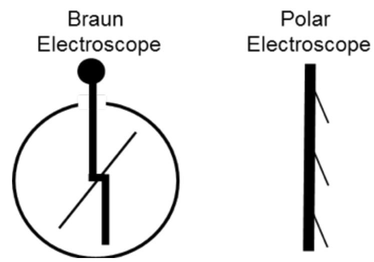
Most Important Concepts

1. Know how to experimentally determine the charge on something without having to look it up on the triboelectric series. This requires a comparison with a known charge.

2. Know how a charged electroscope differs in behavior from a neutral electroscope when you bring charged or neutral objects nearby (from the top) and when you make contact.
   - Apply this to a polar electroscope
   - Apply this to a standard (Braun) electroscope



3. Recognize the steps to charge an object by [electrostatic] induction (applies to conductors). Be able to diagram the +/- charges in each step.
   i. Polarize an object by bringing a charged object nearby.
   ii. Ground one side.
   iii. Remove the polarizing object.
   iv. Experimentally determine the resulting charge.

Questions to consider

1. Is attraction conclusive evidence that two objects are charged and of the opposite sign?

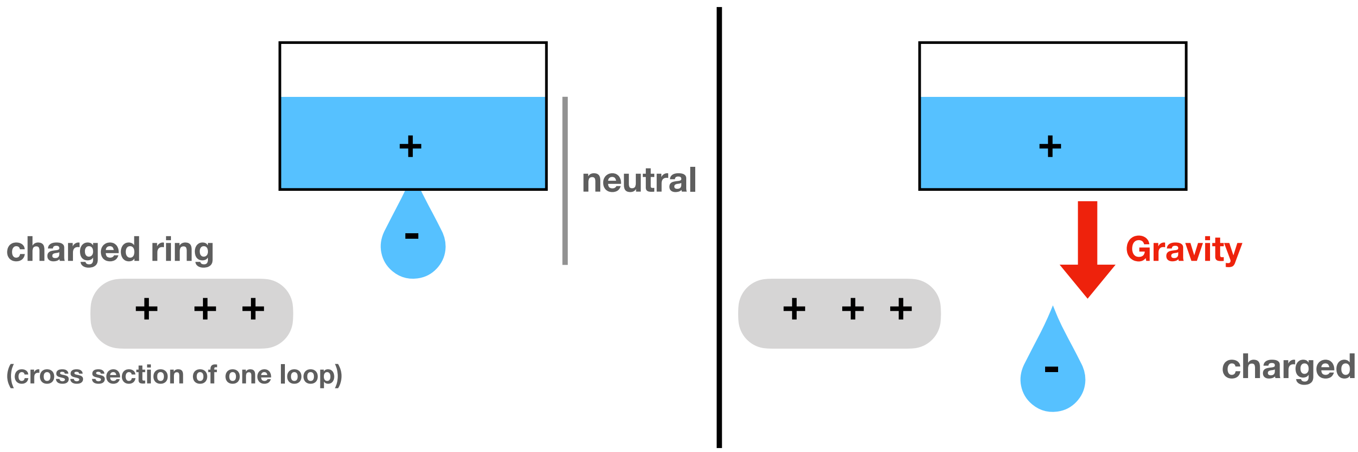
2. Suppose I have two identical long, metallic rods in a completely empty room and I tell you that exactly one of them is charged (but not whether the charge is positive or negative). How can you determine which of the two rods is charged without using any other outside charged materials or electroscope? You may assume that you can touch both rods with an insulating glove so that you will not charge/discharge them and that the working environment (floor, walls, ceiling) does not discharge the rod.

3. I touch a polar electroscope with an unknown object to transfer (positive/negative/no) charge. I then bring in a positively charged object near the top and notice equal deflection of foil at the top and bottom of the electroscope, but nearly no deflection in the middle. What, if at all, was the charge of the initial unknown object?

Pre Lab: Electrostatic Generator (question 2)

The energy of the generator is first quantified the moment the water droplet separates from the reservoir. The choice of charge is rather arbitrary when the machine first turns on, but once a random (small) charge is established in one of the pools, the corresponding ring on the opposite column shares that charge and subsequently **polarizes** the water droplets just before they fall.

