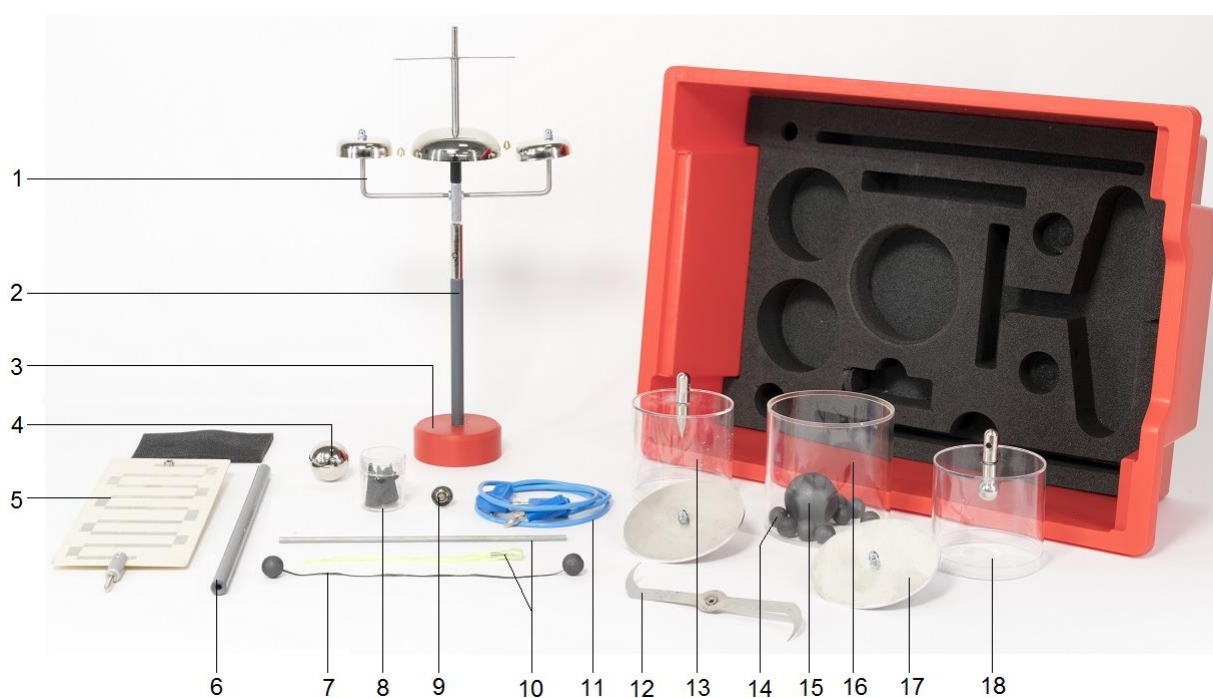


## Electrostatic Equipment Set 1021369

### Instruction sheet

03/18 ALF



- |                                                    |                                                  |
|----------------------------------------------------|--------------------------------------------------|
| 1 Bell chimes                                      | 10 Fringes on rod                                |
| 2 Insulated stand rod with 4-mm socket             | 11 Experiment leads (2 each)                     |
| 3 Stand base                                       | 12 Pointed propeller                             |
| 4 Conductor sphere 30 mm diam., with connector pin | 13 Box with pointed electrode                    |
| 5 Luminous pane                                    | 14 Polystyrene balls with conductive coating (8) |
| 6 Friction rod, plastic with 4 mm plug             | 15 Plastic ball with conductive coating          |
| 7 Double pendulum                                  | 16 Plastic tube                                  |
| 8 Scented candles                                  | 17 Capacitor plate with connector pin (2 each)   |
| 9 Needle with connector pin                        | 18 Box with spherical electrode                  |

### 1. Safety instructions

- When conducting experiments using high voltage, warning sign W08 "Warning against dangerous high voltage" compliant with German health and safety regulations UVV should be displayed at the work place.
- At-risk persons (e.g. those with heart pacemakers) are not permitted to remain in the vicinity of charged components.
- Discharge experimental equipment before touching.
- Discharge Wimshurst machine and Van der Graaf generator before touching.
- Observe safety instructions for the high voltage sources used here. When using a Van der Graaf generator, attach the ground terminal to ground.



