Demonstration of the type of charge on films and plates

Physics > Electricity & Magnetism > Electrostatics & electric field

Difficulty level	Group size	Preparation time	Execution time
easy	-	10 minutes	10 minutes

This content can also be found online at:

http://localhost:1337/c/6425e00fe22e3d00020134c4

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Teacher information

Application

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Lightning in a thunderstorm

Objects take on different properties when they are electrically charged. A basic distinction is made between positive and negative charge.

Equally charged objects repel each other, whereas unequally charged objects attract each other.

If certain materials are brought into close contact with each other, their electrical charge changes.

Lightning is a classic example of the exchange of electrical charge. In this case, the exchange happens between clouds and the ground.

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Other teacher information (1/2)

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Prior knowledge

Students should already have learned and understood the principle of electric charge.

Principle

Certain materials charge differently when they are brought into close contact.

Other teacher information (2/2)

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Learning objective

The students recognise that two insulators made of different materials are charged differently when they touch each other. They can demonstrate the type of charge with a glow lamp and an "electrical scale". They attribute the charge to a separation of charges.

Tasks

In this experiment, students will use a glow lamp and an "electrical scale" to investigate how a polycarbonate sheet and an acetate sheet become charged when they rub against paper and touch each other.

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Safety instructions

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The general instructions for safe experimentation in science lessons apply to this experiment.

Notes on set-up and procedure:

In order to largely eliminate the influence of the table on the charge separation of the polycarbonate plate and the transparent film, i.e. to obtain defined test conditions, it is necessary, especially for the proof of the positive charge of the polycarbonate plate, to carry out the separation of the plate and the film only after lifting it off the table plate. If the plate is left on the table, positive or negative charges can occur depending on the material of the table surface. Accordingly, this could lead to undesired results, especially during the third measurement on the polycarbonate plate. Therefore, several layers of paper should be used uniformly as a base.

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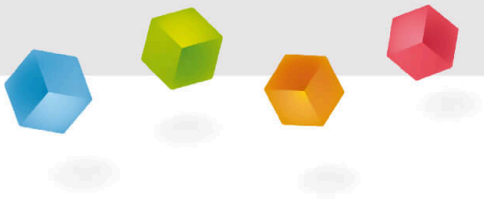

Student information

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Motivation

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Lightning in a thunderstorm

The exchange of electrical charge is an everyday phenomenon. Electrons migrate from one object to another if the latter has different charge properties.

This exchange can often be seen visually during a thunderstorm. The lightning represents a very strong and brief exchange of electrical charge. The two bodies in contact are usually the thundercloud and the ground.

In this experiment, static charge separation is investigated using different materials.

Tasks

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In this experiment you have to investigate the electrical charge of different objects with different materials.

Proceed as follows and investigate:

1. with a glow lamp
2. with an "electric scale",

how a polycarbonate sheet and an acetate sheet become charged when rubbed with paper and touching each other.

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Equipment

Position	Material	Item No.	Quantity
1	Electroscope w. metal pointer	13027-01	1
2	Polycarbonate plate, 136x112x1 mm	13027-05	1
3	Polypropylene rod, l=175mm, d=10 mm	13027-09	1
4	Neon tube	06656-00	1
5	Clip for rods, with cord	13027-16	1
6	Film, transparent, DIN A4, 100 sheets	08186-10	1

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Additional Equipment

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Position	Equipment	Quantity
1	Dry, rough paper	DIN A4

