

Unit Title: Human Impact on Global Temperature (Solar Sprint)

Course Title: Physical Science

Grade Level: Grade 8 Instructors: B. Heller, A. Smith, K. Tribou and D. Zarra

Stage 1: Desired Results					
<p><u>Established Goals</u></p> <p>8.MS-ESS3-5. Examine and interpret data to describe the role that human activities have played in causing the rise in global temperatures over the past century.</p> <p>7.MS-ETS1-2. Evaluate competing solutions to a given design problem using a decision matrix to determine how well each meets the criteria and constraints of the problem. Use a model of each solution to evaluate how variations in one or more design features, including size, shape, weight, or cost, may affect the function or effectiveness of the solution.</p>	<p>Transfer</p> <p><i>Students will be able to independently use their learning to:</i></p> <ul style="list-style-type: none"> ● Define criteria and constraints of a design problem with precision ● Examine and interpret data to describe the role human activities have played in the rise of global temperatures over time ● Construct, analyze, and/or interpret graphical displays of data and/or large data sets to identify linear and nonlinear relationships 				
	<p>Meaning</p> <table border="1"> <thead> <tr> <th><u>Understandings</u></th> <th><u>Essential Questions</u></th> </tr> </thead> <tbody> <tr> <td> <ul style="list-style-type: none"> ● Our life can be positively impacted by technology ● That there are alternative resources to choose from that negatively and positively impact our environment </td> <td> <ul style="list-style-type: none"> ● How does technology impact human life? ● How does technology impact the environment? ● How do people interact with the environment? </td> </tr> </tbody> </table>	<u>Understandings</u>	<u>Essential Questions</u>	<ul style="list-style-type: none"> ● Our life can be positively impacted by technology ● That there are alternative resources to choose from that negatively and positively impact our environment 	<ul style="list-style-type: none"> ● How does technology impact human life? ● How does technology impact the environment? ● How do people interact with the environment?
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	<ul style="list-style-type: none"> The kinds of alternative resources available today. 									
Stage 2: Evidence										
Evaluation Criteria	Assessment Evidence									
<ul style="list-style-type: none"> Rubric on Solar Sprint assignment 	Performance Task(s): <ul style="list-style-type: none"> Solar Sprint Solar Energy Sales Pitch Presentation 									
	Other Evidence: <ul style="list-style-type: none"> Human Impact on Global Temperature Test 									
Stage 3: Learning Plan										
Core/Tier 1										
<ul style="list-style-type: none"> Watch the film <i>An Inconvenient Truth</i> Promote discussion through analysis questions about the movie (<i>Inconvenient Truth</i> Analysis Questions from aurumscience.org-link below) NWF's Carbon Cycle Activity (separate pdf file) Discuss the differences between renewable and nonrenewable energies Students will calculate their own carbon footprint using http://www.meetthegreens.org/features/carbon-calculator.html Have students create presentations on energy sources and their advantages vs. disadvantages (Discussion will include: Which of the sources are renewable/non-renewable? What are the Pros and Cons of each? Where does a majority of our energy come from? What changes can we make to the ways we generate and use energy?) <table border="0" style="width: 100%; margin-left: 20px;"> <tr> <td>- Wind Energy</td> <td>-Geothermal Energy</td> <td>-Hydropower</td> <td>-Fossil Fuels</td> </tr> <tr> <td>- Biomass</td> <td>-Solar</td> <td>-Nuclear</td> <td></td> </tr> </table> 			- Wind Energy	-Geothermal Energy	-Hydropower	-Fossil Fuels	- Biomass	-Solar	-Nuclear	
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<u>Literacy</u> <ul style="list-style-type: none"> Students will create a Slide Presentation about renewable and nonrenewable resources. Students will analyze a model they created in order to see where people can make changes to reduce global warming. <u>An Inconvenient Truth: The Crisis of Global Warming, Al Gore, 2006</u> 	<u>Instructional Technology</u> <ul style="list-style-type: none"> An Inconvenient Truth documentary (2006) Solar Energy Powerpoint Solar Car Sales Pitch Digital Presentation 									
Tier 2	Extension/Enrichment									
<ul style="list-style-type: none"> Provide step-by-step tutorial videos for constructing the solar car. 	<ul style="list-style-type: none"> The <i>Solar Sprint Car</i> can be entered into the Cape Cod Junior Solar Sprint Competition. 									



