

Intro Electricity and Magnetism

Van De Graaff Generator

Capacitor

RC Circuit

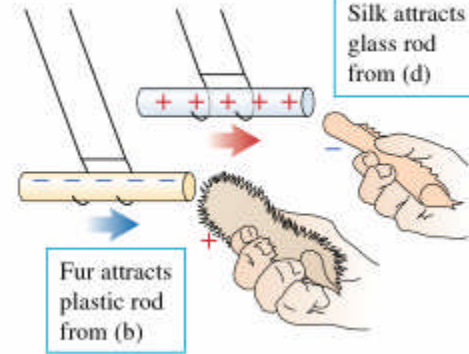
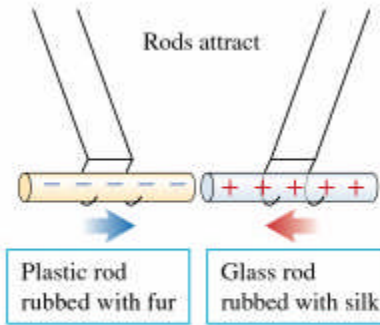
Enrique Ramirez

What is electric charge?

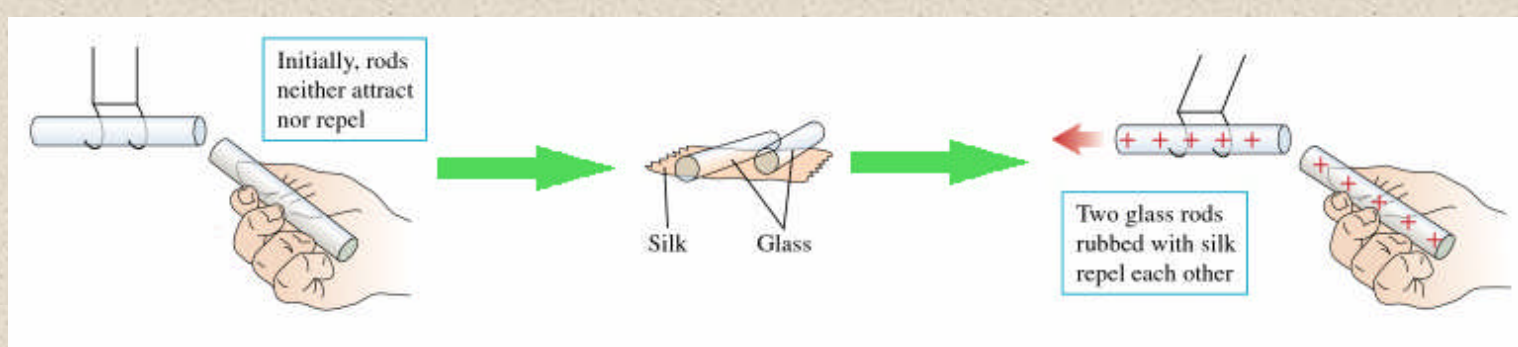
ELEKTRA

ELEKTRA (or Electra) was the Okeanid Nymph wife of the sea god Thaumas, and mother of Iris the rainbow, and the storm-wind Harpyiai.

Greek Name: Ηλεκτρα
 Transliteration: Êlektêrê
 Latin Spelling: Electra
 Translation: Amber Coloured (êlektron)



