

1.2: Activities

Equipment

- scotch tape
- drinking straws and cups
- balloons
- foam pads
- aluminum foil balls on thread
- plastic tubes
- pvc pipe segments
- plastic bottles
- aluminum cans

The General Idea

This lab is all about static electric charge. We are going to explore three elements of this phenomenon, though this exploration will be observational, and not quantitative like most of our experiments are. These three elements are:

1. Cataloging the signs of charge accumulated on various objects.
2. Recording the importance of the specific action on the sign of charge accumulated (can one object be made to hold different signs of charge if different actions are taken?).
3. Examining the difference between how insulators (non-metals) and conductors (metals) behave with static charge present.

Atoms are neutrally-charged, but we can separate a few of the electrons from their atoms, making the object where the electrons accumulate negatively-charged, and the object from which they were taken positively-charged. We will do this with "surface interactions" – namely, friction and adhesion (pulling sticky tape from a surface). We won't know specifically when we charge something positive or negative, but if we define one case as "positive," we can use attractive or repulsive static electric force to determine the signs of all the other charge accumulations we manage to create.

Some Things to Think About

- You will need to create what is essentially a "detector." This is just something that you can use to observe the attraction/repulsion of the charges you are cataloging. This detector should have the following properties:
 - It should be *sensitive*. That is, it should move easily and unambiguously under the influence of a static electric attraction or repulsion.
 - The sign of charge held on this detector needs to be consistent and repeatable. It is a disaster for consistent results if your detector has a positive sign at the start of your experiment and a negative charge at the end. Note that this means that if you need to "recharge" it, you better do it exactly as you did the first time.
- Always remain aware of your procedures. Electric charge can be carried on your hands, for example. One good rule of thumb is to always "discharge" objects and your hands before embarking on a new measurement. Probably the best way to do this is with humidity – hot breath provides water vapor that picks up spare charge and carries it into the air. Another is to touch a "grounded conductor" such as a chalk tray, or doorknob, but keep in mind that this will tend to only discharge the part of your insulator that comes in contact with it, and charge can be left elsewhere on it.
- The scotch tape is particularly interesting. Sticking it to a surface and pulling it off suddenly will charge it, and different signs of charge can be produced for different surfaces. You have lots of surfaces to work with to see this in action (and you can even pull two pieces of tape apart!).
- Aluminum cans don't require a lot of force to get them rolling, so laying them on their sides may produce some interesting results. In particular, try attracting/repelling a can that you have not charged at all. Try it with both signs of charge. Can you explain the result? Ask your TA if you have the explanation right.
- Your lab report should include a catalog (perhaps in tabular form?) of objects that you charged, the specifics of how you charged them, and the sign of the charge (relative to your detector, which you can define as "positive") in each case. It should also give an account of what you observed with a conductor like the aluminum can, along with some speculation about what might be happening in that case.

Lab Report

Craft a lab report for these activities and analysis, making sure to include every contributing group member's name on the front page. You are **strongly encouraged** to refer back to the [Read Me](#) as you do this, to make sure that you are not leaving out anything important. You should also feel free to get feedback from your lab TA whenever you find that your group is at an impasse.

Every member of the group must upload a separate digital copy of the report to their lab assignment in Canvas *prior to leaving the lab classroom*. These reports are not to be written outside the lab setting.

Controls

There are only a few things to keep in mind in order to keep your experiment under control. Remembering to neutralize charge between tests, as mentioned above is one of them. Another has to do with when the experiment turns to conductors. As these materials will allow charge to flow through them, a single point of contact is enough to discharge the entire object, so if you wish to keep a conductor charged, you will want to insulate it from its surroundings. Also, don't forget that your own body can collect and distribute charge. It is not a great conductor, but if in one part of the experiment you collected charge on your fingertips, this charge could have an adverse effect on a later part of the experiment.

Also keep in mind that after a cloth is used to rub the insulator, *the cloth is charged* (charge is conserved, so if there is net charge on the insulator, there is the opposite net charge on the cloth). If that cloth is reused, it may deposit charge and have the opposite of the desired effect. Humidity should help with this as well.

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