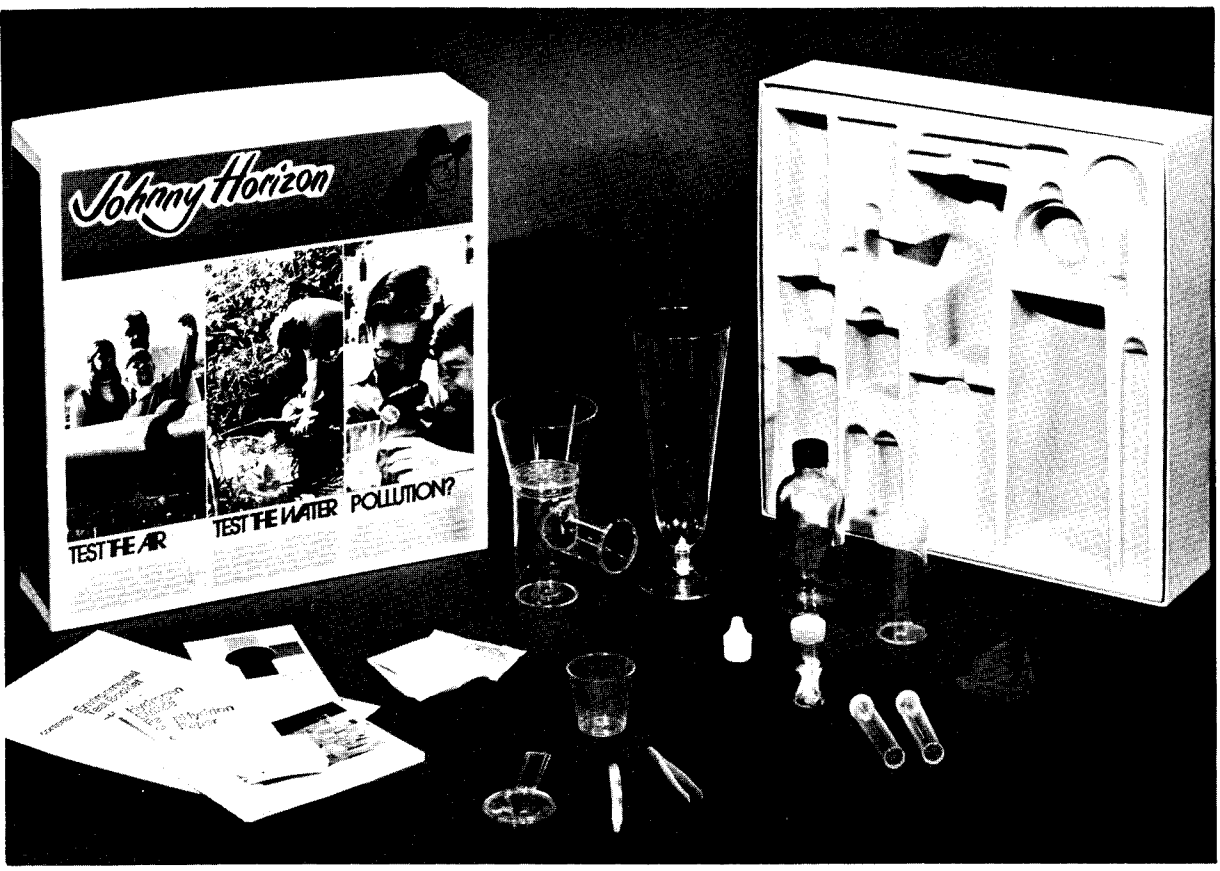
PARKER BROTHERS



Johnny Horizon

Environmental Test Kit

New and timely! The only such kit licensed by the U.S. Department of the Interior. Helps youngsters learn about their environment by performing ten key tests; 6 for water, 4 for air. Designed to make a comprehensive analysis of the air and water in a given locale, all tests are easy to perform and can be repeated several times. Refill package of supplies available from Parker Brothers. Kit includes equipment and materials for all tests, patented Millipore filtration system, illustrated 32-page booklet with charts and complete instructions. Photos and description on box bottom.

Item size – 13″ x 13″ x 3¼″ 2.5 lbs.
Packed ½ dozen
Carton size – 20″ x 13½″ x 13½″ (1.9 cu. ft.)
Weight 13½ lbs.

