Elementary School Lesson Plans:

- Is it a Good Air Day for Me to Play Outside? (Grade 1)
- Ready, Set, Stop Idling (Grade 1)
- Make a Good Choice: Choose No Idling (Grade 2)
- Idlers: Please Stop Your Engines (Grades 3-5; Science and Math)
- Please Do Not Make Us Cough, Turn Your Engine Off (Grades 3-5; Science)
- Traffic Jams (Grade 5; Science and Math)
- The Six Infamous Pollutants (Grade 5; English/Language Arts and Science)
Is it a good air day for me to play outside?
Grade 1

National Science Standards:
As a result of activities in grades K-4, all students should develop the abilities necessary to do scientific inquiry and understanding about scientific inquiry.

As a result of activities in grades K-4, all students should develop an understanding of organisms and their environments.

Georgia Performance Standards:
S1L1-Students will investigate the characteristics and basic needs of plants and animals.

S1E1-Students will observe, measure, and communicate weather data to see patterns in weather and climate.

Focus:
Students will investigate air quality by using the Air Quality Index. Students will distinguish between good air and bad air days and how the Air Quality Index can give us important information about the air. Students will use a website to gather information about the Air Quality Index and what it means to them.

Materials:
- Crayons
- Colored pencils
- Drawing paper
- Computer access
- Student Sheet-Air Quality Index

Vocabulary:
- Pollutants: things that harm the environment
- Smog: air polluted by fume from cars and factories (smoke and fog)
- Pollution: adding pollutants to the environment
- Air Quality Index: a scale that tells us about the quality of the air
**Background:**
Animals need clean air to breathe to stay healthy. Pollutants in the air can cause the air to be dirty and not as safe to breathe. The Air Quality Index is used to tell us about the air in our area on a given date/time. The Air Quality Index is one source we can use to help make choices about the time we spend outside on a given date and time.

**Resources:**
http://www.cleanaircampaign.org/Air-We-Breathe/Smog-and-Air-Quality/Sources-of-Smog  
http://www.cleanaircampaign.org/Air-We-Breathe/Today-s-Air-Quality  
http://airnow.gov/index.cfm?action=static.aqi  
http://airnow.gov/index.cfm?action=aqikids_new.main  
http://airnow.gov/index.cfm?action=aqikids.air  

**Procedure:**
http://airnow.gov/index.cfm?action=aqikids.air  

On an overhead projector or in the computer lab, access the above link and read and discuss clean air and dirty air. Ask students how they would know the air is healthy to breathe besides just looking at it.

- Introduce students to the Air Quality Index. Explain that colors and words are used to help us understand whether the air is safe to play outside and precautions we should take to stay safe on different air quality days.

Use the following link for discussion.
http://airnow.gov/index.cfm?action=aqikids.air  

In teams, have students access the link below and select Kindergarten and 1st Grade. Complete the Student Air Quality Sheet as a class.
http://airnow.gov/index.cfm?action=aqikids_new.main  

Have students fold a piece of white drawing paper in half. Label one side “Dirty Air” and the other side “Clean Air”. Have students create pictures depicting each. Have students write and/or illustrate what they should be doing on each of the days in the pictures.
Extension: http://www.cleanaircampaign.org/Air-We-Breathe/Today-s-Air-Quality

Sign up with CleanAirCampaign.org to receive Smog Alerts. Have student’s take turns having the job of reporting daily air quality to the class. Use colors and/or words to collect data of air quality throughout the year. At the end of each month add up the number of green days, yellow days, etc... Compare and Contrast the number of air quality days in the fall, winter and spring.

Assessment: Participation in Class Activities and Student Sheets

Follow-Up:
After you have taught this lesson plan, please tell the Clean Air Schools program about your efforts in a brief, 60-second online survey at CleanAirCampaign.org. The information you provide is invaluable in helping this non-profit education program direct its resources to improving these lesson plans and creating new materials for your students. Thanks!
Ready, Set, Stop Idling
Grade 1

Length of lesson:
One class period

National Science Standards:
As a result of activities in grades K-4, all students should develop abilities necessary to do scientific inquiry

As a result of activities in grades K-4, all students should develop an understanding of organisms and their environments

Georgia Performance Standards:
S1CS5 Students will communicate scientific ideas and activities clearly.

ELA1W2 The student writes in a variety of genres, including narrative, informational, persuasive and response to literature.

Focus: Air Pollution and Idling
Students will gain background knowledge regarding what is good for the air and what is bad for the air through class discussion and watching a short video clip. Students will then participate in an activity sorting cards that illustrate things that are good for the Earth and things that are bad for the Earth. Students will then participate in an activity acting out cars idling and not idling to gain an understanding of what idling is and how it polluted the air. Student will make a drawing and write sentences on the topic of idling.

Materials:
• Activity Cards
• Magazines, construction paper, scissors, glue, writing paper,
• computer access or printed information from website
• Reproducible #1 Sorting Activity Cards.
• Reproducible #2 Rubric

Vocabulary:
• Air pollution
Idling

**Background:**
http://pbskids.org/eekoworld/index.html?load=air water
Watch video clip that contains background on air and air pollution.

**Background Information:** Sources of Smog, Air Quality, and Idling Information
http://www.cleanaircampaign.com/Air-We-Breathe/Smog-and-Air-Quality/Sources-of-Smog
http://www.cleanaircampaign.com/Air-We-Breathe/The-Truth-About-Idling

**Procedure:**
Warm-up: Show the quick video clip about air from the following website: http://pbskids.org/eekoworld/index.html?load=airwater

Place a T-Chart on the board. Share with students that all living things need air. Ask the following questions:
Are plants and animals living things?
Are you an animal?
We breathe air all the time. Do you think it is important to breathe clean air?
Do you think our air is clean?
Do you think people can help make the air dirty?
What are some things people do to make the air dirty?
What are some things people do to make the air clean?

Brainstorm a list on the T-Chart.

**Activity One:** Sorting Cards on T-Chart
http://www.epa.gov/airnow/agikids/index.html

1. As a whole group, hold up one card. Ask students what is going on in the picture. Ask students if they think the activity did good or bad for the air and why? Place the activity card on the correct side of the T chart.
2. Review all activity cards once they have been placed on the T-
Chart.
3. When the activity card that says idling take time to act out.
4. Have kids take turns acting like a car. You may use black butcher paper to create “roads through the room. They move around the room pretending to drive cars. Periodically, ask them to stop. Set the timer for various time lengths. If the timer is set for less than 30 seconds, they will not pretend to turn off their car. If the timer is set for 30 seconds or more and goes off while they are stopped, they must turn off their engines and stop idling. Point out when they are just sitting with the car running more than 30 seconds, all the pollutants are going into the air and they are not driving anywhere. Have students repeat this scenario until they understand the concept of idling.
5. Ask students if there are any places at school where someone would be sitting in their car for more than 30 seconds just idling.
6. If students do not know, suggest the car rider lane. Through discussion, student should realize that the car rider line is one place that a high volume of idling occurs.
7. Do you think this is good for the air at our school?
8. What could be done to teach people that idling is bad for the air?
9. Brainstorm ways to accomplish this task.

**Activity Two:** Drawings and sentences
1. Have students illustrate a car idling.
2. Have students write sentences educating people about idling and asking them to stop idling.

**Extension:** Clean Air No Idling Campaign Toolkit
Students will extend the No-Idle Campaign by obtaining a toolkit available from The Clean Air Campaign including signage and pledge cards.
http://www.cleanaircampaign.org/Kids-Schools/The-Clean-Air-Schools-Program/Program-Components/No-Idling-Program
Student may be provided with magazines. Students will cut out pictures and create a collage on folded paper. One side will state things that are good for the air. The other side will state things that are bad for the air. Student will cut out and glue pictures on each side.

---
This lesson plan is available thanks to SunTrust Directed Funds – Harriet McDaniel Marshall Trust and Walter H. & Marjory M. Rich Memorial Fund

The Clean Air Schools program is helping educate future leaders about air quality and transportation. Learn more at CleanAirCampaign.org.
**Assessment:**
- Participation in class discussion and class activities
- Completion of **Reproducible #1 Activity cards**.
- Rubric for drawing and sentences.

**Follow-Up:**
After you have taught this lesson plan, please tell the Clean Air Schools program about your efforts in a brief, 60-second online survey at CleanAirCampaign.org. The information you provide is invaluable in helping this non-profit education program direct its resources to improving these lesson plans and creating new materials for your students. Thanks!

**Teacher Commentary:**
This was a great lesson to introduce 1st graders to idling! They truly understood after pretending to be cars idling and not idling. They enjoyed the activity. It was a good connection to writing about something meaningful that impacts their life and trying to change it for the better.
Sample Student Work:

This lesson plan is available thanks to SunTrust Directed Funds – Harriet McDaniel Marshall Trust and Walter H. & Marjory M. Rich Memorial Fund

The Clean Air Schools program is helping educate future leaders about air quality and transportation. Learn more at CleanAirCampaign.org.

7/22/2009
Reproducible #1
Activity Cards

Carpooling  Planting Trees  Cutting Down Trees

No Idling  Idling  Factory

This lesson plan is available thanks to SunTrust Directed Funds –
Harriet McDaniel Marshall Trust and Walter H. & Marjory M. Rich Memorial Fund

The Clean Air Schools program is helping educate future leaders about air quality and transportation.
Learn more at CleanAirCampaign.org.

7/22/2009
Reproducible #2
Rubric

<table>
<thead>
<tr>
<th>Does not Meet</th>
<th>Meets</th>
<th>Exceeds</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Picture</td>
<td>Picture Related to Topic</td>
<td>Detailed Picture Related to Topic</td>
</tr>
<tr>
<td>Less than 3 Sentences on Topic</td>
<td>3 Sentences on Topic</td>
<td>More than 3 Sentences on Topic</td>
</tr>
</tbody>
</table>

This lesson plan is available thanks to SunTrust Directed Funds – Harriet McDaniel Marshall Trust and Walter H. & Marjory M. Rich Memorial Fund

The Clean Air Schools program is helping educate future leaders about air quality and transportation. Learn more at CleanAirCampaign.org.

