

Carbon Cycle and Its Effect on the Polar Region

Introduction

In this unit, we will study the carbon cycle and its effect on the polar region. There is always been a debate over global warming. The reality the word global warming can be misleading because not every part of the world experiences the same effect in different seasons. It's the overall climate change that the scientists are concerned about. CO₂ is an important greenhouse gas which contributes to the warming of the planet. There are data records and models that well demonstrate this warming effect over many centuries. In this unit, we want to have a focus on this greenhouse gas CO₂, how it comes about in the carbon cycle and its affect on the polar region. As the level of CO₂, the global temperature is increasing. This warming of the global temperature leads to the melting to polar ice. Polar ice is especially sensitive to melting because cause of the positive feedback inserted by Albedo. As more ice is melted, less solar energy is being reflected and more energy is absorbed by the ocean. As a result, the rate of energy increase is amplified, and therefore increases the rate of melting. This unit is a good addition at the end of meteorology unit, where the students have a chance to examine current environment issues concerning global warming at the polar region.

Grade Level: 8th grade

Population Characteristics: This group is a diversified group, consists of learners with different cultural background and levels of performance. The reading and math levels range from 2 to 4. This group has some basic knowledge on Earth Science. In this class, we learn various aspects of Earth Science, which include the structure and properties of the atmosphere, biosphere, hydrosphere, lithospheres, energy exchange in atmosphere, the dynamics of Earth such Earthquakes and Volcanoes. In addition, students have some basic knowledge of Life Science such as photosynthesis, decomposition, cellular respiration and decomposition. Furthermore, students have some background in basic chemistry such as atom, molecules, compounds, bonds, structures of molecules and compounds. I would like to add this unit at end of meteorology unit to discuss the changes in the climate.

Lesson Groupings: Whole class lecture and group activities. Some sessions are to be completed by individual student.

Common Core Standards

CCSS.ELA-Literacy.RS.6-8. Key Ideas and Details

1. Cite specific textual evidence to support analysis of science and technical text.
2. Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.

3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context.
6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.

CCSS.ELA-Literacy.WS.6-8.1. Write arguments focused on discipline-specific content.

b. Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.

e. Provide a concluding statement or section that follows from and supports the argument presented.

New York State Earth Science Regents Standards

1. Deductive and inductive reasons are used to reach mathematical conclusion.
Critical thinking skills are used in the solution of mathematical problems.
Beyond the use of reasoning and consensus, scientific inquiry involved the testing of proposed explanations involving the use of conventional techniques and procedures and usually requiring considerable ingenuity.
- 2.2. a insolation heats Earth's surface and atmosphere unequally due to variations in characteristics of materials absorbing the energy such as color, texture, transperance and specific heat.
- 2.2. d Temperature and precipitation patterns are altered by human influences including deforestation and production of greenhouse gases such as carbon dioxide.
6. Identifying patterns of change is necessary for making predictions about future behavior and conditions.

Graph and interpret the nature of cyclic change such as atmospheric carbon dioxide.

7. The knowledge and skills of mathematics, science, and technology are used together to make informed decisions and solve problems, especially those relating to issues of science/technology/society, consumer decision making, design, and inquiry into phenomena.

Objectives:

1. Students will be able to demonstrate the carbon cycle and describe level CO₂ increases by human activities and natural phenomenon.
2. Students will be able to explain that CO₂ absorbs solar energy.
3. Students will be able to demonstrate albedo effect.
4. Students will be able to describe the process of the melting of the polar cap and albedo feedback.

Lesson Sequence.

1. Carbon Cycle: How CO₂ is introduced in the atmosphere
Students will be able to demonstrate the carbon cycle.
2. How does human activities and natural phenomenon affect the carbon cycle? Describe how does level of CO₂ increase by human activities and natural phenomenon.
3. How CO₂ causes global warming
Introduce the electromagnetic spectrum and the types of energy.
Students will have to create CO₂ models and demonstrate how CO₂ absorbs energy.
4. Polar Region Albedo Effect
Use different materials to demonstrate absorption and reflection of solar energy.
5. Melting of the polar cap through global warming and its feedback
Identify the polar region on a map and describe its effect of global warming and albedo feedback.

