

CLOUD CHAMBER



The cloud chamber is a device that is used to observe directly the products of radioactive decay. In particular, it is exceptionally good for observing the path of α particles. As the radioactive particles travel through the chamber they ionise the atoms in their path. The dipolar vapour molecules surround each of these ions to form a visible droplet path.

There are several different cloud chambers two of which are shown in the photograph. They all consist of two main parts, the top section being the actual cloud chamber where radioactive particle tracks can be observed. The bottom section provides the cooling mechanism which may consist of a second chamber for dry ice, a stem of metal which rests in a vacuum flask filled with dry ice, or a large spring which holds the dry ice in contact with the chamber.

The cloud chamber is very simple to use. Safety precautions should be observed.

SAFETY PRECAUTIONS

- Radioactive sources should *not* be handled with bare hands. Thick leather gloves must be worn or the sources handled with tongs or forceps.
- Wash hands thoroughly after using any radioactive sources (β -particles do not penetrate the skin but are dangerous if ingested).
- Sources should be clearly labelled and properly stored in a 6mm thick sealed lead container.
- All experimental work should be carried out at a safe working distance of at least 30cm.
- Replacement of school sources every 10 years is recommended.
- Avoid touching the dry ice with your fingers by using thick leather gloves.

SETTING UP AND USING THE CLOUD CHAMBER

C It is worth checking the following items before an experiment is set up:

- Ensure that the base is black - in some models the black paint on the bottom tends to peel off. If necessary repaint the surface with hobby enamel paint and allow to dry.
- Ensure that dry ice has been ordered for the required time. Dry ice will last a maximum of 2 days in an ordinary freezer. It can be purchased from the warehouses of the major ice-cream manufacturers. Some companies will also deliver a block of dry ice to the school, providing they already supply the school canteen.

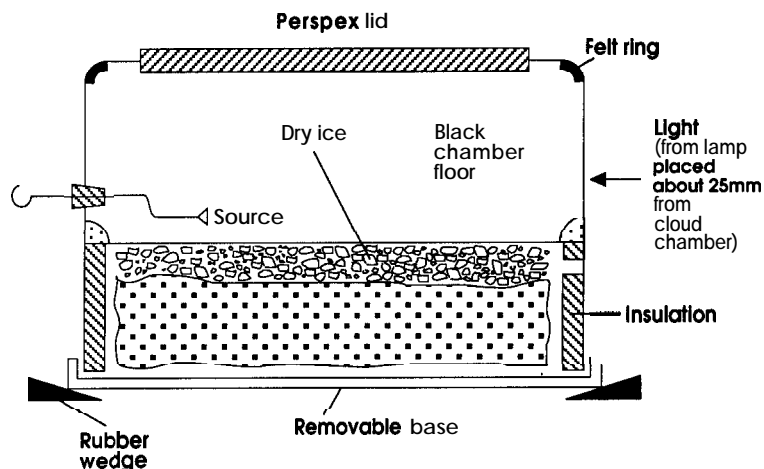
X Extra equipment for the suggested learning experiences includes:

- a block of dry ice
- gloves or tongs to handle the dry ice
- a hammer
- alcohol and dropper
- a flannel cloth
- power pack

- 2 leads
- a small globe for use as a light source which does not create too much heat (some models have them built in)
- radioactive sources mounted on a small metal probe (available from ANSTO) - not the type encased in perspex

S Setting up the Cloud Chamber

- Place the dry ice between sheets of newspaper and, using a hammer, break the ice into small pieces (notcrushed). Place the dry ice into the lower section of your cloud chamber and set it up to ensure there is maximum surface area contact with the upper chamber.



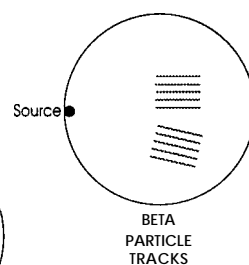
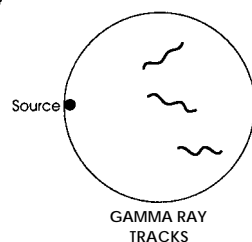
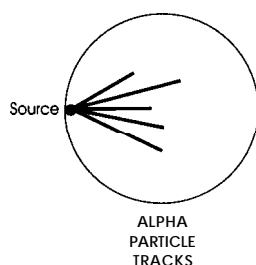
- Where applicable, place the small rubber wedges under the unit to ensure that it is entirely lifted off the desk and completely level.
- Open the perspex lid of the chamber and soak the sponge/paper ring with alcohol so that the air inside the chamber is super-saturated. If in doubt, use *more* rather than less alcohol. Ensure that one of the rings is at the top of the chamber.
- Replace the lid and *wait* 1-2 minutes.
- Connect the light source to the power supply and turn the light on. The light must be bright but not hot. Position the light so that the chamber is illuminated from the *side*, rather than the top.
- Insert the radioactive source into the small hole in the side of the chamber.
- Repeatedly rub the perspex lid with a flannel cloth in order to give it an electrostatic charge.

HANDY HINT

- If the experiment is unsuccessful check the age and activity of your radioactive sources by using a geiger counter.

SUGGESTED LEARNING EXPERIENCES

1. Observe alpha particle tracks as short, shooting lines radiating from an alpha source such as Americium-241 (see *below*).
2. Observe the tracks from a beta source such as Strontium-90 or Caesium-137. These are seen as faint wavelike, parallel lines visible only for a short period of time (see *opposite*).



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3. Observe gamma or X-ray tracks from a source such as Cobalt-60. These are seen as very obvious squiggly lines that follow a short, random path (see *opposite*).