

The mobility of charges in insulators and conductors

Task and equipment

Information for teachers

Additional Information

The pupils learn that in insulators charges are locally bound but in metals, that is conductors, they are free to move.

Suggestions for Organization and Implementation

The results of this experiment are a pre-requisite for understanding other experiments. For an electroscope to function, charges in it must be mobile while in the experiment with a rubbed plastic rod it is necessary that charges are locally bound, otherwise a discharging via the hand would immediately follow.

The additional exercises should pick up such aspects. In this context, reference can be made to many experiments from electrotechnics in which this knowledge can be applied (the use of electrical conductor connections is necessary for current flow; the use of insulators at those points where no current should flow).

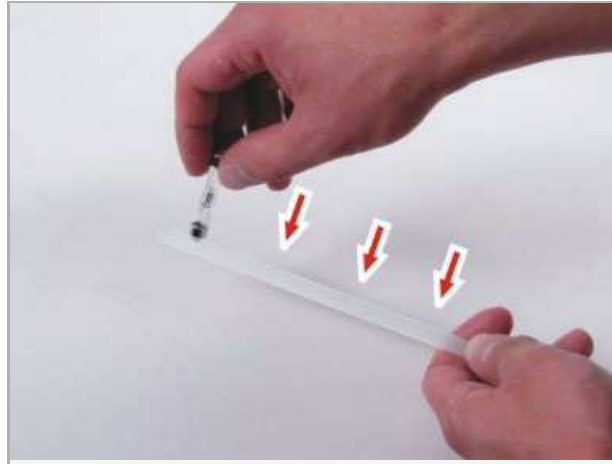
The mobility of charges in insulators and conductors

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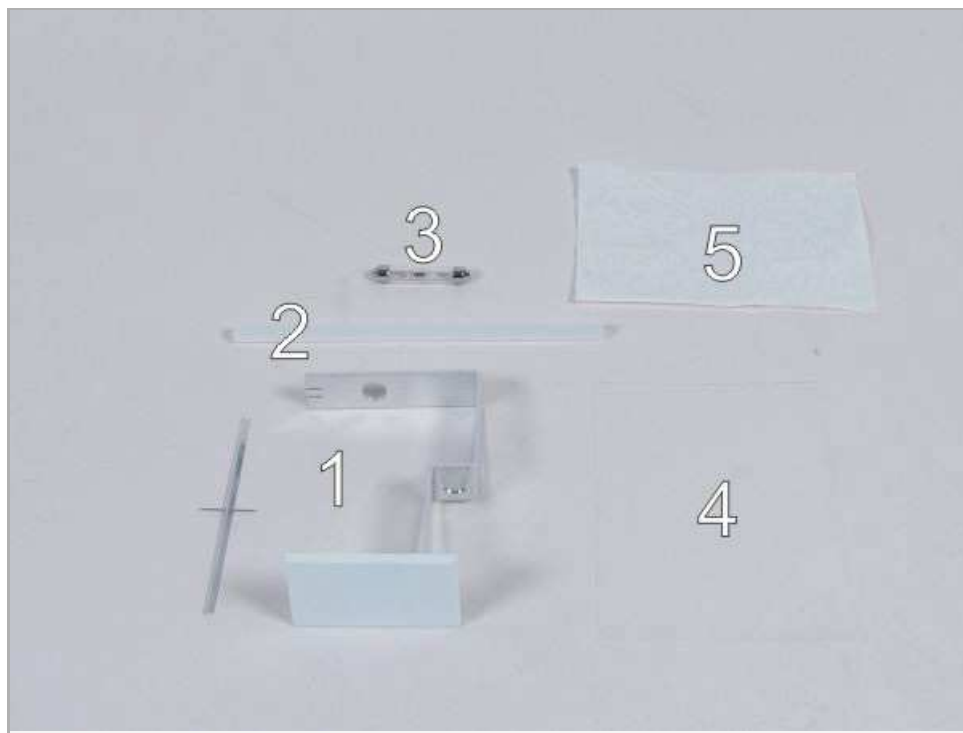
Task

Can the charges in bodies be shifted?

Investigate various different electrically-charged bodies to see if the charges in them can be shifted.



Equipment



Position No.	Material	Order No.	Quantity
1	Electroscope w. metal pointer	13027-01	1
2	Polypropylene rod, d. 8mm, l. 175mm	13027-07	1
3	Neon tube	06656-00	1
4	Film, transparent, DIN A4, 100 sheets	08186-10	1 sheet
Additional material			
5	dry, rough paper		1 sheet