Assessments

Students will be presenting a poster on how polar region is affected by the carbon cycle
Students will be complete worksheets, lab activities and model building.

Subject/Course:	Earth Science		
Topic:	Carbon Cycle and Its Effect on the Polar Region		
Lesson Title:	Day 1 Carbon Cycle		
Level:	8 th grade	Lesson Duration:	60 minutes
Lesson Objective:	Students will be able to demonstrate the carbon cycle.		
Summary of Tasks/Actions: Scope and Sequence	<ol style="list-style-type: none"> 1. Do Now: What is the carbon? Where do you find carbon? (5 min) Carbon is an atom, which is the building block of all living things. You can find carbon in animal, plant, organic rocks and minerals such as coal and diamond. Carbon even exist in the atmosphere. Why? Don't forget, carbon can exist in different forms. The most common form is CO₂, which is present in the atmosphere. 2. Group work: Making connection activity (20 min) There are carbon-related interactions all around us. Can you give an example? Use your prior knowledge on Life Science and Earth Science to demonstration the carbon-related interactions among the items. <ol style="list-style-type: none"> a. Students are divided into groups of four. b. Cut out all the pictures in worksheet 1. c. Spread the pictures on a piece of a legal sized printing paper. Use only one side. d. Use a glue stick to glue the pictures on the printing paper. e. Draw arrows using a pencil to indicate the carbon-related interactions among the pictures. f. Round Robin Share. 		

1. Each person from the original group is given a number from 1-4.
 2. Students with the same number form a new group.
 3. Each person in the new group talks about their original group ideas on the carbon-related interactions.
 4. Students take detailed notes during the sharing session.
3. Show a video on carbon cycle. (10 min)
http://www.youtube.com/watch?v=xFE9o-c_pKg
 Allow the students to turn to a partner and discuss what they've learned.
- a. Why is it called the carbon cycle?
 - b. What is the carbon cycle?
 - c. What did you find surprising in the video?
 - d. List five new things that you've learned from the video.
4. Make corrections to the carbon-related interactions you created in previous activity (15 min)
 Students can make edition by erasing the pencil marks and use different color of markers to make arrows.
 Write on the arrows how does the carbon flow occur.
 Be sure to label define the following words on the poster: You can look up the words in the textbook - Earth Science.
- a. Carbon
 - b. Carbon dioxide
 - c. Atmosphere
 - d. Lithosphere
 - e. Hydrosphere
 - f. Biosphere
 - g. Algae
 - h. Photosynthesis
 - i. Respiration.
5. Students will present their finalized poster on carbon cycle. (10 min)

Materials/Equipment:

Worksheet one
 Scissors
 Printing paper
 Glue
 Markers

Vocabulary:

Carbon: a naturally abundant, nonmetallic element that occurs in all organic compounds and can be found in all known form of life.
 Carbon dioxide: a colorless, odorless gas that is present in the atmosphere, formed during respiration, produced during organic decomposition, used by plants in photosynthesis, and formed when any fuel containing carbon is burned.
 Atmosphere: the mixture of gases surrounding the earth, held in place by gravity.
 Lithosphere: rigid, rocky outer layer of the earth.

Hydrosphere: all of the earth's water, including surface water, groundwater, snowcover, ice, and water in the atmosphere, including water vapor. Biosphere: the parts of the land, sea, and the atmosphere in which organisms are able to live. Algae: a general term for microscopic or larger aquatic plants. They differ from trees, bushes, and other flowering plants because they lack true roots, stems, and leaves. Photosynthesis: the process by which green plants, algae, diatoms, and certain forms of bacteria make carbohydrates from carbon dioxide and water, using energy captures from sunlight. Respiration: processes that take place in the cells and tissues during which energy is released and carbon dioxide is produced.
Assessment:
Students present their carbon cycle poster at the end of the first day. Students will be grade based on <ol style="list-style-type: none"> 1. The quality and the accuracy of their poster. 2. Class participation 3. How well they work in groups in all the group activities.
Reference:
http://www.calacademy.org/teachers/resources/lessons/Carbon-Cycle-Roleplay-3-12/ http://www.youtube.com/watch?v=xFE9o-c_pKg Textbook Glencoe Earth Science

