



Educational Activities **9th Grade – 12th Grade**

Objective:

To help students develop an understanding and interest in air, and its properties. These lessons cover the Michigan Educational Assessment Program (MEAP) objectives in science, mathematics, language and writing.

The West Michigan Clean Air Coalition in efforts to expand the public education campaign would like to thank the Clean Air Coalition of Southeast Michigan for the permission to use their packet and adapt it to the needs of West Michigan. The Coalition would also like to thank the individuals who contributed to the development of the public education campaign.

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What is Ozone? Why is it important?

Overview

With these activities, students can study ozone as both scientific and a social issue as it protects and threatens public health and as it impacts economic, political and social decision-making. This packet contains information on the molecular structure of ozone in the stratosphere and the troposphere. Also, included are activities encouraging students to look beyond science to understand the issue of ground-level ozone in their own communities. Targeted mainly at science in the classroom, cross-curricular extensions expand the educational impact.

Background information

Our planet is surrounded by a sea of gases we call the atmosphere. We breathe these gases into our bodies over 22,000 times a day. Our atmosphere is made up of 78 percent nitrogen, 21 percent oxygen and a one percent mixture of carbon dioxide, water vapor and other gases. One of these other gases is ozone.

Ozone in the stratosphere is good, protecting us from the sun's harmful ultraviolet rays. Ozone (O_3) is a natural forming gas, formed when molecular oxygen (O_2) combines with a single atom of oxygen (O).

Ozone in the troposphere, where we breathe, is harmful to our health. This is the ozone targeted by the Ozone Action! program. Ground-level ozone is formed when hydrocarbons and nitrogen oxides from emissions (such as from industry, cars, and buses) react with sunlight. The pollution cooks like a soup on hot (temps above the mid-80's), windless days with little cloud cover. At ground-level, ozone can cause lung damage, eye irritation, respiratory tract problems and can damage vegetation.

Weather

Weather - meaning temperature, precipitation and air mass movements- varies daily. Changing weather conditions affect our air quality. When air masses shift, they move air pollutants from one location to another. Stagnant air, conversely, can result in increased concentrations of harmful pollutants. Though precipitation washes pollutants from the air and onto the ground, it often creates land and surface water pollution.

In West Michigan, ozone levels are monitored in several stations throughout the region to make sure that the region continues to meet federal health standards for ground-level ozone.

On *Ozone Action!* days we all can help minimize ozone formation by voluntarily reducing the amount of hydrocarbons emissions we put into the air. Your *Ozone Action!* tip sheet contains the most helpful Actions! for keeping air clean.

By learning how ozone is formed and how we all contribute to its production, we can begin to think about how to stop this pollution problem. Learning how to keep our air clean is a valuable lesson for today and the future.

Michigan science objectives covered by this activity:

Constructing new scientific knowledge

1. Developing questions or problems for investigation that can be answered empirically.
2. Designing and conducting scientific investigations.
3. Gathering synthesizing information from books and other sources of information.
4. Discussing topics in groups by being able to restate or summarize what others have said, asking for clarification or elaboration, and considering alternative perspectives.
5. Reconstructing previously learned knowledge.

Reflecting on scientific knowledge

1. Justify plans or explanations on a theoretical or empirical basis.
2. Describing some general limitations of scientific knowledge.
3. Showing how common themes of science, mathematics and technology apply in real-world contexts.
4. Evaluating alternative long-range plans for resource use and by-product disposal in terms of environmental and economic impact.

Using scientific knowledge

1. Analyzing properties of common household and agricultural materials in terms on risk/benefit balance.
2. Explaining chemical changes in terms of the arrangement and motion of atoms and molecules.
3. Describing, comparing and contrasting changes in atoms and/or molecules during physical, chemical and nuclear changes.
- 4.

Understanding scientific and social issues regarding pollution

Students will understand:

- Formation of ground-level ozone
- Pollution sources
- How weather contributes to ozone formation
- How the U.S. government regulates pollution
- Why government, industry, health and environmental groups disagree about clean air, even though it is something that is critical to Earth and human survival.

