Concept Presentation – Honours Specialist Biology Summer 2010

1. **Candidates Name**: Andrew Smereczynsky 840451270
2. **Title of Concept**: Energy (Weather and Climate Change)
3. **Background Information**:

Weather and climate both depend on the amount of energy a region. Almost all the energy on Earth is initially solar radiation which is transmitted as waves that radiate from the sun. Life as we know it depends on solar energy.

My presentation is based on the concept of energy as it is found throughout the grade 10 Climate Change Unit (pg 78 of Ontario Curriculum grades 9 and 10). The overall picture of this concept in the unit will be as follows:

1. Where does this energy come from?
2. How does this energy get here?
3. What happens to this energy once it reaches Earth?
4. Is keeping too much of this energy good or bad?
5. How has human activity affected this energy? What can we change?
6. **Map of “Energy” Concept in the K-12 curriculum:**

Page references for the entries below refer to the following document

Ontario Curriculum Grades 1-8 Science and Technologies year 2007

**Grade1**: Specific Expectations : Earth and Space Systems Unit “Daily and Seasonal Changes”

* 2.2 page 54 examine changes in the amount of light from the sun per day/night
* 2.3 page 54 examine changes in the amount of heat from the sun per season
* 3.1 page 55 identify the sun as Earth’s primary source of heat and light
* 3.3 page 55 describe changes in the amount of heat and light from sun per season
* 3.4 page 55 describe and compare the four seasons

**Grade 2**: Specific Expectations :Earth and Space Systems Unit “Air and Water”

- 2.4 page 67 examine the water cycle, this is related to thermal Energy

-3.1 page 68 identify air as a gaseous substance, surrounds planet, affects Energy amount

**Grade 3**: None. The curriculum focus is on Soils, Forces and Structures

**Grade 4**: Specific Expectations : Matter and Energy Unit “Light and Sound”

* 2.2 page 91 investigate reflection of light ie. Albedo effect
* 3.3 page 92 describe properties of light
* 3.7 page 92 distinguish between sources of light that give off light and heat

**Grade 5**: Specific Expectations : Earth & Space Systems Unit “Conservation of Energy and Resources”

* 1.1 page 108 human uses of energy, its long term impact
* 1.2 page 108 effects of various technologies on Energy consumption
* 2.2 page 108 investigate issues related to energy conservation
* 2.3 page 108 build a device that transforms one form of energy into another
* 3.1 page 109 identify a variety of forms of energy
* 3.2 page 109 identify renewable and non-renewable sources of energy
* 3.3 page 109 describe how energy is stored/transformed in a system
* 3.4 page 109 recognize that energy cannot be created or destroyed
* 3.5 page 109 explain how “lost” energy is actually transformed energy

**Grade 6:** Specific Expectations : Earth & Space Systems Unit “Space”

* 3.5 page 123 describe the effects of the relative positions and motions of the earth, moon and sun.

**Grade 7**: Specific Expectations : Understanding Life Systems “Interactions in the Environment”

* 2.2 page 127: design and construct a model ecosystem
* 3.1 page 127: demonstrate an understanding of an ecosystem
* 3.2 page 127: identify and describe biotic and abiotic interactions
* 3.4 page 128: describe the energy transfer in a food chain
* 3.8 page 128 describe how human activities alter environmental balances

: Specific Expectations : Understanding Earth and Space Systems “Heat in the Environment”

* 2.2 page 136: effects of heating and cooling on the volume of objects
* 2.4 page 136: heat transfer through conduction,convection,radiation
* 3.1 page 136: how does heat energy affect particle motion?
* 3.2 page 136 how is heat produced
* 3.4 page 137 how is heat transmitted through conduction
* 3.5 page 137 how is heat transmitted through convection
* 3.6 page 137 how is heat transmitted through radiation
* 3.7 page 137 describe the role of radiation in heating and cooling the earth
* 3.8 page 137 identify common sources of greenhouse gases

**Grade 8:** Specific Expectations: Understanding Earth and Space Systems “Water”

* 3.4 page 151: identify factors ex. Temperature that affect the size of glaciers and ice caps. Describe their effects on local and global water systems

Page references for the entries below refer to the Ontario Curriculum Grades 9 and 10 Science 2008

**Grade 9**: Specific Expectations: Biology Unit “Sustainable Ecosystems”

* B3.1 Biotic and abiotic characteristics of sustainable and unsustainable ecosystems
* B3.3 describe the limiting factors of ecosystems
* B3.5 identify human activity that has an impact on ecosystems