### 2. Description

This equipment set can be used in conjunction with an electrostatic generator such as a Wimshurst machine (e.g. 1002967) or a Van der Graaf generator (e.g. 1022544) to perform a wide variety of experiments investigating electrostatic phenomena including some historic experiments.

The experiment components are equipped with 4-mm connector pins so that they may be quickly mounted on or removed from an insulated stand. Experiment leads with 4 mm plugs are included for connection to the charge source.

We recommend using the Wimshurst machine 1002967 as the source of charge for these experiments.

### 3. Operation

The equipment only produces satisfactory experimental results if kept clean and dry.

- Before each experiment, discharge all components of the experiment set-up and do not connect them to the voltage source (which must also be previously discharged) until the set-up is complete.

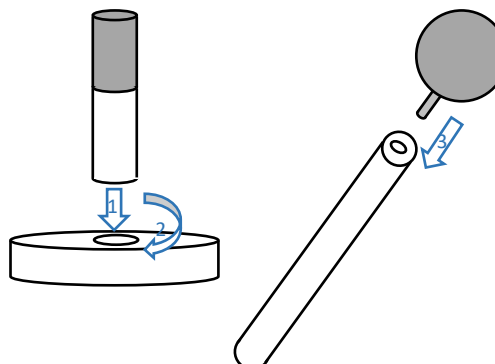
When the weather is damp, it is advisable to use a fan. Should the fringes on the rod (10) or the double pendulum (7) tend to stick together due to uneven charging, we recommend spraying them with anti-static spray.

- Put the experiment set-up onto the stand and connect it to the charge source via experiment leads. Keep leads carrying different charges as far away from one another as possible.
- Observe safety advice.

## 4. Example experiments

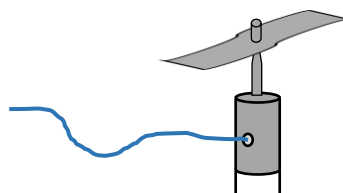
### 4.0 Preparation for all experiments

- Screw stand rod (2) into the stand base (3). This establishes an insulated base for all the experiments.
- Insert the conductor sphere (4) into the end of the friction rod (6). This allows charges to be transferred or eliminated by short-circuiting electrodes with the sphere.



### 4.1 Discharge from points

- Insert the needle (9) into the stand and put the pointed propeller (12) onto it. Connect to the source of charge to charge up the wheel.
- Since the strongest electric field strength is at the tips, either electrons are emitted from them or charged and polarised particles are attracted from the air to them. The recoil of the electrons or the transfer of momentum from the attracted particles causes the propeller to start turning.
- Increasing the charge causes the wheel to spin more quickly.



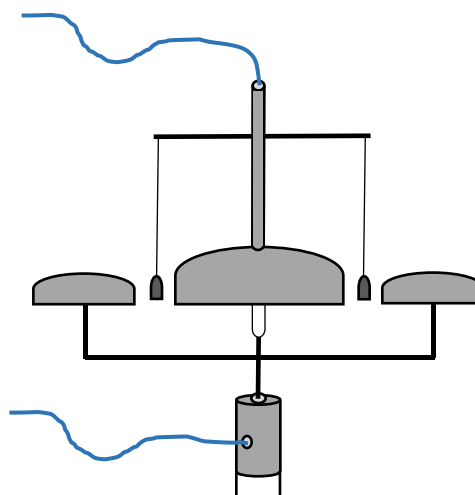
### 4.2 Bell chimes

- Attach the bell chimes (1) to the stand, connect to the source of charge and gradually increase the charge until the hammers strike the bells.

**Be careful!** Excessive charge can cause sparks between the mountings.

The supply of charge causes the hammers to charge up and be attracted or repelled by the bells. When the hammers touch the bells, they discharge and swing back. The process starts again when they are loaded with the opposite charge.

**Tip:** If the bell chimes are only connected via a single pole, the hammers transfer charge onto the bells which have no contact. The build-up of charge this causes can be demonstrated using the elec-troscopes from experiments 4.3 or 4.4.

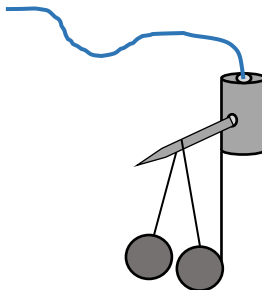


#### 4.3 Double pendulum

- Suspend the double pendulum (7) over the needle (9) protruding sideways from the stand. Connect to the source of charge to charge up the pendulum.

