# Discovering the Connection:

# Your Environment, Your Health

*Afterschool Science Club Curriculum for Middle School Students*

## Unit 2: Air Quality

Developed by K-12 Specialized Information Services group,
National Library of Medicine, National Institutes of Health

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# About Discovering the Connection: Your Environment, Your Health

## Purpose of the Curriculum

*Discovering the Connection: Your Environment, Your Health* uses the Tox Town Web site (toxtown.nlm.nih.gov) developed by the National Library of Medicine (NLM) to introduce middle school students to environmental health issues in everyday life. The curriculum includes information and laboratory research and communication activities, stressing the relevance of science to informed citizenship and integrating science, society, and literacy. The curriculum is for an afterschool club, but can also be used in the science classroom. The curriculum is based on National Science Education Standards.

### Teaching and Learning Approaches

The curriculum uses inquiry-based learning and problem-based learning approaches. These are student-centered approaches that promote in-depth understanding and critical thinking by fostering students' active engagement with the subject matter. Students develop content knowledge and scientific reasoning skills through collaborative work on real world problems. They explore ideas, formulate meaningful questions, collect and analyze data, and evaluate and communicate their findings.

### Tox Town Web Site

Tox Town (toxtown.nlm.nih.gov) is visually engaging and is an authoritative, reliable educational Web site, dedicated to highlighting the connections among chemicals, the environment, and the public's health.

### Curriculum Development Team

This effort was initiated and coordinated by the NLM K-12 Specialized Information Services group. The NLM, one of the institutes of the National Institutes of Health (NIH), has been a center of information innovation since its founding in 1836. The K-12 group develops authoritative resources for a variety of science education areas, coordinates outreach to educators and school health professionals, and conducts research into teaching and learning.

The working group for this curriculum consists of: the NLM K-12 staff; Daniel M. Levin, a professor of science education from the University of Maryland College of Education; and five teachers from Montgomery County, MD, and the District of Columbia. The teachers are Jacquelyn Geer (science), Maura Hinkle (science), Sandra Garner (language arts), Kelley Knox (social studies), and Berneatta Barnes (science).

## Curriculum Overview and Suggested Use

The curriculum contains six units. Each unit introduces one environmental health topic and includes three or four 50-60 minute lessons in the following format:

- Topic introduction and information research activity using Tox Town;
- Hands-on experiment or activity reinforcing understanding, conducted with simple materials; and
- Communication and social action activity where students share their understanding of the topic with others and translate their understanding into actions.

The units can be used sequentially or individually to support the existing middle school science curriculum. They can also be used to support the science/society connection in the social science or language arts classroom. The entire curriculum was pilot-tested as an afterschool club at the Cabin John Middle School, Montgomery County, MD.

## The Six Units of the Curriculum

1. ***Water Quality:*** Introduces students to drinking water quality issues and the water treatment process. Includes experiments where students test school drinking water, compare it with water from other sources, and communicate the findings to the school community.
2. ***Air Quality:*** Introduces students to air quality issues and the impact of air pollution on human health. Students test air quality in several locations in and around the school.
3. ***Chemicals in Your Home:*** Informs students about potentially toxic chemicals in common products and introduces safer alternatives.
4. ***Food Safety:*** Introduces students to biological, chemical, and physical contaminants in food. Uses an experiment to teach safe food handling.
5. ***Runoff, Impervious Surfaces, and Smart Development:*** Introduces students to the relationship among runoff, water pollution, and human health. Also introduces the idea of responsible development.
6. ***The Great Debate: Bottled Water vs. Tap Water in Our School:*** Students perform research about pros and cons of different sources of drinking water, engage in a debate, and develop persuasive arguments to advocate for bottled or tap water as a primary source of drinking water in the school.

## Symbols Used in This Curriculum

 – information research via Tox Town

 – lab experiment

 – hands-on activity

 – communication and social action activity

 – excerpt from student handouts in teacher directions

# Unit 2: Air Quality

## Table of Contents

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# Unit 2: Air Quality

## Unit Overview

This unit uses the Tox Town Web site (toxtown.nlm.nih.gov) developed by the National Library of Medicine to introduce students to environmental health issues in their everyday life through *inquiry-based learning* and *problem-based learning* approaches. Inquiry-based learning is a student-centered approach that promotes in-depth understanding and critical thinking by fostering students' active engagement with the subject matter. Students explore ideas, formulate meaningful questions, collect and analyze data, and evaluate and communicate their findings. Problem-based learning is another student-centered approach, where students develop content knowledge and scientific reasoning skills through collaborative work on real world problems.

### National Science Education Standards

**E.C.3 Organisms and Environments**

c. All organisms cause changes in the environment where they live. Some of these changes are detrimental to the organism or other organisms, whereas others are beneficial.

