Unit the last - Electricity

Questions for small group discussion:

1. How would you describe *static electricity*?
2. What examples of static electricity are you familiar with?
3. What do you think is the difference between static electricity and current electricity?
4. What is lightning?

1. How would you describe static electricity?

↳ not moving

- an imbalance of - and + charges
- particles/energy not moving
-

2. Examples? - frizzy hair - stands up - e.g. rubbing a balloon
   - rub hand on something and touch something else (shock)
   - hair brush/comb your hair
   - dryer.

3. Difference between static and current electricity?

- Current → moving charges , static → not moving charges
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4. What is lightning?

- current electricity
- a large discharge (shock) of static electricity

Static Electricity: A (Really) Brief History - with a little language lesson!

~ 600 BC Early Greeks - 'ελεκτρον

transliterated - elektron

translated - amber - gemstone, fossilized tree sap.

When polishing amber, pieces of dust and lint were attracted to it.

16th Century - William Gilbert - physician to QE I

- father of electromagnetism
- wrote paper "De Magnete" - Latin
- recorded that like amber, many substances could be "elektrified" - "charged"
- could not charge metals.

(that happened about 150 y later)

By Benjamin Franklin's time (late 18th century) experiments showed

1. Charged objects attract uncharged ones
2. Two charged objects can either repel OR attract.
3. The size of the force between two objects increases as the distance between them decreases

Two types of charge: Ben looked at #1 and #2 and recognized they could be explained by 2 types of charge

positive (+) → has more + than - charges
negative (−) → has more - than + charges

An uncharged object → has equal amounts of + and -

Like charges repel
Unlike charges attract
] Law of static electricity.

Ben defined a negative charge as the charge left on a rubber rod when rubbed with wool (or fur)

A positive charge is defined as the charge left on a glass rod when rubbed with silk

Law of Conservation of Charge

The total charge within a group of objects remains the same no matter what happens between the objects (as long as no charge gets in or out).

This means that charge moves between objects, but we don't create or destroy total charge (we can't make a positive charge without an equal negative one).

Three possible ways for charge to transfer:

1) negative charges transfer
2) positive charges transfer
3) BOTH charges transfer.

allows us to reasonably eliminate #2.
- proton is about 2000x heavier than e^-
- and the e^- is on the outside.

The fact that we see no changes in the elements in the objects is evidence that ONLY the negative charges (e^-s) are transferring.

Conductors and Insulators

Conductor - a substance that allows e⁻s to move through it easily.

- e.g. metals; salt, acid, base solutions; graphite

Insulator - a substance that does not allow e⁻s to pass through easily

- rubber, fur, glass, silk, wood, most gases, most liquids (including pure water), cork, styrofoam, ...

Methods of Charging

Charging by Friction -

Charging by Conduction -