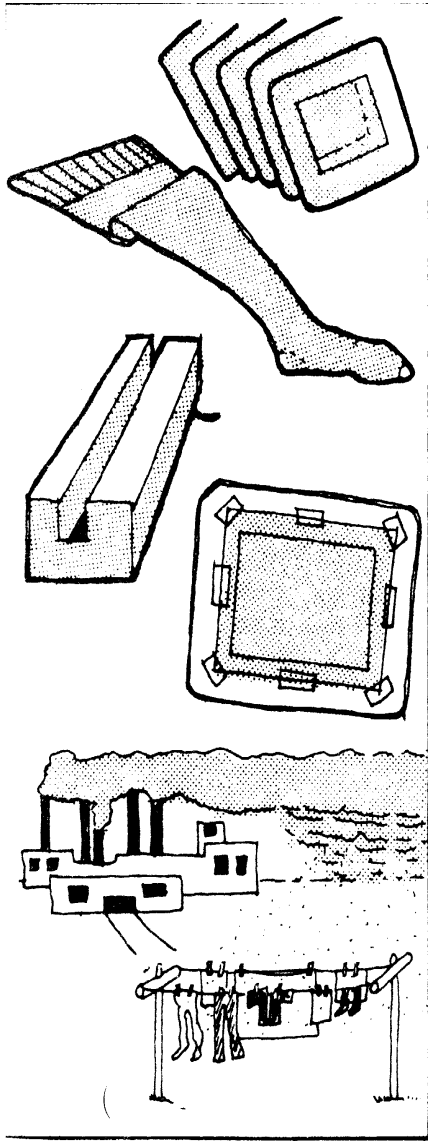
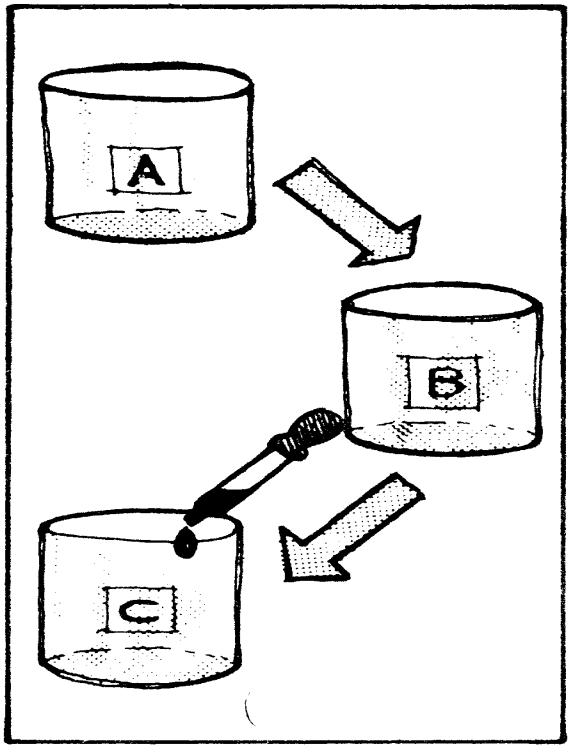
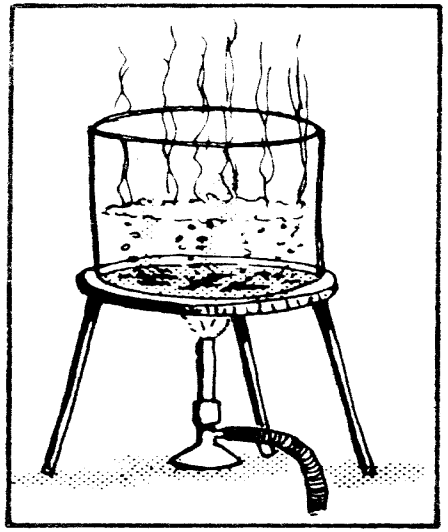
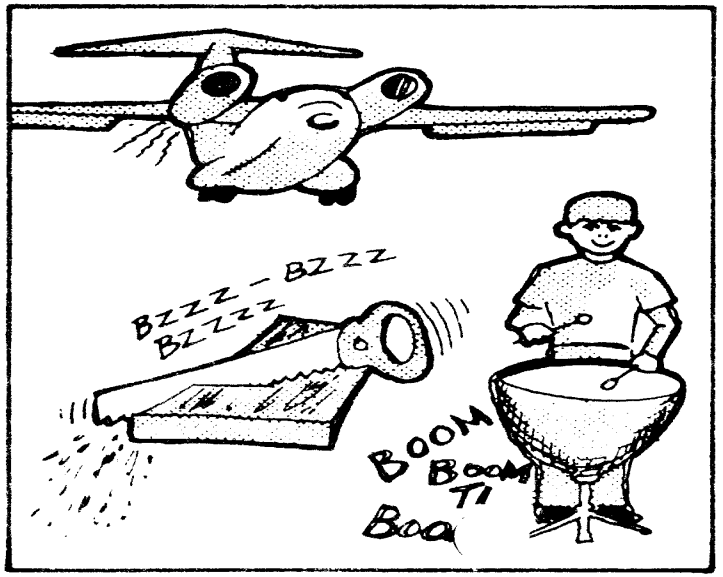


DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION



AVIATION
EDUCATION





TEACHER'S INFORMATION

Demonstration Aids for Aviation Education- Volume 11 is a series of simple, concrete revealing experiments developed by the Civil Air Patrol Center for Aerospace Education Development or the Federal Aviation Administration specifically for upper elementary grades. These activities can be adapted to meet the needs of varied teaching situations and different grade levels.

These materials are primarily designed as pupil directed experiences. In some instances the teacher may want to further extend the investigations. This series is intended to be a springboard for your own ideas to demonstrate concepts of the Air Age to your students. Young children can learn scientific principles through simple learning activities; older students can benefit from a review using the same activities.

The purpose of this series is to illustrate certain principles related to various concepts of aviation and space. More important, it is an opportunity for you to directly involve students in investigations and in making discoveries on their own.

You needn't be an "expert" in science to use this material. In fact, you shouldn't be expected to have all the correct answers to the questions presented in the material. Moreover, many of the activities are designed to include interdisciplinary skills and need not be used in sequence.

Each packet in the series forms a coherent program of instruction on a single topic: Non-powered Flight, Aerospace and the Environment, Space Exploration and Communications. Most of the tasks are introduced as a question. In order to answer the question, the students may want to first predict the solution. Then have them follow the activity instructions to arrive at an answer. This kind of student involvement may lead to other related questions generated by the teacher, other students, or suggested on the cards themselves.

Most of the activities utilize materials readily available from any given community and can be completed in the classroom. Others may require that you borrow some equipment from your science resource center or from a junior or senior high school in your district.

Please let us know your reactions to the materials and feel free to ask for more information related to aviation or space. We wish you success and many enjoyable experiences as you use these packets.

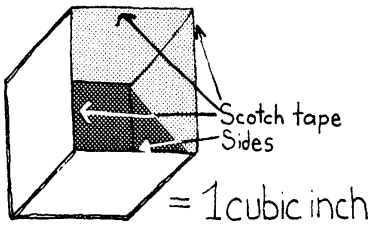
Written by Ms Debbie Williams and Ms Carol Hickson
Editorial Assistance by Mrs. Patricia Smithson
Illustrated by M r. Harley A. Samford

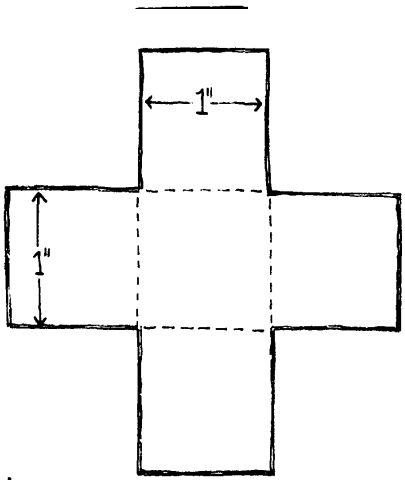
HOW MANY Is **1,000,000** **AP-1** **ONE MILLION?**

Air pollution is a serious problem in today's world. Pollutants are measured in parts per million (ppm). A million is difficult for us to understand. It is: 1000 x 1000 or 100 x 10,000 or 10 x 1 00,000 or 1,000,000. That's a lot to count. Let's find out how many 1,000,000 is.

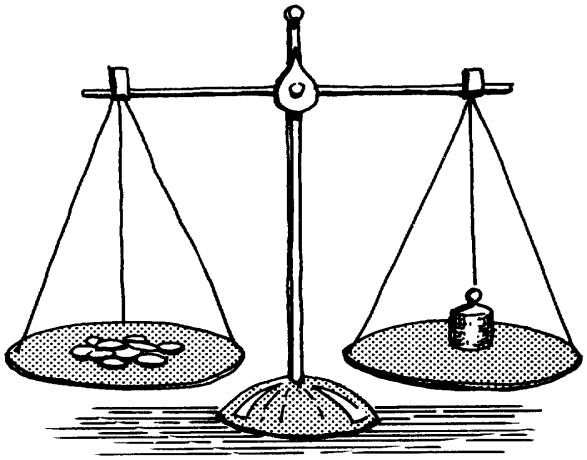
MATERIALS: Construction paper, scissors, scotch tape, rice, 10 pennies, balance (or postage scale), deck of playing cards, ruler

Use construction paper to build a box 1 inch on each side. Fill the box with rice (level to the top). Count the number of grains of rice in the box. How many cubic inches would a box have to be to hold 1,000,000 grains of rice?

