



Saskatchewan Catholic Schools Curriculum Permeation

**REVEALING
CHRIST
IN ALL WE TEACH

SCIENCE 9**

2012

“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.



Science 9 Faith Permeation Essential Connections

Unit Theme: Life Science – Reproduction and Human Development

NOTE: All highlighted/shaded areas indicate faith permeation.

In the provincial curriculum students are asked to take a position on cultural and social issues that surround types of reproductive technologies, biotechnologies and genetic research. They are expected to learn how various social and cultural groups respond to reproductive technologies and biotechnologies such as cloning, in vitro fertilization, artificial insemination and their use. This permeation unit will be concerned chiefly with outcomes RE9.1 indicators (a), (e), (f) and outcome RE9.4 indicators (d), (e), (f).

Catholic Faith Focus for Learning:

Throughout history, the people who make up the Church have wrestled with the many social and moral issues that arise from new contraceptive, reproductive and biomedical procedures and technology. In an age where biotechnologies can affect, shape and even alter the genetic code of any living thing, our students need to develop the skills required to weigh the associated benefits and risks on society, nature and human wellbeing. The way we employ these technologies must be guided by our beliefs, principles and Catholic values. Our conviction as Catholic educators is that the various biotechnologies that the provincial Science curriculum expects Catholic students to learn about must be carefully considered in the light of the gospel and Church teachings.

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

- Any technologies applied to reproduction must respect the value of human life from conception, the integrity of family and the sacrament of marriage.
- Students will understand that “A child is a gift of God, the supreme gift of marriage. There is no such thing as a right to have children (e.g. “a child at any cost”). But a child does have the

right to be the fruit of the conjugal act of its parents as well as the right to be respected as a person from the moment of conception.” (Catechism of the Catholic Church #2378)

- We must never do harm even for the sake of accomplishing something good. We should always treat others with the same love and respect with which we wish to be treated. Everything we do should reflect genuine concern for other people (Gr. 9 *Be With Me* - Unit 4)
- “Scientific, medical, or psychological experiments on human individuals or groups are morally legitimate when they are at the service of the integral good of the person and of society, without disproportionate risks to the life and physical and psychological integrity of the subjects who must be properly informed and consenting.” (Compendium of the Catechism of the Catholic Church #475)
- The use of animals in biotechnology, in research and medicine must be for the good of people. Animals may not be abused or mistreated. Animals, being creatures of God, are under our care as faithful stewards of the earth.

Catholic Faith Essential Skills:

- Students will list and describe the various contemporary reproductive technologies and the Church’s position on these technologies.
- Students will understand the advantages and pitfalls of the various reproductive technologies.
- Students will explain how the dignity of the human person and the value of human life are affected by the development of reproductive technologies.
- Students will learn and appreciate Catholic views on animal biotechnologies.

Catholic Faith Essential Questions:

- What is the Catholic position on contraception, reproductive technologies, genetic modification and biotechnologies?
- How might the use of these technologies positively or negative impact the dignity of the human person?
- How does our belief in the worth of human life guide our decisions regarding contraception, reproductive technologies, genetic modification and biotechnologies?
- How does the virtue of good stewardship guide our use of animal biotechnologies?

Faith Permeation Lessons:

Lesson 1: Animal Biotechnologies

Description: In this lesson students will appreciate and understand the Church’s position regarding genetic engineering, reproductive technologies in animals and their use/modification for human needs. They will learn that we are called by our loving God to be stewards of the earth. In this regard, we are asked to treat animals with the respect, to do no unnecessary harm to animals and plants, and to protect them from abuse and neglect. Any technologies that we apply to agriculture and animal husbandry must reflect these beliefs.

Required time: 3 hours.

Provincial Curriculum Outcomes Addressed:

RE9.1 Examine the process of and influences on the transfer of genetic information and the impact of that understanding on society past and present.

Provincial Curriculum Indicators Addressed:

- a. Identify questions to investigate related to genetics.
- h. Select and synthesize information from various sources to illustrate how developments in genetics, including gene therapy and genetic engineering, have had an impact on global and local food production, populations, the spread of disease, and the environment.

Faith Permeation Teacher Notes:

- The Catholic Church teaches that as good stewards of the earth, we are to recognize animals and plants as God’s creatures deserving of respect and kind treatment. Furthermore, in regards to biotechnologies involving animals and plants, we are to judge their merits by weighing the potential good to humanity on the one hand against the potential harm to animals and plants on the other. In most cases, the Church proposes that we approach each issue of animal/plant biotechnology carefully by gathering as much evidence as possible. Only when we have measured its worth in light of its harm can we make an informed and ethical decision.
- The Catholic Church provides the following teachings regarding the use of animals for human good. We are to keep these teachings in mind when assessing biotechnologies involving animals.
 - **2415** The seventh commandment enjoins respect for the integrity of creation. Animals, like plants and inanimate beings, are by nature destined for the common good of past, present, and future humanity.¹⁹⁵ Use of the mineral, vegetable, and animal resources of the universe cannot be divorced from respect for moral imperatives. Man's dominion over inanimate and other living beings granted by the Creator is not absolute; it is limited by concern for the quality of life of his neighbor, including generations to come; it requires a religious respect for the integrity of creation.¹⁹⁶
 - **2416** *Animals* are God's creatures. He surrounds them with his providential care. By their mere existence they bless him and give him glory.¹⁹⁷ Thus men owe them kindness. We should recall the gentleness with which saints like St. Francis of Assisi or St. Philip Neri treated animals.
 - **2417** God entrusted animals to the stewardship of those whom he created in his own image.¹⁹⁸ Hence it is legitimate to use animals for food and clothing. They may be domesticated to help man in his work and leisure. Medical and scientific experimentation on animals is a morally acceptable practice if it remains within reasonable limits and contributes to caring for or saving human lives.
 - **2418** It is contrary to human dignity to cause animals to suffer or die needlessly. It is likewise unworthy to spend money on them that should as a priority go to the relief of

human misery. One can love animals; one should not direct to them the affection due only to persons.

Instruction Procedure:

- First ensure that students have read sections 2.3 in Pearson Saskatchewan 9, on P. 58- 70. This will provide students with the necessary background knowledge needed to engage in the following activities. Ensure that students all receive a copy of the black line master entitled, **Activity 1: Animal Biotechnology and the Church.**
- Teachers may also wish to consider using this activity in conjunction with unit task A in Pearson Saskatchewan Science on P. 114.
- Divide students into groups of two or three, and have them discuss the information in Activity 1.
- Have the students discuss as a class the teachings of the Church from the Catechism regarding the treatment of animals.
- Ask key questions:
 - a) Is the treatment of animals respectful and appropriate in the use of each of these technologies: artificial insemination, invitro fertilization, genetic engineering, cloning, grafting of plants, selective breeding?
 - b) Why might the Catholic Church remain undecided about the morality of some of these technologies?
- **Optional:** Teachers may wish to show students the TED talk called, “Paul Root Wolpe: It's time to question bio-engineering”. In this short TED talk, Paul Root - chief bioethicist for NASA - discusses the ways that humans have affected evolution. He describes three waves of evolution - one that is natural and Darwinian, a special kind of evolution called civilization, and the third known as bioengineering. From hybrid mammals to animals that glow in the dark, from selective breeding to the fashioning of robot- animals, Paul Root asks the question, “Are human going too far?”
- Teachers may then have students engage in the optional activity, a debate called “Because we can do, should we?” Students will pick a position and defend their position. This activity covers the curriculum outcome RE9.1, indicator ‘h’. (See appendix A: Black Line Masters Unit: Reproduction)

References:

- <http://www.marymeetsdolly.com/blog/index.php/?archives/706-What-is-the-Catholic-view-on-genetic-engineering.html>
- <http://www.agbioworld.org/biotech-info/religion/catholic.html>
- <http://ncronline.org/blogs/all-things-catholic/vatican-issues-new-document-biotechnology>
- http://www.clonesafety.org/documents/Cloning_FAQ.pdf
- <http://greenbio.checkbiotech.org/news/cat>
- <http://www.mmiweb.org.uk/gcsere/revision/xtainpers/decisions/artificial.html>
- [holic_church_oks_biotechnology](http://www.roman-catholic.com/Roman/Articles/Cloning1.htm)
- <http://www.roman-catholic.com/Roman/Articles/Cloning1.htm>
- <http://www.isaaa.org/resources/publications/pocketk/18/default.asp>
- <http://www.scu.edu/ethics/publications/iie/v1n3/>

Lesson 2: Genetic Conditions

Description: In this lesson, students learn that changes in DNA can be caused by accidental factors and/or personal choices. Based on the belief that our bodies are the temple of the Holy Spirit, students will learn that the Catholic Church advocates moderation in all aspects of life and that excess can damage the body. As a result, the focus of this lesson is importance of wise personal choices.

The following lesson provides the Catholic permeation information intended to be taught in conjunction with section 2.3 subsection “Accidental Changes in DNA” in Pearson Saskatchewan Science 9 P. 64.

Required time: 1 hour.

Provincial Curriculum Outcomes Addressed:

RE9.1 Examine the process of and influences on the transfer of genetic information and the impact of that understanding on society past and present.

Provincial Curriculum Indicators Addressed:

- a. Identify questions to investigate related to genetics.
- f. Discuss environmental factors and personal choices that may lead to changes in a cell’s genetic information (e.g., toxins, carcinogens, pesticides, smoking, overexposure to sunlight, and alcohol abuse).

Faith Permeation Teacher Notes:

In this section, students learn that many conditions to which we are exposed – such as the foods we eat and the air we breathe - can change our DNA. Some of those changes are accidental and beyond our control, while others are the result of exposure to chemicals that we purposefully ingest such as tobacco, drugs and alcohol. It is important for teachers to relay that any teaching of the Church regarding personal health is aimed at the protection of the body and the desire of the Church for humanity’s wellbeing.

“Or do you not know that your body is a temple of the Holy Spirit within you, which you have from God, and that you are not your own?” (1 Corinthians 6:19 NRSV)

Instructional Procedures:

- You will need another hour to introduce Activity 2: Catholic Perspectives-How Our Choices Affect Our Genes
- Provide students with the handouts “How Our Choices Affect Our Genes’ and give them time to work on this activity.

- Have students reflect as a class upon how their choices might affect their personal health and wellbeing, perhaps even at the cellular level.

Lesson 3: The Catholic Church and Reproductive technologies

Description: In this lesson, students will learn about the Catholic Church's position regarding reproductive technologies in the light of the gospel and Catholic teachings on the sanctity of life, the sacrament of marriage and the conception of life.

This unit is to be presented as part of section 3.5 in Pearson Saskatchewan Science 9.

Required time: 4 hours.

Provincial Curriculum Outcomes Addressed:

RE9.4 Analyze the process of human reproduction, including the influence of reproductive and contraceptive technologies.

Provincial Curriculum Indicators Addressed:

- d. Acknowledge differing cultural perspectives, including First Nations and Métis perspectives, regarding the sacredness, interconnectedness, and beginning of human life.
- e. Provide examples of scientific knowledge that has resulted in the development of reproductive technologies (e.g., in vitro fertilization, artificial insemination, and embryo transfer) and contraceptive technologies (e.g., condoms, oral contraceptive pill, diaphragm, intra-uterine devices, sterilization, and the morning after pill).
- f. Examine social and cultural issues related to the use of reproductive and/or contraceptive technologies in humans and defend a given position on an issue related to the use of reproductive and/or contraceptive technologies in humans.

Faith Permeation Teacher Notes:

- The Church's position on issues of human reproductive technologies and biotechnologies in humans are based on its understanding of the sanctity of human life and the sacrament of marriage. The Church believes that all reproductive technologies such as contraception, in vitro fertilization, artificial insemination and cloning of human embryos have such harmful moral implications that their use cannot be condoned.
- The Church opposes contraception in all its forms because it prevents the conception of human life. Fundamental to its understanding on the sanctity of human life is the belief that life begins at the moment of conception. Contraception prevents the union of egg and sperm, and so eliminates the possibility that future life might begin. As a result, the use of artificial

birth control opposes the Church's view on the second purpose of intercourse within marriage: procreation.

- The Church's opposition to forms of reproductive technology that enable couples to conceive a child (e.g. in vitro fertilization, embryo transfer, artificial insemination and surrogacy) seems counter-intuitive. Why not support reproductive technologies that would enable infertile couples to bring life into the world? To understand why the Church opposes reproductive technologies, we must understand its view on the sexual act. The Church believes that the union of a married couple has two intended purposes; one is unitive - to join a man and his wife both emotionally and spiritually. The second purpose is a biological one - to bring life into the world. As reproductive technologies often contradict these two purposes, the Church cannot support them. For example, with in vitro fertilization conception takes place in a laboratory and the embryo is then surgically implanted in the mother's womb. As conception in this case does not occur as a result of sexual intercourse between husband and wife, the unitive purpose of sexual intimacy is nullified. The same rationale can also be applied to surrogacy.
- The position of the Church regarding reproductive technologies are not to be understood as punitive but rather as consistent with its position on the two-fold purpose of sexual intercourse. The Catholic Church doesn't oppose these technologies in themselves, nor does she discredit their possible benefits. Rather, the Church acknowledges that while there may be benefits, the harmful effects of these reproductive technologies are more considerable, long lasting and possibly irreversible.

Instructional Procedures:

Part A: Catholic Responses to Contraception

- These permeation lessons are intended to work in conjunction with section 3.5 entitled "Contraception and Reproductive Technologies" in Pearson Saskatchewan Science on P. 101.
- Read "Social and Cultural Perspectives" in PSS9 on P.102 and "Contraception" from P. 103-105.
- Begin by discussing the Catholic standpoint on the gift of the child (Catechism of the Catholic Church # 2373 – 2379) and the Catholic view on the sacrament of marriage (Catechism of the Catholic Church # 1643, #1652-1654). See Appendix D.
- Ask key questions:
 - a) In light of our understanding that children are God's gift, how does contraception contradict that view?
 - b) What are the reasons behind the Church's decision to oppose contraception?
 - c) Why should we abstain from sexual intercourse before marriage?
- Provide students with Activity 3: Chastity, an alternative perspective. Have students read the activity and respond to the questions.

Part B: Catholic Responses to Reproductive Technologies

- Provide students with Activity 4 "Catholic Perspectives on Reproductive technologies".
- Discuss the students' responses to the activity.

- Some key discussion questions:
 - a) Why have reproductive technologies been developed?
 - b) What are the reproductive technologies? (These can be described by the teacher or students can use their text and/or other resources to create lists.)
 - c) What issues are raised by the development and use of reproductive technology?
 - d) Which of the reproductive technologies are consistent with Catholic values?
- Brainstorm with students about the possible reasons why people would be interested in alternative methods for having a child (e.g. infertility of various types, genetic disease, social reasons, genetic modification).

Optional Activities: Gene therapy

Description: In this lesson, students will learn how some technologies like gene therapy may have benefits but may also result in negative consequences. This is presented as an optional activity because an equivalent topic is not found in Pearson Saskatchewan Science 9. However, it does address outcome RE9.1, indicator (h) in the provincial curriculum.

Required time: 1 hour.

Provincial Curriculum Outcomes Addressed:

RE9.1 Examine the process of and influences on the transfer of genetic information and the impact of that understanding on society past and present.

Provincial Curriculum Indicators Addressed:

RE9.1 (h) Select and synthesize information from various sources to illustrate how developments in genetics, including gene therapy and genetic engineering, have had an impact on global and local food production, populations, the spread of disease, and the environment.

Instructional Procedure:

- Provide students with a copy of the Optional Activity “Catholic Perspectives On Gene therapy”. Read the activity together and discuss the following ideas:
 - a) What is gene therapy?
 - b) Why does the Church support somatic cell gene therapy but opposes germ line gene therapy?
 - c) The Church’s opposition to germ line gene therapy is based on which doctrine?
 - d) Why does the Church support gene therapy for therapeutic reasons but not for modification and ‘improvements’ to the human body?

Additional Note: Human Cloning is not mentioned in Pearson Saskatchewan Science at all, nor is it specifically stated in curriculum. However, as students may raise this topic, teachers need to know both the Church’s and society’s position on this issue. First, human cloning is illegal in nearly every country around the world. Secondly, the Catholic Church is strongly opposed to human cloning because it contradicts the Church’s understanding regarding the dignity of each

human person. It also confuses the issue of whose soul resides in the cloned embryo. Lastly, the Church considers cloning as an unnatural method of conception that contravenes the unitive and procreative purposes of marriage.

"The event therefore, powerfully, brings us to repeat with force that the beginning of human life cannot be fixed by convention at a certain stage of development of an embryo; it exists, in reality, at the very first instant of existence of the embryo itself. This is understood more easily in the 'human' method of insemination between egg and sperm, but we must learn to recognize it also in the face of an 'inhuman' method, such as that of the reprogramming of a somatic nucleus in an egg cell; even with this method a new life can be created - as shown unfortunately in the experiment that was announced - a life that preserves, in any case, its dignity just as that of every human life brought into existence.
Vatican Communiqué Cloning of Human Embryo in the U.S. Nov. 27, 2001

Faith Permeation Culminating Tasks - Integrating Catholic Faith

Culminating Task Option A

- The culminating task takes into consideration all the activities that are done in this unit. Therefore teachers may need to make the appropriate modification to this activity. Divide the students up in partners or small groups. Provide each student with the handout below. The activity is entitled, "What Do You Believe is Right? Catholicism and Reproductive technologies\Biotechnologies". This activity is modeled after the corresponding STSE activity found on P. 109 in Pearson Saskatchewan Science 9.
- The modification to this activity, which makes it different from the Pearson one, includes a summary of all Church teachings on the biotechnologies and reproductive technologies in this unit. The culminating task also asks students to consider how faith plays a role in the Church's understanding on these issues. It asks students to consider whether they agree or disagree with Church teaching. In this regard, teachers need to be cautious. Remember that while we are a Catholic institution, there are students who come to our schools from different faiths and traditions, as well as cultures. These alternate views must be respected just as we ask students to respect the Catholic perspective. While there may be opposing views to certain issues and strong opinions raised by students, the activity is valuable in a self-reflective capacity. It asks students to reflect on their own values and opinions just as it is asked in curriculum: "*Examine social and cultural issues related to the use of reproductive and/or contraceptive technologies in humans and defend a given position on an issue related to the use of reproductive and/or contraceptive technologies in humans. Examine social and cultural issues related to the use of reproductive and/or contraceptive technologies in humans and **defend a given position** on an issue related to the use of reproductive and/or contraceptive technologies in humans.*"
- Furthermore the activity helps students achieve another vital indicator in curriculum: "*Acknowledge differing cultural perspectives, including First Nations and Métis perspectives, regarding the sacredness, interconnectedness, and beginning of human life.*"
- While it may be argued that the Catholic position is faith-based rather than cultural, the differing perspectives to which the curriculum refers can reasonably be extended to include religious as well as social dimensions.

- Lastly, teachers may use the culminating task as a possible option to the Unit Tasks presented on P. 114 in Pearson Saskatchewan Science 9. Teachers may also choose to adapt the Unit Tasks from Pearson to include Culminating Task B option.

Culminating Task Option B

- In this option, students are asked to consider how a choice of careers in biotechnology or reproductive technology might conflict with the Catholic faith. Students will examine at least one career as identified by *reSearch* box in the margin on P. 70 of Pearson Saskatchewan Science 9. For their chosen career, students will create a poster that includes a description of the career (salary, duties, other important facts). As well, they are to include a short paragraph in which they identify the conflicts that might arise between the Catholic faith and their chosen career. This activity is designed to encourage students to consider whether or not they could work in a career in biotechnology or reproductive technology that might conflict with their religious principles.

Appendix A: Black Line Masters

Science 9

Unit: Reproduction

Activity 1: Animal Biotechnology and the Church

When animals and plants are modified for the needs of human beings, their use and the technology that makes those modifications possible belong to a realm of science called biotechnology. Biotechnology includes research and development in areas like artificial reproductive technologies, cloning and genetic engineering. While it is true that humankind has used animals throughout history, at what point does it become unethical? In this activity, you will read and learn about the Catholic Church's opinion on types of biotechnology and the morality of their use.

Artificial Reproductive Technologies:

In 'Pearson Saskatchewan Science 9' you read about artificial reproductive technologies like artificial insemination and in vitro fertilization used in agriculture. In vitro fertilization refers to the union of gametes - sex cells - outside of the body, often in a petri dish in a laboratory. In artificial insemination, sperm from male livestock such as cattle or horses are used to artificially fertilize females to produce offspring with desired features.

For the Catholic Church, these types of technologies need to be approached with caution. The Church has definitive teachings about how we are to treat other living things. These teachings can help us determine whether a specific biotechnology is or is not acceptable. These teachings include the fact that God calls us to be good stewards of the earth. This stewardship includes *dominion over the animals* - a great responsibility given to us by God - but it does not give us the right to abuse or recklessly exploit animals in whatever way we want. The Catechism of the Catholic Church provides us more detail regarding these teachings.

Respect for the integrity of creation

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

2416 *Animals* are God's creatures. He surrounds them with his providential care. By their mere existence they bless him and give him glory.¹⁹⁷ Thus men owe them kindness. We should recall the gentleness with which saints like St. Francis of Assisi or St. Philip Neri treated animals.

2417 God entrusted animals to the stewardship of those whom he created in his own image.¹⁹⁸ Hence it is legitimate to use animals for food and clothing. They may be domesticated to help man in his work and leisure. Medical and scientific experimentation on animals is a morally acceptable practice if it remains within reasonable limits and contributes to caring for or saving human lives.

2418 It is contrary to human dignity to cause animals to suffer or die needlessly. It is likewise unworthy to spend money on them that should as a priority go to the relief of human misery. One can love animals; one should not direct to them the affection due only to persons.

Questions:

1. What does the Church say regarding the treatment of plants and animals?
2. How do we apply the teachings of the Church to biotechnology?
3. Do you agree or disagree with the Church's position on biotechnology?
4. In what way(s) would such technology be a benefit to people? In what ways might these technologies be harmful?
5. Are these types of biotechnologies necessary? If so, how?

Appendix A: Black Line Masters

Science 9

Unit: Reproduction

Optional Activity: Debate - Because we can do, should we?

Watch the TED talk called, “Paul Root Wolpe: It's time to question bio-engineering”. In this short TED talk, Paul Root - chief bioethicist for NASA - discusses the ways that humans have affected evolution. He describes three waves of evolution: one that is natural and Darwinian; a special kind of evolution called civilization; and a third known as bioengineering. From hybrid mammals to animals that glow in the dark, from selective breeding to the fashioning of robot-animals, Paul Root asks the question, “Are human going too far?”