**H.F.4 Environmental Quality**

a. Natural ecosystems provide an array of basic processes that affect humans. Those processes include maintenance of the quality of the atmosphere, generation of soils, control of the hydrologic cycle, disposal of wastes, and recycling of nutrients. Humans are changing many of these basic processes, and the changes may be detrimental to humans.

### Unit Objectives

At the end of this unit, students will be able to:

- Identify at least five air pollutants; discuss their sources, locations, and health effects
- Evaluate the occurrence of particulate matter in indoor and outdoor air in and around the school
- Communicate their findings about the occurrence of particulate matter to the community

### Essential Questions

How does air pollution affect human health?

What human activities impact air quality?

### Technology Education Skills

Students will use computer resources to explain how air pollution can affect human health.

# L 2.1 What's in My Air?

## L 2.1.1 Objectives, Materials, and Teacher Preparation

### Objectives

Students will be able to:

- Describe how different pollutants affect air quality
- Identify where air pollutants can be found in the environment and discuss their sources

### Materials Needed for Lesson

- Dirty furnace or air filter
- Computers with Internet access
- *What's in My Air? Student Activity Sheet* (H 2.1.1)

### Teacher Preparation

1. Prepare copies of *What's in My Air? Student Activity Sheet* (H 2.1.1).
2. Find and bring a dirty furnace or air filter to show the students.
3. Ensure access to computers with Internet connection (for accessing Tox Town, toxtown.nlm.nih.gov).

## L 2.1.2 Activator

### Teacher Directions

1. Allow students to have a close look at the dirty furnace or air filter and ask them to describe what they see.
2. Have a small group discussion about their observations and introduce the concept of air pollution.
3. Explain that the dirt and particles found on the filter come from particulate matter (also called particle pollution), a pollutant found both inside and outside the home.
4. Ask students to give examples of other substances that pollute the air and impact human health (e.g., cigarette smoke, exhaust from cars, smoke from smoke stacks of industrial plants, etc.).

## L 2.1.3 Activity

### Teacher Directions

1. Assign students to working pairs or groups, or instruct them to work individually.
2. Distribute *What's in My Air? Student Activity Sheet* (H 2.1.1) and go over the explanation and the instructions. Emphasize the following:

There are many kinds of air pollutants. The Environmental Protection Agency (EPA) calculates the Air Quality Index (AQI) for five major air pollutants regulated by the Clean Air Act: ground-level ozone, particle pollution (particulate matter), carbon monoxide, sulfur dioxide, and nitrogen dioxide. Ozone and particle pollution (particulate matter) are two common pollutants found in many parts of the country.

3. Instruct students to complete the chart on the *What's in My Air? Student Activity Sheet* (H 2.1.1) using the Tox Town Web site (toxtown.nlm.nih.gov).
4. Let the students know that the five pollutants located on the chart are the five pollutants used by the EPA to measure air quality.

5. After students have completed their worksheets, ask them to reflect upon what they learned about each pollutant. Use L 2.1.3.1 *Teacher Sample Answer Key* below to scaffold the discussion.

## L 2.1.3.1 Teacher Sample Answer Key

For *What's in My Air? Student Activity Sheet* (H 2.1.1)

| Air Pollutant | How can I be exposed? | Impact on my health |
|---|---|---|
| Particulate Matter | Outdoors by breathing polluted air that contains it; in the summer, when the sun and hot temperatures react with pollution to form smog; at home or at work, indoors or outdoors, through smoking cigarettes or breathing second-hand smoke. | Exposure can aggravate respiratory conditions such as asthma. It can also cause increased coughing, wheezing, respiratory irritation, and painful breathing. |
| Nitrogen Oxides (Nitrogen Dioxide and Nitric Oxide) | Outdoors by breathing air that contains it, especially if you live near a coal-burning electric power plant or areas with heavy motor vehicle traffic.<br><br>***Note:*** *Teachers can also mention that humans can be exposed to nitrogen oxides from tobacco smoke and second-hand smoke. Low-level exposure may occur from kerosene heaters, stoves, and fireplaces that burn wood.* | Exposure to high industrial levels of nitric oxide and nitrogen dioxide can cause death. It can cause collapse, rapid burning and swelling of tissues in the throat and upper respiratory tract, difficult breathing, throat spasms, and fluid build-up in the lungs. It can interfere with the blood's ability to carry oxygen through the body, causing headache, fatigue, dizziness, and a blue color to the skin and lips. |
| Ground-Level Ozone | Outdoors in the summer, when the sun and hot temperatures react with pollution to form ozone; if you exercise or work outdoors during the summer. | Exposure to ozone can irritate your respiratory system, causing you to cough, feel irritation in your throat, or feel uncomfortable in your chest. Breathing ozone can cause headache, upset stomach, congestion, fatigue, and vomiting. |
| Sulfur Dioxide | Outdoors by breathing air that contains it, most likely in the summer, when the sun and hot temperatures react with pollution to form smog; through natural pollution sources, such as plant decay and volcanoes. | Breathing sulfur dioxide can irritate the nose, throat, and lungs and cause coughing and shortness of breath. Short-term exposure to sulfur dioxide can cause stomach pain, menstrual disorders, watery eyes, inhibition of thyroid function, loss of smell, headache, nausea, vomiting, fever, convulsions, and dizziness. |
| Carbon Monoxide | Motor vehicle exhaust; appliances at home that burn fuel but are not operating correctly; if your appliances are not vented; if your chimneys, vents, and flues are blocked or damaged; leaving your car running in a garage; using stoves or clothes dryers for heating your home; breathing tobacco smoke; burning charcoal or using portable fuel-burning camping equipment inside your home, garage, vehicle, or tent; using gasoline-powered tools and engines indoors. | Exposure can cause fatigue, chest pain, shortness of breath, memory loss, skin lesions, sweating, and flu-like symptoms. In the long term, exposure to low levels can cause heart disease and damage to the nervous system. Skin contact with liquid carbon monoxide in the workplace can cause frostbite.<br><br>***Note:*** *Teachers can also mention that accidental CO poisoning kills a few hundred people a year.* |