Subject/Course:	Earth Science		
Topic:	Carbon Cycle and Its Effect on the Polar Region		
Lesson Title:	Day 2 How does human activities contribute to the carbon cycle?		
Level:	8 th grade	Lesson Duration:	60 minutes
Lesson Objective:	Students will be able to observe and describe how human activities affect the carbon cycle?		
Summary of Tasks/Actions:	Scope and Sequence		
In this lesson activity, students will take a field trip to Gantry Plaza State Park. This is a great location to observe the carbon cycle because there are rocks, river, grass, trees, cars, factories, buildings and animals birds, squirrels and small insects etc...All the lesson activities are to be completed in the park. The duration of this lesson does not include the traveling time to the park.			
<ol style="list-style-type: none"> 1. Review (5 min) <ul style="list-style-type: none"> What is the carbon cycle and where do you find the carbon cycle? The carbon cycle is the journey of the carbon atoms on Earth which can be found everywhere including Gantry Plaze State Park. 2. Observation of the carbon cycle (20 min) <ol style="list-style-type: none"> a. Students walk around the park and make detailed observations on the presence of the carbon cycle. 			

- b. Students look for any human activities that contribute to the carbon cycle.
 - c. Students assess whether the identified human activities cause positive or negative impact on the carbon cycle.
 - d. Based on their prior knowledge, students describe any natural phenomenon that can affect the carbon cycle.
 - e. Student complete worksheet 2 as they make observations.
3. Role play (30 min)
- a. Students are divide into the original group of four (same group as day 1)
 - b. Groups formulate a plan to demonstrate how human activities can contribute to the carbon cycle by role play. In this assignment, students have to
 - 1. Clearly identify two human activities or factors that contribute to the carbon cycle.
 - 2. Accurately demonstrate how the two factors contribute to the flow carbon in carbon cycle.
 - 3. Indicate whether the factors have a positive or a negative impact on the carbon cycle.
 - 4. Each group has five minutes to perform.
 - 5. Groups can use can props that are available, including the carbon-cycle poster they created in day 1.
 - 6. Groups act out their plans to demonstrate how human activities and natural phenomenon that can contribute to the carbon cycle.
4. Conclusion/ Comments and discuss (5 min)
Teach leads a small discussion on what students learned from the lesson and the role-play from the groups.

Materials/Equipment:

Worksheet 2
Clipboards
Pens/pencils
Carbon Cycle posters created in Day 1

Vocabulary:

Carbon: a naturally abundant, nonmetallic element that occurs in all organic compounds and can be found in all known form of life.
Carbon dioxide: a colorless, odorless gas that is present in the atmosphere, formed during respiration, produced during organic decomposition, used by plants in photosynthesis, and formed when any fuel containing carbon is burned.
Atmosphere: the mixture of gases surrounding the earth, held in place by gravity.
Lithosphere: rigid, rocky outer layer of the earth.
Hydrosphere: all of the earth's water, including surface water, groundwater, snowcover, ice, and water in the atmosphere, including water vapor.
Biosphere: the parts of the land, sea, and the atmosphere in which organisms are able to live.
Algae: a general term for microscopic or larger aquatic plants. They differ from trees, bushes, and other flowering plants because they lack true roots, stems, and leaves.
Photosynthesis: the process by which green plants, algae, diatoms, and certain forms of