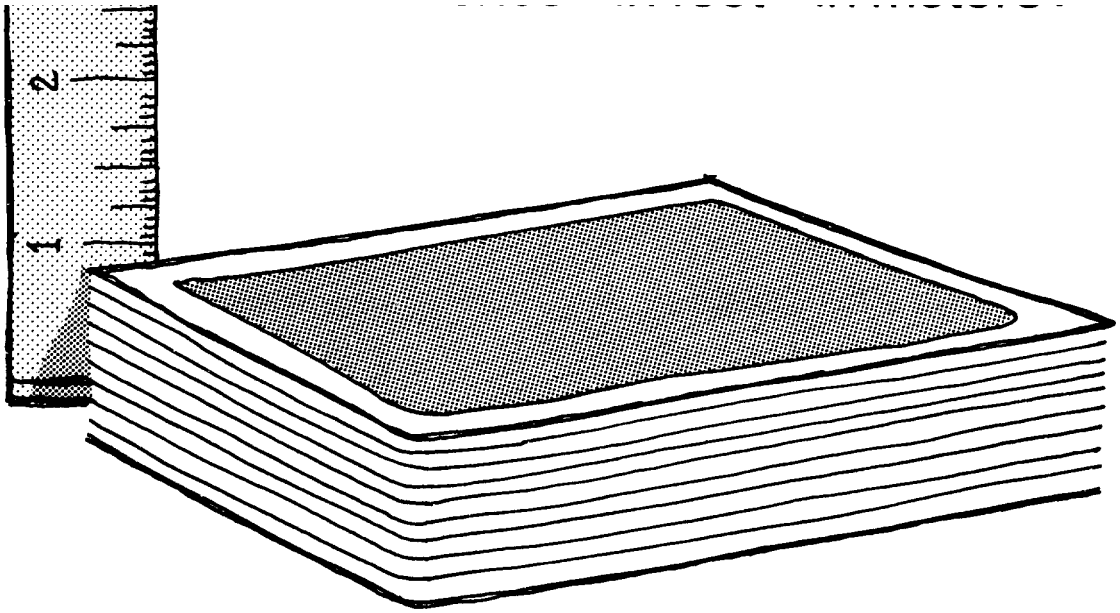




Place 10 pennies on the balance scale. How much do they weigh? How much would 1,000,000 pennies weigh?



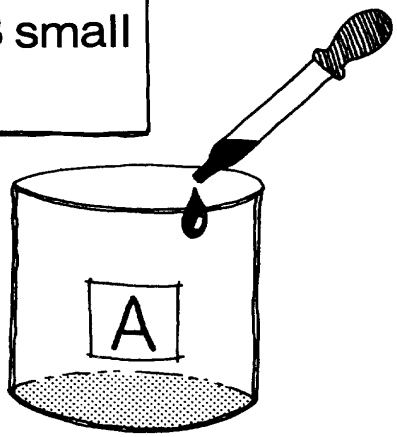
Remove 2 cards from a deck of playing cards (leaving 50 remaining). Use a ruler to measure the thickness of the stack. How thick is the stack of 50 cards? How high would a stack of 1,000,000 cards be? In inches? In feet? In meters?



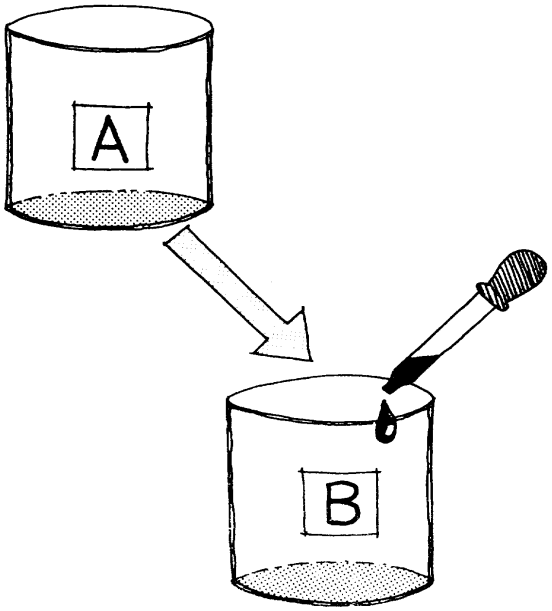
WHAT IS ONE PART PER MILLION (1 **P.P.M.)?**

AP-2

MATERIALS:
Food coloring, water, eye dropper, 3 small beakers, peppermint flavoring.