7/22/2009
Make a Good Choice: Choose No Idling!
Grade 2

Length of lesson:
Two Class Periods

National Science Standards:
As a result of activities in grades K-4, all students should develop abilities necessary to do scientific inquiry and have an understanding about scientific inquiry.

As a result of activities in grades K-4, all students should develop an understanding of organisms and their environments.

Georgia Performance Standards:
S2CS5 Students will communicate scientific ideas and activities clearly.

Focus: Air Pollution and Idling
Students will read the book, The Lorax to gain understanding on how one person can impact the environment. Students will explore how making good choices can help the environment while bad choices do the opposite. Students will gain an understanding of idling and how it can negatively affect our air quality. Students will create posters to illustrate good choice (No idling) vs. bad choice (idling) and “T—shirts” that communicate the message of no idling. Students will display posters and “T-Shirts” in the hallways of the school to promote no-idling.

Materials:
- The Lorax by Dr. Suess
- Computer access or printed information from website
- Clean Air Campaign Website Idling Facts
- Reproducible #1 Graphic Organizer: The Lorax: Good Choices vs. Bad Choices
- Reproducible #2 Poster Directions
- Reproducible #3 T-Shirt Directions and Template
Vocabulary:
- Air pollution
- Idling
- Smog

Background:
http://pbskids.org/eekoworld/index.html?load=air_water
A short video clip for students to watch that discusses air and air pollution.
This will build background knowledge for students on air pollution
Idling Myths to share for The Clean Air Campaign
http://cleanaircampaign.com/AIr-We Breathe/The-truth-About-Idling

Procedure:
Read The Lorax by Dr. Suess.
Ask students:
1. Why is the Lorax so upset?
2. What was the Lorax trying to protect? Why?
3. Why were the animals so happy in the beginning of the story and so sad at the end?
4. How was the Once-ler harming the air?
5. What is smog? What did the smog do to the birds? The other animals?
6. What could this town have done differently to stop the pollution?
7. Do you think we have smog in our city?
8. What things cause air pollution in our city? Around our school?
   List on the board.
9. Is there anything we can do to be like the Lorax and teach others how to reduce air pollution around our school and make the air healthier for us to breathe?
10. Ask students how they came to school today? How will they ride home?
11. Ask students if they notice pollution going into the air from these vehicles?
12. Did you notice that the vehicles were ever stopped and still running (not turned off) Give some examples: Vehicles running in the car rider line when they are not moving.

This lesson plan is available thanks to SunTrust Directed Funds –
Harriet McDaniel Marshall Trust and Walter H. & Marjory M. Rich Memorial Fund

The Clean Air Schools program is helping educate future leaders about air quality and transportation.
Learn more at CleanAirCampaign.org.

7/21/2009
13. Introduce and explain the term idling using examples of pictures from the Lorax
14. Why is idling unhealthy for the air? For us? How can we stop vehicles from idling in the car rider line? Brainstorm ideas on the board.

**Activity One:** Good Choice (No Idling) vs. Bad Choice (Idling) Posters
http://www.epa.gov/airnow/agikids/index.html
1. Use information from the website above to list facts about idling on the board.
2. Break students into groups of 4 to create posters illustrating good choice (no idling) vs. bad choice (idling)
3. Have each group list 1 “Did you Know” fact about idling from the board.
4. Hang posters in the hallways of the school or the car rider lane to encourage no idling.

**Activity Two:**
1. Bring in several T-Shirts to share with students. Discuss how information can be communicated on a T-Shirt. Look at graphics and words that send a message.
2. Provide each student with a T-Shirt template.
3. Share with students they will be creating a T-shirt to encourage No Idling in the car rider line. They may include pictures and words. After the T-shirts have been designed, they may share them with the class. Hang T-Shirts in the hallways to encourage No Idling.

**Ask students the following questions:**
1. What is air pollution?
2. How does Idling contribute to air pollution?
3. How do you think your posters and T-Shirts will help people make a good choice and not idle?
4. What else can we do to promote No Idling at our school?

**Extension:** Clean Air No Idling Campaign Toolkit
Students will extend the No-Idle Campaign by obtaining a toolkit available from The Clean Air Campaign including signage and pledge cards.

This lesson plan is available thanks to SunTrust Directed Funds – Harriet McDaniel Marshall Trust and Walter H. & Marjory M. Rich Memorial Fund

The Clean Air Schools program is helping educate future leaders about air quality and transportation. Learn more at CleanAirCampaign.org.

7/21/2009
http://www.cleanaircampaign.org/Kids-Schools/The-Clean-Air-Schools-Program/Program-Components/No-Idling-Program

Student may be provided with magazines. Students will cut out pictures and create a collage on folded paper. One side will state things that are good for the air. The other side will state things that are bad for the air. Student will cut out and glue pictures on each side.

Assessment:
- Participation in class discussion and group work.
- Completion of Reproducible #1: The Lorax: Good Choices/Bad Choices
- Completion of Reproducible #2-Student T-Shirts
- Completion of Posters

Follow-Up:
After you have taught this lesson plan, please tell the Clean Air Schools program about your efforts in a brief, 60-second online survey at CleanAirCampaign.org. The information you provide is invaluable in helping this non-profit education program direct its resources to improving these lesson plans and creating new materials for your students. Thanks!

Teacher Commentary: 2nd Grade
The students were engaged by the book and easily see that people can make choices that harm or help the air. They made the connection that idling pollutes the air and people should not idle. They were excited that their posters encouraging no idling would be displayed in the hall. They realized that even as second graders, they have the power to help keep the air clean. The video clip was great to have them view for background.
Reproducible #1

**The Lorax: Good Choices vs. Bad Choices**

<table>
<thead>
<tr>
<th>Lorax Good Choices</th>
<th>Once-Ler Bad Choices</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This lesson plan is available thanks to SunTrust Directed Funds – Harriet McDaniel Marshall Trust and Walter H. & Marjory M. Rich Memorial Fund

The Clean Air Schools program is helping educate future leaders about air quality and transportation. Learn more at [CleanAirCampaign.org](http://CleanAirCampaign.org).

7/21/2009
Reproducible #2

Student Poster Directions:

Student Directions:

1. Your team should create a poster encouraging people to make a good choice and stop idling.

2. Each poster should be divided in half. One half will show a vehicle idling and why this is a bad choice. The other half will show a vehicle not idling and why this is a good choice.

3. Your poster should encourage no idling.

4. You will share your poster with the class.

Answer the following question:

Do you think your poster will encourage No Idling? Why or Why Not?
Reproducible #3

T-Shirt Directions and Template
Use words and/or pictures on your T-shirt to encourage No Idling.

This lesson plan is available thanks to SunTrust Directed Funds – Harriet McDaniel Marshall Trust and Walter H. & Marjory M. Rich Memorial Fund

The Clean Air Schools program is helping educate future leaders about air quality and transportation. Learn more at CleanAirCampaign.org.

7/21/2009
Idlers: Please Stop Your Engines!
Grade 3-5, Science and Math

Length of Lesson:
Two to three class periods

National Science Standards:
NS. K-4.1, NS.5-8.1 Science as Inquiry
As a result of activities in grades K-4, and 5-8 all students should develop abilities necessary to do scientific inquiry and understandings about scientific inquiry

NS.K-4.6, NS. 5-8.6 Science in Personal and Social Perspectives
Levels: K-4
• Personal Health
• Changes in Environments
Levels 5-8
• Personal Health
• Natural Hazards

NM-DATA.3-5.1
• design investigations to address a question and consider how data-collection methods affect the nature of the data set;
• collect data using observations, surveys, and experiments;
• represent data using tables and graphs such as line plots, bar graphs, and line graphs;
• recognize the differences in representing categorical and numerical data.

Georgia Performance Standards
S3L2 Students will recognize the effects of pollution and humans on the environment

M3D1 Students will create and interpret simple tables and graphs.

M5D1 Students will analyze graphs

M5D2 Students will collect, organize and display data using the most appropriate graph.
Focus: Air Pollution and Idling
Students will read background information on the main air pollutants and complete a graphic organizer illustrating that information. Students will collect idling data from the school’s parking lot or car line for one week. Students will compile the data to create 4 types of graphs illustrating the data. Students will create slogans for mock bumper stickers to encourage no-idling in the car rider line and will display graphs and “bumper stickers” in the hallways of the school to promote no-idling.

Materials:
- Colored pencils, graph paper, card stock paper cut into strips for “bumper stickers”
- Computer and internet access or printed information from websites
- Reproducible #1 Graphic Organizer: Air Pollutants
- Reproducible #2 Collecting Daily Idling Collection
- Reproducible #3 Data Table: Collecting Daily Idling Collection
- Reproducible #4 Analyzing Idling Data
- Reproducible #5 Graphing Idling Data (4 pages)
- Reproducible #6 Graphing Rubric
- Reproducible #7 Bumper Stickers

Vocabulary:
- Air pollution: substances in the airs that have harmful or unpleasant effects.
- Idle or Idling: inactive, not in use, not moving or in operation.
- Other: Line graph, bar graph, pictograph, interval, key, x and y axis

Background:
These websites provide additional background information about pollutants and how idling contributes to air pollution and poor air quality and dispel some common myths about idling.
http://www.cleanaircampaign.com/Air-We-Breathe/Smog-and-Air-Quality/Sources-of-Smog

---

This lesson plan is available thanks to SunTrust Directed Funds – Harriet McDaniel Marshall Trust and Walter H. & Marjory M. Rich Memorial Fund

The Clean Air Schools program is helping educate future leaders about air quality and transportation. Learn more at CleanAirCampaign.org.