<p>bacteria make carbohydrates from carbon dioxide and water, using energy captures from sunlight.</p> <p>Respiration: processes that take place in the cells and tissues during which energy is released and carbon dioxide is produced.</p> <p>Fossil fuel: fuels formed by natural processes such as anaerobic decomposition of buried dead organisms.</p> <p>Combustion: act or process of burning.</p>
<p>Assessment:</p> <p>Student present Role – Play the carbon cycle at the end of the second day.</p> <p>Students will be grade based on</p> <ol style="list-style-type: none"> 1. The quality and the accuracy of their group role-play. 2. Class participation 3. How well they work in groups in all the group activities.
<p>Reference:</p> <p>Textbook Glencoe Earth Science</p> <p>NASA</p>

Subject/Course:	Earth Science		
Topic:	Carbon Cycle and Its Effect on the Polar Region		
Lesson Title:	Day 3 How does CO2 affect the global temperature.		
Level:	8 th grade	Lesson Duration:	60 minutes
Lesson Objective:	<ol style="list-style-type: none"> 1. Students will be able to explain that CO2 absorbs solar energy. 2. Students will be able to describe how the amount of CO2 affects global temperature. 		
Summary of Tasks/Actions:	Scope and Sequence		
	<ol style="list-style-type: none"> 1. Students use scientific data to explore how the amount of CO2 affects the average global temperature. (20 min) <ol style="list-style-type: none"> a. Each student is assigned to a computer with internet access. b. Go to http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=90&pid=44&aid=8&cid=regions&syid=1980&eyid=2011&unit=MMTCD c. Browse through the CO2 emission data in different countries d. Answer the following questions based on the data <ol style="list-style-type: none"> 1. How does the amount of global CO2 emission change from 1980 to 2011? 2. Which country has the greatest amount of CO2 emission? Why do you think this is the case? What factors can contribute to this observation? 3. Which country has the greatest amount of CO2 emission increase? Why do you think this is the case? What factor can contribute to this observation? 		

- e. Go to http://data.giss.nasa.gov/gistemp/graphs_v3/
 - f. Exam the nine different graphs on global temperature data.
 - g. Compare and contrast the different graphs
 - h. How does the amount of CO₂ emission affect the average global temperature?
 - i. Teacher leads the class to discuss that CO₂ is a greenhouse gas, which causes global warming. As the level of CO₂ increases, the average global temperature increase. It is pointed out on the graph temperature change fluctuates from year to year. Some of the dramatic changes are due to sudden and unexpected events such as volcanic eruption, which leads to temperature decrease. It is the average overall temperature that increases over time.
2. Science exploration activity (30 min)
- a. Students are divided into group of four.
 - b. Each group is given a set of lab materials: toothpicks, gumdrops, electromagnetic spectrum chart, candle, a piece of glass, match, goggles. (hint: What is a greenhouse?)
 - c. Students use the lab materials to formulate a procedure to demonstrate why CO₂ causes warming of the planet.
 - d. Students answer the follow questions
 - 1. Why is CO₂ known as a greenhouse gas?
 - 2. Why does it lead to global warming?
 - e. Each group demonstrates the procedures to the class.
3. Conclusion/summary (10 min)
- a. Teacher draws the structure of CO₂ on the board.
 - b. Students make the structure of CO₂ molecule using toothpicks and gumdrops.
O=C=O
 - c. Teacher points out that the double bond in CO₂ absorbs infrared energy when the energy reflected back from the surface of the Earth. CO₂ is acting as a greenhouse that keeps the Earth warm. As the amount of CO₂ increase, the global temperature increases accordingly. This effect is called global warming. An analogy of global warming is like a car in the summer time. When the sun hits the car, solar energy travels pass through the window of the car. As the solar energy passes through the window, it converts to infrared energy, which is a weaker form of energy that doesn't have enough strength to pass reflect back out the car window. Therefore infrared energy is trapped inside the car, and the car heats up inside.
 - d. Students complete the exit slip
How does CO₂ affect the temperature? How does the structure of CO₂ enable it to act as a greenhouse gas?

Materials/Equipment:

Computer, toothpicks, pieces of glass 6x6, gumdrops, electromagnetic spectrum, candles, match, goggles.

Vocabulary:

Carbon: a naturally abundant, nonmetallic element that occurs in all organic compounds and can be found in all known form of life.

