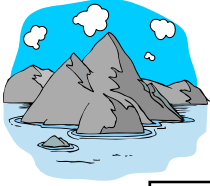

Weather Changes



Lesson 2a: Ozone (Extension Lesson)

Essential Question: How can the sun be harmful to the earth?



TEKS Objectives:

Science

- **Identify** and **describe** the importance of gases of the atmosphere and **classify** them as renewable, nonrenewable, or inexhaustible resources. (3.11A)

Math

- **Graph** a given set of data using an appropriate graphical representation such as a picture or line graph. (5.13C)
- **Describe** the relationship between sets of data in graphic organizers such as lists, tables, charts and diagrams. (5.5A)
- **Use** addition and subtraction to solve problems involving whole numbers and decimals. (5.3A)
- **Solve** problems using elapsed time. (5.11B)



Student Outcomes

- Students will conduct an interactive ozone depletion model by exploring competing atmospheric roles of the ozone layer, the sun's UV radiation and harmful human-made CFCs (chlorofluorocarbons).
- Students will investigate environmental issues related to ozone.



Suggested Time:

Two hours

Engage – 15 minutes

Explore – 30 minutes

Explain – 30 minutes

Elaborate – 60 minutes

Evaluate – 30 minutes



Background Information:

Read the introduction included in *Battling for Oxygen*.



Vocabulary:

atmosphere – the layer of air that surrounds the planet

oxygen – a gas found in the air

gas – a state of matter that has no definite shape and does not take up a definite amount of space.

carbon dioxide – a gas found in the air that animals exhale.

air pollution - The presence in the atmosphere of one or more contaminants such as dust, fumes, gas, mist, odor, smoke, or vapor in quantities and of characteristics and duration such as to be injurious to human, plant, or animal life or to property, or to interfere unreasonably with the comfortable enjoyment of life and property.

ozone – an unstable gas that is formed naturally in the ozone layer by atmospheric oxygen; also formed in the lower atmosphere by the photochemical reaction of certain pollutants.

chlorofluorocarbons (CFCs) – a compound believed to cause the depletion of the atmospheric ozone layer

ultra violet – an invisible band of radiation at the upper end of the visible light spectrum molecule

radiation – energy emitted in the form of rays or waves.



Materials:

Explore

Per group for *Battling for Oxygen*

175 Round toothpicks

300 gumdrops

Masking tape

Graph paper

Graph of Global CFC Production, 1952-2000

Battling for Oxygen sheet (1 per student)



Suggested Literature:

Sciencesaurus pp. 339 - 341



Teacher Preparation

Read the introduction included in *Battling for Oxygen*.



Technology:

- United Streaming: *Weather Smart: Ozone and Pollution*
- Websites:

NASA: Ozone Layer Shielding Our Planet
<http://svs.gsfc.nasa.gov/vis/a000000/a000800/a000834/>

Ozone Basics
<http://www.ozonelayer.noaa.gov/science/basics.htm>

NASA: Update on the Ozone Layer
http://science.nasa.gov/headlines/y2006/26may_ozone.htm

NASA: Ozone hole 2004 (Click on the MPEG link to view the animation)
<http://svs.gsfc.nasa.gov/vis/a000000/a003000/a003067/index.html>

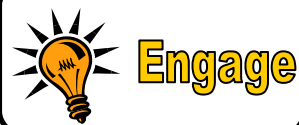
EPA: SunWise Kids
<http://epa.gov/sunwise/kids.html>

EPA: On the Trail of the Missing Ozone
<http://www.epa.gov/ozone/science/missoz/index.html>

Smog City
<http://www.smogcity.com/>

EEK! The Air Around Us
<http://www.dnr.state.wi.us/org/caer/ce/eeek/earth/air/index.htm>

BrainPop: Ozone



1. Ask and discuss:
 - **Have you ever been sun burned?**
 - **What causes a sun burn?**
 - **What can help prevent sun burn?**
 - **Why does it matter if you get burned by the sun?**
2. Record students' responses for each question on the board or chart paper.
3. Then ask students if they have any questions related to sun burns. Record the questions so they can be addressed throughout the lesson.