After you have watched the video, engage in a debate which explores and discusses the following perspectives:

A) *Biotechnologies such as genetic modification and cloning of animals benefits humankind. Modification to animals isn't all that different than the selective breeding that we've used for generations to create certain breeds of animals. Their exploitation for food and for industry has resulted in many goods that we enjoy today. The benefits far outweigh the consequences.*

or

B) *From the perspective of the Catholic Church, the use of animal biotechnologies must benefit people but it also strongly urges people to be careful stewards of animal life. As a result, technologies like cloning and genetic modification may be condoned but no undue harm should befall the animals in our care. The use of biotechnology must be carefully considered and used wisely.*

or

C) *First Nations Elders believe that all living things have spirits, made by the hand of Creator. As a result, all life is precious. To tamper with the DNA of animals or plants and to alter them through technologies like cloning would create grievous harm. Thus the use of biotechnologies should never be allowed, whatever the benefit.*

Questions:

1. Which perspective is similar to yours?
2. Is there always a right choice? Justify your answer?
3. What are the consequences, both positive and negative, for each of those perspectives?
4. Do you think that genetic modification of animals for the benefit of humanity can ever be consistent with good stewardship?

Appendix A: Black Line Masters

Science 9

Unit: Reproduction

Activity 2: Catholic Perspectives - How Our Choices Affect Our Genes

There are many factors that can cause changes to our DNA. Some changes are natural - the result of mutation – while others are the result of our choices and so are artificial. Either way, these changes have long term consequences. Perhaps the most commonly known example of negative changes to DNA is cancer. In many cases, factors such as asbestos (insulation), nicotine (smoking), and overexposure to UV (sun tanning) increases the likelihood of cancer, which is the corruption of the normal function in a cell's DNA. These causes of cancer are the direct result of the choices people make.

Scripture and our Catholic beliefs have much to say about how we are to treat our bodies. The Catholic Church teaches that we are made in the image of God. We believe that our bodies house our souls which have been specially created by God. As a result, we are to treat our bodies with the utmost respect, for as St. Paul declares in his letter to the Corinthians, our body is the “temple of the Holy Spirit.”

The following are statements from the Catechism of the Catholic Church about the way we need to treat our bodies. These teachings help us better understand that our health, including the health of individual cells, is determined by the choices we make.

Respect for health

2288 Life and physical health are precious gifts entrusted to us by God. We must take reasonable care of them, taking into account the needs of others and the common good. Concern for the health of its citizens requires that society help in the attainment of living-conditions that allow them to grow and reach maturity: food and clothing, housing, health care, basic education, employment, and social assistance.

2290 The virtue of temperance disposes us to avoid every kind of excess: the abuse of food, alcohol, tobacco, or medicine. Those incur grave guilt who, by drunkenness or a love of speed, endanger their own and others' safety on the road, at sea, or in the air.

2291 The use of drugs inflicts very grave damage on human health and life. Their use, except on strictly therapeutic grounds, is a grave offense. Clandestine production of and trafficking in drugs are scandalous practices. They constitute direct co-operation in evil, since they encourage people to practices gravely contrary to the moral law.

While the Catechism makes no direct statement about how our choices affect our DNA (our genes), it helps us understand that when we choose to treat our bodies as sacred temples, we can prevent unnecessary changes to our cells. By choosing to wear more sunscreen, we can reduce exposure to harmful UV rays and so lower the chances of skin cancer. When we choose not to

smoke, we substantially reduce the risk of lung cancer because we are not subjecting the DNA of our lung cells to harmful substances. While some changes to our genes are beyond our control, we must realize that making choices which do not respect the sacredness of our bodies can result in harmful and potentially fatal changes to our DNA.

Answer the following questions:

Questions:

1. How does the Church view the human body and health?

How does this perspective help us appreciate the way we are to treat our bodies?

2. What can cause a natural change to our DNA?

3. What is our role in artificial changes to our DNA?

Identify examples of this type of artificial cause.

Appendix A: Black Line Masters

Science 9

Unit: Reproduction

Optional Activity: Catholic Perspectives on Gene therapy

As you have previously learned in Science 9, genes are sections of useful DNA that code for proteins. Such proteins can produce molecules like insulin and components for tissues like skin, muscle and hair. Sometime mutations - changes to the DNA - result in harmful conditions or diseases. Gene therapy involves the change or removal of that defective genetic information in a cell, and replacing it with viable healthy genes.

Two kinds of gene therapy exist: somatic and germ line. In somatic gene therapy, DNA is removed from somatic cells - cells originating in the body other than sex cells such as sperm and egg. Germ line gene therapy alters genes of reproductive cells with new genes which could be passed on to future offspring.

Many years ago, scientists learned that certain vectors, such as viruses, can introduce foreign DNA into a host cell. When viruses enter cells, certain enzymes they possess are able to splice out sections of host DNA and insert their own DNA or RNA, thereby infecting the host cell. This new viral DNA or RNA provides a template which is then copied by the cell to produce new copies of the viruses. Scientists have since discovered that viruses can incorporate new genes into their own genome. With this knowledge, scientists learned that genes can be transferred from one cell to another through an agent or a vector. Gene therapy makes use of vectors such as a virus. In gene therapy, scientists transfer healthy human DNA from a healthy cell into host cell using a viral vector. The procedures are very costly, time consuming and difficult.

The Catholic Church only supports somatic gene therapy for therapeutic purposes. In the Church's view somatic gene therapy is morally acceptable because the technology is used to cure genetic diseases like cancer or Huntington's disease. This form of gene therapy targets specific tissues and organs in individuals. However, the Church opposes somatic cell gene therapy for modification and 'improvements' to the human body. To make changes to a cell on such a fundamental level simply to improve on a trait like height for example, is to change our very self and radically interferes with God's creation and his plan for that individual.

In regards to the second form of gene therapy - germ line cell therapy - the Church is opposed. Although germ line therapy can also be curative, the insertion of new genes in sex cells is problematic because such changes can have profound consequences not only to an unborn child but also to future generations. As a result, the Church can't support germ line cell therapy even if it offers a cure for disease.

Questions for discussion:

1. Why does the Church agree to one form of gene therapy and not to the other?
2. Why does the Church believe that modifications and improvements to the self, on a genetic level, are wrong?
3. Do you agree or disagree with the Catholic Church on its view of gene therapy?

Appendix A: Black Line Masters

Science 9

Unit: Reproduction

Activity 3: Chastity, an alternative perspective

From what you have learned about regarding various cultural and social perspectives on contraception in Pearson Saskatchewan Science 9, you have no doubt seen that opinions vary greatly and that a person's choices in this area have moral implications. Various cultural views, such as the ones espoused by First Nations Elders and religious ones like the Catholic Church, maintain that all human life is sacred. In view of this fundamental teaching about the sanctity of human life, artificially interfering or preventing the beginning of a human life is understood as a grave injustice because it denies the most basic of human rights – the right to life. For this very reason, the Catholic Church has very strong teachings against the use of artificial contraception.

As you have learned previously in the Fully Alive program and in Religion/Christian Ethics classes, Catholics teens are urged to live by the virtue of chastity. The focus of chastity isn't simply the prevention of pregnancy or venereal disease. In fact, chastity is not simply an alternative to birth control nor is it simply not engaging in premarital sex. Rather chastity is a choice to live one's sexuality fully according to the plan God has set out for life-giving human intimacy. Living a life of chastity is for everyone – both single and married – and offers the best way for us to develop true self-integrity, both spiritually and physically, as well as to respect the God-given dignity of others. It is a choice to preserve the gift we are given by God to be intimately united to our spouse and to cooperate with God in the creation of new human life. While living a chaste life is a big challenge, especially in our over-sexualized culture, it is really the most appropriate and beneficial life-style choice.

Questions for discussion:

1. Why is chastity not simply an alternative to contraception?
2. Why does it make sense to discuss chastity in Science class?
3. What is chastity truly? What is it truly not?
4. How might we honor the perspective of elders and of the Church even if we disagree with them?
5. Why might living a chaste life be considered living fully?
6. What possible consequences are there to choosing to use contraception?
7. What possible consequences are there to choosing to live by the virtue of chastity?
8. Do you agree with the Church's view on chastity? If so, why? If not, why not?

Appendix A: Black Line Masters

Science 9

Unit: Reproduction

Activity 4: Catholic Perspectives on Reproductive Technologies

Like the First Nations Elders whom you learned about in Pearson Saskatchewan Science 9, the Holy Catholic Church places great value on human life. Church leaders consider human life to be so sacred that they have many teachings regarding its sanctity. The Bible, Christ and the Church provide reasons why, as well as concrete ways of how we are to respect human life.

Specific teachings on technologies that have consequences on human life are examined in this activity. By the end of this activity you will learn where the Church stands on issues of abortion, reproductive technologies and the Church's rationale.

The Church has a great moral and social interest in regards to reproductive technologies that involve the beginning of human life (conception). The basic reason for this interest is that these technologies profoundly affect the institution of marriage as well as act of human sexual intercourse, both of which the Church safeguards.

In the case of reproductive technologies that enable couples to conceive a child (like in vitro fertilization, embryo transfer, artificial insemination and surrogacy), the Church's opposition seems contradictory. If the Church promotes a pro-life life stand, then why not support reproductive technologies that can possibly enable couples to have children? To understand why the Church opposes reproductive technologies, we must understand its view on sexual intercourse.

The Church believes that the physical union of a married couple through the act of sexual intercourse has two intended purposes. The first is "unitive", that is to say that sexual intercourse strengthens the union between a husband and wife physically, emotionally and spiritually. The second purpose is "procreative", which means that when a husband and wife come together in this way, they are to be open to the possibility of creating with God a new human life. Let us keep these two purposes of sexual intercourse in mind as we consider various reproductive technologies.

In the case of in vitro fertilization, the conception of a child takes place outside of the woman's body. This is done by extract an egg from the mother and placing it with sperm from the father in a laboratory in hopes that one of the sperm will fertilize the egg. Because this process does not involve the physical union of the wife and husband through the act of sexual intercourse which is understood as the "unitive" purpose of marriage, in vitro fertilization does not conform to the Church's understanding and teaching on conception. A technology like in vitro fertilization might bring human life into the but because fertilization is done in a laboratory and then the embryo is placed inside the mother, the unitive purpose - the emotional, physical and spiritual joining of husband and wife - is totally bypassed. As a result, the Catholic Church does not agree with in vitro fertilization.

The same can be said about surrogacy because the fertilization of the embryo that is implanted in the surrogate mother is not the result of sexual intercourse between the couple who want to have the child. Again, this bypasses the “unitive” purpose of sexual intercourse.

In regards to reproductive technologies that prevent conception, the Church also has a definite stance. A fundamental moral teaching that the Church upholds is the belief that life begins at the moment of conception. Artificial contraception prevents the union of egg and sperm, and so radically interferes with the creation of a new human life. It is easy to see that the “procreative” purpose of sexual intercourse is not respected, which is why the Catholic Church opposes all forms of artificial birth control.

The Catholic Church does not oppose these forms of reproductive technologies simply for the sake of opposing them. The Church is not blind to the benefits of these technologies. However, with the sanctity of marriage, as well as the unitive and procreative purposes of human sexual intimacy as fundamental convictions, the Church honestly believes that the harmful consequences of such reproductive technologies to both the people involved and to society as a whole outweigh the potential benefits.

Reflection:

Write a reflection that considers the following questions:

1. Why does the Church create teachings and ‘rules’ regarding reproductive technologies?
2. Taking the Church’s perspective as your own, identify some of the cultural, moral, and social consequences of these technologies.
3. Do the harmful consequences of such reproductive technologies outweigh their benefit?
4. How do we respect and honor the Church’s teachings even though they may differ from our own cultural or religious beliefs?

Appendix B: Culminating Tasks Black Line Master

Culminating Task A

Science 9

Unit: Reproduction

What Do You Believe is Right? Catholicism and Reproductive Technologies and Biotechnologies

Having learned about the Church's position on reproductive technologies and biotechnologies, it is time to synthesize those ideas and to defend a position.

Purpose: To summarize what you've learned about the views of the Church regarding reproductive technologies and biotechnologies. Create a summary statement that can support, refute, critique or evaluate the Church's teachings on these issues.

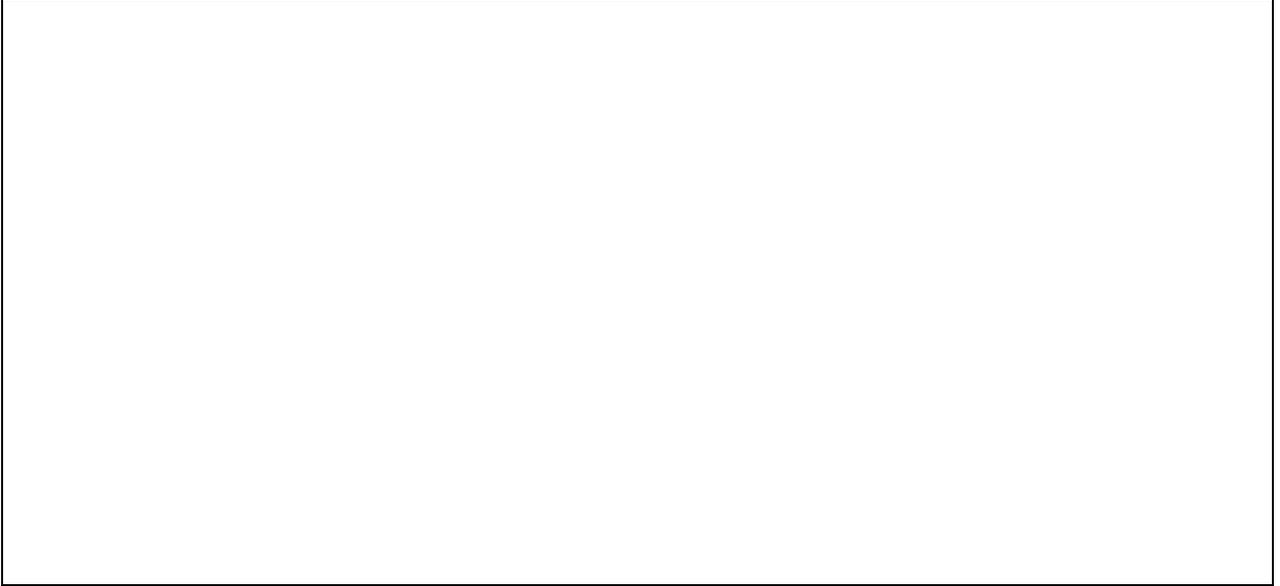
Procedure:

- i. Complete the table below. For each of the reproductive technologies, state the Church's position. Then identify a doctrine or the belief that underlies that position.
- ii. Use the following questions to help you create a summary statement expressing your ideas and opinions in regards to ONE reproductive technology or biotechnology.
 - What is the teaching of the Church regarding this particular technology?
 - What reasons does the Church give for their position on this technology?
 - Which teachings do you agree with? Explain your position.
 - Which teachings do you disagree with? Explain your position.
 - How does faith play a role in your belief and understanding of this technology?

Table: Church's Stance on Reproductive technologies and Biotechnologies

Reproductive technology\ biotechnology	Catholic Church's position	Doctrine or Belief that underlies the Church's position
Cloning of animals		
Cloning of people		
Somatic cell gene therapy		
Germ line cell gene therapy		
Genetic modification of animals		
In vitro Fertilization in animals		
Contraception		
Surrogacy		
In vitro Fertilization In humans		
Artificial insemination in animals		
Artificial insemination in people		

Summary Statement:



Appendix B: Culminating Task Black Line Master

Culminating Task B

Science 9

Unit: Reproduction

Questions

How does our faith or our beliefs affect the choices we make in for a career in biotechnology or reproductive technologies?

Task Overview:

There are numerous careers in the areas of biotechnology and reproductive technologies. These growing fields of research have many social impacts. In this task you will examine one career found on P. 70 of Pearson Saskatchewan Science 9. Create a poster that includes a description of the career, the associated salary, duties and facts. Keeping in mind the Catholic perspectives which you have learned about, write a paragraph in which you identify the possible conflicts that could arise between your faith and the career you have chosen. Finally, explain whether you would be able to work in that area of biotechnology or reproductive technology given the conflicts that may be present with your faith or beliefs.

Appendix C: Table of Correlation

Faith Permeation lesson Documents	Pearson Saskatchewan Science 9	Outcome and Indicator	Catechism of the church	Gospel/ Church documents and encyclicals	Christian Ethics resources
<p>Lesson 1: Animal Biotechnologies</p> <p>Activity 1: Biotechnology and the Church.</p> <p>Optional activity: TED talk, “Paul Root Wolpe: It's time to question bio-engineering”.</p>	Section 2.3 P. 58-64.	RE9.1 (h)	#2416, #2417, #2418, #2419	<p><i>No official position but the Church cautions careful consideration- weigh the needs of growing human population, research and the ethical treatment of animals see- website:</i> http://www.agbioworld.org/biotech-info/religion/catholic.html <i>For more information and press releases.</i></p>	Gr. 9 Christian Ethics program <i>Be With Me</i> - Unit 6 Section: How can Earth survive? P. 140-147
<p>Lesson 2: Genetic Conditions</p> <p>Activity 2: Catholic Perspectives-How Our Choices Affect Our Genes</p>	Section 2.3 P. 64	RE9.1 (a) (f)	2288, 2290, 2291	<p><i>Humanae Vitae</i> Pope Paul VI (July 25, 1968)</p> <p><i>Donum Vitae</i> (February 22, 1987)</p> <p><i>Dignitas Personae</i> Congregation for the Doctrine of the Faith (2008)</p> <p><i>Charter for Health Care Workers</i> John Paul II, of the Pontifical Academy for Life, (February 11, 1994),</p>	Gr. 9 Christian Ethics program <i>Be With Me</i> - Unit 2 Section: A body fit for God P. 24-26 Teacher supplement “Be with me” handout “The Fifth Commandment”
<p>Lesson 3:</p> <p>Optional Activity: Catholic Perspectives on Gene therapy</p>	No Pearson correlation	RE9.1 (h)	2288, 2290, 2291, 2288, 2290, 2291	<p><i>Humanae Vitae</i> Pope Paul VI (July 25, 1968)</p> <p><i>Donum Vitae</i> (February 22, 1987)</p> <p><i>Dignitas Personae</i> Congregation for the Doctrine of the Faith (2008)</p> <p><i>Charter for Health Care Workers</i> John Paul II, of the Pontifical Academy for Life, (February 11, 1994)</p>	Gr. 9 Christian Ethics program <i>Be With Me</i> - Unit 2 Section: A body fit for God P. 22-29

<p>Lesson 4: The Catholic Church and Reproductive Technologies</p> <p>Activity 5: Chastity, an Alternative View.</p> <p>Activity 6: called “Catholic Perspectives on Reproductive Technologies”.</p>	<p>Section 3.5 P. 101-107</p>	<p>RE9.4 (d) (e) (f)</p>	<p># 2373-2379</p> <p># 1643, #1652-1654.</p>	<p><i>Humanae Vitae</i> Pope Paul VI (July 25, 1968)</p> <p>Donum Vitae (February 22, 1987)</p> <p><i>Dignitas Personae</i> Congregation for the Doctrine of the Faith (2008)</p> <p><i>Charter for Health Care Workers</i> John Paul II, of the Pontifical Academy for Life, (February 11, 1994),</p>	<p>Gr. 9 Christian Ethics program <i>Be With Me</i> - Unit 4 Section: Why Wait? P. 86-95</p>
<p>Culminating Task A</p>	<p>STSE activity found on P. 109</p> <p>possible option to the Unit Tasks presented on P. 114 in Pearson Saskatchewan Science 9</p>	<p>RE9.4</p>	<p># 2373-2379</p> <p># 1643, #1652-1654.</p> <p>2288, 2290, 22912288, 2290, 2291</p>	<p><i>Humanae Vitae</i> Pope Paul VI (July 25, 1968)</p> <p>Donum Vitae (February 22, 1987)</p> <p><i>Dignitas Personae</i> Congregation for the Doctrine of the Faith (2008)</p>	<p>Gr. 9 Christian Ethics program <i>Be With Me</i> - Unit 6 Section: How can Earth survive? P. 140-147</p>
<p>Culminating Task B</p>	<p>P. 70 of Pearson Saskatchewan Science 9</p>	<p>RE9.4</p>	<p># 2373-2379</p> <p># 1643, #1652-1654.</p> <p>2288, 2290, 22912288, 2290, 2291</p>	<p><i>Humanae Vitae</i> Pope Paul VI (July 25, 1968)</p> <p>Donum Vitae (February 22, 1987)</p> <p><i>Dignitas Personae</i> Congregation for the Doctrine of the Faith (2008)</p>	<p>Gr. 9 Christian Ethics program <i>Be With Me</i> - Unit 6 Section: How can Earth survive? P. 140-147</p>

Appendix D: Additional Resources (Catechism of the Catholic Church)

Faith and Reason:

29 “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.” (Compendium of the Catechism of the Catholic Church #29)

Respect for human life

2258 "*Human life is sacred* because from its beginning it involves the creative action of God and it remains for ever in a special relationship with the Creator, who is its sole end. God alone is the Lord of life from its beginning until its end: no one can under any circumstance claim for himself the right directly to destroy an innocent human being."⁵⁶ (Compendium of the Catechism of the Catholic Church #2258)

Respect for health

2288 Life and physical health are precious gifts entrusted to us by God. We must take reasonable care of them, taking into account the needs of others and the common good. (Compendium of the Catechism of the Catholic Church #2288)

Concern for the health of its citizens requires that society help in the attainment of living-conditions that allow them to grow and reach maturity: food and clothing, housing, health care, basic education, employment, and social assistance.