# L 2.2 How Clean Is Your Air? Lab Activity, Part 1

## L 2.2.1 Objectives, Materials, and Teacher Preparation

### Objectives

Students will be able to:

- Hypothesize about locations in and around the school that have the greatest occurrence of particulate matter
- Set up an experiment to observe the amount of particulate matter in and around the school

### Materials Needed for Lesson

- Vaseline
- Index cards (4x6) with a hole punched in a corner
- String
- Glass slides
- Permanent markers
- Heavy-duty tape
- Pennies
- Images of household dust, dust mites, and mold under a microscope (e.g., from the Internet image search)
- *How Clean Is Your Air? Part 1 Lab Overview/Procedures* (H 2.2.1) handout

### Teacher Preparation

1. Prepare copies of *How Clean Is Your Air? Part 1 Lab Overview/Procedures* (H 2.2.1).
2. Use the Internet to find images of dust, dust mites, and mold under a microscope.
3. Create a lab kit for each student group that will be participating in the activity. Each kit should contain the following: a small Vaseline container, three strings, a permanent marker, three index cards with holes punched in the corner, three glass slides, heavy-duty tape, and a penny.

## L 2.2.2 Activator

### Teacher Directions

1. Explain to the students that they will be participating in an experiment to determine the amount of particulate matter found in the air in and around their school.
2. Ask students "Where do you think we will find the most particulate matter within our school community?" This can include indoor or outdoor locations.
3. Discuss with the students why they believe that some locations may have more particulate matter than others.
4. Using a computer or paper printouts, show the students images of dust, dust mites, and mold to give them a visual representation of what they can find.

## L 2.2.3 Activity (How Clean Is Your Air? Lab, Part 1)

### Teacher Directions

1. Divide students into small groups and distribute a lab kit to each group.
2. Ask students to brainstorm locations in and around the school where they would like to measure particulate matter. Create a list of student responses on a whiteboard. Ask each group to choose one location (groups' selections should not overlap). Tell students that they will collect three samples of particulate matter at that location.

   ***Note:*** If some of the chosen locations are outdoors, you may want to check the weather forecast for the chance of rain or snow and plan accordingly.
3. Instruct the groups to open their kits. Ask students to label the back of each card with the location name and sample number, e.g., "Media room, Sample 1."
4. Have students read the following instructions from *How Clean Is Your Air? Part 1 Lab Overview/Procedures* (H 2.2.1), which are as follow:

1. Tie a string through the hole in each card to make loops for hanging cards in chosen locations.
2. Using a permanent marker, trace the outline of a penny onto a glass slide in order to create your sample area.
3. Securely tape the edges of the slide to the center of one of your index cards.
4. Smear a thin layer of Vaseline on the sample area on the glass slide.
5. Repeat steps 2-4 for the remaining cards.
6. As a group, take your index cards to your chosen location and find three secure places to hang or place your cards for collecting your samples.
7. Leave your index card at its location until the next session.