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|--|--|
| <ul style="list-style-type: none">- Provide an outline and example of a renewable energy powerpoint presentation.- Students may use the Inconvenient Truth book to support their video discussion and analysis questions.- Allow extra time to complete the Human Impact on Global Temperature quiz and repeat instructions if necessary | |
|--|--|

Inconvenient Truth Discussion Questions- <http://www.bhasd.org/wp-content/uploads/sites/143/2013/09/125338495-Inconvenient-Truth-Answer-Key.pdf>



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Name: _____

Date: ____/____/____ Period: ____

Human Impact on Global Temperature Quiz

1. Scientists think that in the next 100 years global warming will cause water levels in oceans to:

- A. Decrease at least 100 cm
- B. Stay the same
- C. Increase by between 15 and 95 cm

2. Kenya is the world's fourth largest tea producer and its second biggest exporter. If temperatures rise by 2°C, what would happen to tea growers in Kenya?

- A. They'd be able to grow more tea in more parts of the country
- B. Many of the areas where they grow tea would become unsuitable for tea growing
- C. They would be able to grow better quality tea

3. The greenhouse effect is caused by...

- A. Greenhouse gases in the lower atmosphere absorbing solar radiation
- B. Greenhouse gases in the lower atmosphere absorbing radiation from the Earth's surface, and preventing much of it escaping into space
- C. Too much heat in the atmosphere
- D. Too much sunshine reaching Earth

4. Which of these natural events affect the climate?

- A. Thawing permafrost
- B. The path of the Earth around the sun
- C. Volcanic eruptions
- D. All of the above

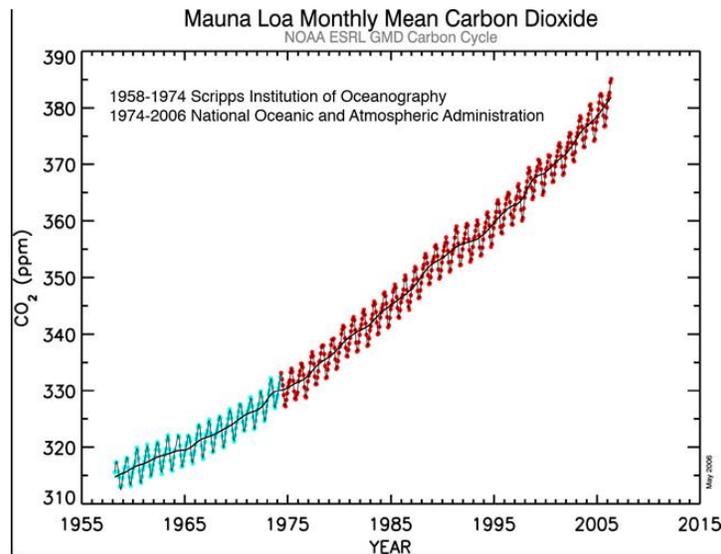
5. Which of these greenhouse gases is most abundant in the atmosphere?

- A. Carbon dioxide
- B. Methane
- C. Nitrous oxide
- D. Water vapour

6. Which of these countries has the highest per capita carbon dioxide emissions?

- A. United States
- B. Australia
- C. Saudi Arabia
- D. China

7. What does the data collected at Mauna Loa (illustrated in the graph below) has been the trend in recent atmospheric CO₂ levels? What is likely causing this trend? How do the CO₂ levels relate to climate change and global warming?



8. How are glaciers indicators of climate change?

9. List some of the ways in which human activities are contributing to global warming.

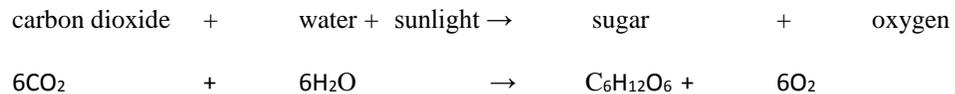
10. If global warming continues into the coming centuries, what are some consequences predicted by models?

The Carbon Cycle

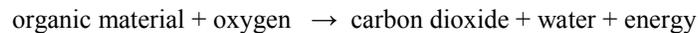
Purpose: To understand the carbon cycle in the context of climate change.

Background Information:

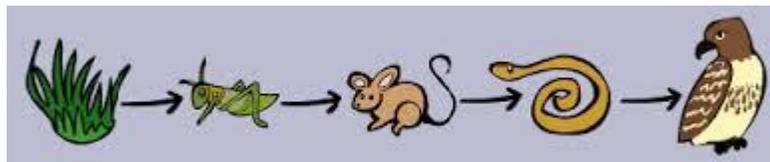
- Everything is connected to everything else in ecology which means that changes must occur in other Earth systems.
- Energy can be changed from one form to another, but it cannot be created or destroyed.
- Photosynthesis is the basis of life on Earth:



- Respiration is the reverse of photosynthesis:



Box Modeling: As a part of this activity, you will create a box model to show how matter and energy move through a system. Arrows in a box model show where matter and energy are moving to and from. Below is a very simple box model of a food chain:



Procedures:

1. Read and explore the “Illustrated Carbon Cycle” handout. Pay attention to the direction of the arrows since they indicate where matter and energy are moving to and from.

