Name _____ Date _____ Period _____ 126

THE CARBON CYCLE

Activity 1 – The Great CO_2 Escape

Materials: Goggles, 2 empty plastic bottles, 1/2 Alka-Seltzer tablet, 50 ml beaker, 2 thermometers, ring stand, heat lamp, timer, and water

WARNING – Heat lamp bulbs can explode because they get hot, once the lamp is turned on you **MUST KEEP YOUR GOGGLES ON FOR THE REMINAINING TIME** it is plugged in.

Procedures:

1. Use the beaker and measure 50 mL of COLD water and pour into the 1st plastic bottle labeled WATER ONLY. Use the beaker to measure another 50 mL of COLD water and pour into the 2nd plastic container labeled "WATER AND ALKA-SELZTER".
    a. The air and water in each bottle is model of gases in our atmosphere.
2. Turn on 2 digital thermometers and set undisturbed on the tables. For the experiment to work, the thermometers need to read the same or almost the same temperatures
3. Use the ring stand from the front of the lab station set on top of the table.
4. Slide the heat lamp, also found in the front of the cabinet, onto the ring stand; plug in the heat lamp to turn it on.
5. Place plastic containers evenly under the heat lamp
6. Simultaneously (at the same time), prepare both clear, plastic containers:
    a. In bottle #1, place the lid on and tighten the lid, the place the thermometer in the lid.
    b. In bottle #2, drop ½ an Alka-Seltzer tablet in to the container and quickly place the lid on and tighten it to the container, then place the thermometer in the lid.
7. Place the bottles in front of a heat lamp for 3 minutes recording the temperature every 30 seconds Make sure the heat lamp is an **equal distance from each bottle**.
8. After 3 minutes **turn off** the heat lamp and allow the bottles to cool for 3 minutes. Take a temperature reading on the bottles every 30 seconds and record. You may remove the goggles after the lamp has been turned off.

Time	Bottle "1" ˚C Water Only	Bottle "2" ˚C Alka-Seltzer	Time	Bottle "1" ˚C Water Only	Bottle "2" ˚C Alka-Seltzer
30 sec			**3 min 30 sec**		
1 min 30sec			**4 min 30 sec**		
2 min			**5 min**		
2 min 30 sec			**5 min 30 sec**		
3 min			**6 min**		
	Turn Heat Lamp Off			Clean up lab and put away supplies	

Analysis Questions

9. Explain the results of this experiment?

Activity 2 – Carbon Footprints

An individual's carbon footprint is defined as the amount of carbon dioxide emitted due to the use of fossil fuels. This may be direct (like using a dishwasher) or indirect (eating a banana – more on this later), but the sum of it all is the carbon footprint.

In the table is data for the average CO_2 emissions for different modes of transportations. The "Pounds of CO_2" is calculated for each passenger mile.

Please note this does not mean an airplane has less carbon emissions than a car, but since an airplane carries more passengers, the total carbon emissions are divided among each person. In other words, they share the responsibility.

CO_2 Emissions per Activity	
Mode of Transportation*	***Pounds of CO_2 per Passenger Mile***
SUV	1.67
Car	1.10
Airplane	0.97
Bus (1/4 full)	0.80
Hybrid Car	0.62
Rail (1/4 full)	0.56
Carpool (3 occupants)	0.40
Vanpool (6 occupants)	0.35
Bus (3/4 full)	0.28
Rail (3/4 full)	0.24
Walk / Bike	0

*There is huge variability between manufacturers and styles, but these measurements are based on averages of scientific studies
Source: sightline.org

Analysis Questions

Directions - analyze the individual transportation emissions in the following scenarios using the data table above.

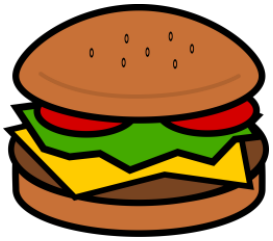
1. What is the definition of an individual's carbon footprint?

2. Troy is a geologist; he rides his bike 4 miles and then shares a carpool for 8 miles. What is his daily carbon footprint?

3. Allen is a middle school student. He walks 1 mile to the bus stop, and then rides the bus 12 miles to school. Then he rides the bus 12 more miles to the bus stop and walks 1 more mile to get home. What is Allen's daily carbon foot print?