7/21/2009
http://www.cleanaircampaign.com/Air-We-Breathe/The-Truth-About-Idling

Resources:
http://www.epa.gov/air/urbanair
http://epa.gov/airnow/aqikids/index.html
http://www.cleanaircampaign.com/Air-We-Breathe/Smog-and-Air-Quality/Sources-of-Smog
http://www.cleanaircampaign.com/Air-We-Breathe/The-Truth-About-Idling
http://www.mass.gov/dep/air/community/schbusir.htm

Procedure:
Warm-up: Idling Introduction and Discussion
1. Ask students to think of times when they observed or were riding in a vehicle that was idling. Solicit as many examples as possible and list them on the board. Some examples may include waiting in a drive-thru line, waiting in a long line to enter a place such as an amusement park, traffic jams, waiting for someone, etc..
2. Ask students why this practice of idling is not good for the air or our health.
3. Ask students if they can think of times they have observed idling at their school. When and where at the school have they observed or do they think the most idling occurs?
4. Ask students if they think they could reduce idling at school? Ask them how they would go about accomplishing that task?
5. Through discussion, students should realize that the car rider line is one place where a high volume of idling occurs. In this lesson, students will work to create education and awareness about idling and begin a campaign to stop idling in the car rider lanes.

Activity One: Researching Pollutants
http://www.epa.gov/air/urbanair
http://www.epa.gov/airnow/aqikids/index.html
1. Break students into groups of 3 or 4. Assign each group one of the 6 air pollutants.
2. Provide each student with Reproducible #1 Six Major Air Pollutants. Have each group use the following websites to research the causes and effects of the air pollutant they have been assigned:
   http://www.epa.gov/air/urbanair
   http://www.epa.gov/airnow/aqikids/index.html
3. Students will share their findings with the class and compile information into one graphic organizer on the board. All students should add missing information to their own organizer.
4. As a class, discuss the information and talk about how reducing idling would decrease pollutants in the air.

**Activity Two: Collecting Data from the Car Rider Lanes**
1. For this activity, break students into lab groups of three to five students. Each lab group will need Reproducible #2: Daily Data Collection for Car Rider Lane, a clipboard and a pencil. You will need a separate copy of Reproducible #2 for each day you will collect data.
2. Each group should collect data for thirty minutes at the same time each morning and each afternoon for one week. They will document the type of vehicle, weather and time(s) the data was collected. *If students are unable to collect data at designated times, an alternative would be to have adults collect the data and students compile the data.
3. After data has been collected for the week, provide each student with a copy of Reproducible #3: Data Table: Compiling Idling Data and complete as a class on the board. Each student should copy down the information from the board into their own table.

**Activity Three: Analyzing Data**
1. Each student should use their data table to independently answer the questions about the idling data table found on Reproducible # 4 Analyzing Idling Data. This worksheet will be part of assessment.

**Activity Four: Graphing Idling Data**
1. Provide each student with Reproducible #5 Graphing Idling Data
2. Students will work in groups to complete graphs and questions. Students will represent the data using pictographs, double bar graphs, line graphs, and pie graphs. As well, they will each formulate two questions related to the graphs and then trade papers to answer the questions.
3. After creating the graphs on their worksheets, each group will create the 4 graphs on poster board (1 of each type) to display in the halls of the school. For assessment, you may collect Reproducible #5 and/or grade the graphs on poster using Reproducible #6: Graphing Rubric.

**Activity 5: Bumper Stickers**
1. Provide each student with Reproducible #7 Bumper Stickers
2. Have students work in groups of 3 or 4 to produce a bumper sticker to encourage No Idling.
3. The worksheet instructs the students to brainstorm/list ideas and choose/list the ideas that will be used for the bumper sticker. As well, there is space provided for the students to draw their bumper sticker.
   You may choose to use the provided space for a rough draft or final.
   We suggest using cardstock paper to make the final bumper stickers.
1. What are the 6 major air pollutants?
2. How does idling contribute to air pollution?
3. Are graphs an effective way to communicate information about idling at our school?
4. Did you see trends and/or patterns when you analyzed the data?
5. How do you think education and awareness will reduce idling at our school?
6. What else can we do to promote No Idling at our school?

At the conclusion of this lesson, students will be able to identify the six major air pollutants, discuss how idling contributes to air pollution, create graphs to represent actual data collected from their school, and begin a campaign to reduce idling at your school.

**Extension:** Clean Air No Idling Campaign Toolkit
Students will extend the No-Idle Campaign by obtaining a toolkit available from The Clean Air Campaign including signage and pledge cards.
[http://www.cleanaircampaign.org/Kids-Schools/The-Clean-Air-Schools-Program/Program-Components/No-Idling-Program](http://www.cleanaircampaign.org/Kids-Schools/The-Clean-Air-Schools-Program/Program-Components/No-Idling-Program)

**Assessment:**
- Participation in class discussion and group work.
- Completion of Reproducible #4 Analyzing Idling Data.

This lesson plan is available thanks to SunTrust Directed Funds – Harriet McDaniel Marshall Trust and Walter H. & Marjory M. Rich Memorial Fund

The Clean Air Schools program is helping educate future leaders about air quality and transportation. Learn more at [CleanAirCampaign.org](http://www.cleanaircampaign.org).
• Completion of Reproducible #5 Graphing Idling Data
• Posters of Graphs- See Reproducible #6: Graphing Rubric
• “Bumper Stickers” on card stock paper and/or Reproducible #7: Bumper Stickers

Follow-Up:
After you have taught this lesson plan, please tell the Clean Air Schools program about your efforts in a brief, 60-second online survey at CleanAirCampaign.org. The information you provide is invaluable in helping this non-profit education program direct its resources to improving these lesson plans and creating new materials for your students. Thanks!

The Clean Air Schools program is helping educate future leaders about air quality and transportation. Learn more at CleanAirCampaign.org.
### Six Major Air Pollutants

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Causes</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ozone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrogen Oxides</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfur Dioxide</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Particulate Matter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lead</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This lesson plan is available thanks to SunTrust Directed Funds – Harriet McDaniel Marshall Trust and Walter H. & Marjory M. Rich Memorial Fund

The Clean Air Schools program is helping educate future leaders about air quality and transportation. Learn more at [CleanAirCampaign.org](http://CleanAirCampaign.org).

7/21/2009
Data Collection for Car Rider Lane:

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Idling Y or N</th>
<th>Truck</th>
<th>Car</th>
<th>SUV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Data Table - Compiling Idling Data:

Materials:
Raw data collected from car rider line for one week

Data Table
Procedure: Use data collected over the past week and compile into the data table.

<table>
<thead>
<tr>
<th>Day of Week</th>
<th># Vehicles Idling a.m.</th>
<th>Weather a.m.</th>
<th># Trucks Idling a.m.</th>
<th># Cars Idling a.m.</th>
<th># SUVs Idling</th>
<th>Weather p.m.</th>
<th># Trucks Idling</th>
<th># Cars Idling</th>
<th># SUVs Idling</th>
</tr>
</thead>
</table>

Analyzing Idling Data

Directions: Use the Idling Data to Answer the Following Questions.

On which day of the week did most of the idling occur?

Did more idling occur in the morning or the afternoon?

Did the type of weather seem to contribute to how much idling occurred?

Which type of vehicle was observed idling the most ______ and least________?

What percentages of vehicles were idling?

Monday _______
Tuesday _______
Wednesday_______
Thursday _______
Friday _______
Graphing Idling Data - Student Directions

Student Directions:
1. Your team should create 4 graphs using the data table complied by the class. Each student should draw all graphs and answer/ask questions stated.
2. Each graph should be clearly labeled with a title, x and y axis, intervals, and appropriate keys.
3. Write 2 questions that can be answered by interpreting the data in each of your graphs.
4. As a team, create 1 of each type of graph enlarged on poster board to display in the hall.

Graph 1:
Create a pictograph to show how much idling occurred on each day. Use the following key: 1 tire=20 cars ½ tire=10 cars
Why is a pictograph effective to show this data?
Questions about this Graph:
1.
2.

Graph 2:
Create a double bar graph to show how many vehicles were idling in the morning vs. the afternoon.
Why is a bar graph good to show this data?
Questions:
1.
2.

