Electric Charge

- fundamental property of matter
- basis of al electric and magnetic phenomena

The Atom:	Proton	charge +1
	Electron	charge –1
	Neutron	charge 0

Net charge $q_{net} = q_{(+)} + q_{(-)}$ Neutral means $q_{net} = 0$

Law of Conservation of Charge: Net charge of a closed system never changes.

Polarization – neutral object has (+) separated from (–).

Discuss conductors, insulators, semiconductors, superconductors

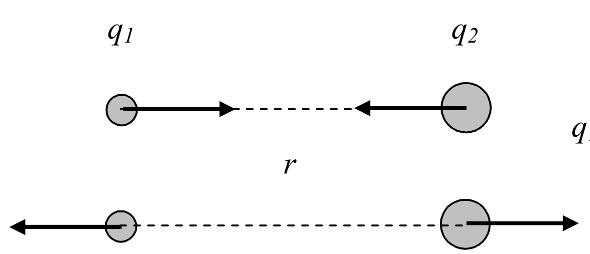
Grounding – create a conducting path to the ground (common discharge method).

Charging Macroscopic Objects: q_{net} (+) lost electrons, q_{net} (–) gained electrons

1) Rubbing – friction
2) Conduction – contact
3) Induction – polarize, then ground

Coulomb's Law

- unlikes attract, likes repel



$$\boxed{F_E = \frac{k|q_1 q_2|}{r^2}}$$

q_1, q_2 must be measured in coulombs (C)

$k = 8.99\times10^9$ N-m^2/C^2

Elementary charge $e = 1.602\times10^{-19}$ C = charge on proton/electron

Electric Field

- invisible "signal" around every charge
- represented as a vector at every point in space

$\mathbf{F_E} = q\mathbf{E}$ → "my field causes your force" and vice versa

$E = \dfrac{k|q|}{r^2}$ magnitude of field at distance r from single point charge

Accelerator Problems, Part 1:

$\mathbf{a} = \mathbf{F_E}/m = q\mathbf{E}/m$ + constant acceleration toolkit:

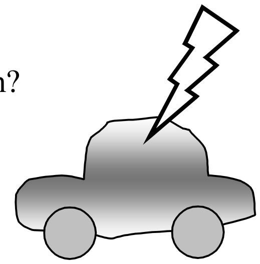
$v_f = v_i + at$ $d = v_it + \frac{1}{2}at^2$

$d = \frac{1}{2}(v_i + v_f)t$ $v_f^2 = v_i^2 + 2ad$

Kinetic energy $K = \frac{1}{2}mv^2$

Conductors in Electrostatic Equilibrium

- why should you stay inside your car during a thunderstorm?



Suppose lightning deposits a net charge to your neutral car.
What happens?

1) Excess charge stays on outer surface.
2) Excess charge accumulates along sharp points and edges.
3) No electric field penetrates to the interior.
4) Electric field sits perpendicularly to the outer surface.