Electric Fields

Part Two

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Storing Charges

- Capacitors
  - designed to store electrical charge
  - made of two conductors separated by an insulator
  - measured in farads (F)
  - most commercial capacitors are usually 10×10^{-12} F to 500×10^{-6} F
  - to find capacitance

$$C = \frac{q}{\Delta V}$$

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Sample Problem

- A sphere has an electric potential difference between it and the Earth of 60.0 V when it has been charged to 3.0×10^{-6} C. What is its capacitance?

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Sample Problem (cont.)

- $\Delta V = 60.0$ V $q = 3.0 \times 10^{-6}$C

$$C = \frac{q}{V} = \frac{3 \times 10^{-6}}{60}$$

$$= 5 \times 10^{-8} \text{ F}$$

Answer: 5.0×10^{-8} F

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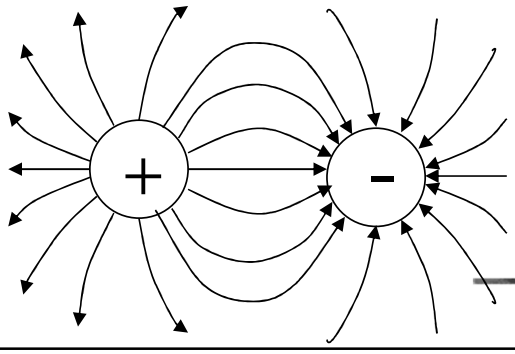
Electric Field Lines

- A model used to symbolize the force and direction felt on a charge in an electric field.
- Point away from positive charges and towards negative charges



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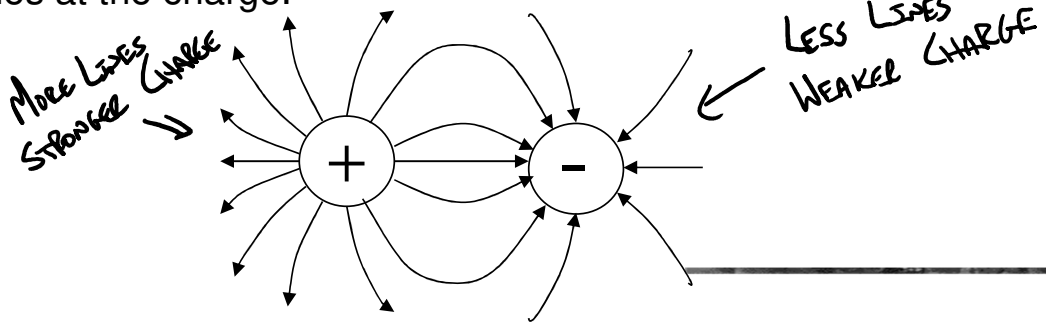
Electric Field Lines

- Intensity of force is symbolized by the number of lines in a given area.
- The relative amount of the charge can be shown by the number of lines at the charge.



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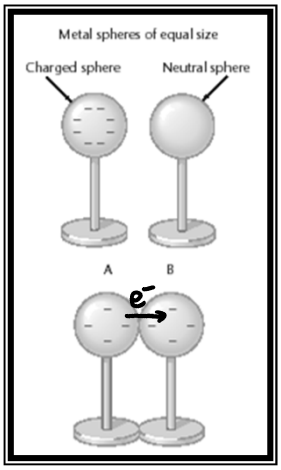
Sharing Charge

- Like gravitational potential energy, charged objects want to have the least amount of electric potential
- Charges will flow until all parts of the conducting object are at the same potential (equipotential)



EQUAL AMOUNT OF CHARGE ON EQUAL SIZE

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Grounding

- The earth is considered to be an unlimited source of electrons, and a limitless sink that electrons can be "poured" into without changing the potential.
- The earth and any conductor attached to the earth is given a potential of zero, and is said to be grounded.

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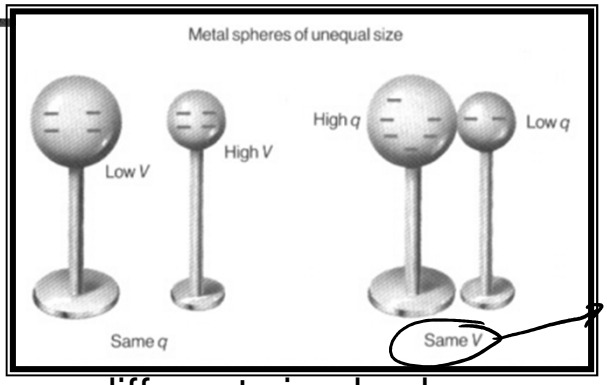
Charges vs. Potential



- Same charges on different sized spheres produce different potentials

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Charges vs. Potential

- The larger an object's surface area, the more charges it can hold while only increasing the potential a small amount
- Reducing the excess charge on an object by touching the earth is known as grounding

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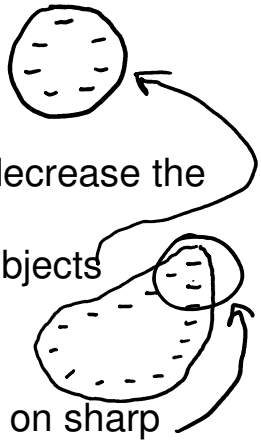
Electric Fields and Conductors



- Charges try to spread out as much as possible to decrease the amount of energy on a conductor
- Charges are equally spaced on smoothly shaped objects
- The surface is equipotential
- Inside the conductor is zero potential
- Charges and e-fields are more highly concentrated on sharp parts of objects
- Example: Lightning Rod

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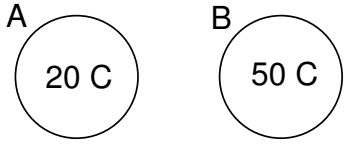
Sample Problem

- Two equal – sized spheres have charges as shown:



  Which sphere has the higher potential? B => More Charge Same Size

- If the spheres were touched together, what would be the charge on each sphere? $70/2 \Rightarrow 35$ C EACH
- If sphere A has an area of 10 cm^2, what would sphere B's radius have to be to have the same potential? $\frac{50}{20} = \frac{x}{10}$ $x = 25$

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