2290 The virtue of temperance disposes us to *avoid every kind of excess*: the abuse of food, alcohol, tobacco, or medicine. Those incur grave guilt who, by drunkenness or a love of speed, endanger their own and others' safety on the road, at sea, or in the air. (Compendium of the Catechism of the Catholic Church #2290)

2291 The *use of drugs* inflicts very grave damage on human health and life. Their use, except on strictly therapeutic grounds, is a grave offense. Clandestine production of and trafficking in drugs are scandalous practices. They constitute direct co-operation in evil, since they encourage people to practices gravely contrary to the moral law. (Compendium of the Catechism of the Catholic Church #2291)

Medical Interventions on Humans:

475 “Scientific, medical, or psychological experiments on human individuals or groups are morally legitimate when they are at the service of the integral good of the person and of society, without disproportionate risks to the life and physical and psychological integrity of the subjects who must be properly informed and consenting.” (Compendium of the Catechism of the Catholic Church #475)

Chastity: The integrity of the person

2338 “The chaste person maintains the integrity of the powers of life and love placed in him. This integrity ensures the unity of the person; it is opposed to any behavior that would impair it. It tolerates neither a double life nor duplicity in speech.”¹²⁵ (Compendium of the Catechism of the Catholic Church #2338)

2340 “Whoever wants to remain faithful to his baptismal promises and resist temptations will want to adopt the means for doing so: self-knowledge, practice of an asceticism adapted to the situations that confront him, obedience to God's commandments, exercise of the moral virtues, and fidelity to prayer. "Indeed it is through chastity that we are gathered together and led back to the unity from which we were fragmented into multiplicity."¹²⁸ (Compendium of the Catechism of the Catholic Church #2340)

2344 “Chastity represents an eminently personal task; it also involves a *cultural effort*, for there is "an interdependence between personal betterment and the improvement of society."¹³¹ Chastity presupposes respect for the rights of the person, in particular the right to receive information and an education that respect the moral and spiritual dimensions of human life.” (Compendium of the Catechism of the Catholic Church #2344)

2345 “Chastity is a moral virtue. It is also a gift from God, a *grace*, a fruit of spiritual effort.¹³² The Holy Spirit enables one whom the water of Baptism has regenerated to imitate the purity of Christ.”¹³³ (Compendium of the Catechism of the Catholic Church #2345)

Children as Gift from God:

2374 Couples who discover that they are sterile suffer greatly. "What will you give me," asks Abraham of God, "for I continue childless?"¹⁶⁴ And Rachel cries to her husband Jacob, "Give me children, or I shall die!"¹⁶⁵

2375 Research aimed at reducing human sterility is to be encouraged, on condition that it is placed "at the service of the human person, of his inalienable rights, and his true and integral good according to the design and will of God."¹⁶⁶ (Compendium of the Catechism of the Catholic Church #2375)

2376 Techniques that entail the dissociation of husband and wife, by the intrusion of a person other than the couple (donation of sperm or ovum, surrogate uterus), are gravely immoral. These techniques (heterologous artificial insemination and fertilization) infringe the child's right to be born of a father and mother known to him and bound to each other by marriage. They betray the spouses' "right to become a father and a mother only through each other."¹⁶⁷ (Compendium of the Catechism of the Catholic Church #2376)

2377 Techniques involving only the married couple (homologous artificial insemination and fertilization) are perhaps less reprehensible, yet remain morally unacceptable. They dissociate the sexual act from the procreative act. The act which brings the child into existence is no longer an act by which two persons give themselves to one another, but one that "entrusts the life and

identity of the embryo into the power of doctors and biologists and establishes the domination of technology over the origin and destiny of the human person. Such a relationship of domination is in itself contrary to the dignity and equality that must be common to parents and children."¹⁶⁸
"Under the moral aspect procreation is deprived of its proper perfection when it is not willed as the fruit of the conjugal act, that is to say, of the specific act of the spouses' union Only respect for the link between the meanings of the conjugal act and respect for the unity of the human being make possible procreation in conformity with the dignity of the person."¹⁶⁹
(Compendium of the Catechism of the Catholic Church #2377)

2378 A child is not something *owed* to one, but is a *gift*. The "supreme gift of marriage" is a human person. A child may not be considered a piece of property, an idea to which an alleged "right to a child" would lead. In this area, only the child possesses genuine rights: the right "to be the fruit of the specific act of the conjugal love of his parents," and "the right to be respected as a person from the moment of his conception."¹⁷⁰ (Compendium of the Catechism of the Catholic Church #2378)

2379 The Gospel shows that physical sterility is not an absolute evil. Spouses who still suffer from infertility after exhausting legitimate medical procedures should unite themselves with the Lord's Cross, the source of all spiritual fecundity. They can give expression to their generosity by adopting abandoned children or performing demanding services for others. (Compendium of the Catechism of the Catholic Church #2379)

Respect for animals

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

2416 "*Animals* are God's creatures. He surrounds them with his providential care. By their mere existence they bless him and give him glory.¹⁹⁷ Thus men owe them kindness. We should recall the gentleness with which saints like St. Francis of Assisi or St. Philip Neri treated animals." (Compendium of the Catechism of the Catholic Church #2416)

2417 "God entrusted animals to the stewardship of those whom he created in his own image.¹⁹⁸ Hence it is legitimate to use animals for food and clothing. They may be domesticated to help man in his work and leisure. Medical and scientific experimentation on animals is a morally acceptable practice if it remains within reasonable limits and contributes to caring for or saving human lives." (Compendium of the Catechism of the Catholic Church #2417)

2418 “It is contrary to human dignity to cause animals to suffer or die needlessly. It is likewise unworthy to spend money on them that should as a priority go to the relief of human misery. One can love animals; one should not direct to them the affection due only to persons.” (Compendium of the Catechism of the Catholic Church #2418)

Sacrament on Marriage: purposes of marriage- unity and procreation

1643 "Conjugal love involves a totality, in which all the elements of the person enter - appeal of the body and instinct, power of feeling and affectivity, aspiration of the spirit and of will. It aims at a deeply personal unity, a unity that, beyond union in one flesh, leads to forming one heart and soul; it demands *indissolubility* and *faithfulness* in definitive mutual giving; and it is open to *fertility*. In a word it is a question of the normal characteristics of all natural conjugal love, but with a new significance which not only purifies and strengthens them, but raises them to the extent of making them the expression of specifically Christian values." (Compendium of the Catechism of the Catholic Church #1643)

1642 "By its very nature the institution of marriage and married love is ordered to the procreation and education of the offspring and it is in them that it finds its crowning glory."¹⁶²

Children are the supreme gift of marriage and contribute greatly to the good of the parents themselves. God himself said: "It is not good that man should be alone," and "from the beginning [he] made them male and female"; wishing to associate them in a special way in his own creative work, God blessed man and woman with the words: "Be fruitful and multiply." Hence, true married love and the whole structure of family life which results from it, without diminishment of the other ends of marriage, are directed to disposing the spouses to cooperate valiantly with the love of the Creator and Savior, who through them will increase and enrich his family from day to day.¹⁶³

1653 “The fruitfulness of conjugal love extends to the fruits of the moral, spiritual, and supernatural life that parents hand on to their children by education. Parents are the principal and first educators of their children.¹⁶⁴ In this sense the fundamental task of marriage and family is to be at the service of life.” (Compendium of the Catechism of the Catholic Church #1653)

1654 “Spouses to whom God has not granted children can nevertheless have a conjugal life full of meaning, in both human and Christian terms. Their marriage can radiate a fruitfulness of charity, of hospitality, and of sacrifice.” (Compendium of the Catechism of the Catholic Church #1654)

Appendix E: 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 Embryos
- 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 F: Excerpts from Doctrine, Encyclicals and Instructions

Abbreviations: Humanae Vitae (HV) , Donum Vitae (DV), and Evangelium Vitae (EV) and Charter for Health Care Workers:

Faith and Reason:

On the special creation of the human soul “Even if the presence of a spiritual soul cannot be ascertained by empirical data, the results themselves of scientific research on the human embryo provide ‘a valuable indication for discerning by the use of reason a personal presence at the moment of the first appearance of a human life: how could a human individual not be a human person?’” –EV, 60

Medical Interventions on Humans:

Gene therapy: "In moral evaluation a distinction must be made between strictly ‘therapeutic’ manipulation, which aims to cure illnesses caused by genetic or chromosome anomalies (genetic therapy), from manipulation ‘altering’ the human genetic patrimony. A curative intervention, which is also called ‘genetic surgery,’ ‘will be considered desirable in principle, provided its

purpose is the real promotion of the personal well-being of the individual, without damaging his integrity or worsening his condition of life." -- *CHCW, 12*

"On the other hand, interventions which are not directly curative, the purpose of which is 'the production of human beings selected according to sex or other predetermined qualities,' which change the genotype of the individual and of the human species, 'are contrary to the personal dignity of the human being, to his integrity and to his identity. Therefore they can be in no way justified on the pretext that they will produce some beneficial results for humanity in the future,' 'no social or scientific usefulness and no ideological purpose could ever justify an intervention on the human genome unless it be therapeutic, that is its finality must be the natural development of the human being.'" –*CHCW, 12*

"The application to humans of biotechnology learned from animal fertilization has made possible various interventions in human procreation, giving rise to serious questions of moral lawfulness. 'The various 'techniques of artificial reproduction', which would seem to be at the service of life and which are frequently used with this intention, actually open the door to new threats against life.'" – *CHCW, 21*

"Applied biology and medicine work together for the integral good of human life when they come to the aid of a person stricken by illness and infirmity and when they respect his or her dignity as a creature of God. No biologist or doctor can reasonably claim, by virtue of his scientific competence, to be able to decide on people's origin and destiny." –*DV, Intro, 3*

Children as Gift from God:

On surrogacy, IVF and other reproductive technologies: "The desire for a child, sincere and intense though it be, by the spouses, does not legitimize recourse to techniques which are contrary to the truth of human procreation and to the dignity of the new human being. The desire for a child gives no right to have a child. The latter is a person, with the dignity of a 'subject.' As such, it cannot be desired as an 'object.' The fact is that the child is a subject of rights: the child has the right to be conceived only with full respect for its personhood." – *CHCW, 25*

On reproductive technologies: "Various procedures now make it possible to intervene not only in order to assist but also to dominate the processes of procreation. These techniques can enable man to "take in hand his own destiny," but they also expose him "to the temptation to go beyond the limits of a reasonable dominion over nature." They might constitute progress in the service of man, but they also involve serious risks. Many people are therefore expressing an urgent appeal that in interventions on procreation the values and rights of the human person be safeguarded." – *Donum Vitae (DV), Intro, 1*

Life begins at conception- dignity of the embryo: "Since the human individual, in the prenatal stage, must be given the dignity of a human person, 'research and experimentation on human embryos and fetuses' is subject to the ethical norms valid for the child already born and for every human subject." – *CHCW, 82*

Embryonic stem research or other genetic research on embryos: "The negative ethical evaluations outlined here apply to all genetic manipulatory interventions concerned with

embryos. On the other hand there are no moral objections to the manipulation of human body cells for curative purposes and the manipulation of animal or vegetable cells for pharmaceutical purposes." – *CHCW, 14*

On reproductive technologies: "For this reason marriage possesses specific goods and values in its union and in procreation which cannot be likened to those existing in lower forms of life. Such values and meanings are of the personal order and determine from the moral point of view the meaning and limits of artificial interventions on procreation and on the origin of human life. These interventions are not to be rejected on the grounds that they are artificial. As such, they bear witness to the possibilities of the art of medicine. But they must be given a moral evaluation in reference to the dignity of the human person, who is called to realize his vocation from God to the gift of love and the gift of life." –*DV, Intro, 3*

On reproductive technologies IVF: "Advances in technology have now made it possible to procreate apart from sexual relations through the meeting *in vitro* of the germ-cells previously taken from the man and the woman. But what is technically possible is not for that very reason morally admissible. Rational reflection on the fundamental values of life and of human procreation is therefore indispensable for formulating a moral evaluation of such technological interventions on a human being from the first stages of his development." –*DV, Intro, 4*

"Techniques of fertilization *in vitro* can open the way to other forms of biological and genetic manipulation of human embryos, such as attempts or plans for fertilization between human and animal gametes and the gestation of human embryos in the uterus of animals, or the hypothesis or project of constructing artificial uteruses for the human embryo. *These procedures are contrary to the human dignity proper to the embryo, and at the same time they are contrary to the right of every person to be conceived and to be born within marriage and from marriage.*" – *DV, I.6*

"Conception *in vitro* is the result of the technical action which presides over fertilization. *Such fertilization is neither in fact achieved nor positively willed as the expression and fruit of a specific act of the conjugal union.*" –*DV, II.5*

On surrogate motherhood: "Surrogate motherhood represents an objective failure to meet the obligations of maternal love, of conjugal fidelity and of responsible motherhood; it offends the dignity and the right of the child to be conceived, carried in the womb, brought into the world and brought up by his own parents; it sets up, to the detriment of families, a division between the physical, psychological and moral elements which constitute those families." –*DV, II.3*

Respect for animals

Genetic Research/ biotechnologies/ genetic modification of animals:

"The negative ethical evaluations outlined here apply to all genetic manipulatory interventions concerned with embryos. On the other hand there are no moral objections to the manipulation of human body cells for curative purposes and the manipulation of animal or vegetable cells for pharmaceutical purposes." – *CHCW, 14*

"The application to humans of biotechnology learned from animal fertilization has made possible various interventions in human procreation, giving rise to serious questions of moral lawfulness. 'The various 'techniques of artificial reproduction', which would seem to be at the service of life and which are frequently used with this intention, actually open the door to new threats against life.'" – *CHCW*, 21

Sacrament on Marriage: purposes of marriage- unity and procreation

"From this it follows that they [married couples] are not free to act as they choose in the service of transmitting life, as if it were wholly up to them to decide what is the right course to follow. On the contrary, they are bound to ensure that what they do corresponds to the will of God the Creator. The very nature of marriage and its use makes His will clear, while the constant teaching of the Church spells it out." –*Humanae Vitae (HV)*, 10

Appendix G: Additional Resources (Scripture)

On creation, the body and the spirit:

1 Corinthians 15.39-49: "Not all flesh is alike, but there is one flesh for human beings, another for animals, another for birds, and another for fish. There are both heavenly bodies and earthly bodies, but the glory of the heavenly is one thing, and that of the earthly is another. There is one glory of the sun, and another glory of the moon, and another glory of the stars; indeed, star differs from star in glory. So it is with the resurrection of the dead. What is sown is perishable, what is raised is imperishable. It is sown in dishonour, it is raised in glory. It is sown in weakness, it is raised in power. It is sown a physical body, it is raised a spiritual body. If there is a physical body, there is also a spiritual body. Thus it is written, 'The first man, Adam, became a living being'; the last Adam became a life-giving spirit. But it is not the spiritual that is first, but the physical, and then the spiritual. The first man was from the earth, a man of dust; the second man is from heaven. As was the man of dust, so are those who are of the dust; and as is the man of heaven, so are those who are of heaven. Just as we have borne the image of the man of dust, we will also bear the image of the man of heaven.

Respect for human life and health

1 Corinthians 6.19: "Do you not know that your body is the temple of the Holy Spirit within you, which you have from God, and that you are not your own?"

Ecclesiastes 30.16: There is no wealth better than health of body, and no gladness above joy of heart.

1 Corinthians 12.18-28: But as it is, God arranged the members in the body, each one of them, as he chose. If all were a single member, where would the body be? As it is, there are many members, yet one body. The eye cannot say to the hand, 'I have no need of you', nor again the head to the feet, 'I have no need of you.' On the contrary, the members of the body that seem to be weaker are indispensable, and those members of the body that we think less honourable we

clothe with greater honour, and our less respectable members are treated with greater respect; whereas our more respectable members do not need this. But God has so arranged the body, giving the greater honour to the inferior member, that there may be no dissension within the body, but the members may have the same care for one another. If one member suffers, all suffer together with it; if one member is honoured, all rejoice together with it.

Chastity: The integrity of the person

1 Corinthians 6.18: “Shun fornication! Every sin that a person commits is outside the body; but the fornicator sins against the body itself.”

Children as Gift from God:

Matthew 19.13-15: Then little children were being brought to him in order that he might lay his hands on them and pray. The disciples spoke sternly to those who brought them; but Jesus said, ‘Let the little children come to me, and do not stop them; for it is to such as these that the kingdom of heaven belongs.’

Respect for animals and stewardship

Genesis 1.26: Then God said, ‘Let us make humankind in our image, according to our likeness; and let them have dominion over the fish of the sea, and over the birds of the air, and over the cattle, and over all the wild animals of the earth, and over every creeping thing that creeps upon the earth.’

Sacrament on Marriage: purposes of marriage- unity and procreation

Matthew 19:4-6: "Haven't you read," he replied, "that at the beginning the Creator 'made them male and female,' and said, 'For this reason a man will leave his father and mother and be united to his wife, and the two will become one flesh' ? So they are no longer two, but one. Therefore what God has joined together, let man not separate."

Teacher Catholic Faith Integrations Reflections

What have I learned about teaching this unit?

Science 9

Unit: Reproduction

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 Comments:



Science 9 Faith Permeation Essential Connections

Unit Theme: Physical Science – Atoms and Elements

NOTE: All highlighted/shaded areas indicate faith permeation.

The provincial science outcomes for this unit expect that students will learn about the makeup of matter from scientific and cultural perspectives. This unit will explore matter from a Catholic faith perspective. It will address indicators AE9.2 (a) and AE9.2 (c). The following lessons will help students learn how our catholic understanding of the created world – matter - comes from scripture, Catholic teachings, the Jewish roots of our faith, and our experience of faith.

Catholic Faith Focus for Learning:

- There is an abundance of scientific proof that elements, atoms, molecules and compounds are the fundamental building blocks of matter. What created atoms and elements, where they come from is still a matter of speculation and theorizing within the scientific community. For Catholics our belief that God created and directed the formation of these basic building blocks of matter from nothing underlies our understanding of the substances that make up all things.
- The Catechism of the Catholic Church clearly states: "We believe that God needs no preexistent thing or any help in order to create, nor is creation any sort of necessary emanation from the divine substance. God creates freely 'out of nothing'" (*Catechism of the Catholic Church* #296).

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

- Many ancient peoples believed that matter was formed from four basic elements: earth, air, water and fire. For the Jewish people, from whom Catholics trace their roots, these four basic elements were created by God.
- In Catholic doctrine, little is said of these four elements. Rather the Catholic Church teaches that God creates all substances in the universe by his will and from nothing. (CCC 296). This teaching has been upheld by many councils throughout the history of the Catholic Church.

Catholic Faith Essential Skills:

- Students will learn how early cultures - including the Jewish culture, from which the Catholic Faith derives - understood the creation of matter in terms of the four fundamental elements of earth, air, water and fire.
- In terms of elements and atoms as the modern fundamental building blocks of matter, students will understand and appreciate how and why the Catholic Church teaches that all created matter has its existence in God.
- Students will be able to distinguish between views on the nature of matter from a scientific view and a Catholic perspective.

Catholic Faith Essential Questions:

- How does the Church view matter and its existence?
- What did the early Hebrews, from whom our faith derives, understand about matter?

Faith Permeation Lessons:

Lesson 1: Other Views on Understanding Matter.

Description:

The following lesson provides the Catholic permeation pieces intended to be taught in conjunction with section 4.1 in Pearson Saskatchewan Science 9 P. 123.

In this lesson, students learn how other cultures have understood matter. They are introduced to a perspective held by many cultures that all things were composed of four basic elements: earth, air, fire and water. Teachers will help students appreciate that our Jewish ancestors retained a belief in these four elements, but that from a Catholic perspective all matter, regardless of the elements that comprise them, are created by God from nothing.

Required time: 1 hour.

Provincial Curriculum Outcomes Addressed:

Outcome: AE9.2

Analyze historical explanations of the structure of matter up to and including:

- Dalton model
- Thomson model
- Rutherford model
- Bohr model of the atom.

Provincial Curriculum Indicators Addressed:

- a. Propose personal explanations for the structure and/or composition of matter.
- c. Describe First Nations and Métis views on the nature and structure of matter.

Faith Permeation Outcomes:

- Students will understand how early cultures, including the Jewish culture, understood the four 'elements'- earth, air, water and fire.

Faith Permeation Teacher Notes:

- For many cultures, civilizations and peoples there is a necessity to understand how constituents of matter comprise substances. Many ancient peoples ascribe the formation of matter from four basic elements: earth, air, water, fire and water. For the early Hebrews, these four constituents were attributable to God. We don't learn from the Torah that God intended to make only four elements and these were the four principle elements, but later sources like the Talmud and the Midrashic literature suggests that the Hebrews believed in four or possibly five elements.

Instructional Procedure:

- Begin by reading 'Understanding Matter' and 'Other Views on Nature of Matter' in Pearson Saskatchewan Science 9.
- Explore question 2 on P. 124 in Learning Checkpoint.
- Ask key questions:
 - a) Besides Greek, Chinese, Roman and Islamic cultures, are there other cultures that sought to explore the nature of matter?"
 - b) How did Jesus' people or his earlier Jewish ancestors view matter?
- Provide students with the handout "Activity 1: The Elements and Creation". Make it clear to the students that while Genesis doesn't specifically refer to water, earth, air and fire as elements, we can see how the ancient Hebrews believed these substances were used by God to create the earth and all life on it.

Lesson 2: God Creates out of Nothing.**Description:**

The following lesson provides the Catholic permeation pieces intended to be taught in conjunction with section 4.1 in Pearson Saskatchewan Science 9 P. 123.

In lesson 1, students learned how many cultures understood all things – matter - was composed of four elements. In this lesson, students will understand that from a Catholic perspective all matter, regardless of the elements that comprise them, are created by God from nothing.

Required time: 1 hour.

Provincial Curriculum Outcomes Addressed:**Outcome: AE9.2**

Analyze historical explanations of the structure of matter up to and including:
◦Dalton model

- Thomson model
- Rutherford model
- Bohr model of the atom.

Provincial Curriculum Indicators Addressed:

- a. Propose personal explanations for the structure and/or composition of matter.
- c. Describe First Nations and Métis views on the nature and structure of matter.

Faith Permeation Outcomes:

- Students will understand and appreciate how and why the Catholic Church teaches that all created matter has its existence in God.
- Students will be able to distinguish between views on the nature of matter from a scientific view and a Catholic perspective.

Faith Permeation Teacher Notes:

In this lesson, teachers are asked to help students understand that God created all substances on earth from nothing. The Catechism of the Catholic Church specifies that on the nature of the divine, God willfully directed creation from nothing (CCC #296). It also states that God needed neither help nor any pre-existing substance. Lastly the Church also teaches that God is transcendent and beyond creation (CCC #300), and that his being and will sustains all things at every moment (CCC #301).

The second half of this lesson asks Catholic students to reflect about walking in two worlds. The idea of two world walking is a First Nation one. Traditional elders and knowledge keepers who walk two worlds constantly balance their traditional beliefs and the information they get from a western perspective. The act of two world walking entails maintaining one's belief and at the same time acknowledges the views of other knowledge systems, views that might even be contradictory to one's own.

In learning science, knowledge that students receive from this worldview and body of knowledge may conflict with knowledge and teachings they receive from the Catholic Church. While the Church defends the position that faith and reason are not opposed, inevitably there are some ideas that will be at odds. i.e. heliocentric vs. geocentric view of the world. In that debate, the Church was wrong and had to amend its position hundreds of years later when it was widely accepted and scientifically shown that the earth rotated around the sun.

There will be students in our classrooms who, being agnostic or atheist or simply trying to make sense of their faith, may doubt the idea that God is omnipotent (all-powerful) or that He exists at all. Teachers need to faithfully present the content from the Church's perspective, and allow students the room to question and even to doubt.

Instructional Procedure:

Distribute Activity 2: "What does the Catholic Church believe on the creation of matter?" and provide time for the students to read and discuss the reflection questions in small groups. Conclude by having the students share their answers as a whole class.

- Read Activity 3 “Two World Walking” with the students. Give students time to quietly reflect on the questions included in this activity.
- In groups or as an entire classroom, discuss what students think about reconciling faith and science. Ask these questions:
 - a) Are faith and science incompatible or is it possible to learn from science and still believe?
 - b) Do you agree with the Church’s position on God creating everything from nothing?
 - c) Does knowing the scientific understanding of matter change or contradict our faith in God’s ability to create from nothing?