2. You will now be placed into one of the sphere groups below:
 - Carbon in the atmosphere
 - Carbon in the lithosphere
 - Carbon in the hydrosphere
 - Carbon in the biosphere

3. In your group, use the internet to gather information on the rates at which carbon flows into and out of the sphere you have been assigned.
4. Now, create a box model for carbon flow in your sphere. Begin by drawing a box with the name of your sphere in the middle of it on your group's flip chart sheet.

5. Draw arrows into and out of your box to indicate carbon inputs and outputs that affect your sphere.

6. Nominate one representative for your group, and have them bring your sheet to the front of the classroom and post it on the board.

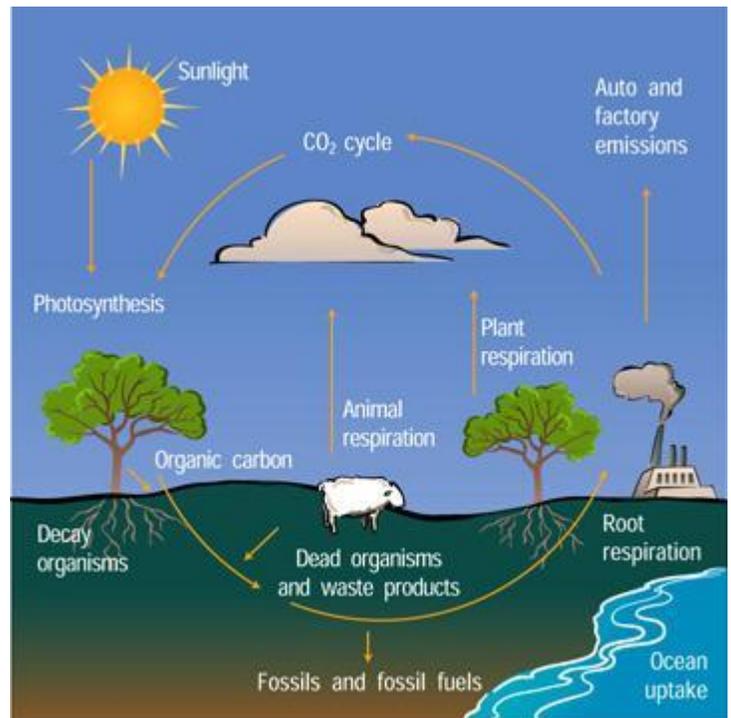
7. As a class, examine the boxes and to create an overall model of the carbon cycle. Where are there links between the boxes?

Analysis:

- Look at the overall model of the carbon cycle we created and identify at least four places in the cycle where humans can make changes to reduce global warming.

The Illustrated Carbon Cycle

The carbon cycle is the process by which carbon is exchanged between the various geological systems of the Earth and its atmosphere. The carbon keeps circulating between the four main carbon reservoirs: the atmosphere (i.e. the air, where it exists mainly as carbon dioxide), lithosphere (i.e., the Earth's crust, including rocks and soil), hydrosphere (i.e., the Earth's water, including fresh and saltwater), and biosphere (i.e., living things on land and in water). Carbon is unquestionably one of the most important elements on Earth. It is the principal building block for the organic compounds that make up life. Carbon's electron structure can readily form bonds with itself, leading to a great diversity in the chemical compounds that can be formed around carbon; hence the diversity and complexity of life. Carbon occurs in many other forms and places on Earth. It is a major constituent of limestone, occurring as calcium carbonate and it is dissolved in ocean and freshwater. It is present in the atmosphere as carbon dioxide, the second most important greenhouse gas. The flow of carbon throughout the biosphere, atmosphere, hydrosphere and lithosphere is one of the most complex, interesting and important of the global cycles. The carbon cycle challenges us more than any other global cycle as it draws together information from biology, chemistry, oceanography and geology. All scientific disciplines are needed to understand how it works and what causes it to change. It is human alteration of the quantity and movement of carbon that is mostly responsible for climate change. You will discuss these processes in more detail as you construct and experiment with various renditions of the carbon cycle.



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Solar Sprint

Purpose: To design, build, and test a car that runs on solar power, and create a Google Slides presentation to pitch your car to Ford Motor Company.

Problem: As we have discussed in class, one of the ways humans have impacted our environment is by burning fossil fuels and adding large amounts of carbon dioxide gas into the atmosphere. One of the major contributors of this gas is the fuel we burn driving our cars. In this assignment, you will design and build a solar powered car and then plan a presentation to explain the importance of your design to an automobile manufacturer.