Teacher Resource Page

Are your students curious about air quality in West Michigan? Have they noticed that sometimes the meteorologists on local weather stations talk about *Ozone Action!* days? Do they know the difference between “good” ozone and “bad” ozone? Do they know what to do on an *Ozone Action!* day?

To help answer these and many more questions, the West Michigan Clean Air Coalition has prepared this website guide for you to find lots of information about ozone. Here is a word on “good” and “bad” ozone...



The chemical structure of ozone is O_3 as compared to oxygen which is O_2 . The additional oxygen atom makes ozone very reactive which is good in the upper atmosphere (the ozone layer) but harmful in the lower atmosphere (a component of smog). Ozone is produced through complex photochemical reactions involving natural atmospheric gases, volatile organic compounds (VOCs), nitrogen oxides and sunlight. Hot days can accelerate these reactions. Elevated levels of ground-level ozone make breathing more difficult – especially for people with respiratory problems. It can also damage vegetation and materials.

The *Ozone Action!* Program informs people when elevated ground-level ozone values are anticipated and it offers tips for reducing ozone formation. Since vehicle exhaust and gasoline vapor contribute to the chemical mix, many of the “clean air” tips involve reducing emissions from cars and equipment such as gasoline powered lawn mowers.

Here are some of the great resources available on ground-level ozone:

West Michigan Clean Air Coalition

<http://www.wmcac.org/>

A group of concerned businesses, educational institutions, non-profit organizations, and government agencies are spreading the word about the West Michigan ozone problem. This site has specific information on when West Michigan *Ozone Action!* days occur, a list of tips for *Ozone Action!* days, and free materials.

Clean Air Coalition of Southeast Michigan

<http://www.semcog.org/Services/OzoneAction/index.htm>

Check out the fantastic teacher resources at this site. You are going to want the Spatially Plotted Ozone Tracking System (S.P.O.T.S) program for your computer and there are excellent downloadable lessons complete with grade appropriate lessons. Material was specifically developed (by educators) to tie in with Michigan math and science goals and objectives and MEAP science proficiency standards. Don't miss this one!



Would you like maps that show ozone levels and where the Ozone Action! days are happening?

✧ Take a look at the **U.S. Environmental Protection Agency Region 5** website at: <http://www.epa.gov/docs/reg5oair/ozoneday/ozoneday.htm> for regional information and links to ozone action day programs.

✧ The **Michigan Department of Environmental Quality** <http://www.deq.state.mi.us/aqi/ozone.shtml> provides hour-by-hour ozone readings at selected sites on Ozone Action! days and information about air quality in Michigan.



✧ Also, the **National Weather Service** in Grand Rapids has an interesting site. http://www.crh.noaa.gov/grr/main/weather/current/index_current.html

✧ One of the best national sites is **AIRNow** at <http://www.epa.gov/airnow/> that has information on the Air Quality Index, ozone maps and animation, air quality forecasts, a kid's page, and facts about health issues. This site offers students the opportunity to compare air quality with meteorological events on a national scale.



Some other fun sites with games, activities, and fact sheets include:



Southeast Texas Regional Planning Commission
<http://www.ozoneactionday.org/ozone.asp>

Houston-Galveston Area Council
<http://www.cleanairaction.org/education/education.html>

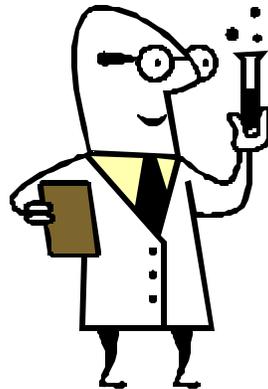


Air & Waste Management Association
The A&WMA West Michigan Chapter offers teacher workshops and can provide Air Quality Resource Guides upon request.
<http://www.wmawma.org/> and
<http://www.awma.org/resources/education/ozone.pdf>



Many other Internet websites provide information and activities that can help you teach your students about *Ozone Action!* If you find some good links, e-mail the West Michigan CAC at: cleanair@wmcac.org and we can add them to our list. Let us know if you would like to request an *Ozone Action!* speaker to come to your classroom or if we can help you with other resources.

What is Ozone?
Why is it important?
Lab



What is Ozone?

Why is it important?

