

Ch 16. Electric Charge & Electric Field

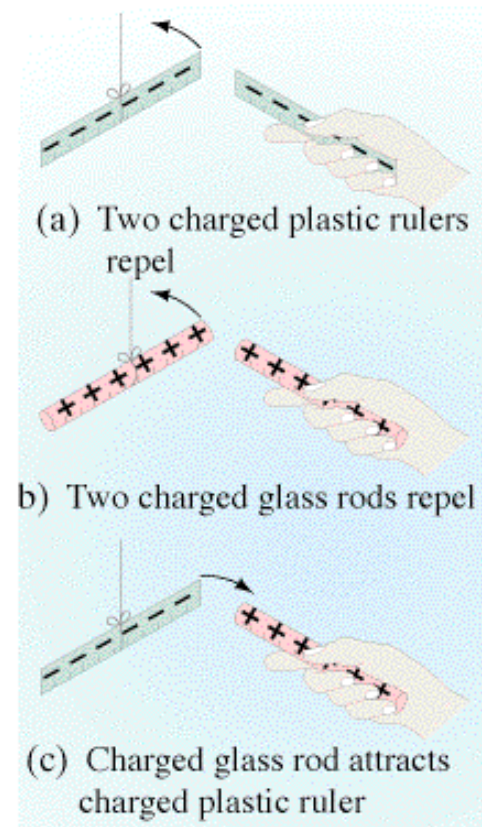
I. Basic Concepts

Static electricity: charges at rest

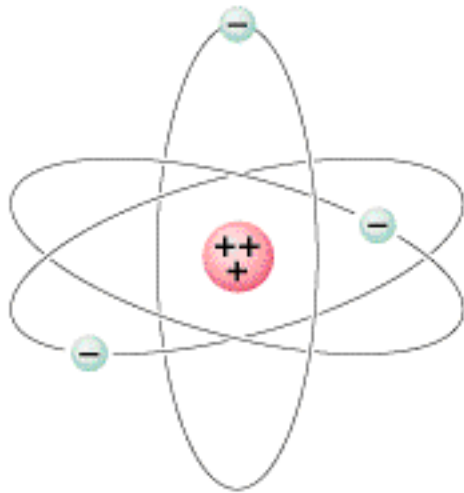
Electric charge

Like charges repel

Unlike charges attract



Electric Charge



Electron charge: $-e$

Proton charge: e

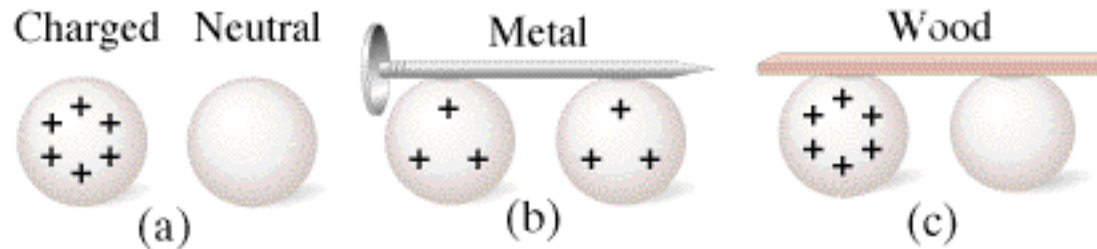
Elementary charge

$e = 1.6 \times 10^{-19}$ coulomb (C)

Atoms, and most things, are neutral:
total positive charge = total negative charge

Conservation of electric charge:
the net amount of electric charge produced in any process is zero

Insulators & Conductors



Conductors: lots of

Metals

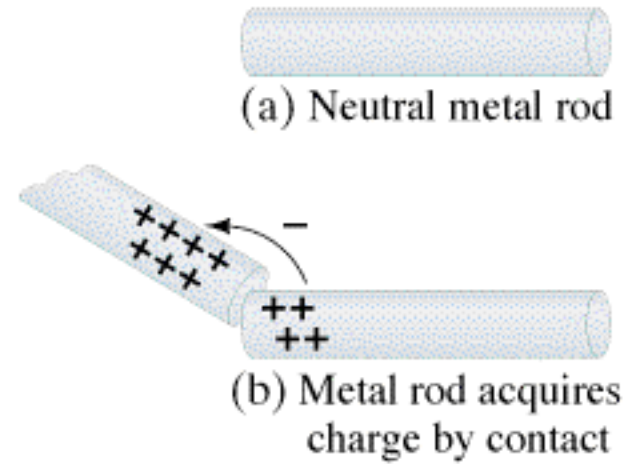
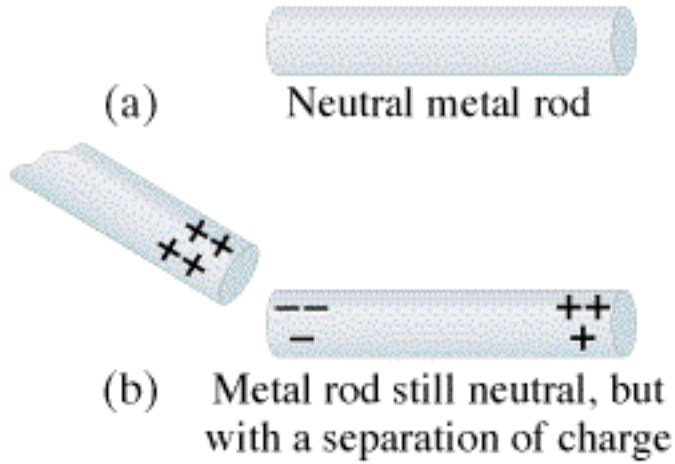
Semiconductors: some free electrons that can move around

Silicon, germanium, carbon

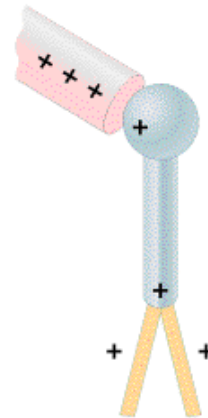
Insulators: almost none

most other materials

Charge Manipulations

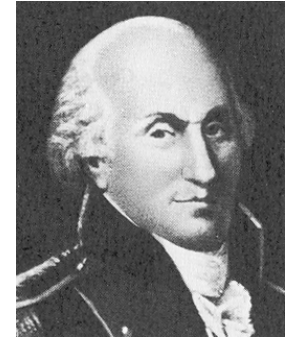


Induced charge



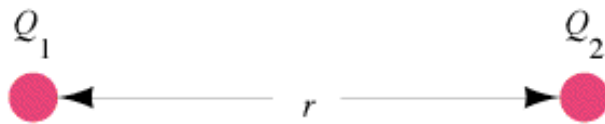
Charge transfer by contact

II. Coulomb's Law



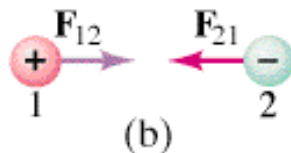
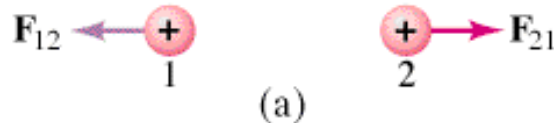
Charles Augustin de Coulomb
French Physicist 1736-1806

Forces between two point charges:



F_{12} = force on 1
due to 2

F_{21} = force on 2
due to 1



$$F = k \frac{Q_1 Q_2}{r^2}$$

$$k = 9.0 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2$$

Direction: attraction/repulsion

More than one forces: superposition principle

$$\mathbf{F}_{\text{net}} = \mathbf{F}_1 + \mathbf{F}_2 + \dots$$