

DIY Cloud Chamber: Visualize Cosmic Rays



Grade: 8th Grade | **Topic:** DIY Cloud Chamber: Visualize Cosmic Rays | **Measurement:** US Customary (cups, ounces, inches, etc.)

Purpose

This experiment allows students to see the invisible tracks of cosmic rays and other particles as they pass through a cloud chamber. It demonstrates how particles interact with supersaturated vapor to create visible trails.

Hypothesis

If a supersaturated alcohol vapor environment is created inside a sealed container with cold temperature, then tiny charged particles from cosmic rays will leave visible trails as they pass through the vapor.

Materials

- Clear glass or plastic jar with a lid (about 1 quart size)
- Black felt or black construction paper (cut to fit inside the lid)
- Isopropyl alcohol (rubbing alcohol), 90% or higher, about 1 cup
- Dry ice (about 5 pounds) - handle with gloves
- Thick gloves or tongs (for handling dry ice)
- Styrofoam cooler or a thick foam tray (to hold dry ice)
- Flashlight or bright LED light
- Tape (optional)
- Thermometer (optional)

Procedure

1. Wear gloves to handle dry ice safely. Place about 1 inch of dry ice at the bottom of the Styrofoam cooler or foam tray.
2. Pour about 1 cup of isopropyl alcohol onto the black felt or black paper so it is fully soaked but not dripping.
3. Secure the alcohol-soaked felt to the inside of the jar lid. The black background will help you see the particle tracks more clearly.
4. Quickly place the lid (felt side down) onto the jar, then invert the jar and place it on top of the dry ice inside the cooler. The jar should be upside down with the felt touching the cooler's top surface.
5. Wait 5-10 minutes. The alcohol will evaporate and cool, creating a cold, alcohol vapor-filled environment inside the jar.
6. Dim the room lights. Shine the flashlight sideways into the jar to illuminate the alcohol vapor.
7. Look carefully inside the jar. You should see thin, white streaks or lines forming and disappearing inside the vapor. These are particle tracks caused by cosmic rays or natural background radiation.
8. Observe and note the number, length, and movement of the tracks over several minutes.
9. When finished, carefully lift the jar away from the dry ice to stop the reaction.

Results

You should see thin white streaks or lines appear and move inside the jar. These tracks vary in length, brightness, and speed, representing cosmic rays or tiny charged particles moving through the vapor.

Conclusion

The experiment shows that cosmic rays and other ionizing particles constantly pass through us and the environment, but are normally invisible. By creating a supersaturated alcohol vapor and cold environment, the cloud chamber makes these particles visible as temporary trails.

Learning Objectives

- Understand what cosmic rays and ionizing particles are
- Learn how a cloud chamber makes invisible particles visible
- Observe and describe different particle tracks
- Practice careful observation and recording of experimental data

Teacher Notes:

Key Concept: A cloud chamber works by creating a supersaturated alcohol vapor that condenses around charged particles passing through, leaving visible trails. Cosmic rays are high-energy particles from outer space that can ionize atoms as they travel through the atmosphere.

Answer/Explanation: The white streaks are caused by alcohol droplets forming along the ionized paths left by cosmic ray particles. The cold dry ice cools the alcohol vapor to just below its condensation point, creating the perfect conditions for these droplets to form.

Teaching Tips:

- Encourage students to be patient and observe closely, as tracks may be faint or brief.
2. Use a flashlight at an angle to improve visibility of the trails.
 3. Remind students to never touch dry ice with bare hands.
 4. Discuss the natural sources of radiation and cosmic rays before the experiment for context.

Relevant Standards: MS-PS1-3, MS-PS4-3, NGSS MS-ESS1-3



Name: _____

Date: _____

Experiment Title:

Purpose: *(I wonder...)*

Hypothesis: *(I think...)*

Materials:

Procedure:

Results: *(What happened?)*

Conclusion: *(I learned...)*