
LESSON 1: Ozone is News!



Concepts:

You will learn about ozone in the environment while practicing your library and Internet research skills.

Lesson:

Search for "ozone" on your favorite Internet news sites for real headlines and associated stories to read together. Find newspaper and magazine articles about ozone in your local library and write summaries. Start science vocabulary lists from these summaries to use in future science lessons.

From the list you create make a glossary of terms that you can index easily. Draw illustrations by each of the entries if possible to illustrate the words.

Ask permission to cut pictures that illustrate your words out of the magazines and newspapers.

LESSON 2: Where is the Ozone!



Concepts:

You will learn about the layers of the atmosphere and the presence of ozone in the two layers closest to Earth, the troposphere and the stratosphere.

Lesson:

The Earth's atmosphere is divided into four layers that differ in their composition and temperature.

Name of Layer	Distance from Earth (English)	Distance from Earth (metric)
Troposphere	0 to 9 miles	0 to 14.5 kilometers
Stratosphere	9 to 31 miles	14.5 to 50 kilometers
Mesosphere	31 to 53 miles	50 to 85 kilometers
Thermosphere	53 to 372 miles	85 to 600 kilometers

[Data from Science@NASA - Lift-off, The Earth's Atmosphere](#)

The lowest region, the troposphere, extends from the Earth's surface up to about 14.5 kilometers (km) in altitude. Mt. Everest, the tallest mountain on the planet, is only about 9 km high. Virtually all human activities occur in the troposphere.

The next layer, the stratosphere, continues from 14.5 km to about 50 km. Most commercial airline traffic occurs in the lower part of the stratosphere. Most atmospheric ozone is concentrated in a layer in the stratosphere.

Use the table and the instructions from the attached Ozone in the Atmosphere **worksheet** to draw a model of the Earth's atmosphere. Ask them to include drawings in the layers depicting the activities that influence the level of ozone in the troposphere and the stratosphere.

Resources

- [Good Up High](#)
- [The Earth's Atmosphere](#)

LESSON 3: Making and Breaking Ozone



Concepts:

You will learn about the chemical composition of ozone and the chemical reactions of its synthesis and breakdown.

Lesson:

Use the chemical equations outlined on the attached **Making and Breaking Ozone worksheet** to compare the chemical reactions of ozone in the troposphere, "low level reactions" and in the stratosphere, "high level reactions." Follow the instructions on the worksheet to model the chemical reactions using toothpicks and jellybeans. (Suggestion: you can use green and red grapes for the healthy choice!) After you have completed answering the questions on this worksheet, you can **check your answers on the answer sheet attached**.

LESSON 4: Ozone Pollution: Smog Alert!



Concepts:

You will learn about the effects of ozone as a pollutant when it is found in the lower atmosphere.

Lesson:

Ozone is the same molecule regardless of where it is found, but its significance varies. Stratospheric ozone is found 9 to 18 miles high where it shields us from harmful ultraviolet rays from the sun. High accumulations of ozone gas in the lower

atmosphere at ground level is air pollution and can be harmful to people, animals, crops and other materials.

In this activity, developed by the Texas Natural Resource Conservation Commission, you will learn about ozone pollution and perform a simple experiment to demonstrate the build-up of pollution as smog in cities and near areas of heavy industrial activity.

Additional Resources

- [Ozone Pollution Lesson and Data](#)

LESSON 5: Students Rescue Earth!



Concepts:

You will use what you learn about the effects of ozone on the environment to write a letter to your community from a scientific perspective.

Lesson:

Use the Web resources listed below to help your children learn about the environmental problems related to changes in the ozone levels in the Earth's atmosphere. Have them select one of the ozone related problems in the environment:

1. Air pollution caused by increased low-level ozone concentrations
2. Increases in UV penetration to Earth's surface caused by ozone depletion

Identify five specific human activities that have been shown to cause the selected problem. With this information in hand, write letters to the editor of your local newspaper explaining what they have learned and requesting the community to take specific actions to stop pollution in the troposphere and/or ozone depletion in the stratosphere.

Make sure to submit the letters to the newspaper!

Additional Resources

- [Ozone Depletion](#)
 - [Ozone in Texas](#)
 - [Stratospheric Ozone Depletion](#)
 - [Air Quality Where You Live](#)
 - [Good Up High](#)
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LESSON 6: Keeping the Rays OUT!



Concepts:

You will learn about experimental design and the effectiveness of substances used as sunscreens.

