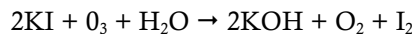


Tropospheric Ozone Lab




In this lab, you will prepare and use chemically reactive paper to measure the concentration of ground-level (tropospheric) ozone. The ozone test paper used in this lab was first developed by Christian Friedrich Schoenbein (1799-1868), as a result it is called Schoenbein paper. To prepare the Schoenbein paper, filter paper will be coated with a mixture of potassium iodide, starch and water. To use the Schoenbein paper, you will hang it, in air, out of direct sunlight, for eight hours which will allow a chemical reaction to take place. If there is ozone in the air, Schoenbein paper takes advantage of its high reactivity. Ozone in the air will oxidize the potassium iodide on the Schoenbein paper to produce iodine. The iodine reacts with the starch to produce a purple color. The shade of purple on exposed Schoenbein paper correlates with the concentration of ozone present in the air at the test site. The two chemical reactions follow:




Materials

- | | | | |
|---|---|---------------------------------------|--|
| <input type="checkbox"/> safety goggles | <input type="checkbox"/> hot plate | <input type="checkbox"/> cornstarch | <input type="checkbox"/> small paint brush |
| <input type="checkbox"/> lab apron | <input type="checkbox"/> distilled water | <input type="checkbox"/> glass plate | <input type="checkbox"/> stirring rod |
| <input type="checkbox"/> 250-mL beaker | <input type="checkbox"/> potassium iodide | <input type="checkbox"/> filter paper | <input type="checkbox"/> ziplock bags |

Preparation Procedure

1. Place 100 mL of distilled water in a 250-mL beaker. Stir in approximately 5 g of cornstarch.
2. Place the beaker on a hot plate. Heat the mixture, over low heat, while stirring, until it is thick and translucent.
3. Remove the beaker from the hot plate. Stir approximately 1 g of potassium iodide into the mixture.
 **Use soap to wash hands and scrub under fingernails after working with potassium iodide!!**
4. Cool the solution.
5. Lay a piece of filter paper on a glass plate and use a small paint brush to brush the paste evenly onto both sides of the filter paper. Apply the paste as uniformly as possible. (Note: For immediate testing, the paper is ready for use at this point.)
 **Use soap to wash hands and scrub under fingernails after working with potassium iodide!!**
6. Dry the Schoenbein paper in a drying oven, at a low temperature. Never expose Schoenbein paper to direct sunlight.
7. Cut the Schoenbein paper into 2.5-cm wide strips. Place the strips in an airtight ziplock bag and keep them out of direct sunlight.
 **Use soap to wash hands and scrub under fingernails after working with potassium iodide!!**

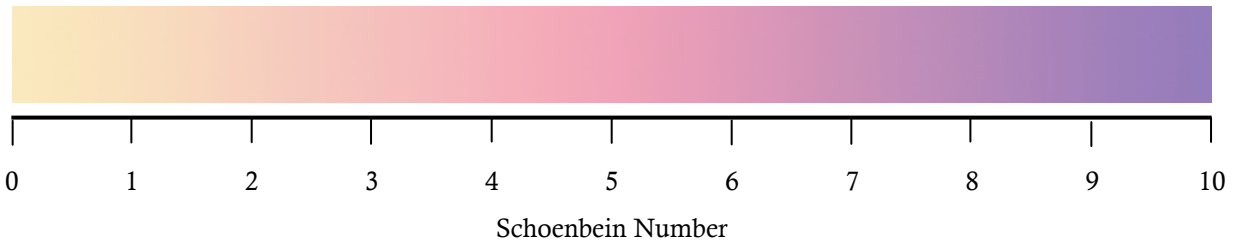
Testing Procedure

1. Moisten a strip of test paper with distilled water and hang it, out of direct sunlight, at the test site. The strip must hang freely.
 **Use soap to wash hands and scrub under fingernails after working with potassium iodide!!**
2. Expose the strip for approximately eight hours. Remove the strip and place it in an airtight ziplock bag out of direct sunlight until the results are recorded.
3. Determine the ozone concentration of the air at the test site as follows:
 - a. Moisten the strip with distilled water, then compare the color of the strip with the Schoenbein Color Scale and determine the Schoenbein Number. If the color of the paper is not uniform, use the color in the area with the most conspicuous change to determine the Schoenbein Number.
 - b. Determine the relative humidity at the test site and round it to the nearest 10%.
 - c. Use to the Relative Humidity/Schoenbein Number Chart as follows:
 - i. Along the bottom of the chart, find the point that corresponds to the Schoenbein Number.
 - ii. Draw a line upward from the Schoenbein Number until it intersects the curve that represents the correct relative humidity.
 - iii. Draw a line from the intersection in "ii" to the left side of the chart.