Set-up and procedure

Procedure

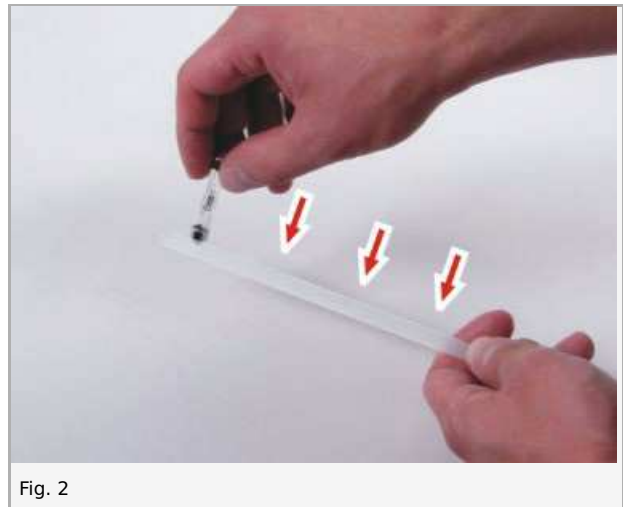
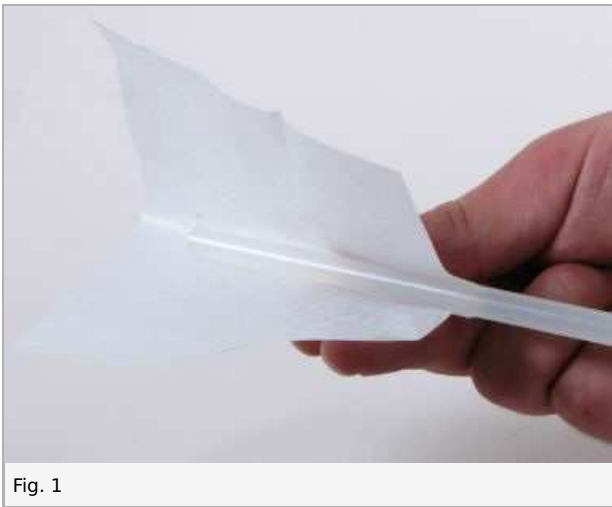
Note down your observations during each part of the experiment in the report.

First part of the experiment

- Hold the polypropylene rod steady in the middle and rub one end firmly with the dry, rough paper (Fig. 1). Test first of all the non-rubbed and then the rubbed end with the neon tube for charge.

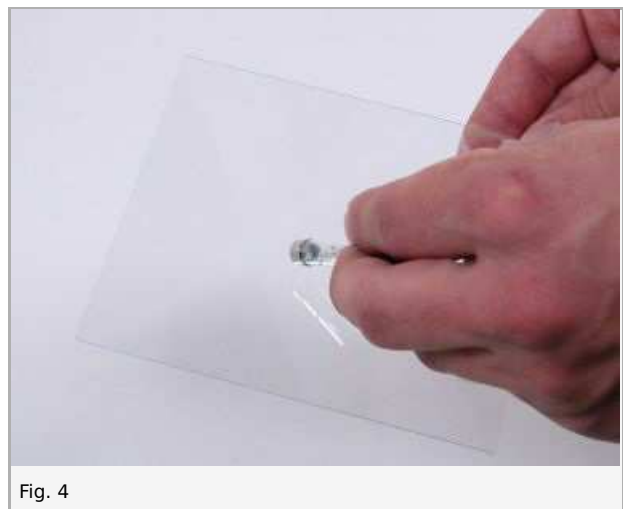
Second part of the experiment

- Hold the polypropylene rod firmly at one end and rub it the full length with paper. Now use the neon tube to test for charges at different positions (Fig. 2).



Third part of the experiment

- Rub the acetate film lying on the table with paper (Fig. 3). Lift it up from the table and test it for the distribution of charges by running the neon tube over its surface (Fig. 4).



Fourth part of the experiment

- Charge up the electroscope with the rubbed polypropylene rod by touching it on its upper arm (Fig. 1,5). Test with the neon tube first on the upper arm and then on the lower arm for charges (Fig. 6-7).

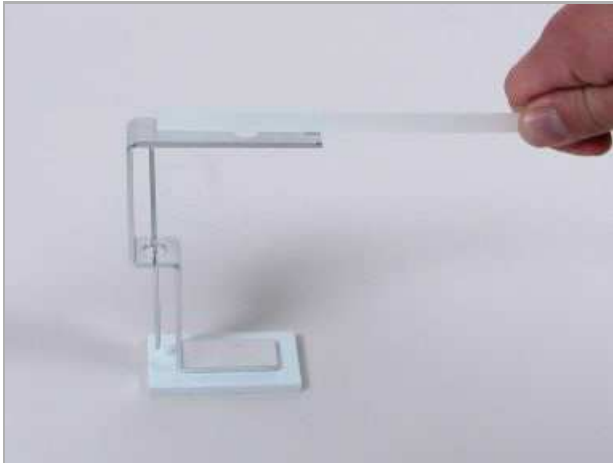


Fig. 5



Fig. 6



Fig. 7

Fifth part of the experiment

- Charge up the electrostatic demonstrator again as in before (Fig. 1,5). Now test first of all on the lower arm and then on the upper arm for charges (Fig. 6-7).

Report: The mobility of charges in insulators and conductors

Result - Observations 1

On which side did the neon lamp light up during the first part of the experiment?

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Result - Observations 2

Where did the neon lamp indicate something during the second part of the experiment?

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Result - Observations 3

What did you observe on traversing with the neon lamp during the third part of the experiment?

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Result - Observations 4

Where did you see charges during the fourth part of the experiment?

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Result - Observations 5

Where did you find the charges during the fifth part of the experiment?

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Evaluation - Question 1

What did you recognize from parts 1, 2 and 3 of the experiment about the mobility of charges in insulators?

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Evaluation - Question 2

Can you give two possible explanations for the observed phenomena in the 4th part of the experiment?

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Evaluation - Question 3

The 5th part of the experiment gave more precise information about the mobility of charges in metals. What did you observe?

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Evaluation - Additional Task 1

Can you give an explanation, using the knowledge you have now acquired about the mobility / non-mobility of charges, why you can transport charges from a polypropylene rod held in the hand to the electroscope but that you can also discharge the electroscope with the hand?

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Evaluation - Additional Task 2

Note down other experiments in which the mobility of charges play an important role.

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