DO NOT WRITE ON THIS LAB

Air Quality Lab:

Airborne particulates are among the unhealthiest components of air pollution to humans. Particulates are solid or liquid particles that remain suspended in air for a long period of time. Most are less than 500μm in diameter. Particulates are a common component of the air around us. It is a mixture of dust particles and tiny water droplets that form the clouds in the sky. The source of these particulates is varied. The sources of particulates can be natural as well as anthropogenic. They can be soil particles blown by the winds or dust from volcanic eruptions. They can have an anthropogenic source such as smoke from a factory or the exhaust of a diesel truck. Airborne dust, pollen, soil, or particles from the smoke and exhaust of automobiles, factories, and power plants all contribute to the total amount of particulates in the air. Regardless of their origin, they can have a detrimental impact on the health of living organisms. They are easily inhaled by humans and can irritate or scar the lungs. In cases of extreme exposure, they can cause serious lung problems such as the "black lung" disease suffered by coal miners. Very small particulates can lodge deep inside lung tissue where they can stay throughout the life of a person.

Tropospheric ozone, O_3, is a secondary, photochemical pollutant formed by numerous reactions involving VOCs and oxides of nitrogen. NO_x along with VOC's and sunlight react to form ground level ozone. Ozone days occur during the long sunshine-filled days of late spring, summer, and early fall. It is also produced by lightning, electrical motors, arc welders, and by copiers and laser printers. It is a highly reactive oxidizing agent that strips electrons from molecules that it encounters. Obviously when living tissue comes into contact with higher than normal ozone levels serious damage can occur. Lung tissue is especially susceptible to injury. This is why asthmatics are cautioned to restrict outdoor activity during Ozone Action Days. Crops and trees are also damaged by higher than normal ozone concentrations. Ozone damages cell walls and chlorophyll molecules reducing the capacity of leaves to carry on photosynthesis.

In this lab you will use Schöenbein paper to observe ozone levels. Schöenbein paper is simply a strip of paper coated with a mixture of plant starch and potassium iodide. When the strips are exposed to O_3 and water, a triiodide ion, I_3^-, is formed which complexes with the starch molecules to produce the reddish-blue color associated with the often used starch-iodine test.

$$2KI + O3 + H2O \rightarrow 2KOH + O2 + I2$$

The depth of color produced on the strips is matched to a color scale which is then corrected for humidity.

Pre-Lab

1. What is particulate matter and where does it come from?
2. Is particulate matter a primary or secondary pollutant? How do you know?
3. What is tropospheric ozone and where does it come from?
4. Is ozone a primary or secondary pollutant? How do you know?
5. Write a hypothesis for where (inside or outside) the particulate matter and ozone measurements will be the highest.

Procedure:

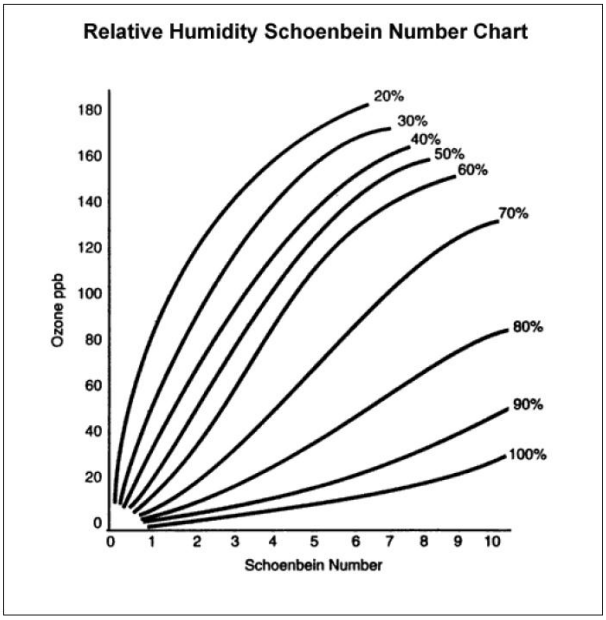
Particulate Matter:

1. Prepare a particulate collector by smearing a circle of petroleum jelly in the center of two microscope slides.
2. Place the slides jelly-up in separate petri dishes.
3. Label one ***inside*** and one ***outside***.
4. Place the one labeled inside somewhere inside. Place the one labeled outside somewhere outside. Remember it needs to be places that will not get disturbed for at least 2 days. Both need to be placed about 6 feet above the ground or floor. Record exactly where you placed your slides.
5. After about a day collect your slides.
6. Look at your particulate matter slide under the microscope. Focus your microscope so you can see the surface of the petroleum jelly. It will appear thick and wavy under the microscope. Use the fine focus knob to focus through the jelly until you can view the particulates embedded within the jelly.
7. Describe the types and numbers of particulates in a data table. If you are uncertain about any description, then do the best you can. See the table below.

Types of Particulates		
Name of Particulate	**Radius Size (μm)**	**Description**
Raindrops	500-5000	Round, light *** Use as a size reference point ***
Sea salt droplets	1-40	Light, regular and round
Ground limestone	30-800	Light, granular
Fly ash	3-80	Dark, irregular edges with definite planes
Pollen	20-60	Light colored, round, with protrusions
Bacteria	1-15	Round and dense
Foundry sand	20-200	Light colored, granular shaped
Coal dust	10-400	Dark, irregular edges with definite planes
Cement dust	10-150	Light, irregular edges with definite planes
Fertilizer	30-800	Round and dense
Milled flour	10	Tan, round with flat edges

Tropospheric Ozone:

1. Moisten a testing strip with distilled water and hang it, out of direct sunlight, at a test side of your choosing. The strip must hang freely. Place the strip in a location where it will not be bothered. Sites to consider for testing: near roads, parking lots, areas of large congregations of people, etc.
2. Leave your strip hanging overnight.
3. One person in your group will need to collect the test strip the next morning and bring it to Ms. Coleman's room to compare the color of the test strip to the Schoenbein Color Scale.
4. Moisten the test strip with distilled water and then compare it to the Schoebein Color Scale. If the color of the paper is not uniform, use the color in the area with the most conspicuous change to determine the Schoebein Number.
5. Record this number and share it with your group on Day 2.
6. Use the number and the relative humidity given to you by Ms. Coleman to determine the Ozone concentration. Record this number.



Conclusion:

1. Which was the most frequently found type of particulate on the indoor collector? How frequent was it?
2. Which was the most frequently found type of particulate on the outdoor collector? How frequent was it?
3. What was the most unusual particulate found on either of your collectors?
4. How could you reduce the amount of particulate matter at your two collection sites?
5. What is one natural way that the earth removes particulate matter from the air?
6. Name one effect of excessive particulates on plant life.
7. Compare your results on the ozone test with those of another group. Do their results differ than yours? Explain the differences in the areas tested that would cause such a difference. (Even if there isn't a difference)
8. Explain why the color change would be more intense at higher relative humidity?
9. Why would ozone concentrations be lower in the winter than in the summer?
10. Ground level ozone pollution is caused by human activities. Make a list of such activities.