Chapter 9
Static Electricity

9.1 - Types of Electric Charge

**Static Charge** - a charge at rest

**Discharge** - a static charge that is lost to either another object or into the air

**Electrostatics** - the study of static electricity

Can we see electric charge?

Ben Franklin

Two types of charges

Positive (+)    Negative (-)

**Law of Electric Charges** - like (same) charges repel and unlike (different) attract
Atomic Structure and Electric Charge

What is matter made of?
   Atoms

What are atoms made of?
   Protons, Neutrons, Electrons

What is the charge of an atom?

What do we call an atom with a charge?
Positive, Negative and Neutral Objects

Neutral objects have the same amount of +/- charges
When an object becomes charged, only the electrons transfer (move)

Why is this?

The Electrostatic Series

Some objects lose electrons easier than others. The list on the right gives a few examples.
Attraction of Neutral Objects to Charge Objects

**Induced Charge Separation** - no gain or loss of elections, just a movement (or attraction) of a neutral object caused by another object with a charge.

![Diagram](image)

**Figure 5** (a) A neutral ruler (b) The neutral ruler is attracted to a positively charged ruler.

**Homework:** Read 9.1 in your textbook and do the following questions pg. 278 - # 2 - 6, 8 - 11
9.2 - Charging by Friction, Conduction and Induction

**Charging by Friction** - occurs when two objects are rubbed together
Charging by Conduction - occurs when objects touch and charge is transferred

Ex: scuffing feet across carpet and touching a metal doorknob
Charging by Induction - occurs when objects are charged without touching

Ex: buildup of charge on tv screens/computers

Homework: Read 9.2 in your textbook and do the following questions
pg. 281 - # 1, 4 - 9
9.3 - Insulators and Conductors

**Insulator** - material in which the electrons cannot escape easily

**Conductor** - material in which the electrons can freely move/transfer

Metals are good conductors

**SemiConductor** - material in which the electrons can freely, but with some resistance

**Table 1** Examples of Insulators, Conductors, and Semiconductors

<table>
<thead>
<tr>
<th>Good insulators</th>
<th>Good conductors</th>
<th>Semiconductors</th>
</tr>
</thead>
<tbody>
<tr>
<td>oil</td>
<td>silver</td>
<td>carbon</td>
</tr>
<tr>
<td>fur</td>
<td>copper</td>
<td>germanium</td>
</tr>
<tr>
<td>wool</td>
<td>gold</td>
<td>silicon</td>
</tr>
<tr>
<td>rubber</td>
<td>aluminum</td>
<td>selenium</td>
</tr>
<tr>
<td>glass</td>
<td>tungsten</td>
<td>polyacetylene</td>
</tr>
<tr>
<td>plastic</td>
<td>nickel</td>
<td>silicon carbide</td>
</tr>
</tbody>
</table>
**Metal-leaf Electroscope**

Determines the presence of electric charges.

![Diagram of metal-leaf electroscope](image)

**Grounding** - removing/discharging an object by connecting it to the Earth/ground

**Figure 2**

(a) The vertical leaves indicate that there is no charge.
(b) The leaves spread apart indicating that there is a charge near the metal ball.
(c) The vertical leaves indicate that there is no charge.

**Homework:** Read 9.3 in your textbook and do the following questions

pg. 284 - # 1 - 9
9.4 - Electric Force

**Van de Graaff generator** - device that separates large quantities of electric charge

**electric force (electrostatic force)** - the force between two static charges.

Either a PULL (attraction) or a PUSH (repulsion)

Measured in NEWTONS (N)
Electric Force

Amount of force increase as the distance from the charge decreases

As something gets closer, the force gets stronger.

As something gets further away, the force gets weaker.

This is called an inverse relationship

It is known as Coulomb’s Law

The size of the electric charge is measured in coulomb’s (C)

1 coulomb (C) = the charge of $6.25 \times 10^{18}$ electrons

**Homework:** Read 9.4 in your textbook and do the following questions
pg. 287 - # 1, 3 - 9
Lightning

Water droplets that are evaporated rise up and form clouds.

These droplets collide with other droplets and electrons are exchanged.

This leads to a build up of negative charges (at the bottom of the cloud), and positive charges (at the top of the cloud).

Once the charges at the bottom of the cloud (negative) become too large, they repel the negative charges on Earth.

This leads to a build up of positive charge on Earth’s surface and LIGHTNING!
Laser Printers

Lasers and lights use charge differences to “write” on the paper and attract toner to the page.

Fabric Softener Sheets and Static Cling

Neutralize negative charge build up and reduce friction between clothes.
Electrostatic Precipitators

Used to help clean the emissions from coal plants

Ash is given a negative charge, then gets stuck on a plate with a positive charge

Homework: Read 9.5 in your textbook and do the following questions pg. 290 - # 2 - 5, 8 - 11