Solar Car Procedures:

1. View these tutorial videos to familiarize yourself with building a *Solar Sprint Car*:
 - [How to Build a Model Solar Car](#)
 - Tutorial videos:
 - [How to make a Solar Car](#)
 - [Solar Activity: How to Build a Solar Car](#)
 - [Solar Car Tutorial](#)
2. As a group, come up with a list of variables that might affect the way your car works. For example; How does the size of a wheel affect the speed of a car? Research your variables to determine the optimal design for your car.
3. Design a prototype of the Solar Sprint Car that fits the following criteria:
 - The materials used to construct the model car must cost less than \$50. Original receipts for all materials purchased should be put in an envelope and placed in the notebook. The total cost of construction materials should be clearly written on the outside of the envelope. Model cars that exceed this construction cost limit will be disqualified from the competition.
 - The Junior Solar Sprint kit sold by Solar Made and the Ray Catcher Sprint Kit sold by PITCO are the solar panel/motor kits that are recommended, but not required, to be used in the competition. Solar panels cannot be shaved, drilled, or delaminated. Only the motor supplied in the kit can be used. Motors cannot be re-wound or disassembled. If an evaluation group convened by the event coordinator determines that the solar panel and/or motor have been modified, the car and team will be disqualified from the competition.
 - The remainder of the vehicle can be innovative in design and materials.
 - One solar panel (limited to a maximum output of 3.2 W), and one motor (limited to a maximum 3.0 VDC) are allowed per car. Reflectors, supports, and power leads can be added to these components as needed. Energy-enhancing devices, like mirrors, must be firmly attached to the vehicle.
 - The vehicle must be structurally sound, without the solar panel attached. The solar panel cannot be used as the chassis, or body of the car. The axles and wheels cannot be directly attached to the solar panel. The model car must not exceed the following dimensions: 30 cm (11 3/4 inches) wide by 60 cm (23 5/8 inches)

long by 30 cm (11 3/4 inches) high (as measured from the surface the car is resting upon to the highest point of the car with all its components attached) and positioned as during the time trials and races.

- The team is encouraged to decorate the body of the car, but a clearly visible 3-cm square space must be available on the car to attach an assigned car number for the race.
 - The sun's light is the only energy source that can be used to power the vehicle. Batteries, capacitors, flywheels, or any other energy storage devices are prohibited.
4. Collaborate with your group members to determine what you think the best design is.
 5. Build and test your car.
 - o Recommended Suppliers for materials:
 - [PITSCO](#)
 - [Solar Made](#)
 6. Brainstorm ideas on how to improve the car's performance and make any changes necessary.
 7. Race the car against classmates.

Google Slides Presentation Requirements:

1. As a group, create a presentation to pitch your Solar Sprint car design to Ford Motor Company. Do some research to fully explain the need for a solar car.
2. Your presentation must include the following slides:
 - a. An explanation of the link between carbon dioxide emissions and rising global temperature.
 - b. Information about the amount of carbon dioxide generated annually by the average American by driving a gasoline powered car.
 - c. Information about how solar energy works and its advantages.
 - d. Your car's design and how it works.
 - e. What is the future of solar energy? What other uses might there be?
3. Remember, digital presentations are meant to be visual. Try not to have too much text on your slides, use mostly labeled diagrams.

Solar Car/Presentation Rubric (from the Junior Solar Sprint 2016)

Criteria	Needs improvement 1-4	Satisfactory 5-8	Exemplary 9-10
Technical Merit – Does the car pass inspection and how well do the components work individually?	Car does not pass inspection.	Car passed inspection, and some elements of the car, for example, the frame, bearing, or tires are constructed with precision and accuracy.	Car passed inspection, and the frame, bearings tires, and other elements of the car are constructed with precision and accuracy.
Innovation – How are creativity and innovation evidenced in design?	The design of the car does not show creativity or innovation.	The design of the car is shows some creativity and innovation.	The design of the car shows exemplary innovation and originality.
Craftsmanship and Design - How well constructed is the car overall?	Car is unsteady or unable to race.	Car is steady and able to race, but movement could be better if some elements of the car were to be altered.	Car is steady and able to race, and there is evidence of thoughtful craftsmanship and attention to construction.
Best Use of Recycled Materials – How much of the car is constructed using recycled, not purchased, materials	Car shows very little use of recycled materials.	Car shows some use of recycled materials.	Car is almost or entirely crafted of recyclable materials.
Speed – Speed will be determined via races			
Google Slides Presentation	The presentation is incomplete and lacks detail.	The presentation includes all required slides but lacks thorough research and/or is not visually appealing.	The presentation includes all required slides, is visually appealing, and well-researched.