Overview

This lesson provides students with an opportunity to study the characteristics and chemistry of ozone in both the stratosphere and the troposphere. It is a useful introduction to ozone in science/chemistry environment and social studies classes.

Time

One Class Period (two class periods, if including the weather forecasting extension).

Materials

- Background Information
- Handouts/transparencies
- Ozone Action! forecasting (if desired)

Objectives

Students will be able to:

- Distinguish between ozone in the troposphere and ozone in the stratosphere.
- Describe the chemical make-up of ozone.
- Identify the two main pollutants that form ozone and identify their sources.
- Explain the health effects to ground-level ozone.
- Describe the weather conditions that contribute to elevated level of ozone in the troposphere.

What is Ozone?

Why is it important

Procedure

1. Provide background information to students by reading the following segment and supplying them with *Ozone Action!* background information.
2. Invite students to answer the “Linking activity to *Ozone Action!*” questions.
3. Discussion can expand to include writing assignments, or an extension into weather studies, government studies or the environment.

Background information for students

Since 1995, the West Michigan Clean Air Coalition has been working to educate people about the ground-level ozone problem.

Ozone in the stratosphere, which is formed naturally, is good, protecting us from the sun’s harmful ultraviolet rays. When ozone from air pollution forms in the troposphere, where we breathe, ozone can be harmful to our health. This is the ozone targeted by the federal government as one of the six criteria pollutants that must be reduced in the interest of the public health as well as the ozone targeted by the *Ozone Action!* program.

On Ozone Action! days we all can help minimize excessive ozone formation by voluntarily reducing the amount of hydrocarbon emissions we put into the air. Your *Ozone Action!* tip sheet contains helpful actions that can keep our air clean.

What is Ozone?

Why is it important

By learning how ozone is formed and how we all contribute to its production, we can begin to think about how to stop this pollution problem. Learning how to keep our air clean is a valuable lesson for today and the future.

Good Ozone

Naturally occurring stratospheric ozone is good ozone and protects us from the harmful rays of the sun. In the stratosphere, Ozone (O₃) absorbs ultraviolet radiation and is split into an oxygen molecule and an oxygen atom:



Oxygen molecules can also be split by ultraviolet light to form oxygen atoms

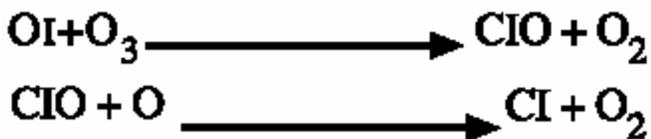


These changes allow ozone to be reformed to react with more ultraviolet light:



This process allows most of the ultraviolet light to be filtered out before it reaches the earth.

Now humans have introduced chlorofluorocarbons (CFCs) to the atmosphere and the chlorine in CFCs reacts with the ozone and changes the whole process. CFCs can be found in aerosol spray cans such as hair spray, cleaning products and spray paint.



In these reactions, the chlorine also acts as a catalyst. Before the chlorine is finally removed from the atmosphere (in one to two years by precipitation), each chlorine atom will have destroyed approximately 100,000 ozone molecules-exposing the earth to more harmful ultraviolet rays.

Bad Ozone

Troposphere (ground-level) ozone is bad. When ozone forms in high concentrations down here where we breathe, it can be a health hazard. Ozone is formed in a photochemical reaction between volatile organic compounds (such as hydrocarbon emissions from factories, automobiles, boats and gasoline-powered lawn equipment), nitrogen oxides and the sun. High temperatures, minimal or no cloud cover, and stagnant winds are perfect conditions for ground-level ozone formation.

Hydrocarbon emissions + nitrogen oxides + sunlight + weather factors = ozone (O₃)

What is Ozone?

Why is it important

Questions

1. What are the differences between good ozone and bad ozone?
2. Why is ozone considered a “pollutant” in the troposphere and not in the stratosphere? What is your definition of a pollutant?
3. How much scientific evidence should we have before taking action to control a pollutant? Who should make the decision? How?
4. What actions can you take to protect the stratospheric ozone layer?
5. What actions can you take to prevent forming ozone in the troposphere?