Carbon dioxide: a colorless, odorless gas that is present in the atmosphere, formed during respiration, produced during organic decomposition, used by plants in photosynthesis, and

formed when any fuel containing carbon is burned.

Atmosphere: the mixture of gases surrounding the earth, held in place by gravity.

Lithosphere: rigid, rocky outer layer of the earth.

Hydrosphere: all of the earth's water, including surface water, groundwater, snowcover, ice, and water in the atmosphere, including water vapor.

Biosphere: the parts of the land, sea, and the atmosphere in which organisms are able to live.

Algae: a general term for microscopic or larger aquatic plants. They differ from trees, bushes, and other flowering plants because they lack true roots, stems, and leaves.

Photosynthesis: the process by which green plants, algae, diatoms, and certain forms of bacteria make carbohydrates from carbon dioxide and water, using energy captures from sunlight.

Respiration: processes that take place in the cells and tissues during which energy is released and carbon dioxide is produced.

Fossil fuel: fuels formed by natural processes such as anaerobic decomposition of buried dead organisms.

Combustion: act or process of burning.

Global warming: unequivocal and continuing rise in the average temperature of Earth System.

Greenhouse gas: a gas in an atmosphere that absorbs and emits radiation within the thermal infrared range.

Infrared energy: heat energy

Electromagnetic Spectrum: the entire range of wavelengths or frequencies of electromagnetic radiation extending from gamma rays to the longest radio waves and including visible light

Absorb: take in

Reflect: to move in one direction, hit a surface, and then quickly move in a different and usually opposite direction

Assessment:

Exit slip

Students will be graded based on the quality of

1. Class participation.
2. Teamwork
3. Science inquiry demonstration

Reference:

Textbook Glencoe Earth Science

<http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=90&pid=44&aid=8&cid=regions&syid=1980&eyid=2011&unit=MMTCD>

http://data.giss.nasa.gov/gistemp/graphs_v3/

Subject/Course:	Earth Science		
Topic:	Carbon Cycle and Its Effect on the Polar Region		
Lesson Title:	Day 4 Albedo Effect		
Level:	8 th grade	Lesson Duration:	60 minutes
Lesson Objective:			

1. Students will be able to demonstrate albedo effect.
2. Students will be able to describe how different color surfaces affect the rate of radiation of heat energy.

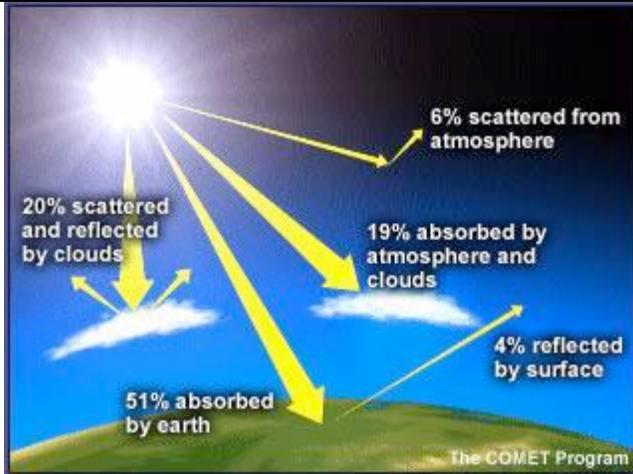
Summary of Tasks/Actions:
Scope and Sequence

1. Experimental Design: How does the color of an object affect its ability to radiate energy (60 min)
 - a. State a hypothesis in a cause and effect relationship based on your prior knowledge. Identify the independent and dependent variable.
 - b. List materials needed.
 - c. Design the procedure to test your hypothesis. Be sure to make a controlled experiment where only one variable is being changed and all the other factors are being constant.
 - d. Make a data table to collect and record data.

