: http://astrobiology.nasa.gov/ask-an-astrobiologist/intro/nibiru-and-doomsday-2012-questions-and-answers

  See Appendix A*: Catechism of the Catholic Church #2116 :*

  > *All forms of divination are to be rejected: recourse to Satan or demons, conjuring up the dead or other practices falsely supposed to "unveil" the future. Consulting horoscopes, astrology, palm reading, interpretation of omens and lots, the phenomena of clairvoyance, and recourse to mediums all conceal a desire for power over time, history, and, in the last analysis, other human beings, as well as a wish to conciliate hidden powers. They contradict the honor, respect, and loving fear that we owe to God alone.*

  Compendium of the Catechism of the Catholic Church #445

  This (first)commandment forbids:

… Superstition which is a departure from the worship due to the true God and which also expresses itself in various forms of divination, magic, sorcery and spiritism.

Faith Permeation Resources:

For a good article on the calculation of time in the Church and in society, see the Catholic Encyclopaedia article:*http://www.newadvent.org/cathen/03168a.htm*

Lesson 3:

Outcome:
SS6.3 Evaluate past, current, and possible future contributions of space exploration programs, including space probes and human spaceflight, which support living and working in the inner solar system.

Indicators

a) Construct a timeline of Canadian and worldwide space exploration programs related to living and working in space, including collaborative efforts among countries.
b) Analyze how astronauts are able to meet their basic needs (e.g., food, water, shelter, and waste elimination) while living and working in space.
c) Research the various work roles and worldwide locations required to support human spaceflight programs.
d) Describe instances where scientific ideas and discoveries have led to new inventions and applications (e.g., lunar buggy, space shuttle, Canadarm, Dextre, and the International Space Station) that support human exploration of space and which have extended scientific knowledge related to living and working in space.
e) Identify potential personal, societal, technological, and environmental barriers to living and working in space.
f) Design a model of a habitable space vehicle that can travel to and return from a student-selected location in the inner solar system.
g) Investigate the work being done in preparation for future space travel and make predictions about future achievements related to living and working in space.

Faith Permeation Ideas:

- Space belongs to everyone. We explore it to expand our knowledge, and benefit all mankind, not for exploitation or military advantage. Ask students, "Who owns space and the objects in space? Whoever gets there first? Whoever is more powerful? Whoever claims it now?"

Faith Permeation Resources:

- Appendix A: especially Catechism of the Catholic Church #340, 341, 344 and the Compendium of the Catechism of the Catholic Church #51
- Appendix G: Background information and articles relating to the notion that space belongs to all people.

Teacher Catholic Faith Integrations Reflections What have I learned about teaching this unit?	
Subject: Gr. 6 Science	**Unit: Our Solar System**

What permeation ideas worked well in this unit?

How well did the permeation prompts engage the students?

Describe how the faith permeation prompts helped your students to grow in understanding the Catholic faith.

As a teacher, describe how the faith permeation prompts helped you to grow in understanding the Catholic faith.

It would have been good to have...

If I adapted / modified this unit I would...

General Comment:

Appendix A – Additional Resources

Catechism of the Catholic Church

340 God wills the *interdependence of creatures*. 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.
341 The *beauty of the universe*: 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.
344 There is a *solidarity among all creatures* arising from the fact that all have the same Creator and are all ordered to his glory: May you be praised, O Lord, in all your creatures, especially brother sun, by whom you give us light for the day; he is beautiful, radiating great splendor, and offering us a symbol of you, the Most High. . .

> *May you be praised, my Lord, for sister water, who is very useful and humble, precious and chaste. . .*
> *May you be praised, my Lord, for sister earth, our mother, who bears and feeds us, and produces the variety of fruits and dappled flowers and grasses. . .*
> *Praise and bless my Lord, give thanks and serve him in all humility.*[212]

2116 All forms of *divination* are to be rejected: recourse to Satan or demons, conjuring up the dead or other practices falsely supposed to "unveil" the future. Consulting horoscopes, astrology, palm reading, interpretation of omens and lots, the phenomena of clairvoyance, and recourse to mediums all conceal a desire for power over time, history, and, in the last analysis, other human beings, as well as a wish to conciliate hidden powers. They contradict the honor, respect, and loving fear that we owe to God alone.

Compendium of the Catechism of the Catholic Church
445. What does God prohibit by his command, "You shall not have other gods before me" (*Exodus* 20:2)?
This commandment forbids:

> ... *Superstition* which is a departure from the worship due to the true God and which also expresses itself in various forms of divination, magic, sorcery and spiritism.

3. How is it possible to know God with only the light of human reason?
Starting from creation, that is from the world and from the human person, through reason alone one can know God with certainty as the origin and end of the universe, as the highest good and as infinite truth and beauty.
29. Why is there no contradiction between faith and science?
Though faith is above reason, there can never be a contradiction between faith and science because both originate in God. It is God himself who gives to us the light both of reason and of faith.

> *"I believe, in order to understand; and I understand, the better to believe."* (Saint Augustine)

51. What is the importance of affirming "In the beginning God created the heavens and the earth" (*Genesis* 1:1)?
The significance is that creation is the foundation of all God's saving plans. It shows forth the almighty and wise love of God, and it is the first step toward the covenant of the one God with his people. It is the beginning of the history of salvation which culminates in Christ; and it is the first answer to our fundamental questions regarding our very origin and destiny.

54: How did God create the universe?
God created the universe freely with wisdom and love. The world is not the result of any necessity, nor of blind fate, nor of chance. God created "out of nothing" (*ex nihilo*) (2 *Maccabees* 7:28) a world which is ordered and good and which he infinitely transcends. God preserves his creation in being and sustains it, giving it the capacity to act and leading it toward its fulfillment through his Son and the Holy Spirit.

216: What is the hope of the new heavens and the new earth?
After the final judgment the universe itself, freed from its bondage to decay, will share in the glory of Christ with the beginning of "the new heavens" and a "new earth" (*2 Peter* 3:13).

On authority and the passing on of Revelation: (see also # 11-15)

16. To whom is given the task of authentically interpreting the deposit of faith?
The task of giving an authentic interpretation of the deposit of faith has been entrusted to the living teaching office of the Church alone, that is, to the successor of Peter, the Bishop of Rome, and to the bishops in communion with him. To this Magisterium, which in the service of the Word of God enjoys the certain charism of truth, belongs also the task of defining dogmas which are formulations of the truths contained in divine Revelation. This authority of the Magisterium also extends to those truths necessarily connected with Revelation.

17. What is the relationship between Scripture, Tradition and the Magisterium?
Scripture, Tradition, and the Magisterium are so closely united with each other that one of them cannot stand without the others. Working together, each in its own way, under the action of the one Holy Spirit, they all contribute effectively to the salvation of souls.

Scripture: (New Revised Standard Version)

- Wisdom 13:5 For from the greatness and beauty of created things comes a corresponding perception of their Creator.