Extension

- Use Ozone Action! forecasting to elaborate on the weather conditions that contribute to ground-level ozone formation.
- Assign research papers to students on “good” and “bad” ozone, asking them to detail the chemistry formation and environmental issues inherent to each.
- Break students into groups. Have each group design an emissions-free city and write about whether or not they think that same city would be free of ground-level ozone.
- Assign a debate to the class on public health vs. corporate profit.
- Assign a research paper to students on alternative energy sources (fuel cells, solar power etc.).
- Assign students to write a position paper on “what is the role of the government in protecting public health” or “what is the role of government of regulating industry”.

Taking Action!

An important part of any lesson is turning knowledge into action – empowering students to act. Challenge students to help build awareness based on the information they have learned about West Michigan’s ozone problem. Brainstorm with students...identify ways they can contribute to the solution of this problem. The following list of actions is just the beginning.

- Use the school radio station or newspaper to inform other students about *Ozone Action!* days and *Ozone Action!* tips for reducing emissions.
- Organize a school bike and carpool day (for students and teachers).
- Teach younger students about ozone. Older students are great role models and can very effectively teach others about the environment and how to protect it.

Synthesizing Written Information Activity



Synthesizing Written Information

Overview

Ozone Action! in the classroom provides opportunities for students to improve reading performance along with providing important science, social studies and environmental information and skills.

Time

Two class periods.

Materials

- *Ozone Action!* background information
- Reading materials from “Bonus Activity Packet”
- “Exploring Air Issues Through a Community Survey” (also in “Bonus Activity Packet”)

Objectives

Participating in this activity, students will:

- Learn to gather information by reading written material.
- Provide evidence of their understanding of the material through classroom discussion and possible writing assignments.
- Gain hands-on experience in field research.

Synthesizing Written Information

Procedure

1. Have students read “What is ozone? Why is it important?” background information (page 4), and *Ozone Action!* related information. Please find resourceful websites listed below:

DEQ Air page

<http://www.michigan.gov/deq> and click on "AIR"

Project A.I.R.E page:

<http://www.epa.gov/region01/students/teacher/aire.html>

AIRNOW page (regional and national ozone maps):

<http://www.epa.gov/airnow/>

Midwest Hazecam for live pictures and corresponding air quality conditions at:

<http://www.mwhazecam.net/>

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2. After reviewing these printed materials, invite students to participate in a class discussion on ground-level ozone and how they can help reduce its production. What are students willing to give up to help reduce the levels of ozone in the air? Do students understand ozone’s impact as a technology, government, business, health and environmental problem?
3. Discover the depth of their knowledge by asking them the following questions and discussing answers.

Questions:

- What is an Ozone Action! day?
- Why is there concern about ground-level ozone?
- What types of actions are people asked to consider on Ozone Action! days? Why?
- Based on your reading, or your own experience, what is the public’s attitude toward taking action to reduce air pollution?
- What are the health effects of ozone at ground-level? Who is most susceptible?
- What is the current federal standard for ozone levels?
Why does the U.S. Environmental Protection Agency have an ozone standard?

- Think about the complex relationship of clean air, government, industry and environmental activism. Monitor the newspaper for articles on issues that involve these stakeholders.
2. Now give students “Exploring Air Issues Through a Community Survey” with instructions to conduct a mini-survey in school with at least five students.
 3. During the second class, tally the survey results and discuss the outcome.

Extension

Have the student’s survey parents and other adults outside school and compare the results. Are there any differences in attitudes? Have the students explore and explain the differences?

Exploring air issues through a community survey

What is your community's average vehicle occupancy? How do students travel to school? How does your community compare to others in the state? Use this sample opinion poll (or make up one of your own) to investigate air issues in your school and community.

Rate your agreement with each of the following statements on a scale of one to five, with one meaning you strongly disagree and five meaning you strongly agree:

1 = Strongly disagree 2 = Disagree 3 = Neutral 4 = Agree 5 = Strongly Agree

Person Responding (check one): Male Female

1. Air pollution is a major health problem in my community. _____
2. Industry is a major contributor to air pollution in my community. _____
3. Vehicles are a major contributor to air pollution in my community. _____
4. Other states are a major contributor to air pollution in my community. _____
5. People traveling to work should be required to carpool or take public transportation if it is available. _____
6. Students should be required to carpool or take public transit. _____
7. Taxes should be increased to support mass transit programs. _____
8. The government should increase research support for the electric car. _____
9. Auto makers need to increase fuel mileage on all cars and trucks. _____
10. Developing countries should address air pollution as a major environmental problem. _____
11. Communities should increase their construction of bike trails for workers and students to use. _____
12. I am willing to modify my behavior to avoid causing pollution. _____

*Adapted from "Exploring Air Issues Through Community Survey" by the Wisconsin Department of Natural Resources.

