



Lesson: School Choice: Lots of Watts!

Environmental Literacy Question: How have humans affected the Chesapeake Bay and its watershed?

Topic/Essential Question: How is the earth's climate changing?

Unit/Lesson Sequence: This is a school choice option at Arlington Echo for 1st and 2nd quarter.

Content Standards:

Environmental Literacy Quarter 3

- 3.B.1.d. Explain and diagram how greenhouse gasses increase thermal energy in the atmosphere and its effect on earth's temperature and systems.
- 6.A.1. Identify and describe natural changes in the environment that may affect the health of human populations and individuals.

Science

3.4.F.1.a. Identify and describe the interactions of organisms present in a habitat.

6.4.B.1. Recognize and describe that people in Maryland depend on, change, and are affected by the environment.

Common Core Standards for English Language Arts Standards- Speaking and Listening-4th Grade

Comprehension and Collaboration

- CCSS.ELA-Literacy.SL.4.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 4 topics and texts*, building on others' ideas and expressing their own clearly.

Length of lesson: 35 minutes

Student Outcomes:

- Use background knowledge of climate change and the carbon cycle to estimate their carbon foot print.
- Investigate how humans can reduce their greenhouse emissions and carbon footprint.
- Determine the amount of energy their household electronics use.
- Record examples of human reduction for carbon footprints in their journals.

Knowledge of the Learner:

- Prerequisite knowledge, skills and processes: weather effects and greenhouse gasses; beginning knowledge of the carbon cycle.
- Student needs, interests, previous learning: These will be identified in the pre-assessment.
- Conceptual difficulties: Understanding that the everyday things we do impact our

carbon footprint and climate change.

- Differentiation: Students are at the fourth grade level with a diversity of backgrounds and skill levels.

Knowledge of Content:

- Content knowledge for instructor: Provided in the text of the lesson.

- Vocabulary:

Carbon Dioxide	Oxygen	Watt
Carbon Footprint	Photosynthesis	Kilowatt
Carbon Cycle	Atmosphere	Fossil Fuels
Renewable Resources	Energy	Vampire Energy

- Resources:

Pencils	Electronics/chargers	1 Blue hula hoop
Chairs	Carbon Cycle poster	1 Green hula hoop
Clipboards	Kilowatt Meter	
Data sheets	Rope	

Supplements:

- A: Carbon Cycle and Discussion Questions
- B: Kill-A-Watt meter tutorial
- C: Data Sheet
- D: Vocabulary
- E: Carbon is not released for those who...

Instructional Delivery

Lesson setup:

- Set up stations with various household electronics at each. Set all meters to read watts (see instructions in Supplement B). Make sure Carbon Cycle poster is set up and ready to use with students. Chairs should be in a semi-circle facing the poster with clip boards, data sheets, and pens attached under each one.

Pre-Assessment: At the beginning of the lesson invite students to share what they know about human impacts on the environment.

Activity:

Motivation/Warm-Up:

Meet students in the Upper Resource Lab where you set up the electronics. Take them outside to play the carbon game set up in the mulch area.

- 1) Introduction: Explain how the game works by asking the students a series of questions.
 - Ask students if all living things are made of Carbon? (Yes)
 - Is this tree made of carbon? (Yes)
 - How about the leaves? (Yes), and what about you? (Yes)
 - What planet do you think is represented by the blue and green hula hoops? (Earth)
 - What do you think the rope you are standing on represents? (The Earth's atmosphere)
 - What star in the sky shines down on Earth giving Earth energy and making it possible for life on this planet? (The Sun).
- 2) First Round
 - Pick a volunteer to be a carbon molecule. Explain that carbon attracts heat. Tell everyone else that they will be sunrays. Explain that the carbon molecule will walk around the Earth (between the rope and the hula hoops). The sun rays (all the other students) will walk from the edge of the atmosphere, touch the earth and then walk back out to the edge of the atmosphere. The carbon molecule will try to tag any sunrays as they leave the earth and head back to the edge of the atmosphere. Tell sun rays that their goal is to make it through the atmosphere and touch the "Earth" without getting tagged by Carbon molecule also known as CO₂. If tagged inside the atmosphere, sun rays stay and float around as heat with the CO₂.
 - Ask students what they are seeing. What is happening to heat when it is tagged by CO₂?
 - Ask student if it is bad to have this heat inside the atmosphere? (No without this heat the Earth would get too cold at night)
- 3) Second Round
 - Have all sun rays and the CO₂ step back on the rope. Tell students that a great discovery was made in which we found that we could use the carbon that had decomposed in the ground to power cars, electronics, and to heat our house. Now there is a lot more carbon being released. For this reason, pick more people to be CO₂ (About 1/3 of the group). Play the game again. This time more sunrays should be tagged.
 - Ask what happened? (More heat was trapped in the atmosphere.) Tell them this heat can change the climate of different areas which is called global climate change.
 - Bring students back inside to the chairs to discuss the carbon cycle.