# L 2.3 How Clean Is Your Air? Lab Activity, Part 2

## L 2.3.1 Objectives, Materials, and Teacher Preparation

### Objectives

Students will be able to:

- Conduct an experiment to observe the amount of particulate matter found in and around their school
- Analyze and interpret the results

### Materials Needed for Lesson

- Glass slides with collected samples of particulate matter
- Magnifying glass and/or microscope
- Images of household dust, dust mites, and mold under a microscope (e.g., from the Internet image search)
- *How Clean Is Your Air? Part 2 Lab Overview/Procedures* (H 2.3.1) handout
- *How Clean Is Your Air? Lab Results Sheet* (H 2.3.2) handout
- *How Clean Is Your Air? Lab Rubric* (H 2.3.3) handout

### Teacher Preparation

1. Prepare copies of *How Clean Is Your Air? Part 2 Lab Overview/Procedures* (H 2.3.1), *How Clean Is Your Air? Lab Results Sheet* (H 2.3.2), and *How Clean Is Your Air? Lab Rubric* (H 2.3.3).
2. Set up microscopes or magnifying glasses at group tables around the room.

## L 2.3.2 Activity (How Clean Is Your Air? Lab, Part 2)

### Teacher Directions

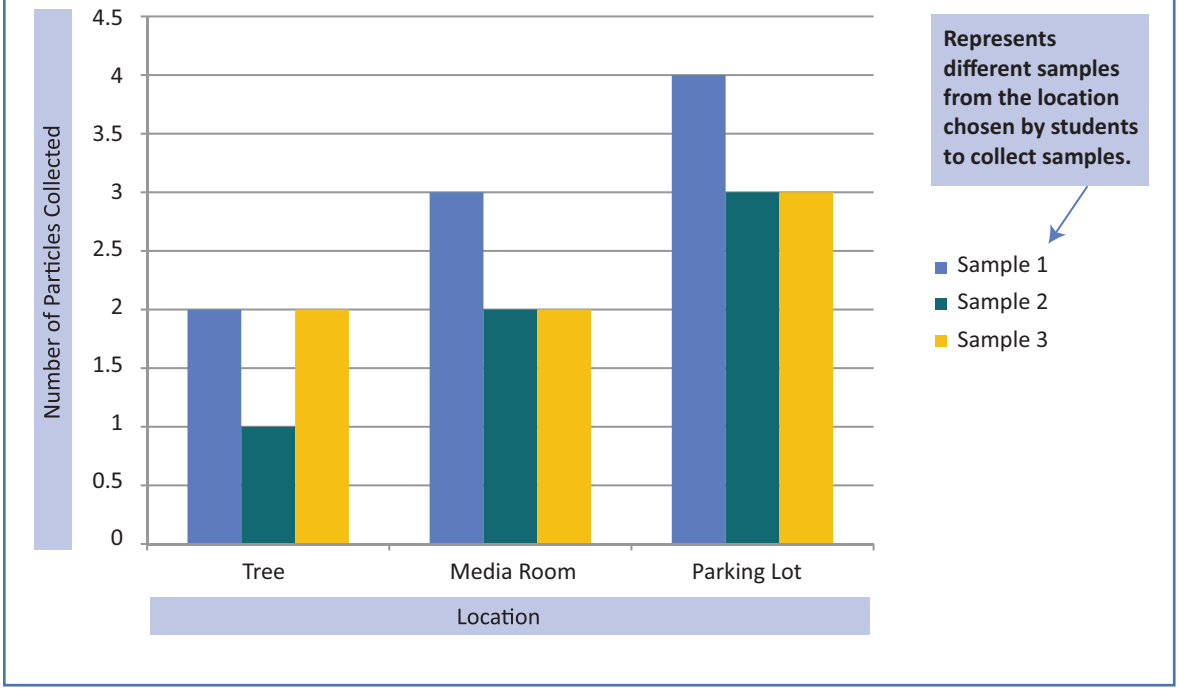
1. Remind students to work with their original groups from Part 1 of the lab.
2. Have students read the following instructions from *How Clean Is Your Air? Part 2 Lab Overview/Procedures* (H 2.3.1):

1. Carefully collect your index cards from their locations, making sure not to touch the Vaseline-covered sample area. Bring your index cards to your group's workstation where you have either a magnifying glass or a microscope.
2. Carefully remove the glass slide from the Sample 1 index card. If using a microscope, hold the slide by the edges, making sure not to touch the sample area, and place it under the microscope. If using a magnifying glass, carefully place the index card with the slide on a flat surface for examination.
3. Using either a microscope or a magnifying glass, count the number of particles in the sample size found inside the Vaseline-covered collection area. A particle is any speck on the slide. It may be dust, pollen, or some other type of matter. If using a microscope and the Vaseline-covered area does not fit within the microscope field, count the particles in the microscope field only.
4. Record the number of particles you counted in the *How Clean Is Your Air? Lab Results Sheet* (H 2.3.2) data table. Make sure your location is labeled in the corresponding row of the table.
5. Repeat steps 2-4 for the remaining two samples collected by your group.

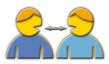
6. Compute the average number of particles collected from your samples.
7. After computing the average at your workstation, move to the next workstation and record the data for the three samples at that workstation. Compute the average. Repeat for each workstation in the room. (***Teacher Note:*** Instruct students to move in a structured rotation to avoid confusion.)
8. After completing your data table, construct a bar graph of the data using three locations: your group's location and two other locations from the data table. Remember to label the axes on your graph.

