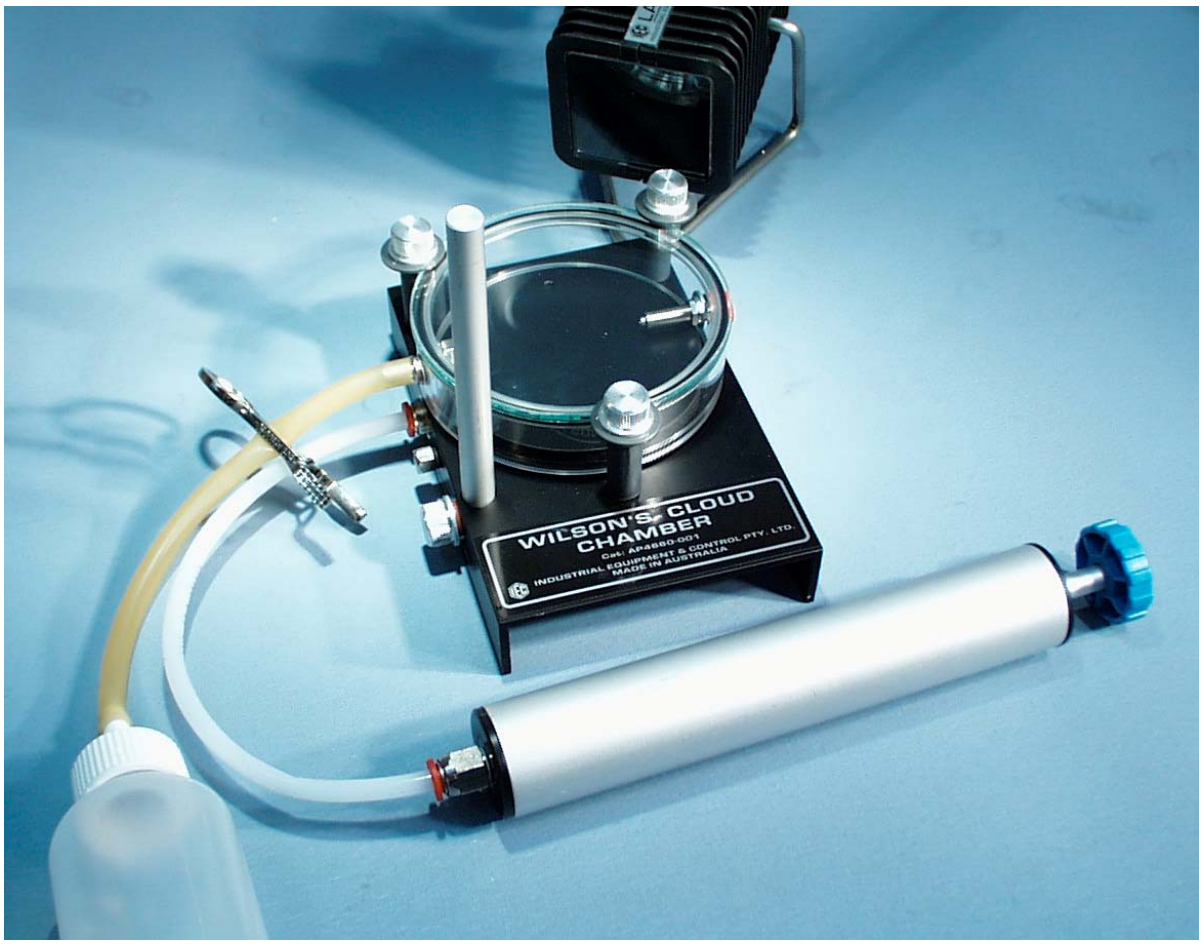
WILSON'S CLOUD CHAMBER - expansion type

Cat: AP4660-001 Wilson's Cloud Chamber

DESCRIPTION: **KIT CONTENTS:**

- Base assembly with chamber sealed and clamped by 3x screws.
- Rod to support an Alpha point source through the side of the cell.
- Hand operated "one pull" vacuum pump with hose.
- Small squeeze bottle to hold a small amount radioactive powder, with chamois filter disc and complete with flexible tubing and Mohr clip.
- Base support rod, with knurled fixing screw permits the cloud chamber to be supported up from the table level for better viewing.