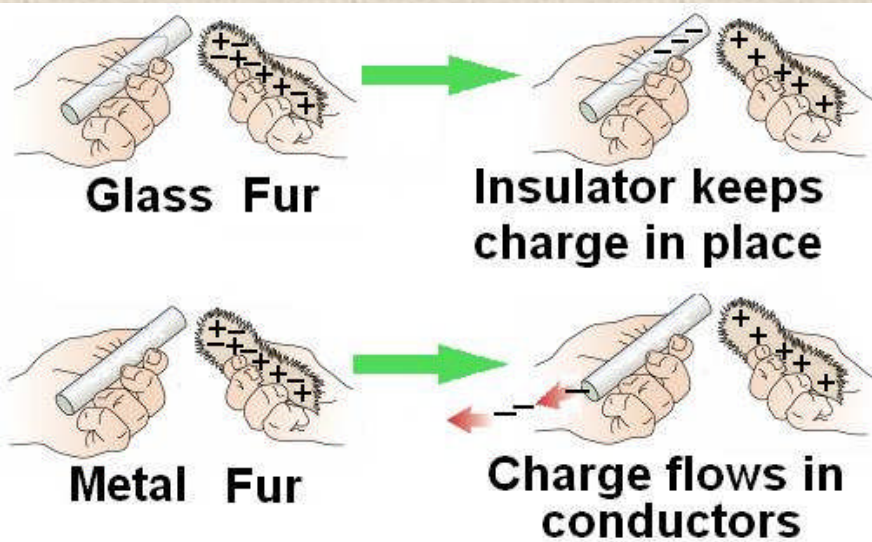
Examples of electric effects



Important stuff about electric charge

- There are two kinds of charges: + and –
- There is charge conservation
- Equal charges repel, unequal charges attract
- Subatomic particles are the source of electricity
- Charge of e = - charge of p
- Charge of e is a unit of charge
- Electrons can be removed from atoms
- “Ions” are atoms with excess charge

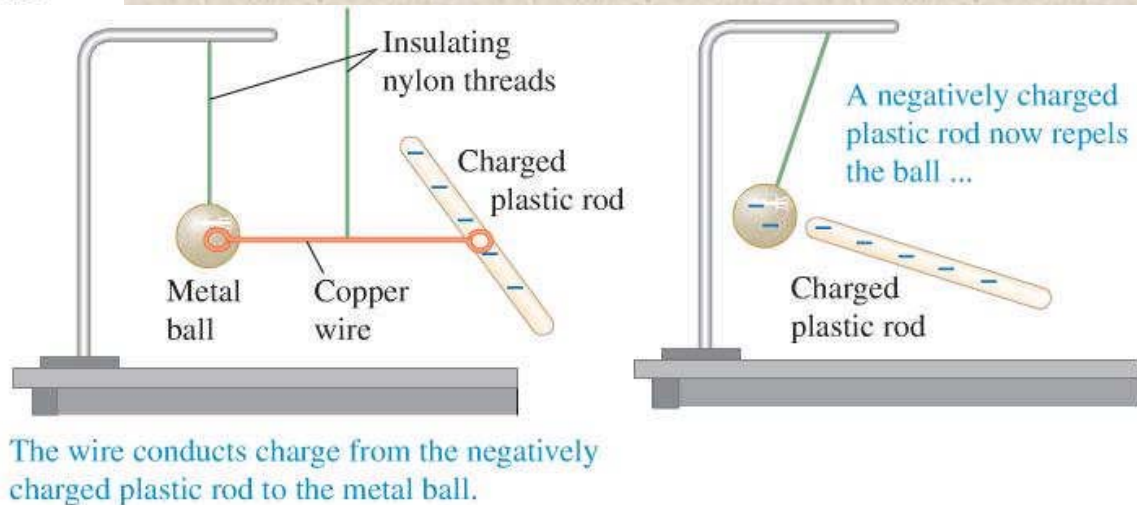
Conductors, insulators and induced charge