Since the balls assume the same charge, they repel one another.

- The double pendulum is a simple electroscope.

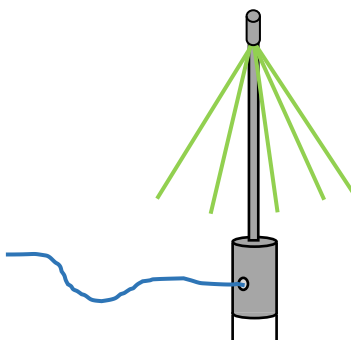


#### 4.4 Fringes on rod

- Put the rod with the fringes (10) onto the stand. Connect to the source of charge and gradually increase the charge.

The fringes all repel one another and spread out to all sides to look like an umbrella frame.

The rod with the fringes is also a simple electroscope.

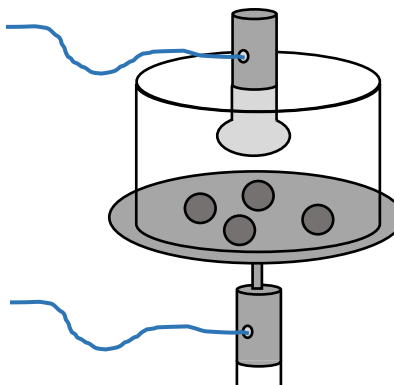


#### 4.5 Electrical dances

- Put a capacitor plate (17) on the stand. Place 2 to 4 polystyrene balls on top of it and put the box with the spherical electrode (18) over the top of them.
- Connect to the source of charge and gradually increase the charge until the balls begin to dance.
- Stop charging and observe what happens.

Since the balls are all charged to the same polarity as the base plate, they are repelled from it and either lose their charge or gain an opposite charge by coming close to the spherical electrode. They then fall back and the process begins again even if the flow of charge entering the experiment is halted, since there will still be sufficient charge remaining.

**Tip:** By using the plastic tube (16) and a second capacitor plate, it is possible to carry out this experiment with more than 4 balls.

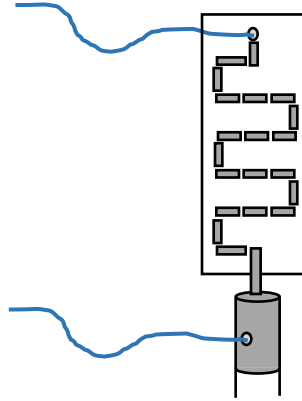


#### 4.6 Luminous pane

- Attach the luminous pane (5) to the stand, connect to the source of charge and gradually increase the charge.

When the voltage is large sparks cross the spaces between the conductors of the pane.

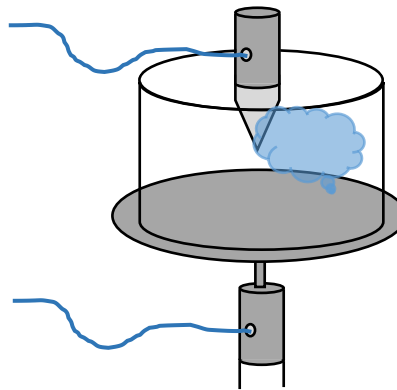
The route taken by the discharge always runs along the path of the greatest field strength, i.e. via the shortest distances between conducting surfaces.



#### 4.7 Smoke eater

- Put a capacitor plate (17) onto the stand, place the box with the pointed electrode (13) over the top and connect to the source of charge.
- Blow smoke from a scented candle (8) or any source of smoke into the box.
- Slowly charge up until the smoke is sucked downwards.
- Repeat the process.

The smoke particles are charged by the pointed electrode, repel one another and are attracted down to the base plate which has the opposite charge.



#### 4.8 Rolling sphere race

- Set up a capacitor plate (17) sideways onto the stand, put the plastic tube (16) over the plate, insert a ball (15) and cover the other end of the tube with the other capacitor plate.
- Make a connection to the source of charge and allow the charge to slowly build up.

Once the charge on the ball is large enough, it will be repelled by the electrode with the same polarity and attracted by the one of opposite polarity. The ball will then roll towards this electrode, where it will discharge and then start charging anew. The ball will then move from electrode to electrode, continuously charging and discharging as long as charge is being conveyed to the plate electrodes.