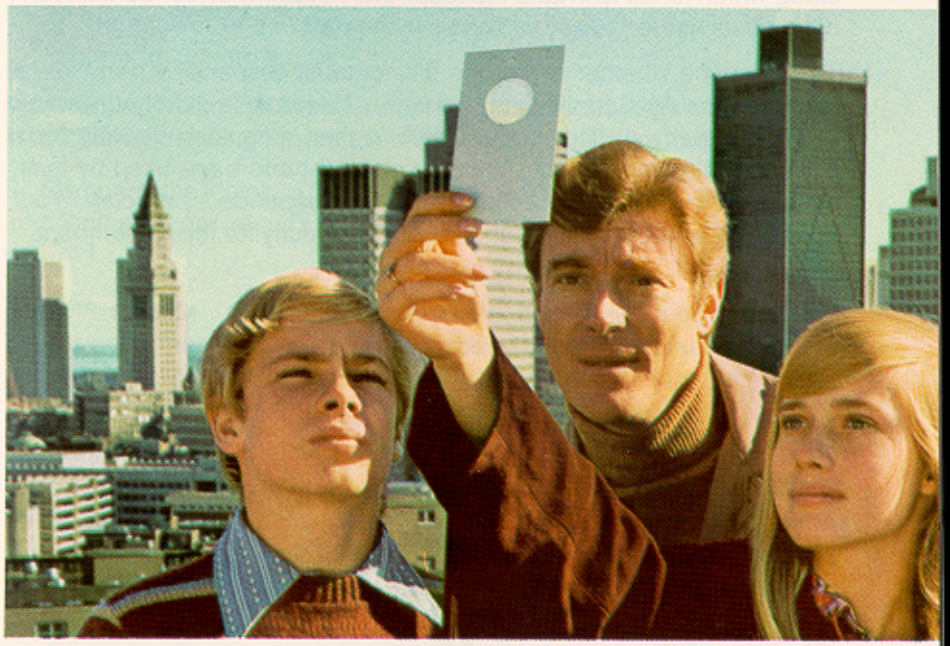
No. 555

Parker Brothers of the Fun Group at General Mills

...way ahead of the game

Index

TEST THE AIR



Experiment 1 Suspended Particles

Explanation

Bits of material so small that they remain in the air for a long period of time are called suspended particles. These pollutants are generally much smaller individually than are wind blown particles which settle quite rapidly. These suspended particles are generally composed of fumes, smoke and other materials commonly found in smog and industrial waste products. Occasionally chemical pollutants will attach themselves to these particles. This may lead to a highly dangerous smog which tends to irritate the respiratory system. Under certain conditions this has led to actual deaths in the past.

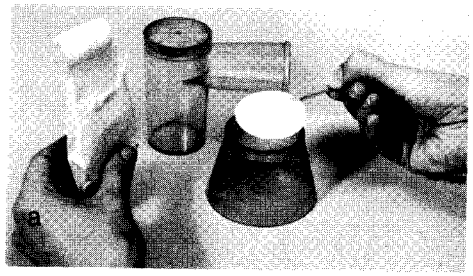
To determine whether or not the air contains suspended particles, a High Volume Air Sampler may be used. This device simply draws air through a piece of filter paper which is then examined visually for a general darkening in color. Vacuum cleaner motors are used by most state and federal agencies that test for suspended particles. Your household vacuum cleaner should work perfectly for this experiment.

Equipment

Filtering apparatus (High Volume Air Sampler), Millipore® filters, vacuum cleaner (adapter if needed).

Procedure

1. Invert funnel portion of filtering apparatus on a clean work surface. Open filter envelope and using tweezers, carefully remove one thin white filter[1*] and place it grid side down into the top half (Photo a). Again using tweezers, remove one heavy white pad from the filter envelope and place it over the filter. Replace bottom half of apparatus and press onto top piece with a firm twisting action (Photo b). Turn assembly over and continue with test.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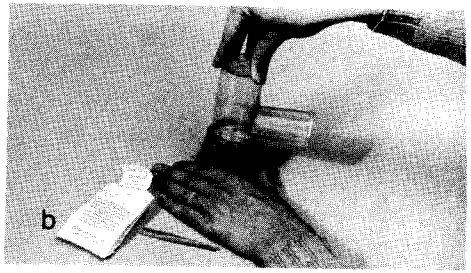
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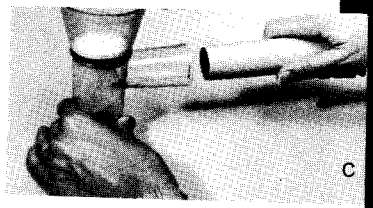

c

2. Plug the High Volume Air Sampler into the suction end of a household vacuum cleaner[2*] (Photo c).

3. Turn the vacuum cleaner on and let it run for 15 minutes. Note: Best results will be obtained if the following precautions are observed:

   a) All Sampling should be done outside of any building.

   b) The bag in the vacuum cleaner should be empty or removed.

   c) The blower end of the vacuum cleaner should not be allowed to blow dirt up into the air.

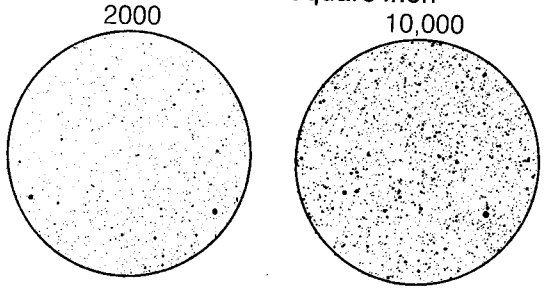
4. After the 15 minute exposure period, shut vacuum cleaner and remove Sampler. Using the tweezers remove the Millipore filter.

5. Compare the color to the High Volume Air Sampler Chart below and indicate your results on the Environmental Analysis Record on page 31.

Results

No change in the filter paper would indicate that your air is relatively free of suspended particles and may therefore be considered unpolluted. Darkening of the filter indicates that many tiny particles have been trapped. This is proof of pollution to some degree. A reading of 2000 or less indicates an acceptable low level; 2000-10,000 a mildly polluted condition; 10,000 or more, a serious air pollution problem.

High Volume Air Sampler Chart
Particles Per Square Inch



1* Blue paper discs are packing material and are not used.

2* If apparatus does not fit your vacuum, inexpensive universal adapters are available at hardware stores.

Experiment 2 Wind Blown Particles

Explanation

Wind Blown Particles may be described as particles of matter held in the air by wind only. They are fairly large in size as compared with suspended particles described in Exp. 1. Large quantities of wind blown particles may be an indication of many types of air pollution. They may indicate industrial pollution from coal burning power plants to processing plants for iron or other ores. They may also indicate agricultural and other types of land pollution where areas of land have been stripped bare of their covering vegetation allowing a great deal of soil to be carried away by the wind. Not all wind blown particles are caused by man but often a large concentration in a given area may be traced directly or indirectly to man.

In using this test a site should be selected which is quite open to the wind; the top of a building, an open field or some other such place. Streets are often poor sites if high buildings line each side, for that interferes with the natural flow of wind from all directions. After setting up this experiment it is good to note on the paper the positions of the compass. This will aid later on when trying to determine why one direction shows more particles than another. For example, a large corporation which may be polluting the air north of your sampling site would show up very well on your sticky paper as a dark blotch in the northerly position.