Set-up

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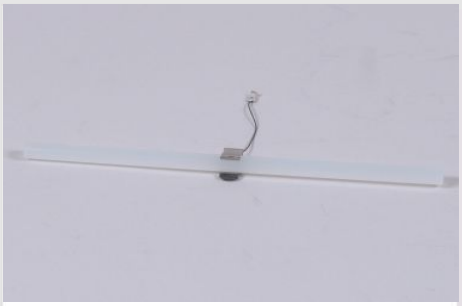
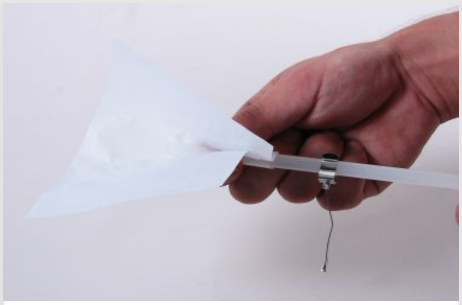
Attach the clamp to the centre of the polypropylene rod, rub one half vigorously with paper and then hang the rod in the suspension without touching the rubbed end as in the illustration. We used it to build an "electric scale" with which you can detect electric charges. The rubbed end of the rod is attracted or repelled by charged objects.



Attach the clamp to the rod



Rub the stick on the paper

Hanging the rod

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Procedure (1/4)

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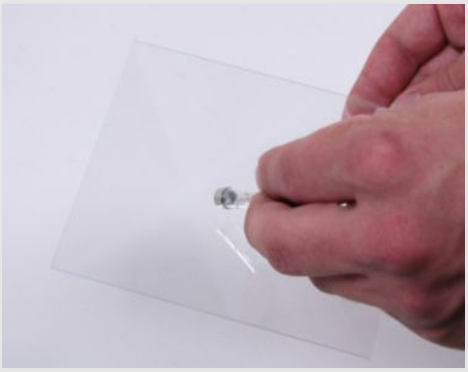
Experiment 1: Place the transparent film on the polycarbonate sheet and rub it vigorously with the paper.

Pick up the film and plate together and then lift the film off the plate.

Touch the foil with a metal cap of the glow lamp. Observe the electrodes closely.



Procedure (2/4)

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Bring the foil and metal cap of the lamp together

1st try:

- Repeat the experiment, but this time check the plate with the glow lamp.
- Repeat the entire 1st part of the experiment if your observation was not completely clear.

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Procedure (3/4)

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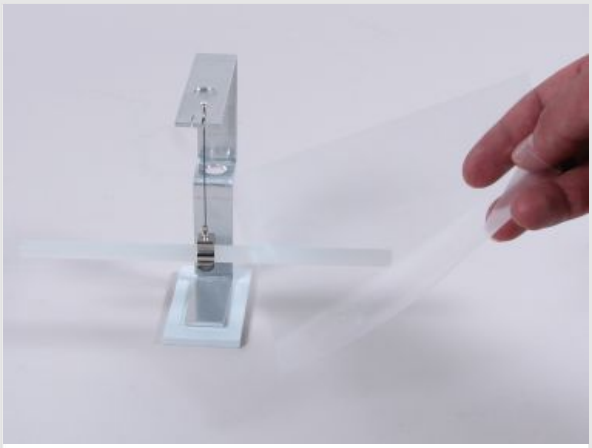

Approach the foil/panel to the end of the bar

2nd try:

- Carry out the experiment as just described. However, use the "electrical balance" to prove the charge.
- Bring the foil or the plate closer to the rubbed end of the suspended rod without touching it and observe the rod.

Procedure (4/4)

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Unloading the film/panel by pressing it firmly together

Third try:

- Unload the foil and plate one at a time by placing each between the palms of your hands and pressing firmly.
- Then place the foil one by one on paper and rub it with another paper.
- Check with the "electrical scale" and with the glow lamp what kind of charge it has.
- Do the same with the plate.

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Report

Task 1

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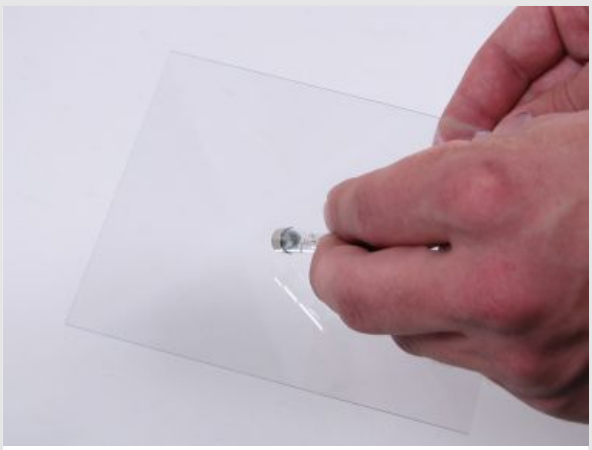

Bring the foil and metal cap of the lamp together

What were your observations during the first trial?

