Ms. Rosenthal

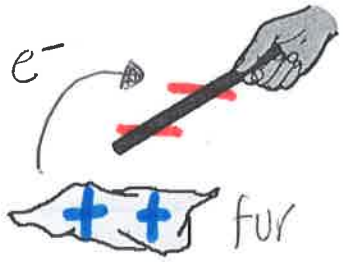
(Electrostatics) Electric Forces and Fields

IB 11

1. What happens in each case below when the two objects are rubbed together? (glass or plastic)

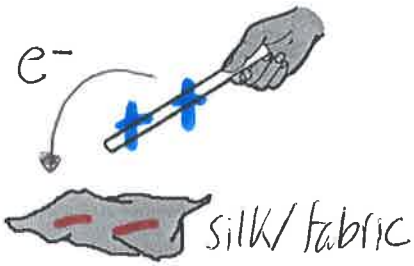
Rubber Rod and Fur

rod is gaining electrons on the surface



Plastic Strip and Fabric / silk

strip is losing electrons



2. What is the only particle that is normally transferred when an object is charged? electron

Why? protons + neutrons are tightly bound in the nucleus of the atom; electrons in outer orbitals can move places

3. Sketch each of the following and determine the net charge.

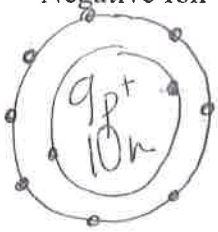
Neutral Atom **He** — #p = #e

2p+
2e⁻
Ø

Positive Ion **Li⁺**

3p+
2e⁻
+1

Negative Ion **F⁻**



9p+
10e⁻
-1

Elementary charge: (e.c.) +1 e.c. for proton -1 e.c. for an electron

	Proton	Electron	Neutron
Symbol	p^+ or ^1_1p	e^- or $^0_{-1}e$	n ^1_0n
elementary Charge (e)	q = +1 e.c.	q = -1 e.c.	q = Ø
unit of Charge (C)	$q = 1.6 \times 10^{-19}$ C	$q = -1.6 \times 10^{-19}$ C	q = Ø C
Mass (kg)	1.673×10^{-27} kg = 1 a.m.u	9.11×10^{-31} kg = Ø a.m.u.	1.675×10^{-27} kg = 1 a.m.u.

Electric charge

Symbol: q or Q Units: [C] = Coulombs

Electrostatics: the study of electric charges that are not moving

Types of materials:

a) **Conductors**: materials in which electric charges move freely (e.g. metals, graphite)
b) **Insulators**: materials in which electric charges do not mo ve freely (e.g. plastic, rubber, dry wood, glass, ceramic)
c) **Semiconductors**: materials with electrical properties between those of conductors and insulators (e.g. silicon)
d) **Superconductors**: materials in which electrical charges move without resistance (e.g. some

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Charging by Friction: transfer of electrons by rubbing two objects together

Charging by Conduction: charging by touching two objects so that the electrons are transferred

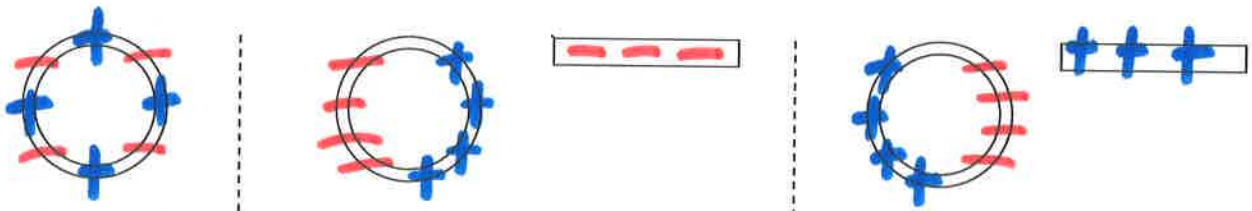
Discharging:

a) Grounding: allowing electrons to flow in or out of an object by connecting it to the Earth or another large object

A ground is a large object that serves as an infinite source or sink of electrons.

b) Leakage: discharge of an object due to electrons being transferred to or from the air

4. Sketch what happens when a charged rod is brought near a soda can.



Neutral object | Nearby negative rod | Nearby positive rod

Polar: overall object is neutral but one side is positively charged and the other is negatively charged

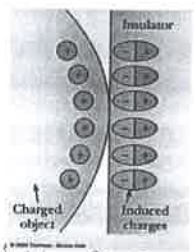
Induction (Separation of charge): the separation of charge caused by a nearby object

General Conclusion

neutral objects are always attracted to charged objects

5. Why do rubbed balloons stick to walls?

surface charge can be induced on an insulator



molecules can rotate 2 in an insulator