Equipment

Sticky paper, clean can (not rusty) or jar, compass or map.

Procedure

1. Select a test site where the sticky paper will be exposed to breezes from all directions. (For best results the site should be located several feet above the ground or rooftop.)

2. Remove the backing from the sticky paper using care not to touch the exposed sticky side.

3. Carefully mount a strip of sticky paper on any old jar or can with the sticky side exposed to the air.

4. Label the 4 compass directions on your sample.

5. Leave the sample of sticky paper exposed to the air for one week.

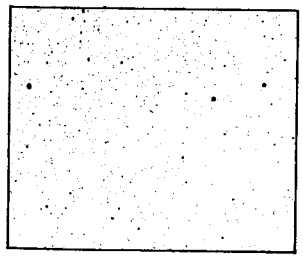
6. At the end of one week remove the sticky paper and compare it with the Sticky Paper Chart below.

7. Indicate your results on the Environmental Analysis Record.

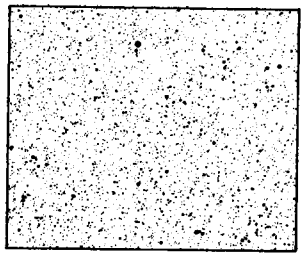
Results

In reading the results use the *dirtiest portion* of the sticky paper. No change in the sticky paper would indicate that the air is relatively free of wind blown particles and may therefore be considered unpolluted. Darkening of the sticky paper indicates that many particles have been trapped. A reading of 2000 or less indicates an acceptably low level; 2000-10,000 a mildly polluted condition; more than 10,000 a serious air pollution problem.

Sticky Paper Chart



2000



10,000

Particles Per Square Inch

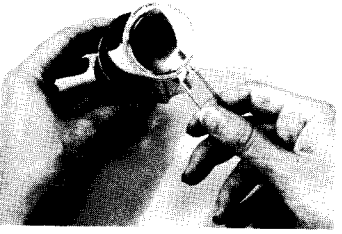
Experiment 3 Nylon Deterioration

Explanation

Stretched nylon is readily attacked by a variety of chemical pollutants. These pollutants range from soots containing acids to hydrocarbons emitted by internal combustion engines. These chemicals cause breaks in the weave. The more breaks found in the material the greater is the concentration of pollutants. Air pollutants can become so concentrated as to cause women's stockings to melt! While such concentrations as these are rare, it is common to find levels of pollutants high enough to cause nylon breakage over a long exposure period.

Procedure

1. Cut a piece of nylon from the sample provided. Stretch it over the cardboard tube and use the elastic to hold it in place. Inspect the exposed nylon for runs or holes and record these so as not to mistake them for results of your testing.



2. Select a site where it will be adequately exposed to the air. Secure so that it will not be blown away and protect it from rain.

3. At the end of 30 days remove it from your exposure site.

4. Carefully examine the stretched nylon with the magnifying glass and count the number of breaks found in it.

5. Indicate your results on the Environmental Analysis Record.

Results

The air may be considered to be relatively free of chemical pollutants if after a 30 day exposure, the nylon sample remains intact with *no* fibers broken. If 6 or less nylon fibers have been broken the air may be considered mildly polluted. Any more than 6 breaks indicates a serious problem.

Experiment 4 Smoke Density Comparator

Explanation

The Smoke Density Comparator is one of the easiest and best methods available for measuring the amount of pollution emitted by factories. With this comparator the smoke density from the plume is simply and accurately measured. For this test you may use one or more smokestacks in your area. In using more than one it is best to average the results of all samples.

Equipment

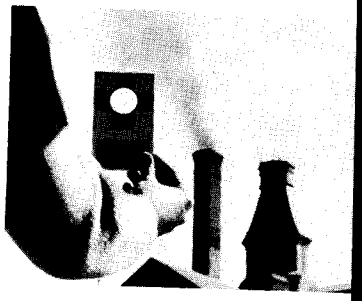
Smoke Density Comparator

Procedure

1. Select your site or sites to be tested.

2. Stand at least 100 feet but not more than ¼ mile from the smokestack or chimney with the sun at your back.

3. Look through the hole in the Comparator at the smoke as it emerges from the top of the smokestack. HOLD THE CHART AT ARM'S LENGTH (Photo a).



4. Compare the grey segments on the Comparator with the view through the hole.

5. Indicate your results on the Environmental Analysis Record.

Results

A reading of 1 or less is generally considered acceptable, whereas a reading of 2 or 3 indicates mild to semi-heavy pollution and 4 is regarded as an unacceptable heavy pollution reading.

Note

The grids and readings on the Smoke Density Comparator are based on the Ringelmann Smoke Chart, U.S. Bureau of Mines Information Circular 8333 dated May 1967.

TEST THE WATER

NOTICE

The water tests in this kit are designed to indicate the presence of certain types of water pollution. These tests do NOT identify all types of pollution. Therefore even though your water sample passes all the tests in this kit, IT STILL MAY NOT BE SAFE TO DRINK.

Experiment 5 Coliform Analysis

Explanation

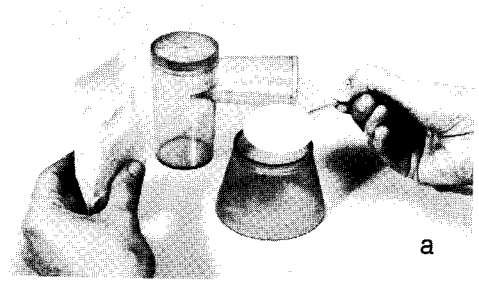
Coliform analysis serves as a method of determining human waste contamination in water. The word coliform (pronounced kol'-i-form) is used to designate a certain type of bacteria found only in the intestines of human beings and other animals. These bacteria by themselves are relatively harmless but since they come from waste materials they may serve as an indicator of disease causing bacteria. Typhoid Fever, for example, is caused by organisms found in the intestines. Many other diseases are also caused by such intestinal bacteria. The detection of these organisms is therefore an extremely important indicator of polluted water. Most public health agencies, in their tests for water pollution, test primarily for coliform bacteria. Water containing coliforms should never be used for drinking or other purposes without first having been properly sterilized by boiling for at least 30 minutes.