- [ ] The electrode facing away from the plate lit up.
- [ ] None of the other answers are correct.
- [ ] The electrode facing the foil lights up.

Check

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Task 2

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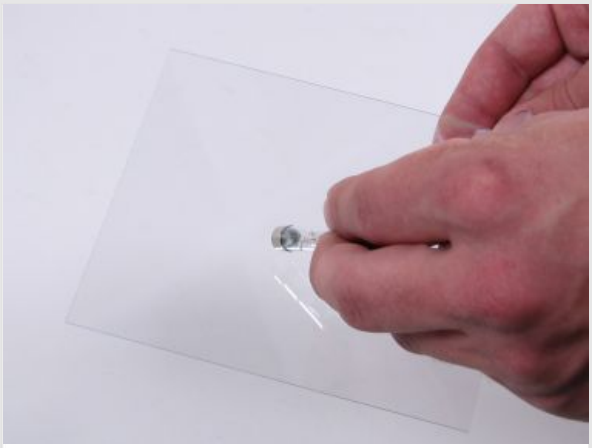


Bring the foil and metal cap of the lamp together

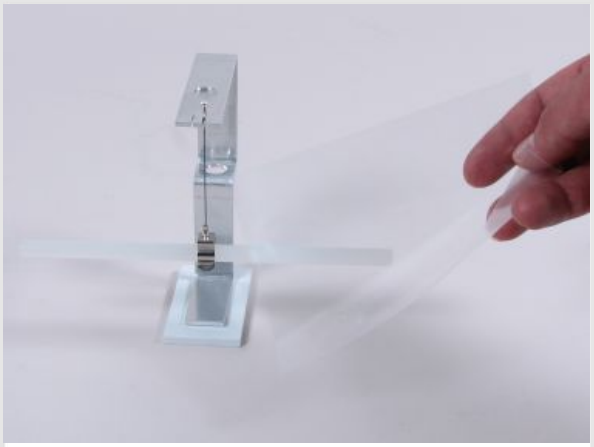
Which of the following statements are correct?

- [ ] The acetate film is negatively charged.
- [ ] The polycarbonate sheet is negatively charged.
- [ ] The polycarbonate sheet is positively charged.
- [ ] The acetate film is positively charged.

Check

Task 3

PHYWE



Approach the foil/panel to the end of the bar

What were your observations during the second attempt?

- [ ] None of the other statements is correct.
- [ ] The rod is repelled from the acetate film.
- [ ] The rod is attracted to the polycarbonate sheet.

Check

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Task 4

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Unloading the film/panel by pressing it firmly together

What did you find out about the charge types of the individually rubbed film or plate (3rd attempt)?

- [ ] Plate and foil were both positively charged.
- [ ] The foil and the plate were electrically charged with the same charge type.
- [ ] The foil and the plate were electrically charged in opposite directions.
- [ ] Plate and foil were both negatively charged.

Check

Task 5

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Drag the words into the correct boxes!

The results of the third measurement differ from those of the first two measurements. The type of charge on an _____ depends on what other substance it was in contact with. The _____ can charge both _____ (when in contact with the _____) and _____ (when in contact with paper).

polycarbonate plate
acetate foil
insulator
negatively
positively

Check

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Slide	Score / Total
Slide 17: Observation: Experiment 1	0/2
Slide 18: Explanation: Experiment 1	0/2
Slide 19: Observation: Experiment 2	0/2
Slide 20: Different types of cargo	0/2
Slide 21: Conclusion	0/5

Total 0 / 13

Solutions Repeat

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