Culminating Task:

There is no culminating task for this unit. The possibility of genuine permeation of faith is limited because of the nature of this unit. Fewer permeation lessons are possible as none of the other indicators and outcomes lend themselves to authentic permeation. As a result, a meaningful culminating task that would adequately assess curriculum outcomes and indicators is not possible.

Appendix A: Black Line Masters

Activity 1: The Elements and Creation

Science 9

Unit: Atoms and Elements

Many cultures, civilizations and peoples since the early beginning of humanity have tried to understand and explain what makes up all material things – matter. They didn't use scientific words like atoms and molecules to describe matter and the chemical interactions in matter. They didn't possess the scientific body of knowledge regarding chemistry and physics that may have helped them explain how chemical elements make up all things.

Instead, cultures through their observation of the natural world, tried to understand matter as they knew it. They thought that certain substances made up other substances. For example, they believed that wood held the element of fire and air because when wood burned it produced fire and smoke (air or wind). In their understanding, fire could not be broken down into other simpler substance. Likewise, nothing else could make up air, and therefore air also had to be a basic building block. These cultures knew that air also sustained life. Similarly, water made up living things and nothing that they knew of could make up water. The same was thought of earth. Therefore, through these similar understandings and experiences of water, fire, earth and water, many cultures across the world came to the conclusion that these four basic substances made up all created things. The Greeks, the Chinese, the Egyptians and various First Nations here in Canada believed in four elements shared this view. For the Jewish People - from whom Catholics trace their roots - their understanding about the nature of these constituents (fire, water, air and earth) were attributable to God for their creation. From the account in the Pentateuch -the first five books that make up our bible and are the five books that make up the Torah in Judaism - we can see how the ancient Hebrews thought about matter in the book of Genesis.

Genesis 1.1-6

¹In the beginning when God created* the heavens and the earth, ²the earth was a formless void and darkness covered the face of the deep, while a wind from God* swept over the face of the waters. ³Then God said, 'Let there be light'; and there was light. ⁴And God saw that the light was good; and God separated the light from the darkness. ⁵God called the light Day, and the darkness he called Night. And there was evening and there was morning, the first day.

⁶ And God said, 'Let there be a dome in the midst of the waters, and let it separate the waters from the waters.'

Questions:

1. What 'elements' are described in Genesis?
2. The word fire isn't represented anywhere in the passage but what allusions are made to fire?
3. What do you think might be 'the face of the deep'?

Genesis 1.7-31

So God made the dome and separated the waters that were under the dome from the waters that were above the dome. And it was so. God called the dome Sky. And there was evening and there was morning, the second day.

And God said, ‘Let the waters under the sky be gathered together into one place, and let the dry land appear.’ And it was so. God called the dry land Earth, and the waters that were gathered together he called Seas. And God saw that it was good. Then God said, ‘Let the earth put forth vegetation: plants yielding seed, and fruit trees of every kind on earth that bear fruit with the seed in it.’ And it was so. The earth brought forth vegetation: plants yielding seed of every kind, and trees of every kind bearing fruit with the seed in it. And God saw that it was good. And there was evening and there was morning, the third day.

Questions:

1. What other elements do we see in these passages?
2. Why do you suppose the ancient Hebrews believed that water from the earth was separated from water above in the sky?
3. Where does vegetation come from? Why might the Hebrews think the ground, or earth yielded plants?

And God said, ‘Let there be lights in the dome of the sky to separate the day from the night; and let them be for signs and for seasons and for days and years, and let them be lights in the dome of the sky to give light upon the earth.’ And it was so. God made the two great lights—the greater light to rule the day and the lesser light to rule the night—and the stars. God set them in the dome of the sky to give light upon the earth, to rule over the day and over the night, and to separate the light from the darkness. And God saw that it was good. And there was evening and there was morning, the fourth day.

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.’ So God created the great sea monsters and every living creature that moves, of every kind, with which the waters swarm, and every winged bird of every kind. And God saw that it was good. God blessed them, saying, ‘Be fruitful and multiply and fill the waters in the seas, and let birds multiply on the earth.’ And there was evening and there was morning, the fifth day.

Questions:

1. What elements do we see in these passages?
2. Where do sea animals come from? Why might the Hebrews think the water yielded sea animals?
3. Where do the birds come from? Do we learn from what element birds may have been made?

And God said, ‘Let the earth bring forth living creatures of every kind: cattle and creeping things and wild animals of the earth of every kind.’ And it was so. God made the wild animals of the earth of every kind, and the cattle of every kind, and everything that creeps upon the ground of every kind. And God saw that it was good.

Question:

1. Where do animals come from? Why might the Hebrews think the ground, or earth yielded animals?

Then God said, ‘Let us make humankind* in our image, according to our likeness; and let them have dominion over the fish of the sea, and over the birds of the air, and over the cattle, and over all the wild animals of the earth,* and over every creeping thing that creeps upon the earth.’ So God created humankind* in his image, in the image of God he created them; male and female he created them.

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.’ God said, ‘See, I have given you every plant yielding seed that is upon the face of all the earth, and every tree with seed in its fruit; you shall have them for food. And to every beast of the earth, and to every bird of the air, and to everything that creeps on the earth, everything that has the breath of life, I have given every green plant for food.’ And it was so. God saw everything that he had made, and indeed, it was very good. And there was evening and there was morning, the sixth day.

Questions:

1. What important element did God give to all living things?
2. Why did the Hebrews believe that ‘air’ or the ‘breath’ of God is important for all life?
3. What are the physical science truths that we can draw from this story?

Genesis 2: 1 - 9

Thus the heavens and the earth were finished, and all their multitude. And on the seventh day God finished the work that he had done, and he rested on the seventh day from all the work that he had done. So God blessed the seventh day and hallowed it, because on it God rested from all the work that he had done in creation.

These are the generations of the heavens and the earth when they were created. In the day that the LORD God made the earth and the heavens, when no plant of the field was yet in the earth and no herb of the field had yet sprung up—for the LORD God had not caused it to rain upon the earth, and there was no one to till the ground; but a stream would rise from the earth, and water the whole face of the ground - then the LORD God formed man from the dust of the ground, and breathed into his nostrils the breath of life; and the man became a living being. And the LORD God planted a garden in Eden, in the east; and there he put the man whom he had formed. ⁹Out of the ground the LORD God made to grow every tree that is pleasant to the sight and good for food, the tree of life also in the midst of the garden, and the tree of the knowledge of good and evil.

Questions:

1. From what ‘elements’ did God create the first man?
2. Why would people believe that humans are made of air and earth?

Appendix A: Black Line Masters

Activity 2: What does the Catholic Church believe on the creation of matter?

Science 9

Unit: Atoms and Elements

The exploration of matter, from Greek thinking to modern day science, has led to the science of chemistry. Today science shows that there are 98 naturally occurring elements on earth and another 30 are synthesized during very powerful reactions in laboratories. Scientists postulate that all elements were formed moments after the big bang when the heat and energy lessened and the universe cooled enough to form matter. Neither the theory itself nor the scientific community at large attempts to describe what or who started the big bang.

For the Catholic Church, the big bang theory may be a means that God could have used to create the universe. If God chose a ‘big bang’ beginning, then Church attributes its beginning, unfolding and creation to Him. This can be seen from the Vatican I Council when the Church put forward this infallible teaching on the creation of matter: “the world and all things which are contained in it, both spiritual and material, as regards their whole substance, have been produced by God from nothing” (*Canons on God the Creator of All Things*, canon 5). In other words, God created all matter from nothing and not from elements like wind, water, air or earth that already existed.

What does the Catechism teach us about God and creation of matter?

As a church, we believe that God is omnipotent, which means He is all-powerful. Needing no help or any pre-existing matter or substance, He freely created all things from nothing. (CCC 296). We also believe that God is greater and beyond creation (CCC 300) and that He sustains all things at every moment (CCC301).

How does a belief in God co-exist with scientific explanation of Matter?

Science cannot nor does it claim to be able to explain the existence or the nature of God. However, the Catholic Church teaches us that God has revealed Himself to us throughout history. Scripture and the ongoing teachings of the Church explain that God shows Himself to us in natural world, through the angels, in revelation, in the writing of apostles, in the message of prophets, in dreams, and mostly importantly through our Lord Christ Jesus, His son. Just as ‘big bang’ isn’t a story of faith, neither is our ‘creation story’, a scientific theory on the existence of atoms and elements. Rather like the traditional stories of the First Nations peoples, biblical accounts are ways that Catholics explain the meaning of their place in God’s creation and how we are part of His plan.

Questions for reflection:

1. Why is it possible to believe in fundamental particles like atoms which at the same time believing that God created them?
2. What is an infallible teaching? What significance does that have for Catholics?

Appendix A: Black Line Masters

Activity 3: Two World Walking

Science 9

Unit: Atoms and Elements

Like traditional First Nations people who live their spirituality in a modern world and try to make sense of the information they learn from science and technology, Catholics face a similar challenge. That challenge is to walk in two worlds. Two world walking is an ability to live out our spirituality while at the same time living with what we learn from a technological age.

In a short paragraph, respond to these questions.

In what way can we, as Catholic live out our faith and at the same time make sense of the knowledge that we derive from science and technology?

Does knowing about atoms and elements, for example, mean that we have to abandon our belief about God's act of creation?

Does knowing and believing in one thing mean the loss of another?

Appendix C: Table of Correlation

Faith Permeation lesson Documents	Pearson Saskatchewan Science 9	Outcome and Indicator	Catechism of the church	Gospel/ Church documents and encyclicals	Christian Ethics resources
<p>Lesson 1: Other Views on Understanding Matter Other Views</p> <p>Activity 1: “Activity 1: The Elements and Creation”</p>	Section 4.1 P. 123	AE9.2 (a) (c)	#300, #301	<p>Nicene Creed</p> <p>1st Vatican Council, chapter 1 On God the Creator of All Things.</p> <p><i>Summa Theologica</i> St. Thomas Aquinas</p>	<p>Gr. 9 Christian Ethics program <i>Be With Me</i> - Unit 3 Section: Believing what can’t be proved P. 54-55</p> <p>Reflection questions 1-4</p>
<p>Lesson 2: God Creates out of Nothing</p> <p>Activity 2: What does the Catholic Church believe on the creation of matter?</p> <p>Activity 3: Two World Walking</p>	Section 4.1 P. 123	AE9.2 (a) (c)	#300, #301	<p>Nicene Creed</p> <p>1st Vatican Council, chapter 1 On God the Creator of All Things.</p> <p><i>Summa Theologica</i> St. Thomas Aquinas</p>	<p>Gr. 9 Christian Ethics program <i>Be With Me</i> - Unit 3 Section: Believing what can’t be proved P. 54-55</p> <p>Reflection questions 1-4</p>

Appendix D: Catechism of the Catholic Church

God creates "out of nothing"

296 We believe that God needs no pre-existent thing or any help in order to create, nor is creation any sort of necessary emanation from the divine substance.¹⁴⁴ God creates freely "out of nothing".¹⁴⁵ (Compendium of the Catechism of the Catholic Church #296)

If God had drawn the world from pre-existent matter, what would be so extraordinary in that? A human artisan makes from a given material whatever he wants, while God shows his power by starting from nothing to make all he wants.¹⁴⁶

298 Since God could create everything out of nothing, he can also, through the Holy Spirit, give spiritual life to sinners by creating a pure heart in them,¹⁴⁸ and bodily life to the dead through the Resurrection. God "gives life to the dead and calls into existence the things that do not exist."¹⁴⁹ And since God was able to make light shine in darkness by his Word, he can also give the light of faith to those who do not yet know him.¹⁵⁰ (Compendium of the Catechism of the Catholic Church #298)

God transcends creation and is present to it.

300 God is infinitely greater than all his works: "You have set your glory above the heavens."¹⁵⁶ Indeed, God's "greatness is unsearchable".¹⁵⁷ But because he is the free and sovereign Creator, the first cause of all that exists, God is present to his creatures' inmost being: "In him we live and move and have our being."¹⁵⁸ In the words of St. Augustine, God is "higher than my highest and more inward than my innermost self".¹⁵⁹ (Compendium of the Catechism of the Catholic Church #300)

God upholds and sustains creation.

301 With creation, God does not abandon his creatures to themselves. He not only gives them being and existence, but also, and at every moment, upholds and sustains them in being, enables them to act and brings them to their final end. Recognizing this utter dependence with respect to the Creator is a source of wisdom and freedom, of joy and confidence:

For you love all things that exist, and detest none of the things that you have made; for you would not have made anything if you had hated it. How would anything have endured, if you had not willed it? Or how would anything not called forth by you have been preserved? You spare all things, for they are yours, O Lord, you who love the living.¹⁶⁰

(Compendium of the Catechism of the Catholic Church #301)

Appendix E: Scripture Passages on Creation and God

Hebrews 1:3: God, who, at sundry times and in diverse manners, spoke in times past to the fathers by the prophets, last of all, in these days, has spoken to us by his Son, whom he has appointed heir of all things, by whom also he made the world. Who being the brightness of his glory and the figure of his substance and upholding all things by the word of his power, making purgation of sins, sits on the right hand of the majesty on high”

Acts 17:24-27: God, who made the world and all things therein, he being Lord of heaven and earth, dwells not in temples made with hands. Neither is he served with men's hands, as though he needed anything: seeing it is he who gives to all life and breath and all things: And has made of one, all mankind, to dwell upon the whole face of the earth, determining appointed times and the limits of their habitation.

Judith 9.12: Please, please, God of my father, God of the heritage of Israel, Lord of heaven and earth, Creator of the waters, King of all your creation, hear my prayer!

Psalms 138:5-17: Behold, O Lord, you have known all things, the last and those of old: you have formed me, and have laid your hand upon me. Your knowledge has become wonderful to me: it is high, and I cannot reach to it. Whither shall I go from your spirit? Or whither shall I flee from your face? If I ascend into heaven, you are there: if I descend into hell, you are present. If I take my wings early in the morning, and dwell in the uttermost parts of the sea: Even there also shall your hand lead me: and your right hand shall hold me. And I said: Perhaps darkness shall cover me: and night shall be my light in my pleasures. But darkness shall not be dark to you, and night shall be light all the day: the darkness thereof, and the light thereof are alike to you. For you have possessed my reins: you have protected me from my mother's womb. I will praise you, for you are fearfully magnified: wonderful are your works, and my soul knows right well. My bone is not hidden from you, which you have made in secret: and my substance in the lower parts of the earth. Your eyes did see my imperfect being, and in your book all shall be written: days shall be formed, and no one in them. But to me your friends, O God, are made exceedingly honourable: their principality is exceedingly strengthened.

Job 12:10: In his hand is the life of every living thing and the breath of every human being.

Teacher Catholic Faith Integrations Reflections
What have I learned about teaching this unit?

Science 9

Unit: Atoms and Elements

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 Comments:



Science 9

Faith Permeation Essential Connections

Unit Theme:

Physical Sciences- Characteristics of Electricity

NOTE: All highlighted/shaded areas indicate faith permeation.

In this unit, the provincial curriculum expects that students will explore and learn about the characteristics of electricity. Aside from the scientific and technical aspects of learning about electrical theory and principles, students are required to know and appreciate how consumption of electricity, along with the resources that are exploited to make electricity, impact the earth. This Catholic Faith permeation unit will explore the Catholic social teaching on stewardship of the earth. God calls us to be good and faithful keepers of the earth's resources as well as everything that lives on it. Students will learn to assess from a Catholic perspective the consequences of technologies that harness electrical power or which convert electrical power from other natural resources.

Catholic Faith Focus for Learning:

- Scripture and Tradition never cease to teach and celebrate this fundamental truth: "The world was made for the glory of God." St. Bonaventure explains that God created all things "not to increase his glory, but to show it forth and to communicate it", for God has no other reason for creating than his love and goodness: "Creatures came into existence when the key of love opened his hand." The First Vatican Council explains: "This one, true God, of his own goodness and 'almighty power', not for increasing his own beatitude, nor for attaining his perfection, but in order to manifest this perfection through the benefits which he bestows on creatures, with absolute freedom of counsel 'and from the beginning of time, made out of nothing both orders of creatures, the spiritual and the corporeal. . .'" (CCC #293)
- 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. (CCC #340)
- People are the recipients of God's divine love and gifts. As stewards of creation we are committed to the care of creation in a sustainable fashion. God has entrusted all the living

things of the earth and all of the earth's resources into our care. Through our labor humans harvest, reap and take the products of the earth for our needs. These gifts are for all people to use. (CCC #2402).

- People must have regard for the needs of others and cultivate a way of life that includes sharing our goods with others, protecting the earth and God's gift for all people and for the generations of people to come.
- Use of the mineral, vegetable, and animal resources of the universe cannot be divorced from respect for moral imperatives. Man's dominion over inanimate and other living beings granted by the Creator is not absolute; it is limited by concern for the quality of life of his neighbor, including generations to come; it requires a religious respect for the integrity of creation. Thus production of electricity must consider how the original primary sources, as gifts from God, are exploited to maximize the good of all people, not merely the interests of a few or of industry, and to ensure that harm to the earth is minimized so that future generations may enjoy these resources. (CCC #2415)
- The dominion granted by the Creator over the mineral, vegetable, and animal resources of the universe cannot be separated from respect for moral obligations, including those toward generations to come. (CCC #2456)
- We must re-establish the links with nature that we have damaged. We now know that we are tied much more closely to the environment in which we live than we had imagined. Our planet is a spacecraft on which we navigate together with the environment, for better and for worse. As Saint Paul says, "the whole creation has been groaning in labour pains until now," in the hope "to be set free from its bondage to decay" (Romans 8.22 and 21). Is development that is more respectful of nature's laws and rhythms not a first step toward its freedom? (Canadian Conference of Catholic Bishops-Our Relationship with the Environment: a need for conversion)
- The issue of the environment, now so crucial, ties us to one another as never before. Selfishness is no longer merely immoral, it is becoming suicidal. We no longer have a choice about new solidarity and new forms of sharing. (Canadian Conference of Catholic Bishops-Our Relationship with the Environment: a need for conversion)
- Are we not like the prodigal son who asked his father for his inheritance and then left home and proceeded to waste it (Luke 15.11-32)? In our drive to earn more, to possess more, to consume always more, we have sacrificed a great deal to the economic almighty, which has become like the substance of modern life. We have mismanaged the Garden of Eden entrusted to us. It has lost part of its integrity and beauty. (Canadian Conference of Catholic Bishops-Our Relationship with the Environment: a need for conversion)

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

- Globally, nationally and provincially sources that are commonly exploited for electricity are often non-renewable, easily available and cheap. In Canada and even more so in Saskatchewan, one of the leading resources used to make electricity is coal. While new technologies have reduced the types of harmful emissions produced by burning coal, the combustion of coal still releases considerable amounts of greenhouse gases and other pollutants into the atmosphere.

- Good stewards are careful and thoughtful managers and caretakers of God’s gift - the earth and its resources - entrusted to us to use wisely for the good of all people, in this generation and the ones to come.
- As good stewards of the earth, we must learn to reduce our consumption and conserve electricity. We must consider how the types of resources that we use to generate electricity impact the environment and how those choices impacts future generations.

Catholic Faith Essential Skills:

- Students will learn that all forms of electricity generation have benefits and costs, both socially and the environmentally.
- Students will appreciate that all benefits and costs must be considered before we precede with electricity generation projects especially when it concerns society, now and in the future, as well as the environment.
- Students will understand and appreciate the position of the Catholic Church on the stewardship of natural resources for human activities.

Catholic Faith Essential Questions:

- What is meant by the term “steward of creation?”
- In what way(s) must we, as good stewards of the earth, expect our government and industry to care for the resources that they exploit?
- What considerations should we, as good stewards, have about our electrical usage and the ways that we produce electricity?

Faith Permeation Lessons:

Lesson 1: What is Stewardship?

Description: In this lesson students will learn how to assess the consequences of major resources used to make electricity.

Required time: 2 hours

Provincial Curriculum Outcomes Addressed:

CE9.4 Critique impacts of past, current, and possible future methods of small and large scale electrical energy production and distribution in Saskatchewan.

Provincial Curriculum Indicators Addressed:

- f. Describe scientific, technological, societal, and environmental perspectives related to past, current, and proposed large-scale methods of electrical energy generation in Saskatchewan (e.g., hydroelectric dams, coal and natural gas-fired plants, wind turbines, solar energy, geothermal, biomass, and nuclear plants).
- g. Evaluate evidence and sources of information created by different stakeholders related to various methods of electrical energy production in Saskatchewan, including alternative energy sources such as geothermal, biomass, clean coal, and co-generation.

Faith Permeation Outcomes:

- Students will understand the Church's position on stewardship.
- Students will understand the cost and benefits of each method used to generate electricity, and that stewardship of these resources is necessary.

Instructional Procedure:

- This unit is taught in conjunction with unit C, chapter 8, P. 268 in Pearson Saskatchewan Science 9.
- Begin with a review of concepts in this unit. Review ways that electricity is generated in Saskatchewan and in Canada (coal, hydro, natural gas, wind). Describe each method with the class.
- Divide students into groups of 3. Chart the relative costs and benefits of each method. Students will assess how much each type of resource (coal, hydro, natural gas and wind) is used provincially and compare these with national statistics. Also P. 274-277 in Pearson Saskatchewan Science describes types of resources used to make electricity.
- The following resources will provide additional information regarding the environmental consequences associated with each type of natural resource used in electrical generation in Canada:
 - <http://www.scienceonline.co.uk/energy/renewable-energy.html>
 - <http://www.international.gc.ca/enviro/energy-energie/facts-faits.aspx?lang=eng&view=d>
 - <http://www.electricity.ca/media/pdfs/backgrounders/HandBook.pdf>
 - <http://www.nrcan.gc.ca/energy/renewable/1297>
 - <http://www.nrcan.gc.ca/energy/sources/electricity/1387>
- Ask key questions:
 - 1) Are any of these methods “clean”?
 - 2) What are the consequences for each type of resource?
- Discuss the idea of consequence - both positive and negative - for each natural resource. Discuss that there are positive and negative social consequences, as well as positive and negative environmental consequences which we must consider in our choices. Social consequences impact people and society. i.e job creation, good for the economy, delivery of electricity, cheap source therefore cheap prices. These positive and negative social consequences are offset and complimented as well by positive and negative environmental consequences. Environmental consequences consider the damage and the changes we make to the environment as we exploit these natural resources. Some examples of positive and negative environmental consequences are loss of habitats for plants and animals, changing landscape and climate, endangering or even causing the extinction of a species etc.
- See Pearson Saskatchewan science 9 P. 278- 279 which provides graphs that describe sources of energy used to produce electricity in Canada. Teachers may wish to consider the various sources across Canada and how different parts of the country use them. Students need to know that sometimes we can increase the production of energy in a part of the country only if that area has access to that resource.
- Provide each student with the worksheet “Activity 1: Comparing the Consequences”. Have each student or group fill out the table in the activity.