Equipment

Filtering apparatus, Millipore filter, Millipore nutrient pad, Petri dish, eye dropper, magnifying glass, household bleach, glass of tap water (left uncovered for 24 hours), water to be tested, tweezers, measuring cup, vacuum cleaner.

Procedure

1. Invert funnel portion of filtering apparatus on clean work surface. Open filter envelope and, using tweezers, carefully remove one thin white filter and place it grid side down into the top half (Photo a). Again using tweezers, remove one heavy white pad from the filter envelope and place it over the filter. Replace bottom half of apparatus and press onto top piece with a firm twisting action (Photo b). Turn assembly over.



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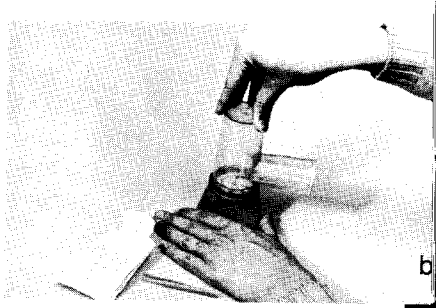

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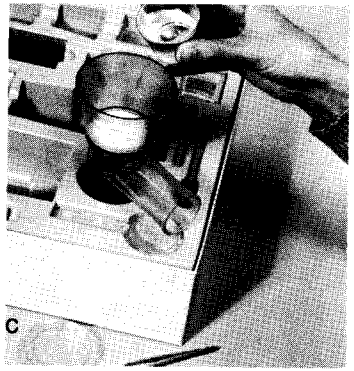
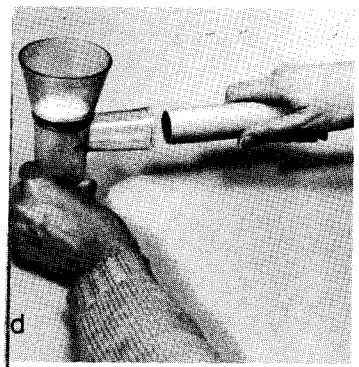


c

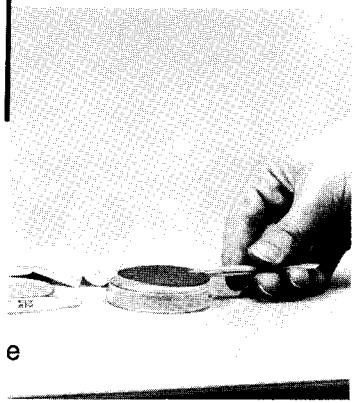
2. Pour *tap water* into measuring cup up to the 25cc mark and pour this amount into the funnel. (NOTE: At all times keep filtering apparatus vertical and secured with one hand. Apparatus may be placed in the tray stand under the Petri dish in your kit.) Using the eye dropper, place 1cc of *test water* into the funnel. (Photo c.)



d

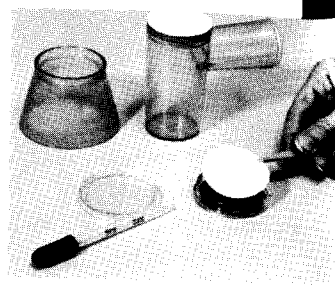
3. Connect filtering apparatus to the vacuum cleaner suction tube. Turn vacuum on until all the water has been pulled into the bottom of the filtering apparatus (about 30 seconds). Do NOT tip apparatus and allow water to suck into vacuum. Turn vacuum off and remove suction tube. Set filtering apparatus to one side. (Photo d.)

4. Using the handle of the magnifying glass open Petri dish. *Do not touch inside surfaces.* Using eye dropper, place 2cc's plus three drops of *tap water* into bottom half of Petri dish.



e

5. Using tweezers, remove one green nutrient pad from envelope and holding it parallel to and just above the water *quickly drop* it into the Petri dish. (Photo e.)



6. Remove funnel from top of filtering apparatus. Using tweezers, very carefully remove the *filter only* and place this, grid side up, on top of the wet nutrient pad in the Petri dish. (Photo f.)

7. Place cover on Petri dish, close tightly and carefully turn upside down. Leave undisturbed for 48 hrs. at room temperature. After 48 hrs. examine the filter in the Petri dish with the magnifying glass. *Do not remove top of Petri dish.* Look for round grey blue colonies of bacteria.

8. Count these and indicate your results on the Environmental Analysis Record.

Results

Little round grey to blue circles are coliform bacteria colonies. The presence of *any* of these colonies indicates that the water is polluted and should not be used for drinking or swimming.

A count of 1-5 colonies indicates mild pollution and any count of 6 or more is evidence of heavy pollution. Overgrowth or total coverage of the filter is possible and indicates the severest of conditions. NOTE: Each colony represents 1 coliform per 1cc. or 100 coliform per 100cc.

IMPORTANT

Cleaning and sterilizing of Petri dish: (This should be done under adult supervision.) Carefully open Petri dish and place cover to one side. Using eye dropper, place enough household bleach in dish bottom to cover nutrient pad and filter. Replace cover of Petri dish. Set to one side for about one-half hour. You have now deactivated any bacteria that may have grown on the filter and nutrient pad. After one-half hour open Petri dish, set cover aside and dispose of bleach, filter and pad. Rinse Petri dish with water, shake off excess water and rinse out again with rubbing alcohol and set aside to dry on paper towel. After dry put Petri dish together *without touching inside surfaces.* It is now ready for another experiment. Rinse out eye dropper using above procedure.