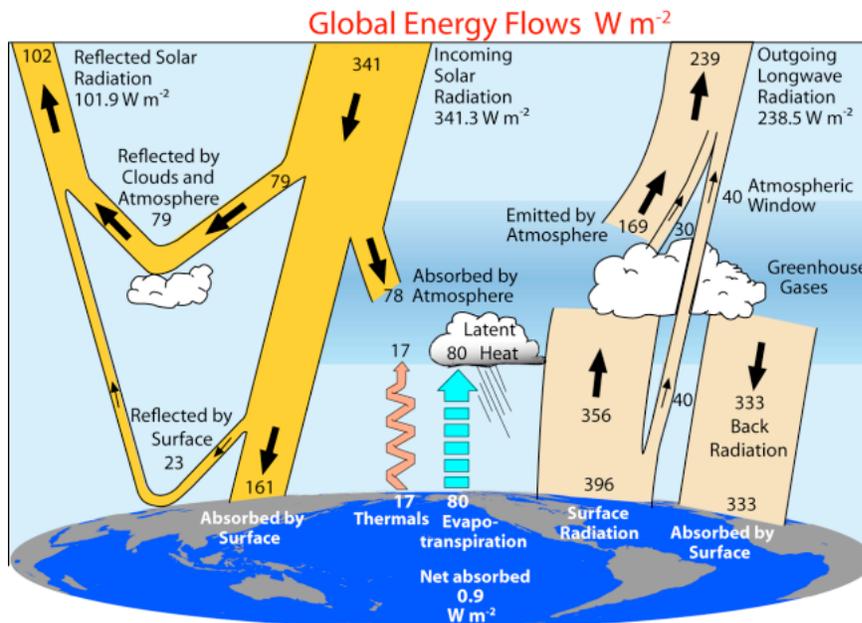
Example of data table:

Time in minutes	Temperature of dark can	Temperature of silver can
0		
1		

- e. Carry out the experiment and collect data.
- f. Make a graph using your data
- g. Make a conclusion based on your data
- h. What is the relationship between the amount of energy radiation and the color of the object? Does your experiment support your hypothesis?
- i. Answer the conclusion question?
 1. Which color can absorb energy more rapidly?
 2. Which colored can radiated heat more rapidly?
 3. How did the heat get to the thermometers inside the cans?
 4. Which road do you think will be warmer a few hours after sunset, a concrete (light color road) or an asphalt (dark colored road)? Why?
 5. Which areas in the world allow the greatest absorption of heat? Which areas allow the greatest radiation of heat? Why?
 6. How does properties of surfaces affect the rate of energy radiation?
 7. Albedo is a scientific word that describes the fraction of the solar energy that is reflected from Earth back to space. Describe the Earth's energy balance in the diagram below? How many percent of the solar energy is reflected and absorbed.



8. Look at the world map, located the places where heat is absorbed and reflected. Find the area with the greatest albedo.
9. Now for a more challenging chart
Look at the energy budget diagram, compare and contrast this diagram with the diagram in question 7.



The global annual mean Earth's energy budget for the March 2000 - May 2004 period ($W m^{-2}$). The broad arrows indicate the schematic flow of energy in proportion to their importance. - From Trenberth et al., 2009.

Materials/Equipment:

Black can, silver can, goggle, 100 W light, thermometers, graph paper, world map and timer.

Vocabulary:

Radiate: emit

Earth's Energy balance: Describes how the incoming energy from the sun is used and returned to space.

Absorb: takes in

Infrared energy: heat energy

Albedo: the fraction of solar energy reflected from the Earth back into space.

Assessment:
Students will be assessed based experimental procedures, results and analysis questions.
Reference:
Textbook Glencoe Earth Science http://www.nc-climate.ncsu.edu/secc_edu/images/solarenergydrivesclimate.JPG http://hmxearthscience.com/Warehouse/meteorology/documents/Energy%20Absorption%20LAB.pdf http://www.cgd.ucar.edu/cas/Topics/energybudgets.html