1. Complete the *Battling for Oxygen* Activity.
2. Choose three students to be “Ozone Makers” (OMs) and three students to be “UV Light” (UVs).
3. On the floor, use the masking tape to create a circle approximately five feet in diameter (or big enough for 12 children to sit around.)
4. Place 100 molecules inside the circle, evenly distributed, along with 50 free gumdrops and 25 toothpicks.
5. Say “GO,” and give the OM and UV students 30 seconds to assemble or disassemble the molecules as quickly as possible. The UVs will “destroy” the existing oxygen or ozone molecules by pulling them apart. The OMs will assemble oxygen or ozone molecules using the free gumdrops and toothpicks, including gumdrops and toothpicks that the UVs are pulling apart.
6. At the end of 30 seconds, there should be as many molecules in the circle as there was at the beginning. Students should count and record the number of each molecule in their Journals. Students may want to count different sections and then combine their totals.



1. **Ask and discuss:**
 - **What was the role of the OMs and the UVs?**
 - **How is stratospheric ozone important?**
 - **Explain why the UVs did not reach earth during the first run.** Even though the UVs were breaking the molecules, the oxygen atoms were recombining to form oxygen and ozone just as fast, so they were able to absorb UV once again. This represents a natural balance in the atmosphere.
 - **Explain how this process is a natural balance?**
 - **What would happen if UV radiation was allowed through the atmosphere?**
2. Show the NASA web page: Ozone Layer Shielding Our Planet. Click on the MPEG link to view the animation. <http://svs.gsfc.nasa.gov/vis/a000000/a000800/a000834/>.
3. Students will be able to identify the ozone layer surrounding the earth.



1. Refer to the Global CFC Production Graph for 1952-2000. Note the amount of CFCs in 1956.
2. Assign one student to be a “CFC” (representing the impact of the 100,000 tons of CFCs in 1956). Repeat the activity for another 30-second interval, with the OMs assembling molecules, and the UVs **AND** the CFC disassembling the molecules.
3. At the end of the interval, count and record the number of molecules remaining. The UVs and CFCs should have “won.” The number of intact molecules should be somewhat less than were present at the beginning of the interval. After counting and recording the number of molecules, restore the number of intact molecules to approximately 100 total, in preparation for the next step.
4. Look at the CFC graph again and determine the number of CFCs that were present in 1962. Add the appropriate number of CFC students (2). Repeat the activity. Count and record the number of molecules at the end of the time interval.
5. Complete the activity up to the 2000 values.
6. Students should represent the data using graphs.
7. **Ask and discuss:**
 1. **Where do the CFCs go?** All of the CFCs since 1952 should still be disassembling molecules in 2000, because the CFCs that entered the atmosphere since 1950 are still there, and will be for quite some time. Chlorine containing compounds can last 60-400 years in the atmosphere. Scientists expect the ozone hole to remain for 50-100 years, even though fewer new CFCs are being introduced to the atmosphere today.
 2. **Based on the graph, when do you think CFCs started to become prohibited from production by many countries?**
 3. **What is the difference between stratospheric and ground level ozone? How is each important?**
8. Look back and see if students can explain answers to the questions they asked at the beginning of the lesson.
9. Share how students graphed and analyzed the data.
10. Show BrainPop: *Ozone* and/or United Streaming: *Weather Smart: Ozone and Pollution*. Students may add new information to their Journals.
11. As a class, step through the Smog City website to see how our actions affect ozone levels.
Smog City
<http://www.smogcity.com/>



Evaluation

1. Students may complete one of the following:

- Students may research and report on the ozone hole including where it is located throughout the year and predictions for the future. Presentations may be a poster, PowerPoint, Inspiration, etc. Use the following websites:

EPA: SunWise Kids

<http://epa.gov/sunwise/kids.html>

Ozone Basics

<http://www.ozonelayer.noaa.gov/science/basics.htm>

NASA: Update on the Ozone Layer

http://science.nasa.gov/headlines/y2006/26may_ozone.htm

NASA: Ozone hole 2004 (Click on the MPEG link to view the animation)

<http://svs.gsfc.nasa.gov/vis/a000000/a003000/a003067/index.html>

EPA: On the Trail of the Missing Ozone

<http://www.epa.gov/ozone/science/missoz/index.html>

- Research skin cancer and develop a campaign to educate people on how to protect themselves from the harmful rays of the sun. Include information about the UV index. Use the following websites:

EPA: SunWise Kids

<http://epa.gov/sunwise/kids.html>

- Create and public service campaign educating people on how their actions affect ozone levels. Use the following website:

Smog City

<http://www.smogcity.com/>

EEK! The Air Around Us

<http://www.dnr.state.wi.us/org/caer/ce/eeek/earth/air/i/index.htm>



Extension

1. Research acid rain and other forms of air pollution.

TAKS Formatted Assessment

Resources

Pages

Kamico

Step up to the TAKS

TAKS Science Dailies