Experiment 6 pH Test

Explanation

pH is a measure of the degree of acidity or alkalinity of a substance. In more scientific terms it is the concentration of Hydrogen Ions in a solution. pH is measured on a scale ranging from 0 to 14. If the pH of a substance is 7, the material is said to be neutral. Pure water has a pH of 7. If the pH is less than 7 the substance is said to be acid. A sour tasting food indicates acid. A lemon is a good example of this. If the pH is greater than 7 the substance is said to be basic. Here cranberries provide a good example and exhibit the characteristic basic trait, bitterness. If a substance is either highly basic (very high pH) or highly acid (very low pH) the material may be very dangerous in that it has the capacity to destroy materials by a caustic or eating away action.

Mild acidity or alkalinity is normally found in nature as evidenced by the above examples of cranberries and lemons, but a very strong acid or base concentration in large volume is usually the result of man-made pollution. This contamination may be from industrial sources, agricultural sources or both. Refinement of ores, production of chemicals and other substances, and even mining may cause industrial pollution by acids and bases, while runoff from fields where artificial fertilizers and other chemicals have been employed may also cause this kind of pollution problem.

Procedure

1. Remove a short strip of *pHydrion paper* from the envelope so marked.

2. Dip one end of the paper into the water to be tested. (This procedure should be performed on a recently obtained water sample.)

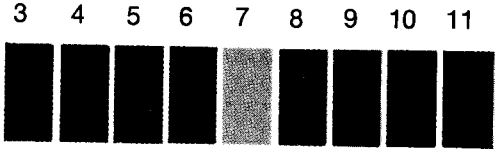
3. Compare the color of the *wet* end of the paper with the pH Color Chart below. The pH of the water is the number above the closest matching color.

4. Indicate your results on the Environmental Analysis Record.

Results

If the pH falls between 6 and 8 the water may be considered to be normal. If the pH falls below 6 or above 8 the water may be considered to be polluted. If it is below 4 or above 10 the problem is particularly serious.

pH Color Chart



Experiment 7 Settleable Solids

Explanation

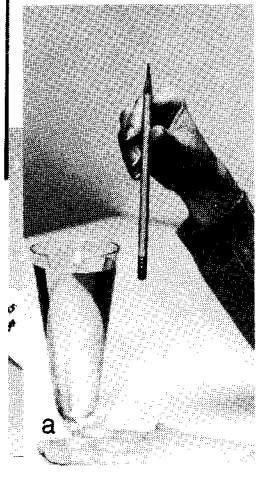
Settleable Solids may be defined as particles of matter too heavy to remain in water after the water has had a chance to stand motionless for some time. These particles may consist of sludge from sewage treatment plants, mine tailings, ore refinement wastes, soil runoff from farms, mud runoff from areas where man has caused massive erosion, and a host of other sources. A certain amount of such settleable matter is always found in nature, but in areas where it occurs abundantly the most likely cause is man. Measurement of settleable solids provides an extremely good indicator as to how seriously man has adversely affected his land. Since these particles settle when water is motionless, the best place to sample would be streams, rivers or other bodies of moving water. Small lakes and ponds will generally not give true results as most solids will have already settled out.

Equipment

Imhoff Cone, pencil

Procedure

1. Fill Imhoff Cone with test water to within ½ inch from the top. (Remember – Sample should be taken from body of flowing water.)



a

b

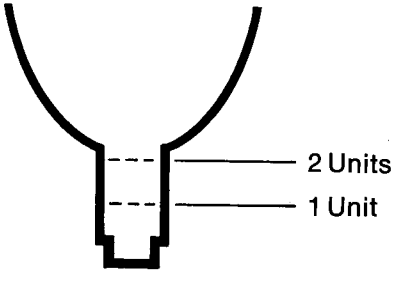
2. Let stand for 1 hour. Tap Imhoff Cone LIGHTLY with pencil every 15 minutes to shake down any dirt clinging to the sides. (Photo a.) DO NOT STIR WATER.

3. Using your Imhoff Cone Chart as reference, after one hour carefully read and indicate your findings on the Environmental Analysis Record. (Photo b.)

Results

If the amount of settleable matter falls between 0 and 1 Unit the water may be considered unpolluted; between 1 and 2 Units, mildly polluted; above 2 Units, highly polluted. NOTE: 1 Unit equals ¼ cc or 1 part in 1200.

Imhoff Cone Chart



Experiment 8 Hydrogen Sulfide (H_2S)

Explanation

Hydrogen Sulfide is a chemical compound often found with decomposing sewage and very frequently given off by factories involved in industrial processing. It has a foul smell like rotten eggs. Water may, however, contain Hydrogen Sulfide in concentrations considered unsafe even though the characteristic smell is absent. Water may also have the "rotten egg" smell but contain no Hydrogen Sulfide. This test is well suited for checking industrial pollution and to a lesser extent human and agricultural pollution.

Equipment

Measuring cup, Bottle "B", Alka-Seltzer, Hydrogen Sulfide Paper. (Read caution on envelope and handle only with tweezers.)

Procedure

1. Using the measuring cup, fill Bottle "B" with 25cc of the water to be tested.

2. Place one Hydrogen Sulfide Paper disc into the cap of Bottle "B". (DO NOT WET TEST PAPER.) (Photo a.)

3. Drop one Alka-Seltzer Tablet into the bottle and quickly replace cap containing test paper. (Photo b.)

4. Allow Alka-Seltzer to completely bubble away.

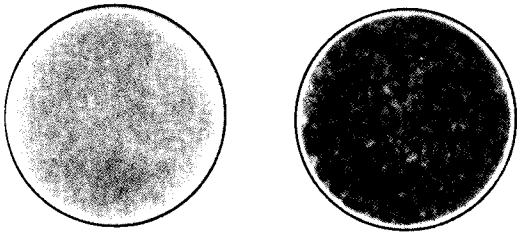
5. Using tweezers, remove the paper disc from the cap and compare it to the Hydrogen Sulfide Color Chart below. Immediately dispose of disc after making comparison.

