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: _____

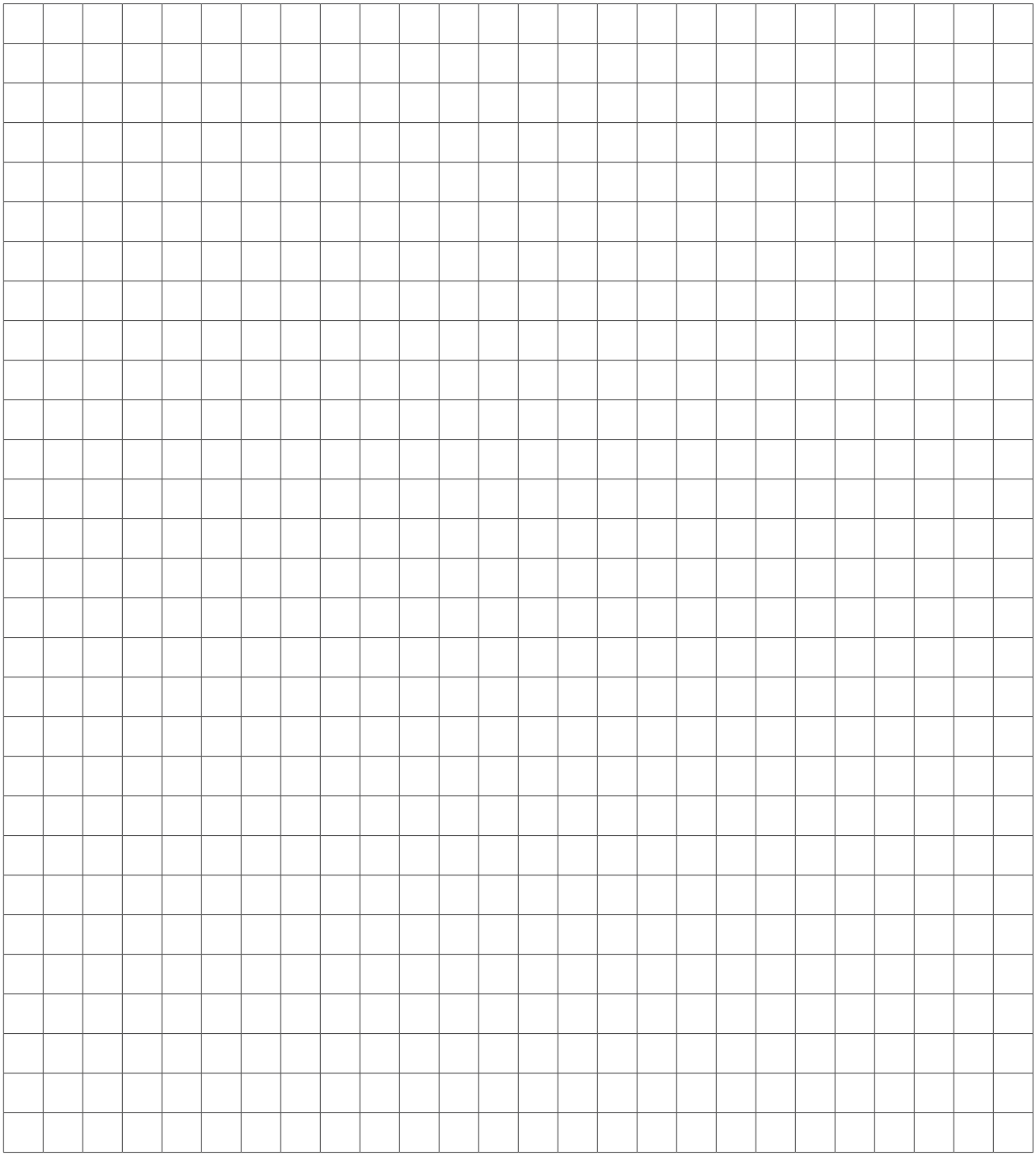
Directions:

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**

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 (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

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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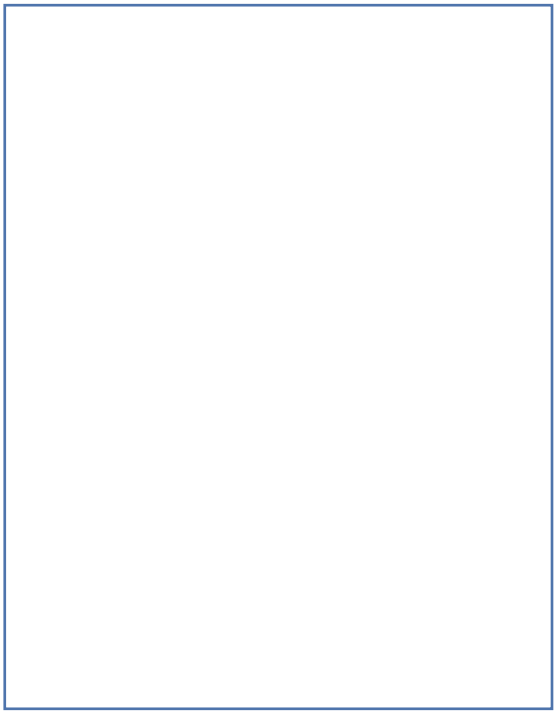
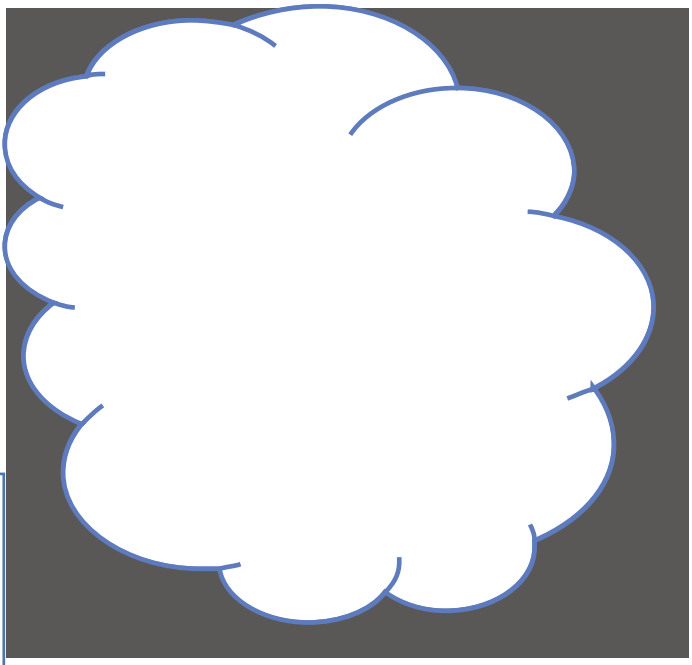
Optional Templates for Your Magnet





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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.

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.