Graph 3
Create a line graph to show which type of vehicle was idling on each day (car, truck, SUV).
Why is a line graph a good graph to use to reflect this data?
Questions:
1.
2.
Graph 4
Create a circle or pie graph to illustrate the percentage of vehicles idling on each day of the week.
Why is a circle or pie graph good for showing this data?
Questions:
1.
2.
## Graphing Rubric

<table>
<thead>
<tr>
<th>Graphing Rubric</th>
<th>Labels 0-3 pts</th>
<th>Intervals and Keys 0-3 pts</th>
<th>Data Display 0-3 pts</th>
<th>Neatness and organization 0-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line Graph</td>
<td>0=no labels</td>
<td>0=no interval, no keys</td>
<td>0=all data incorrectly displayed</td>
<td>0=lack of neatness and organization</td>
</tr>
<tr>
<td></td>
<td>1= 1 of 3 labeled (title, x, y axis)</td>
<td>1= reasonable interval or key labeled.</td>
<td>1=most data incorrectly displayed</td>
<td>1=somewhat neat and organized</td>
</tr>
<tr>
<td></td>
<td>2=2 of 3 labeled (title, x, y axis)</td>
<td>2=reasonable interval and correctly labeled interval or correctly labeled key.</td>
<td>2=most data correctly displayed</td>
<td>2=adequate neatness and organization</td>
</tr>
<tr>
<td></td>
<td>3=3 of 3 labeled (title, x and y axis)</td>
<td>3=reasonable interval and correctly labeled interval and correctly labeled key.</td>
<td>3=all data correctly displayed</td>
<td>3=very neat and organized</td>
</tr>
<tr>
<td>Pictograph</td>
<td>0=no labels</td>
<td>0=no interval, no keys</td>
<td>0=all data incorrectly displayed</td>
<td>0=lack of neatness and organization</td>
</tr>
<tr>
<td></td>
<td>1= 1 of 3 labeled (title, x, y axis)</td>
<td>1= reasonable interval or key labeled.</td>
<td>1=most data incorrectly displayed</td>
<td>1=somewhat neat and organized</td>
</tr>
<tr>
<td></td>
<td>2=2 of 3 labeled (title, x, y axis)</td>
<td>2=reasonable interval and correctly labeled interval or correctly labeled key.</td>
<td>2=most data correctly displayed</td>
<td>2=adequate neatness and organization</td>
</tr>
<tr>
<td></td>
<td>3=3 of 3 labeled (title, x and y axis)</td>
<td>3=reasonable interval and correctly labeled interval and correctly labeled key.</td>
<td>3=all data correctly displayed</td>
<td>3=very neat and organized</td>
</tr>
<tr>
<td>Bar Graph</td>
<td>0=no labels</td>
<td>0=no interval, no keys</td>
<td>0=all data incorrectly displayed</td>
<td>0=lack of neatness and organization</td>
</tr>
<tr>
<td></td>
<td>1= 1 of 3 labeled (title, x, y axis)</td>
<td>1= reasonable interval or key labeled.</td>
<td>1=most data incorrectly displayed</td>
<td>1=somewhat neat and organized</td>
</tr>
<tr>
<td></td>
<td>2=2 of 3 labeled (title, x, y axis)</td>
<td>2=reasonable interval and correctly labeled interval or correctly labeled key.</td>
<td>2=most data correctly displayed</td>
<td>2=adequate neatness and organization</td>
</tr>
<tr>
<td></td>
<td>3=3 of 3 labeled (title, x and y axis)</td>
<td>3=reasonable interval and correctly labeled interval and correctly labeled key.</td>
<td>3=all data correctly displayed</td>
<td>3=very neat and organized</td>
</tr>
<tr>
<td>Circle Graph</td>
<td>0=no labels</td>
<td>0=no key</td>
<td>0=all data incorrectly displayed</td>
<td>0=lack of neatness and organization</td>
</tr>
<tr>
<td></td>
<td>1=title</td>
<td>1=an incorrect key</td>
<td>1=most data incorrectly displayed</td>
<td>1=somewhat neat and organized</td>
</tr>
<tr>
<td></td>
<td>2=title and partial sections labeled.</td>
<td>2=partially correct key</td>
<td>2=most data correctly displayed</td>
<td>2=adequate neatness and organization</td>
</tr>
<tr>
<td></td>
<td>3=Title and all sections labeled.</td>
<td>3=correct key</td>
<td>3=all data correctly displayed</td>
<td>3=very neat and organized</td>
</tr>
</tbody>
</table>

This lesson plan is available thanks to SunTrust Directed Funds – Harriet McDaniel Marshall Trust and Walter H. & Marjory M. Rich Memorial Fund

The Clean Air Schools program is helping educate future leaders about air quality and transportation. Learn more at [CleanAirCampaign.org](http://CleanAirCampaign.org).

7/21/2009
Bumper Stickers

Divide students into groups of 4 or 5 to create artwork and/or a slogan to stop idling in the car rider line at your school.

1. Brainstorm ideas with your group.

2. Select an idea or combination of ideas.

3. Create a “bumper sticker” here or on the cardstock provided.
**Teacher Commentary:** 5th grade class

- Great way to utilize math skills and work on a school-wide project -
- Wonderful way to integrate science concepts with necessary math skills
- Wonderful culminating activity for a graphing unit using real-life problems and data that not only analyzes data, but works toward finding solutions
- Students were completely engaged in this lesson knowing they were using authentic data from their school and sharing the data could influence air pollution!
- On their own, they noticed and shared trends in the data. Great lesson!

Sample Student Work:

![Student work image]

---

*This lesson plan is available thanks to SunTrust Directed Funds – Harriet McDaniel Marshall Trust and Walter H. & Marjory M. Rich Memorial Fund*

The Clean Air Schools program is helping educate future leaders about air quality and transportation. Learn more at [CleanAirCampaign.org](http://CleanAirCampaign.org).

7/21/2009
Please Do Not Make Us Cough, Turn Your Engine Off.
Grades 3-5, Science

Length of lesson:
Two class periods

National Science Standards:
NS. K-4.1, NS.5-8.1 Science as Inquiry
As a result of activities in grades K-4, and 5-8 all students should develop
- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry

NS.K-4.6, NS. 5-8.6 Science in Personal and Social Perspectives
Levels: K-4
- Personal Health
- Characteristics and Changes in Populations
- Types of Resources
- Changes in Environments
- Science and Technology on Local Challenges

Levels 5-8
- Personal Health
- Populations, resources, and Environments
- Natural Hazards
- Risks and Benefits
- Science and Technology in Society

Georgia Performance Standards:
ELA5R3 The student understands and acquires new vocabulary and uses it correctly in reading and writing.

ELA5W2 The student demonstrates competence in a variety of genres.

ELA3W2 The student begins to write in a variety genres, including narrative, informational, persuasive, and response to literature.
ELA4LSV2 The student listens to and views various forms of text and media in order to gather and share information, persuade others, and express and understand ideas.

Introduction:
Using background information gathered from websites, students will complete a graphic organizer related to the six pollutants and how idling contributes to pollution. From that information, they will create a persuasive writing organizer. Students will write a five paragraph essay creating education and awareness about the harmful effects of idling and try to persuade others to stop idling.

Objectives:
After completing this lesson, students will be able to:
- Identify the 6 major air pollutants
- Understand how pollution impacts themselves and the world.
- Understand there are things that can have a negative or positive effect on air quality.
- Create Persuasive Essays communicating the need to reduce idling to improve air quality
- Communicate the information through published essays in the school newspaper, read aloud on school news show, and hanging in the hallways.
- Encourage No-Idling

Materials:
- Computer access or printed information from websites
- Reproducible #1 Graphic Organizer: Air Pollutants
- Reproducible #2 Persuasive Essay: Student Directions
- Reproducible #3 Persuasive Essay: Rubric
- Reproducible #4 Creative Debate Directions

Assessment:
- Participation in class discussion and group work.
- Completion of Reproducible #1: Graphic Organizer.
- Completion of Reproducible #2 Persuasive Organizer
- Persuasive Essays and Rubric

This lesson plan is available thanks to SunTrust Directed Funds – Harriet McDaniel Marshall Trust and Walter H. & Marjory M. Rich Memorial Fund

The Clean Air Schools program is helping educate future leaders about air quality and transportation. Learn more at CleanAirCampaign.org.
Lesson Background

Vocabulary:
- Air pollutants
- Idling
- Smog
- Air Quality

Background Resources:
http://www.cleanaircampaign.com/Air-We-Breathe/Smog-and-Air-Quality/Sources-of-Smog
http://www.cleanaircampaign.com/Air-We-Breathe/The-Truth-About-Idling
http://www.epa.gov/air/urbanair
http://www.epa.gov/airnow/aqikids/index.html

Lesson Steps

Warm-up:
What does idling mean? Solicit responses. Have students run in place for 1 minute. Ask them if they traveled anywhere. Ask them if this was a waste of energy. If they were outside, and needed to run a distance, would it make sense to run in place before they started traveling? Why would this idea be using a lot of energy wastefully? Now, think about a vehicle. What does a vehicle do? Get you from place to place. Does it make sense to simply let your vehicle run in place without going anywhere? Why is this a bad idea? Why do you think people would do this? When people do this, they are idling. This is expending energy. In a vehicle, idling contributes to air pollution. Have you noticed any cars idling at our school? Lead students to a discussion about the car rider lane. Is this good for us? Could you use the power of your writing to inform others about the negative impact of their actions and try to influence them to stop idling?

Activity One: Researching Pollutants
http://www.epa.gov/air/urbanair
http://www.epa.gov/airnow/aqikids/index.html

1. Break students into groups of 3 or 4. Have them use the referenced websites to and assign each group one of the 6 air pollutants.
2. Provide each student with Reproducible #1-Six major Air Pollutants
3. Have each group research the causes and effects of each air pollutant.
4. Students will share their findings with the class and compile information into one graphic organizer on the board. All students should add missing information to their own organizer.
5. As a class discuss the information and talk about how reducing idling would reduce pollutants in the air.

**Activity Two:** Transferring to Persuasive Organizer
1. Students will categorize facts into 3 reason categories such as health related, environment and economic.
2. Select three specific facts for each reason category.
3. Student will write an introduction, and use each of the reasons as a body paragraph, and end with a conclusion.
4. Students will follow the writing process by completing a rough draft, editing, revising, and a publishing.

**Assessment:** Ask students the following questions
1. What are the six major air pollutants?
2. How does idling contribute to air pollution?
3. Are graphs an effective way to communicate information about idling at our school?
4. Did you see trends and/or patterns when you analyzed the data?
5. How do you think education and awareness will reduce idling at our school?
6. What else can we do to promote No Idling at our school?

**Extension:** Clean Air No Idling Campaign Toolkit
Students will extend the No-Idle Campaign by obtaining a toolkit available from The Clean Air Campaign including signage and pledge cards.

http://www.cleanaircampaign.org/Kids-Schools/The-Clean-Air-Schools-Program/Program-Components/No-Idling-Program

Students can artistically represent their message through creating a class mural to hang behind their writings.

Students could have a creative debate on why we should or should not idle.