“Tennis” Anyone *Class Debate*



“Tennis” anyone?

Overview

The controversy surrounding the new National Ambient Air Quality Standards for ozone and particulate matter is good material for developing critical thinking and debating skills. This activity, applicable to subjects that include government, science and health, speech and public policy, helps students learn how to use both critical and logical thinking to make decisions based on fact and testimony while acquainting students with government policy.

Time

One Class Period

Materials

- Newspaper articles that students find (optional)
- Ozone Action! Q & A (included)

Objectives

Participating in this activity, students will:

- Learn logical thinking
- Utilize critical thinking
- Develop practical speaking skills
- Become acquainted with governmental policies
- Make decisions based on fact and testimony

Background Information

The United States Environmental Protection Agency (USEPA) is required to review its National Ambient Air Quality Standards (NAAQS) every five years. With the goal of protecting public health and welfare, the standards detail the maximum amounts of certain pollutants permitted in the air. In the summer of 1997, under the leadership of Carol Browner, USEPA Administrator the USEPA passed new, more stringent standards for both ozone and particulate matter.

The new standards remain cause for much debate as business, local governments and others pit themselves against the USEPA and supporters in a battle about the revised standards. In general, those who support the USEPA’s proposed standard argue that improved public health, number of lives saved and further emission reductions would improve quality of life and the environment. Those against the standards believe that there is no clear evidence that the standards are necessary and that the new standards would be difficult or impossible to meet while generating major costs and job losses.

“Tennis” anyone?

Attainment designation in West Michigan

From 1978 until 1994, West Michigan (Kent, Ottawa, and Muskegon Counties) failed to meet federal air quality standards for ozone; that non-compliance resulted in the designation of the area as a "moderate" non-attainment area by the USEPA. In 1996, the State of Michigan applied for a re-designation of West Michigan (Kent & Ottawa Counties) as an attainment area, and the USEPA granted the area as attainment maintenance. Muskegon followed suit the following year. Currently, Kent, Muskegon, and Ottawa counties are considered attainment maintenance status by the United States Environmental Protection Agency.

The old 1-hour standard stated that the continuous air monitor must not exceed 0.12 parts per million more than once a year, averaged over three years. The new 8-hour standard is a three year average of the fourth highest daily maximum of continuous air monitoring data which must not exceed 0.08 parts per million.

Issues

Many local governments feel that the new standards are too stringent and that requirements for emission reductions are too costly to compare fairly with the associated health benefits of reducing ground-level ozone. The government and corporations are concerned about how more stringent limits on emissions may affect the economic health of their area. They feel that air quality improvement programs will help “clear the air” without the new stricter standard.

The industries most affected by the expected controls are concerned about their costs and worry that they will not be able to compete in the marketplace. Consumers are also concerned about costs. Controls on utility companies, for instance, will drive consumer process higher.

Many in industry agree that the old standard of 120 parts per billion (ppb) required revision, but disagree with the USEPA about how much tougher the standard had to be and how fast it had to take effect. They are also particularly concerned about the practicality of asking for so much emission reduction so quickly.

On the other hand, environmental and health organizations are satisfied with the new standard, arguing that it will achieve greater health benefits including lower rates of infant mortality, reduced hospital admissions due to respiratory problems and lower death rates in non-compliant urban areas. They see the new standards as a forward step toward cleaner air, healthier residents and health-cost savings.

“Tennis” anyone?

The disagreement between health, environmental organizations, corporations, and industry groups began in September 1996 when the USEPA announced its proposal to revise the standards. The debate continued with industry hoping for Congressional action against the standards, and health/environmental agencies hoping to keep the new standards. Currently, the USEPA is in the process of implementing the new eight hour standard.