- Have each group assign a speaker to report what they have discussed. Students will present their findings and conclusions on the social and the environmental consequences, both good and bad, for each type of primary energy source that they described and discussed in their small groups.
- Finally pose the question, “From a stewardship perspective, which resource is best for Saskatchewan?” Teachers may follow up the activity by having their students journal. In their journals, students will use a stewardship perspective to defend the resources that maximizes social good and does the least harm to environment.

Lesson 2: Applying our understanding of Catholic Stewardship

Description: Students will then apply their knowledge about stewardship to create an awareness program or an action plan for their school or home. This activity involved will involve work at home and will take a month to gather results.

Required time: 2 hours

Provincial Curriculum Outcomes Addressed:

CE9.3: Assess operating principles, costs, and efficiencies of devices that produce or use electrical energy.

Provincial Curriculum Indicators Addressed:

- g. Make informed decisions about personal use of devices that use electrical energy, taking into account environmental and social advantages and disadvantages.
- h. Propose a course of action to reduce the consumption of electrical energy in Saskatchewan, taking into account personal, societal, and environmental needs.

Faith Permeation Outcomes:

- Students will understand the Church’s position on stewardship.
- Students will create an action plan based on the stewardship model.

Teacher notes:

- This lesson works in tandem with section 8.2 “Reducing our Electrical Energy Consumption” from Pearson Saskatchewan Science 9, P. 284-293. You may do this activity as compliment or as an extension of the Inquiry Activity on P. 291 in Pearson Saskatchewan Science

Instructional Procedure:

- Provide students the activity ‘Activity 2: Catholic Perspectives on stewardship’. Read through the activity as a class or in groups.
- Have the students examine what the Church has taught about the use of earth’s resources through scripture and the Catechism of the Catholic Church. The students will then reflect on the question, “As stewards of earth’s resources, how have humans done? Can we apply stewardship values to our own consumption of electricity in Saskatchewan?”

Faith Permeation Culminating Tasks - Integrating Catholic Faith

Culminating Task A

“Culminating Activity: Stewardship Action Plan” can be done as a stand-alone activity or could be used as a compliment to Problem Solving Activity on P. 292. Alternatively, this activity could be used to supplement the culminating activity found on P. 298 in Pearson Saskatchewan Science 9.

- Students are asked to create an action based on the principles and value of stewardship. Their plan needs to consider aspects such as social and environmental responsibility, reduction of harm to the environment and maximization of good for everyone concerned. They will need time to review the activity and implement their plan. It is also crucial that students begin immediately if they should choose this task. ***The plan requires a significant amount of time and so some thought should be given to starting this action plan at the beginning of the unit. A suggestion would be to reorganize the electricity unit in the Pearson Saskatchewan Science 9, i.e. consider teaching Section 8 before returning to section 6 and 7.***
- Read the instructions through with the students. As a classroom, consider how and what actions the students may do for their action plan. Brainstorm a list: suggestions are also provided on the activity sheet. Have them record the actions they have decided to take into the action plan table found on the culminating activity. One of the columns asks students to observe and to document changes to behaviours of their family members. This may not be doable towards the end of their month long project.
- Before the end of the unit, ensure that students have thoughtfully and thoroughly completed the reflection questions that are found at the end of the task.

Appendix A: Black line Masters

Activity 1: Comparing the Consequences

Science 9

Unit: Characteristics of Electricity

As we humans continue to live on the planet, damage to the environment is unavoidable. It is impossible to have zero impact. When we drive, shop, eat, farm, build homes, cities, roads, etc. we create an environmental impact. How big the impact is depends on our choices. The same principle applies when we make choices about the resource we use to produce electricity. In this activity, we'll examine the consequences of each natural resource we use to produce electricity in Saskatchewan. By the end of the lesson, you will also be able to explain how a Catholic view of stewardship helps to evaluate each resource.

What is good stewardship?

- ***For the good of all people:*** In the Book of Genesis, God gives people dominion over the plants and animals of the earth to use and to domesticate for our needs, for food and clothing. **The resources of the earth are meant for the good all people.** The Catechism of Catholic Church explains that “In the beginning God entrusted the earth and its resources to the common stewardship of mankind to take care of them, master them by labor, and enjoy their fruits. The goods of creation are destined for the whole human race. (CCC #2402)
- ***Responsibility for those resources for this generation and the generations of people to come:*** The use of Earth's resources must respect the moral obligation that God gave to us when He entrusted the earth to us. We have to be responsible and accountable for the way we use those resources for everyone alive today and for future generations of people (CCC #2456)
- ***Kind and respectful treatment of all resources, especially animal and plant life because they reveal the glory of God.*** (CCC #2415-2418)

Stewardship is the responsible, morally appropriate management of earth's natural resources for the good of all people including the future generations. In short responsible stewardship is sustainable and respectful for all people and for the environment.

For each of the resources used to make electricity note the consequences, both good and bad, for people and for the environment in the table provided. In your answers, distinguish between social advantages\disadvantages from environmental advantages\disadvantages. Social advantages and disadvantages describe the positive and negative consequences on people and society, while environmental advantages and disadvantages describe the positive and negative consequences on the land, ecosystems, plants and animals.

Example

Natural resource: Hydroelectricity	advantages	disadvantages
Social	Could provide employment for many people.	Change the flow of river systems that might impact homes and farms that rely on a source of water.
Environmental	Environmentally sustainable. Water is a renewable resource and little pollution to no pollution is created.	Damming of rivers alter and destroy existing habitats. Changes the course and flow of rivers. Alters water height and drainage.

Table 1: Social and Environmental Consequences of the use of natural resources to make electricity

Natural resource: Fossil Fuels	advantages	disadvantages
Social		
Environmental		

Natural resource: Biomass	advantages	disadvantages
Social		
Environmental		
Natural resource: Nuclear Energy	advantages	Disadvantages
Social		
Environmental		

Natural resource: Geothermal Energy	advantages	Disadvantages
Social		
Environmental		
Natural resource: Hydroelectricity	advantages	disadvantages
Social		
Environmental		

Natural resource: Solar	advantages	disadvantages
Social		
Environmental		
Natural resource: Wind energy	advantages	disadvantages
Social		
Environmental		

Natural resource: Tidal	advantages	disadvantages
Social		
Environmental		

Appendix A Black Line Master

Activity 2: Catholic Perspectives on Stewardship

Science 9

Unit: Characteristics of Electricity

The greatest threat to the future of people may not be war or disease. Instead, the UN and other international organizations suggest that global warming and damage caused by human activity to the earth may ultimately and irrevocably harm future peoples, their food and water supplies, as well as global and local ecosystems. Furthermore, human activity will shape and change climatic patterns in many areas around the world.

The Catholic Church, as well as many other faiths around the world, recognises the importance of the relationship that people have with the land that sustains them. While the Catholic view of the environment may differ in some ways from other cultural beliefs like those of First Nations peoples, we share similar values. Like many First Nations people in Saskatchewan, the Church believes that we are part of creation and that we have a responsibility for all things in the created order.

That responsibility is part of the Catholic teaching on stewardship. Though our creation narrative contained in the Book of Genesis describes people as the pinnacle of creation, we are not ‘lords over the creation’. Unfortunately, the phrase ‘dominion over the land’ has often used as a rationale to justify the exploitation of the earth and its natural resources. Properly understood, stewardship means that we are to care for all those things which are entrusted to us by God. The Church teaches that we have been given the great responsibility to care for the land as its caretaker for the good of all people and for future generations.

Therefore good stewardship is:

- 1) **Thankful and humble:** We recognized that God has entrusted the earth and all its resources for our use. We are stewards or caretakers not lords. Any private property we own we are asked to share for the benefit of all people.
- 2) **Just and socially responsible:** The earth and all its resources are for the good of all people of today and the people of the future. That means that the choices we make must protect the earth and its resources for future generations. This belief is similar to the ‘seven generation teaching’ of the Mohawk nation where people are asked to consider how their immediate actions impact people seven generations into the future.
- 3) **Environmentally responsible:** This means caring for and protecting the earth because all creation reflects God’s glory and through creation God reveals himself to us.

Consider the following information from Stats Canada website:

- In 2007, Canadian households consumed 1,368,955 terajoules (TJ) of energy in the home (Table 3-1). This includes energy from sources including electricity, natural gas, oil, wood and wood pellets and propane. 4

- The average Canadian household consumed 106 gigajoules (GJ) of energy in 2007 for use in the home (Table 3-2)
- Households in Alberta (129 GJ) and Saskatchewan (126 GJ) had the highest average energy consumptions per household, while households in Quebec (94 GJ) and British Columbia (98 GJ) had some of the lowest consumption levels (Table 3-2).
- Natural gas (43%) and electricity (38%) consumption represented the bulk of household energy use. However, wood and wood pellets accounted for 13% of total household energy use, followed by oil (6%).
- Electricity is used by households for lighting and powering appliances. Over a third of households also used electricity as their main source of heating, while others used it for supplementary heating. Households consumed 520,250 TJ of electricity in 2007 (Table 3-1), with average electricity consumption of 40 GJ per household (Table 3-2).
- Electricity was the principal source of energy used in three provinces (Table 3-1). In Quebec, it accounted for 61% of total energy use, compared to 54% in Newfoundland and Labrador, and 53% in New Brunswick. Electricity accounted for 42% of total household energy use in Manitoba, 37% in British Columbia, 33% in Nova Scotia, 30% in Ontario, 25% in Prince Edward Island, 24% in Saskatchewan and 20% in Alberta.
- Average per household use of electricity was highest in Newfoundland and Labrador (62 GJ), New Brunswick (60 GJ) and Quebec (57 GJ). It was lowest in Alberta (26 GJ), Prince Edward Island (30 GJ) and Saskatchewan (30 GJ) (Table 3-2).

Questions:

1. What is a good steward?
2. How can we be good stewards of Saskatchewan's electrical resources?
3. Where does Saskatchewan rank nationally in terms of energy usage?
4. Though Saskatchewan ranks second lowest in the country in terms of electrical energy use, we rank the second highest in overall energy consumption. What accounts for that difference?
5. Even though Saskatchewan ranks second lowest in the country in 2001 for electrical energy usage, what are some ways we can further reduced the consumption of electricity?
6. In what ways can we apply the value of stewardship to our consumption of electricity?

Appendix B

Culminating Activity: Stewardship Action Plan

Science 9

Unit: Characteristics of Electricity

Ever wonder how much electricity you really use? According to Stats Canada, the average Saskatchewan household uses 30 gigajoules per year. A joule is enough energy to raise the temperature of 1 cubic centimeter of water, one degree celcius. Thus, one gigajoule is equal to one billion joules of energy. One billion gigajoules of energy could power roughly 115 (100 watt) light bulbs in a 24 hour period. That's a lot of inefficient light bulbs! Luckily we don't leave a 115 inefficient light bulbs burning day and night.

Instructions:

- Interview your parents and ask them how much they pay and how much they use in electricity every month. This can be done by checking their monthly electricity bill.
- Do an inventory in your house. Examine the large appliances to see how much electricity they use. Energy efficient appliances significantly reduce the amount electricity used.
- Examine each room to determine what kinds of lights are used. Are they energy efficient fluorescent bulbs?
- Check to see if appliances like televisions, computers, game consoles are plugged in. Even though they remain 'off', these devices may still draw significant amounts of energy.

To Action:

- Create an action plan. In your action plan you may wish consider:
 - a) Messages and posters: a small reminder to please turn off the light placed around light switches may remind people to turn off lights, computers, etc.
 - b) Changes inefficient light bulbs in the house to energy efficient bulbs.
 - c) Unplugging computers and other devices that draw significant amounts of energy at night.
 - d) If you house is heated by electrical heat, consider lowering the thermostat at night.
 - e) Using timers for block heaters in winter.
 - f) Consider how passive heating and cooling might affect temperatures during summer months. How can cooling a house naturally by shutting blinds and opening windows at night might reduce the amount of electricity used to run an air condition unit all day and night during summer months?
- Start your action and run it for a month to see what the effects are on the energy savings on each monthly bill.

Things to consider:

- Does my plan consider the good of all people? If so, how?
- In what ways does my plan affect future generations?
- In what ways does my plan attempt to reduce harm to the environment?

Action Plan:

Action taken in the house	Your family's response	Observations \ Changes in family behavior?

Questions:

- 1) After one month on the action plan, how much did your family save on the cost of electricity?
- 2) Which strategies were effective?
- 3) Were there noticeable changes in your family? If so, what changes did you notice?
- 4) Why do you believe that these changes must be done to benefit the environment?
- 5) How are these changes necessary for the future of humanity?

Appendix C: Table of Correlation

Faith Permeation lesson Documents	Pearson Saskatchewan Science 9	Outcome and Indicator	Catechism of the church	Gospel/ Church documents and encyclicals	Christian Ethics resources
<p>Lesson 1: What is Stewardship?</p> <p>Activity 1: Comparing the Consequences</p>	<p>Section P. 286-279</p> <p>Graphs on P. 278- 279</p>	CE9.4 ‘f’ and ‘g’	#293 #340 #2402 #2415 #2456	<p>Genesis 1:31 Genesis 2:15 Daniel 3:74-81 Hosea 4:1-3 Romans 8.22 and 21 Luke 15.11-32 World Day of Peace address- Pope John Paul II Jan. 1990 <i>Evangelii Nuntiandi</i>, Dec. 8, 1975 Pope Paul VI</p>	<p>Gr. 9 Christian Ethics program <i>Be With Me</i> - Unit 5 Section: 5.2 P. 130 “the common good”</p> <p>Gr. 9 Christian Ethics program <i>Be With Me</i> - Unit 5 Section: 6.2 P. 132 “How much is enough?”</p> <p>Section 6.3 P. 140-144 140-142 “How can earth survive” reflection questions 2-5</p>
<p>Lesson 2: Applying our understanding of Catholic Stewardship</p> <p>Activity 2: Activity: Catholic Perspectives on stewardship’</p>	<p>Section 8.2 P. 284-293.</p> <p>Section 8.2 P. 284-293.</p> <p>Or as compliment or as an extension of the Inquiry Activity on P. 291</p>	CE9.3, ‘g’ and ‘h’	#2402 #2415 #2456	<p>Genesis 1:31 Genesis 2:15 Daniel 3:74-81 Hosea 4:1-3 Romans 8.22 and 21 Luke 15.11-32 World Day of Peace address- Pope John Paul II Jan. 1990 <i>Evangelii Nuntiandi</i>, Dec. 8, 1975 Pope Paul VI</p>	<p>Gr. 9 Christian Ethics program <i>Be With Me</i> - Unit 5 Section: 5.2 P. 130 “the common good”</p> <p>Gr. 9 Christian Ethics program <i>Be With Me</i> - Unit 5 Section: 6.2 P. 132 “How much is enough?”</p> <p>Section 6.3 P. 140-144 140-142 “How can earth survive” reflection questions 2-5</p>
<p>Culminating Activity</p>	<p>Culminating Activity: Stewardship Action Plan” can Problem Solving Activity on P. 292. Alternatively this activity could be used to supplement the culminating activity found on P. 298 in</p>	CE9.3, ‘g’ and ‘h’ CE9.4 ‘f’ and ‘g’	#293 #340	<p>Genesis 1:31 Genesis 2:15 Daniel 3:74-81 Hosea 4:1-3 Romans 8.22 and 21 Luke 15.11-32 World Day of Peace address- Pope John Paul II Jan. 1990 <i>Evangelii Nuntiandi</i>, Dec. 8, 1975 Pope Paul VI</p>	<p>Gr. 9 Christian Ethics program <i>Be With Me</i> - Unit 5 Section: 5.2 P. 130 “the common good”</p> <p>Gr. 9 Christian Ethics program <i>Be With Me</i> - Unit 5 Section: 6.2 P. 132 “How much is enough?”</p> <p>Section 6.3 P. 140-144 140-142 “How can earth survive” reflection questions 2-5</p>

Appendix D: Catechism of the Catholic Church

293 Scripture and Tradition never cease to teach and celebrate this fundamental truth: "The world was made for the glory of God." St. Bonaventure explains that God created all things "not to increase his glory, but to show it forth and to communicate it", for God has no other reason for creating than his love and goodness: "Creatures came into existence when the key of love opened his hand." The First Vatican Council explains:

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

(Compendium of the Catechism of the Catholic Church #293)

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. (Compendium of the Catechism of the Catholic Church #340)

2402 People are the recipients of God's divine love and gifts. As stewards of creation we are committed to the care of creation in a sustainable fashion. God has entrusted all the living things of the earth and all of the earth's resources into our care. Through our labor humans harvest, reap and take the products of the earth for our needs. These gifts are for all people to use. (Compendium of the Catechism of the Catholic Church #2402).

2415 Use of the mineral, vegetable, and animal resources of the universe cannot be divorced from respect for moral imperatives. Man's dominion over inanimate and other living beings granted by the Creator is not absolute; it is limited by concern for the quality of life of his neighbor, including generations to come; it requires a religious respect for the integrity of creation. Thus production of electricity must consider how the original primary sources, as gifts from God, are exploited to maximize the good of all people, not merely the interests of a few or of industry, and to ensure that harm to the earth is minimized so that future generations may enjoy these resources. (Compendium of the Catechism of the Catholic Church #2415)

2456 The dominion granted by the Creator over the mineral, vegetable, and animal resources of the universe cannot be separated from respect for moral obligations, including those toward generations to come. The dominion granted by the Creator over the mineral, vegetable, and animal resources of the universe cannot be separated from respect for moral obligations, including those toward generations to come. (Compendium of the Catechism of the Catholic Church #2456)

Appendix E: Catholic Church Teachings and Documents

1. **Our Relationship with the Environment: A need for conversion**

Canadian Conference of Catholic Bishops

http://www.cccb.ca/site/images/stories/pdf/enviro_eng.pdf

2. **Catholic Social Teaching and Environmental Ethics**

United States Catholic Conference

<http://www.webofcreation.org/DenominationalStatements/catholic.htm>

3. **Apostolic Exhortation, *Evangelii Nuntiandi*, On Evangelization in the Modern World,**

Pope Paul VI (December 8, 1975)

<http://conservation.catholic.org/popes.htm>

Address for World Day of Peace

John Paul II (January 1, 1990)

<http://conservation.catholic.org/ecologicalcrisis.htm>

Appendix F: Scriptural Passages on Creation and Stewardship

Genesis 1: 27 - 31

So God created humankind in his image, in the image of God he created them; male and female he created them. **2**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." God said, "See, I have given you every plant yielding seed that is upon the face of all the earth, and every tree with seed in its fruit; you shall have them for food. And to every beast of the earth, and to every bird of the air, and to everything that creeps on the earth, everything that has the breath of life, I have given every green plant for food." And it was so. God saw everything that he had made, and indeed, it was very good.

Genesis 2:15-16

The LORD God took the man and put him in the garden of Eden to till it and keep it. And the LORD God commanded the man, "You may freely eat of every tree of the garden".

Teacher Catholic Faith Integrations Reflections
What have I learned about teaching this unit?

Science 9

Unit: Characteristics of 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 Comments:



Science 9 Faith Permeation Essential Connections

Unit Theme: Earth and Space Science - Exploring our Universe

NOTE: All highlighted/shaded areas indicate faith permeation.

In this unit of study, the provincial curriculum expects that students will explore cultural and scientific explanations for the formation of the universe, its evolution and ways that science and culture has contributed to those understandings. By the end of the unit, the curriculum stresses that students must also have a strong awareness about how various cultures represent different types of astronomical phenomena. To this end, this faith permeation document will address outcome, EU9.3 with a focus on indicators (c) and (d) and outcomes EU9.1, indicators (c) and (e). This faith permeation unit will also help students appreciate ways that faith and science are complimentary.

Catholic Faith Focus for Learning:

A significant element of human culture is represented by the various faiths and religions of the world. For the vast multitude of people of these different faith traditions, the need to know and to understand their place in the universe is deeply ingrained. That is no different for the Catholic faith. While the Catholic faith doesn't comprise a single culture of people, it has devoted itself throughout its historical development to understanding humanity's place in the created universe and how astronomical bodies and the formation of the universe reveal God's goodness. This permeation unit will help students understand the Judeo-Christian story of the universe's creation and formation and the subsequent formation of the bodies in our solar system from a Catholic perspective.

Students will learn how a faith-based perspective of the solar system can augment our appreciation of the astronomical bodies that populate our part of the univers. Finally, students will learn that science expands our understanding of the physical universe and gives an explanation for its formation, as well as how this information complements our faith and belief in our Creator.

Catholic Faith Focus for Learning Outcomes:

- Describe the Catholic positions regarding the origin of the universe and how scientific explanations complement them.
- Examine and understand how astronomical phenomena are understood and represented in the Catholic faith.

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

- Scientific theory about the formation and evolution of the universe is the means by which scientists describe and make sense of the evidence they gather. Evidence such as red shift of galaxies, background cosmic radiation, and the abundance of light elements strongly support this theory. Scientists theorize that the formation of stars, nebulae, and the planets in our solar system – in fact all matter – occurred during the cooling of the universe in the aftermath of the big bang. This theory, however, does not attempt to describe the force or cause behind the big bang.
- The big bang is a theory supported by much evidence, and the Church has carefully examined and thoughtfully considered all of this scientific evidence. However, the Church has not ruled whether the big bang was or was not the actual means by which God created the physical universe. In Vatican I, the Church upheld the infallible teaching that God created the universe from nothing: “the world and all things which are contained in it, both spiritual and material, as regards their whole substance, have been produced by God from nothing” (*Canons on God the Creator of All Things*, canon 5). God may well have used the big bang as the means to create the universe, and if that is the case, then the Church dogmatically holds that God created the big bang from nothing.
- In a similar vein, the Church has not endorsed any official view or proposed any official teaching on the formation and evolution of stars, nebulae and planets. However, if we look at Church teachings and scripture, we can positively state that no matter the way in which stars and galaxies evolve and change, the Church attributes their creation, evolution and formation directly to God. "By the word of the Lord the heavens were made, and all their host [stars, nebulae, planets] by the breath of his mouth" (Ps. 33:6).
- In trying to understand the workings of the physical universe, we grow in awe of God's goodness and His work. Faith and reason (Catholic belief and science) do not contradict each other because it is God from which all truth comes. Therefore science and faith can and do complement each other. The first explains external natural workings and provides an intellectual framework for observable phenomena, while the second describes a spiritual truth about an invisible reality - that of the spirit, its creation and connection to God.

Catholic Faith Essential Skills:

- 1) Students will be able to describe the Catholic perspective and positions
 - on the origin and formation of the universe
 - the formation and evolution of astronomical bodies like planets, nebulae, stars
 - the origin of the world, people and life on earth
- 2) Students will explore and describe Catholic (as well as Jewish) perspectives and views on
 - ways that astronomical phenomena are represented in scripture,
 - ways that astronomical phenomena are represented and described by Catholic scientists

- how scientific understanding of astronomical phenomena may have conflicted with but ultimately added to our understanding of astronomical phenomena.

Catholic Faith Essential Questions:

1. What is the Catholic perspective on the origin of the solar system and the universe?
2. How do scientific explanations complement Catholic perspectives on the formation of the universe?
3. How are astronomical phenomena represented in scripture (our Jewish roots) and teachings of the Catholic faith?