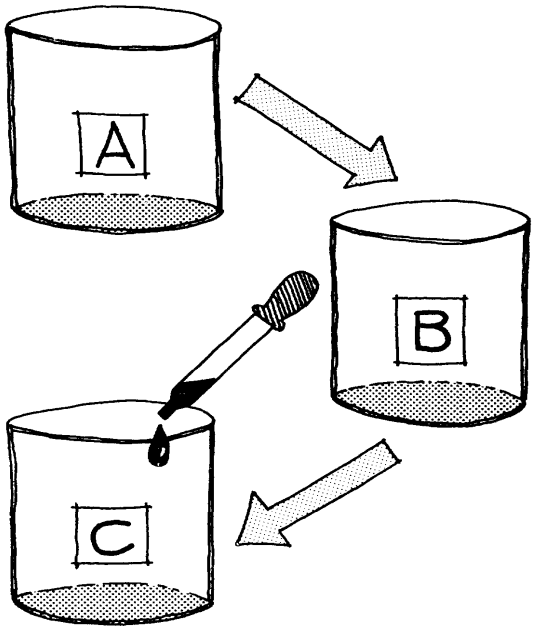


Put 99 drops of water into a small beaker labeled "A." Add one drop of food coloring for a total of 100 drops. Stir well. The food coloring measures one part per 100, or 1/100.



Put 99 drops of water into another small beaker labeled "B." Add one drop from beaker "A" for a total of 100 drops. Stir well. The food coloring in beaker "B" is now one part per 10,000 or 1/10,000 (1/100x1/100). Can you still see the color?

Put 99 drops of water into another beaker labeled " C - " Add one drop from beaker " B" for a total of 1 00 drops. Stir well. The food coloring in beaker "C" is now one part per million (1 /1 00 x 1 /1 0,000). Can you still see the color?



Repeat the experiment using 2 or 3 drops of food coloring in beaker "A" to see how many P.P.M. must be present to be seen. Remember the total number of drops in each beaker must be 1 00.

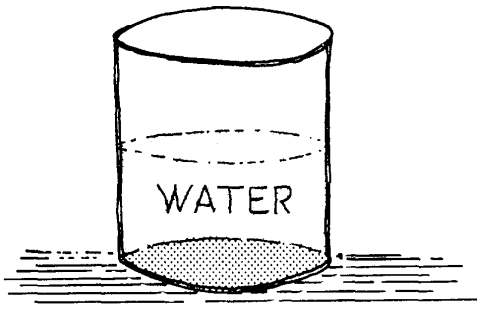
You may also want to repeat the experiment using peppermint flavoring instead of food coloring. You can compare your senses of sight, smell, and taste.

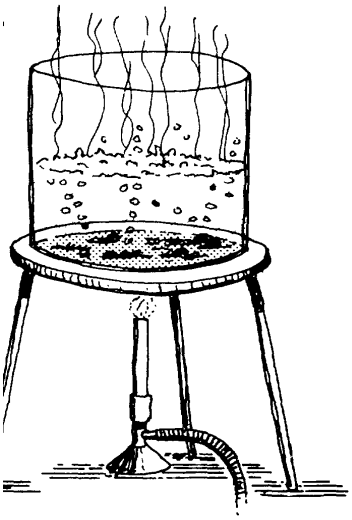
HOW CAN WE MEASURE AIR POLLUTION?

AP-3

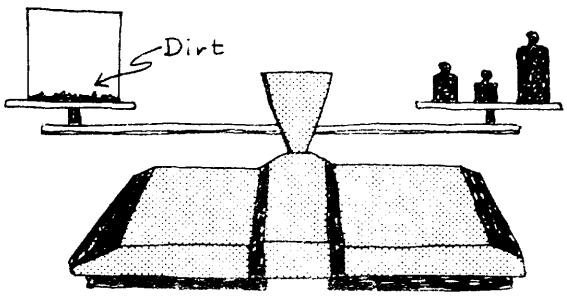
MATERIALS:
Deep glass container, distilled water, heat source, balance, weights

Choose an open area away from trees and buildings. Place the glass container half filled with distilled water in position for 30 days. Keep adding water to the container to trap dirt failing into it.



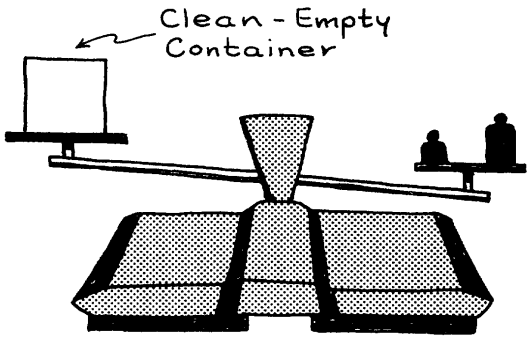


Evaporate the water over low heat being careful not to burn the collected materials
in the bottom of the container.