**Conclusion:**
At the conclusion of this lesson, students will be able to communicate information about idling at your school, the impact of idling on air pollution, and begin a campaign of education and awareness at your school.
Follow-Up:
After you have taught this lesson plan, please tell the Clean Air Schools program about your efforts in a brief, 60-second online survey at CleanAirCampaign.org. The information you provide is invaluable in helping this non-profit education program direct its resources to improving these lesson plans and creating new materials for your students. Thanks!

Teacher Commentary:
Excellent topic for a persuasive essay. Students were able to make real life connection to their environment and be able to express themselves.

Sample Student Work:

No Idling

Did you know that about 57 million people experience ozone levels that exceed the standard by 501 or more? It’s true, because of air pollutants like ozone, carbon monoxide, and nitrogen oxides. These pollutants are very bad for your lungs. Thanks to these pollutants many Americans are suffocating, so let’s stop it.

First let’s discuss the ozone. The ozone reacts to lung tissues because of this harmful pollutant changes in breathing passages causes both coughing and chest pains. Major ozone sources are refineries, gas-stations, motor vehicles, chemical plants, paints, and solvents. Smog is also the major harmful ingredient to cause ozone layers in the environment. Myriads of people lose their lives every day because of this horrible pollutant. The ways we can prevent this is by educating ourselves and stop the idling. This is just one of many ways to prevent this horrible cause of pollution.

The next pollutant is carbon monoxide. This pollutant is also very deadly because it is spread rapidly. Every year the number of deaths caused by carbon monoxide is increased. This toxin can stop our breathing and can make it harder for us to breathe if we are around it everyday. This is deadly substance that we have released in our air because many of us choose to idle.

Nitrogen oxides are chemicals precursor of ground level ozone. These are produced whenever fossil fuels are burned and primarily produced by motor vehicles and power plants. The sun’s ultra violet rays project onto the
ground level ozone. This can make ozone worse if we produce nitrogen oxides.

All of these are just a few facts on why idling is deadly to humans and the environment. In conclusion, stop idling because now you know that you aren’t just harming yourself, you are also harming the environment and everyone else around you. We can all make a huge difference if we tell others about these harmful pollutants and take action to STOP IDLING!
Reproducible #1

Six Major Air Pollutants

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Causes</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ozone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrogen Oxides</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfur Dioxide</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Particulate Matter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lead</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This lesson plan is available thanks to SunTrust Directed Funds – Harriet McDaniel Marshall Trust and Walter H. & Marjory M. Rich Memorial Fund

The Clean Air Schools program is helping educate future leaders about air quality and transportation. Learn more at CleanAirCampaign.org.

7/21/2009
The Clean Air Schools program is helping educate future leaders about air quality and transportation. Learn more at CleanAirCampaign.org.
# Reproducible #2

## Rubric

<table>
<thead>
<tr>
<th></th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Persuasive Genre Attributes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Position clearly stated and provided 3 substantiated reasons to support their Position.</td>
<td>Position clearly stated, however, fewer or unsubstantiated reasons</td>
<td>Position not clearly stated, however, fewer or unsubstantiated reasons</td>
<td>Position not clearly stated and reasons are unsubstantiated.</td>
<td></td>
</tr>
<tr>
<td><strong>Ideas</strong></td>
<td>There is evidence of at least 3 individual cohesive, well articulated ideas to support the topic.</td>
<td>Ideas do support the topic, however, there too few in number or not well articulated.</td>
<td>Ideas may not be well articulated. They may be repetitive; however, they do support the topic.</td>
<td>Ideas are not well articulated or cohesive. Ideas do not support the topic.</td>
</tr>
</tbody>
</table>

---

This lesson plan is available thanks to SunTrust Directed Funds – Harriet McDaniel Marshall Trust and Walter H. & Marjory M. Rich Memorial Fund.

The Clean Air Schools program is helping educate future leaders about air quality and transportation. Learn more at [CleanAirCampaign.org](http://CleanAirCampaign.org).

7/21/2009
Student Directions:
Persuasive Essay

1. Create a persuasive essay to convince the community to reduce idling.

2. The paper should have a clear title and introduction that list your 3 primary reasons drivers should not idle.

3. Your paper needs to have a body paragraph for each of the 3 primary reasons and they need to be filled with substantiating data.

4. Your paper should have a conclusion that reaffirms your position on no idling and summarizes the three reasons.

5. You paper should be easy to read and evidence of editing and revision should be present. You should strive for clarity in your writing.

6. Your paper should be organized with an introductory paragraph, 3 paragraphs, and a concluding paragraph.
Traffic Jams
Grade 5, Science and Math

Length of Lesson:
3 hours 15 minutes

National Standards:
NAAEE Guidelines for Excellence in Environmental Education
Strand 2.4 Human / Environment Interactions

Georgia Performance Standards:
M5D2 - Students will collect, organize, and display data using the most appropriate graph.

M5P4 - Students will make connections among mathematical ideas and to other disciplines.
c. Recognize and apply mathematics in contexts outside of mathematics.

M5P5 - Students will represent mathematics in multiple ways.
c. Use representations to model and interpret physical, social, and mathematical phenomena.

S5CS2 - Students will have the computation and estimation skills necessary for analyzing data and following scientific explanations.
a. Add, subtract, multiply, and divide whole numbers mentally, on paper, and with a calculator.

Focus:
Students will be engaged in simulation and data collection activities to explore how vehicles contribute to the problem of congestion and air pollution in Georgia. In the hands-on simulation, students will collect and analyze data, construct graphs, interpret data and draw conclusions pertaining to traffic. Students will also draw conclusions from self-collected data. Using simple traffic simulation models, students will learn about road capacity, the benefits of using high occupancy vehicles like transit, buses, and vanpools, and pollution-free transportation alternatives. A PowerPoint presentation and other resources are included.

The Clean Air Schools program is helping educate future leaders about air quality and transportation. Learn more at CleanAirCampaign.org.

7/29/2009
Materials:
- Traffic Simulator Key (to be written on chart paper or on board)
- Drawing paper (one sheet per student)
- Set of colored pencils, crayons, or makers (one set per student)
- Traffic Simulation Data Table 1 (one per student)
- Traffic Simulation Data Tables 2-5 (one set per student)
- Soda bottle preforms or narrow jars with lids (one per team of two - four students)
- Large lima beans, kidney beans, black beans, lentils, and split peas or other objects of comparable size (enough to more than fill all preforms or jars)
- Plastic cups (five per team of two - four students)
- Calculator (optional per student)
- School Transportation Plan (three per student)
- Computers with Internet access (optional for extension)

Procedure:
Step One: Teacher Preparation
- Review all steps in this lesson prior to beginning.
- Make one “traffic simulator” for every 2-4 students. A traffic simulator is a soda bottle preform (“baby soda bottle” and cap that can be ordered online - http://www.teachersource.com/Chemistry/PreformsAndSodaBottles/SodaBottlePreformsandCaps_30pk.aspx) or plastic or glass jar (skinny olive jars work well) filled with three kinds of beans of different sizes. To make simulators, place one large lima bean in each preform or jar. This large bean represents a form of mass transit (bus) carrying 55 people. Next, place two black beans in each preform or jar. The black beans represent a carpool with three people in the vehicle. Then, fill the rest of the jar with small kidney beans until it is tightly packed. The kidney beans represent vehicles (cars, trucks and SUVs) carrying one person. Finally, put the top on the preform or jar and seal tightly.
- To go with each traffic simulator you made, you will also need to prepare two small cups of small beans (one with lentils, representing bicycles; the other with split peas representing pedestrians). Later in the lesson, students will be asked to exchange these smaller beans with some of the larger beans in the simulators. (Note: you may use other kinds of beans or...
marbles, beads, etc. instead, but be sure they are of similar variations in sizes.)

- On the board or a piece of chart paper, create a traffic simulator key chart as shown in the attachment below. (Leave blank areas as shown to fill in later.)
- Make one copy of each data table per student (attached in "Student Handout")
- Make three copies of the School Transportation Plan chart per student (attached in "Student Handout")

**Step Two:** Duration - 15 minutes
Ask students if they have ever been in a traffic jam and discuss briefly. Distribute one sheet of blank paper and a set of colored pencils, markers, or crayons to each student and ask them to draw a quick sketch of a traffic jam. Give them three to five minutes to draw and then ask them what they think causes traffic jams. Answers may include "too many vehicles," "not enough people in each vehicle," "not enough lanes or roads," or "accidents." Then tell them to draw something to represent the air quality in the picture. Give them three minutes to complete this and then discuss. Guide students to identify ground-level ozone, nitrogen oxides, and carbon monoxide as the "famous" pollutants that come heavily from cars, trucks and other motor vehicles. Write the chemical symbols for these pollutants (O3, NOx, CO) on the board, naming each one, and have students write these on their drawings if they haven't already. Then write the word "emissions" and explain that the exhaust that comes from car tailpipes is called "emissions;" explain that emissions also come from under the hood of the car when the engine gets hot. Ask students to explain why a traffic jam would cause even more pollution than a large number of cars moving freely. Guide students to understand that cars idling in traffic use fuel inefficiently because they are not moving forward toward their destination.

**Step Three:** Duration - 15 minutes
Write the word “congestion” on the board and ask students to define it; explain how “congestion” is applied to traffic. Tell students that there are people called transportation planners whose job it is to figure out how to get rid of the congestion in cities; these people often use models in their work to get a picture of what traffic might be like in a city. In cities like Atlanta, traffic planners have to think a lot about how to reduce air pollution. Show students a pre-made traffic simulator and
tell them that in this lesson they will be transportation planners using a model called a “traffic simulator.” Divide students into teams of two, three, or four (depending on the number of traffic simulators available). Give each team a simulator and explain that the simulator represents a traffic jam. Explain what each type of bean represents using the Traffic Simulator Key chart (created during Step One - teacher preparation). Have students gently shake their simulators. Ask them what happens. Students should respond that the beans barely move. Ask students why this model is like a highway or street. Point out that it’s a confined space and can only hold a finite amount. When you have too many cars on a highway, the vehicles slow down and can’t move much. When there’s all that congestion, air pollution increases and people waste time.