What do you think; Can you still stand for health if you do not support the new standards? Is clean air possible while maintaining current consumer lifestyles? Are corporations as well as the American people ready to make changes to improve health and safeguard the environment?

Ozone Action!

Ozone Action! a voluntary emission reduction program encourages people and businesses to reduce emissions on the days when weather conditions are most conducive to elevated amounts of ground-level ozone in the troposphere. Throughout debates about the new federal standard for ozone, the program is one thing that both sides agree with.

In West Michigan, the *Ozone Action!* program is administered by the West Michigan Clean Air Coalition – a group of government, business, health, and environmental organizations working together to “clear the air”. The Coalition works together to achieve cleaner air in the region through education and promotion of voluntary emission reduction activities.

An Impromptu Debate

1. Prepare your class

- Divide the class into two groups.
- Initiate discussion about air quality in the region, federal health standards and Ozone Action! – a voluntary emissions reduction program.
- Engage students in researching the National Ambient Air Quality Standards (NAAQS) from the perspectives of:
 - i. U.S. Environmental Protection Agency (USEPA)
 - ii. Big Business
 - iii. Ozone Transport – Ground-level ozone can be created in a one community and transported to neighboring communities by wind
 - iv. Public Health

“Tennis” anyone?

2. Activity

- Designate one side of the class as for the new NAAQS, and the other side as against the new National Ambient Air Quality Standard.
Recommendations: Give both sides an identity (invite them to participate as Midwest vs. Eastern States, Industry vs. Environmental Groups, Local Units of Governments vs. USEPA).
- Allocate 30 minutes for the class to prepare arguments. Group members (all players: political, business and special interest groups, such as health and environmental) should speak as representative from their groups (for example: a mayor of a Midwest urban area, a CEO of a large utility company, etc.). The group should argue the reasons the group is for or against the new NAAQS. Groups need to determine what solution is best for both groups and why.
- Allocate 30 minutes for a “tennis” debate. A tennis debate is a very informal debate where participants “volley” arguments back and forth. As moderator, the instructor could throw out questions allowing each side to respond to it or to serve as discussion starters.
- Twenty-five minutes into the debate, stop and allow two minutes for one speaker from each side to present a closing argument or concede to the opposition.

“Tennis” Debate – Follow Up

- Homework assignment: require students to write a brief summary of why their opponents have a legitimate reason for supporting/opposing the new standards.
- Have the class vote to determine if new standards should be maintained or rescinded.
- Group discussion- How will the new National Ambient Air Quality Standards (NAAQS) affect students? Their parents? Will it be for the better or worse (take into account jobs, public health, cost of implementation, health care costs, and quality of life).
- Discuss *Ozone Action!* and how it can help to “clear the air”. How does this program bridge the gap between supporters and opponents of the new NAAQS? Does the program’s importance change because of the new standard? How can people contribute to improve air quality in West Michigan?
- Expand the activity to a prepared debate. Allow students to do outside research and follow a traditional debating procedure, such as a Lincoln-Douglas debate or parliamentary debate.

Buses are better! Activity



Buses are better!

Overview

The impact of public transit on regional pollution is often misunderstood. Traffic studies give students an opportunity to learn about public transportation in terms of its environmental impact while participating in hands-on field work.

Time

Two class periods plus introduction (approximately 15 minutes).

Objectives

By participating in this traffic survey, students will:

- Learn about automobile pollution emissions: CO, NO_x and VOCs.
- Discuss the differences between levels of car and bus pollution emissions.
- Determine what type of transportation is better for the environment.
- Develop skills in teamwork.
- Utilize critical thinking in problem-solving exercises.
- Develop practical experience in fieldwork.
- Become acquainted with pollution prevention techniques.
- Make decisions based on hard data.

Background Information

Fossil fuel powered transportation is responsible for a large number of pollutants. Carbon monoxide (CO), Oxides of nitrogen (NO_x) and volatile organic compounds (VOCs or hydrocarbons) are all responsible for a number of adverse health effects including reduced oxygen in blood, reduced lung capacity, respiratory tract problems, eye irritation and lung damage. NO_x and VOCs, together react photochemically with the sunlight in the warm summer months to create ground-level ozone.