Subject/Course:	Earth Science		
Topic:	Carbon Cycle and Its Effect on the Polar Region		
Lesson Title:	Day 5 Why is the polar cap melting and why is it harmful?		
Level:	8 th grade	Lesson Duration:	60 minutes
Lesson Objective:	Students will be able to describe the process of the melting of the polar cap and albedo feedback.		
Summary of Tasks/Actions:	Scope and Sequence		
	<ol style="list-style-type: none"> 1. Inquiry by design activity: How long can we keep the ice from melting? (20 min) <ol style="list-style-type: none"> a. Class is divided into groups of four b. Groups are given a set of materials to design an environment to keep the ice from melting as long as possible. The materials are empty egg cartoon, waxed paper, masking tape, newspaper, aluminum foil, rubber bands and goggles. <ol style="list-style-type: none"> a. Groups are given ice cubes and timers to test how long can the ice last from melting. b. One person from each group to report the time on the white board. 2. Teach asks the class what is the purpose of this melting ice demonstration? How is it related to our topic in this unit? (4 min) Answer: This design activity is trying to model that the polar ice is melting due to global warming. The design process is a way to show that there are ways that human can do to slow down polar ice from melting. 3. Project a world map on the board, ask the students to locate the polar region (1 min) 4. Self exploration (15 min) 		

- a. Each student is assigned to a computer with internet access.
 - b. Go to <http://nsidc.org/arcticseaicenews/>
 - c. Explore all the resources data and news on the arctic sea ice. Read all the articles and graph on this page.
 - d. Write down five things you've learned about the polar ice in the Arctic.
5. Albedo feedback at the polar region: Why is Arctic sensitive to global warming? (15 min)
- a. Introduce the word climate feedback: it's the result of a process that can in turn affect the process itself. Positive feedback is when the result of a process is being amplified. Negative feedback is when the result of a process is being dampened.
 - b. Go to <http://nsidc.org/cryosphere/seaice/processes/albedo.html>
 - c. Exam the three diagrams on open ocean, bare ice and ice with snow.
 - d. Answer the following questions according to the diagrams
 - 1. Which surface absorbs most amount of solar radiation?
 - 2. Which surface reflects most amount of solar radiation?
 - 3. Which surface has the greatest albedo?
 - 4. How does the change in albedo affect the rate of melting in the Arctic?
 - 5. Is albedo feedback a positive or a negative feedback?
6. Conclusion/summary (5 min)
- As the level of CO₂, the global temperature is increasing. This warming of the global temperature lead to the melting to polar ice. Polar ice is especially sensitive to melting because cause of the positive feedback inserted by Albedo. As more ice is melted, less solar energy is being reflected and more energy is absorbed by the ocean. As a result, the rate of energy increase is amplified, and therefore increases the rate of melting.
- Exit slip
Describe the positive albedo feedback

Materials/Equipment:
Empty egg carton, ice cubes, waxed paper, masking tape, newspaper, aluminum foil, rubber bands, goggles, timer, and colored world map.
Vocabulary:
Radiate: emit Earth's Energy balance: Describes how the incoming energy from the sun is used and returned to space. Absorb: take in Infrared energy: heat energy Albedo: the fraction of solar energy reflected from the Earth back into space. Melting: a physical process that results in the phase transition of a substance from a solid to a liquid. Climate feedback: the result of a process that can in turn affect the process itself.
Assessment:
Exit slip

Reference:

Textbook Glencoe Earth Science

<https://earthdata.nasa.gov/featured-stories/featured-research/younger-sea-ice-and-scarcer-polar-bears>

<http://nsidc.org/cryosphere/seaice/processes/albedo.html>

Climate Change by Edmond Mathez

Curriculum link:

This unit is to carry out at the end of meteorology unit where students already examined the different types of weather and climate condition. This unit is a good introduction point to some of the current environmental issues that we are facing today such as global warming and melting of the polar ice. Future projects would include finding solutions to some of the current environmental problems.

Evaluation of the lesson:

The success of these lessons will be based on the quality of work turned in by the students at the end of each lesson. The assessments given at the end of lesson is a way to test for the understanding of the content delivered in each lesson. The assessment data can be use modified the lesson and to see how well the students understand the material.