Majesty of Creation:

- Ecclesiasticus 18:1-2: He who lives for ever created the whole universe; the Lord alone is just.
- Genesis 1.16: God made the two great lights—the greater light to rule the day and the lesser light to rule the night—and the stars.
- Ecclesiasticus 42.17: The Lord has not empowered even his holy ones to recount all his marvellous works, which the Lord the Almighty has established so that the universe may stand firm in his glory.
- Psalm 8:3-4: When I look at your heavens, the work of your fingers, the moon and the stars that you have established; what are human beings that you are mindful of them, mortals that you care for them?
- Job 31.26: if I have looked at the sun when it shone, or the moon moving in splendour,
- Job 25.5: If even the moon is not bright, and the stars are not pure in his sight,
- Psalm 104.19: You have made the moon to mark the seasons; the sun knows its time for setting.
- Psalm 148.3: Praise him, sun and moon; praise him, all you shining stars!
- Daniel 3:62-63: Sun and moon, bless the Lord; praise and exalt him above all forever. Stars of heaven, bless the Lord; praise and exalt him above all forever. *(Note: This text comes from the Deuterocanonical addition to the book of Daniel (found only in Catholic bibles), and could lead do a discussion about the canon of scripture and authority in the Church. See Compendium # 20.)*

God is Lord and Master of the Heavens:

- Joshua 10.13: And the sun stood still, and the moon stopped, until the nation took vengeance on their enemies. Is this not written in the Book of Jashar? The sun stopped in mid-heaven, and did not hurry to set for about a whole day.
- Job 26.9: He covers the face of the full moon, and spreads over it his cloud.
- Isaiah 24.23: Then the moon will be abashed, and the sun ashamed; for the Lord of hosts will reign
- Ezekiel 32.7: When I blot you out, I will cover the heavens, and make their stars dark; I will cover the sun with a cloud, and the moon shall not give its light.
- Luke 23:44-45: It was now about noon, and darkness came over the whole land until three in the afternoon, while the sun's light failed;
- Isaiah 38:8: 'I will make the shadow cast by the sun go back the ten steps it has gone down on the stairway of Ahaz.' So the sunlight went back the ten steps it had gone down.
- Joel 3:15: The sun and moon will be darkened, and the stars no longer shine.

Creation is to lead us to God, not other beliefs:

- Deuteronomy 4.19:And when you look up to the heavens and see the sun, the moon, and the stars, all the host of heaven, do not be led astray and bow down to them and serve them, things that the Lord your God has allotted to all the peoples everywhere under heaven.
- Colossians 2.8: See to it that no one takes you captive through philosophy and empty deceit, according to human tradition, according to the elemental spirits of the universe, and not according to Christ.
- Deuteronomy 17:2b-3: a man or woman who does what is evil in the sight of the Lord your God, and transgresses his covenant 3by going to serve other gods and worshipping them—whether the sun or the moon or any of the host of heaven, which I have forbidden –
- Isaiah 47.13: You are wearied with your many consultations; let those who study the heavens stand up and save you, those who gaze at the stars and at each new moon predict what shall befall you.

Other quotes:

- Philippians 2: 14-15: Do all things without murmuring and arguing, so that you may be blameless and innocent, children of God without blemish in the midst of a crooked and perverse generation, in which you shine like stars in the world.
- Preface V for Sundays in Ordinary Time:

All things are of your making, all times and seasons obey your laws, but you chose to create us in your own image, setting us over the whole world in all its wonder.
You made us the stewards of creation, to praise you day by day for the marvels of your wisdom and power, through Jesus Christ our Lord.

- "You get yourself out there in space and say to yourself: that's home. That's the only home we have, and the only one we're going to have for a long time."

- Edgar Dean Mitchell, Apollo 14 astronaut

- "This is a present from a small distant world … We are attempting to survive our times so that we may live into yours.

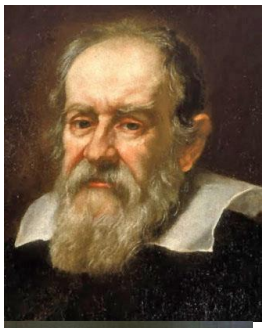
- recorded message on board the Voyager space probe

"The aim of publically funded science is to promote the common good. The goal of corporately funded science is to maximize profits for their shareholders. There are dangers in mixing commerce with education and research."

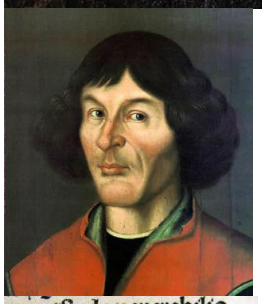
- Rev Sean McDonagh SSC From the article "When it comes to biotechnology, money talks" in the Prairie Messenger, vol.87, No.5, June 24, 2009)

Appendix B - Some Catholic Scientists who studied space with the eyes of faith

Copyright Notice: Links embedded in the name of the scientist and the photo point to one of two sources used:
1) Wikipedia, where text is covered under the Creative Commons Attribution/Share-Alike License 3.0.
Images themselves are from the Wikimedia Commons.
2) The Catholic Encyclopaedia Online: http://www.newadvent.org/cathen/ , used with permission.



Galileo Galilei (1564-1642) Physician and astronomer who was famously condemned by the church for his theory that the earth revolved around the sun, but he was a devout Catholic himself.



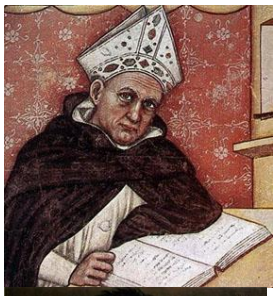
Nicholas Copernicus (1473-1543) : first proposed the theory of the earth revolving around the sun (the Copernican Theory) for which Galileo was condemned, but unlike Galileo, Copernicus taught it as theory not fact so his Catholic status remained untouched.

Bede, the Venerable (c.672–735) Catholic monk who wrote two works on "Time and its Reckoning." This primarily concerned how to date Easter, but contained a new recognition of the "progress wave-like" nature of tides. He was an influence early medieval knowledge of the natural world.

Pope Sylvester II (c.950–1003 A scientist and book collector, he influenced the teaching of math and astronomy in church-run schools

Hermann of Reichenau (1013–1054) He wrote on geometry, mathematics, and the astrolabe. (used to locate and predict the positions of the Sun, Moon, planets, and stars; determine local time given local latitude and vice-versa). He composed many religious hymns.

Albertus Magnus (c.1193–1280) Also known as Pope St. Albert the Great. Patron saint of scientists. He was proficient in every branch of learning cultivated in his day. He proved to the world that the Church is not opposed to the study of nature, that faith and science may go hand in hand.



Johannes Kepler (1571–1630) His first model of the cosmos was explicitly driven by religious ideas; his later and most famous scientific contribution was the Kepler's laws of planetary motion. He had wanted to be a theologian at one time and his Harmonice Mundi discusses Christ at points.

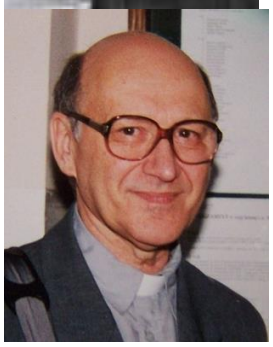
Anton Maria Schyrleus of Rheita (1597-1660) Capuchin astronomer. He dedicated one of his astronomy books to Jesus Christ, a "theo-astronomy" work was dedicated to the Blessed Virgin Mary, and he wondered if beings on other planets were "cursed by original sin like humans are."