Procedure:

1. Introduce the concept of the carbon cycle to students. Explain why the carbon cycle is so important and what it has to do with humans and our changing climate (**Supplement D**).

2. Present felt board with carbon cycle pieces to students while they are seated, and have them come up one at a time to create a carbon cycle. Use carbon cycle key (**Supplement A**) for guidance.
3. Remind them that when fossil fuels are burned to produce electricity, extra carbon dioxide is released into the atmosphere.
4. Have students brainstorm some things around their homes that require electricity. Tell them that they will be testing some of those items to determine how much energy each of them uses in order to operate.
5. Inform students they will be using a kilowatt meter to read how many watts each item uses. Inform them that a “watt” is a measurement of how fast energy is used (“just like an inch is a measurement of length, a watt is a measurement of energy”).
6. Show them how to use the meters. Turn on item and read the meter in Watts and record. Turn off read the meter in watts record. Never plug anything in or unplug anything.
7. Have students get into groups of 2-3.
8. Discuss safety rules with students before they begin. Do not unplug devices. If the electrical device needs to be measured when it is unplugged, switch the power strip off before unplugging the devices.
9. Have groups get a clipboard, pen, and data sheet from the instructor to record the results from each station. They should fill in the table as they go through each station (see Supplement C).
10. Walk around and oversee each group. Help with meter use when needed. Have students record the information they find on the data sheets.
 - Guide students to test items powered on and powered off.
11. After groups have gone to each station, have students return to their chairs. Discuss their findings (students can talk about things they already know about energy use, and what they learned at the different stations):
 - Which item uses the most energy?
 - Which item uses the least?
 - Was energy still being used when electronics were powered off? This is called vampire energy.

Assessment:

1. Discuss the importance of conserving energy. We now know how much energy many of the things we use require, but *where* does that energy come from?
 - *By using fossil fuels (coal, oil, natural gas). We use these fuels to produce the electricity we need. By burning these fuels, CO₂ is generated and released back into*

the atmosphere.

2. Conclude with a brief discussion on renewable energy sources. Not only are fossil fuels adding excess CO₂ into our atmosphere, they are also in limited supply.
 - *We cannot make more fossil fuels if we run out because they are non-renewable. This means they take millions of years to form. Instead we are learning alternative energy sources that are 'renewable,' meaning (wind, solar, water). These sources are not only renewable, but also much cleaner – they do not release CO₂ into the atmosphere.*
3. Have students answer the questions in their journals. “How can I help to reduce my carbon footprint at home?” Discuss some ideas with them
 - *Plant trees, replace regular light bulbs with energy efficient ones, turn off lights/fan/TV when not in use, unplug chargers when not in use, keep heaters at lower levels, etc.*
4. Play the game “Carbon is not released for those who”
 - Tell students that in this game we will think of ways that we can help reduce the amount of carbon being released into the atmosphere.
 - Have all but one student stand on one of the poly spots in the circle. This student should stand in the middle of the circle.
 - Have the student in the middle think of something they do to reduce carbon from being released into the air. They should then say “Carbon is not released for those who...”
 - If the statement applies to them, students will run to another poly spot, as long as it is not right next to them.
 - One student will again be without a poly spot, so this student will go in the middle and give another statement.
 - Continue the game until time runs out or all students have had a chance to be in the middle.
 - If students have a hard time generating answers, use the suggestions in supplement E

After the lesson is finished, students will move to their next activity, or back to the module introduction location for a debriefing activity led by an Arlington Echo staff member.

Notes for Clean up:

Please clean, organize and return the lesson materials to their proper locations at the end of each day of instruction. Remember to inform the Arlington Echo staff if you need assistance or if any materials are damaged or missing.