6. Indicate your results on the Environmental Analysis Record.

Results

If the sample contains less than 0.5 parts per million (ppm) Hydrogen Sulfide the water may be considered to be uncontaminated with H_2S. If it contains from 0.5 to 2 ppm, the water may be considered mildly polluted. A reading of 2 or more ppm indicates a serious pollution problem. This means that the water may be dangerous to drink, swim in or use for other purposes. If the source of Hydrogen Sulfide is industrial, it is possible that the water contains other harmful chemicals.

Hydrogen Sulphide Color Chart



0.5 ppm 2 ppm

Experiment 9 Relative Stability

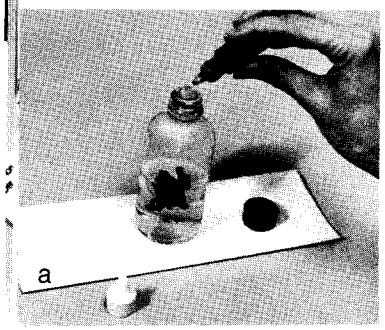
Explanation

Relative Stability provides a good measure of the amount of free and combined oxygen dissolved in water. All water has a certain amount of free oxygen dissolved in it. This plus oxygen combined with various chemicals (e.g. Nitrates) is the oxygen measured by the Relative Stability Test.

Most forms of life require oxygen and this is true not only of plants and animals but of microscopic bacteria as well. The faster bacteria grow, the more oxygen they will need. Frequently substances are emptied into our waterways that provide a large supply of food for bacteria living there. This over-supply of food causes the bacteria and other small organisms to grow so fast that virtually all the oxygen in the water is used up. When this happens, aquatic life of all types die. Such occurrences have caused massive fish kills in the past. Pollution of this type is extremely varied. Such oversupplies of food that create fish kill situations come from many sources. A few such examples are phosphates from homes, sludge from sewage disposal plants, certain chemicals from manufacturing plants, runoff of fertilizer from farms and a host of other possibilities. Fish and other water animals killed in this fashion by one or more of the above causes tend to make the situation even worse by providing more food for bacteria. This domino effect can and has severely upset the ecology of many rivers, streams and lakes.

Equipment

Bottle "A" Methylene Blue Bottle, paper towel


a

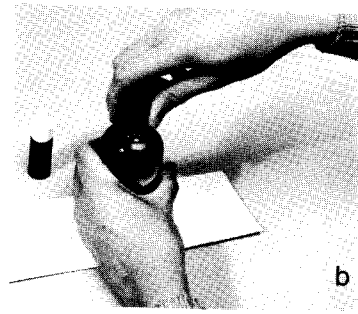
Procedure

1. Apply tape that may be written on, to Bottle "A" and record the time and date of experiment.

2. Working on a paper towel, *half* fill Bottle "A" with *test water*. (Photo a.)

3. Put 3 drops of the Methylene Blue Solution into the bottle. (Caution: do not spill this solution since it will stain anything it touches.) Carefully add more *test water* to the bottle until it is full to the brim.

4. Screw the cap on tight, pressing down firmly so that the bottle is sealed and *NO* air bubbles are left inside. If air bubbles occur, remove cap, add a few drops of *test water* and replace cap tightly as before. (Photo b.)


b

5. Let the bottle stand at room temperature and note the number of days it takes for the water to become clear. Check color using a sheet of plain white paper as background.

6. Indicate your results on the Environmental Analysis Record.

Results

If the length of time the sample takes to become clear is 6 days or greater, the water may be considered normal. If the length of time is 4-6 days the water may be considered mildly polluted. If the water takes 3 days or less to become clear, it may be considered very polluted.

Experiment 10 Phosphates

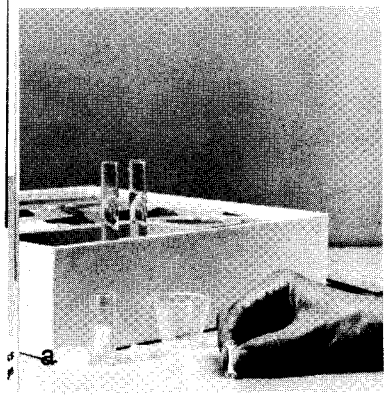
Explanation

Phosphates are chemical compounds necessary to all living organisms. At the same time an excess of phosphates in water can cause serious problems. The source of phosphates causing phosphate pollution problems is extremely varied. They may be released in the manufacture of various industrial products, they may be found in sewage, and they may be found in agricultural wastes and runoff from farmlands. One of the most common sources is ordinary household detergents and some enzyme action cleaning agents. Such cleaning agents cause great problems when they reach our natural bodies of water. In rivers, streams and lakes, algae and other microscopic organisms utilize phosphates in their growth. This can produce an oxygen depletion problem and the entire body of water may "suffocate." Detection and control of phosphates is an important step in saving our bodies of water.

Equipment

Phosphate Pillows (Read caution on bottle), measuring cup, scissors, two small test tubes.

Procedure



a

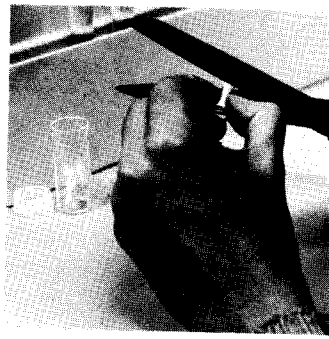
1. After removing the covers from the two test tubes, stand them up in the tray. (Photo a.)

