Cloud Formation

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Topic

Cloud formation

Time

30 minutes

Safety

Please click on the safety icon to view the safety precautions. Be extremely careful when using matches. Make sure you close the cover before striking the match, and don't let the flame make contact with the bottle.

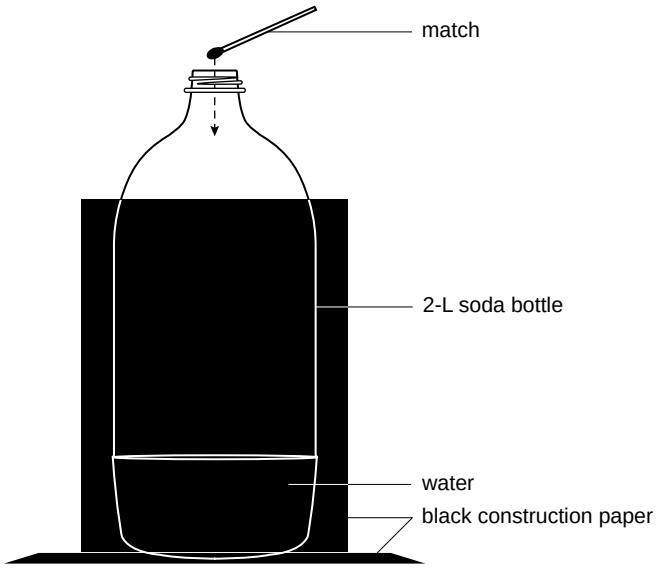
Materials

two pieces black construction paper
matches
one 3-L plastic soda bottle
bottle stopper or cork
bicycle pump (a floor pump with hose is best)
small nail or awl
warm water
inflation needle (the kind used to inflate footballs)
petroleum jelly

Procedure

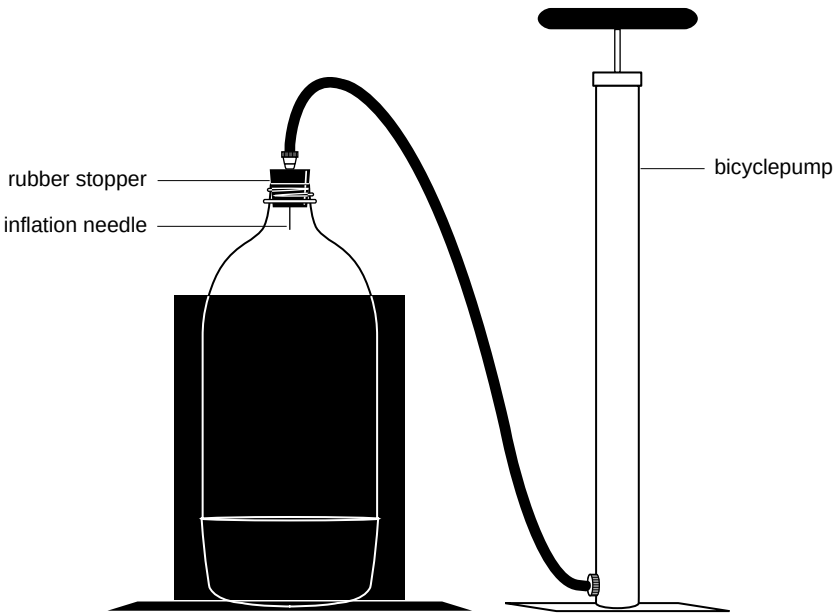
1. Using an awl or small nail, make a small hole through a bottle stopper or cork.
2. Spread some petroleum jelly on the inflation needle, and push it into the hole in the stopper until it protrudes from the bottom of the stopper. Attach this to the pump.
3. Pour warm water into the bottle to a level of about 8 cm. Add some food coloring to this (to make the cloud more visible; it helps if the water is a dark color).
4. Place the bottle on top of one piece of black construction paper, and place the other piece behind it (this also helps to make the cloud more visible).
5. Strike a match and hold it at the mouth of the bottle for a second, then drop it in (see figure 1).

Figure 1



6. Insert the stopper into the bottle. Supporting the bottle neck and stopper in one hand, begin pumping air into the bottle (see figure 2).
7. When the air pressure in the bottle is sufficient, the stopper will blow out, and you will see a cloud form.

Figure 2



8. Why is it necessary to drop the lighted match into the bottle?
9. Why do you think warm water is used in the bottle?
10. Clouds are formed when evaporated water rises in the atmosphere to an area of lower temperature and pressure. How does this activity demonstrate that?