3. Prepare a sample bar graph to show what the students' results should look like (see Figure 1 below).

**Figure 1. Sample Bar Graph of the Results**




4. After students construct the bar graphs, ask students to analyze their data using the questions found at the end of the *How Clean Is Your Air? Lab Results Sheet* (H 2.3.2).
5. Ask students to complete the lesson rubric *How Clean Is Your Air? Lab Rubric* (H 2.3.3).
6. Initiate a discussion using the following questions:
   - What were the similarities in their findings?
   - What were the differences in their findings?
   - How might the placement of their slides affect their results?
   - Do they have any ideas for ways to reduce the particulate matter in and around their school?

# L 2.4 Stick with Clean Air  

## L 2.4.1 Objectives, Materials, and Teacher Preparation

### Objectives

Students will be able to:

- Understand what actions individuals and societies can take to improve air quality
- Communicate ways to improve air quality to their community

### Materials Needed for Lesson

- Computers with Internet access
- Colored pencils/markers
- Medium-sized flat magnets
- White glue
- Cardstock/construction paper
- *Stick with Clean Air Student Activity Sheet* (H 2.4.1)

### Teacher Preparation

1. Prepare copies of *Stick with Clean Air Student Activity Sheet* (H 2.4.1).
2. Ensure access to computers with Internet connection (for accessing Tox Town, toxtown.nlm.nih.gov).

## L 2.4.2 Activator

### Teacher Directions

1. Ask students to brainstorm actions people can take to improve indoor and outdoor air quality (prompt students to discuss personal steps, such as replacing air filters, and societal actions, such as supporting public transportation). Write down their ideas on a whiteboard or chart paper.

## L 2.4.3 Activity

### Teacher Directions:

1. Divide students into small groups.
2. Distribute *Stick with Clean Air Student Activity Sheet* (H 2.4.1) to each group.
3. Instruct each group to select three ideas from the list on the whiteboard or chart paper.
4. Ask each group to list its three ideas in the table on the *Stick with Clean Air Student Activity Sheet* (H 2.4.1) and find at least two supporting details for each idea using the following links:

   **Link:** Improving Indoor Air Quality (Environmental Protection Agency) - epa.gov/iaq/is-imprv.html

   **Link:** Improving Air Quality in Your Community (Environmental Protection Agency) - epa.gov/air/community

   **Link:** Tox Town (National Library of Medicine) - toxtown.nlm.nih.gov
5. Refer students to the magnet templates on the *Stick with Clean Air Student Activity Sheet* (H 2.4.1). Instruct them to create a magnet that promotes one or more of their ideas for improving air quality.
6. Have groups present their magnets and supporting ideas for improving air quality.

## Helpful Web Sites for Teachers

1. **Air Now (Environmental Protection Agency)** – defines the Air Quality Index that is frequently referenced in the news
   airnow.gov/index.cfm?action=aqibasics.aqi
2. **Air Now Kids' Page (Environmental Protection Agency)** – includes games
   airnow.gov/index.cfm?action=aqikids.index
3. **Particulate Matter (Environmental Protection Agency)** – general information on particulate matter
   epa.gov/pm
4. **Environmental Health Student Portal (National Library of Medicine)** – information about air pollution and human health for middle school students
   kidsenvirohealth.nlm.nih.gov
5. **AQI Air Quality Index: A Guide to Air Quality and Your Health (Environmental Protection Agency)** – information on the Air Quality Index and human health effects of air pollutants
   epa.gov/airnow/aqi_brochure_08-09.pdf

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# Student Handouts

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# H 2.1.1 What's in My Air? Student Activity Sheet

Name(s): _____ Date: _____

**What Is Air Pollution?** We get the oxygen we need by breathing air; it's a natural thing. We don't usually stop to think about what's in the air. However, besides elements like oxygen and nitrogen, the air we breathe may also contain pollutants. Air pollution is a problem that affects life all over the world. For example, you saw the pollutants that were collected on the dirty air filter. We can see these pollutant particles once they have accumulated on the filter, but we do not always see them in the air.

There are many kinds of air pollutants. The Environmental Protection Agency (EPA) calculates the Air Quality Index (AQI) for five major air pollutants regulated by the Clean Air Act: ground-level ozone, particle pollution (particulate matter), carbon monoxide, sulfur dioxide, and nitrogen dioxide. Ozone and particle pollution (particulate matter) are two common pollutants found in many parts of the country.

Many human activities create air pollution. In turn, the pollution causes problems for the health of humans and other life on our planet. To slow down that process, we can learn about what causes poor air quality and how to protect our life on Earth.

