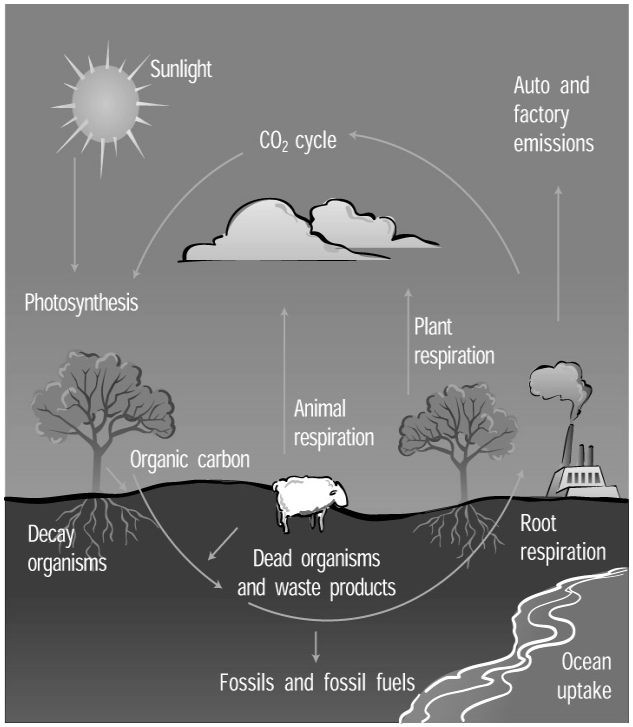
Name:_____ Date:_____ Period:_____

Carbon Cycle and Greenhouse Gases



Introduction:
The Carbon Cycle is a system in which carbon is transferred from Earth's interior to the atmosphere, oceans, crust, and living things. Carbon can be released in a variety of ways. Some of these ways are naturally occurring events while others are manmade. Some events that would release carbon include but are not limited to: volcanic activity, automobile emissions, animal and plant respiration, and factory emissions. Carbon can also be absorbed as well. Some ways that carbon can be absorbed are photosynthesis, and as organisms die and decay the carbon is absorbed to make the shells of many mollusks, or forms petroleum reserves known also as fossil fuels.

Maintaining the carbon cycle helps to keep Earth warm much like a greenhouse. If there is an abundance of carbon then we would have the heating up the earth and the alteration of climates, growing areas, and economic catastrophes to feed and provide building materials to living organisms. Another theory states that water cycle then would have more convection and condensation which would produce more clouds and eventually the earth would cool down until we see a vast ice-age and the impact would be the same on the living organisms economically, ecologically and these would be life threatening to all.

Student Goals:

Students will model changes in the Earth's carbon cycle.
Students will predict results of modifying the Earth's carbon cycle.
Students will represent the natural world using models and identify their limitations.

TEK 8.10 b Describe Interactions among solar, weather and ocean systems.
Adapted by Jimmie Thomas from http://www.uchar.edu/learn/1_2_2_9t.htm

Name:_____ Date:_____ Period:_____

Materials:

Deck of Playing Cards
Pencils
Graph Paper
Markers

Procedure:

1. Shuffle a deck of cards 3 times (no Jokers in the deck).

2. The **Black cards** will represent a negative change in temperature values for a year globally. **Red cards** will represent a positive change in temperature values for a year globally.

3. Display 30 cards, one at a time, face up. You will have cards left, set them aside to pull from in step 7. Each card represents one year, hence 30 cards, 30 years. Is there a pattern?

4. View the table, you will see there are columns for keeping count of our cards for each 30 years. Separate your cards into red and black groups. We will place the value for each card on the table and then compute the temperature increase or decrease. Count your cards, then make computations.

5. Make a bar graph of each value for the red, warmer and black cooler years.

6. Find the total temperature difference for the 30 year period.

7. Remove 4 black cards from the deck. Gather 4 more cards from the remainder of the cards from step 3. Shuffle the deck 3 times and repeat steps 3 -7 for 90 more years.9. If there are fewer than 4 black cards drawn, then reshuffle .