Faith Permeation Lessons:

Lesson 1: The View from Earth: Jewish perspective

Description: This lesson is a supplement to the section ‘Human Interest in Space’ section 9.1 in Pearson Saskatchewan Science 9 P. 304-313.

Required time: 1 hour

Provincial Curriculum Outcomes Addressed:

EU9.1 Inquire into the motion and characteristics of astronomical bodies in our solar system and the universe.

EU9.3 Examine how various cultures, past and present, including First Nations and Métis, understand and represent astronomical phenomenon.

Provincial Curriculum Indicators Addressed:

EU9.1 (a) Pose questions about the characteristics of and relationships between astronomical bodies.

EU9.1 (b) Observe and identify movement patterns of the major visible bodies in the night sky.

EU9.1 (c) Compare historical and modern explanations for the real and apparent motion, including real and apparent retrograde motion, of celestial bodies (e.g., sun, moon, planets, comets, and asteroids) and artificial satellites.

EU9.3 (c) Explain the importance many individuals and cultures place or have placed on the summer and winter solstices and vernal and autumnal equinoxes.

Faith Permeation Outcomes:

- By the end of this lesson, students will explore and describe Catholic (as well as Jewish) perspectives and views on ways that astronomical phenomena are represented in scripture and in culture.

Faith Permeation Notes:

In this lesson students learn about the names of stars used by the ancient Hebrews in scripture. Several key points are worth noting:

- 1) There are various translations of the Hebrew Scriptures which form books of our bible. There is also disagreement among biblical scholars about which constellations are described by the Hebrews. Sometimes different names will be used for the same Hebrew constellation. It is important to let students know that in some cases there is a disagreement about which Greek constellation represents these Jewish constellation. For example, most scholars agree that the Hebrew name 'Ash' is thought to be the constellation Hyades but in some translations Ash was thought to be 'Hesperus' or 'Arcturus'.
- 2) Sources like *the New Advent Catholic Encyclopedia* suggest that because of a fear of idolatry, Hebrews didn't develop star knowledge. For this reason, there was little development of star teachings by the ancient Hebrews. By Contrast, the Dakota people in southern Saskatchewan not only avoided star worship but also developed a significant and systematic set of oral teachings about the stars and constellations. A fear of star-worship did not prevent the Dakota people to create a system of star knowledge. The difference might lie in that tribal groups among First Nations were quite autonomous and smaller while the Hebrews were surrounded by, traded with, and mixed with other very powerful and influential cultures like the Syrians. Some Hebrews may have adopted the religious beliefs of their neighbors.

Instructional Procedure:

- Begin by reading chapter 9, P. 305 "The View from Earth" in Pearson Saskatchewan Science 9. After reading this section, present students with the handout "Biblical Star Names". In this activity, students will learn some of the ancient Hebrew and Greek names that are used for several constellations and planets in the Bible.
- Read through the activity with the students and have the students answer the questions. When the students are done, discuss their answers in pairs or as a class.
- Use this activity to compare the Hebrew star names with some of the First Nation star names found on P. 306 in Pearson Saskatchewan Science.
- Ask the following key questions:
 - a) How are constellations important to the First Nations? *The constellations are significant because they helped the people know when to hunt, to migrate to summer and wintering groups, when to perform special ceremonies.*
 - b) How is this significance of the stars different for the First Nations and the Hebrew? *For First Nations star knowledge, their collections of oral teachings about the stars and related ceremonies helped them in practical ways such as hunting and navigation while for the Hebrews 'star knowledge' revealed God's wonder and his power but they feared that such knowledge might lead to idolatry.*
- End the lesson with the **reSearch** activity on P. 305 which invites students to research and to learn about constellation in other cultures.

- Additional faith permeation information could be inserted at the following spots:

A) Pearson Saskatchewan Science P. 307 ‘Using the Sky as a Calendar’. Use Black line master Activity #2: Hebrew Calendar

Like the Mayans and First Nations in Canada, the ancient Hebrews used a lunar calendar too. However, their calendar accounted for the solar year as well. Like many other cultures, the Hebrew calendar denoted important events. For the ancient Hebrews, the year began at spring time with the Passover.

In Activity 2: Hebrew Calendar, students will learn about the Hebrew calendar and their calendar year. They will also learn about corresponding important Catholic celebrations. By understanding the Hebrew calendar, students will learn why the Easter’s date changes every year.

B) On P. 308 Equinoxes in Pearson Saskatchewan Science, students learn the importance of equinoxes. For the ancient Hebrews, equinox was an important time of year. Often Passover occurred one month after equinox but because of the way their calendar was structured with years that had additional months, sometimes Passover was two months after equinox.

C) On P. 338 in Pearson Saskatchewan Science 9, characteristics of comets are described. The following faith information may be shared with students. Biblical historians have puzzled and debated over the nature of the astronomical phenomenon that was described as the Star of Bethlehem. Colin Humphreys from the department of Material Sciences and Metallurgy at Cambridge suggests that historical writings support the idea that the Star of Bethlehem was a comet.

The following is an excerpt from his article, The Star of Bethlehem- a comet in 5 B.C.- and the date of the Birth of Christ:

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.

Source: Humphreys, C. J. , University of Cambridge, Quarterly Journal of the Royal Astronomical Society, 1991, vol. 32, no4, pp. 389-407

Lesson 2: The Church and Big Bang theory

Description: This lesson is meant to be taught in connection with sections 11.1 on P. 373 and section 11.2 ‘Explaining the Origin of the Universe’ in Pearson Saskatchewan Science 9, P. 378-386.

Required time: 2 hour

Provincial Curriculum Outcomes Addressed:

EU9.3 Examine how various cultures, past and present, including First Nations and Métis, understand and represent astronomical phenomenon.

Provincial Curriculum Indicators Addressed:

EU9.3 (d) Identify common characteristics of stories, past and present, describing the origin of the world from various cultures and those in fantasy literature

Faith Permeation Outcomes:

Students will be able to describe the Catholic perspective and positions

- on the origin and formation of the universe
- the formation and evolution of astronomical bodies like planets, nebulae, stars
- the origin of the world, people and life on earth

Students will explore and describe Catholic and biblical perspectives and views on

- ways that astronomical phenomena are represented and described by catholic scientists
- how scientific understanding of astronomical phenomena may have led to a conflict with faith but that these conflicts arouse around competing social interests. Ultimately the scientific understanding of these phenomena has added to our understanding and our awe of God’s work.

Faith Permeation Teacher Notes:

- Teachers should read information from the following sites before engaging students in this activity. These sites include:
<http://www.holyspiritinteractive.net/columns/stevehemler/lifelittlelearnings/27.asp>
<http://www.catholic.com/tracts/adam-eve-and-evolution>
<http://blog.adw.org/tag/monogenism/>
<http://blog.adw.org/2010/10/can-a-catholic-accept-evolutionary-theory-uncritically>
<http://blog.adw.org/2010/10/on-the-genre-of-genesis-and-a-strange-little-question/>
- Please refer to the Catholic Faith Big Ideas in this section. It summarizes the Church’s position on big bang, the formation of the planets.
- It is important for teachers to stress to students that biblical accounts of creation are not meant to be scientific but instead the accounts express that God created the material universe from nothing, was involved with each aspect of that creation, and created it with purpose.

- Where there are differences between evolution and Catholic teachings on the origin of people or the creation of the universe, teachers need to acknowledge those differences. Those differences arise as both ‘teachings’ come from vastly different systems replete with their own sets of values, beliefs, worldviews etc. Students have to understand that the paradigm of science is itself a worldview. Science possesses values like objectivity, belief in validity, honesty in reporting data etc. The scientific community has definite beliefs, opinions and biases about the world and how it works. It is how we approach these areas of tension between science and faith that help our students understand the differences as well as to appreciate how both faith and science often complement each other.
- It is important to respect and recognise that students will be at different points in their faith journeys, come from other faith traditions, or may lack faith altogether. As teachers, we are to provide an open, safe and respectful environment where all students are free to voice their ideas and share their opinions.
- Lastly, the tension between science and faith has been ongoing. These faith permeation lessons will help students understand that Church is not the antagonist of reason or science. In fact, in recent history, many of the popes like John Paul II have acknowledged the power and the good that science brings. In the Vatican in Rome, a college of science has even been created to study various sciences.

Instructional Procedure:

- This lesson is to be taught synchronously or can be used after students read section 11.2 in Pearson Saskatchewan Science 9.
- Begin the lesson by asked the following questions:
 - a) How do scientists believe the universe unfolded? Point out the fact that the big bang only describes the formation not the creation of the universe.
 - b) How do other cultures understand their place in the universe? What are some cultural creation stories?
 - c) What do Catholics believe about our creation and the creation of the universe\solar system? How does the bible describe creation?
- Invite the students to read the biblical passages on creation from Genesis. Have students illustrate the events and the chronology of the creation account. Have the students compare and discuss their drawings. Another option is that teachers may wish to use the template provided in appendix A: black line master Activity 3: Biblical View of Creation.

Things to consider:

- A) How did each student interpret their creation story?
- B) How did their final drawing look?
- C) What order did they represent in their illustration?

This first interpretation is a summary from the Catholic Encyclopedia article “Hexaemeron” the six days of Creation.

It divides Genesis into two creations.

First Creation:

Earth and Heaven. Earth is void. God's spirit moves over the waters.

Second Creation:

Day 1: Light is separated from darkness. Day and night created

Day 2: Divides the waters above and below with the firmaments (sky or the dome of the sky)

Day 3: Gathers up the waters and causes land to appear. Plants, trees and flowers appear.

Day 4: God creates the Sun, Moon, stars and places them in the firmament

Day 5: He makes the creatures of the sea and the birds

Day 6: God makes land animals and finally humans

Day 7: God rested.

D) Is the Genesis story of creation to be taken literally or metaphorically\ allegorically?

E) Even though the Catholic Church teaches that the creation story in the Book of Genesis is allegorical, why is the story still valid?

- Introduce Activity 4: The Church and Big Bang. The purpose of this activity is twofold. The first is to help students understand that science and faith are not incompatible. Secondly, students will understand the Church's position on Big Bang. By the end of this lesson students will evaluate how these ideas might be complementary despite some differences.
- Discuss student answers.

Lesson 3: Evolution.

Description: This lesson is meant to be taught in connection with sections 11.1 on P. 373 and section 11.2 'Explaining the Origin of the Universe' in Pearson Saskatchewan Science 9, P. 378-386.

Required time: 2 hour

Provincial Curriculum Outcomes Addressed:

EU9.3 Examine how various cultures, past and present, including First Nations and Métis, understand and represent astronomical phenomenon.

Provincial Curriculum Indicators Addressed:

EU9.3 (d) Identify common characteristics of stories, past and present, describing the origin of the world from various cultures and those in fantasy literature

Faith Permeation Outcomes:

- Students will be able to describe the Catholic perspective regarding the origin of the world, people and life on earth.
- Students will understand the position of the Catholic Church on the theory of evolution, as an overarching principle that describes how the mechanisms of heredity and transmission of

genetics are passed on from parent to offspring.

- Students will understand that evolution, which is the product of random changes in DNA, is not in conflict with Church teaching about the origin of the universe or of the origin of the human race. “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.” (Compendium of the Catechism of the Catholic Church #29)

Faith Permeation Teacher Notes:

- It is important for teachers to review the Faith Permeation Teacher Notes in Lesson 2 of this unit.

Instructional Procedure:

- Ask the students: What differences do you see among the people in our class? (height, hair colour, eye colour, skin colour). Explain that these are natural variations in populations; the larger the population, the more variations possible.
- Explain that evolution is the result of **natural selection**: those characteristics of individuals that allow them reproductive success will be passed on to future generations. Characteristics which prevent reproductive failure will die out.
- Use examples to have students discuss what characteristics of a given population of animals (or humans) could lead to reproductive success (or the reverse).
- Introduce Activity 5: The Church and Evolution. The purpose of this activity is twofold. The first is to help students understand the science and faith are not incompatible. Secondly students will understand the church’s position on Evolution. By the end of the lesson students will evaluate how these ideas might be complementary despite some differences.
- Ensure that every student gets a handout of Activity 5 “The Church and Evolution.”
- Teachers will also need to obtain copies of “Does the Catholic Church Accept Evolution” from the website:
<http://www.holyspiritinteractive.net/columns/stevehemler/lifelittlelearnings/27.asp>
Please familiarize yourself with this document before reading it together with your class. Read the article from the website Catholic Answers with students
<http://www.catholic.com/tracts/adam-eve-and-evolution>. You may wish to have students respond to the following questions as an entire class, individually or in dyads or tetrads.
- Review key questions with students:
 1. What does the Church say about evolution?
 2. Is there any conflict between biblical creation and how scientists believe that life came about through evolution?
 3. What does the Church say about evolution of lower life forms and the age of the earth?
 4. What does the Church say about the creation of the soul?

Lesson 4: Geocentric vs. Heliocentric models of the earth

Description: This permeation lesson is intended to be taught in conjunction with section 11.2 in Saskatchewan Pearson Saskatchewan Science 9 P. 386-387

Required time: 1 hour

Provincial Curriculum Outcomes Addressed:

- EU9.1 Inquire into the motion and characteristics of astronomical bodies in our solar system and the universe.
- EU9.3 Examine how various cultures, past and present, including First Nations and Métis, understand and represent astronomical phenomenon.

Provincial Curriculum Indicators Addressed:

- EU9.1 (c) Compare historical and modern explanations for the real and apparent motion, including real and apparent retrograde motion, of celestial bodies (e.g., sun, moon, planets, comets, and asteroids) and artificial satellites.
- EU 9.1 (e) Compare the efficacy of various historical and contemporary models of planetary motion, including geocentric and heliocentric models, for explaining observed astronomical phenomena.

Faith Permeation Outcomes:

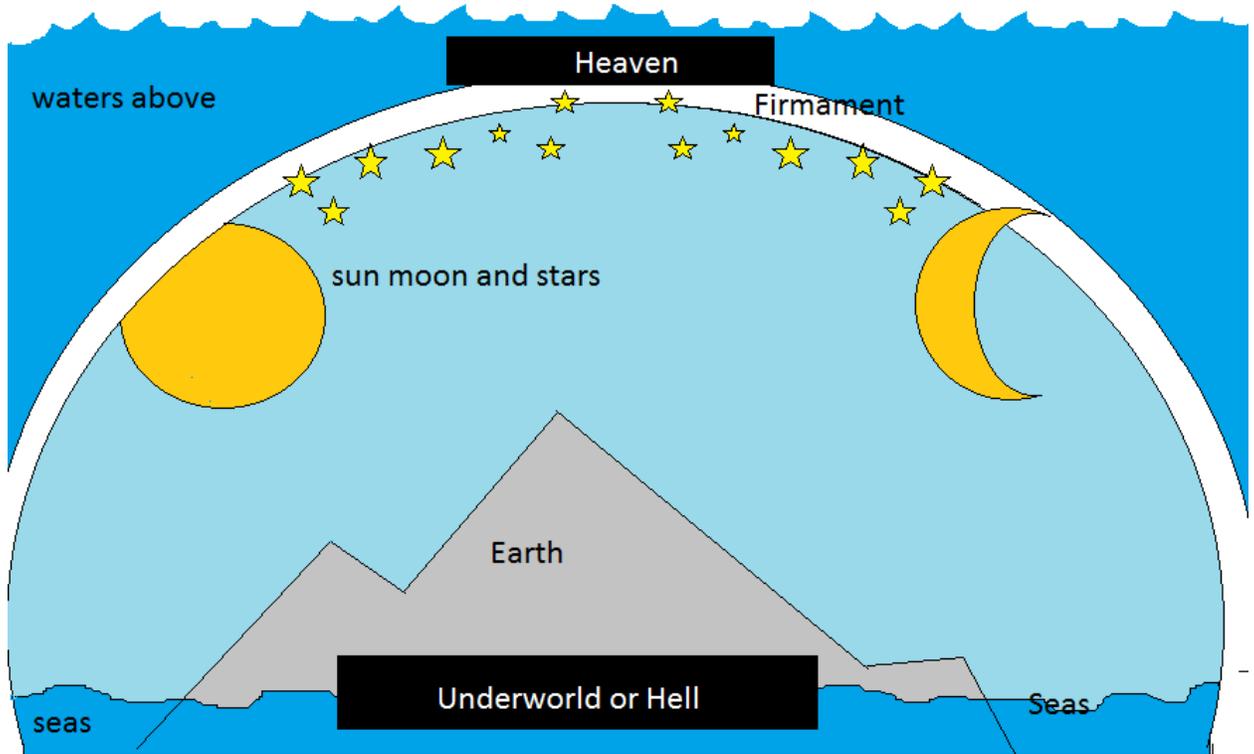
Students will explore and describe Catholic and biblical perspectives and views on

- ways that astronomical phenomena are represented and described by catholic scientists
- how scientific understanding of astronomical phenomena may have led to a conflict with faith but that these conflicts arouse around competing social interests. Ultimately the scientific understanding of these phenomena has added to our understanding and our awe of God's work.

Instructional Procedure:

- Please ensure that students have read and understand Planetary Motion, Geocentric and Heliocentric models of the solar system as presented on P. 387- 388 in Pearson Saskatchewan Science.
- Begin by asking the following key questions:
 - a) Now that we've read about theories on the formation of the universe and have read the account of creation in Genesis, what did the earth look like or seemed like to ancient people?
Student will give various responses but hopefully the response that you will get concerns a flat earth with a dome of celestial bodies.
- Show students the following drawings made by medieval artist Flammarion. The link is: http://en.wikipedia.org/wiki/Flat_Earth#Modern_times
- Provide students with Activity 6: Geocentric vs. Heliocentric views of the Solar System. Do Part 1: biblical view of the world
- Have students illustrate the complete creation. Their drawing should look similar to the diagram below.

Diagram 1: Biblical View of Creation



- Have students compare diagrams with neighbors or in groups.
- Ask students if their drawings reflected a biblical view of the world that was a 'round' or 'flat'.
- Show students the biblical passages included in Activity 6, Part 2. These passages are here for teachers, along with commentaries for each (in italics)
 - **Ecclesiastes 1:5** The sun rises and the sun goes down, and hurries to the place where it rises.
If the sun hurries back to its place, that would imply that is the sun that moves and the earth is fixed.
 - **Joshua 10:12–13** On the day when the Lord gave the Amorites over to the Israelites, Joshua spoke to the Lord; and he said in the sight of Israel, "Sun, stand still at Gibeon, and Moon, in the valley of Aijalon."
If God gives Joshua the power to immobilize the sun and move, this implies that they are moving through the sky, and not the earth moving around them.
 - **Psalms 104:5** You set the earth on its foundations, so that it shall never be shaken.
Setting the earth on its foundation implies that the earth is rooted and fixed.
 - **Isaiah 66:1** Thus says the Lord: Heaven is my throne and the earth is my footstool; what is the house that you would build for me, and what is my resting place?
The earth has to be fixed to be the footstool of God. A revolving and moving earth would make a terrible footstool!

- **Chronicles 16:30** tremble before him, all the earth. The world is firmly established; it shall never be moved.
- **Psalm 119:90** Your faithfulness endures to all generations; you have established the earth, and it stands fast.
- **Proverbs 3:19** The Lord by wisdom founded the earth; by understanding he established the heavens;
- **Psalm 74:16** Yours is the day, yours also the night; you established the luminaries and the sun.

'Established' implies fix or rootedness.

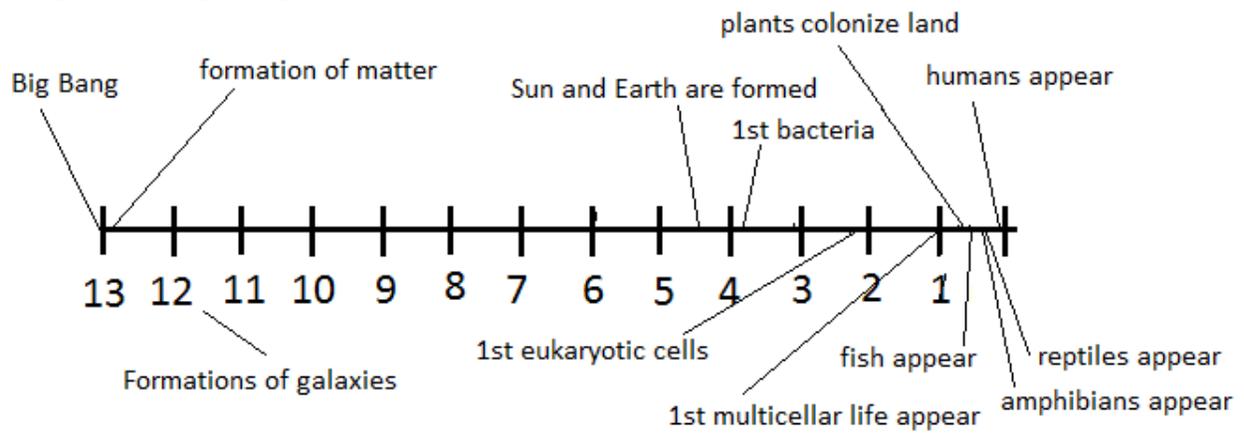
- **Psalm 148:1-7** Praise the Lord! Praise the Lord from the heavens; praise him in the heights! Praise him, all his angels; praise him, all his host! Praise him, sun and moon; praise him, all you shining stars! Praise him, you highest heavens, and you waters above the heavens! Let them praise the name of the Lord, for he commanded and they were created. He established them forever and ever; he fixed their bounds, which cannot be passed. *Heaven, earth, stars moon, sun are all fixed or rooted, immovable.*

- Provide students with Activity 5: Geocentric vs. Heliocentric views of the Solar System. Have students read about Galileo and the Church in Part 2: Opposing views-a heliocentric model of the earth.
- Have students respond to the questions in pairs or in small group. Have each group or pair name a recorder. Give students about 15 minutes to discuss their answers and ideas. After 15 minutes have students reconvene and share in large group.

Faith Permeation Culminating Task - Integrating Catholic Faith

- At the end of the unit on P. 430 Unit Tasks, teachers may choose to add this activity as a faith permeation option. Provide students a copy of the appendix B: Culminating Task.
- Have the students draw the unfolding of the universe. Invite students to diagram the Big Bang Timeline. Provide students with the Culminating Task handout. They will use the charts to create two timelines.
- See the diagram below. Compare Big Bang timeline and the drawings they made of Creation. Compare similarities and differences. Ask students "Is this a fair comparison? Why or why not?" The students will write a short reflection on the two timelines. Students are to consider what each timeline of events aims to do. i.e. impart faith or to create a comprehensive model of the formation of the universe, solar system, life on earth etc.
- Time line for evolution should look something like the diagram below.