2. Using the measuring cup, pour 5cc of *test water* into each test tube.

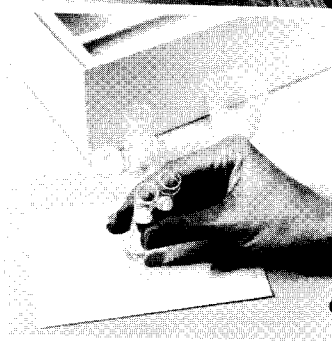
3. Take one Phosphate Pillow and holding it upright tap it on table until the powder settles down from the top of the Pillow. (Photo a.)

4. Using scissors, carefully cut off the top of the Pillow and add the entire contents to one

of the test tubes. Cover and shake this test tube for a moment. Remove the cover and place the tube back on the tray. (Photo b.)



5. After one minute, hold both test tubes about one inch above a piece of white paper (used to reflect light up through the test tubes). Look down through both test tubes simultaneously and compare the colors of the water in both. (Photo c.)



6. Indicate your results on the Environmental Analysis Record.

7. After recording your results, dispose of the empty Phosphate Pillow. Empty the test tubes and thoroughly wash them out with clear tap water, dry, and put away.

Results

If the color in both test tubes remains identical, there is little or no phosphate present. If a light blue-violet color appears as in (a) it is evidence of phosphate pollution. A color resembling (b) or darker indicates a high concentration of phosphates.

a b

What can you do?

What can you do to help protect your environment? Listed below you will find ten suggestions. If each and every person were to conscientiously subscribe to these, pollution in the United States could be meaningfully reduced. Remember, only YOU can make it happen!

1. Read books, become well-informed about all aspects of our current environmental crisis.

2. *Do Not Litter;* As Johnny Horizon says, "This is your land – keep it clean."

3. Avoid use of pesticides, herbicides and artificial fertilizers unless absolutely necessary.

4. Encourage and use recycling projects in your area. Many materials including aluminum, paper, glass and even rags and cloth can be recycled rather than dumped into the countryside.

5. Use soaps in place of detergents. Even non-phosphate detergents haven't been proven biologically harmless.

6. Boycott *No-Deposit, No-Return* bottles; buy only returnable bottles.

7. Reduce consumption of disposable plastic products. Remember, they are not biodegradable.

8. Do NOT buy products made from animals of an endangered species.

9. Where possible, travel by mass transit system or even bicycle. Automobiles are a major source of air pollution.

10. Finally, you can report specific examples of localized pollution to your town or city government or to the Environmental Protection Agency in your Federal region. Test results from this kit would make good evidence and photographs are also extremely helpful.

Glossary

Acid – chemical compounds which may react to form hydrogen ions (H^+); they ma be very corrosive and are characterized by a sour taste; compounds with a pH valu below 7 are considered acid.

Aerosol – particles of liquid or solid matter generally under 1 micron in diameter because of their small size they usually remain suspended in air.

Alkaline – having the properties of a base; a pH value greater than 7 and the char acteristic bitter taste; may be very corrosive.

Aquatic – growing or living in the water.

Base – chemical compounds which may react to form hydroxyl ions ($OH^\pm$); they may be very corrosive and are characterized by a bitter taste; compounds with a pH value above 7 are considered basic.

Biochemical Oxygen Demand (BOD) – The quantity of oxygen used in the biochemical breakdown of organic matter in a given time and at a given temperature; it is a measure of the organic matter to undergo decomposition in a body of water; large quantities of matter are often found in sewage and other wastes.

Biosphere – all living material on the planet earth; this includes all organisms found in air, water and soil.

Carcinogenic – cancer-producing.

Chemicals, Hard – chemicals which are very stable and do not readily break down when released into the environment; many are extremely dangerous.

Chemicals, Soft (Biodegradable) – chemicals which quickly break down when released into the environment; they are more easily handled by natural systems and generally not as dangerous as hard chemicals.

Coliform Bacteria – harmless bacteria which live in the intestines of animals and excreted with feces; their presence is used as an indicator of contamination by sewage.

Culture Medium – the "soil" for growing microorganisms; it contains the food nutrients required for proper growth of bacteria, etc.

Decompose – The breakdown of matter, usually organic.

Dissolved Oxygen (DO) – the amount of free oxygen found between molecules of water; it is usually expressed in parts per million.

Dust – any solid particulate matter over 1 micron in size.

Ecology – the branch of biology dealing with the interrelationships between living organisms and their environment.

Effluent – any liquid, solid or gaseous waste, treated or untreated, given off into the environment.

Environment – all of the physical and biological conditions affecting the life, development and survival of an organism.

Erosion – the wearing away of earth by the action of wind and water.

Eutrophication – the ecological aging of bodies of water; this is greatly hastened by addition of nutrients in the form of sewage or industrial waste.

High Volume Air Sampler – a device used in the measurement and analysis of suspended particulate pollutants.

Hydrocarbons – any of a vast family of compounds containing hydrogen and carbon in various combinations; fossil fuels are excellent examples; some hydrocarbons may be carcinogenic and many are major air pollutants.

Hydrogen Sulfide – a chemical compound with the formula H_2S; it exhibits a characteristic smell of rotten eggs; while it occurs naturally a large source derives from industrial processes.

Imhoff Cone – a device used to measure settleable solids.

Inversion – a condition occurring when a layer of cool air becomes trapped by a layer of warmer air above it, thus preventing the bottom layer from rising; a special problem in polluted areas because gaseous and particulate wastes are prevented from dispersing.

Methylene Blue – a harmless but heavy staining dye.

Microscopic – unable to be seen with the naked eye; must be viewed with a microscope.

Micron – symbol α; a unit of measure equal to $\frac{1}{1{,}000{,}000}$ of a meter (or 1/25,000 of an inch). A human hair is 80 microns in diameter.

Millipore® Filters – special "membrane" filters containing billions of microscopic pores; they are capable of screening out bacteria and retaining them on their surface for culturing or identification.