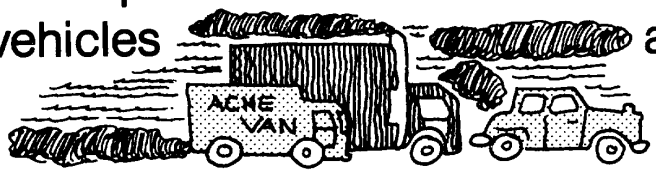
Weigh the container and its contents. Wash and dry the container.

Weigh the container again. The difference is the weight of the dirt collected.



Find out how much dirt falls per square inch, per square foot, per square mile. HINT-How many square inches is the opening in your container? Area of a circle = πr^2 **.** If you divide the weight of the dust collected by the area of the opening you will have the amount of pollutants per square inch. How many square inches in a square foot? _____ How many square feet in a square mile?_____

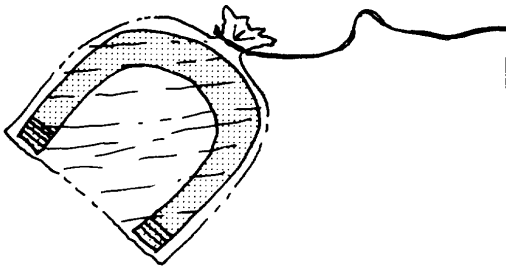
HOW CLEAN IS THE AIR AROUND YOU? AP-4

Some pollutants found in the atmosphere from vehicles 

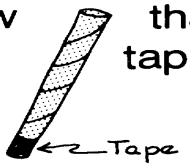
and factories

are magnetic you will need: . To find some of these

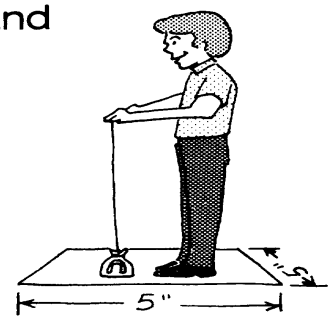
MATERIALS:
Small magnet, string, plastic sandwich bag, tape, soda straw.



Place the magnet inside the bag and tie the string around it.

Select a measured area 5 feet by 5 feet and move the bag over the area touching the ground. Collect the material in a soda straw 

that has one end sealed with tape.

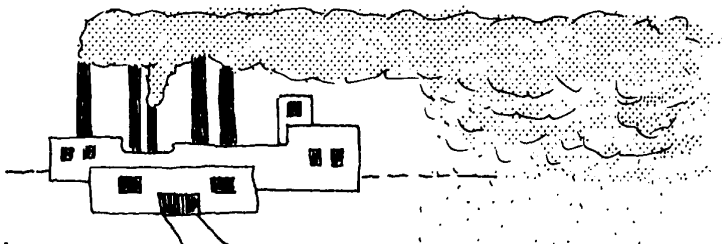


Compare the amount of material found in different locations. Use the same size area-5 feet x 5 feet.

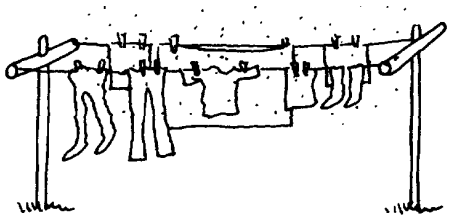
Try an area near a highway or busy street -on the school playground - in the country - near a factory etc.

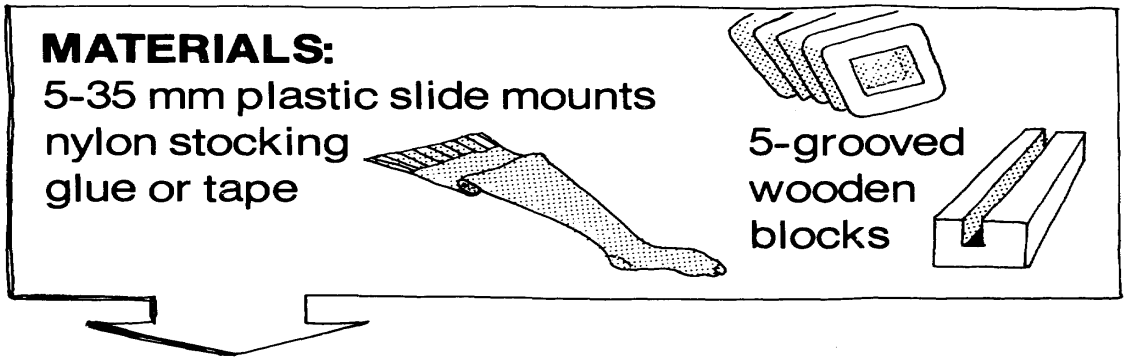
HOW DOES POLLUTION AFFECT CLOTHING?

