

Build a Cloud Chamber

NAYGN: Kits for Kids

Ingredients

- Clear glass or plastic jar (leak-proof) with a wide mouth and a tight-fitting metal lid
- Thick felt
- Rubber-based glue
- Dark material (e.g. black velvet or dark-colored felt)
- 91% isopropyl alcohol
- Thick gloves
- Dry ice
- A light source with an intense beam of light (e.g. strong flashlight)
- Radioactive source (optional)
- Strong magnet

Description

Although ionizing particles are invisible, you can use a cloud chamber to see the tracks the particles leave behind.

Procedure: Building a Cloud Chamber

- 1) Get a clear glass or plastic jar that has a wide mouth and a tight-fitting metal lid, preferably a lid with a rubber gasket to achieve an airtight seal. The jar must be leakproof.
- 2) Cut a piece of thick felt into a doughnut shape. Line the bottom of the jar with the felt, attaching it with a rubber-based glue. Allow the glue to dry thoroughly.
- 3) Cut a disk-shaped piece of dark material (such as black velvet or dark-colored felt). Glue the disk to the inside of the metal cover. The material must not cover the gasket. Allow the glue to dry thoroughly.
- 4) Saturate the doughnut-shaped felt in the bottom of the jar with 91 percent isopropyl alcohol (not the more common 70 percent that is sold for home use).

Caution: Isopropyl alcohol is flammable and poisonous. Keep it away from heat and open flame. Use it in a well-ventilated area, wear plastic gloves to protect your skin, and never drink it.

- 5) Screw the lid on, sealing the jar tightly. Turn the jar over so that the saturated felt is at the top of the chamber and the metal lid is on the bottom.
- 6) Wearing thick gloves, place the jar so that its metal lid rests directly on a cake of dry ice (available from some grocery or ice-cream stores).

Caution: Dry ice can severely damage your skin. Never handle it bare-handed; always wear thick gloves and eye protection. Set the dry ice in a box or on a tray to protect your tabletop or work surface. Dry ice changes to carbon dioxide gas, so operate your cloud chamber in a well-ventilated area.

- 7) Turn off the room lights. Direct an intense, well-focused light beam through the jar from the side, pointing it along the bottom of the chamber. A slide projector lamp or a strong, well-focused light source from a microscope works best. A flashlight can sometimes be used successfully if the beam is intense and tightly focused.

Note: You can get a small radioactive source at a rock or hobby shop or an educational supply store to place in the jar and increase the radiation, rather than depend on natural cosmic rays.

- 8) Allow 10 or 15 minutes for the chamber to cool. The inside should be foggy from the alcohol. Near the bottom you should begin to see tracks as naturally occurring cosmic rays pass through the vapor, leaving thin trails of alcohol droplets visible against the dark lining of the metal lid. You should be able to see two or three tracks per minute, possibly more.
- 9) Hold a magnet up to the jar and observe its effect on the tracks. Put the magnet in different places and describe what you see.

Troubleshooting

If you do not see any tracks:

- 1) Make sure the metal lid is tightly closed and the jar is airtight.
- 2) Be sure the metal lid is in good contact with the dry ice.
- 3) Wait about 15 minutes for the chamber to get cold enough.
- 4) Use a strong light, well placed to shine across the bottom of the chamber where the vapor is supercooled.
- 5) If you see only a very thick mist and no tracks, open the jar and let some of the vapor escape.
- 6) Rebuild the cloud chamber, using a jar that is a little shorter or taller.