Juan Caramuel y Lobkowitz (1606-1682) Cistercian monk who did work on Combinatorics and published astronomy tables at age 10. He also did works of theology and sermons.

Temple Chevallier (1794-1873): Priest and astronomer who did important observations of sunspots. He wrote "*Of the proofs of the divine power and wisdom derived from the study of astronomy*" and translated the works of the Church Fathers Clement of Alexandria, Polycarp and Ignatius of Antioch. He also founded the Durham University Observatory.

E. T. Whittaker (1873-1956): Converted to Catholicism in 1930 and member of the Pontifical Academy of Sciences. His 1946 Donnellan Lecture was entitled "*Space and Spirit. Theories of the Universe and the Arguments for the Existence of God."*

Georges Lemaître (1894-1966): Roman Catholic priest who first proposed the "Big Bang" theory.



Michał Heller: (born 1936): He is a Catholic priest, a member of the Pontifical Academy of Theology, a founding member of the *International Society for Science and Religion.'* His cross-disciplinary book Creative Tension: Essays on Science and Religion came out in 2003. For this work he won a Templeton Prize. He teaches at Kraków.

Giuseppe Maria Asclepi (1706 – 1776) was an Italian astronomer and physician. He was a Jesuit and director of the observatory at the Collegio Romano.

Brother **Guy J. Consolmagno**, SJ (born September 19, 1952 in Detroit, Michigan), is an American research astronomer and planetary scientist at the Vatican Observatory.

Urbain Leverrier (1811-1877): discovered the planet Neptune. Always a faithful and active Catholic, when dying he said in the words of the aged Simeon: "Now Lord, you let your servant go in peace."

Appendix C - The Liturgical Calendar

- Compendium **of the Catechism of the Catholic Church**

  242. What is the function of the liturgical year?

  In the liturgical year the Church celebrates the whole mystery of Christ from his Incarnation to his return in glory. On set days the Church venerates with special love the Blessed Virgin Mary, the Mother of God. The Church also keeps the memorials of saints who lived for Christ, who suffered with him, and who live with him in glory.

- Apostolic Letter, ***Tertio Millennio Adveniente,*** Of His Holiness Pope John Paul Ii For The Jubilee Of The Year 2000

  10. *In Christianity time has a fundamental importance*. Within the dimension of time the world was created; within it the history of salvation unfolds, finding its culmination in the "fullness of time" of the Incarnation, and its goal in the glorious return of the Son of God at the end of time. *In Jesus Christ, the Word made flesh, time becomes a dimension of God,* who is himself eternal. With the coming of Christ there begin "the last days" (cf. *Heb* 1:2), the "last hour" (cf. *1 Jn* 2:18), and the time of the Church, which will last until the Parousia.

  From this relationship of God with time there arises *the duty to sanctify time*. This is done, for example, when individual times, days or weeks, are dedicated to God, as once happened in the religion of the Old Covenant, and as happens still, though in a new way, in Christianity. In the liturgy of the Easter Vigil the celebrant, as he blesses the candle which symbolizes the Risen Christ, proclaims: "Christ yesterday and today, the beginning and the end, Alpha and Omega, all time belongs to him, and all the ages, to him be glory and power through every age for ever". He says these words as he inscribes on the candle the numerals of the current year. The meaning of this rite is clear: it emphasizes the fact that *Christ is the Lord of time;* he is its beginning and its end; every year, every day and every moment are embraced by his Incarnation and Resurrection, and thus become part of the "fullness of time". For this reason, the Church too lives and celebrates the liturgy in the span of a year. *The solar year is thus permeated by the liturgical year*, which in a certain way reproduces the whole mystery of the Incarnation and Redemption, beginning from the First Sunday of Advent and ending on the Solemnity of Christ the King, Lord of the Universe and Lord of History. Every Sunday commemorates the day of the Lord's Resurrection.

Liturgical Year:

For Sundays and other special days throughout the church year, there are three sets of readings assigned to Liturgical Years A, B, and C. Years which are evenly divisible by 3 are assigned year C, such as 2010. Bear in mind that Liturgical Years start on the first Sunday of Advent of the previous year, so November 30th, 2008 started Liturgical Year B for 2009.

Liturgical Cycle:

For weekdays in ordinary time and other special days throughout the church year, there are two sets of readings assigned to Liturgical Cycles I and II. Odd years are assigned cycle I, and even years are assigned cycle II. Bear in mind that Liturgical Cycles also start on the first Sunday of Advent.

Seasons of the Liturgical Year:

- The liturgical year begins 4 weeks before Christmas with **Advent** season -- a time to prepare for the birth of Jesus Christ. The word Advent originated from the Latin word "venio" meaning to come. The season starts four Sundays prior to Christmas day. The beginning of the Advent season is also considered the start of the liturgical year.Advent is a time of expectant waiting when we reflect on the coming of Jesus. The faithful prepares with great anticipation and solemnity.
- **Christmas** season begins at the sunset of Christmas Eve and ends on the Solemnity of the Epiphany. Christmas came from the word the Old English word, Cristes Maesse or Christ's Mass. It has become known as The Twelve Days of Christmas because there are twelve days in this season. The Church celebrates God's embodiment as a human being through Jesus Christ. As the Son of God, Jesus was born on earth to save us.
- There are two periods of **Ordinary Time**, the first from the close of Christmas season until Ash Wednesday. *Note that "Ordinary" comes from "ordered," meaning "numbered" or set in a particular progression with a purpose, and not simply "plain" or "commonplace."* The gospel readings of Matthew, Mark and Luke are read to reflect on Jesus' life, his teachings and ministry.
- Ash Wednesday marks the beginning of the season of **Lent**, a forty-day period of reflection, penance and fasting before Easter Sunday. The word 'Lent' originated from the Latin word Quadragesima, meaning forty days. The season starts on Ash Wednesday. Marking the foreheads with ashes reminds the faithful the virtue of humility and the transient nature of life on Earth.
- **Holy Week,** or the last week of Lent, is a time to venerate and reflect on Jesus' suffering, crucifixion and death. Palm Sunday marks the beginning of Holy Week. It celebrates the Triumphal Entry of Jesus into Jerusalem. The **Paschal Triduum** (*"Three Days"*) begins after the Lord's Supper on Holy Thursday. We celebrate the suffering, death and resurrection of the Lord and it is the high point of the liturgical year. Easter Sunday, the celebration of the resurrection of Christ, marks the start of the **Easter** season. During the Easter season, we focus on the new life we have received in the resurrection of the Lord. It is a time of thanksgiving and joy and symbolized by the color of white illustrating new life, triumph and glory.which continues as a time of celebration for 50 days until Pentecost Sunday when the Church commemorates the descent of the Holy Spirit upon the Apostles fifty days after the resurrection of Christ. Pentecost Sunday marks the start of the second period of **Ordinary Time**, which continues until the **Advent** season begins again.
    - the Date of Easter affects other movable feasts: Ascension Thursday (which is always the date of World Catholic Education Day) is 40 days after Easter, (moved to the following Sunday in Canada), Pentecost Sunday is 50 days after Easter, (if Easter is Day1), Trinity Sunday is the Sunday following Pentecost and Corpus Christi or the "Body and Blood of Christ" is the Sunday following Trinity Sunday.