AP4660-001 Wilson's Cloud Chamber



Physical size: 120x110x65mm LxWxH **Weight: 0.34kg**

Supplied with puffer bottle, hose and spring clip, vacuum pump and support rod for lamp illumination. Radio active sources and illumination lamp not included.

HOW IT WORKS:

Iso-propyl alcohol is introduced into the cell to create a saturated vapour of alcohol in the air. When the radioactive source is in the chamber, the particles from the r/a source strike the air molecules to create ions. A hand operated vacuum pump draws out some of the air to reduce the pressure and to reduce the temperature in the chamber.

As the cell cools slightly, the vapour becomes super-saturated such that the vapour MUST condense on Ions due to the Alpha particles passing through the air. In the first few evacuations, the dust and other particles are condensed upon and they fall to the bottom of the cell and a voltage is applied across the cell to sweep away any charged particles.

Finally, with light shining at an angle through the side of the cell, when the fall in pressure occurs again, the tracks of condensed vapour can be seen coming from the r/a source.

A delay of about 20 seconds between successive evacuations to permit the alcohol to re-evaporate into the air will give the best results.

CELL & BASE ASSEMBLY:

The heavy wall acrylic cell is fitted at each end with a rubber sealing ring which is located on a ledge in the edge of the cell. When the glass viewing window is fitted and the assembly is gently compressed to the metal base, a perfect seal should result. The three pillars locate the cell and the three knurled head clamp screws with their washers press on the edge of the viewing window to form the seal. DO NOT OVER-TIGHTEN.

The cell should be positioned so that the 4mm socket terminal, which is rubber sealed into the cell wall, is on the same side as the 4mm socket in the metal base. It can be seen that this terminal is connected to a metal loop recessed into the cell wall for protection. A potential of between 200 and 600 Volt DC will be applied between this loop and the base as an "ion clearing field" across the cell. The metal loop should be towards the UPPER EDGE of the cell next to the glass viewing window.

On the opposite side to the 4mm socket is a metal nozzle through which radioactive material is introduced into the cell. This nozzle is internally threaded to accept the point source rod when required. The point source rod is stored in a threaded hole in the edge of the base.

Inside the cell a pad of felt is attached to the base and is covered by a black aluminium disc. Air from the cell is withdrawn from the underside centre of the felt disc. This technique ensures even air distribution with minimum turbulence within the cell during evacuation.

The black metal disc provides a suitable background for viewing and carries the few ml of the iso-propyl alcohol that is necessary for operation.

The air is drawn from the cell through the air hose fitting protruding from the side of the base. The nylon tube from the pump pushes into the fitting to seal. To remove the tube, firmly press in the front ring on the fitting while pulling on the tube.

THE VACUUM PUMP:

This pump has a piston seal so that it draws air in (sucks air) when the handle is pulled. The nylon tube pushes into the air fitting in the front of the pump. To create a super saturated vapour in the cell, the pump knob is pulled rapidly to draw out the air quickly.

RADIOACTIVE SOURCE …. Contaminated air:

NOTE; Thorium Oxide or Hydroxide is often difficult to obtain. Therefore an Alpha point source experiment is usually preferred to "Contaminated air".

If the radioactive material is to be air, place about 5g of a mildly radioactive Thorium salt (alpha source) into the squeeze bottle. The nozzle on the squeeze bottle is attached by the flexible hose to the nozzle on the side of the cell. The bottle has a chamois filter in the neck to prevent any r/a salt from escaping during puffing. **Be sure this is intact.**

Shake the bottle so the air in the bottle is contaminated by the by-product of the r/a Thorium salt called 'RADON 220' and when the bottle is squeezed by fingers, the contaminated air is puffed through the chamois filter and into the cell. The clip on the hose is released for puffing and re-applied about 2cm from the cell to seal the hose before evacuation.

Squeeze the spring clip to open it and puff the bottle then let the clip re-seal the hose. A quantity of mildly radioactive air is now introduced into the cell.

