

Date of Lab 2/1/17

Date of Submission 2/8/17

Laboratory Report

Title

表題 Electric Chare Lab

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Lab Partners Aoi Hadama
共同実験者

Summary

In this lab, we tested with charges of insulators and conductors and understood the movements of electrons. Electrostatic induction occurred in conductors for having free electrons while polarization occurred in insulators. We've confirmed that like charges repel and opposite attracts. Humans are great examples of conductors.

- Meet a deadline
- Write logically
- Write clearly
- Write with your own words
- 締切り守って
- 論理的に
- わかりやすく
- 自分のことばで

Teacher Comments

簡潔だが正確でわかりやすい(まとめいい)
Cathode, anode に注意

1	2	3	4	5	6	7	8	9
Due 提出期限	Summary 要旨	Intro. 序	Method. 方法	Results 結果	Table/Fig. 表/図	Discussion 考察	Clearness わかりやすさ	General 全般
+					+	++	++	+++

* Write your report in Japanese or in English * Use this form as a cover sheet.
* Submit your reports by the seventh day after your lab.

Electric Charge- Static Electricity and Electroscope Lab

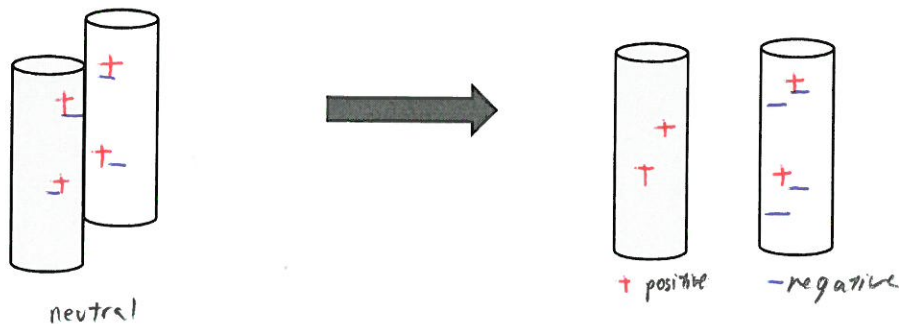
11K Yamato Oishi

Objectives: Seeing electric charges in experiments

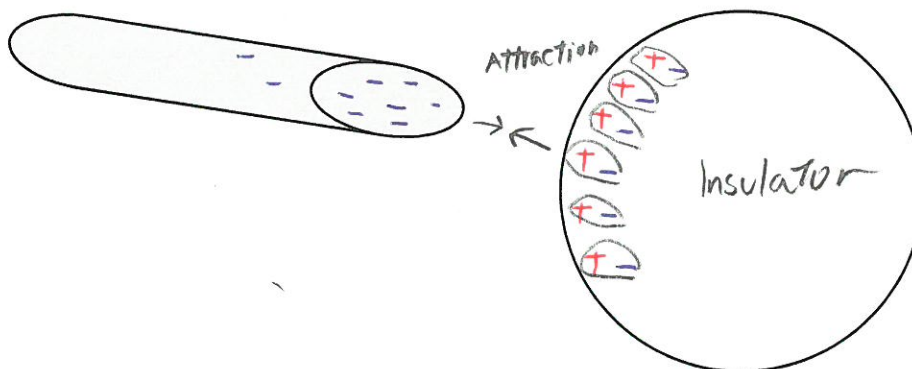
- Lab-1 Charging by rubbing
- Lab-2 Insulators and conductors
- Lab-3 Leaf Electroscope
- Lab-4 Electric tray generator
- Lab-5 Van de Graaff Generator

Theory:

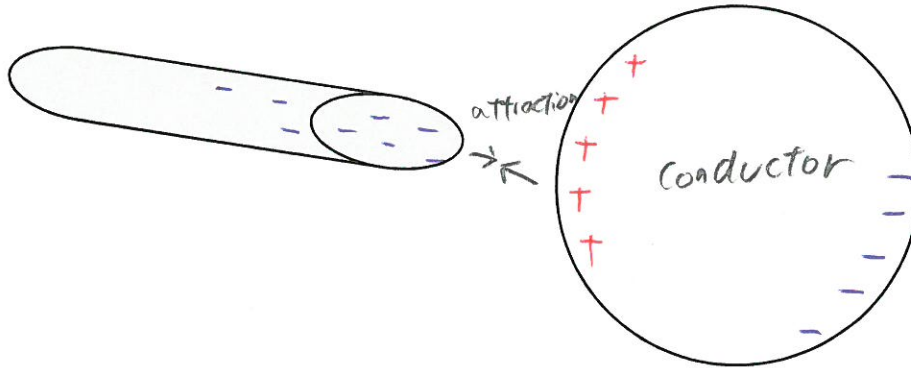
Frictional Electricity- By applying frictional force against a neutrally charged object with another, it allows for the electrons to move across through the contacting surface. The electrons will move to the object with a higher electronegativity. The object that loses the electrons will be charged positively, and the one that gains would be charged negatively. This movement is called frictional electricity.



Polarization- When a charged object is brought near an insulator, the electric charge opposite within the insulator is attracted. However, since there are no free electrons, the charged particles move in pairs, thus the side with the object will have a lean electric charge. This lean is called polarization.



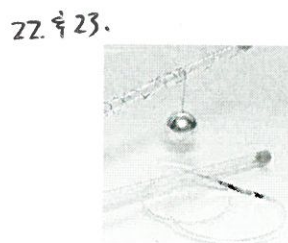
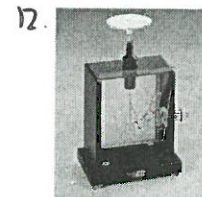
Electrostatic Induction- When a charged object is brought near a conductor, since the electrons are free to move (free electrons), the electric charge opposite within the conductor would be attracted to the object and the same charge would repel.



Experiment:

Equipment:

1. PVC Rod
2. Ebonite Rod
3. Fur
4. Silk
5. Glass Rod
6. Acryl Rod
7. Stand
8. Aluminum-coated balls
9. Polystyrene balls
10. Baby bottles
11. Suspender
12. Electroscope
13. Aluminum tray
14. Saran Wrap
15. Polystyrene board
16. Tissue
17. Plastic cup
18. Neon lamp
19. Van de Graaff generator
20. Discharge electrode
21. Insulation stool
22. Flying ball
23. Silver snake



Procedure and Results:

[Lab 1]- Charging by rubbing

Procedure:

1. Suspend aluminum-coated balls and polystyrene balls from the stand
2. Rub the PVC rod with fur and bring it close to both types of balls. Observe.
3. Rub the glass rod with silk and bring it close to both types of balls. Observe.

Results:

Rod type	Aluminum-coated balls	Polystyrene balls
PVC (-)	First attracts, then repels	Attracts
Glass (+)	First attracts, then repels	Attracts

Discussion:

When rubbing PVC with fur, the plus charge is taken away, and the PVC gets charged negatively. By bringing the charged PVC close to the aluminum-coated ball, a conductor, the free electrons within are attracted and the ball itself is attracted. However, once it touches, negative electrons are transferred and thus, repels. Opposite charges are attracted by the charged glass rod, but are technically the same as the PVC. Insulators, like the polystyrene balls, are just attracted to the PVC and the glass, since they have no free electrons and can be polarized.

[Lab 2-a]- Reaction between two charged insulators

[Lab 2-b] Reaction between charged and uncharged insulators

Procedure:

1. Suspend the suspender from the stand
2. Rub one side of an ebonite rod, and place it on the suspender
3. Rub the PVC rod and bring it close to the charged side of the ebonite rod. Observe.
4. Bring it close to the uncharged side of the ebonite rod. Observe.
5. Repeat the procedure for different combinations of insulators.

Results:

Rod in hand	Rod on suspender	Uncharged side	Charged side
PVC (-) / Fur (+)	Ebonite	Attract	Repel
PVC (-) / Fur (+)	Glass	Attract	Attract
Glass (+) / Silk (-)	Glass	Attract	Repel
Acryl / Silk	Ebonite	Attract	Attract
Acryl / Fur	Ebonite	Attract	Repel

Discussion :

Since all rods are insulators, the uncharged sides are attracted by charged objects due to polarization. By using fur, the ebonite was charged negatively, thus repelled the negatively charged PVC and attracted the positively charged glass. By rubbing silk on glass, the charge of the glass becomes positive, thus would repel the positively charged glass rod. Acryl charged by silk would become positive and would attract a negatively charged ebonite. Other ways around for an acryl charged negatively with fur.

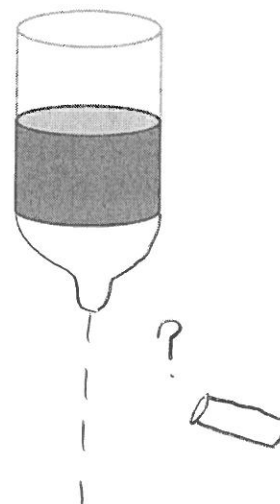
[Lab-2-b]- Reaction between a charged insulator and water

Procedure:

1. Drip down water slowly from a baby bottle
2. Bring close a charged PVC rod to the droplets. Observe.
3. Do the same with a charged glass rod. Observe.

Result:

Rod	Movement
PVC	Attracts
Glass	Attracts



Discussion:

Water molecules contain polar bonds, thus can be attracted by either sides, positive or negative.

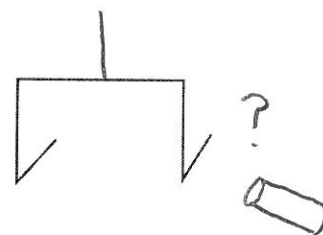
[Lab-2-c]- Reaction between a charged insulator and water

Procedure:

1. Suspend the suspender from the stand
2. Bring close a charged PVC. Observe.
3. Do the same with a charged glass rod. Observe.

Result:

Rod	Movement
PVC	Attracts
Glass	Attracts

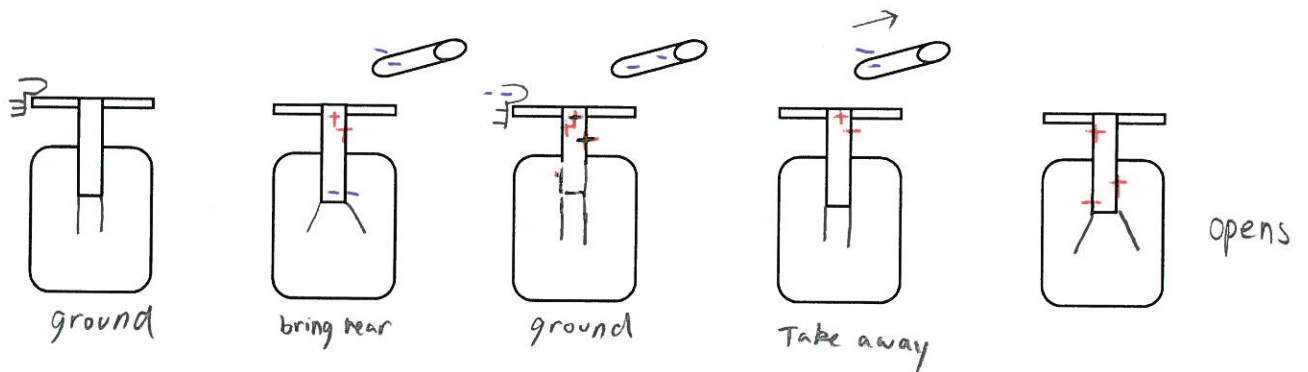
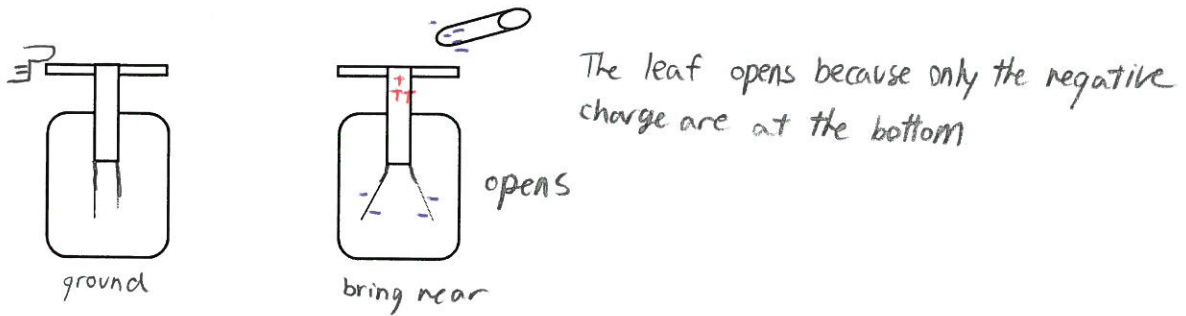


Discussion:

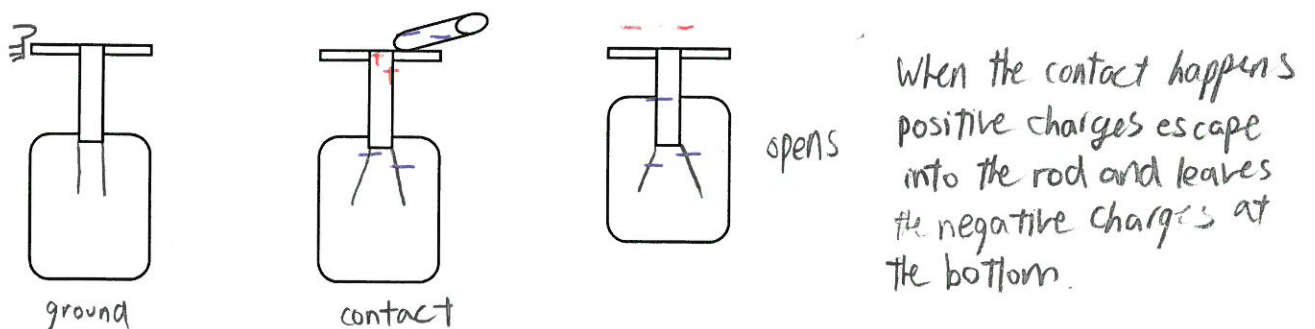
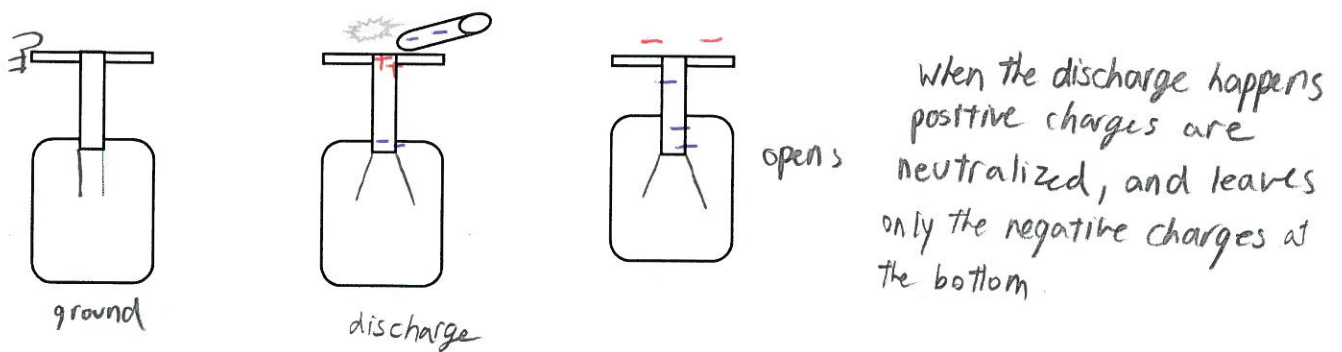
Due to electrostatic induction, the conductor (suspender) allows for its free electrons to be attracted by the both charges, positive or negative.