4. Damian lives in Hurricane, Utah and drives his SUV 67 miles every day to work in Mesquite, Nevada. He does walk to lunch on most days to reduce his carbon emissions. What is his daily carbon footprint?

5. Write your own daily carbon foot print. How do you get to Dixie Middle School every day (use the most common method)?



Food typically adds to an individual's carbon footprint in two ways: transportation & production. Transportation The food had to get to you somehow! In the table Transportation Emissions, there are carbon emissions values that estimate the footprint of transporting food. Food typically is either shipped by plane, boat, train, or truck and of course combinations of all four.

For example if 2 pounds of food is shipped 1000 miles by plane, then the total carbon footprint could be calculated:

****(2 lbs)*(1000 miles)* (0.00177) = 3.54 lbs of CO2 emissions**

Transportation Emissions Pounds of CO_2 emissions per mile traveled for each pound of food
Plane = 0.00177
Boat = 0.00021
Train = 0.00003
Truck = 0.00043

Food Footprint Chart

Food Item	Production emissions **in lbs of CO_2 per 1lbs of food item**	Transportation Mileage Estimates	
		Local Provider (All by Truck)	Traditional Provider and Method of Transport
Cheese	4.46	65 miles	Maine – 1721 mi – Truck
Milk	0.36	39 miles	Indiana – 1462 mi – Truck
Eggs	0.96	60 miles	Washington – 1611 mi – Train
Orange	0.07	Not local	California – 382 mi – Truck
Banana	0.12	Not local	Costa Rica –2015 mi – Boat 487 mi - Truck
Rice	1.2	Not local	Thailand – 2186 mi – Plane 121 mi – Train 77 mi – Truck
Beef	7.38	18 miles	Texas – 1091 mi – Train 171 mi – Truck
Salmon	2.21	Not local	Alaska – 147 mi – Boat 335 mi – Plane 391 mi – Truck
Broccoli	0.16	Not local	Oregon – 976 mi – Train
Potatoes	0.12	82 miles	Idaho – 741 mi – Train 85 mi – Truck
Tomatoes	0.08	18 miles	Mexico – 1651 mi – Truck

the production emissions are calculated based on the production of 1 pound (lb) of the item. If 5 lbs is created, the number is multiplied.

Analysis Questions

1. What are 2 ways food is added to an individual's carbon footprint?

2. Grandma is purchasing food for dinner tonight. She goes to Harmon's and buys 5 lbs of beef, 1 lb of cheese, and 1 lb of oranges. All items are local, what is her carbon footprint in pounds?

3. Abby is at a local farmer's market. She buys 2 lbs of Broccoli, 2 lbs of potatoes, 1 lb cheese. And 1 lb of milk? What is her footprint in pounds?

4. Jeremy wants is getting food at Lins Market, where all food is provided traditionally. He only needs to get 2 lbs of bananas. And 5 lbs of potatoes. What is his carbon footprint in pounds?

5. Daniel is cooking salmon for dinner tonight. He needs to buy 5 lbs of salmon, 1 lb of broccoli and 1lb of rice, all of which are not available locally. What is Daniel's carbon footprint in pounds?

6. Miguel is trying to figure out what is so great about local food. He doesn't want to commit to buying all of his food locally, but is willing to purchase items that have the largest difference in CO2 emissions. He loves fruits and vegetables and is going to research the emissions of a pound of each. Complete the chart below to help Miguel with the research

Food	Local Emissions	Traditional Emissions
Orange		
Banana		
Broccoli		
Tomato		

7. Which item should Miguel buy locally and what is the difference in CO2 emissions for a pound of food? Explain your reasoning using the table above.

8. After falling face first into a puddle of mud, you had to take a shower. The carbon footprint of a hot shower is modeled by the equation y = 0255x. Where x is the number of minutes in the shower and y is the carbon emissions. In order to get all of the mud out of your hair, you had to take a 9 minute shower. Calculate your carbon emissions.

9. When you get home from school, you decide to call your bff and tell them how amazing your science class was for 20 minutes. Little did you know, using a cellphone brings with it a carbon footprint that can be modeled by the equation y = 0142x, where x is the number of minutes on the phone. Calculate your carbon emissions.

10. What are possible solutions to reduce the amount of carbon emissions in your own home?