Cloud Chamber

Topic

Cloud formation

Time

1 hour

Safety

Please click on the safety icon to view safety precautions.
Do not touch dry ice with bare hands.

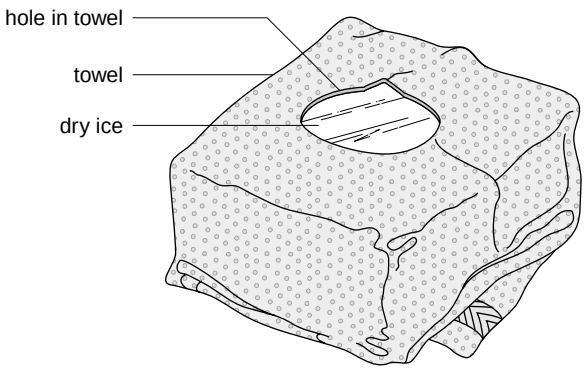
Materials

empty, wide-mouthed quart glass jar and lid
block of dry ice, 8 in. 2 5 in.
hand towel
black material, preferably velvet
glue
scissors
rubbing alcohol
200-W light (projector light)
blotter paper
warm water

Procedure

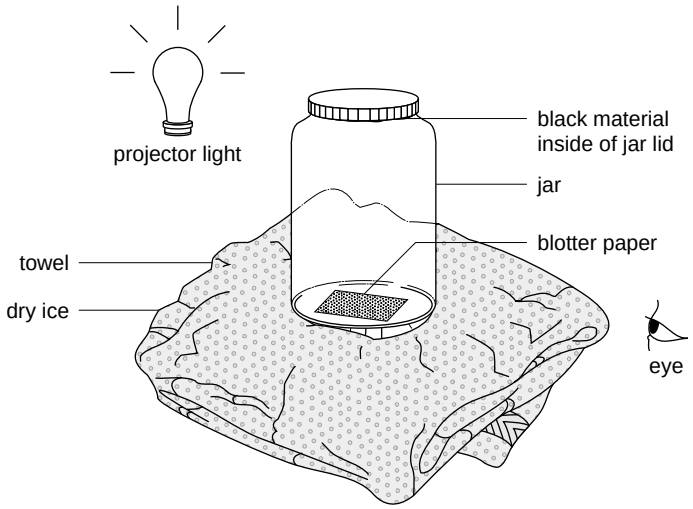
1. In the center of the towel, cut a hole the size of the jar lid.
2. Wrap the towel around the dry ice so that the hole is centrally positioned on the dry ice (figure 1).

Figure 1



3. Cut a circle in the black material the size of the inside jar lid. Glue the circle of material to the inside of the jar lid.
4. Cut a circle in the blotter paper the size of the bottom of the glass jar. Glue the circle of blotter paper in the inside bottom of the jar.
5. Run warm water on the outside of the jar.
6. Pour rubbing alcohol onto the blotter in the jar until the blotter is saturated. Pour off any excess alcohol.
7. Screw the lid onto the jar.
8. Place the lidded jar onto the dry ice, as shown in figure 2.
9. Shine light directly into the jar.
10. Observe the velvet cloth; record what you see.

Figure 2



What's Going On

The dry ice lowers the temperature of the bottom of the container (jar lid) to provide an environment of extreme temperatures. The jar lid is covered with black velvet for you to more easily observe vapor trails, which appear as white streaks. The jar bottom is covered with blotting paper, which absorbs a quantity of rubbing alcohol. Rubbing alcohol vaporizes easily. When radiation particles hit the vapor molecules, water droplets form, and you can see cloud trails as white streaks. Alpha nuclei (protons) leave a straight trail, and beta particles (electrons) leave crooked trails.

Connections

Using a cloud chamber, you can observe one way that clouds may develop. Cirrus, cumulus, and stratus are the three basic cloud formations. Stratus clouds are grayish color and appear to be layered Cumulus clouds are white and puffy above a flat plane. Cirrus clouds are also white and look long and thin. Watching clouds to determine if a figure in a cloud formation can be seen is not the only reason for studying clouds. Scientists who research changing weather patterns study a field of

science called “weather modification.” General Electric Corporation began weather modification in l946 with the discovery of cloud seeding with dry ice. Scientists have used various chemicals to make rain; this process is called cloud seeding. Sometimes cloud seeding to make rain does the opposite; therefore, the results of weather modification research are inconclusive. This indeed is an area of meteorology that needs further exploration.

Troubleshooting

If the jar cools before you screw on the lid, repeat the procedure.

Additional Activities

Place a watch with a luminous dial near the jar lid. Take pictures of the vapor trails using a 35-mm camera and 200 ASA film.

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