

Electrostatics

A night photograph of a city skyline with several bright, jagged lightning bolts striking down from a dark, stormy sky. The city lights are visible in the lower portion of the frame, and the lightning bolts are the primary focus, creating a dramatic and powerful scene.

Electrical Charges

- Electrostatics = electricity at rest.
- All matter is made up of charges.
- These charges come from the particles that make up the atoms.
- Protons have a positive charge.
- Electrons have a negative charge.
- Why they have these charges is much more complicated than we care about.
- If an object has the same amount of positive and negative charges, or none at all (very unlikely), it is said to be neutral.

Charges cont.

- Like charges repel, opposite charges attract.
- These charges create electrical forces that can cause objects to move and do work.
- Conservation of Charge- there is always an equal amount of positive and negative charge and none can be lost or gained
- All objects have a charge equal to a multiple of the charge of an electron

Coulomb's Law

- A Coulomb is the unit of electric charge (C)
- Equal to the charge on 6.24×10^{18} e⁻. 100W bulb?
- Remember Newton's Law of Gravitation?
- This is related!
- $F = \frac{k q_1 q_2}{d^2}$

F = attractive or repulsive force

k = electrical proportionality constant

$$9 \times 10^9 \text{ N m}^2/\text{C}^2$$

q = the charge of the two objects

d = the distance between them

Difference with gravity?

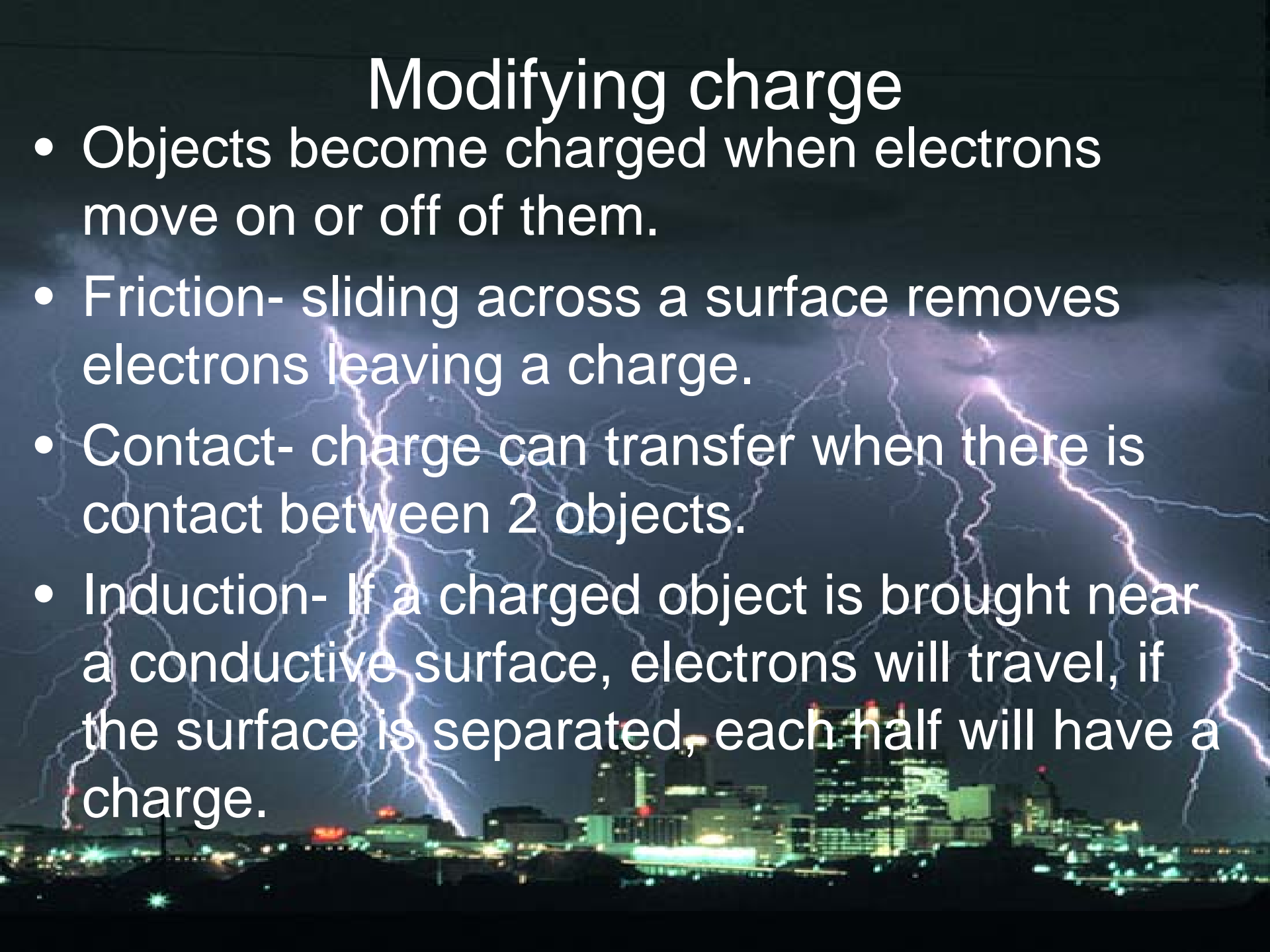
- Gravity only attracts, while electrical forces can attract or repel.
- Most large objects have equal amounts of positive and negative forces so there is no forces involved.
- Gravity only interacts at this point.
- At atomic sizes are where the electrical forces overwhelm gravity.
- Chemical bonds are small volumes of space where electrical charges are not balanced.

Conductors and insulators

- Electrons can move better in some materials than others.
- Conductors are materials where electrons freely roam. (metals)
- Insulators are materials where electrons cannot travel easily (nonmetals)
- Semiconductors are materials where the conductivity can change do to conditions.
- Layers of semiconductors make up transistors.
- Some materials at low temperature have infinite conductivity. Superconductors.

Modifying charge

- Objects become charged when electrons move on or off of them.
- Friction- sliding across a surface removes electrons leaving a charge.
- Contact- charge can transfer when there is contact between 2 objects.
- Induction- If a charged object is brought near a conductive surface, electrons will travel, if the surface is separated, each half will have a charge.



More Charge Modifying

- Polarization- if a charged object is brought near an insulator, the individual molecules can align their charges.
- This is electrical Polarization
- Paper, Plastic and static electricity?
- Water is?
- An object in contact with the ground can have an infinite transfer of charge. This is called grounding.