Here is your chance to learn more about air pollution. Check out Tox Town at toxtown.nlm.nih.gov and investigate all the different things you can breathe and how they can affect you.

| Air Pollutant | How can I be exposed? | Impact on my health |
|---|---|---|
| Particulate Matter | | |
| Nitrogen Oxides (Nitrogen Dioxide and Nitric Oxide) | | |
| Ground-Level Ozone | | |
| Sulfur Dioxide | | |
| Carbon Monoxide | | |

# H 2.2.1 How Clean Is Your Air? Part 1 Lab Overview/Procedures

Name(s): _____ Date: _____

## Objective

In this experiment you will test the quality of air by measuring the number of particles from different locations.

## Testable Question

How does the testing location (indoors or outdoors) affect the amount of particulate matter collected on the index card samples?

## Materials

- Vaseline
- Three index cards (4x6) with a hole punched in a corner
- Three strings
- Three glass slides
- Permanent marker
- Heavy-duty tape
- A penny

## Procedure

1. Tie a string through the hole in each card to make loops for hanging cards in chosen locations.
2. Using a permanent marker, trace the outline of a penny onto a glass slide in order to create your sample area.
3. Securely tape the edges of the slide to the center of one of your index cards.
4. Smear a thin layer of Vaseline on the sample area on the glass slide.
5. Repeat steps 2-4 for the remaining cards.
6. As a group, take your index cards to your chosen location and find three secure places to hang or place your cards for collecting your samples.
7. Leave your index card at its location until the next session.

# H 2.3.1 How Clean Is Your Air? Part 2 Lab Overview/Procedures

Name(s): _____ Date: _____

## Objective

In this experiment you will test the quality of air by measuring the number of particles from different locations.

## Testable Question

How does the testing location (indoors or outdoors) affect the amount of particulate matter collected on the index card samples?

## Materials

- Magnifying glass and/or microscope

## Procedure

1. Carefully collect your index cards from their locations, making sure not to touch the Vaseline-covered sample area. Bring your index cards to your group's workstation where you have either a magnifying glass or a microscope.
2. Carefully remove the glass slide from the Sample 1 index card. If using a microscope, hold the slide by the edges making sure not to touch the sample area, and place it under the microscope. If using a magnifying glass, carefully place the index card with the slide on a flat surface for examination.
3. Using either a microscope or a magnifying glass, count the number of particles in the sample size found inside the Vaseline-covered collection area. A particle is any speck on the slide. It may be dust, pollen, or some other type of matter. If using a microscope and the Vaseline-covered area does not fit within the microscope field, count the particles in the microscope field only.
4. Record the number of particles you counted in the *How Clean Is Your Air? Lab Results Sheet* (H 2.3.2) data table. Make sure your location is labeled in the corresponding row of the table.
5. Repeat steps 2-4 for the remaining two samples collected by your group.
6. Compute the average number of particles collected from your samples.
7. After computing the average at your workstation, move to the next workstation and record the data for the three samples at that workstation. Compute the average. Repeat for each workstation in the room.
8. After completing your data table, construct a bar graph of the data using three locations: your group's location and two other locations from the data table. Remember to label the axes on your graph.

# H 2.3.2 How Clean Is Your Air? Lab Results Sheet

Name(s): _____ Date: _____

## Directions:

1. Record the number of particles you counted in the data table below. Make sure your locations are labeled in the corresponding rows of the table.