Michigan's struggle to "clear the air" includes the *Ozone Action!* program – a voluntary emission reduction program that asks people to take voluntary actions that help reduce the amount of ground-level ozone formation on days that weather conditions assist in the ground-level ozone formation.

Procedure

1. Prepare your class

- Divide class into groups of two.
- Initiate discussion about air quality in the region, reading the background information to the students.
- Allocate an intersection of the community for each group of students to study.

2. Activity

- During or after school, send students to an intersection where they can SAFELY observe traffic for 30 minutes.
- Count all cars and buses (separately) that pass by in one direction. Record the number of passengers in each vehicle on a worksheet.
- After data collection, return to the classroom. The next step is to study the data, solving problems using collected data.

Buses are better!

Data Analysis

- If one bus is equal to 58 automobiles (assuming the national average automobile occupancy is 1.2 persons) how many buses would have passed through your intersection to carry the total number of occupants to their respective destinations?
- If one bus emits 3.05 grams per passenger mile carbon monoxide and single occupancy vehicles (SOVs) emit 15.06 grams per passenger mile of carbon monoxide how much Carbon Oxide (CO) emissions could have been avoided if all of your SOVs had traveled by bus?

Follow Up

- Homework assignment – Require students to write a brief summary of the benefits of mass transit. (Make sure they take into consideration cost, wear and tear on automobiles and roads, traffic congestion, benefits to the air and environment, etc.)
- Group discussion- How could students and their families utilize mass transit options in their area? How would increased use of buses affect their lives? (remind students about the new National Ambient Air Quality Standard (NAAQS) and the negative health effects of ground-level ozone).
- Brainstorm – Why don't more people use mass transit? What could city government and planners do to promote and encourage more people to use mass transit?
- Have students research a successful mass transit system in the United States.

Teacher Evaluation Form

Your feedback is necessary to make these resource guides a success.

Remain anonymous, if you wish, but please do complete the following items and return this form to the West Michigan Clean Air Coalition:

Name _____

School _____

Address _____

City _____ State _____ Zip _____

Phone Number (____) (____ - _____) Email: _____

Please tell us what grade level and/or subjects you teach: _____

Total number of students participating in class using
Ozone Action! classroom materials _____

Which *Ozone Action!* Resource Guide(s) did you use?

- ? K-5
- ? Grade 6-8
- ? Grade 9-12

Please rate your agreement with the following statements using a scale of 1 to 5.

Ozone Action! background information is complete and helpful.

1 = strongly disagree 2 = disagree 3 = neutral 4 = agree 5 = strongly agree

Ozone Action! classroom science activities are useful and relevant to class room needs.

1 = strongly disagree 2 = disagree 3 = neutral 4 = agree 5 = strongly agree

Ozone Action! classroom science activities are complete and easy-to-follow.

1 = strongly disagree 2 = disagree 3 = neutral 4 = agree 5 = strongly agree

Ozone Action! classroom activities are easy to integrate into daily lessons.

1 = strongly disagree 2 = disagree 3 = neutral 4 = agree 5 = strongly agree



Activities are well-received by students.

1 = strongly disagree 2 = disagree 3 = neutral 4 = agree 5 = strongly agree

I would teach *Ozone Action!* activities in my classroom again.

1 = strongly disagree 2 = disagree 3 = neutral 4 = agree 5 = strongly agree

I will use *Ozone Action!* classroom activities and lessons again next year.

1 = strongly disagree 2 = disagree 3 = neutral 4 = agree 5 = strongly agree

Please share your thoughts on the *Ozone Action!* education packet. What I liked best about the Ozone Action! Teacher Resource Kit. (Please give us an idea of what worked well for you).

What I liked least about the *Ozone Action!* Teacher Resource Kit. (Please give us an idea of what did not work well for you, any information you felt was missing, etc.)

What changes would most help you meet you teaching needs? Please use a separate sheet for additional comments if necessary.

*Fax or send completed form to
West Michigan Clean Air Coalition
c/o Grand Valley Metro Council
40 Pearl Street NW – Suite 410
Grand Rapids, MI 49503
Phone (616) 776-7696
Fax (616) 774-9292*