Dust In The Air

Topic

Air pollution

Introduction

The air contains tiny particles such as pollen, dust, and soot. The levels of pollen in the air vary according to the time of year and the weather conditions. Particles polluting the air are the result of emissions from factories and motor vehicles; these levels also vary from place to place, according to the time of year and with weather conditions. Variations are possible within a small area – for instance, between a street and the adjoining park. In this experiment, you will be collecting samples of air particles to test the hypothesis that air pollution is greater at sites closest to traffic.

Time required

30 minutes to prepare the experiment
24 hours to leave the experiment after preparation
1 hour to collect and analyze the data

Materials

1 microscope slide per site
double-sided transparent tape (2.5 cm wide)
self-adhesive labels (25 mm × 15 mm or larger)
scissors
transparent ruler with millimeter divisions
microscope
notebook and pen
calculator
modeling clay or adhesive tape (2.5 cm wide)

Safety note

Work in groups with a minimum of three people. Be careful when positioning the slides and when using the scissors.

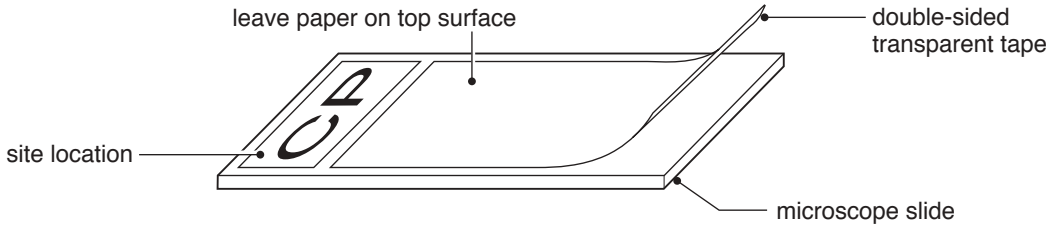
Procedure

Note: this procedure can be carried out only during dry weather (i.e., when there is no moisture in the air).

Part A: Preparing the experiment

1. In your groups, discuss where you expect there to be differences in the amount of particles in the air (e.g., at the school entrance, street junctions, a pedestrian-only area, the center of a park or an open area). Decide how many sites you want to visit and count out the same number of slides (you need one slide per site).
2. Cut the self-adhesive labels into pieces, each 2.5 cm × 1.5 cm (or a suitable size to fit onto the end of each slide as in diagram 1 below). Allow one piece of label per slide.
3. For each slide, write the site location on its label (e.g., school entrance or center of park). Use an abbreviation if necessary. Place the label at one end of the slide as in diagram 1 below.
4. Cut a piece of double-sided tape the same length as the slide. Attach the tape to the same side of the slide as the label. Leave the cover strip of paper on the tape until you place the slide at the required site (see diagram 1 below).

1

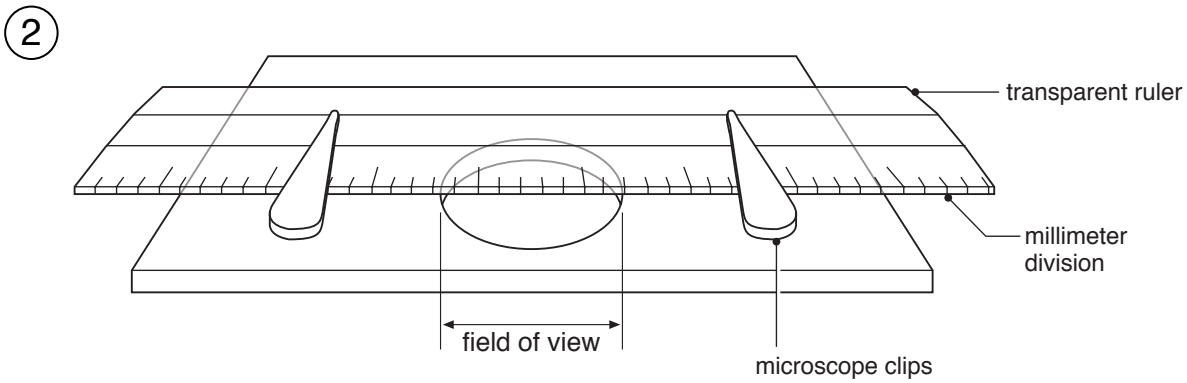


Preparing a slide for sampling the air at a site

5. Repeat steps 3 and 4 for each slide.
6. At each location, find a place to lay the slide so that the surface with the tape is facing up and the slide is accessible to the air and will not be disturbed. Secure the slide at both ends with either modeling clay or adhesive tape. Peel the paper off the tape on the slide to expose the sticky surface.
7. Leave the slides for 24 hours.

Part B: Collecting and analyzing the data

1. After 24 hours, collect the slides and bring them back to school.
2. Place the slide from the first site under the microscope and choose an area of the slide to view. Select a magnification that allows you to count the number of particles in your field of view. Use the same magnification for the rest of the experiment.
3. Count the number of particles you can see and record the number against "Site 1" in the data table on the next page.
4. Repeat steps 2 and 3 for the other sites.
5. Measure the diameter of the field of view by placing the ruler under the microscope and focusing on its edges (see diagram 2 on the next page).



Measuring the field of view

6. Record the diameter in the data table.

DATA TABLE		
Slide location	Number of particles	Number of particles per mm^2
Site 1:		
Site 2:		
Site 3:		
Site 4:		
Site 5:		
Site 6:		
Diameter of field of view:	= mm	
Area of field of view:	= mm^2	
Date of sampling:		
Weather conditions:		

Part C: Looking for different types of particles

1. Using the high power of the microscope, look at all the slides again to see if you can identify different types of particles. Record any differences in size, shape, and color in your notebook.

Analysis

1. Calculate the number of particles per square millimeter on each slide using the method shown below and record in the data table.

   Step 1: calculate the radius of the field of view (in mm)

   $$\text{radius of the field of view (r)} = \frac{\text{diameter of the field of view (in mm)}}{2}$$

   Step 2: calculate the area of the field of view

   $$\text{area of the field of view} = \pi r^2 \text{ mm}^2$$

   Step 3: calculate the number of particles per mm^2

   $$\text{number of particles per mm}^2 = \frac{\text{number of particles}}{\text{area of the field of view}}$$

   The area of the field of view will remain the same for all the slides.
2. Describe the pattern of your results. Which sites had the highest and the lowest particle densities?
3. What different types of particles could you identify?
4. Which site suffered the most particle pollution? Can you explain why?
5. Are there any results that you did not expect? Suggest what might have affected your results.
6. Do you accept the hypothesis?
7. Would you expect the particle densities to vary at different times of the day or year?
8. What types of air pollution would not be detected by the method you used?

Want to know more?