Lesson:

The ozone layer absorbs a portion of the radiation from the sun, preventing it from reaching the Earth's surface. Most importantly, it absorbs the portion of ultraviolet light called UVB. UVB has been linked to many harmful effects, including various types of skin cancer, cataracts, and harm to some crops, certain materials, and some forms of marine life.

Using UV sensitive Energy Beads from [Sundance SolarTM](#), to design an experiment that will determine the effectiveness of different sun blocking agents. Make sure that the experimental design includes the major elements of the scientific method:

Observe the elements of the system that you are investigating and identify a question that you are interested in answering.

Research information about what you plan to investigate using library books, the Internet, newspapers, and interviews with professionals.

Formulate an hypothesis (an educated guess) by predicting the answer to your question.

Design an experiment to test your hypothesis following the guidelines for correct experimental procedure:

1. Select only one variable.
2. Use a "control" group.
3. Repeat the tests.

Gather and **Record** data to test the hypothesis.

Analyze the data.

Draw a conclusion.

Communicate the results to your peers.

Use the Discussion Questions from [YOU ME & UV](#) at the [Enviro-Tackle Box](#) to help guide your follow-up discussions.

Additional Resources

- [Sundance SolarTM](#)
 - [You&Me&UV](#)
 - [Scientific Method](#)
 - [Experimental Science Projects](#)
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LESSON 7: The Sky is Falling

Developed by Matthew Binder (8th grade Earth Science), Centerville Middle School, Hempfield School District, Landisville, PA.



Concepts:

You will learn about the technology scientists use to measure global ozone and learn how to access the data from the Total Ozone Mapping Spectrometer (TOMS) using the Internet.

Lesson:

The ozone layer has been a major concern in the last half of the 20th century. This activity encourages you to interact with the latest real-time ozone data on the Web. The lesson will access data from the TOMS Web page (Total Ozone Mapping Spectrometer; a satellite instrument used to measure ozone levels) to study real-time local and global ozone amounts and variations. This activity will also teach you how to use the TOMS data for research purposes. (Excerpt from [TOMS Resource Materials for Science Educators](#). This activity was created by the TOMS research team and acts as a tutorial for the Web site.)

Additional Resources

- [The Sky is Falling](#)

LESSON 8: An Ozone Puzzle



Concepts:

You will get to test your knowledge of the importance of ozone in our environment by completing this online crossword puzzle.

Lesson:

Test your knowledge of ozone layer science and ozone depletion in this crossword puzzle developed by the United States Environmental Protection Agency (EPA).

Additional Resources

- EPA online crossword puzzle [The online version](#)
[The print version](#)

Article by Marie Perrie, HLN Curriculum Development



Homeschool Learning Network Ozone in the Atmosphere

Name _____

Date _____

Materials:

Butcher-block paper or blank newsprint paper (1m x 1m), metric ruler, world map, pencil and colored pencils, jar lid, a .5m piece of string, a pin or tape to fasten the string to the paper.

Have your students follow the instructions below, checking off each step as it is completed.

_____ Obtain a 1m x 1m piece of paper.

_____ Use the jar lid to draw a circle in the middle of the paper. This circle represents the Earth's circumference.

_____ Using a world map or atlas, color the Earth blue and green to represent oceans and continents. Pin or tape one end of your string to the center of this circle, Earth.

_____ The first layer of the Earth's atmosphere is called the troposphere and extends from the surface of the Earth to about 14 km above the Earth. Place an **X** 14 mm from the surface of your Earth to represent a point on the upper boundary of the troposphere.

_____ Answer the following question: What scale are you using to draw your atmosphere map?

_____ Draw a circle representing the upper boundary of the troposphere using the following instructions. First, extend the string from the center of the Earth out to the point marked with an **X**. Then, tie the pencil to the unattached end of the string and draw a circle around the center point with the string pulled taut. This circle represents the upper boundary of the troposphere.

_____ Label the inside of this circle 'troposphere'. Draw a scaled picture of a 9 km high mountain to represent Mount Everest extending into the troposphere.

_____ The stratosphere is the second atmospheric layer and extends from 14 to 50 km above Earth's surface. Using the same technique you used to draw the troposphere, measure and draw a circle 50 mm from your Earth's surface. Label this layer 'stratosphere'.

_____ The ozone layer occurs in a thin layer within the stratosphere. The chemical formula for ozone is O_3 , where the O represents the atom oxygen and the small 3 indicates that there are three oxygen atoms per ozone molecule. Represent the ozone layer with a light circle midway between the upper and lower boundaries of the stratosphere. Label this circle with the chemical formula for ozone. Leave a region above the North and South Poles blank to indicate the Ozone Holes.