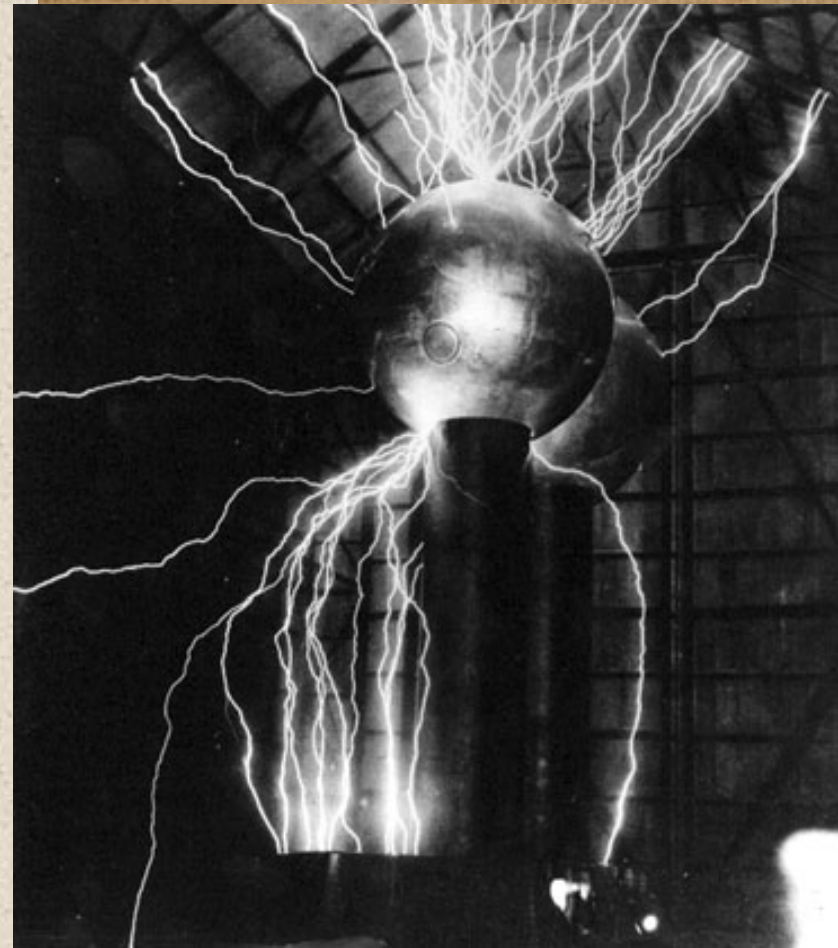
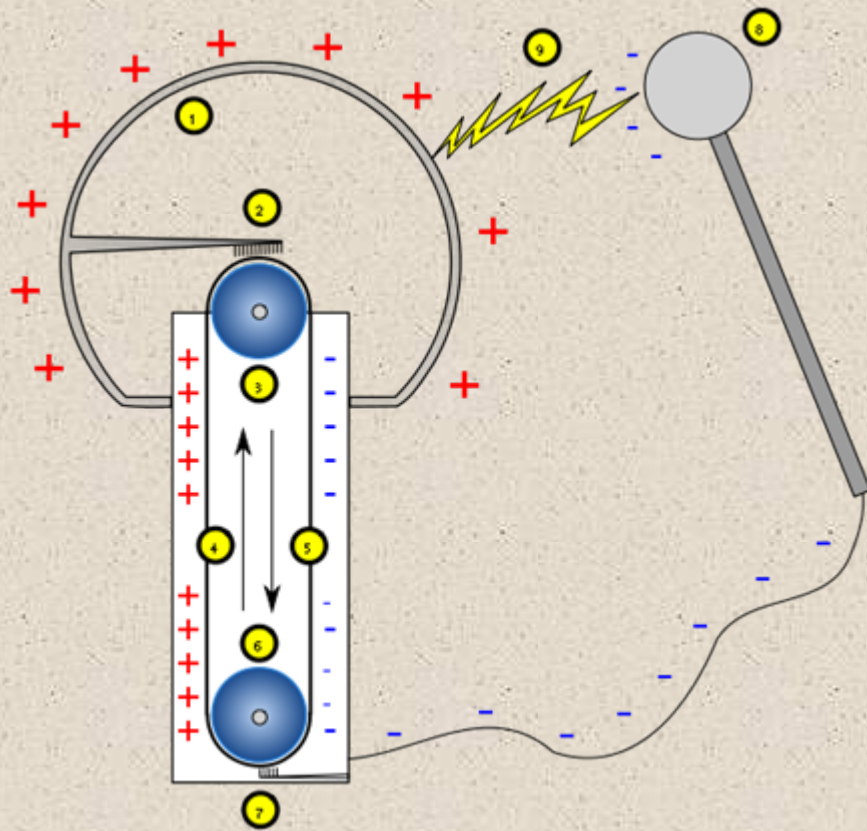
Insulators can be charged by friction

“Conductors” can conduct electrons
Insulators cannot conduct
Semiconductors are in between

Conductors must be charged in isolation

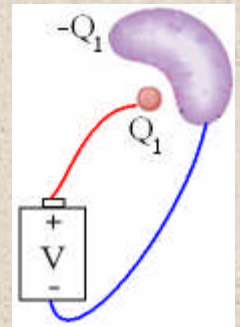


Van de Graaff generator



Capacitance

- Any two conductors can store charge and be a capacitor
- Capacitance = ability of the capacitor to store charges under a V. [F]
- $C = Q / V = \epsilon_0 A / d$ $\epsilon_0 = 8.85 \times 10^{-12} \text{ F/m}$



RC Circuit

- *Charging a capacitor* $q = Q (1 - e^{-t/\tau})$
- *Discharging* $q = Q e^{-t/\tau}$

- *Where does this come from?*
- Using Kirchhoff' law...
- $\varepsilon - IR - q/C = 0 \rightarrow$ a differential equation!
- $dq/dt = -q/RC + \varepsilon/R$
- $dq/(q - C\varepsilon) = -dt/RC$ Things worth noting for tau
 $\tau = RC \rightarrow$ 66% of charge
- $\int_0^q \frac{dq}{q - C\varepsilon} = -1/RC \int_0^t dt$
- $q = C\varepsilon (1 - e^{-t/RC})$