AP-5

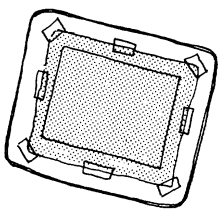


Pollution in the air causes damage to clothing every year. Pollutants such as nitrogen oxides, sulfuric acid, and hot smoke particles destroy nylon.

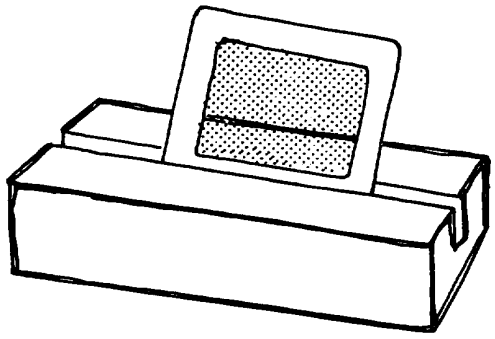




Prepare six experiments by cutting a square of nylon stocking to cover each of the 35 mm slide mounts. Stretch the nylon over each of the slide mounts and glue or tape in place.



Mount each slide on one of the wood blocks so that it can stand upright.



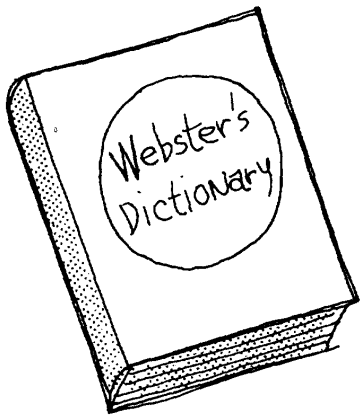
Select two outdoor locations such as the roof of the school or other building. Place two slides in each of the locations and keep one indoors for comparison. Leave one slide at each location for 30 days and the other in each location for 60 days.

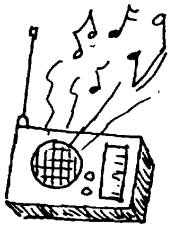
You can best see the damage caused by the air pollution if you use a hand lens or a slide projector.

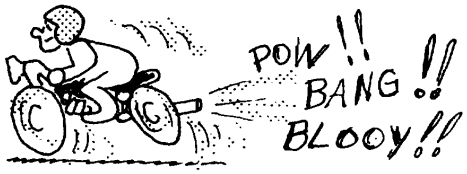
WHAT IS NOISE?

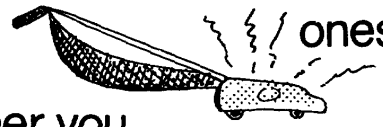
NP-1

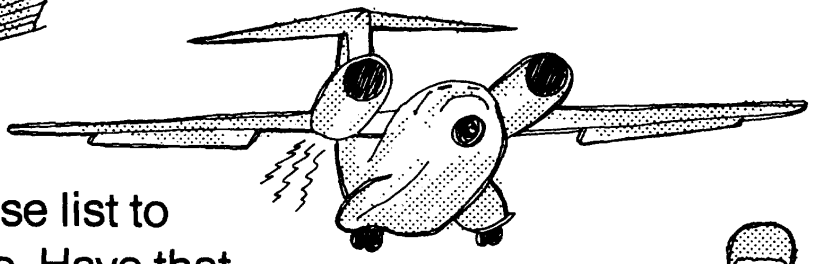
Find out how Webster defines noise. How would you define noise?



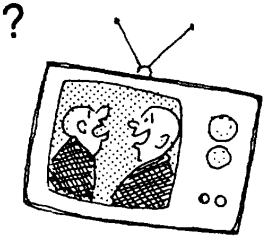


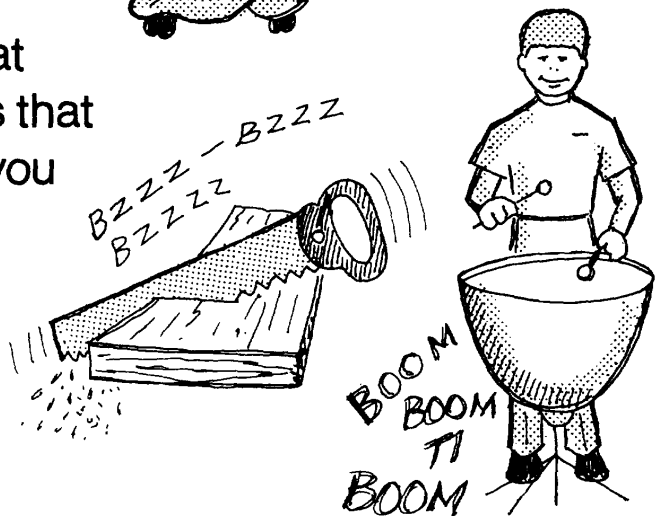


Make a list of things around you that make noise. Mark the  ones that bother you.