[Lab-3] Leaf Electroscope

Procedure, result, discussion:

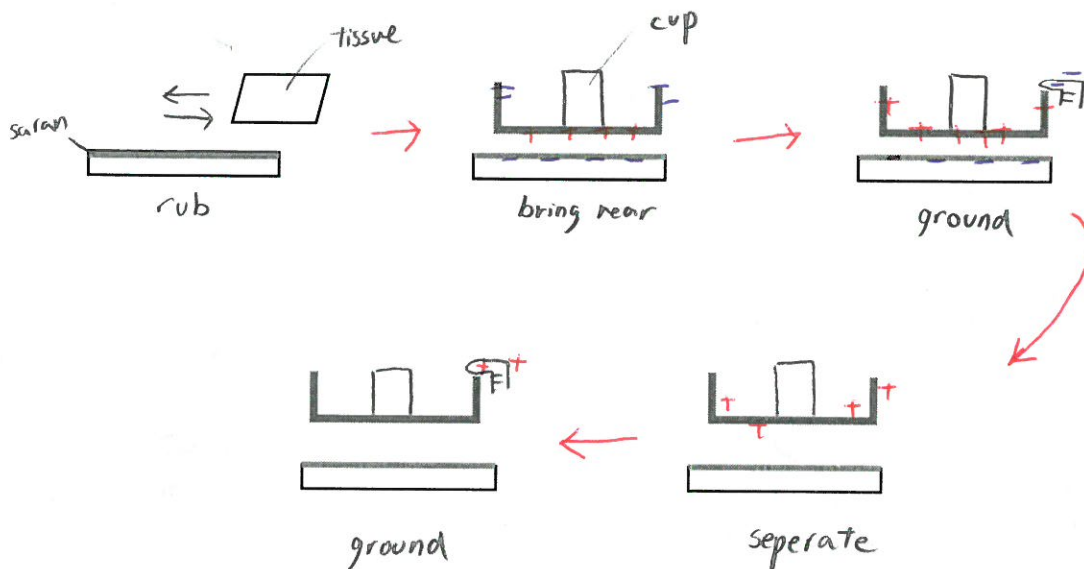


The leaf ultimately stays open because the leaf is positively charged. Negative charges escaped into the hand



[Lab-4-a]- Tray generator

Procedure:



Result:

On both times grounding the experiment, we felt a little shock. Movement of electrons were observed and confirmed.

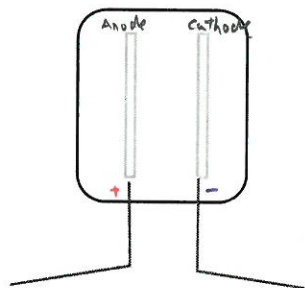
Discussion:

By rubbing the tissue on the Styrofoam wrapped with saran wrap, friction occurred, and the saran wrap becomes charged negatively. By bringing the tray, the positive free electrons within the tray are attracted to the bottom, while negative electrons repel to the top. By grounding the tray while the positive electrons are attracted, the negative electrons escape through the hand, creating a shock. After separating, the tray is now charged positively throughout without the negative electrons. By grounding the tray for the second time, the remaining positive electrons flow through the hand.

[Lab-4-b]- Identifying the sign of charge with a Neon lamp

Procedure:

1. Repeat the procedures of lab-4-a
2. Instead of grounding with your hand, touch with the neon lamp. Observe.



← anode, cathode の
呼び方の注意

Result:

On the first grounding, the anode side glowed. On the second, the cathode side glowed.

Discussion:

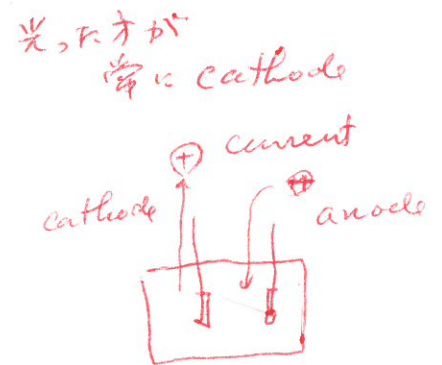
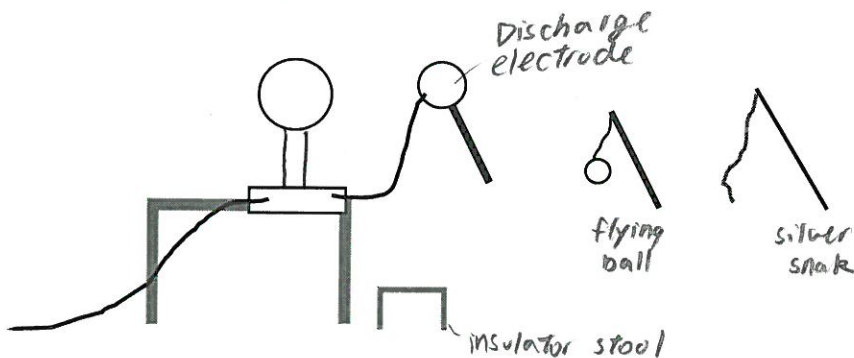
The anode side (+) glows on the first grounding because it releases negative electrons. The cathode side (-) glows on the second grounding because the remaining positive electrons are released.

) x

[Lab-5]- Van de Graaff Generator

Procedure:

1. Set up the apparatus



2. Turn on the generator
3. Place the discharge electrode near the generator. Observe.
4. Place the flying ball near the generator. Observe.
5. Place the silver snake near the generator. Observe.

6. Turn off.
7. Stand on the insulation stool and place hands on the generator.
8. Students form a chain holding hands
9. The person on the stool will touch the chain. Observe.

Results:

When the discharge electrode came near, visible shock was observed.

When the flying ball came near, it was attracted and then repelled.

When the silver snake came near, it was attracted and then repelled.

The person touching the generator had their hair stand up. When contacting another, everyone in the chain felt a shock instantly. However, most of the time, the people at the end of the chain felt barely anything.

Discussion:

Between the generator and electrode, an immense number of electrons are discharged, up to a point where it is visible.

The flying ball gets attracted at first since the free electrons within are attracted. It repels once it touches and discharges, since only like charges stay.

The silver snake is also a conductor, thus did the same as the flying ball.

The hair will stand up on the person touching the generator, because electrons are trying to spread equally throughout the body. The person will not be discharged since they are standing on top of a stool, which prevents the body from grounding. The shock will pass through the chain of people, since humans are great examples of conductors, and electrons can move freely to the next person.

Conclusion:

Rubbing causes for electrons to transfer from object to object and become charged. Object receiving these electrons would be charged negatively and losing would be charged positively. Like charges repel and opposites attract. Electrostatic induction occurs with the free electrons of a conductor, while polarization occurs in insulators that lack free electrons.

Opinion:

Not at all did I know or try to understand the system of charges and movements of electrons. This lab has solved for me the mystery of the static electrical shocks that occurs. I was excited to see the Van de Graaff generator that are used in TV programs, and doing the lab as a class was very enjoyable. Now that I know how electrons are transferred, my perspective in daily life would Change

Reference:

Yumi Murai, Haruka Ogino, Mauro Niikura (Past reports)