Allow a few seconds for the alcohol to evaporate and the turbulence to subside, then fully withdraw the vacuum pump handle swiftly but smoothly to create a partial vacuum in the cell. A random pattern of numerous short ray paths should be evident for a few seconds while vacuum is maintained. The random directions of the ALPHA PARTICLE SCATTER should be obvious.

Repeat the evacuation each 30 seconds or so to observe the activity decay inside the cell until only perhaps two or three tracks remain. Then, to repeat experiment, open the spring clip, puff once, restore the clip and wait a few seconds before evacuating the cell again.

RADIOACTIVE SOURCE …. Point radioactive source:

This is the preferred experiment: Radiation from an Alpha point source rather than from contaminated air.

Option 1) Take the "Point Source" and poke it through the port used by the puffer bottle so that it enters the cell about 10mm or so. On the outside, use a small piece of "blue tak" to completely seal the pin into the hole.

Option 2) The "support pin" with the small knurled head can be found stored in the edge of the base. Its rod is used for fixing to the stem of a cut-down "Point Source" so it can point into the cell. It screws into the port and seals completely as it tightens. The point source will need to be cut very short so it can be fixed to the support rod and not extend too far into the cell. The best 'fixing' is to solder the two together to behave as one piece and to store into the edge of the base when not in use.

When iso-propyl alcohol is introduced into the cell and a partial vacuum is suddenly created, alpha particle tracks should be seen to radiate from the tip of the "Point Source" fixed to the pin.

The tracks can sometimes extend all the way to the opposite side of the cell. Relax the vacuum, wait a few seconds for the alcohol to evaporate again inside the cell, then pull the partial vacuum again.

THE MOUNTING ROD and LIGHT SOURCE: The straight 12mm diameter rod may be inserted either pointing down for supporting the chamber up from the bench or pointing up to carry a small light source to shine through the side of the cell .

A microscope lamp can be used for a light source. It is usually best to be shining generally horizontally through the side of the cell with some downwards angle ….. or a small LED torch can be clamped to the support rod to shine through the side of the cell.

PROCEDURE FOR AN EXPERIMENT:

- Remove the clamp screw from one of the cell location pillars and loosen the other two clamp screws. Remove the glass viewing cover. Be sure the glass is clean.
- Place say 1ml of ISO-PROPYL or ETHYL alcohol on the black metal disc inside the cell and allow it to spread. Up to 2ml may be used, but do not 'flood' the cell. Alcohol liquid should not be drawn through into the vacuum pump.
- Replace the viewing glass on the rubber seal. Be sure both rubber sealing rings are correctly positioned in their grooves on the edges of the cell.
- Re fit the clamp screws and tighten all three gently to create a perfect seal top and bottom of the cell. DO NOT OVER TIGHTEN.

If a sealing ring comes off: To replace a sealing ring, gently stretch it over the small locating ledge provided on the upper and lower edges of the cell.

- Connect a DC. Power Supply to the red socket on the cell (positive) and to the base socket (negative). Apply from 200V to 600V.DC. to keep the field clear of charged particles.
- Push the tube of the vacuum pump into the fitting provided on the side of the base. When the pump handle is withdrawn, a partial vacuum will be created in the cell.
- Aim a light source through the transparent side of the cell. A simple microscope lamp is a suitable light source. DO NOT TRANSMIT HEAT TO THE CELL. The chamber is now ready for an experiment.

IMPORTANT NOTES:

- *Upon evacuation, if the whole cell becomes cloudy, repeat the expansion several times until cloudiness disappears. Re-introduce the r/a source and expand again. Be sure the cell is not gaining heat from the light source.*
- *Sometimes better tracks are found if the vacuum is created more gradually and the creation if often better at a partial vacuum (partial pull of the pump).*
- *If turbulence is evident in the chamber, and the rays are being broken up too badly, check for leaks and, if "Contaminated Air" experiment is being performed, for proper clamping of the Mohr clip over the hose. Check the three clamping screws for firmness.*
- *When storing the instrument, always remove the top glass viewing window so that the plate can dry out. Wipe any alcohol from the metal plate. If this is not done, the alcohol during storage can affect the acrylic cell and cracks may occur.*

Designed and manufactured in Australia