

Electrostatics  
Electric charges

## Charge separation due to friction

## Objects of the experiments

1. Detecting charge separation when a friction rod is rubbed with a friction foil
2. Investigating the polarity of charged friction rods after they have been rubbed with various friction foils

## Setup



## 1. Detecting charge separation

- Rub the discharged acrylic rod with the leather, hold it in the Faraday's cup so that about a quarter of its length is inside the cup, and observe the deflection of the multimeter pointer.
- Remove the acrylic rod.
- If necessary, discharge the Faraday's cup, hold the leather over the opening of the cup, and observe the deflection of the multimeter pointer.
- Remove the leather.

## 2. Investigating the polarity of friction rods

- One after another rub the PVC and the acrylic rod with leather and paper. Each time hold the respective rod in the Faraday's cup so that about a quarter of its length is inside the cup.
- Observe the deflections of the multimeter pointer, each time taking down the polarity of the charged friction rods.

## Measuring example

## 1. Polarity of the friction rod and the friction foil after charge separation

Friction rod	Polarity of the friction rod	Friction foil	Polarity of the friction foil
Acrylic	-	Leather	+

## 2. Polarity of friction rods after being rubbed with various friction foils

Friction rod	Friction foil	Polarity of the friction rod
Acrylic	Polyethylene	+
PVC	Polyethylene	+
Acrylic	Leather	-
PVC	Leather	-
Acrylic	Paper	+
PVC	Paper	-

## Apparatus

1 Electrometer amplifier.....	532 14
1 Connecting rod .....	532 16
1 Faraday's cup.....	546 12
1 Clamping plug.....	590 011
1 Capacitor, 1 nF, STE 2/19 .....	578 25
1 Capacitor 10 nF, STE 2/19 .....	578 10
1 Friction rods, PVC and acrylic.....	541 00
1 Leather .....	541 21
1 Polyethylene friction foils, set of 10.....	686 63
1 Butane gas burner .....	666 711
1 Butane cartridge 19 g, set of 3.....	666 712ET3
1 Demo multimeter, passive .....	531 906
1 Power supply, 450 V, 230 V.....	522 27
1 Connecting leads, 19 A, 50 cm, black, pair .....	501 451
1 Connecting leads, 19 A, 50 cm, red/blue, pair.....	501 45
1 Connecting lead, 19 A, 50 cm, yellow/green .....	500 420

## Carrying out the experiment

## Remark:

Before carrying out the experiments, discharge the friction rods and the Faraday's cup in order to obtain reproducible experiment results.

For discharging the friction rods, quickly move them longitudinally through the non-luminous flame of the cartridge burner several times. The Faraday's cup is discharged by touching it with the connecting rod until the multimeter displays a voltage of  $U = 0$  V.

## Evaluation

When a friction rod is rubbed with a friction foil, charge separation takes place.

In the course of charge separation electrons are transferred from one body (friction rod or friction foil) to the other.

The body which has lost electrons (friction rod or friction foil) carries a positive charge after the process of friction.

The body which has acquired electrons (friction rod or friction foil) carries a negative charge.

The polarities of the charges on the friction rod and the associated friction foil are always of opposite signs.

The polarity of the charges carried by a friction rod after being rubbed depends on the materials the friction rod and the friction foil are made from.