Red Card Values (Carbon Releasers)

Suit	Change in Temp.	Role
Ace	+0.1 °F	Factory Emissions
2-10	+0.2 °F	Auto Emissions
Jack	+1.0 °F	Animal Respiration
Queen	+1.5 °F	Plant Respiration
King	+2.0 °F	Volcanic Activity

Black Card Values (Carbon Absorbers)

Suit	Change in Temp	Role
Ace	-0.1°F	Animal Waste
2-10	-0.2°F	Decomposition
Jack	-1.0	Earth's Crust
Queen	-1.5 °F	Photosynthesis
King	-2.0°F	Ocean Absorption

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Name:_____ Date:_____ Period:_____

Card Value	Round 1 – first 30 years						Round 2- second 30 years						Round 3-third 30 years						Round 4- fourth 30 years					
	Red	*value*	*total*	**Black**	value	total	**Red**	Value	total	**Black**	Value	total	**Red**	Value	total	**Black**	**value**	**total**	**Red**	**Value**	**total**	**Black**	**Value**	**Total**
Ace		+0.1			-0.1			+0.1			-0.1			+0.1			-0.1				+0.1		-0.1	
2 -10		+0.2			-0.2			+0.2			-0.2			+0.2			-0.2				+0.2		-0.2	
Jack		+1.0			-1.0			+1.0			-1.0			+1.0			-1.0				+1.0		-1.0	
Queen		+1.5			-1.5			+1.5			-1.5			+1.5			-1.5				+1.5		-1.5	
King		+2.0			-2.0			+2.0			-2.0			+2.0			-2.0				+2.0		-2.0	
Total from Red Cards																								
Total from Black Cards																								
Total from Red + Black																								

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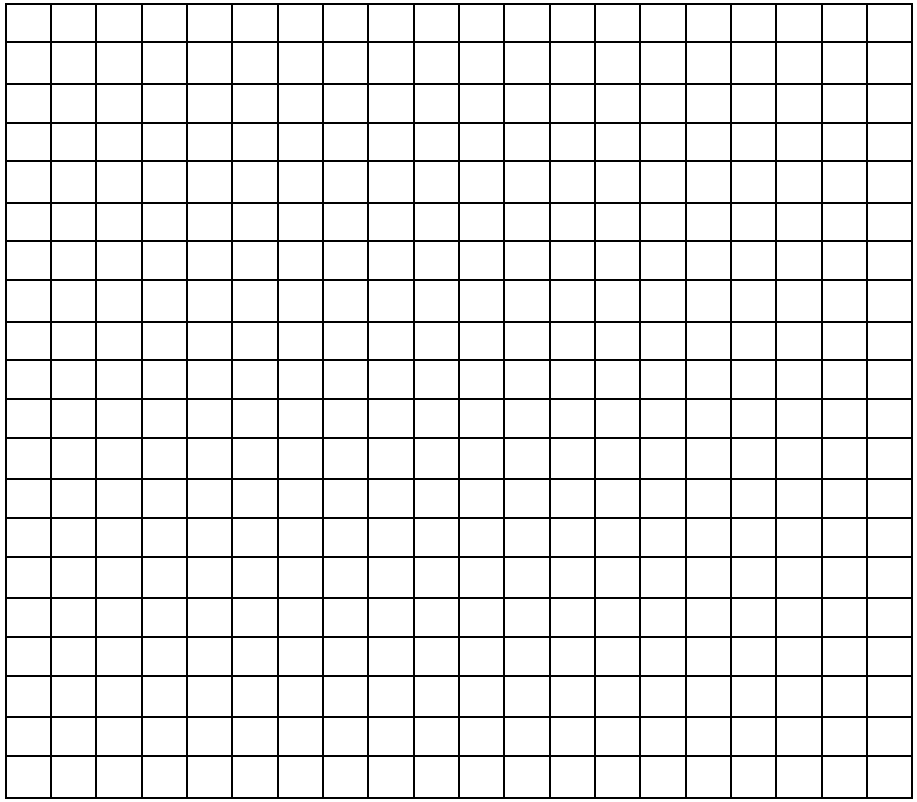
Observations: Make your graphs here. All four rounds should fit on this one sheet of graph paper. Color each round a different color. Label the warmer years and the cooler years on the top of each bar. Give your graph an appropriate title. (20WX20L)



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Analysis Questions:

1. Using your graph for reference, what could you infer about the temperature fluctuations during one 30 year period?

2. What are the limitations of using the playing cards to model the carbon cycle?

3. Predict what would happen to the Earth if there was more carbon in the atmosphere than natural methods could absorb.

4. Would it be possible for there to be an overabundance of carbon absorbing materials? Predict the outcome of such an occurrence.

5. What might happen to the data if cards were reshuffled each time instead of simply discarding and adding cards at random?

6. Consider the following scenario where a group has predominantly red cards. How would the data be impacted?

Extension:
You are a climatologist of world renown. A citizen's group has asked you to explain why the Carbon Cycle and the Greenhouse Effect are so closely related. You have the option to do so graphically, or in words. Good Luck.

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