Give your noise list to someone else. Have that person mark the noises that bother him or her. Are you bothered by the same noises?



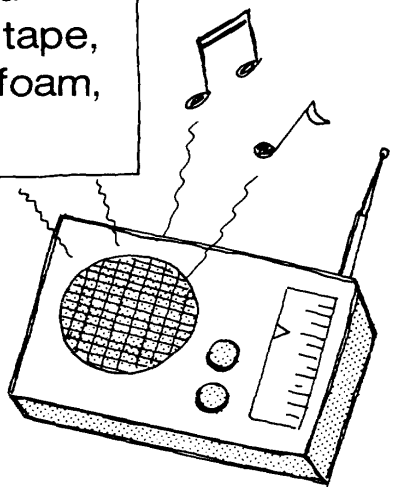


Can you list some noises
that bother a lot of people - Would you say these noises contribute to noise pollution? Try to list some ways to make things less noisy.

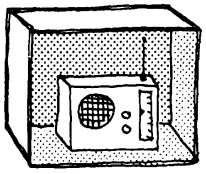
WHERE DID THE NOISE GO? NP-2

What kinds of things can be used to absorb sound? Will hard smooth things work better than soft rough things?

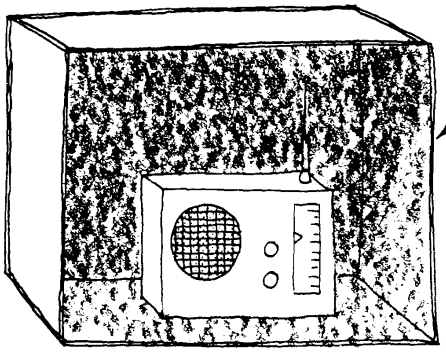
MATERIALS: Battery operated radio, cardboard box, staples, tape, samples of cloth, carpet, styrofoam, newspaper, etc.



Turn on the radio and set the volume. Place the radio inside the empty cardboard box and seal the box. Move away from the box until you can no longer hear the radio.



Carpet sample



Measure the distance. Line the inside of the box with the carpet samples. Use the same volume setting as before. Measure the distance again.

Repeat the experiment using the other materials. Which materials are the most effective?

How can you use what you have learned to make yours a quieter environment?

N0TES

AEROSPACE AND THE ENVIRONMENT

AP-1	HOW MANY IS 1,000,000?
AP-2	WHAT IS ONE PART PER MILLION (1 P.P.M.)?
AP-3	HOW CAN WE MEASURE AIR POLLUTION?
AP-4	HOW CLEAN IS THE AIR AROUND YOU?
AP-5	HOW DOES POLLUTION AFFECT CLOTHING?
NP-1	WHAT IS NOISE?
NP-2	WHERE DID THE NOISE GO?

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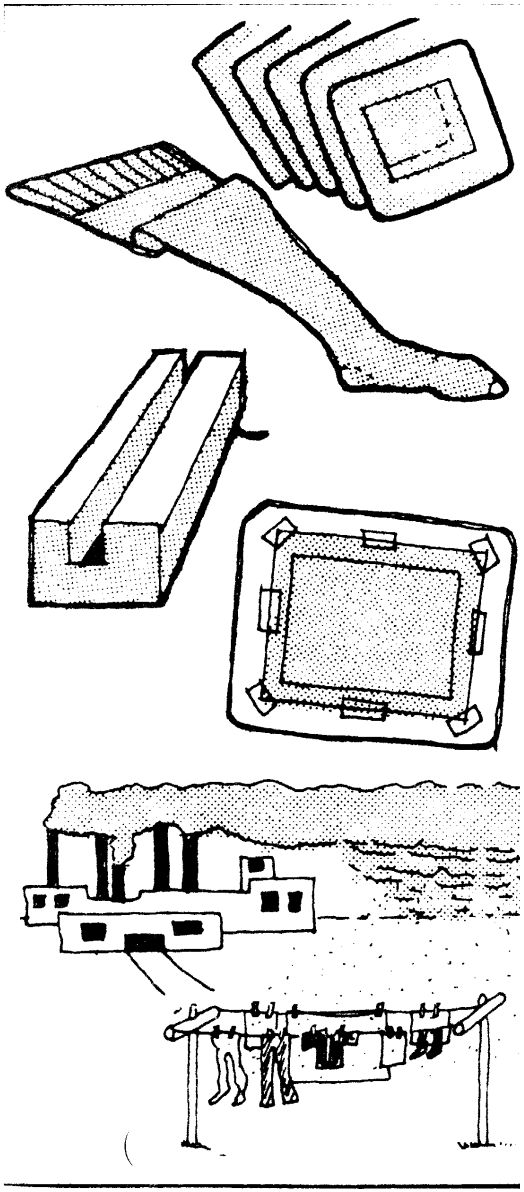