**Step Four:** Duration - 20 minutes
Explain that this model represents a “rush hour” situation in which people are trying to get to work in the morning. Discuss the size of each “vehicle” and the number of people it can move. Give each student a copy of “Traffic Simulation Data Table 1” (attached in "Student Handout"). Have students open the traffic simulator and count the number of beans/vehicle of each type currently in the simulator. Have them record this data in the Data Table 1. Guide students to determine the mathematical operation for finding out how many total people are carried by each type of vehicle (multiplication) and demonstrate with an example (e.g. 5 buses x 55 people per bus = 275 people carried by buses.) Ask students to calculate the total number of people carried by each type of vehicle and enter this data in Data Table 1. Instruct students to also calculate the total number of vehicles in this scenario as well as the total number of people being moved and write the numbers in the Totals column of Table 1. Tell students to leave the “Pollution Value” row blank for now.

**Step Five:** Duration - 5 minutes
Tell students that, as good transportation planners, we want the beans/vehicles to move about freely so that the people can get where they’re going in a timely fashion and not create excess air pollution. Ask students if there are any other options for getting to work and briefly discuss. (If students suggest trains, planes, or boats, indicate that we are focusing on roads in cities.) Focus on bicycles and walking as two ways people can get to work and write them in on the traffic simulator key in the blank spaces next to lentil and split pea; indicate,
too, that they each carry one person and write that in the "number of people" column. Hand out two additional cups of small beans; one with lentils, representing bicycles, and the other with split pea representing walkers or “pedestrians.” Discuss why these beans are small (a bicycle takes up approximately 1/12 the space a car does); indicate, however, that it takes longer to go far distances by bicycle and even longer to go on foot. In addition, tell students that some employees are allowed to telework which means they can work from home rather than at the office. In this simulation, no more than five people who are represented in the simulators at the beginning will be allowed to telework, so students may take out up to five beans.

**Step Six:** Duration - 20 minutes
Now challenge the students to work in a group using the simulator to find bean combinations that allow the bean “traffic” to move freely but move the maximum number of people possible. Give each team three additional plastic cups to put their extra beans in. Make extra beans of each type available to students as well. Hand out copies of the Traffic Simulation Data Tables 2-5 (attached at "Student Handout" below) to each student. Have the groups work together to try different combinations and shake simulators to determine if the scenario allows for movement of the vehicles and people. After each trial combination, each student should individually record the numbers of vehicle types, bikes, or pedestrians and calculate the number of people moving by each mode of transportation. Students should try at least four different combinations and record their results in Data Tables 2-5. Remind students to calculate the total number of vehicles, bikes, or pedestrians and total number people moved for each scenario and write the numbers in the each table’s “totals” column. Tell students to leave the “Pollution Value” rows blank for now. Each team should then select their “best-case scenario” model that allowed the bean vehicles, bikes, and pedestrians to move most freely while moving the greatest number of people.

**Step Seven:** Duration - 30 minutes
Have each group share their results with the class. Guide students to draw some conclusions as transportation planners about what can be done to reduce traffic jams. Tell students that calculating the number of people moving freely is very important in transportation planning; but planners also have to think about air quality – in fact the Environmental Protection Agency insists that transportation planners in

---

The Clean Air Schools program is helping educate future leaders about air quality and transportation. Learn more at [CleanAirCampaign.org](http://CleanAirCampaign.org).
certain cities use models to calculate pollutants from cars. Tell students that as planners we are going to assign a number to each mode of transportation according to how much pollution it puts out for every person it carries. On the traffic simulator key, write the number “10” in the Pollution Value column in the Car row. Write in "3" for Car Pools, "2" for buses, "0" for bicycles, and "0" for pedestrians. (Note the values are per person; they are rough approximations of proportionate values.) Briefly explain why the number assigned to a carpool is approximately 1/3 as much as for a single-occupancy car and why the number assigned to a bus is very small. Ask students to explain why the number for bicycles and walking is "0." Demonstrate on the board how to calculate the Total Pollution Value by multiplying the number of people carried per vehicle by the pollution value assigned. Work through the pollution value calculations for Table 1 as a class. Have students work in groups to calculate pollution values for at least two of their other trials, including the "best-case scenario" for movement. They should use scratch paper to work out the multiplication. Students should record the totals in the “Pollution Value” row of their data tables. Ask students to share their results with the class.

**Step Eight:** Duration – 90 minutes
Remind students that they were analyzing a morning rush hour situation in which people were going to work. Tell them that often there are traffic jams around schools in the morning and many people are concerned about that. Write the number of students in your school on the board. Tell students that as transportation planners they have been hired to help the school come up with a good plan to get students to school on time, reduce congestion around the school and improve the air quality. Distribute three copies of the “School Transportation Plan” tables (attached in "Student Handout") to each student. Work with students to calculate the current transportation scenario at their school (If possible, obtain numbers of car riders, carpoolers, walkers, bike-riders, and bus riders; if unavailable, estimate the number for each.) Then have students work on their own to calculate the worst-case scenario and the best-case scenario for the school. Place limits as needed according to your school situation; for example, if some students live far distances, indicate that not all students can walk or bike, but define with the class how many might be able to. Tell students that they may use two of the sheets as worksheets for trying out combinations and making calculations and
one sheet will be their final. The final table will be turned in for assessment. Also assign students to construct simple graphs (comparing current, worst, and best case scenarios) based on their data. Also assign students to write an accompanying paragraph identifying the problem and making recommendations to the school principal for the best transportation plan for the school that will reduce congestion and improve air quality. The paragraph should explain why the student is making these recommendations.

**Extension:**
Go to the Georgia Department of Transportation Web site (http://www.georgia-navigator.com/maps/georgia) and have students explore real-time traffic patterns on Georgia highways.

AND/OR

Have students keep a travel log for two weeks. Have them log how they (or a family member) get around. Have them count trips in the car, bus, train, walking, carpooling, or bicycling and graph their results. Have them write a paragraph or letter describing what they did and suggesting how they (or their family member) could change their practices to incorporate more forms of mass transit, car pools or other forms of transport that contribute less to air pollution. They could present this information in class.

**Assessment:**
A rubric for assessing the student's participation in group activities; the student's ability to use data tables and graph data; and the student's ability to explain, evaluate, and propose solutions to a problem in written form.

**Follow-Up:**
After you have taught this lesson plan, please tell the Clean Air Schools program about your efforts in a brief, 60-second online survey at CleanAirCampaign.org. The information you provide is invaluable in helping this non-profit education program direct its resources to improving these lesson plans and creating new materials for your students. Thanks!
The Clean Air Schools program is helping educate future leaders about air quality and transportation.
Learn more at [CleanAirCampaign.org](http://CleanAirCampaign.org).

7/29/2009
<table>
<thead>
<tr>
<th>Traffic Simulation Data Table #1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name:</strong></td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
<tr>
<td><strong>Cars, SUVs, Trucks</strong></td>
</tr>
<tr>
<td><strong>Car Pools</strong></td>
</tr>
<tr>
<td><strong>Buses</strong></td>
</tr>
<tr>
<td><strong>Number of Vehicles:</strong></td>
</tr>
<tr>
<td><strong>Bicycles or Pedestrians</strong></td>
</tr>
<tr>
<td><strong>Number of People</strong></td>
</tr>
<tr>
<td><strong>Pollution Value</strong></td>
</tr>
</tbody>
</table>

**Notes and Calculations:**
### Traffic Simulation Data Table #2

<table>
<thead>
<tr>
<th></th>
<th>Buses</th>
<th>Car Pools</th>
<th>Cars, SUVs, Trucks</th>
<th>Bicycles</th>
<th>Pedestrians</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of Vehicles,</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Bicycles or Pedestrians</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Number of People</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pollution Value</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Traffic Simulation Data Table #3

<table>
<thead>
<tr>
<th></th>
<th>Buses</th>
<th>Car Pools</th>
<th>Cars, SUVs, Trucks</th>
<th>Bicycles</th>
<th>Pedestrians</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of Vehicles,</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Bicycles or Pedestrians</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Number of People</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pollution Value</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Traffic Simulation Data Table #4

<table>
<thead>
<tr>
<th></th>
<th>Buses</th>
<th>Car Pools</th>
<th>Cars, SUVs, Trucks</th>
<th>Bicycles</th>
<th>Pedestrians</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of Vehicles, Bicycles or Pedestrians</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Number of People</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pollution Value</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Traffic Simulation Data Table #5

<table>
<thead>
<tr>
<th></th>
<th>Buses</th>
<th>Car Pools</th>
<th>Cars, SUVs, Trucks</th>
<th>Bicycles</th>
<th>Pedestrians</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of Vehicles, Bicycles or Pedestrians</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Number of People</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pollution Value</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# School Transportation Plan

**Current Transportation Scenario**

<table>
<thead>
<tr>
<th></th>
<th>Students &amp; Staff Traveling to School This Way</th>
<th>Pollution Value Per Person</th>
<th>Estimated Pollution Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus</td>
<td></td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>Car Pool</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Car, SUV, Truck</td>
<td></td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Bicycle</td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Pedestrian</td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>-----</strong></td>
</tr>
</tbody>
</table>

**Worst Transportation Scenario**

<table>
<thead>
<tr>
<th></th>
<th>Students &amp; Staff Traveling to School This Way</th>
<th>Pollution Value Per Person</th>
<th>Estimated Pollution Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus</td>
<td></td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>Car Pool</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Car, SUV, Truck</td>
<td></td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Bicycle</td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Pedestrian</td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>-----</strong></td>
</tr>
</tbody>
</table>

**Best Transportation Scenario**

<table>
<thead>
<tr>
<th></th>
<th>Students &amp; Staff Traveling to School This Way</th>
<th>Pollution Value Per Person</th>
<th>Estimated Pollution Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus</td>
<td></td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>Car Pool</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Car, SUV, Truck</td>
<td></td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Bicycle</td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Pedestrian</td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>-----</strong></td>
</tr>
</tbody>
</table>
The Six Infamous Pollutants
Grade 5; English/Language Arts and Science

Length of Lesson:
2 hours 45 minutes - 4 hours

National Standards:
NAAEE Guidelines for Excellence in Environmental Education
Strand 2.4 Human / Environment Interactions

Georgia Performance Standards:
ELA5LSV2 - The student listens to and views various forms of text and media in order to gather and share information, persuade others, and express and understand ideas.
a. Shapes information to achieve a particular purpose and to appeal to the interests and background knowledge of audience members.
b. Uses notes, multimedia, or other memory aids to structure the presentation.
c. Engages the audience with appropriate verbal cues and eye contact.
d. Projects a sense of individuality and personality in selecting and organizing content and in delivery.
e. Shapes content and organization according to criteria for importance and impact rather than according to availability of information in resource materials.
f. Uses technology or other memory aids to structure the presentation.