Postlab Questions—Write out and respond to the following.

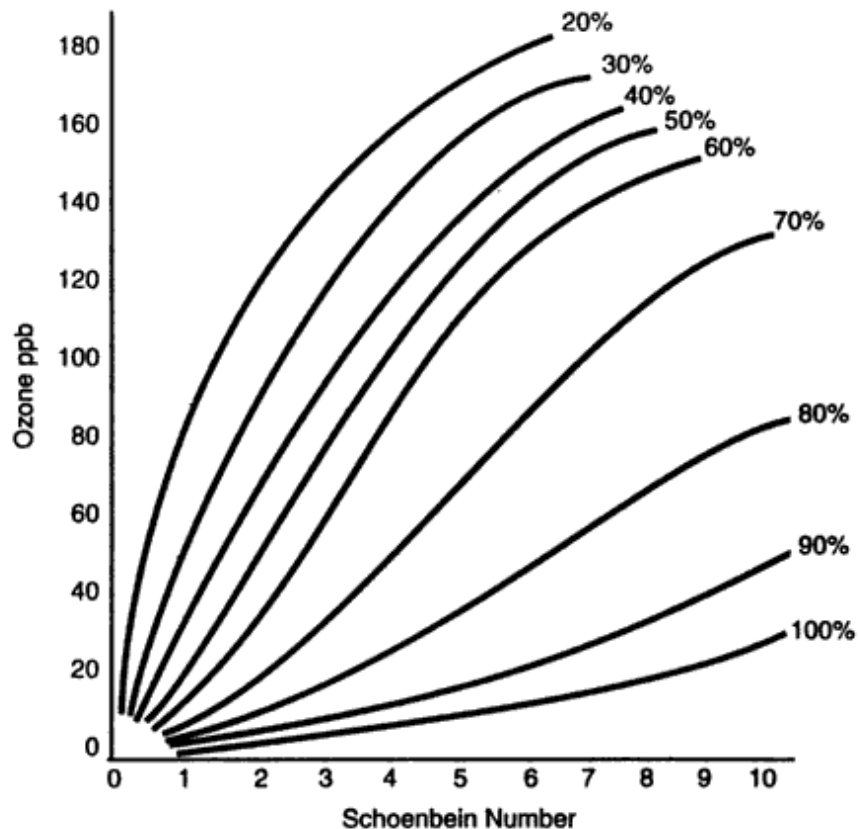
1. Determine the ozone concentration for Schoenbein paper with a Schoenbein Number of 2 at a relative humidity of 23%, 48%, and 81%.
2. Determine the ozone concentration for Schoenbein paper with a Schoenbein Number of 5 at a relative humidity of 18%, 53%, and 77%.
3. If the ozone concentration in two areas was 100 ppb, determine the Schoenbein Number if the relative humidity was 28%, 40%, and 72%.
4. Describe the changes you observed in the Schoenbein paper you used.
5. Compare your Schoenbein paper to those of other students. Note, account for, and discuss the differences you observe.
6. Determine the wind direction during your study and discuss how it likely affected your measurements.
7. Compare your data with data obtained from the South Coast Air Quality Management District. Based on this comparison, discuss the reliability of using Schoenbein paper to measure tropospheric ozone.
8. Determine the UV Index at the test site during the lab. Explain how the UV Index is related to the concentration of ozone present in air.

Schoenbein Color Scale

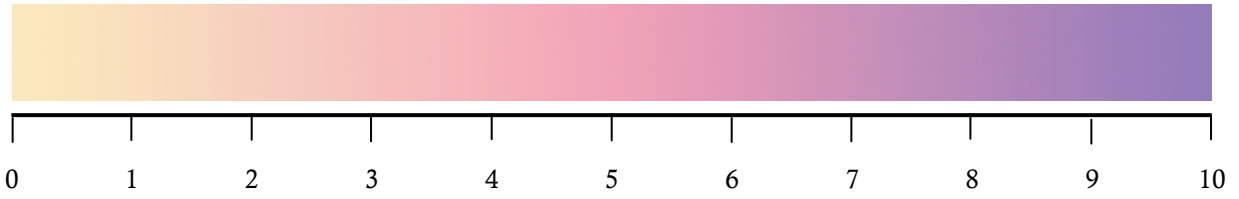


0-3	Little or no change
4-6	Lavender Hue
7-10	Blue or Purple

Relative Humidity/Schoenbein Number Chart



Schoenbein Color Scale



Schoenbein Number

0-3	Little or no change
4-6	Lavender Hue
7-10	Blue or Purple