Diagram of Big Bang and evolution:



Appendix A: Black Line Masters

Activity 1: Biblical Star Names

Science 9

Unit: Exploring our Universe

In ancient times, the Hebrews were surrounded by many cultures that worshiped the stars as gods. Even though the ancient Hebrews marveled at the stars, they didn't create a system to study the stars because they feared that such a system could lead to idolatry – the worship of false gods. However, there are many references to stars by their biblical names found in scripture. When the Bible was translated into the Greek (Septuagint) and Latin (Vulgate), the Greek names for these stars and constellations were used. As a result, when you read the Bible today, you will see the Greek names rather than the original Hebrew names. One version of the bible called Young's Literal Translation (not a version used by the Catholic Church) uses the Hebrew names. For example, from Job 9:9 from Young's Literal Translation, you read, *“Making Osh, Kesil, and Kimah, And the inner chambers of the south”*

In the following activity you will learn the Hebrew and Greek names of some stars, constellations and even some planets in specific biblical passages.

Table 1: Greek and Hebrew Names for Stars and Constellations

Greek Names for stars or constellations	Hebrew Names for stars or constellations	Biblical reference
the Pleiades (The greek names for the stars appear in our translation of the bible. To find the Jewish names we would have to look to the original Jewish scriptures.)	<i>Kimah</i> (translated as Pleiades in the Vulgate)	<p>Amos 5: 8 The one who made the Pleiades and Orion, and turns deep darkness into the morning, and darkens the day into night, who calls for the waters of the sea, and pours them out on the surface of the earth, the LORD is his name</p> <p>Job 9: 9 [God] who made the Bear and Orion, the Pleiades and the chambers of the south;</p> <p>Job 38:31-33 "Can you bind the chains of the Pleiades, or loose the cords of Orion? Can you lead forth the Mazzaroth in their season, or can you guide the Bear with its children? Do you know the ordinances of the heavens?"</p>
Orion	<i>Kesil</i> (translated into Arcturus in the Vulgate)	Amos 5: 8 The one who made the Pleiades and Orion, and turns deep darkness into the morning, and darkens the day into night, who calls for the waters of the sea, and

	<i>Kesil</i> is translated as Orion in the book of Job in the Greek translation of the bible called the Septuagint.	pours them out on the surface of the earth, the LORD is his name, Job 9: 9 [God] who made the Bear and Orion, the Pleiades and the chambers of the south; Job 38:31-33 "Can you bind the chains of the Pleiades, or loose the cords of Orion? Can you lead forth the Mazzaroth in their season, or can you guide the Bear with its children? Do you know the ordinances of the heavens?"
the Hyades	Osh, Ash , or Ayish	In some translations of the bible, namely the Vulgate, Hyades is used rather than the 'Bear' constellation Ursa Major. Job 9:9
the Bears (Great and Little) Ursa Major and Minor	Mezarim,	Job 9: 9 [God] who made the Bear and Orion, the Pleiades and the chambers of the south; Job 38:31-33 "Can you bind the chains of the Pleiades, or loose the cords of Orion? Can you lead forth the Mazzaroth in their season, or can you guide the Bear with its children? Do you know the ordinances of the heavens?"
Canopus, the Southern Cross, and a Centauri;	•Hadre theman — "the chambers of the south" —	Job 9: 9 [God] who made the Bear and Orion, the Pleiades and the chambers of the south;
Draco	Nachash	Job 26:13 His spirit has adorned the heavens, and his obstetric hand brought forth the winding serpent. Footnote : The winding serpent, a constellation of fixed stars winding round the north pole, called Draco. This appears from the foregoing part of the same verse, His spirit hath adorned the heavens. (Challoner)

Questions:

1. How did the ancient Hebrews think about the stars?
2. How are the stars used by the ancient Hebrews in the Bible?

Table 2: Greek and Biblical Names for the Planets

Greek Names for planets	Hebrewl Names for the planets	Biblical reference
Venus	Mazzaroth	Job 38:31-33 "Can you bind the chains of the Pleiades, or loose the cords of Orion? Can you lead forth the Mazzaroth in their season, or can you guide the Bear with its children? Do you know the ordinances of the heavens?"
Saturn	Kaiwan (in this text Saturn is called a star-god and the prophet Amos is denouncing Hebrew idolaters who worship Kaiwan.	Amos 5:25-27 Did you bring to me sacrifices and offerings the forty years in the wilderness, O house of Israel? You shall take up Sakkuth your king, and Kaiwan your star-god, your images, which you made for yourselves; therefore I will take you into exile beyond Damascus, says the LORD, whose name is the God of hosts.

Questions:

1. Only Saturn and Venus were mentioned in the Old Testament. They were also called stars. Why might the ancient Jews describe these planets as stars?
2. Why were only names given to two ‘stars’?
3. Why did ancient Hebrews not have their own kind of astronomy?

Appendix A: Black Line Masters

Activity 2: Hebrew Calendar

Science 9

Unit: Exploring our Universe

Like many other cultures, the ancient Hebrews – the culture to which Jesus belonged - used the movement of the moon and the sun to help them keep track of time. Their calendar was based on three things: the passing of the sun, the phase of the moon and the 24 hour rotation of the earth on its axis. As a result, the Hebrew calendar considered:

- a) the solar day: the rotation of the earth on its axis.
- b) the solar year: earth's rotation around the sun
- c) the lunar cycles

Each lunar month is actually 29.5 days. A Hebrew year can have 12-13 lunar months because in a single year (365.25 days), a single rotation of the earth around the sun produces 12.4 lunar cycles. Therefore the ancient Hebrew people designated the months either as 29 or 30 days long.

If the calendars went with 12 lunar months (6 months of 29 days and 6 months of 30) compared to each solar year, the year would be short 11 days.

$$\begin{aligned} 6 \text{ months} \times 29 \text{ days} &= 174 \\ 6 \text{ months} \times 30 \text{ days} &= 180 \end{aligned}$$

$$174 + 180 = 354.$$

$$365 \frac{1}{4} - 354 = 11 \frac{1}{4}$$

If the Hebrews went with 13 months every year, the year would be roughly 19 days longer.

$$\begin{aligned} 6 \text{ months} \times 29 \text{ days} &= 174 \\ 7 \text{ months} \times 30 \text{ days} &= 210 \end{aligned}$$

$$174 + 210 = 384.$$

$$384 - 365 \frac{1}{4} = 19 \frac{1}{4}$$

Therefore the ancient Hebrews would add an extra month to their calendars whenever it was needed in order to adjust for these missing days. Every second or third year, when they added the extra month, the 'leap year' was called *Shanah Me'uberet* which meant 'pregnant year'.

Table 1: Hebrew Months and Corresponding Celebrations and Catholic Liturgical year

Hebrew Months	Compared to Gregorian Calendar	Important biblical Jewish\Hebrew celebrations	Important events Catholic Liturgical Year
Nisan	March\ April	Beginning of the year, spring and the Passover 15 of Nisan	Easter
Iyar	April\May		
Sivan	May\June	Shuvuot	Pentecost
Tamuz	June\July		
Av	July\Aug		
Elul	Aug\Sept		
Tishri	Sept\ Oct	Yom Kippur	
Heshvan	Oct\Nov		
Kislev	Nov\Dec	Hanukkah	Christmas
Tevet	Dec\Jan		
Shevat	Jan\Feb		
Adar	Feb\Mar	Purim	
Adar II	March		

Questions:

1. How did the Hebrew calendar work?
2. Why did the ancient Hebrew people use a 'leap year' lunar calendar?
3. What would happen if the Hebrews went strictly with a 12 month lunar calendar?
4. Why was it important that the months and the seasons matched?
5. Why is it important for Catholics to understand the Hebrew calendar?

Appendix A: Black Line Masters

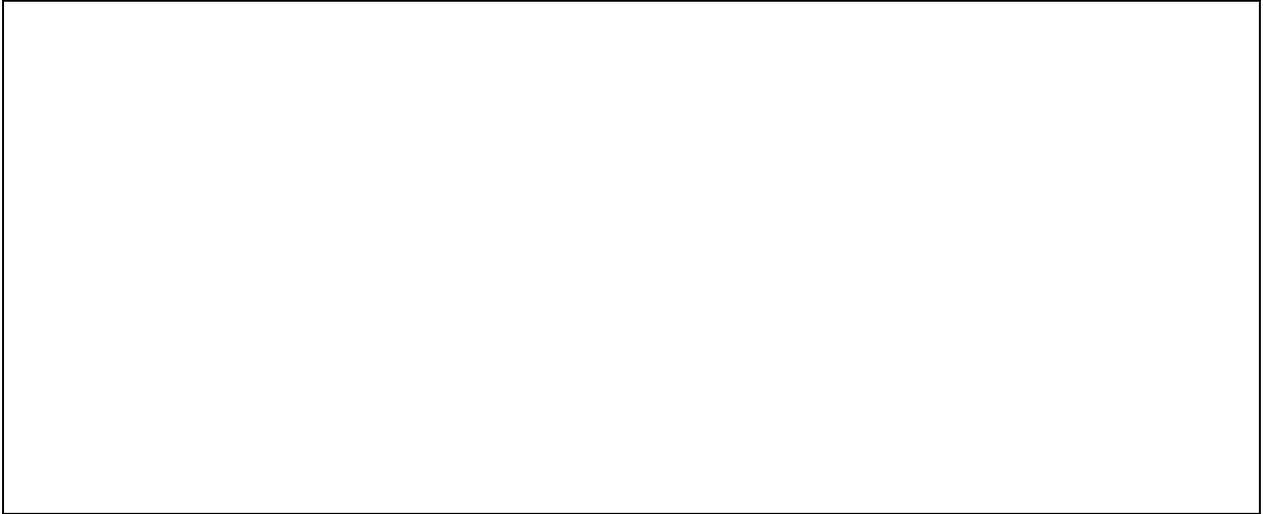
Activity 3: Biblical View of Creation

Science 9

Unit: Exploring our Universe

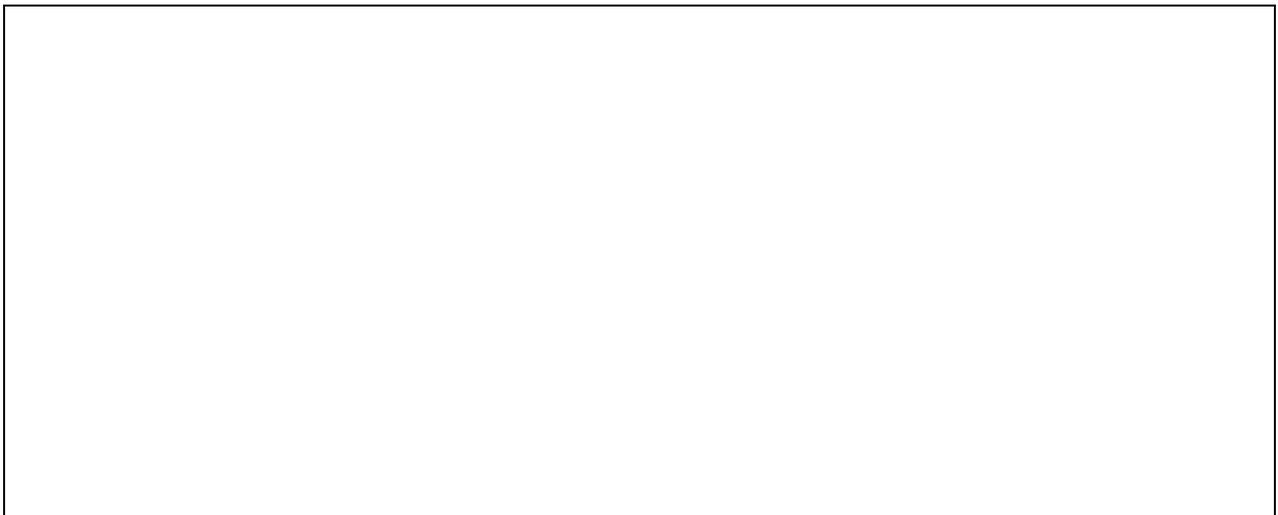
First Creation:

In the beginning God created heaven, and earth. And the earth was void and empty, and darkness was upon the face of the deep; and the spirit of God moved over the waters.

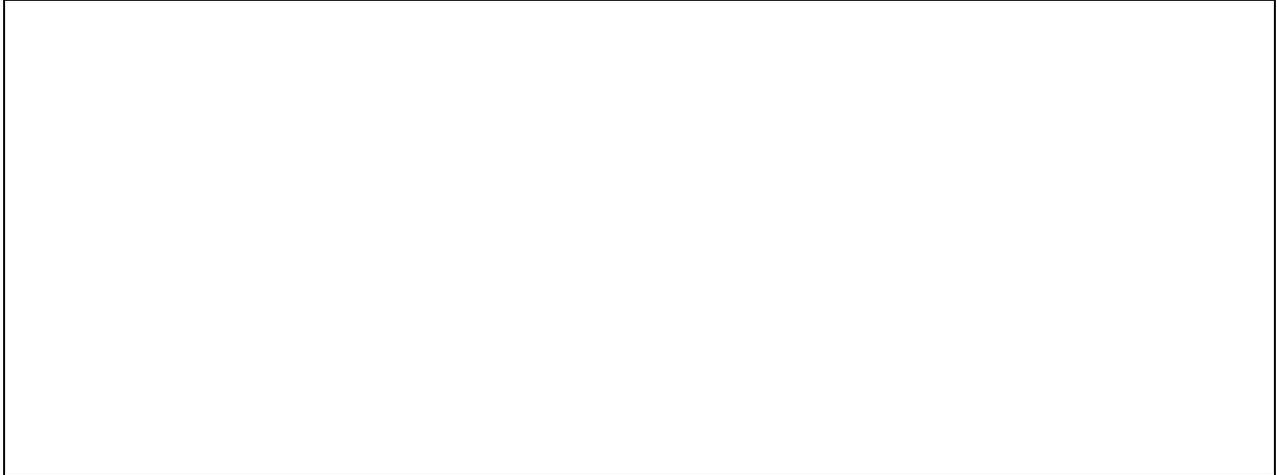


Second Creation

Day 1: Then God said, 'Let there be light'; and there was light. And God saw that the light was good; and God separated the light from the darkness. God called the light Day, and the darkness he called Night. And there was evening and there was morning, the first day.



Day 2: And God said, ‘Let there be a dome in the midst of the waters, and let it separate the waters from the waters.’ So God made the dome and separated the waters that were under the dome from the waters that were above the dome. And it was so. God called the dome Sky. And there was evening and there was morning, the second day.



Day 3: And God said, ‘Let the waters under the sky be gathered together into one place, and let the dry land appear.’ And it was so. God called the dry land Earth, and the waters that were gathered together he called Seas. And God saw that it was good. Then God said, ‘Let the earth put forth vegetation: plants yielding seed, and fruit trees of every kind on earth that bear fruit with the seed in it.’ And it was so. The earth brought forth vegetation: plants yielding seed of every kind, and trees of every kind bearing fruit with the seed in it. And God saw that it was good. And there was evening and there was morning, the third day.



Day 4: And God said, ‘Let there be lights in the dome of the sky to separate the day from the night; and let them be for signs and for seasons and for days and years, and let them be lights in the dome of the sky to give light upon the earth.’ And it was so. God made the two great lights—the greater light to rule the day and the lesser light to rule the night—and the stars. God set them in the dome of the sky to give light upon the earth, to rule over the day and over the night, and to separate the light from the darkness. And God saw that it was good. And there was evening and there was morning, the fourth day.



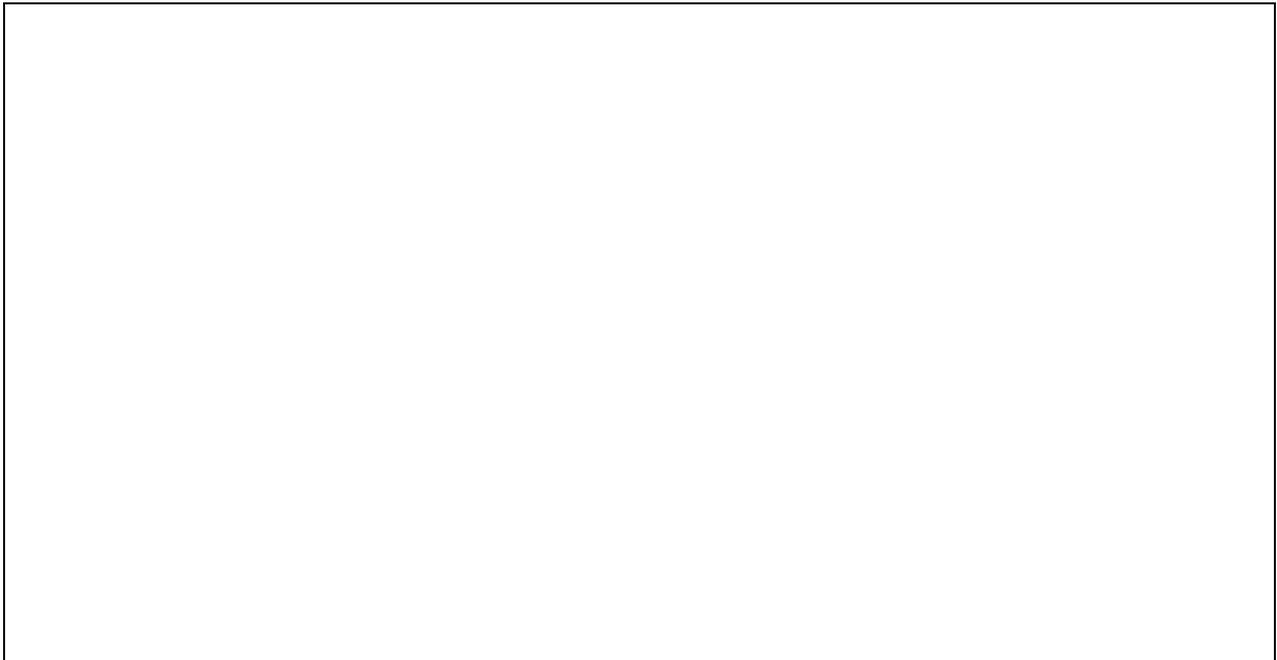
Day 5: And God said, ‘Let the waters bring forth swarms of living creatures, and let birds fly above the earth across the dome of the sky.’ So God created the great sea monsters and every living creature that moves, of every kind, with which the waters swarm, and every winged bird of every kind. And God saw that it was good. God blessed them, saying, ‘Be fruitful and multiply and fill the waters in the seas, and let birds multiply on the earth.’ And there was evening and there was morning, the fifth day.



Day 6: And God said, ‘Let the earth bring forth living creatures of every kind: cattle and creeping things and wild animals of the earth of every kind.’ And it was so. God made the wild animals of the earth of every kind, and the cattle of every kind, and everything that creeps upon the ground of every kind. And God saw that it was good.

Then God said, ‘Let us make humankind in our image, according to our likeness; and let them have dominion over the fish of the sea, and over the birds of the air, and over the cattle, and over all the wild animals of the earth, and over every creeping thing that creeps upon the earth.’

So God created humankind in his image, in the image of God he created them; male and female he created them. 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.’ God said, ‘See, I have given you every plant yielding seed that is upon the face of all the earth, and every tree with seed in its fruit; you shall have them for food. And to every beast of the earth, and to every bird of the air, and to everything that creeps on the earth, everything that has the breath of life, I have given every green plant for food.’ And it was so. God saw everything that he had made, and indeed, it was very good. And there was evening and there was morning, the sixth day.



Appendix A: Black Line Masters

Activity 4: The Church and Big Bang

Science 9

Unit: Exploring our Universe

Introduction

People of all cultures throughout the ages have wondered about how the world and the universe came to be. For many cultures and world religions, creation stories became a way that people described their place in the world. With the invention of writing, people encapsulated their understanding of these mysteries in words and in ways they could understand. This was no different for the Hebrew people from which our Christian faith comes.

The Hebrews attributed the origin of the universe to God. Their creation story as recorded in the Book of Genesis used symbolic language to describe the profound mystery of creation and humankind's relationship to God in a way that helps people both past and present understand. The creation story contains many profound spiritual truths. Those spiritual truths concern a belief in God, our relationship to him, the nature of his love for us, His plan for humanity and salvation. Often the biblical account of creation is compared to modern scientific explanations for the origin of people. However, the creation story wasn't written as a scientific explanation nor should it be understood as such.

Science, on the other hand, has gathered a great body of physical evidence the origin of the universe through observation and mathematical calculation. Science has attempted to explain those findings in an overarching scientific theory called big bang. Supported by considerable scientific evidence and research, this theory proposes that an immense and rapid **expansion** (not explosion) created stars, galaxies and planets. At the birth of the universe, an incredible *singularity* - a structure of infinite density and energy - rapidly expanded and as it cooled, the energy coalesced into the basic building blocks of matter. The singularity didn't explode in the traditional sense that a bomb does, but rather it expanded quickly with great power, heat and energy. Evidence such as cosmic microwave radiation and red shift galaxies supports this idea. This alternative viewpoint that describes how life, the cosmos and the universe may have evolved is now widely accepted by the scientific community as the way the universe has come to be.

A widely held misunderstanding about big bang theory is that it tries to explain what started big bang. That isn't so. Scientists do not speculate on what created big bang. Rather, through the theory, scientists attempts to describe the stages of development of and the changes in universe moments after the beginning. The theory doesn't describe who or what started the event, nor does it consider what lies outside of the physical universe. Mysteries such as these are not the focus of the scientific community.

In regards to the big bang theory, there is a growing acceptance by the Catholic Church that it may be the means by which the universe developed. However, the Church argues that if this

theory is to be accepted, its inception and unfolding could only be attributable to God and His act of creation. The Church contends that the big bang theory does not contradict doctrine nor is it incompatible with faith.

What does the Church believe about big bang?

1. The big bang is a theory supported by much scientific evidence and the Church has carefully examined and thoughtfully considered all the evidence. However the Church has not ruled whether the big bang was or was not the actual means by which God created. Hence big bang may very well be the means by which God created the universe.
2. ***God creates from nothing:*** In the Vatican I Council convened by Paul XXIII, the Church has decreed the infallible teaching that God created the universe from nothing. Vatican I states ‘the world and all things which are contained in it, both spiritual and material, as regards their whole substance, have been produced by God from nothing’ (*Canons on God the Creator of All Things*, canon 5). If God did create the universe by means of the big bang, then the Church believes that he created it from nothing.
3. The Church doesn’t have any official teaching on the formation of stars, nebulae and planets and their evolution but if they formed and changed as described by science, then that change and formation is attributed to God.

Activity:

Read the articles and view the following YouTube videos.

<http://www.foxnews.com/scitech/2011/01/13/pope-benedict-reconciles-science-religion/>

<http://www.youtube.com/watch?v=e3u8KskgpE0>

http://www.youtube.com/watch?v=xhLQ_b3bKdI&feature=related

With a group of peers discuss the following questions:

1. What are some ways that the Catholic Church attempts to understand science and reconcile scientific findings and church teachings?
2. Did it surprise you that a priest, George Lemaitre, first proposed the idea of big bang theory?
3. In what ways are the Catholic faith and scientific theories like evolution and big bang compatible?
4. Are there conflicts between biblical creation and the theories of evolution and big bang? If so, how do we reconcile these differences?
5. In what ways are our Creation story and a theory like big bang compatible? How might they differ?
6. What can the Church and science learn from each other through open dialogue?