      "According to this rule, Easter Sunday is the first Sunday which occurs after the first full moon (or more accurately after the first fourteenth day of the moon) following the 21st of March. As a result, the earliest possible date of Easter is 22 March, the latest 25 April."

Catholic Encyclopedia; http://www.newadvent.org/cathen/05228a.htm

- The date of Christ's birth is often based on calculations of a lunar eclipse

See for example http://www.ewtn.com/library/scriptur/chrdat.txt

Note that Christmas, unlike Easter, does not always fall on a Sunday, but rather on December 25th, as January 1st is always the Feast of Mary, Mother of God. The day

for Christmas does affect the date for the Feast of Holy Family: the Sunday after Christmas (but omitted if Christmas is on a Sunday), Epiphany (the 12th day of Christmas or January 6th, (moved to the first Sunday after January 2nd in Canada) and the Feast of the Baptism of the Lord on the Sunday after Epiphany (unless January 6th is on a Sunday in which case it is omitted).

- A comet is often associated with the Star if Bethlehem :
  "Astronomical and historical evidence suggests that the Star of Bethlehem was a comet which was visible in 5 BC, and described in ancient Chinese records. A comet uniquely fits the description in Matthew of a star which newly appeared, travelled slowly through the sky against the star background and stood over Bethlehem. It is proposed that a remarkable sequence of three astronomical events stimulated the journey of Magi: the triple conjunction of Saturn and Jupiter in 7 BC; the massing of the three planets Saturn, Jupiter and Mars in 6 BC; and finally the appearance in 5 BC of the star of Bethlehem, a comet initially in Capricornus."
  - Humphreys, C. J. , University of Cambridge, Quarterly Journal of the Royal Astronomical Society, 1991, vol. 32, n°4, pp. 389-407

Liturgical Colors:

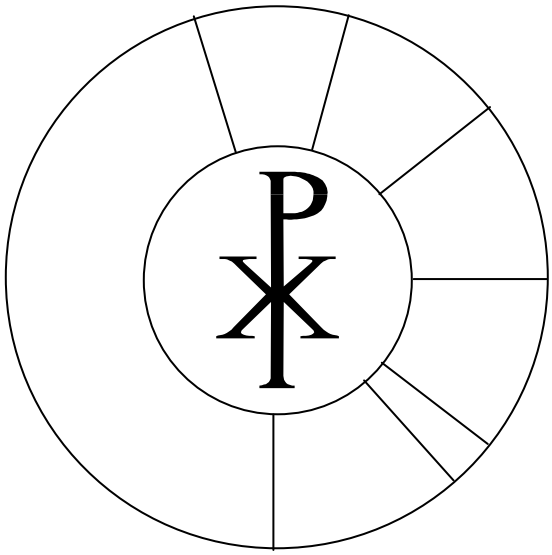
- ***Advent*** - Purple. On the Third Sunday of Advent ("Gaudete Sunday"), Rose symbolizing joy is used.
- ***Christmas*** - White or Gold.
- ***Lent*** – Purple symbolizing penance. On the 5th Sunday of Lent ("*Laetare Sunday*"), Rose is used.
- R*ed* on **Passion/Palm Sunday**.
- Easter Triduum - *White or Gold* on ***Holy Thursday*** and at the ***Easter Vigil***. *Red on* **Good Friday** for the blood of Jesus.
- ***Easter Season*** - White *or* Gold symbolizing new life. Red for **Pentecost Sunday**, reminding us of the flame of the Holy Spirit.
- ***Ordinary Time*** – Green symbolizing hope, except for special colors on particular feasts or occasions:
  - White - Solemnities of the Lord and the Saints; major local feasts; funeral liturgies (Black is also used).
  - Red - Feasts of the **Apostles**, **Martyrs**, or the **Holy Spirit**.

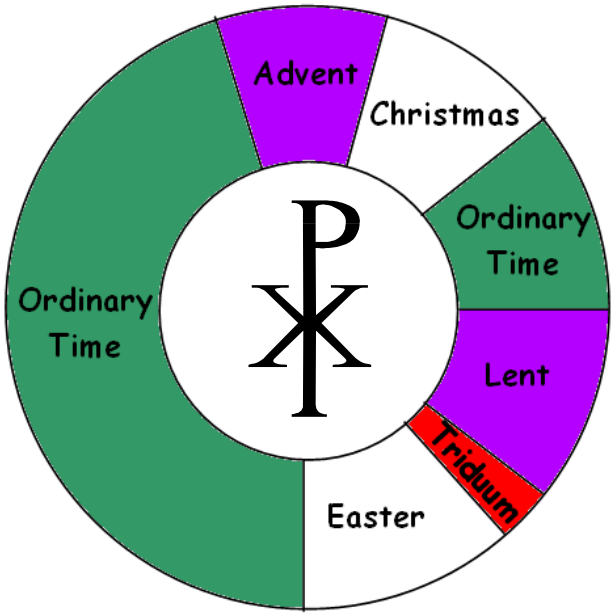
References:

- http://www.easterbrooks.com/personal/calendar/index.php
- http://ourlittlealphacorner.blogspot.com/2007/08/liturgical-year-cycles-seasons-colours.html
- http://www.olphtoronto.com/Prayer_spirituality/seasons_liturgical.php (This link, from Our Lady of Perpetual Help Parish in Toronto, also provides links to readings for each liturgical season.)

- There are some printable activities for the Liturgical Year and a clickable graphic of the Liturgical Year at this site:
  http://www.cyberfaith.com/liturgical_year.cfm
- The Liturgical Calendar
  http://www.wf-f.org/LiturgicalCalendar-info.html
- Seasons of the Liturgical Year
  http://www.catholicculture.org/lit/calendar/season.cfm
- Church Seasons: Mark Your (Liturgical) Calendar
  http://www.americancatholic.org/Newsletters/YU/ay1299.asp
- Meaning of Liturgical Colors
  http://www.catholic.org/clife/lcolors.php

The Liturgical Year is often represented as a circle. A blank template is provided if you want to quiz your students on the seasons of the Church year.





Appendix D: Solar System

Introduction: Our Solar System is immense in size by normal standards. We think of the planets as revolving around the Sun, but cannot really appreciate just how far each planet is from the Sun, let alone the distance between stars. Astronomers use the distance from the Sun to the Earth as one "astronomical unit" to make it easier to understand the relative distances of the other planets from the Sun.

Vocabulary: Astronomical Unit - 1 AU = approximately 150 million kilometres (93 million miles)

Activity: We will make a model of the Solar System to scale for distance (not for size of planets - at this scale, the sun would only be 1mm wide, and the planets would be invisible dots!) The chart below shows the planets and asteroid belt with their distance from the Sun in astronomical units.

Let's use 10 cm to represent one astronomical unit. Fill in the table to show how many centimetres each planet will be from the Sun. Start your model by cutting a piece of string 4.5 m long. Attach a label at one end of the string to identify the Sun. Use the distances in cm that you have calculated in the chart below to measure the distance from the Sun on the string to the appropriate planet and attach a label for each planet. For easy transportation, wrap your string Solar System around a cardboard tube.

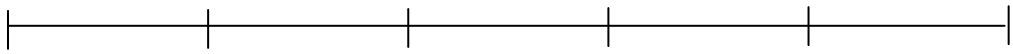
Planet	AU	Scale value (cm)
Sun	0.0 AU	_____ cm
Mercury	0.4 AU	_____ cm
Venus	0.7 AU	_____ cm
Earth	1.0 AU	_____ cm
Mars	1.5 AU	_____ cm
Asteroid belt	2.8 AU	_____ cm
Jupiter	5.0 AU	_____ cm
Saturn	10.0 AU	_____ cm
Uranus	19.0 AU	_____ cm
Neptune	30.0 AU	_____ cm
Pluto	39.0 AU	_____ cm

Consider that if you were traveling at the speed of light (300,000 km/sec.), it would take 8 minutes to travel from the Sun to the Earth (1 AU). It would take 4.3 years to reach the next nearest star, Alpha Centauri!

Appendix E: Geological Time Scale

Imagine $5 billion! What would all that money look like? How much space would it take up? How long would it take to spend it? Can you imagine 5 billion years of time on Earth? A lot could happen in all that time?

Simplified time line of the Earth: **B**illion **Y**ears **A**go (bya):



Creation	Bacteria	Oxygen	plants-people
4.5 bya	3.8 bya	2 bya	0.4bya-0.007 bya

The Earth has a long history nearly 5 billion years long! Understanding geological time and the large numbers is hard. It helps to place events in the order in which they happened on a time line. Here are some of the key events of the history of the Earth.

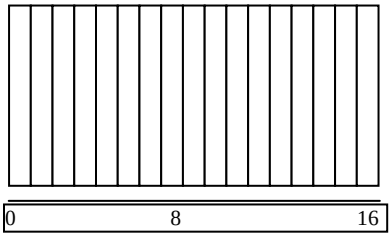
Years Ago	Billions of Years Ago	Event
4,600,000,000	4.6	Creation of the Earth
3,800,000,000	3.8	First cells (without a nucleus) appear
3,700,000,000	3.7	No free oxygen yet.
2,200,000,000	2.2	Cyanobacteria produce oxygen
2,000,000,000	2.0	Oxygen accumulates, forcing cells to adapt to using it
1,400,000,000	1.4	Complex cells (with a nucleus) appear
1,000,000,000	1.0	Even more complex cells appear
700,000,000	0.7	Multicellular plants and animals
600,000,000	0.6	Marine invertebrates appear
500,000,000	0.5	Earliest fish appear
380,000,000	0.380	Oxygen at 20% of atmosphere (same as today)
350,000,000	0.350	First amphibiens appear
300,000,000	0.3	First Trees appear
235,000,000	0.235	First Reptiles appear
220,000,000	0.220	Dinosaurs appear
40,000,000	0.040	Flowering plants
65,000,000	0.065	Extinction of dinosaurs; birds appear
3,000,000	0.003	Human-like animals appear
50,000	0.00005	Homo sapiens (modern humans) appear

Review the difference between 1 million and 1 billion so students are aware that 1,000,000 is the same as 1000 multiplied by 1000; and that 1 billion equals 1000 millions.

To help students realize just how large the numbers used in geological time are, students will place some events of their own lives on a human time line. The time line will be measured in both years and seconds. After they have done their own time lines, they will place the major geological events of the Earth on a time line. After students have made their time lines, you may want to discuss these questions. What can we learn from a time line?

- Did all living things appear on Earth at the same time?
- Why do you think so much time separates the major events?
- Why is the appearance of oxygen so important?
- How does the length of time living ferns have been on Earth compare with the age of the Earth itself?
- Scientists estimate the Earth was formed about 5 billion years ago (bya), but humans appeared only 50,000 years ago. How long did it take before life on Earth resembled what we know today? Did the events occur quickly? Were they evenly spread over time, or were they clustered at various points? How can you illustrate this?

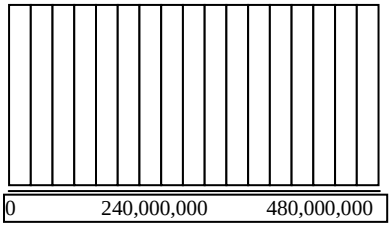
1.Think about your life. How long have you been on Earth? Suppose you are 12 years old and a piece of paper represents your life. Fold the paper in half lengthwise and then in half twice again. Put a mark on each of the creases. Each section represents 1 year of your life (even though you are not yet 16!) Label the bottom left hand side of the tape as 0 years and then label the first section as 1 year and so forth until the last section labelled is 16 years..



Human time line in years.

Think of some important events that have happened in your life - your birth, first bicycle, first plane ride, starting school, learning to swim, major illnesses, special awards, first date, trips, and new siblings. Mark where these events took place on your time line. This is your life in years. What do you think this same time line would look like in seconds?

2. Can you predict how old you are in seconds? Hint: 1 year = 30,000,000 seconds and 10 years = 300,000,000 seconds. Above the 1-year mark, write 30,000,000 seconds. Mark each section of your time line at the top in seconds for each year.



Human time line in seconds.

3. How old were you in seconds when some important events happened? What do you think about these numbers compared to using years?

When scientists deal with the history of the Earth, they must work with numbers of years even bigger than the number of seconds in your life.

4. Tape a 5-meter piece of cash register tape to the wall. It represents 5 billion years of the Earth's history. Mark the meters on the tape. 1 meter represents 1 billion years, so each millimetre represents what? (1000 years)

5. Mark where you think the following events might have taken place on your timeline of the earth:

- Origin of the Earth
- First cells without nuclei appear
- First birds appear
- Oxygen in the atmosphere
- Trees appear
- Dinosaurs appear
- Mammals appear
- Humans appear
- First cells with nuclei appear
- First multicellular organisms appear

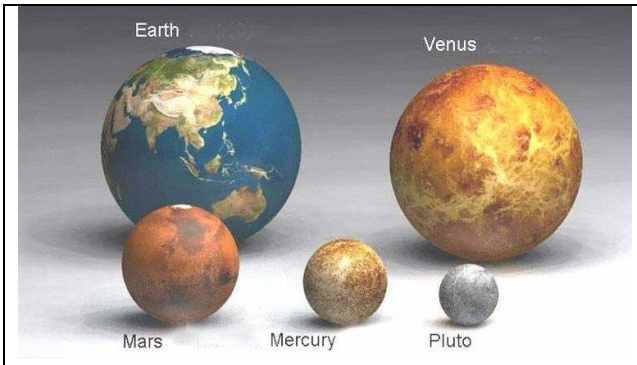
7. Compare your guesses with other groups.

8. Now check your answers against the table shown above. What Did You Find Out?

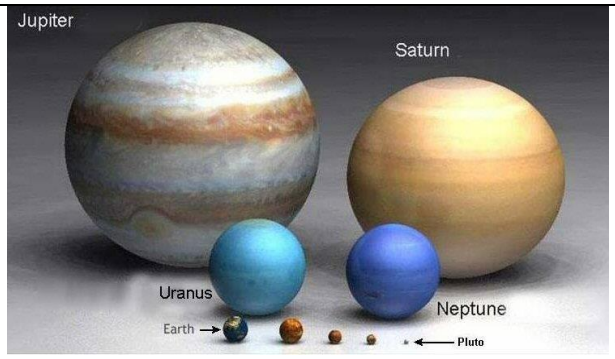
Appendix F: Size Comparison of Astronomical Objects

These images can be found on quite a few internet sites, for example,
http://www.quantrek.org/size_comparison/size_comparison.htm

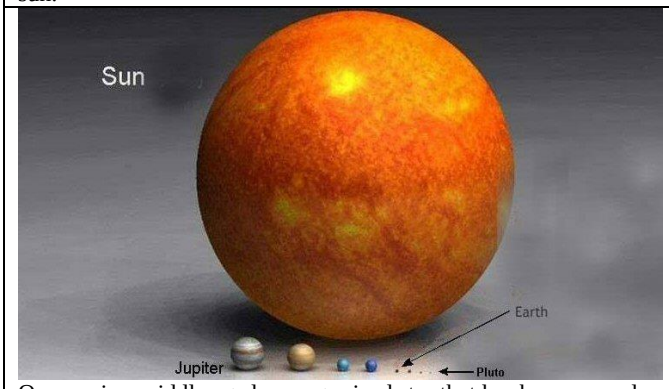
The size of astronomical objects are so large and the distances are so great that they quickly exceed human comprehension. Each picture below shows increasingly larger objects as one moves further from the earth.



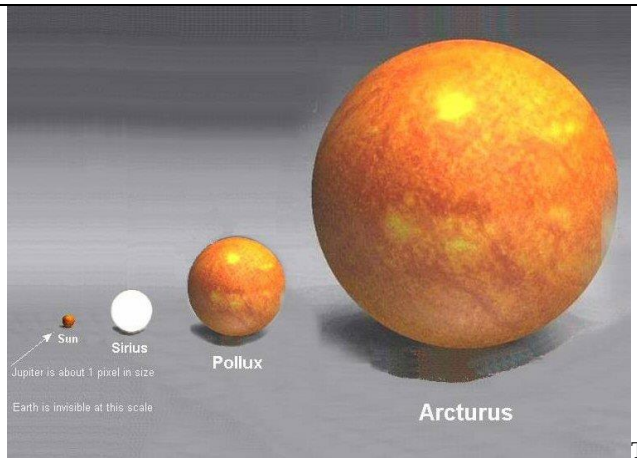
Inner planets of the solar system. These planets are the most dense in the solar system and, with the exception of Pluto, closest to the sun.



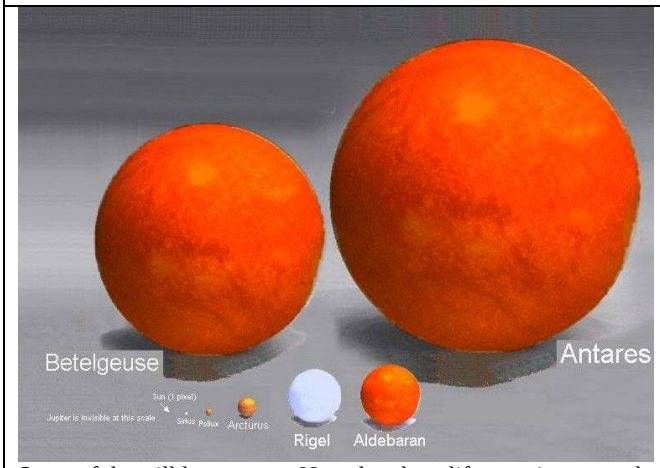
The outer planets (gas giants) of our solar system. They consist largely of frozen gases and are consequently the least dense in the solar system. However due to the extremely large masses they exert very strong gravitational force compared to the inner planets.



Our sun is a middle aged average sized star that has been around for about 5 billion years. it will use up all its fuel in another 4.5 Billion years.

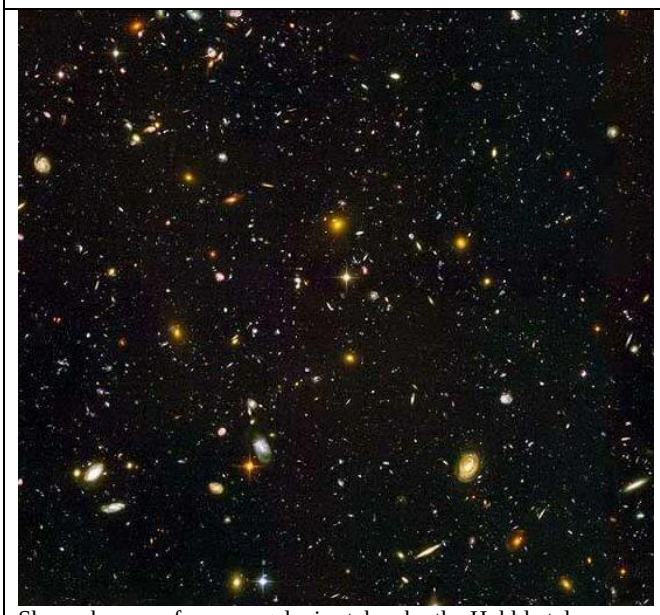
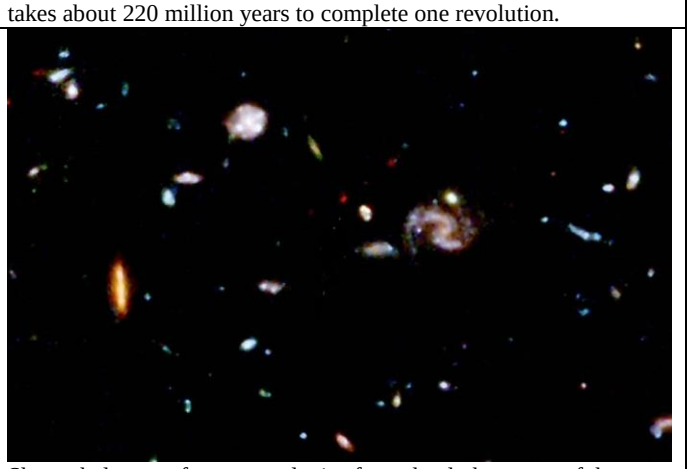


The size of our sun (smallest sphere in the lower left) compared to other nearby stars:



Some of the still larger stars. Note that there life span is extremely short (millions of years) compared to our sun because they must burn hydrogen fuel at a prodigious rate to balance against the

Shown here is the Milky Way galaxy - home of our solar system including the sun and all the planets. It is a spiral galaxy which is

incredibly strong gravitational force trying to compact the star because of their huge masses.	home to between 200 - 400 billion stars (many of which most likely have their own planetary systems). The diameter of our galaxy is about 100,000 light years. Our sun is located on one of the smaller spiral arms of our galaxy within the outer region. Our whole solar system is orbiting the galactic center in a near circular orbit that takes about 220 million years to complete one revolution.
 Shown here are far away galaxies taken by the Hubble telescope billions of light years from earth. There are billions of galaxies in the universe and each one contains billions of stars like the ones shown in the previous pictures. The closest distance between the earth and the nearest star in our own galaxy is 4.5 light years away. The distance our own milky way galaxy and our neighboring galaxies are several hundred thousand to millions of light-years away from the earth. The nearest large galaxy is about 2.9 million light years away.	 Shown below are far away galaxies from the darkest area of the picture above. Given the immense distances, the speed of light and the time elapsed since the Big Bang, we can only see huge extremely bright objects up to approximately 14.5 billion light years away or slightly less than the estimated age of the universe. As we look at these distant objects we are looking back in time because light travels at a finite speed (3 x 108 meters/second) and consequently the incredible time it takes light to travel these immense distances to reach earth.

