A “Carbon footprint” is generally defined as the amount of carbon dioxide (usually in tons) emitted by an activity or organization. It helps us measure the demands that we put on the planet. These demands are a result of many of our daily activities that require the burning of fossil fuels including: producing electricity, driving cars, manufacturing goods, and much more.

Air pollution causes harmful effects on the environment. When carbon dioxide (CO$_2$) is released into the air, it can build up in the atmosphere as well as in the Earth’s water. Combined with water vapor, CO$_2$ is among the greenhouse gases responsible for the greenhouse effect. What exactly is the greenhouse effect? First you need to understand a greenhouse.

A greenhouse is a man made building used to raise plants during all parts of the year. Even in the middle of winter, a greenhouse will stay warm. This is because wavelengths from the sun enter the greenhouse and are then absorbed by objects like greenhouse tables, plants, and even the ground. When heat bounces back off the objects to try to escape the greenhouse, the wavelengths are weaker and can’t all make it back out. The glass reflects that heat back into the greenhouse, while more heat is being added in by the sun. The greenhouse basically traps the heat inside.

Earth’s atmosphere uses the same process as the greenhouse. Like the glass, gases such as carbon dioxide trap heat in the atmosphere. The sun shines through the atmosphere and wavelengths get partially absorbed by objects on Earth and even in the ocean.

Discuss with your class about how the extinction of one species can lead to the extinction of multiple species and how this process can eventually affect human life.
Some of the heat bounces back off of Earth but some of the wavelengths are too weak to escape the atmosphere and are reflected back to Earth, all while more heat from the sun is coming in. The more carbon dioxide that is in the atmosphere, the thicker that wall gets and the harder it is for heat to escape. Because of the greenhouse effect, the average temperature of Earth is rising.

Trees and other plants are good absorbers of CO$_2$, pulling it from Earth’s atmosphere. So everything from planting crops to planting new trees is a good way to combat the greenhouse effect. Many industries are taking their level of responsibility a step further. Industrial businesses are taking action to make sure less pollution ends up in the air. Automobile companies are coming out with more eco-friendly cars that use alternative fuels, which burn more cleanly in the environment. But what about you? Use the “Food For Thought” section to promise to improve your own carbon footprint.

Now it’s time for you to check out the greenhouse effect in the following Carbon Footprint experiment.
**Activity Procedure:**

1. Break one tablet in half and leave the other three tablets whole.
2. Label three plastic bags: ‘1/2’, ‘1’ and ‘2’.
3. Add 237 mL (8 oz) of water to one of the sandwich bags.
4. Seal the bag so that only a small portion is still open and press as much air out as possible.
5. Insert the 1/2 tablet into the opening of the bag labeled ‘1/2’. Be sure not to let air into the bag. Quickly close the bag and double check that it is completely sealed. Shake well for about 3 seconds or until the tablet is completely dissolved.
6. Place the bag on the table in front of you. The bag will begin to fill with gas from the tablet.
7. Add 237 mL (8 oz) of water to the plastic bag labeled ‘1’.
8. Seal the bag so that only a small portion is still open and press as much air out as possible.
9. Insert 1 whole tablet into the opening of the bag labeled ‘1’ (being sure to not let air into the bag). Quickly seal the bag closed and shake for 3 seconds. Double check to make sure the bag is sealed.
10. Place the bag on the table in front of you. The bag will begin to fill with gas from the tablet.
11. Add 237 mL (8 oz) of water to the plastic bag labeled ‘2’.
12. Seal the bag so that only a small portion is still open and press as much air out as possible.
13. Insert the remaining 2 whole tablets in the opening of the bag labeled ‘2’ (being sure to not let air into the bag). Quickly close the bag and double check that it is completely sealed. Shake well for about 3 seconds or until the tablet is completely dissolved.
14. Place the bag on the table in front of you. The bag will begin to fill with gas from the tablets.
15. Observe the bags as the tablets dissolve and release CO2. When the bags are finished fizzing, notice the difference in the bag sizes.
16. Using a ruler, measure each of the three bags at their highest point. This works best by laying the bag on its side and measuring its height from table top to peak of bag. Record your observations in the table on page 4.
Unscramble!

1. eawv hnegslt:
2. acrobn dioiedx:
3. orabnc itonofrpt:
4. neeorseguh fcefe:
5. ssiofl ulsfe:

Something to think about:

Lets say the bag with 1/2 tablet in it represents a city like Bowling Green, KY. This means that the bag with one tablet in it represents a city the size of Lexington and the one with 2 tablets represents a city the size of Louisville in relation to each other. Louisville has a population of 597,337. The average American has a carbon footprint of around 20 metric tons. This means that in Louisville, KY alone, 11,946,740 metric tons of CO\textsubscript{2} will be released in this generation.

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<table>
<thead>
<tr>
<th>Observations</th>
<th>Height (in.)</th>
<th>Other Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bag 1: 1/2 tab</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bag 2: 1 tab</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bag 3: 2 tabs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Discussion

1. Compare the amount of gas produced from such a small tablet inside the plastic bag, with the amount of CO\textsubscript{2} that we must emit in our daily activities. Explain why you believe this amount of CO\textsubscript{2} is a problem.

2. What are 3 different sources or causes of CO\textsubscript{2} gas being released into the atmosphere?

3. What are some of the impacts Kentucky would face if its climate became more arid?

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EKU Answers:

1. wave
2. wavelengths
3. carbon dioxide
4. carbon footprint
5. greenhouse effect
6. fossil fuels
7. acid rain

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