

Topics: Static Electricity

## Materials List

- ✓ Base and post from a 50 to 100-bulk container for CD's or DVD's
- ✓ CD, DVD, or equal
- ✓ Foil square, about 30 cm (12") a side
- ✓ 2 items that will create a charge imbalance, (foam plate and a plate covered with silk(best) or wool)

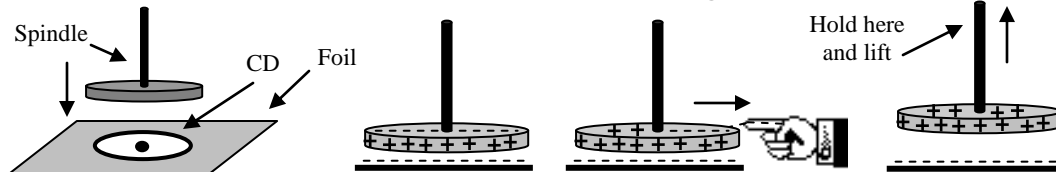
This activity can be used to teach:

Next Generation Science Standards:

- Energy can be transferred and converted (Grade 4, Physical Science 3-2 & 3-4; High School, Physical Science 3-3)
- Electric or magnetic interactions between objects not in contact with each other (Middle School, Physical Science 2-5; High School, Physical Science 3-2, 3-5)

## Electrophorus – a Charge Carrier

Generate “endless” static charges!



An **electrophorus** is simply a metal surface with an insulating handle. The metal can be charged positively (+) or negatively (-) repeatedly through charging by induction!

### Assembly

1. Lay a square of aluminum foil with sides of about 30 cm (12") on a flat surface.
2. Smooth a 12 cm (4¾") circle in the center of the foil, about the size of a CD.
3. Lay a CD, DVD, or similar sized flat object on the center of the foil.
4. Place the base and post on top of the CD as shown.
5. Carefully fold up the foil edges and press down over the top of the base.

**To Do and Notice** (steps 2-4 can be repeated, for awhile, without redoing step 1)

**Note - results will vary with temperature and, especially, humidity!**

1. Rub together 2 different materials (see list). Place one rubbed side upward.
2. Place the foil wrapped base on top of the flat rubbed surface, as shown above.
3. Touch the foil-covered base with a finger, as shown above.
4. Lift the base by touching **only** the post, not the foil!
5. The foil will have a charge imbalance that will attract bits of paper, flash a neon bulb, charge an electroscope, or provide a small “zap” to a nose or finger.

### The Science Behind the Activity

When two different materials make and break contact some electrons may be transferred from one material to the other. The material that lost electrons will have a net positive charge while the material that gained electrons will have a net negative charge. Electrons can move about easily in a metal but not as easily in insulators such as plastic, foam, or dry wood. Bringing a metal object in contact with a negatively charged surface causes the metal's free electrons to move in the opposite direction, as shown above. The metal foil will have a **net** positive charge on one side and a **net** negative charge on the other side. The electrons on the charged insulating materials (foam, wool, silk) do not move about as easily (are “static”) so relatively few, if any, electrons move into the metal. The metal's electrons, that are trying to move as far as possible from the negatively charged material, will move onto the finger. People are good conductors for “static” charges! A small static zap may be felt when touching the metal. The metal will now have a net positive charge. This process is called **charging by induction**. If only the plastic handle is touched when lifted, the metal surface of the electrophorus will retain the positive charge. Repeating the above process with a positively charged surface will generate a net negative charge on the metal; in this case the finger will give up electrons to the metal. In both cases relatively few electrons are removed from or added to the charged insulator. The process can thus be repeated until dust or moisture in the air removes (neutralizes) the charge imbalance (positive or negative) on the charged insulators.

### Taking it Further

Make larger versions from a pie or pizza pan with a straw or a foam cup handle.

**Web Resources** (Visit [www.raft.net/raft-idea?isid=134](http://www.raft.net/raft-idea?isid=134) for more resources!)

- Movie- <http://regentsprep.org/Regents/physics/phys03/aeleclab/induct.htm>
- Pie pan version - [www.exploratorium.edu/snacks/charge\\_carry/index.html](http://www.exploratorium.edu/snacks/charge_carry/index.html)