What's Going On

The particles of smoke given off by the match provide condensation nuclei upon which the water vapor can condense to form the cloud. The clouds you see are formed when these cooled water droplets collect around particles of dust or smoke in the atmosphere, called *condensation nuclei.* Look up in the sky almost any day, and you'll see clouds drifting by. As water evaporates (changes from liquid to gas) out of lakes, streams, and oceans—and from plants and animals—it rises into the upper levels of the atmosphere. At these higher altitudes, the air pressure is lower and the temperature is colder, causing the water vapor to condense (change back to liquid). Most condensation nuclei attract water. When condensation begins, the particle dissolves in the water that surrounds it, forming a solution. As the air cools, the relative humidity increases, and the droplets increase in size. This process continues to grow into a larger cloud formation.

Connections

You may have experienced a weather condition known as sleet. It seems to be neither rain nor snow. In actuality, sleet occurs when a snowflake falls through an above-freezing layer of air and melts into a raindrop. The raindrop keeps falling into a below-freezing layer of air, which freezes the raindrop into sleet. Sleet is an ice pellet that bounces when hitting your car or any solid object.

Safety Precautions

READ AND COPY BEFORE STARTING ANY EXPERIMENT

Experimental science can be dangerous. Events can happen very quickly while you are performing an experiment. Things can spill, break, even catch fire. Basic safety procedures help prevent serious accidents. Be sure to follow additional safety precautions and adult supervision requirements for each experiment. If you are working in a lab or in the field, do not work alone.

This book assumes that you will read the safety precautions that follow, as well as those at the start of each experiment you perform, and that you will *remember* them. These precautions will not always be repeated in the instructions for the procedures. It is up to you to use good judgment and pay attention when performing potentially dangerous procedures. Just because the book does not always say "be careful with hot liquids" or "don't cut yourself with the knife" does not mean that you should be careless when simmering water or stripping an electrical wire. It *does* mean that when you see a special note to be careful, it is extremely important that you pay attention to it. If you ever have a question about whether a procedure or material is dangerous, stop to find out for sure that it is safe before continuing the experiment. To avoid accidents, always pay close attention to your work, take your time, and practice the general safety procedures listed below.

PREPARE

- Clear all surfaces before beginning work.
- Read through the whole experiment before you start.
- Identify hazardous procedures and anticipate dangers.

PROTECT YOURSELF

- Follow all directions step by step; do only one procedure at a time.
- Locate exits, fire blanket and extinguisher, master gas and electricity shut-offs, eyewash, and first-aid kit.
- Make sure that there is adequate ventilation.
- Do not horseplay.
- Wear an apron and goggles.
- Do not wear contact lenses, open shoes, and loose clothing; do not wear your hair loose.
- Keep floor and work space neat, clean, and dry.
- Clean up spills immediately.
- Never eat, drink, or smoke in the laboratory or near the work space.
- Do not taste any substances tested unless expressly permitted to do so by a science teacher in charge.

USE EQUIPMENT WITH CARE

- Set up apparatus far from the edge of the desk.
- Use knives and other sharp or pointed instruments with caution; always cut away from yourself and others.
- Pull plugs, not cords, when inserting and removing electrical plugs.
- Don't use your mouth to pipette; use a suction bulb.
- Clean glassware before and after use.
- Check glassware for scratches, cracks, and sharp edges.
- Clean up broken glassware immediately.

- Do not use reflected sunlight to illuminate your microscope.
- Do not touch metal conductors.
- Use only low-voltage and low-current materials.
- Be careful when using stepstools, chairs, and ladders.

USING CHEMICALS

- Never taste or inhale chemicals.
- Label all bottles and apparatus containing chemicals.
- Read all labels carefully.
- Avoid chemical contact with skin and eyes (wear goggles, apron, and gloves).
- Do not touch chemical solutions.
- Wash hands before and after using solutions.
- Wipe up spills thoroughly.

HEATING INSTRUCTIONS

- Use goggles, apron, and gloves when boiling liquids.
- Keep your face away from test tubes and beakers.
- Never leave heating apparatus unattended.
- Use safety tongs and heat-resistant mittens.
- Turn off hot plates, bunsen burners, and gas when you are done.
- Keep flammable substances away from heat.
- Have a fire extinguisher on hand.

WORKING WITH MICROORGANISMS

- Assume that all microorganisms are infectious; handle them with care.
- Sterilize all equipment being used to handle microorganisms.

GOING ON FIELD TRIPS

- Do not go on a field trip by yourself.
- Tell a responsible adult where you are going, and maintain that route.
- Know the area and its potential hazards, such as poisonous plants, deep water, and rapids.
- Dress for terrain and weather conditions (prepare for exposure to sun as well as to cold).
- Bring along a first-aid kit.
- Do not drink water or eat plants found in the wild.
- Use the buddy system; do not experiment outdoors alone.

FINISHING UP

- Thoroughly clean your work area and glassware.
- Be careful not to return chemicals or contaminated reagents to the wrong containers.
- Don't dispose of materials in the sink unless instructed to do so.
- Wash your hands thoroughly.
- Clean up all residue, and containerize it for proper disposal.
- Dispose of all chemicals according to local, state, and federal laws.

BE SAFETY-CONSCIOUS AT ALL TIMES