

Rubber Band Air Test

Students develop an understanding of the effects of invisible air pollutants with a rubber band and hanger air test. They also learn about methods of reducing invisible air pollutants.

Materials

- Magnifying glass(es)
- Journals for students

You will divide the group into small groups of 3-4. For **each of your groups** you will need:

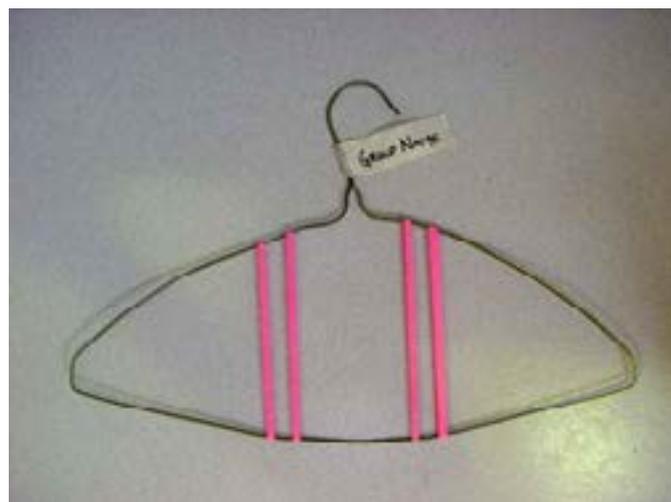
- 1 wire hanger for each small group
- 4 identical, small rubber bands
- 1 piece of masking tape for labeling the group name.

Discussion

Invisible air pollutants are found in all indoor air spaces. Gas stoves, cigarette smoke and many household products can emit pollutants. Many everyday items purchased in stores, especially those made of plastic, are produced in factories using chemicals and glues. Often, we can smell these pollutants, but we cannot see them. Over time, chemical pollutants are released in a process called off gassing. Engineers study the presence of these pollutants in buildings and sometimes add fans (for increased ventilation) or take other actions, to remove them from the enclosed buildings, so people do not get sick from the indoor air.

Activity

1. Divide the class into work teams of 3-4 students.
2. Distribute supplies to each group (1 hanger, 4 identical, small rubber bands, and 1 piece of masking tape for labeling the group name).
3. Demonstrate how to prepare the rubber band air tester. Bend the wire hanger so the rubber bands can be stretched over the hanger. Make sure the rubber bands are tight.
4. Place your sample collector in a drawer or cupboard in your classroom, as a control.
5. Decide on several locations around the school/classroom—inside and outside—which students think invisible pollutants may be found. Keep in mind that the collectors may have to stay at each site, undisturbed, for 1-2 weeks. Choose sites not in direct sunlight. (Possible locations: Near an entry way to the building, teachers' lounge, a stove, the classroom air filter/vent or the school's air intake/vent, etc.) Assign each group to a different collection site.



Rubber Band Air Test

6. Ask students to make predictions about which area they think has more invisible pollutants and why. Have students record their predictions in their journals or on a piece of paper.
7. Have students note the initial qualities of the rubber bands. Use the magnifying glasses. Include suppleness, "stretchiness," color, texture, etc. Have the students record these observations.
8. Place the hangers in the collection sites for 1-2 weeks. Have the groups check them daily and record their observations on the condition of the rubber bands and the collection site.
9. On the final day of observations, bring the hangers back to the classroom for comparison.
10. Have students note the final qualities of the rubber bands. Use the magnifying glasses. Include suppleness, "stretchiness," color, texture, etc. Record these observations. (Expectations: If the rubber bands appear around the same as the beginning, then there were few invisible pollutants present at that site. If they appear cracked and hard, then there were pollutants present.)
11. Have students rank the hangers from the one with the fewest effects to the one with the most. They can line them up in order across a counter or table. Remember to include the control hanger. Ask students to record this information in their journals.
12. Make a school map on large chart paper. For each collection site, cut a hanger shape from colored construction paper and write on it the ranking and location. Adhere each cut-out hanger to the correct location on the map. What conclusions can you draw from the map? Write a few of these conclusions neatly on index cards. Display the map and index cards in a school hallway for others to see.

Discussion Questions

- What have you learned about invisible air pollution from this activity?
- Why do certain areas seem to have more invisible pollutants than others?
- How can we make the air more desirable to breathe?
- Based on these findings, which areas of the school would you try and improve the air quality?

Discussion Points

- Indoor air pollution concentrations can vary greatly from location to location (e.g., science labs vs. English class) and can even vary in the same location based on time of day (e.g., when school is open vs. when it is closed).
- Occupant behavior—i.e., the activities that people in the room/building do—can have a large influence on air pollutants as well. For example, using chalk can contribute to a great amount of chalk dust, using adhesives, solvents, and paints can increase the presence of Volatile Organic Compounds (VOCs). How the room is cleaned, how frequently it is cleaned, and with which products can either lead to more or less pollutants.
- Remind students that they are breathing all the invisible pollutants that altered the rubber bands. There are steps everyone can take to improve the quality of the air we breathe indoors. There are 3 main ways to reduce both visible and invisible pollutants and improve indoor air quality:
 - **Source Control:** eliminate the individual source of pollution and their emissions. For example, eliminating the use of markers that emit strong fragrances and switching to a "low VOC" option. If it is not possible to completely eliminate the source, reduce or manage the source to improve indoor air quality.

Rubber Band Air Test

- **Improve Ventilation:** indoor air is 3-4 times more polluted than outdoor air. Opening up a door or window to draw in fresh, outdoor air will reduce indoor air pollutants. Increase ventilation when the source cannot be completely eliminated.
- **Clean the Air:** Using a portable air cleaner or upgrading the air filter in your furnace or central heating, ventilation and air-conditioning (HVAC) system can help to improve air quality. Portable HEPA air cleaners are a great way to reduce pollutants in a specific room. Run a portable air cleaner in a room with all doors and windows shut.
 - There are many other ways we can reduce the indoor air pollutants, including addressing any water leaks immediately (to prevent mold growth), ensuring garbage is emptied regularly, damp dusting weekly, and keeping the building humidity between 30 and 50% (to reduce chance of dust mites and mold) just to name a few.
 - Policies such as tobacco/vape-free school grounds and school bus anti-idling zones can significantly help to reduce indoor air pollutants.

The source of this material is the *TeachEngineering* digital library collection at www.TeachEngineering.org. All rights reserved.