

# HOW TO CONDUCT ELECTROSTATICS EXPERIMENTS IN TROPICAL HUMID ENVIRONMENT DEMONSTRATION EXPERIMENTS IN ELECTROSTATICS :

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The key to discovery of electricity was the observation of static electrification by friction. Inhabitants of temperate and other dry climates knew that when certain materials are rubbed together, they acquire the property of attracting small pieces of paper, straw, dust etc. It is said that, if not for the temperate climate on some regions of the earth, the present technological advancement dependent on electricity would have been delayed by few centuries.

In a dry temperate climate, mere brushing of a shirt (made of artificial fabric) hissing sounds and the light of sparks can be seen. Such effects are rarely noticed in tropical regions. The reason, is that in a humid atmosphere, the surface of objects are covered with a layer of moisture which is electrically conducting. Salt, dust and carbon dioxide in the air enhances the conductivity of this moisture film. For the obvious reason of charge leaking to the earth, static electrification cannot be observed when two conducting materials are rubbed together.

Electrostatic experiments can be conducted in a tropical environment (humidity 75% or more) provided following precautions are taken.

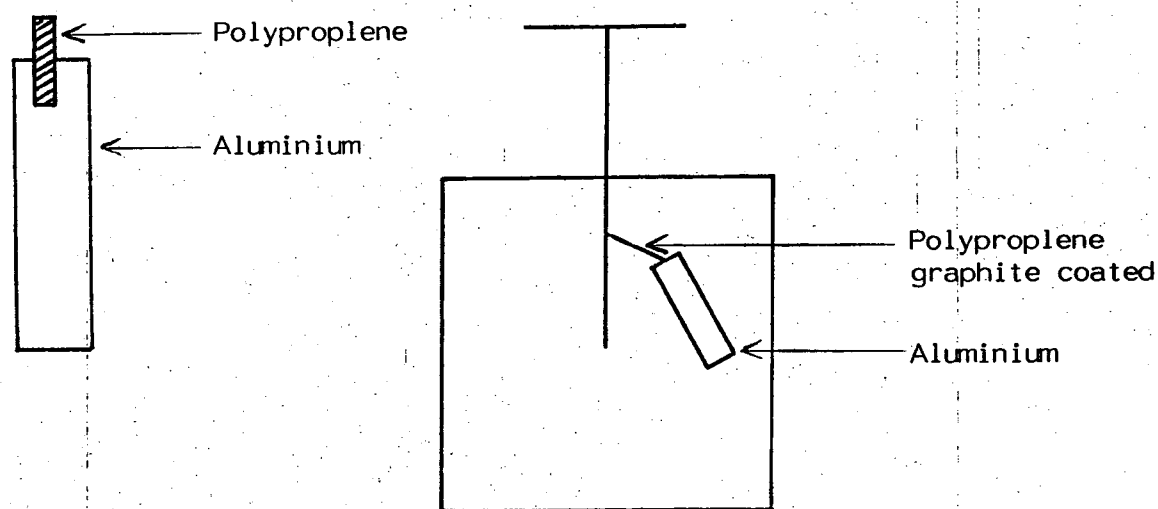
1. Clean the rods and the rubbing materials with a detergent. Wash with distilled water (or rain water) and dry in them in the sun. If available, it is convenient to use a hair dryer. The commercial detergent 'Teepol' works better than soap, because upon rinsing, it leaves no electrolytic residue. Ammonia is even better, because any remaining ammonia vaporizes during drying.
2. Some insulating materials (e.g. ebonite, PVC) have permanent conducting outer layer due to chemical degradation of the surface by oxygen, light etc. If washing as in (1) is not adequate, all you need to do is to clean the surface with sand paper before washing. This process removes the outer conducting layer.
3. If the surface of the electroscope is dirty, it will not work, as charge given to the disc gets leaked to the earth. Here you may have to clean the outer surface of the electroscope with clean tissue. In sometimes it is necessary to wash the surface of the electroscope as described in (1)
4. To observe static electrification, at least one of the materials used for rubbing (ie, either the rod or the rubber) will have to be a good insulator. The earlier experimenters had only a limited number of good insulators suitable for electrostatic experiments. (e.g. ebonite, sealing wax, glass, sulphur, silk, fur) With the development of the plastic industry, better insulators become available. Modern plastics (e.g. PVC, polythene, polypropylene, perspex) are ideal for electrostatic experiments. The parameter that measure the insulating property of a material is resistivity. A table of resistivities is given below.

## RESISTIVITIES (Ohm - cm)

Superconductor	0
Copper (30°C)	$5 \times 10^{-8}$
Graphite	$3 \times 10^{-6}$
Silicon (Semiconductor)	$1 \times 10^{-6}$
Rubber (Insulator)	$10^9$
Sealing wax	$10^9$
Glass	$10^9-10^{10}$
Sulphur	$10^{14}$
Cellulose Acetate	$10^{14}$
Polyethylene	$10^{15}$
Polypropylene	$10^{16}$
PVC	$10^{16}$
Air	$10^{18}$
Teflon	$10^{18}$
Vacuum	Not infinity

### Construction of an Electroscope

Gold leaf electroscope is the instrument commonly used for detecting static electric charges. If a gold leaf electroscope is not available, an electroscope can be constructed with a aluminium foil. However, even the thinnest aluminium foil available is much more stiffer than a gold foil. As a result, an electroscope cannot be constructed by merely pasting an aluminium foil on to a flat metal rod. To construct an electroscope with an aluminium foil, cut a piece of aluminium foil 6 x 0.5 cm. As indicated in the figure below, paste a thin strip of polypropylene film (e.g. type used for making lunch packets). Now coat the polypropylene slip with graphite using a pencil and paste it on to the flat metal rod to which the electroscope disc is connected.



This electroscope works, because the thin polypropylene hinge is sufficiently flexible. Polypropylene is an insulator, coating with graphite makes it conducting and the charge given to the disc is transmitted to the aluminium foil.