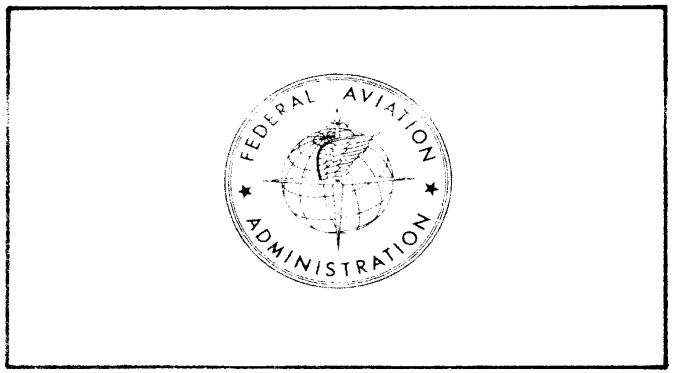

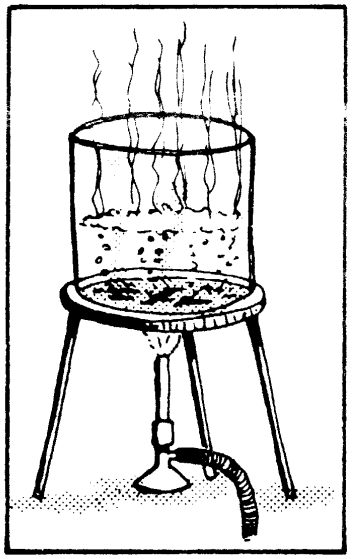

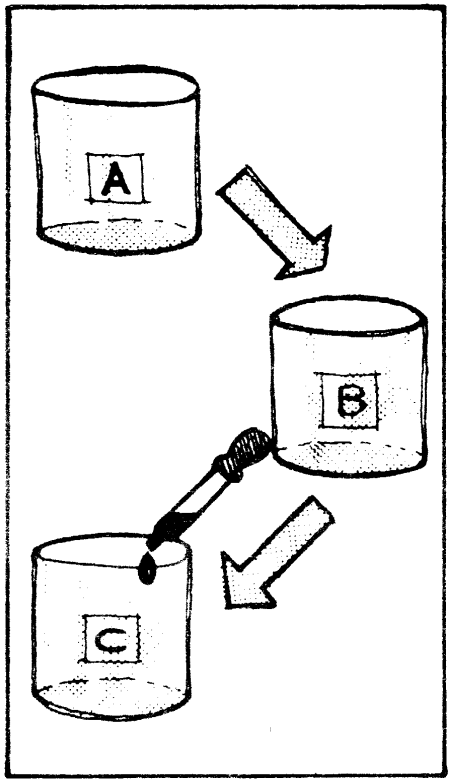
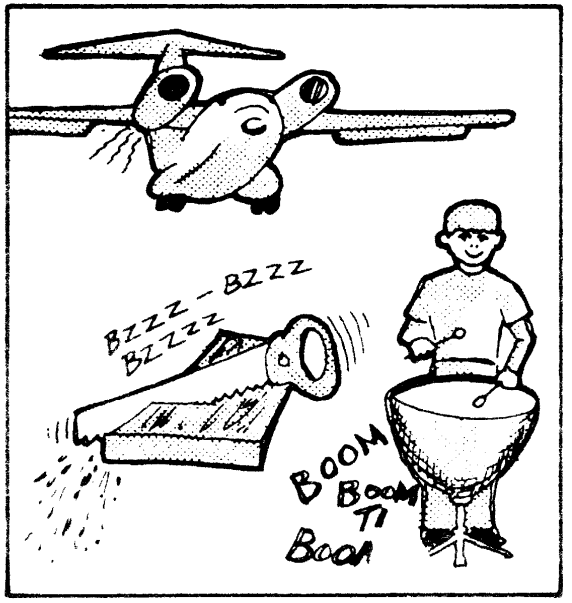
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