As we saw in lab, objects can be polarized and still remain neutral. Naive intuition might lead you to believe that if each individual water molecule is polarized (yet still neutral) when it falls, there should be no net accumulation of charge in the pools below. The correction to this insight comes from letting the neutral condition be shared by the droplet **and** reservoir.



Droplet and reservoir are polarized by nearby charged source.

- If left alone in space, the water droplet would be sucked back into the reservoir via cohesion (primarily hydrogen bonds, which are stronger than the electrostatic attraction to the charged ring nearby).

The weight of the droplet separates it from the reservoir when it was polarized.

- It falls with a small charge and leaves behind the opposite charge in the reservoir.
- The mesh it falls on picks up this charge and further strengthens the polarizing effect of the opposite column

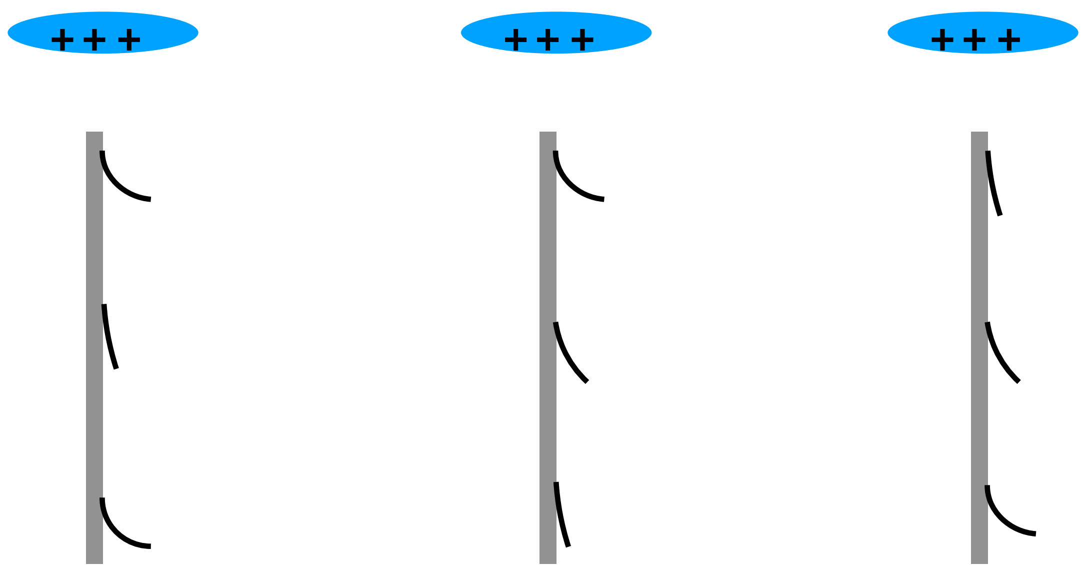
Thus, the parent source of the charge separation comes from gravity.

Most common mistake:
People claimed it was the charged droplets falling into the bottom, oppositely charged reservoir that produced the energy. This is the phenomenon that allows the mesh to stay charged, but it does not isolate the key force in why they get charged in the first place, so it is incomplete. This is also ambiguous, as it could also be taken to mean that it is the mechanical impact of the drop on the bottom reservoir that produces the electrical energy, which is not true. You needed to identify the force that separates the charges in the first place.

Polar electroscope (questions 20-24)

The point of using a long rod instead of the can is to show how the charge behaves near the top (near the source of the charged object) and bottom (far from the source of the charged object). This assumes that you brought the charged object in from the top of the electroscope, as stated in 21.

Notice the difference in behavior between question 21 and questions 23–24. There should be a noticeable difference between the deflection that happens in question 23 and the deflection that happens in question 24. A typical use of this observation might be for me to give you a polar electroscope and I task you with determining if it is charged or not. If it is charged, can you tell me what charge is on it? You could generalize your observations from 22, 23, and 24. There are 3 scenarios to consider.



-q, +q, 0? **-q, +q, 0?** **-q, +q, 0?**

Most common mistake:
Not recognizing the difference in repulsion at top/middle/bottom in each case.