**Grade 10:** Specific Expectations: Earth and Space “ Climate Change Unit ” page 79

* D2.2: build a model to illustrate natural greenhouse effect, explain anthropogenic
* D 2.4: cause and effect of climate change
* D 2.6: examine heat transfer within hydrosphere and atmosphere
* D 2.7: examine influence of ocean currents on global heat transfer
* D 3.2: describe and explain heat transfer in the hydrosphere and atmosphere and its effects on air and water currents
* D 3.4 : describe natural phenomena such as solar energy and how it affects climate
* D 3.6: describe how different C and N compounds influence the trapping of heat energy

Page references for the entries below refer to the Ontario Curriculum Grades 11 and 12 Science 2008

**Grade 11 Biology** SBI 3U Diversity of Living Things Unit

B1.2 page 50: analyse the impact of climate change on the diversity of living things ex. Rising

temperatures can result in habitat loss or expansion.

Sample Questions: Why would an increase in ocean temperatures endanger coral species?

How do higher temperatures affect species in freshwater environments?

**Grade 12 Biology**: None

1. **Description of Difficulties and Misconceptions**

Misconceptions might also be referred to as *preconceived notions, non-scientific beliefs, naive theories, mixed conceptions,* or *conceptual misunderstandings.* Basically, in science these are cases in which something a person knows and believes does not match what is known to be scientifically correct.

**How can teachers best address students' science misconceptions?**

. Misconceptions are not easily given up. Often students work very hard to process information and arrive at their ideas. It takes just as much work to deconstruct those ideas and let go of the incorrect ones. The first step is to be aware of and diagnose student’s misconceptions. This involves going beyond the multiple choice assessment-- to asking open ended questions and truly *listening* to students' ideas. Next, it involves structuring experiences and the learning environment so that there are opportunities for students to "test out" their ideas and prove the correct concepts to themselves.

**Heat Energy and Temperature Misconceptions**

1. Heat is a substance.
2. Heat is not energy.
3. Temperature is a property of a particular material or object. (Metal is naturally cooler than plastic).
4. The temperature of an object depends on its size.
5. Heat and cold are different, rather than being opposite ends of a continuum.

**Climate Change Misconceptions**

1. Weather and Climate are the same thing.
2. Ozone, no matter its location, is bad.
3. Global warming and the greenhouse effect , are the same thing.
4. The ozone hole is a hole in the sky.
5. Global warming and the greenhouse effect are caused by ozone.
6. **Advance Preparation**

All handouts are included in the “handout package” provided to students at the beginning of the course.

It is necessary to provide students with graph paper.

An overhead projector is required as well as a television and DVD/VCR.

For the specific lab and demonstration equipment necessary, please see the materials section in each lab. These student lab handouts are provided to you as an appendix to this handout.

Although not part of the Energy Concept, counting tree rings is performed in this unit.

Thus cutting a class set of tree ring samples will be necessary.

1. **Special Materials Needed**

Chain saw, paper, lighter, overhead projector, TV/DVD, beakers, thermometers, coloured paper, soil, water, tin foil, lamps. For the specific lab and demonstration materials necessary, please see the materials section in each lab. These student lab handouts are provided to you as an appendix to this handout.

1. **Lesson Sequence**

The Climate Change Unit is 15 days in length. The Energy Concept is specifically taught

on days 3,4,5,6 and 11. However it is also found indirectly throughout the whole unit.

Lesson Plans - Climate Change Unit THE ENERGY CONCEPT

Day 1 1. Lesson: Intro of climate Change, weather VS climate, methods of study climate, tree rings

2. Ice core samples (overhead). Go over climatograph lab from **pkg.** Put handout in lab book “Studying Climates”. **Overheads 1,1A**

3. HW Complete part A of the **LAB “Constructing Climatograph**”

Day 2 Take up Climatograph.

1. Lesson: Climate and the Sun (tilt,orbit , angle of incidence and rotation) notes and handout.

Show white video # 25 (3rd show “weather climate and biomes-10 mins). **Overheads 1A**

1. Class work/HW Complete Part B of the **LAB- Tree Ring Growth**

Day 3 Take-up : Tree Growth-Lab

1. Lesson: Energy Balance and Albedo. **pkg** Handout Demo Albedo. Lab write up in Notebook.
2. HW Complete the **lab demo: “Modeling Albedo in the Biosphere”** Overheads from **pkg**

Day 4 1. Lesson: What happens to the 70% of E that is absorbed? Notes: Thermal E transfer, conduction and convection. **(TVO videos)** Heat Capacity, Heat Sink **Overhead 2**

2. HW: Give out “Reflection and Absorption of Energy” worksheet. Read. Questions 1-8,10.

Day 5 1. Take-up worksheet “Reflection and Absorption of Energy”