Appendix G: Space Belongs to All

- Space exploration is to improve the human condition, not for exploitation.
  - see for example, J.P. II
  http://www.vatican.va/holy_father/john_paul_ii/speeches/1984/october/documents/hf_jp-ii_spe_19841002_pontificia-accademia-scienze_en.html
    - 2. …Other great scientists such as Kepler and Newton likewise searched the heavens with the spirit of believers. Poets and philosophers such as Pascal contemplated with awe the mysterious silence of outer space.
    - 3. …a symbol of his ever restless desire for knowledge
    - 6. One of the biggest tasks that can be carried out by the use of satellites is the elimination of illiteracy.
    - 8. Modern space technology properly understood also provides observations useful for the cultivation of the earth, far beyond anything that can be done by any system working on the earth's surface.
- An excellent article on the militarization of space at :
  http://www.globalissues.org/article/69/militarization-and-weaponization-of-outer-space

  begins with these two contrasting quotes:

  "The exploration and use of outer space … shall be for peaceful purposes and shall be carried out for the benefit and in the interest of all countries, irrespective of their degree of economic or scientific development. … [The] prevention of an arms race in outer space would avert a grave danger for international peace and security"

  — *Prevention of an arms race in outer space*, *United Nations General Assembly Resolution, A/RES/55/32, January 2001.*

  "It's politically sensitive, but it's going to happen. Some people don't want to hear this, and it sure isn't in vogue, but—absolutely—we're going to fight in space. We're going to fight from space and we're going to fight into space. That's why the US has development programs in directed energy and hit-to-kill mechanisms. We will engage terrestrial targets someday—ships, airplanes, land targets—from space."

  Commander-in-Chief of US Space Command, Joseph W. Ashy, Aviation Week and Space Technology, August 9, 1996
- See also, for example, the Roman curial document:
  http://www.vatican.va/roman_curia/secretariat_state/documents/rc_seg-st_doc_19990721_unispace-iii_en.html
- The Vatican Observatory is, in its historical roots and traditions, one of the oldest astronomical institutes in the world. See their Web page at: http://vaticanobservatory.org/

Appendix H: Church and Science

- For an article that discusses the "myth" of conflict between Church and Science: http://www.scientus.org/

Or: http://www.bede.org.uk/conflict.htm

- For an excellent article on Galileo and the Church: http://www.christiananswers.net/q-eden/galileo.html
- Or another on Galileo from the Faraday Institute for Science and Religion out of Cambridge Universtiy:

http://www.st-edmunds.cam.ac.uk/faraday/Papers.php

This institute also has an paper on the topic "Age of the Earth" – the controversy over biblical and scientific explanations of the origin of the universe.

- The Catholic Encyclopedia has a long, rather philosophical but very informative and complete article on the relationship of Faith and Science:

http://www.newadvent.org/cathen/13598b.htm

- The dispute between Galileo and the Catholic Church

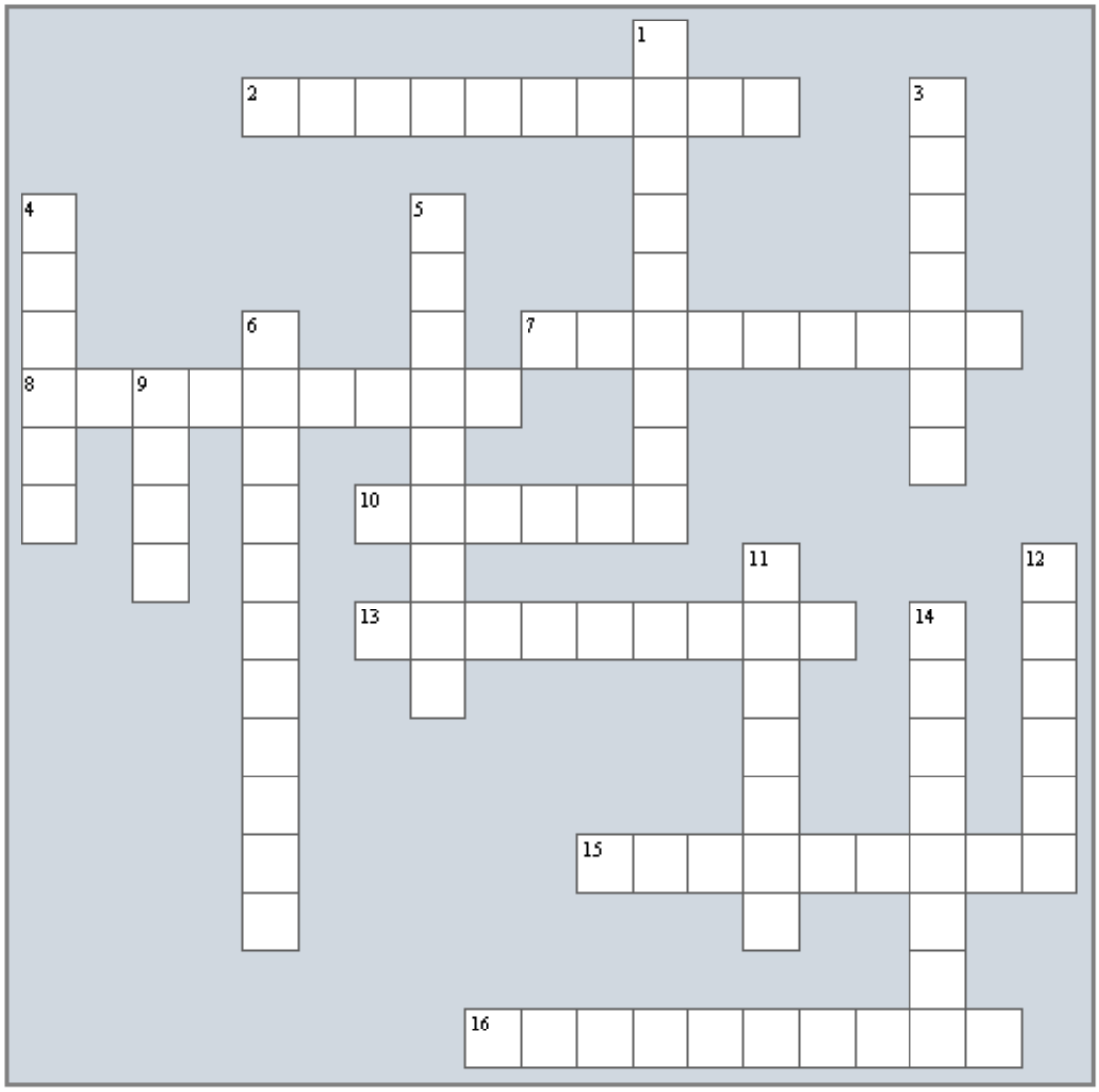
DONALD DEMARCO
http://www.catholiceducation.org/articles/science/sc0043.html