Appendix A: Black Line Masters

Activity 5: The Church and Evolution

Science 9

Unit: Exploring our Universe

Introduction

The theory of evolution describes how organisms change and pass on those hereditary changes over time, and how those changes may influence the development of new species. The mechanisms of change, such as natural selection and mutation, affects all living things and has helped shape the first development of the first living things. While there are some problems with the theory of evolution, a great body of evidence physical evidence in DNA and in the fossil records exist to support evolution.

The Catholic Church does not have any official dogma or doctrine in regards to evolution, but it does provide some guidelines. The Church does not in any way dispute that evolution exists as the means by which life on earth changes and develops. In fact, John Paul II in 1996 revised the Church's position on evolution stating that,

Today, more than a half-century after the appearance of that encyclical, some new findings lead us toward the recognition of evolution as more than a hypothesis. In fact it is remarkable that this theory has had progressively greater influence on the spirit of researchers, following a series of discoveries in different scholarly disciplines. The convergence in the results of these independent studies—which was neither planned nor sought—constitutes in itself a significant argument in favor of the theory. (John Paul II, Oct. 22, 1996 address to the Pontifical college of science)

However, where the theory of evolution and doctrine diverge is in regards to the human soul. Church leaders believe the formation or creation of the soul is strictly the province of God. They proclaim that God creates each human soul to know and to be in relationship and communion with Him.

Instructions:

Read the article “ Does the Catholic Church Accept Evolution?” by Steven R. Hemler provided by your teacher and respond to the following questions.

1. What does the Church say about evolution?
2. Is there any conflict between biblical creation and how scientists believe that life came about through evolution?
3. What does the Church say about evolution of lower life forms and the age of the earth?
4. What does the church say about the creation of the soul?

References Used in Developing these Materials:

http://www.ualberta.ca/~dlamoure/5_human_evolution.pdf

<http://blog.adw.org/tag/monogenism/>

<http://blog.adw.org/2010/10/can-a-catholic-accept-evolutionary-theory-uncritically/>
<http://blog.adw.org/2010/10/on-the-genre-of-genesis-and-a-strange-little-question/>
<http://www.telegraph.co.uk/news/religion/4588289/The-Vatican-claims-Darwins-theory-of-evolution-is-compatible-with-Christianity.html>
<http://www.holyspiritinteractive.net/columns/stevehemler/lifelittlelearnings/27.asp>
<http://www.catholic.com/tracts/adam-eve-and-evolution>
<http://www.talkorigins.org/faqs/homs/species.html>
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC368159/?tool=pmcentrez>
<http://www.newgeology.us/presentation32.html>

Appendix A: Black Line Masters

Activity 6: Geocentric vs. Heliocentric views of the Solar System

Science 9

Unit: Exploring our Universe

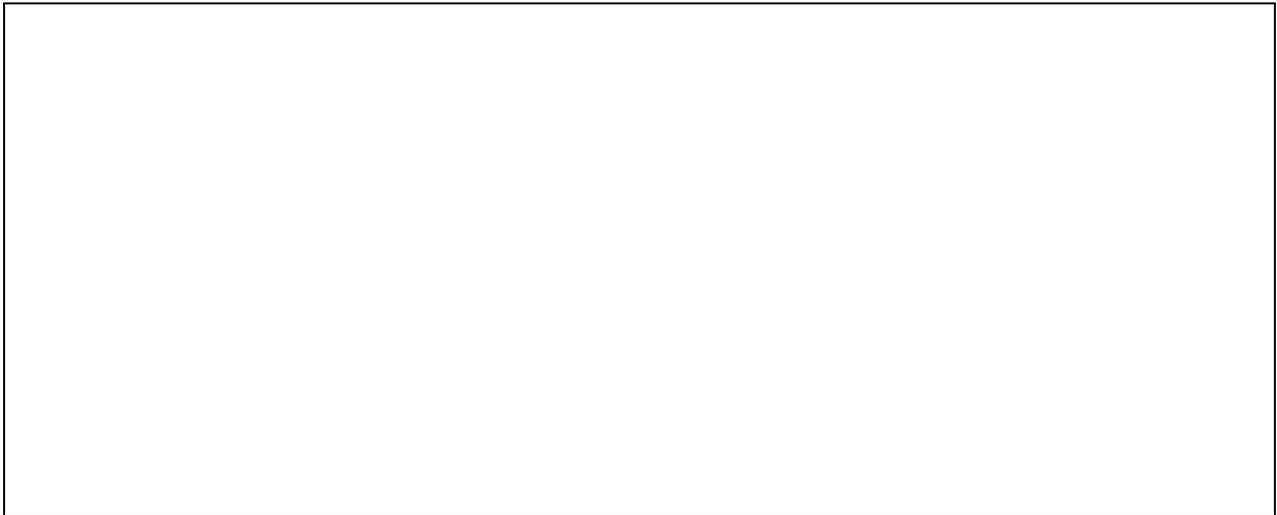
Part 1: Biblical view of the world

The biblical understanding of the earth, similar to that of most ancient cultures, was geocentric. This idea put the earth at the center of the universe and relegated all other astronomical bodies in a dome above a 'flat' earth. Thus, the earth was the center of the universe, and the moon, the stars, the sun rotated around it.

How did early Hebrews and Christians understand the view of the world? According to the Book of Genesis, after God created the heavens and the earth, the earth itself was formless, dark and covered in water. Then as creation continued, God created a dome to separate the waters of heaven and the waters on earth. As God gathered the water together in a single body - a likely reference to the oceans or seas - land appeared. After the appearance of land on which plants then arose, God placed the moon, the stars and the sun into the firmament of the sky, the dome of heaven.

From the description in Genesis, the sky is dome-like into which astronomical bodies such as the sun and stars are placed and under the dome is a flat earth.

Draw in the box below the biblical description of the world.



Part 2: Opposing views-a heliocentric model of the earth.

As you have read in Pearson Saskatchewan Science 9, early Greek thinkers proposed a different view of the earth. Called the heliocentric model, this scientific view of earth argues that our planet rotates around the sun. Copernicus, the first of the renaissance scientists, reintroduced this idea and based his work on the observations of an ancient Greek called Ptolemy. However unlike Ptolemy, Copernicus believed that the sun was the center of the solar system not the earth. Copernicus' work inspired another renaissance scientist, Galileo Galilee. Galileo strongly believed that the rise and fall of tides was the result of the earth's rotation on its axis and its revolution around the sun. If his theory was true then only one tide would be observed but we observe two and now we understand that the tides are also strongly influenced by the gravitational pull of the moon. Even though his theory about the tides was later proven wrong, Galileo believed his theory of tide was the evidence needed to prove the Copernican theory true.

Galileo argued passionately for Copernicus' ideas. His published works contradicted the common belief of the time, that the earth was the center of the solar system, and contradicted church teachings. Passages in the bible convinced Church leaders and common people at that time that the earth was the center of the universe. However Galileo argued as St. Augustine had, that some passages in the bible should be taken metaphorically. Galileo believed that these passages contradicted reason, observation and scientific evidence. The papacy ordered Galileo to drop his defense of Copernican theory. Galileo reluctantly agreed and the initial charges of heresy were dropped.

Over a decade later, Cardinal Maffeo Barberini - Galileo's friend and a devotee of his work - was elected the new pope. Cardinal Barberini became Pope Urban VIII. Galileo returned to Rome and convinced his friend to allow him to continue to develop his ideas on a heliocentric model of the earth which was published as a book called *Dialogue Concerning the Two Chief World Systems*. The pope agreed but stipulated that Galileo's work would be treated as a 'hypothesis' and that each side of the debate must be fairly presented. Galileo initially agreed but as he worked on his book, Galileo's support for the heliocentric model became very evident the opposing view, the geocentric model, was ridiculed. The pope was deeply humiliated, though that wasn't Galileo intention. It appeared to the Church that Galileo strove for the theory's acceptance as a fact which betrayed the promise he had made to the Pope. As a result, Galileo's work, *Dialogue Concerning the Two Chief World Systems*, was condemned and its subsequent publication banned by the Church. Pope Urban VIII convened a commission of church leaders and cardinals who tried Galileo and sentenced him to house arrest for the remainder of his life.

Two popular beliefs suggest that Galileo had been badly mistreated by the Catholic Church. The first - a belief which continues to persist - says he was tortured and blinded by order of the Church, but modern researchers and historians have shown that there is no evidence whatever to support this belief. The second concerns Galileo's burial: it was believed that he was buried in unconsecrated ground on account of his charge of heresy. But this, too, has been proven false as Galileo was buried near a chapel in the Basilica of Santa Croce.

Galileo leaves a great legacy. Many great scientists including Einstein describe Galileo as the 'father of modern science'. Galileo's observation of the moon, Jupiter and its moons, Venus,

sunspots and even a supernova has formed the foundation of our study and understanding of astronomical phenomenon. His great inventions include the compass, a thermometer and the telescope. Galileo's numerous writings in mathematics, astronomy and physics influenced many other scientists.

Galileo's relationship with the Church was always very strained. His scientific books and papers were banned. Twice Galileo was charged with heresy. He was finally tried and placed under perpetual house arrest, but despite this, Galileo remained a steadfast Catholic.

There are people who try to discredit the modern Church by using Galileo's conflict with Rome as an argument that Catholicism of today opposes science. However, such people don't consider the social and historical context. Some historians and church thinkers believed that Pope Urban's papacy acted as it did because the general population as well as much the clergy was not ready to accept these scientific truths. As acceptance of the heliocentric model of the solar system grew, the Church reversed some of its decisions. The ban on Galileo's work was lifted in 1718. In 1939 in his address to the Pontifical Academy of Sciences – the Vatican's scientific body - Pope Pius XII hailed Galileo as a great hero of research. In 1992, Pope John Paul II exonerated Galileo and express a deep regret over Galileo's unjust prosecution and imprisonment. Galileo's legacy has shaped the way people and the Church now see the world and their place in it.

Questions:

1. How did Galileo's scientific achievements help us develop a better sense of our solar system?
2. How did the renaissance Church react to Galileo's view? Describe Galileo's conflict with the Church.
3. How did Galileo view faith and science?
4. What was Galileo's greatest mistake?
5. What great legacies did Galileo leave us?

Appendix A: Black Line Master

Passages of the bible that support the geocentric view of the earth:

- **Ecclesiastes 1:5** The sun rises and the sun goes down, and hurries to the place where it rises.
- **Joshua 10:12–13** On the day when the Lord gave the Amorites over to the Israelites, Joshua spoke to the Lord; and he said in the sight of Israel, "Sun, stand still at Gibeon, and Moon, in the valley of Aijalon."
- **Psalms 104:5** You set the earth on its foundations, so that it shall never be shaken.
- **Isaiah 66:1** Thus says the Lord: Heaven is my throne and the earth is my footstool; what is the house that you would build for me, and what is my resting place?
- **Chronicles 16:30** tremble before him, all the earth. The world is firmly established; it shall never be moved.
- **Psalms 119:90** Your faithfulness endures to all generations; you have established the earth, and it stands fast.
- **Ecclesiastes 1:4** A generation goes, and a generation comes, but the earth remains forever.
- **Proverbs 3:19** The Lord by wisdom founded the earth; by understanding he established the heavens;
- **Psalms 74:16** Yours is the day, yours also the night; you established the luminaries and the sun.
- **Psalms 148: 1 - 7** Praise the Lord! Praise the Lord from the heavens; praise him in the heights! Praise him, all his angels; praise him, all his host! Praise him, sun and moon; praise him, all you shining stars! Praise him, you highest heavens, and you waters above the heavens! Let them praise the name of the Lord, for he commanded and they were created. He established them forever and ever; he fixed their bounds, which cannot be passed.

Appendix B: Culminating Task

Culminating Task: Creation and Big Bang\ Evolution timelines

Science 9

Unit: Exploring our Universe

Use tables 1 and 2 below and turn them into time lines in the space provided. Answer the questions that follow.

Table 1: Creation events

Time	Event
Beginning	God creates heaven and Earth
Day 1	Light is separated from darkness. Day and night created
Day 2	Divides the waters above and below with the firmaments (sky or the dome of the sky)
Day 3	Gathers up the waters and causes land to appear. Plants, trees and flowers appear
Day 4	God creates the Sun, Moon, stars and places them in the firmament
Day 5	creatures of the sea and the birds
Day 6	God makes land animals and finally humans (both man and woman)
Day 7	God rested.

Table 2: Big Bang and Evolution events

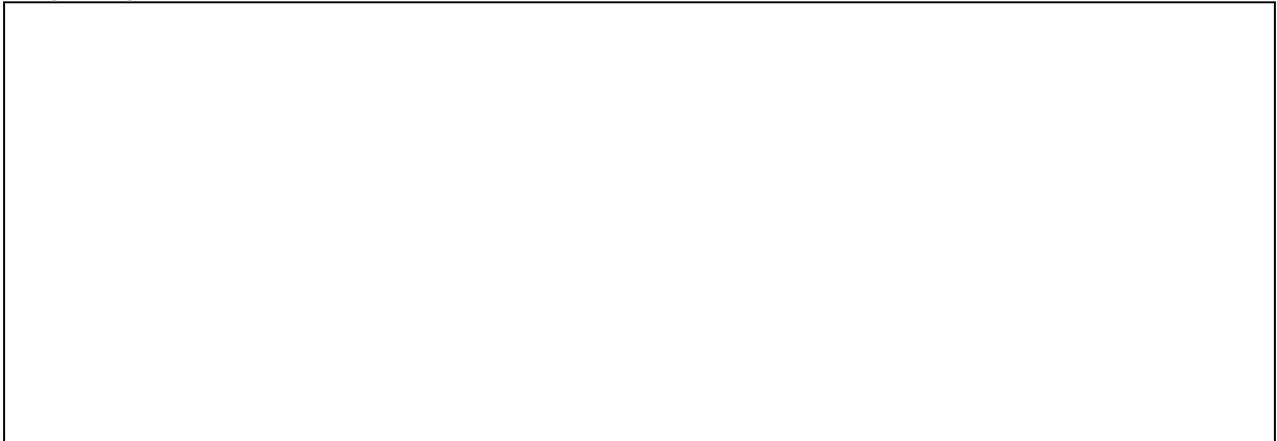
Time	Event
Beginning 13 billion years ago	Big Bang
seconds to years after big bang	Formation of particles and matter
Around 12-11 billion years ago	Formation of stars and galaxies
4.5 billion years ago	Earth and Sun are formed
3.8 billion years ago	Bacterial life appear in fossil record
2 billion years ago	Eukaryotic cells appear in fossil record
1 billion years ago	multicellular life appear in fossil record
600 million years	first animals appear in fossil record
500 million years	fish and proto-amphibians
475 million years	Colonization of land by plants.
360 million years	Amphibians
300 million years	Reptiles
200 million years	Mammals, birds
500 thousand years	Early humans
200 thousand years	Modern humans

Illustrate your time lines below

Creation timeline:



Big Bang\Evolution timeline:



- Write a short journal entry about the activity you've just finished by reflecting on these questions:
 1. How is a scriptural passage about creation supposed to be interpreted?
 2. How is scientific information supposed to be interpreted?
 3. Is this a fair comparison? Why or why not?
 4. Are there underlying messages in the creation story given to people by God that isn't apparent in the passages?
 5. Even if creation didn't occur literally as described in the Book of Genesis, why is the creation story still valid and important for us?

Appendix C: Table of Correlation

Faith Permeation lesson Documents	Pearson Saskatchewan Science 9	Outcome and Indicator	Catechism of the church	Gospel/ Church documents and encyclicals	Christian Ethics resources
<p>Lesson 1: The View from Earth: Jewish perspective</p> <p>Activity 1: Biblical Star Names</p> <p>activity 2: Hebrew Calendar</p>	<p>section ‘Human Interest in Space’ section 9.1 in Pearson Saskatchewan Science 9 P. 304-313.</p>	<p>EU9.1 (a) (b) (c) EU9.3 (c)</p>	<p>#3,#29 #51, #54, #216 #296 #298 #300 #301 #340 #341 # 344</p>	<p>Amos 5: 8 Job 9: 9 Job 38:31-33 Job 26:13 Amos 5:25-27</p>	<p>N\A</p>
<p>Lesson 2: The Church and Big Bang theory</p> <p>Activity 3: The Church and Big Bang</p> <p>Activity 4: Biblical View of Creation</p>	<p>Section 11.1 P. 373-376 ‘Cultural Explanations for the Origins of the Universe</p> <p>section 11.2 ‘Explaining the Origin of the Universe’ P. 378-386</p>	<p>EU9.3 (d)</p>	<p>#3,#29 #51, #54, #216 #296 #298 #300 #301 #340 #341 # 344</p>	<p>Genesis 1 Nicene Creed 1st Vatican Council, chapter 1 On God the Creator of All Things. <i>Summa Theologica</i> St.Thomas Aquinas Humani Generis POPE PIUS XII Pope John Paul II 1996 a message to the Pontifical Academy of Sciences “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</p>	<p>Gr. 9 Christian Ethics program <i>Be With Me</i> – P. 159 Truth and Freedom Unit 7.</p> <p>Gr. 9 Christian Ethics program <i>Be With Me</i> The Bible: Our story P. 214 Truth and the Bible P. 215</p> <p>Gr. 9 Christian Ethics program <i>Be With Me</i> Sparrows Quest P. 34</p>

<p>Lesson 3 Evolution</p> <p>Activity 5: The Church and Evolution.</p> <p>Document: “Does the Catholic Church Accept Evolution?”</p>	<p>Section 11.1 P. 373-376 ‘Cultural Explanations for the Origins of the Universe</p> <p>section 11.2 ‘Explaining the Origin of the Universe’ P. 378-386</p>	<p>EU9.3 (d)</p>	<p>#3,#29 #51, #54, #216 #296 #298 #300 #301 #340 #341 # 344</p>	<p><i>Humani Generis</i> - Pope Pius XII (12 August 1950) <i>Truth Cannot Contradict Truth</i>- Pope John Paul II (October 22, 1996)</p> <p><i>In the Beginning</i> Cardinal Ratzinger (1995)</p> <p><i>International Theological Commission</i> Cardinal Ratzinger (2004)</p>	<p>Gr. 9 Christian Ethics program <i>Be With Me</i> - Unit 2 Section: A body fit for God P. 22-29</p>
<p>Lesson 4: Geocentric vs. Heliocentric models of the earth</p> <p>Activity 5: Geocentric vs. Heliocentric views of the solar system</p>	<p>section 11.2 P. 386-387</p>	<p>EU9.1 (c) EU 9.1 (e)</p>	<p>, #216 #296 #298 #300 #301 #340 #341 # 344</p>	<p>Ecclesiastes 1:5, Joshua 10:12–13, Psalm 104:5, Isaiah 66:1, Chronicles 16:30, Psalm 119:90, Proverbs 3, Psalm 74:16, Psalm 148</p>	<p>Gr. 9 Christian Ethics program <i>Be With Me</i> – P. 159 Truth and Freedom Unit 7.</p> <p>Gr. 9 Christian Ethics program <i>Be With Me</i> The Bible: Our story P. 214 Truth and the Bible P. 215</p>
<p>Culminating Activity</p>	<p>As an alternative to culminating task on P. 430</p>	<p>EU9.1 (a) (b) (c) EU9.3 (c) (d)</p>	<p>, #216 #296 #298 #300 #301 #340 #341 # 344</p>	<p>Ecclesiastes 1:5, Joshua 10:12–13, Psalm 104:5, Isaiah 66:1, Chronicles 16:30, Psalm 119:90, Proverbs 3, Psalm 74:16, Psalm 148</p>	<p>Gr. 9 Christian Ethics program <i>Be With Me</i> – P. 159 Truth and Freedom Unit 7.</p> <p>Gr. 9 Christian Ethics program <i>Be With Me</i> The Bible: Our story P. 214 Truth and the Bible P. 215</p>

Appendix D: 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.

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).

293 Scripture and Tradition never cease to teach and celebrate this fundamental truth: "The world was made for the glory of God." St. Bonaventure explains that God created all things "not to increase his glory, but to show it forth and to communicate it", for God has no other reason for creating than his love and goodness: "Creatures came into existence when the key of love opened his hand." The First Vatican Council explains:

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

(Compendium of the Catechism of the Catholic Church #293)

God creates "out of nothing"

296 We believe that God needs no pre-existent thing or any help in order to create, nor is creation any sort of necessary emanation from the divine substance.¹⁴⁴ God creates freely "out of nothing":¹⁴⁵ (Compendium of the Catechism of the Catholic Church #296)

If God had drawn the world from pre-existent matter, what would be so extraordinary in that? A human artisan makes from a given material whatever he wants, while God shows his power by starting from nothing to make all he wants.¹⁴⁶

298 Since God could create everything out of nothing, he can also, through the Holy Spirit, give spiritual life to sinners by creating a pure heart in them,¹⁴⁸ and bodily life to the dead through the Resurrection. God "gives life to the dead and calls into existence the things that do not exist."¹⁴⁹ And since God was able to make light shine in darkness by his Word, he can also give the light of faith to those who do not yet know him.¹⁵⁰ (Compendium of the Catechism of the Catholic Church #298)

God transcends creation and is present to it.

300 God is infinitely greater than all his works: "You have set your glory above the heavens."¹⁵⁶ Indeed, God's "greatness is unsearchable".¹⁵⁷ But because he is the free and sovereign Creator, the first cause of all that exists, God is present to his creatures' inmost being: "In him we live and move and have our being."¹⁵⁸ In the words of St. Augustine, God is "higher than my highest and more inward than my innermost self".¹⁵⁹ (Compendium of the Catechism of the Catholic Church #300)

God upholds and sustains creation.

301 With creation, God does not abandon his creatures to themselves. He not only gives them being and existence, but also, and at every moment, upholds and sustains them in being, enables them to act and brings them to their final end. Recognizing this utter dependence with respect to the Creator is a source of wisdom and freedom, of joy and confidence:

For you love all things that exist, and detest none of the things that you have made; for you would not have made anything if you had hated it. How would anything have endured, if you had not willed it? Or how would anything not called forth by you have been preserved? You spare all things, for they are yours, O Lord, you who love the living.¹⁶⁰

(Compendium of the Catechism of the Catholic Church #301)

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. (Compendium of the Catechism of the Catholic Church #340)

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.

(Compendium of the Catechism of the Catholic Church #341)

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

(Compendium of the Catechism of the Catholic Church #344)

Appendix E: Additional Resources (Scripture)

Scripture: (New Revised Standard Version)

Majesty of Creation:

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

Teacher Catholic Faith Integrations Reflections
What have I learned about teaching this unit?

Science 9

Unit: Exploring Our Universe

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 Comments: