Physics-NYB **Lab 1: Electrostatics**

The electric charging by contact is known also as *triboelectric charging*. This means that certain materials become electrically charged after they come into contact with another ***different*** material *with or without* friction. Most of static electricity is built by triboelectric charging. For exemple, one can get two ***electrically charged*** objects (*one positive the other negative*) by rubbing *neutral* glass with *neutral* fur, or by passing a *neutral* comb through the hair. The sign of polarity and amount of charges produced differ according to the materials properties (constituency, surface roughness, strain, temperature..)

This property was first recorded by Thales of Miletus and the word "electricity" comes from the Greek word "ēlektron" (amber). Amber acquires an ***excess*** *of electric charge after contact with wool; the same happens to glass touching silk, or hard rubber touching fur. Note that not all the materials can exchange a significant amount of electric charge by contact. The amount of exchanged electric charge can be increases by friction.*

TRIBOELECTRIC SERIES

The following table shows the triboelectric effect polarity for many materials one may find around the house. Items closer to the top get positively charged when they touch items closer to the bottom.

- Human hands (usually too moist, though) **Acquires a positive charge +**
- Rabbit Fur
- Glass
- Human hair
- Nylon
- Wool
- Fur
- Lead
- Silk
- Aluminum
- Paper
- Cotton
- Steel
- Wood
- Amber
- Hard rubber
- Nickel, Copper
- Brass, Silver
- Gold, Platinum
- Polyester
- Styrene (Styrofoam)
- Saran Wrap
- Polyurethane
- Polyethylene (like Scotch Tape)
- Polypropylene
- Vinyl (PVC)
- Silicon
- Teflon **Acquires a negative charge -**

(The above list is adapted from Nature's Electricity, by Charles K. Adams.)

The **relative position** of two substances in the triboelectric table tells what sign of charge they will get when brought into contact. Glass rubbed by silk causes a charge transfer such that they get charged (glass"+" and silk"-"). The same applies for wool"+" and amber"-". The farther is the separation in the table, the greater is the amount of the charge transfered. Reference: http://science.howstuffworks.com/vdg1.htm, retrieved Jan. 20, 2010

Observe the following experiments; s***tate clearly your observations and provide explanations (****using modelling, drawings and the appropriate electrostatics' terminology. +/- charge, conductor, insulator, charge transfer by contact, charging by induction, polarization ,..*) ***for each experiment.***

1. a) Cut a piece (about 5-6cm wide, 30 cm long) of plastic wrap (fig.1) fold it in half lengthwise and hang it on a ruler(or another non metallic object). Rub slowly by your fingers (fig.2) each two plastic strips and remove your fingers(fig.3). If all worked correctly, you will have two charged strips:
a) What way did the strips get charged?....
b) What is the sign of charge on each strip?.....
c) Do the strips attract or repeal each other? Explain why?....
Place your finger between the two strips without touching them.
d) What do you see?.....Explain your observation(refer to the charge sign).

Note: If the strips loose charge during this experiment, you may easily recharge them.

2. Bring the charged plastic strips near some tiny bits of Kleenex paper (fig.4) that are not charged. Describe what happens. Explain what is going on using what you have learned about electrostatics. (Note, that the paper pieces are neutral and very light.)

3. Let flow a thin dribble of water from the tap. Rub a plastic spatula (straw, rod) with a sweater(fig.5) and hold the spatula close to the dribble of water without touching it. What happens ? What sign is the charge of tap water?
You can do some research on line for water molecule and ad your comments.

4. Rub an inflated balloon against hair. Remove it slowly from hair.
a) Write clearly what do you see.
Why does your hair stick up as the balloon leaves the hair? Afterwards, once the balloon has left, why does the hair still stand up?
Rub another time the balloon on hair and try to stick the balloon to the wall. Does it?
b) Explain why what you see by using electric charges and forces.
Why is there a difference when air is dry or there is moisture?

You can see demonstrations of experiments 2,3,4 in the following video.

Watch the video: https://www.youtube.com/watch?v=ffOd7nP5dEw

Refer to the experiments with an electroscope for the following part of the lab.

Charging by induction.

5.Follow the steps below and observe what happen to the leaves of the electrometer **for each step**. In your lab report, explain the observations for each step.

- Placing the electrified rod/straw near the plate of the electroscope (without touching it).
- Touching the electroscope plate while keeping the rod/straw nearby,
- Removing the finger
- Moving the rod/straw away
- Bringing the rod close to the top plate of electroscope without touching it again.

Note the rod doesn't touch any part of the electroscope through the whole process.

Fig.1 A wrap piece (6cm x30cm)

Fig.2 Rubbing by two fingers each strip of wrap

Fig.3 Two plastic strips after removing fingers

Fig.4 Small pieces of Kleenex paper

Fig.5 Rub a plastic spatula with a sweater

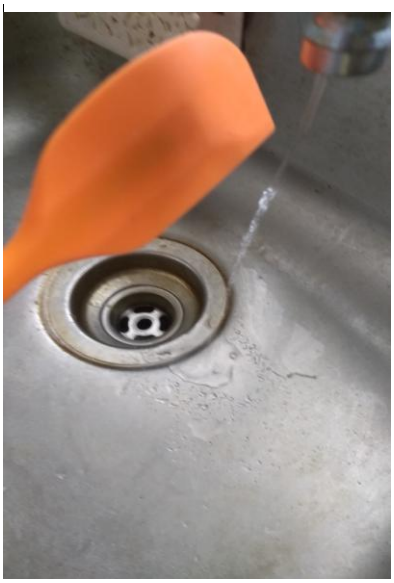

Fig.6 Approaching the spatula to the dribble of water.