**Title:** _____

| Location Name | Sample 1 # particles collected | Sample 2 # particles collected | Sample 3 # particles collected | Average |
|---|---|---|---|---|
| Example: **Locker Room** | **6** | **7** | **5** | **6** |
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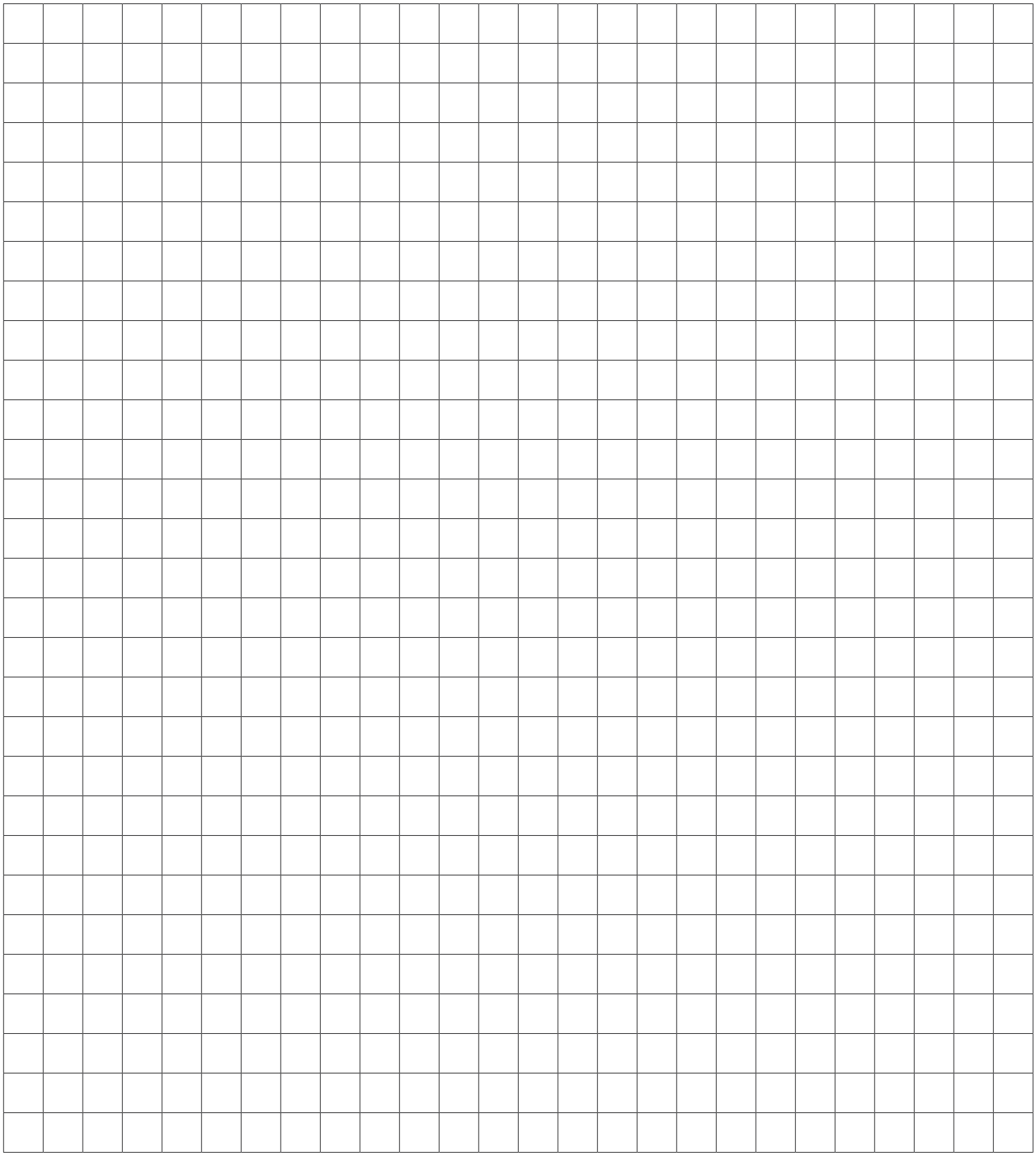
2. Complete a bar graph of your results.



3. Analyze the results collected from your samples. Answer the following questions:

   A. Which location had the most particulate matter over the same time period?

   B. Overall, did indoor air have more or less particulate matter than outdoor air (if relevant)?

   C. Describe the environmental conditions at each location (i.e., spring day, trees are blooming).

   D. What conclusions can you draw from your data?

# H 2.3.3 How Clean Is Your Air? Lab Rubric

Name(s): _____ Date: _____

## Results - Data Table

| | | |
|---|---|---|
| Does your data table have a title? | ____ yes | ____ no |
| Have you filled in all the boxes? | ____ yes | ____ no |
| Did you calculate the average for each column? | ____ yes | ____ no |

## Results - Graph

| | | |
|---|---|---|
| Does your graph have a title? | ____ yes | ____ no |
| Does your graph have correct labels on the axes? | ____ yes | ____ no |
| Are your data correctly plotted? | ____ yes | ____ no |
| If a key was needed, was it constructed correctly? | ____ yes | ____ no |

## Data Analysis and Conclusions

| | | |
|---|---|---|
| Did you determine which location had the most particulate matter? | ____ yes | ____ no |
| Did you state whether the indoor air had more or less particulate matter than the outdoor air (if relevant)? | ____ yes | ____ no |
| Did you describe the environmental conditions at each location (i.e., spring day, trees are blooming)? | ____ yes | ____ no |
| Did you draw conclusions from your data? | ____ yes | ____ no |

# H 2.4.1 Stick with Clean Air Student Activity Sheet

Name(s): _____ Date: _____

## Directions:

Get the word out! Help your family, friends, and neighbors understand the importance of air quality by creating a magnet to place on your refrigerator or car.