ELA5W1 - The student produces writing that establishes an appropriate organizational structure, sets a context and engages the reader, maintains a coherent focus throughout, and signals a satisfying closure. The student
a. Selects a focus, an organizational structure, and a point of view based on purpose, genre expectations, audience, length, and format requirements.
b. Writes texts of a length appropriate to address the topic or tell the story.
c. Uses traditional structures for conveying information (e.g., chronological order, cause and effect, similarity and difference, and posing and answering a question).

The Clean Air Schools program is helping educate future leaders about air quality and transportation.
Learn more at CleanAirCampaign.org.

7/29/2009
Complimentary Standards

**S5CS6** - Students will question scientific claims and arguments effectively.

a. Support statements with facts found in books, articles, and databases, and identify the sources used.

**S5P1** - Students will verify that an object is the sum of its parts.

b. Investigate how common items have parts that are too small to be seen without magnification.

**Focus:**

Fifth grade students work in groups to research and “get to know” the six major air pollutants. Students present information in creative ways to make an invisible and intangible entity (air pollution) a bit more visible and real to them through a “Meet the Pollutants” Press Conference. Students also play a game, similar to tic-tac-toe, which reinforces their knowledge of the six major pollutants.

**Materials:**

- Paper and pencil (per student)
- Newspaper clippings about air quality issues (optional)
- Chart paper and marker
- "Six Infamous Pollutants" poster (attached)
- “Infamous Pollutants Biography” handout (attached; need one per student)
- “Meet the Pollutants Press Conference - Reporter's Notes” handout (attached; need one per student)
- Six computers with Internet access and/or other air pollution reference materials
- X and O Question Cards OR Game Board, Pieces, and Questions for two-person Tic-tac-toe Six Pollutants game. (attached; number of boards, questions, pieces is dependent on how game will be played) Game components should be copied on cardstock
- A variety of art materials for presentation props
- Cardstock and binder ring or other materials for binding the "Air Quality Journal"

**Procedure:**

**Step One:** Teacher Preparation
Review all steps in this lesson prior to beginning. Be sure to collect all the items listed in the materials section, and make copies of hand-outs ahead of time. Please provide each student with a copy of the Assessment Rubric (attached) in the beginning of the lesson, and advise them to save all worksheets and notes to turn in for evaluation. The Student Handout (attached) contains the Pollutant Biography Worksheet, which every student will need a copy of at Step Four. This attachment also includes a Reporter's Notepad, for taking notes on presentations at Step Six. Each notepad page has space for notes on two of the six presentations. Please provide students with three notepad pages, perhaps copied back to back with the Pollutant Biography Worksheet, to save paper.

**Step Two:** Duration - 10 minutes
Write the words “Air Quality” on the board and ask students what they think those words mean. Ask students whether they think the quality of the air in their area is good or bad. How do they know? What evidence is there of air pollution? Have students ever experienced burning eyes or shortness of breath on polluted days? What time of the year does the air seem dirtiest? Tell students that the issue of “air quality;” - how good or bad the air is - is often in the news in Georgia. (Show recent, related news articles if available.) Ask students why there is so much talk about “air quality” guide them to identify the importance of air for living things. Explain that bad air can contribute to a variety of illnesses such as asthma and cancer. Explain that even though air is so very important, and we should know what’s going in and out of our lungs, it’s sometimes hard to grasp because you usually can’t see it, hear it, smell it, touch it, or taste it. It will be the students’ challenge to make invisible air and air pollutants visible and interesting to learn about.

**Step Three:** Duration - 30 minutes
Ask students where air pollution comes from. List their responses on a sheet of flip chart paper or on the board, under the title: “Sources of Air Pollution.” Answers may include: cars, trucks, airplanes, power plants, big factories, fireplaces, and gas stations. Then ask students to identify what air pollution is actually made of; if students can name any of the six major pollutants, applaud them for knowing what so many people don’t know about the air they are breathing. Show
students an enlarged list of the Six Infamous Air Pollutants with shorthand names (make in advance - see attached poster sample). Tell them that there are more pollutants, but that these are the “biggies” and they should be infamous, but many people don’t know anything about them. Tell them that it will be their job to find out to find out as much as they can about the pollutants and be able to share that information with others and make the pollutants “infamous.”

**Step Four:** Duration - 15 minutes

Divide the class into six groups. Distribute the attached “Infamous Pollutant Biography Worksheet” hand-out to each group. Assign one pollutant to each group. Challenge the students to treat the Pollutant as an infamous character about whom they are putting together a biographical sketch. Tell them to use the EPA pollutants and air quality websites for kids, listed on the hand-out, as well as encyclopedias or other resources, to answer the questions and get to know their Pollutant very well. Explain that groups will be preparing this biographical information for a “Meet the Pollutants” Press Conference in which each type of pollutant will be interviewed to find out what they are all about. (Explain that infamous people often hold press conferences and answer questions by reporters). Explain that each person in a group will play a particle of whichever pollutant that group was assigned; each person will speak at the press conference presentation and tell part of the pollutant's life story (based on information from the Student Handout – Infamous Pollutant Biography Worksheet- see attached); and each person in a group should be prepared to answer questions from the "press." The rest of the class will take notes and ask questions, acting as members of the press. Tell students that the groups may use props, special effects, or simple costumes to make the invisible pollutant visible and interesting to others. Mention that props also make good memory devices and help keep a presentation on track. Tell students that each group should have a main point or focus of its presentation, instead of just reciting a list of facts. For instance, a pollutant group could emphasize that their pollutant kills kids, or is the most dangerous, or had a difficult childhood, is not very threatening at all~ and explain how or why. A sample student presentation is included at the end of this document. Please make sure students are referring to the Assessment Rubric while preparing their presentations.
Step Five: Duration 45 – 90 minutes over two days
As students research and develop materials, circulate and assist them as needed. Encourage them to be creative yet scientifically accurate. Emphasize that each member of the group must participate in the presentation, and that each person must fill out his own version of the Infamous Pollutant Biography handout, even if group members collaborate on the research. Allow time for the groups to plan and practice their presentations, after research is complete.

Step Six: Duration – 45 minutes
After students have completed their research and prepared their presentations, set up the classroom for the press conference. Provide a central area for the presenters and an audience area for the rest of the students, who will be acting as reporters. Distribute the Reporter’s Notepad (attached in the Student Handout: each student will need three note pages) and explain that the “reporters” will ask questions, but they must also take good notes: they will be using their notes later. Because students may not be familiar with a press conference format, the teacher will serve as moderator, introducing each Pollutant group, inviting the presentation to start, asking the first question, and guiding the audience to ask subsequent questions. You might want to add some humor by calling the Pollutants by names, such as Ms. CO (carbon monoxide), Mr. Pib (Lead), or Dr. Nox (nitrogen oxide). Limit each pollutant’s entire presentation and interview session to approximately 5 - 10 minutes. After each session, be sure to applaud the presenters and briefly highlight the important points relating to the source of the pollutant, its effects on living things, and what can be done about it. Congratulate the entire class on an exciting press conference and their ability to make invisible things that are hard to grasp much more visible and understandable.

Tell students that many people don’t know much about these Infamous Pollutants and yet they are in contact with them often. Now that the students know the pollutants well, it’s time they share this important knowledge with others. Assign students to choose three of the six major air pollutants and write an article for the “Air Quality Journal” using notes from their Infamous Pollutant Biography.
The Clean Air Schools program is helping educate future leaders about air quality and transportation. Learn more at CleanAirCampaign.org.

Worksheet and Reporter's Notepad (press conference notes). The article must be at least three paragraphs long, describing where the pollutants come from and how they are caused, their effects on living things, and what can be done about them. In addition to telling about each pollutant, the article must compare the three pollutants, pointing out similarities and differences, and must make a main point (such as which pollutant is worst, which affects students in your community most, or which presents a problem students have the power to help solve). The article will differ in point of view from the press conference presentations, which were conducted "in character." For purposes of this article, students should write as junior scientists. Please refer students to their copies of the Assessment Rubric for additional information on criteria for this assignment. The articles may be started in class and continued as a homework assignment. After they are submitted, bind the articles into a “magazine” and entitle it “Air Quality Journal.” You may wish to add newspaper clippings and other pertinent information to the Journal as the class proceeds through the Air Quality unit. Please remind students that their Pollution Biography Worksheets and Reporter's Notepads should also be turned in, along with the self-assessment on the Assessment Rubric.