Nitrates – nutrient chemicals containing nitrogen; nitrates are necessary for growth of all living organisms, but large quantities cause serious problems.

Nutrients – materials necessary for the growth of all living organisms.

Particulate – a particle of solid or liquid matter.

Pathogenic – disease-producing.

Phosphates – nutrient chemicals containing phosphorous; they are necessary for all life but large concentrations cause serious problems.

pH Value – a measure of the acidity or alkalinity of a solution on a scale running from 0 to 14; where 7 represents neutrality, 0, most acid and 14, most basic.

Plume – the rising trail of smoke from a chimney or stack.

Pollute – to make impure or unclean; to violate air, earth or water classification standards.

ppb – parts per billion; the number of parts of pollutant for each billion parts of air, earth or water tested.

ppm – parts per million; the number of parts of pollutant for each million parts of air, earth or water tested.

Relative Stability – the percent of available oxygen compared to the quantity of oxygen necessary for breakdown of existing organic matter; this provides a good measure of the amount of sewage in water.

Ringelmann Chart – actually a series of charts, numbered from 0 to 5, that simulate various smoke densities; they are used for measuring the opacity of smoke arising from stacks and other sources.

Settleable Solids – particulate matter found in air or water which settles out when left motionless.

Sewage Treatment Plants – structures which remove solid and dissolved wastes from human and industrial sewage; most such structures at present do not remove all pollutants.

Sludge – the solid decomposed material removed from sewage.

Smoke – solid or liquid particles under 1 micron in diameter.

Smog – the irritating haze resulting from the sun's effect on certain pollutants in the air, notably those from automobile exhaust; also a mixture of fog and smoke.

Suspended Particles – particulate matter found in air and water, so small that it does not readily settle out when left motionless.

Treatment, Primary – the first major (sometimes the only) treatment of sewage; generally involves removal of most settleable matter but little or no colloidal and dissolved matter.

Treatment, Secondary – the treatment of sewage beyond primary treatment, involving removal of suspended solids and removal or modification of colloidal and dissolved solids.

Treatment, Advanced Waste and Tertiary – treatment beyond secondary, involving complete solid removal and sometimes dissolved nutrients (nitrates, phosphates, etc.).

Wind Blown Particles – particulate matter consisting mostly of settleable solids carried by the wind.

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Recommended Readings in Environmental Science

Group A: For those mildly interested in the environmental scene, here are some books which not only give the whole picture, but are fun reading as well.

Air Pollution Primer; Natl. TB and Respiratory Disease Assoc., New York, 1969.
America The Raped; Marine, Gene, Avon Books, New York, 1970.
A Sand County Almanac; Leopold, Aldo, Oxford Univ. Press, New York, 1970.
Eco-Catastrophe; by the Editors of *Ramparts,* Canfield Press, San Francisco, 1970.
Moment in the Sun; Rienow, Robert & Rienow, Leona Train, Ballantine Books, New York, 1967.
Silent Spring; Carson, Rachel, Houghton Mifflin Co., Boston, 1962.

Group B: If you made it through Group A, here are some additional books. While they are more factually informative than Group A, they are all generally easy reading.

Defoliation; Whiteside, Thomas, Ballantine Books, New York, 1970.
Ecotactics; edited by Mitchell, John G., Pocket Books, Inc., New York, 1970.
Not So Rich as You Think; Stewart, George R., Signet Pub., New York, 1970.
Reason Awake; Dubos, Rene, Columbia Univ. Press, New York, 1970.
Science and Survival; Commoner, Barry, Viking Press, New York, 1969.
Since Silent Spring; Graham, Frank Jr., Houghton Mifflin Co., Boston, 1970.
So Human An Animal; Dubos, Rene, Charles Scribners Inc., New York, 1968.
The Environmental Handbook; edited by DeBell, Garrett, Ballantine Books, New York, 1970.
The Quiet Crisis; Udall, Stewart L., Avon Books, New York, 1968.

Group C: This group is for the real environmentalist. Most of the reading is heavy but it really gives you the facts. If you make it through this group, you'll be able to talk intelligently with anyone discussing environmental matters.

Concepts of Ecology; Kormondy, Edward J., Prentice-Hall Inc., Englewood Cliffs, New Jersey, 1969.
Fundamentals of Ecology; Odum, Eugene P., W.B. Saunders, Co., Philadelphia, 1959.
Man Adapting; Dubos, Rene, Yale Univ. Press, New Haven, 1969.
Pesticides and the Living Landscape; Rudd, Robert L., Univ. of Wisconsin Press, Madison, 1966.
Population, Resources, Environment; Ehrlich, Paul R. and Ehrlich, Anne, H., W. H. Freeman and Co., San Francisco, 1970.
The Subversive Science; edited by Shepard, Paul and McKinley, Daniel, Houghton Mifflin Co., Boston, 1969.

Environmental Analysis Record

Darken in area next to test results for easy reference

Air Tests Location	Clean Environment	Mild Pollution	Heavy Pollution
1. Suspended Particles	2000 or less	2000 to 10,000	10,000 or more
2. Wind Blown Particles	2000 or less	2000 to 10,000	10,000 or more
3. Nylon Deterioration	0 breaks	6 or less	more than 6
4. Smoke Chart	1 or less	2 or 3	4
Water Tests Location	**Clean Environment**	**Mild Pollution**	**Heavy Pollution**
5. Coliform Analysis	0 colonies	1 to 5 colonies	above 6 colonies
6. pH	6 to 8	less than 6 more than 8	less than 4 more than 10
7. Settleable Solids	0 to 1 unit	1 to 2 units	above 2 units
8. Hydrogen Sulfide	0 to 0.5 ppm	0.5 to 2 ppm	above 2 ppm
9. Relative Stability	6 or more days	4 to 6 days	3 days or less
10. Phosphate	no color	(a.)	(b.)

Notes

Name_____

Date_____