Conclusion:

In conclusion, I find this unit very interesting and I think students will enjoy the contents and the activities in this unit. This unit is an example where we as educator try to connect science with real life. Some of the inquiry activities might be challenging for the students. Students are not use to think outside the box. Students can be challenging when asked to make conclusions based on experiments, observations, data analysis and reading external information. At the end, this unit fit really well in the 8th grade Earth Science curriculum and I would like to use it in my classroom in the future.

Worksheet 1

Making connections: Carbon-Related Interactions

Instruction:

- Cut out all the pictures in worksheet 1.
- Spread the pictures on a piece of a legal sized printing paper. Use only one side.
- Use a glue stick to glue the pictures on the printing paper.
- Draw arrows using a pencil to indicate the carbon-related interactions among the living and nonliving things.

Tree



Water Snail



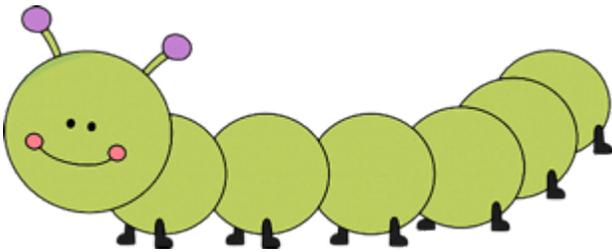
Atmosphere



Algae



Caterpillar



Sediments and rocks



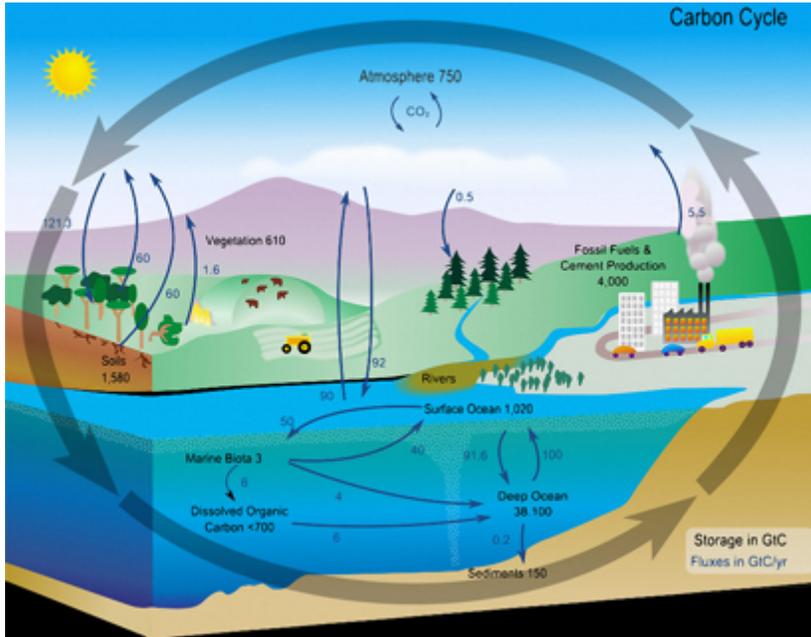
Water



Worksheet 2

Carbon Cycle

Make observations in the natural world. Complete the tables below based on your observations and use the carbon cycle diagram to help you out.



NASA

Figure 1: A cartoon of the global carbon cycle. Pools (in black) are gigatons (1Gt = 1×10^9 Tons) of carbon, and fluxes (in purple) are Gt carbon per year. Illustration courtesy NASA Earth Science Enterprise.

Table 1

Name of living or nonliving thing that contribute to the carbon flow.	How does this thing interact with its surrounding to contribute to the carbon flow?
Ex: atmosphere	Ex: Carbon dioxide from the atmosphere diffuses and dissolves into water. Plant releases carbon dioxide into the atmosphere.

Table 2. Human Activities

Human activities that contribute to the carbon cycle	How does this affect the carbon flow? Is it a positive or a negative impact to the carbon cycle? Why

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Table 3. Natural Phenomenon

Natural phenomenon that contribute to the carbon cycle	How does this affect the carbon flow? Is it a positive or a negative impact to the carbon cycle? Why