2. Lesson : Earth’s Energy Budget overhead and changing Albedo, Biosphere (3 parts)

3. **Pkg** HO: Energy Transfer in the Atmosphere: Wind, Jet stream, Coriolis Effect, Ocean Curent

4. Worksheet on “Earth’s Energy Balance”

Day 6 1. Lesson: “Hydrosphere, climate and E transfer” . Natural Greenhouse Effect

2. Greenhouse gases, **Graphing Activity**-“Graphing Changes in Carbon Dioxide”

3. HW complete the graph and answer the questions. Study for Quiz on Climate Change

Day 7 1. Quiz. Discuss CO2 changes HW

2. Lesson: “Discovering Past Climates” and “Ice Core Analysis”. Start Ice Core Lab

Day 8: Continue Working on Ice Core **LAB**

Day 9: 1. Lesson ANTHROPOGENIC Human Activities and Climate Change Results OZONE Hole

2.**Activity:** “Comparing Global Warming Potential of Greenhouse Gases” Put in Lab book

Day 10. 1. Take up Graph Assig.

2.Lesson: Carbon sources and sinks. Tables 8.4 and 8.5 and changes throughout history

3. Overheads. CW/HW “what can we do about climate change”.

Day 11: **LAB:** Modelling the Greenhouse Effect

Day 12: 1. Lesson: **Overheads** “A Global Pattern”, “ Collecting and Modelling Climate Change” “New Technology and Instruments”

2.HW Create a review sheet summary for this unit

Day 13: 1. Hand in Lab 2.Take up “What can we do About Climate Change” from day 10. REVIEW Unit

Day 14: Review for Test Day 15: Climate Change Test

1. **Teaching Ideas**

To keep this unit and concept interesting a variety of teaching methods are used.

-2 Labs : Modelling Albedo and Greenhouse effect

-hands on counting tree rings activity with actual tree rings

- 2 graphing activities : climatograph and greenhouses gases (instead of just being presented with graph and table data to memorize, students have the opportunity to generate these graphs themselves. This reinforces their learning)

- ice core lab activity - videos and DVD’s

**J**. **Essential Expectations for the “Energy Concept in the Climate Change Unit”**

**Grade 10:** Specific Expectations: Earth and Space “ Climate Change Unit ” page 79 Ontario Curriculum

D2.2: build a model to illustrate natural greenhouse effect, explain anthropogenic

D 2.4: cause and effect of climate change

D 2.6: examine heat transfer within hydrosphere and atmosphere

D 2.7: examine influence of ocean currents on global heat transfer

D 3.2: describe and explain heat transfer in the hydrosphere and atmosphere and its effects on air and water currents

D 3.4: describe natural phenomena such as solar energy and how it affects climate

D 3.6: describe how different C and N compounds influence the trapping of heat energy

**K. Assessment and Evaluation Procedures (based on Markbook Program)**

The grade 10 course evaluation is as follows: Term 70% CPT10% Exam 20%

Achievement Categories are: K/U 25%, T&I 35%, Comm 15%, MC/App 25%

For this specific unit it is as follows:

Ice Core: MC/App out of 18-weight 18 Tree Rings: Formative

Albedo Lab: Comm out of 22-weight 22 Climatograph: Formative

Greehouse Lab: Inquiry out of 15-weight 15

Graph CO2 :MC/App out 10- weight 10

Quiz: KU out of 15-weight 15

Unit Test: KU-15, MC/App-10, Inquiry-18, Communication-12

**L.**  **Applications and Societal Implications :** A society is a group of people who have a distinctive way of life and economic system. Although Earth’s climate system is one interconnected whole, different societies have different impacts on it. We who live in the “developed” or industrialized world enjoy a higher standard of living but have a greater impact on the Earth. Unfortunately, our actions of late have had a negative impact on our climate system and have lead to a climate change that is detrimental to the well being of Earth.

The concept of “Energy in the Climate Change Unit” teaches the student about the primary source of energy on earth. Its properties, behaviour and how it can be manipulated by man both positively and negatively. This knowledge will allow the student to make more informed lifestyle choices so as to minimize the negative effects of climate change.

**M.** **Annotated References e**

1. Pearson Education Canada, Investigating Science 10, 2009. Grade 10 textbook used at Loyola Catholic Secondary School
2. [www.indiana.edu/~w505a/studwork/deborah Accessed 07/07/2010](http://www.indiana.edu/~w505a/studwork/deborah%20Accessed%2007/07/2010) Misconceptions in Science -provides a definition for science misconceptions as well as examples
3. Ministry of Education Ontario, The Ontario Curriculum Grades 1-12. Year 2007-2008