Date of Lab 1/21/2015 Date of Submission 12th Feb 2015

Laboratory Report

Title
表題 Static Electricity Experiments.

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Summary

This experiment is to introduce static electricity as a phenomenon that involves positive and negative charges. It is to determine how the charges act, the effects they have on each other, and to have further understanding about how static electricity is useful to our every day lives. The experiments include conductors and insulators so as to understand polarization and induction.

・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 Summary は実施したことと過去形 Past tense でまとめなさい。
Your English is nice and beautiful. There are some misunderstanding in Discussion. Check them. Also try experiment again concerning the interaction between charged material and water from a baby bottle!

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.

Yumiko Ieminko Murai

Lab 1: Static Electricity

1. Introduction
2. Experiment Materials
3. Methods & Results
4. Discussion
5. Conclusion
6. Thoughts & Impressions

1. Introduction

Static Electricity is known to be the build up of an electrical charge on the surface of an object. The charges remain in one area instead of flowing to another area. We have studied that a static charge is formed when two surfaces touch each other and the electrons move from one object to another.

Objectives:

1. Observing the electric charges through several experiments.
2. Focus on two kinds of electric charges, positive and negative charges.
3. Experimenting how both the insulators and conductors interact with the charged materials. (Polarization and Induction)

Theory:

Frictional Electricity:

Frictional Electricity is when two different substances are rubbed together which leads to the transfer of ~~positive and negative charges~~ electrons. The action creates electricity.

positive and negative charge

Interaction between Charged Materials:

Based on the material's charge, we know that charged materials interact differently with other materials. Like charges repel and the unlike charges attract.

Interaction between Charged Material and Insulators:

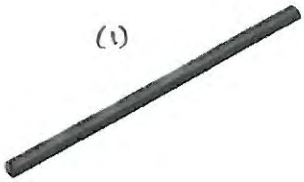
Polarization is the separation of opposite charges within an object. In other words, the positive charge becomes separated from the negative charge.

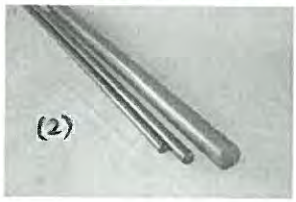
Interaction between Charged Material and Conductors:

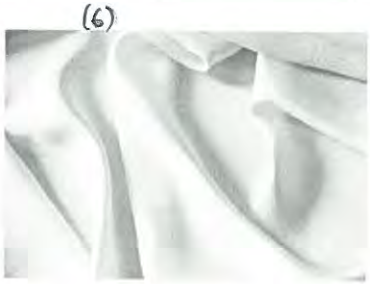
Induction is a method to create static electricity in a material by bringing an electrically charged object near it. It causes the electrical charges to be redistributed.

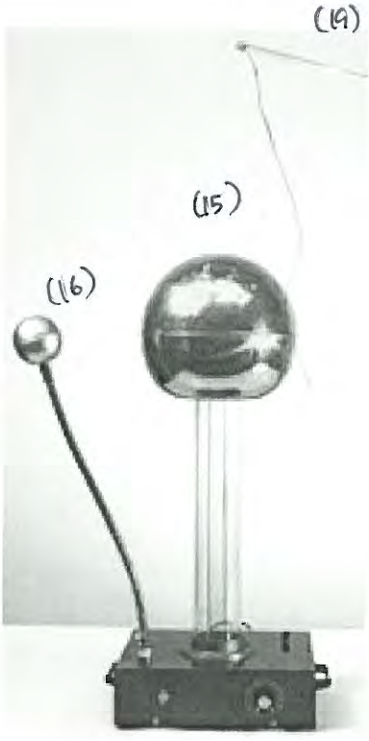
2. Experiment Materials:

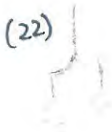
1) PVC Rod
2) Ebonite Rod
3) Fur
4) Glass Rod
5) Acryl Rod
6) Silk
7) Stand
8) Styrofoam
9) Polystyrene Balls
10) Aluminum coated Balls
11) Baby bottles
12) Electroscope
13) Electric Tray
14) Saran Wrap Generator
15) Van de Graaff Generator
16) Discharge Electrode
17) Insulation Stool
18) Flying ball
19) Silver Snake
20) Small light bulb
21) Tissue
22) Suspender
23) A plastic cup

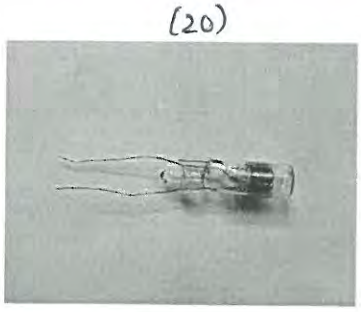


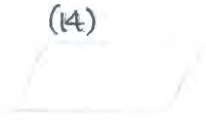












3. Methods & Results

Generate frictional electricity: whether the aluminum coated balls or the polystyrene balls will attract or repel.

Experiment 1: Using the aluminum-coated balls and the Polystyrene balls

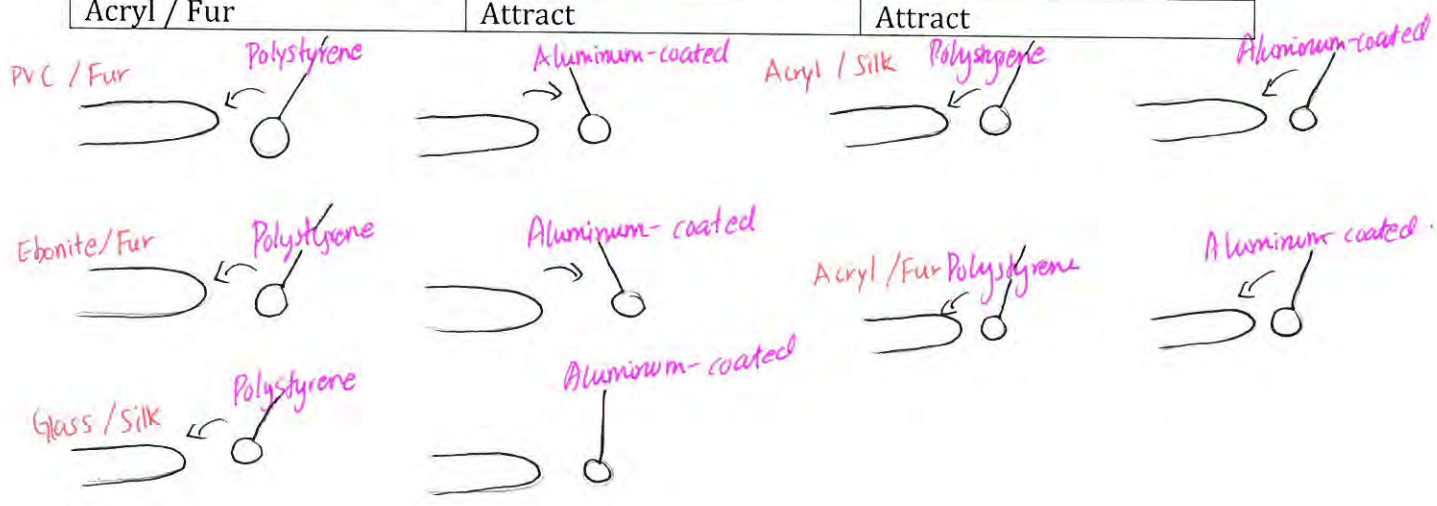
Methods:

1. Suspend the aluminum-coated balls on the stand.
2. Rub the PVC rod with fur and bring it close to the balls.
3. Observe if the balls repel or attract.
4. Rub the Ebonite rod with fur and bring it close to the balls. Observe.
5. Rub the Glass rod with silk and bring it close to the balls. Observe.
6. Rub the Acryl rod with silk and bring it close to the balls. Observe.
7. Rub the Acryl rod with fur and bring it close to the balls. Observe.
8. Do the same for the polystyrene balls after removing the aluminum-coated balls from the stand.

Results:

From the observations we've made, the polystyrene balls are attracted, by all the positively charged rods that have been brought near it. The aluminum-coated balls on the other hand were attracted to both the acryl rods, repelled when the PVC and Ebonite rod was brought near them and the balls stayed neutral, when the glass rod was held near them.

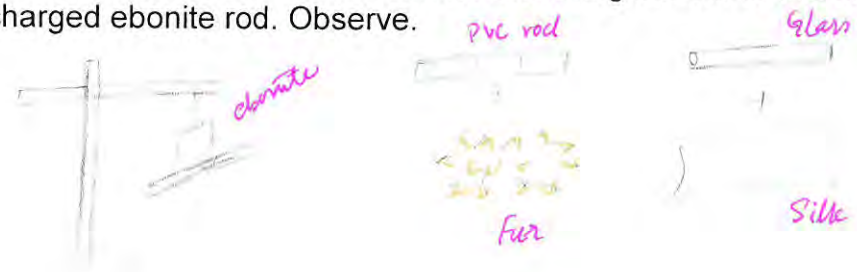
	Polystyrene Balls	Aluminum-coated Balls
PVC (-) / Fur (+)	Attract	Repel
Ebonite (-) / Fur (+)	Attract	Repel
Glass (+) / Silk (-)	Attract	Neutral
Acryl / Silk	Attract	Attract
Acryl / Fur	Attract	Attract



Experiment 2: Using Ebonite

Methods:

1. Suspend the Suspender on the stand.
2. Suspend the Ebonite Rod on the suspender.
3. Hold the PVC, glass, ebonite, and acryl rods, each close to the ebonite rod. Observe.
4. Rub the PVC, ebonite and the acryl rods with fur and bring it close to the neutral ebonite rod. Observe.
5. Then rub the suspended ebonite rod with fur and bring the same three rods, each to the charged ebonite rod. Observe.
6. Rub the glass and acryl rods with silk and bring it close to the neutral ebonite rod. Observe.
7. Then rub the suspended ebonite rod with fur and bring the same two rods, each to the charged ebonite rod. Observe.

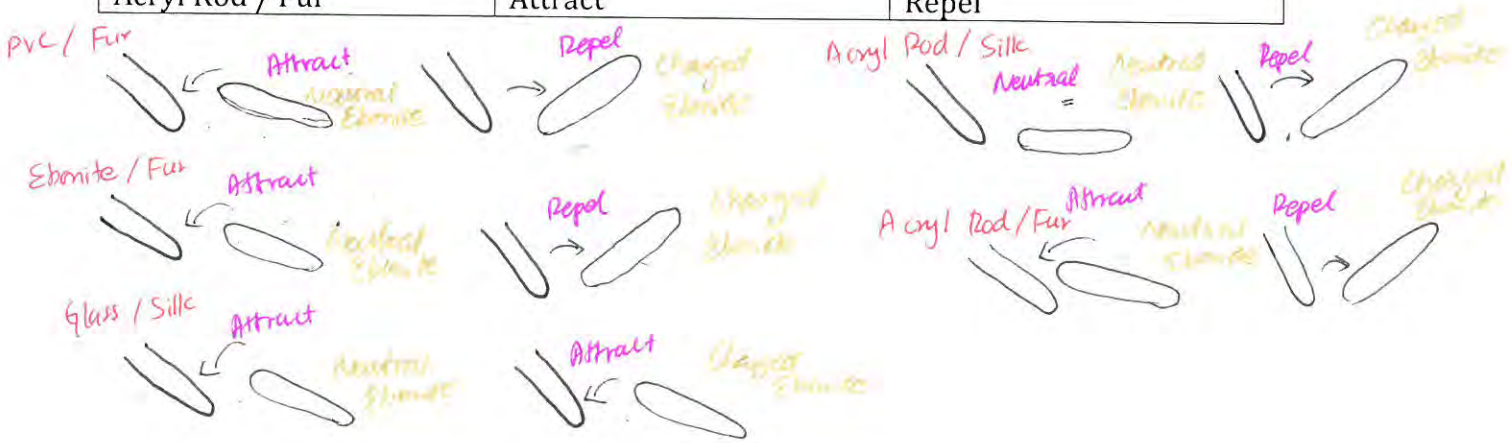


Results:

All the rods that have been brought near the neutral ebonite attracted it, except for the acryl rod that has been rubbed with silk. The neutral ebonite stayed neutral when the acryl rod was brought close to it.

All the rods that have been brought near the charged ebonite have resulted it to repel, except for the glass rod that has been rubbed with silk. The charged ebonite was attracted when it was brought close to the rod.

	Neutral Ebonite	Charged Ebonite
PVC (-) / Fur (+)	Attract	Repel
Ebonite (-) / Fur (+)	Attract	Repel
Glass (+) / Silk (-)	Attract	Attract
Acryl Rod / Silk	Neutral	Repel
Acryl Rod / Fur	Attract	Repel



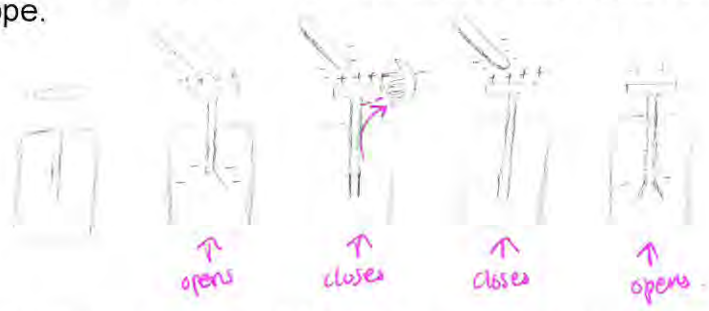
Interaction between Charged Material and Conductors - Induction

Experiment 3: Electroscope

Methods:

1. Rub the PVC rod with fur and place it on top of the electroscope. Observe.
2. Remove the PVC rod from the electroscope and observe.
3. Rub the PVC rod with fur again and place it on top of the electroscope. Observe.
4. Slowly place your finger on top of the electroscope, opposite from the PVC rod. Observe the metal flaps in the electroscope.
5. Pull away your finger, but still have the PVC rod placed on the electroscope. Observe.
6. Remove the PVC rod from the electroscope and observe the metal flaps in the electroscope.

Results:



When the negatively charged PVC rod was placed on top of the electroscope, the metal flaps opened up. When the rod was removed from the top, the metal flaps closed.

When the rod was placed again on top of the electroscope, the metal flaps opened up again. When we placed our finger on the electroscope, the metal flaps slightly closed.

When the finger was removed, the metal flaps stayed closed and when the PVC rod was finally removed, the flaps opened up, meaning that the positive charges have been transferred into the electroscope from the top of the electroscope.

Electric Discharge

<u>Experiment 4: Electric Tray and the Saran Wrap Generator</u>

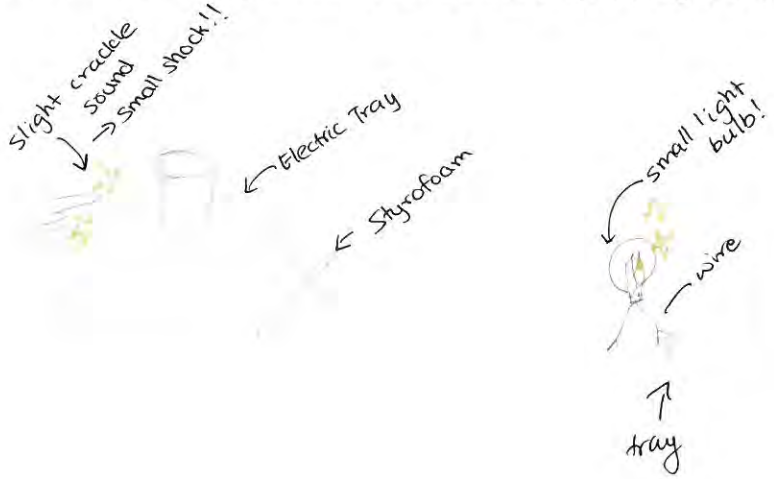
<u>Methods:</u>

1. The Saran Wrap has to cover the entire Styrofoam.
2. Rub a tissue paper against the Styrofoam.
3. Bring the Electric Tray and place it on top of the Styrofoam without touching it.
3. Touch the Electric Tray with your finger and observe.
4. Repeat the same process, and place both wires of a small light bulb on the Electric Tray, instead of your finger. Observe.

<u>Results:</u>

When touching the electric tray, there was a slight crackle sound. We felt a small shock when we touched the tray.

When the wires of the small light bulb touched the tray, the light bulb lit up in an instant.



Van de Graaff Generator

<u>Experiment 5: Van de Graaff generator</u>

<u>Methods:</u>

1. Switch on the Van de Graaff generator.
2. Wait for a few seconds and then place the Discharge Electrode near the Van de Graaff generator. Observe.
3. Place the flying ball near the Generator. Observe.
4. Place the silver snake near the Generator. Observe.
5. Stand on the Insulation Stool and place both hands on the Generator. Observe.
6. All students form a circle, and hold hands.
7. The student at the end will stand near the student on the insulation stool and have him or her touch fingers with the student at the end. Observe what happens to the students, holding hands.

<u>Results:</u>

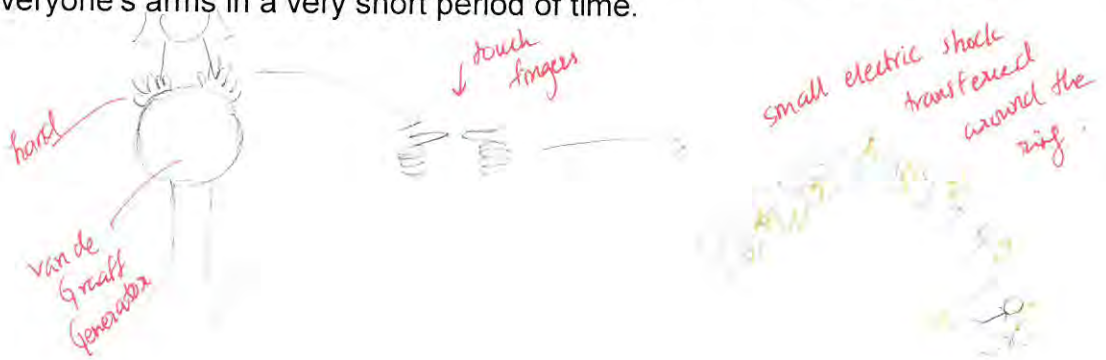
When the discharge electrode was placed neat the Van de Graaff generator, there was a loud sound and a quick visible shock appeared in an instant.

When the flying ball was placed near the Generator, the ball was attracted and then when it touched the generator, it would repel.

When the silver snake was placed near the Generator, the strand would be attracted.

Depending on the lightness of hair, when touching the Generator with both hands, it might lead to a person's hair to stand. According to the results of this experiment, there was only a feeling of shock, prickly feeling through the arms of the student but no change in the hair.

When the student standing on the stool touched the student's finger on the end of the ring, a small electric shock was transferred around the ring, through everyone's arms in a very short period of time.



Experiment 6: Baby Bottle

Methods:

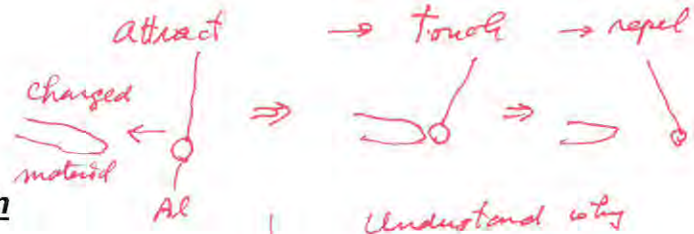
1. Fill a baby bottle with normal temperature water.
2. Pour the water into a cup. Observe.
3. Rub the PVC rod with fur.
4. Pour the water again into the cup and bring the charged PVC rod near the pouring water. Observe

Results:

When the water was poured without any interruption, it poured out smoothly forming a straight line.

When the charged PVC rod was brought near the pouring water, the water didn't pour straightly. It slightly formed a curve due to the repulsive force.

wrong!
attractive force



4. Discussion

Understand why this happens

Using the suspended balls:

Electrons are being transferred from the fur to the PVC rod when being rubbed. It is because of the cause of friction. The aluminum-coated balls stayed neutral when the charged glass rod was brought near it because of the lack of electrons. The aluminum-coated balls repelled when having both the PVC and Ebonite brought near it because of how it is a conductor. Conductors are objects that transmits electricity (in this case). When the charged rod touched the aluminum-coated balls, the charge has been shared between the objects. However, being an insulator, the polystyrene ball does not have the electron-sharing properties. Insulators are objects that do not conduct electricity. They do not share electrons.

Using Ebonite:

In this experiment, we know that almost all the rods used in the experiment attracted the neutral ebonite except for the acryl rod rubbed with silk, which resulted the neutral ebonite to stay neutral. However, the charged ebonite repelled when almost all the rods are brought near it, except for the glass rod rubbed with silk. It attracted the charged ebonite. We know that the same charges would repel from each other, due to the repulsive force. Objects with opposite charges would attract one another, according to the results of the positively charged glass rod and the negatively charged ebonite.

Electroscope:

When the negatively charged PVC was placed on top of the electroscope, the electrons in the electroscope were being repelled, which led the metal flaps to have negative charges and open up.

When the charged rod was removed, the flaps slightly closed up due to the conservation of electric charge, which meant that the electrons were not shared during the process. ?

We know that the flaps open due to polarization and they stay slightly open when the rod was removed because the negative charges stayed on the top of the electroscope and some negative charges were transferred into the electroscope, due to induction.

When placing the finger at the same time the charged PVC rod has been placed, the metal flaps closed. This is because the electrons escaped out of the metal and it gets into our body. The electroscope was left with positive charges. When both the finger and the PVC rod has been finally removed, the metal flaps ended having positive charges which caused them to repel against each other and open

up.

Electric Discharge:

Saran wound around

When a paper tissue was rubbed against the Styrofoam, friction occurred. When the electric tray was placed above the styrofoam, the two objects were attracted. Because the objects are not touching, the crackling sound forms when we touch the electric tray because the electrons are not able to transfer since the objects are not touching and it uses our body to discharge the abundant electrons. The experiment helps to feel the transfer of electrons.

When the wires of the bulb, touches the electric tray, the light bulb lights up. It proves that electrons are going through the bulb.

Van de Graaff Generator:

The sound and the visible shock of electricity that can be seen when the discharge electrode is placed near the Van de Graaff Generator shows the transfer of the electrons.

The flying ball gets attracted by the Van de Graaff Generator because the ball happens to be a conductor and since they both have the same charges, the ball ends up getting repelled. The same goes for the silver string. It gets attracted through induction.

Depending on the lightness of hair, when touching the Generator with both hands, it might lead to a person's hair to stand because the electrons are trying to spread out evenly through our body. According to the results of this experiment, there was only a feeling of shock, prickly feeling through the arms of the student but no change in the hair.

When the student standing on the stool touched the student's finger on the end of the ring, a small electric shock was transferred around the ring, through everyone's arms in a very short period of time. This is because humans are a great example of conductors.

Baby Bottles:

When the water was poured without any interruption, it poured out smoothly forming a straight line. When the charged PVC rod was brought near the pouring water, the water didn't pour straightly. It slightly formed a curve due to the repulsive force. This could be an example of ~~an electrostatic induction.~~

attractive — polarization

5. Conclusion.

Electrons are being transferred when objects of different materials rub against each other. The object that receives electrons ends up with negative charges and the object transferring the electrons ends up with positive charges. In conclusion, the difference between polarization and induction is that for example, if you take an insulating material, and bring a positive charge close together, the electrons will gather closer to the positive charge which leads to polarization, separation of charges. Induction is when the charge the conductor gains its own charge. From the experiments, we know that electrons will try to stay away from the positive charges.

6. Thoughts and Impressions

At first, I was quite confused about the electroscope experiment but writing a lab report on it helped me understand the concepts. It's very interesting and yet still stays very mysterious that we can try to make the invisible transfer of electrons, visible by the movements of the objects and the sounds. Labs have helped me learn new things visually rather than just words written in the textbook. I hope we are able to do more labs because I've come to realize that writing lab reports help me see things in a different perspective and it will definitely help improve my writing skills.

http://www.biologycorner.com/worksheets/labreport.html

http://www.school-for-champions.com/science/static_induction.htm#.VNr19WTF-QM

Sample Lab Report → Hirokazu Matsuda