

R07458

Cloud Chamber

NFU908



## Purpose

The Unilab cloud chamber allows the visualization of atomic particles as they pass through a super saturated Isopropanol Vapour. Energetic charged particles, such as Alpha or Beta particles, collide with the gas molecules in the supersaturated region causing a trail of ionized particles. These ionized gas particles act as nucleation sites on which the super saturated alcohol vapour condenses leaving a cloud like trail that lasts for a few seconds. The large tank size means that the Unilab Cloud chamber is also capable of detecting background radiation particles which are obvious as they leave trails that move inward from the outside of the tank.

## Apparatus Details

The cloud chamber consists of three main components. An Aluminum plate which holds the LED lighting in position and collimates the light to produce less glare. The tray with, foam inserts provides good insulation for the dry ice giving run times of over one hour. Viewing tank with foam evaporator at the top.

## Required Equipment

The cloud chamber requires the following additional equipment:

- 12V d.c. Power supply (e.g. G85458)
- 2 X 4mm leads
- 250-300 ml Dry Ice (approx. 350 – 420g)
- 50-100 ml Isopropanol (99% concentration)

## Safety

- **Eye protection must be worn**
- **Suitable insulated gloves or gauntlets must be worn. Dry ice can cause serious frost bite**
- **Ensure that the room is well ventilated, CO<sub>2</sub> gas is an asphyxiant.**
- **Only teachers and technicians must handle the dry ice**
- **Never place dry ice in a sealed container**



**Isopropanol is highly flammable.**

Do not bring the stock bottle into the lab until all sources of ignition have been removed.

## Operating Procedure

**Before beginning please read the section on safety above**

Remove the aluminium plate, including the LED lighting and move it to one side to access the well for the dry ice. It is not necessary to disconnect the light source. Dry ice is available in different pellet sizes, the smaller pellets will work better, but large pellets may be crushed if necessary (Please see Safety section). Only teachers and technicians must be allowed to handle the dry ice.

Fill the dry ice well to a depth of about 7mm (not critical) and smooth out the dry ice so that it is a uniform depth. Replace the aluminium plate on top of the dry ice and press down so that the plate is in contact with the dry ice. The plate may make a squealing noise for a few seconds as it cools, this is quite normal. Now place the thoriated welding rod in the middle of the plate supported on the two plastic pillars provided, this will keep the rod in the supersaturated alcohol region.

Now invert the viewing tank so that the foam is at the bottom and add the Isopropanol evenly to the evaporator. As the evaporator is mounted using screws, some excess alcohol may leak through the tank at this stage. Turn the tank so that the evaporator is uppermost and fit the tank onto the tray. The tank should be a snug fit into the top foam layer to prevent draughts. Depending on how much Isopropanol has been used, you may see that the evaporator sags between the mounting points. This is quite normal, the foam will regain its normal shape once all the alcohol has evaporated.

Now connect a 12 V d.c. power supply to the 4mm terminals provided and the LEDs will light the aluminium plate from one side. **Reduce the ambient lighting as much as possible, the darker the better for viewing the feint tracks.**

After 5 or 6 minutes, fine droplets should be visible, falling slowly inside the tank. After about 9 minutes, the alcohol will form a supersaturated vapour, just above the plate and the first trails will start to appear. Rubbing the top of the tank with a clean duster will help remove any stray ions and give sharper trails.

Alpha particles are heavy and have a charge of +2. The high charge means that they can cause a lot of ionization in a short distance. Each time an Alpha particle rips an electron from a molecule it slows down and as it slows, it remains closer to atoms for longer, increasing the chance of ionization. Alpha particles are heavy, so they are not easily deflected by collisions with atoms. This is why Alpha particles generate short, fat, straight, ionization trails. All the Alpha trails are about the same length as all the Alpha particles emitted by the source have the same energy.

Beta particles are much lighter than Alpha particles, they travel faster, so cause less ionization, creating longer thinner trails. Beta particles are less ionizing than Alpha, so they lose energy more slowly and travel further. Beta particles have a tiny mass compared to an Isopropanol molecule causing it to deflect when passing close to, or colliding with a molecule, so the tracks tend to wiggle more. Try placing a piece of thin aluminium foil next to the source. The foil will prevent Alpha particles from passing through, but Beta particles can still penetrate the foil.

Background radiation can also be detected. Muons are created by interaction of cosmic rays with the atmosphere. Muons travel at close to the speed of light and so, if you see a cloud track similar to an Beta particle, but completely straight due to its high speed, it may very well be a muon!

## Warnings

For your safety, this product should be used in accordance with these instructions, otherwise the protection provided may be impaired.

## Cleaning

The viewing tank and tray can be cleaned with warm soapy water or a soft cloth with a little isopropanol. Do not use any abrasive cleaners or other organic solvents. If necessary, the Aluminium plate can be disconnected from the tray for cleaning as above.

### Disposal of Waste Electrical and Electronic Equipment (WEEE)



#### Do not dispose of this product with household waste

- For the proper treatment, recovery and recycling please take this product to an appropriate collection point.
- If you are unsure where this is, contact your Local Authority
- By disposing of this product correctly you will be providing positive help to the environment.

## Warranty, repairs and spare parts

The Cloud Chamber is guaranteed for a period of one year from the date of delivery to the customer. This warranty does not apply to defects resulting from the action of a user such as misuse, improper wiring, any operations outside of its specification, improper maintenance or repair, or unauthorized modification.

Our liability is limited to repair or replacement of the product. Any failure during the warranty period should be referred to Customer Services or [techsupport@philipharris.co.uk](mailto:techsupport@philipharris.co.uk)

## Instructions for authorized service technicians

Please refer to the detailed service procedures, safe servicing and continued safety – contact [techsupport@philipharris.co.uk](mailto:techsupport@philipharris.co.uk) for advice.

Please refer to product specific risks that may affect service personnel, the protective measures and verification of the safe state after repair.

## Supplier details

Philip Harris Education, 2 Gregory Street, Hyde, Cheshire, SK14 4TH

### Orders and Information:

Tel: 0345 120 4521

Fax: 0800 138 8881

### Repairs:

Tel: 01978 853555

E-mail : [sales@techlabltd.co.uk](mailto:sales@techlabltd.co.uk)

### Technical Support:

E-mail: [techsupport@unilab.co.uk](mailto:techsupport@unilab.co.uk)

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