**Step Seven:** Duration - 30 minutes (optional)
Tell students they are now going to play a game that will help them get to know all of the Six Infamous Air Pollutants better. This Tic Tac Toe game is similar the "Hollywood Squares" game on T.V. Nine students are seated in the middle of the classroom in three rows of three; six are the Infamous Pollutant personalities from above (you may want to have a different student represent the pollutant), one is Ms./Mr. Earth, one is Ms./ Mr. Dir. T. Air, and another is Dr. Haze. The remainder of the students are divided into two teams, one “X” and the other "O". A student or the teacher may serve as the “Game Show Host.” A player from the X team chooses one of the “celebrities” to answer a question. The host reads a question from an X card and the “celebrity” answers, giving either a correct or an incorrect answer. The X player must decide if the answer given by the celebrity is correct or incorrect; if s/he is accurate, the X team wins the square and the host gives an X card to the celebrity to hold. This is repeated with the O team and continued until one team makes a Tic Tac Toe or the board is filled. OR If the class works better in smaller groups, divide the class
into multiple teams of two students each. Give each team of two a Tic-Tac-Toe Game Board card, "X" and "O" Game Pieces, and "X" and "O" Question cards. Have students cut out the questions and game pieces. (You may wish to laminate the game cards, pieces and game board card for future use and store in a plastic baggie.) Tell them the game is played like Tic-Tac-Toe except they must answer a question correctly before they can claim a space. The "X" player asks questions from the "X" Question card(s) of the "O" player. Similarly, the "O" player asks the "X" player questions off the "O" Question card(s). A player can only place his/her piece on the Game Board card when (he/she) answer(s) the question correctly. Game board, pieces, and questions are attached. Note: This step may be skipped if time is limited or students do not need the reinforcement.

**Step Eight:** Duration – 10 to 40 minutes
Tell students that many people don’t know much about these Infamous Pollutants and yet they are in contact with them often. Now that the students know the pollutants well, it’s time they share this important knowledge with others. Assign students to choose three of the six major air pollutants and write an article for the “Air Quality Journal.” The article must be at least three paragraphs long, describing, at the least, where the pollutants come from, their effects on living things, and what can be done about them. Students may illustrate the article if they wish. This may be done in-class or as a homework assignment. After the editing process, bind the articles into a “magazine” and entitle it “Air Quality Journal.” You may wish to add newspaper clippings and other pertinent information to the Journal as the class proceeds through the Air Quality unit.

**Assessment:**
At the end of the lesson, students will turn in all work products, including the Pollutant Biography Worksheet, Press Conference Reporter’s Notes, and Air Quality Journal article, for assessment. In addition, the teacher will observe and assess research methods and group presentations. Criteria for evaluating all student work is included in the Assessment Rubric. The rubric also includes a Self-Assessment checklist. Please distribute a copy of rubric to each student at the beginning of this lesson.
Follow-Up:
After you have taught this lesson plan, please tell the Clean Air Schools program about your efforts in a brief, 60-second online survey at CleanAirCampaign.org. The information you provide is invaluable in helping this non-profit education program direct its resources to improving these lesson plans and creating new materials for your students. Thanks!

Student Work Sample:

**Infamous Pollutant Biography**

Name of Pollutant: **Nitrogen Oxides** (Dr. Nox)

1) What do you look like?

There are actually lots of nitrogen oxides in my family. I am colorless and you can’t smell me either. But there are some in my family that look kind of red-brown when they hang over cities. (* Student might sprinkle red-brown dust to illustrate or show a picture with red-brown hanging over a city.)

2) Where do you come from?

I come from things that burn fuel – like cars (* Student might show picture of cars or tailpipes and/or make the sound of a car engine revving). I also come from factories (show a picture of smokestack) and from utilities like electric power plants (student might flash the classroom lights.)

3) Where do you hang out?

I’m a traveler – I blow on the wind (student blows or waves a large cloth). I like to hang out over cities, but I can spread far and wide.
4) What problems do you cause for humans and other living things?

Lots! I can mix with other things called volatile compounds and heat and sunlight to make ozone and that can damage human lungs. (Student holds picture of lungs.) I can also mix with particles and cause problems to the lungs.

I can mix with sulfur dioxide and make acid rain. (Sound of rain or picture of rain) That can make damage crops and fish and other things in the water.

I can also add extra nitrogen to the water and that messes up lakes and streams. (Hold up bottle of water or show picture of lake.)

Some of my family members work on global warming - -making the earth heat up. And that changes the whole climate everywhere (act out feeling very hot or show picture of global warming)

I can also mix with other things and make poison! (Show skull and cross bones.) And sometimes I make it hard for people to see things clearly because I block the sunlight (squint).

5) What are humans doing to stop you from doing more harm?

They made a law called the Clean Air Act to try to stop the factories and the electric companies from making so much of me. They’re trying to make cleaner burning fuel for cars (quieter sound of engine revving). And some humans aren’t driving cars as much – they ride buses, walk to places, or ride bikes. (Act out walking and biking). But right now, I’m still pretty powerful! (Show muscles.)
The Clean Air Schools program is helping educate future leaders about air quality and transportation. Learn more at [CleanAirCampaign.org](http://CleanAirCampaign.org).

7/29/2009

### Six Infamous Pollutants Assessment Rubric

Name: __________________________

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Self-Assessment</th>
<th>Value</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conducted research, using Web sites and/or texts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- researched using reliable Internet sites or texts</td>
<td></td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Completed Pollutant Biography worksheet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- made notes that will be useful in preparing for Pollutant Press Conference</td>
<td></td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>- identified / description of pollutant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- origins (cause / where it comes from)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- location (where + when usually found)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- effects (problems, adverse impact)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- solutions (how humans can reduce this form of pollution and/or protect themselves from it)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contributed to group presentation</td>
<td></td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>- presented from point of view of pollutant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- individuality/personality shown (“in character”)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- engaging (eye contact, audience connection)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- used props, special effects to make order of presentation easier for presenter to remember</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- info level appropriate for audience knowledge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- made a main point effectively; had a focus (i.e. worst pollutant in the bunch or not really a threat or presents special danger to little kids)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recorded notes from press conference (6 parts)</td>
<td></td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>- took notes on five pollutants (other than own)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wrote article for Air Quality Journal</td>
<td></td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>- article written as for a science journal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- length appropriate (3 graph min.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- conveyed information content effectively</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- identified causes and effects of 3 pollutants</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- compared pollutants (similar / different)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- had a focus or main point (i.e. Which pollutant is worst? What is the most effective thing people can do to fight pollution? How can people protect themselves from pollution effects? etc)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bonus - completed self-assessment column</td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100+</td>
<td></td>
</tr>
</tbody>
</table>
The Clean Air Schools program is helping educate future leaders about air quality and transportation. Learn more at CleanAirCampaign.org.
The Clean Air Schools program is helping educate future leaders about air quality and transportation.

Learn more at CleanAirCampaign.org.

7/29/2009
SIX INFAMOUS AIR POLLUTANTS
TIC-TAC-TOE BOARD


The Clean Air Schools program is helping educate future leaders about air quality and transportation.
Learn more at CleanAirCampaign.org.
The Clean Air Schools program is helping educate future leaders about air quality and transportation. Learn more at CleanAirCampaign.org.
**SIX INFAMOUS POLLUTANTS**
**TIC-TAC-TOE**

<table>
<thead>
<tr>
<th>“X”- CARDS</th>
<th>“X”- CARDS</th>
<th>“X”- CARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>What type of pollutant includes microscopic particles and tiny droplets of liquid? Answer: particulate matter</td>
<td>During the summer in large urban areas like Atlanta, which pollutant causes the most air pollution? Answer: ground-level ozone</td>
<td>What is the major harmful ingredient in smog? Answer: ground-level ozone</td>
</tr>
<tr>
<td>What pollutants contribute to health problems? Answer: all of them</td>
<td>What are the six major pollutants? Answer: ground level ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter, lead</td>
<td>What pollutant does this describe: Larger types can be stopped in the nose and upper lungs by the body’s natural defenses. The smallest types escape the body’s defenses and go deep into the lungs, where they may become trapped. Answer: particulate matter</td>
</tr>
<tr>
<td>Which pollutant can travel great distances on air currents? Answer: nitrogen oxides</td>
<td>Name three air pollutants that will be reduced if people drive less? Answer: ozone, carbon monoxide, and nitrogen oxides</td>
<td>Which pollutant stops oxygen from getting to the body’s organs? Answer: carbon monoxide</td>
</tr>
</tbody>
</table>


Learn more at [CleanAirCampaign.org](http://CleanAirCampaign.org).

7/29/2009
The Six “Infamous” Air Pollutants

* Ozone \((O_3)\)

* Carbon Monoxide \((CO)\)

* Nitrogen Oxides \((NOx)\)

* Sulfur Dioxide \((SO_2)\)

* Particulate Matter \((PM)\)

* Lead \((Pb)\)
**Infamous Pollutant Biography**

Name of Pollutant: _________________________________

What do you look like?

Where do you come from?

Where do you hang out?

What problems do you cause for humans and other living things?

What are humans doing to stop you from doing more harm?

“Special effects,” props or costume for press conference:

Two possible sources of information are:

http://www.epa.gov/air/urbanair/6poll.html
http://www.epa.gov/airnow/aqikids/index.html

---

The Clean Air Schools program is helping educate future leaders about air quality and transportation. Learn more at [CleanAirCampaign.org](http://CleanAirCampaign.org).

7/29/2009
Meet the Pollutants Press Conference – Reporter’s Notes

Pollutant Name: ____________________________________________________________

What does it look like?

Where is it from?

Where does it hang out?

What problems does it cause?

What is being done about it?

****************************************************************************************************

Pollutant Name: ____________________________________________________________

What does it look like?

Where is it from?

Where does it hang out?

What problems does it cause?

What is being done about it?

****************************************************************************************************