1. Select three ideas for improving air quality.
2. List your ideas in the table on the following page and find at least two supporting details for each idea using the following links:

   **Link:** Improving Indoor Air Quality - epa.gov/iaq/is-imprv.html

   **Link:** Improving Air Quality in Your Community - epa.gov/air/community

   **Link:** Tox Town - toxtown.nlm.nih.gov

3. Create a magnet that explains your group's ideas for improving air quality.

Use these materials to create your magnet:

- Colored pencils/markers
- Medium-sized flat magnets
- White glue
- Cardstock/construction paper

A. Create your magnet on cardstock or construction paper using text and/or images to convey your message. You may use one of the templates provided or design your own shape.

B. Cut out your design.

C. Glue a magnet to the back of your design.

List your ideas for improving air quality.

| Ideas | Supporting Detail 1 | Supporting Detail 2 | Supporting Detail 3 |
|---|---|---|---|
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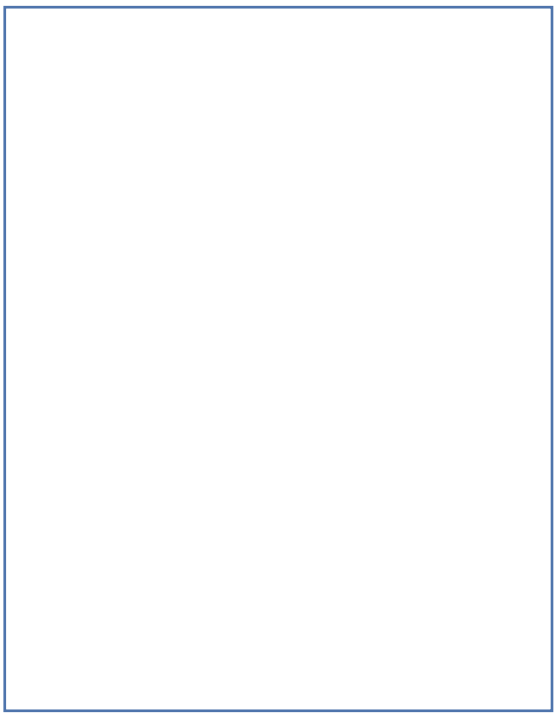
**Optional Templates for Your Magnet**



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## Unit 2 Glossary

**The following vocabulary is featured in Unit 2 of the Tox Town curriculum.**

**carbon monoxide**—Carbon monoxide is a colorless, odorless, and tasteless gas that is highly poisonous. The chemical formula for carbon monoxide is CO, one molecule of carbon and one molecule of oxygen. Under high pressure, it becomes a liquid. It is produced by the incomplete burning of natural gas, gasoline, liquefied petroleum gas, oil, kerosene, coal, charcoal, or wood.

**environmental health**—Environmental health is the field of science that studies how the environment influences human health and disease. "Environment," in this context, means things in the natural environment like air, water, and soil and also all the physical, chemical, biological, and social features of our surroundings.

**exposure**—The act of a living organism coming into contact with another organism or something in the organism's environment.

**nitrogen oxides**— Nitrogen oxides are a group of gases that are composed of nitrogen and oxygen. Two of the most common nitrogen oxides are nitric oxide and nitrogen dioxide. Nitrogen oxides are the most common pollutants found in most of the air in the United States. You can be exposed to nitrogen oxides outdoors by breathing air that contains them, especially if you live near a coal-burning electric power plant or areas with heavy motor vehicle traffic. Exposure to high industrial levels of nitric oxide and nitrogen dioxide can cause death. It can cause collapse, rapid burning and swelling of tissues in the throat and upper respiratory tract, difficult breathing, throat spasms, and fluid build-up in the lungs. It can interfere with the blood's ability to carry oxygen through the body, causing headache, fatigue, dizziness, and a blue color to the skin and lips.

**ozone**—Ozone is a gas that occurs both at the earth's ground level and in the earth's upper atmosphere. Its chemical formula is $O_3$. The ozone in the atmosphere occurs naturally and protects life on earth from the sun's harmful ultraviolet rays. The ozone that occurs on the ground level is formed when sunlight reacts with pollution from motor vehicles, power plants, industrial boilers, refineries, chemical plants, and other industrial sources. Ground-level ozone is the main ingredient of smog, a kind of air pollution found in many U.S. cities, which contributes to climate change.

**particulate matter**—Particulate matter is the term for tiny particles found in the air. These particles can include dust, dirt, soot, smoke, and liquid droplets. Some particulate matter is large and dark enough to be seen, such as soot and smoke. Other particulate matter is so fine that it can be detected only with a microscope that examines air, unless it gets past our nose's filter and into our lungs where it can cause many health issues.

**sulfur dioxide**—Sulfur dioxide is a colorless gas with a pungent and suffocating odor, similar to a just-struck match. It has an acidic taste and is a liquid when under pressure. Sulfur dioxide is formed when fuel containing sulfur, such as coal and oil, is burned. The chemical symbol for sulfur dioxide is $SO_2$. Most sulfur dioxide in the air comes from the burning of coal and oil at electric power plants.