- The Genesis Controversy

George Sim Johnston
http://catholiceducation.org/articles/science/sc0001.html

Appendix I: Catholic Astronomers Crossword

Name: _____



Across

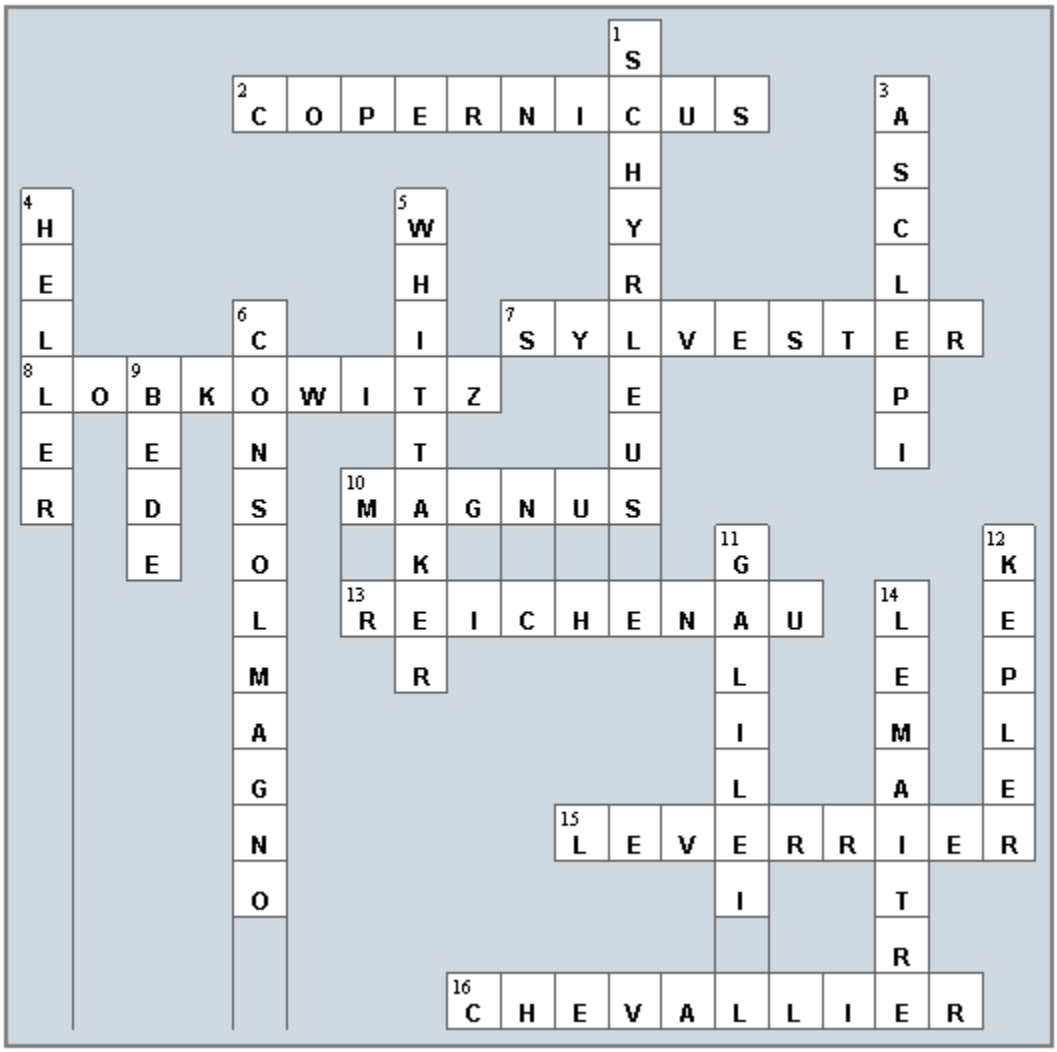
2. First proposed the theory of the earth revolving around the sun.
7. A Pope who promoted astronomy in Catholic schools.
8. Developed astronomy tables at age 10.
10. His name means "Great" for he was proficient in all areas of learning.
13. Composed many religious hymns.
15. Discovered Neptune
16. A priest who studied sunspots.

Down

1. Dedicated one of his astronomy books to Jesus.
3. An Italian Jesuit astronomer.
4. Wrote essays on science and religion.
5. Wrote about arguments for the existence of God from theories of the universe.
6. A planetary scientist at the Vatican Observatory.
9. Primarily concerned with how to date Easter.
11. Condemned by the Church for arguing that the earth revolves around the sun.
12. Very interested in theology, he developed the laws of planetary motion.
14. A priest who first proposed the "Big Bang" theory.

This crossword puzzle was created by Mel Zimmer with EclipseCrossword. Try it today—it's free!

Answer key:


1 S
2 C O P E R N I C U S
3 A S C L E P I
4 H E L E R
5 W H I T T E N
6 C O W O R K E R S
7 S Y L V E S T E R
8 L O B E L I A
9 B E D E
10 M A G N U S
11 G A U L I L
12 K E P L E R
13 R E I C H E N
14 L E M A I T R
15 L E V E R R I E R
16 C H E V A L L I E R

Appendix J – Integration with Pearson Saskatchewan Science 6

Saskatchewan Science 6 (Pearson)	Suggested integration of faith permeation ideas
LAUNCH: Cosmic Journeys p.224	† See Lesson 1: Vast distances and time spans can give us a glimpse of God's eternal presence and grandeur.
1 Tracking Our Nearest Star p.226	† See Lesson 1: Faith and Science don't have to be in conflict.
2 That Glorious Old Sun p.230	
3 Patterns of Light and Darkness p.234	
4 And the Seasons Go Round and Round p.237	† See Lesson 2: The movement of the earth in space provides the basis for our measurement of secular time as well as the Liturgical Year.
5 Worldviews of the Seasons p.242	
ASK AN ELDER: Ken Goodwill: A Lesson from the Stars and the Moon p.245	
6 The Moon's Changing Face p.246	
7 The Moon on the Move p.249	
8 Earth's Companion p.252	
9 Blackout! p.255	
10 The Inner Planets of Our Solar System p.259	See Lesson 2: A host of factors that make the earth habitable are signs of the hand of God in Creation.
11 The Outer Planets of Our Solar System p.263	See Lesson 1: Just as Science needs governing bodies to regulate accepted teaching, so does the Church need the Magisterium, Scripture and Tradition.
12 Comets, Meteoroids, and Asteroids, Oh My! p.268 ASK AN EXPERT: Dr. Stephanie Cote: Astronomer p.272	
13 Sky Pictures p.273	† See Lesson 2: Astrology, divination and the Church's teaching.
14 What's Happening in Space p.277	† See Lesson 3: Space belongs to everyone.
CAREERS AND PROFILES: Dr. Dafydd Rhys Williams: Astronaut and Physician p.281	
15 Living in Space, the New Frontier p.282	† See Lesson 1: The role of faith in Science fiction.
CAREERS AND PROFILES: Dr. Nicole Buckley: Space Scientist p.285	
DESIGN PROJECT: Space Vehicle p.286	
UNIT 4 Summary p.290	
UNIT 4 Review p.291	