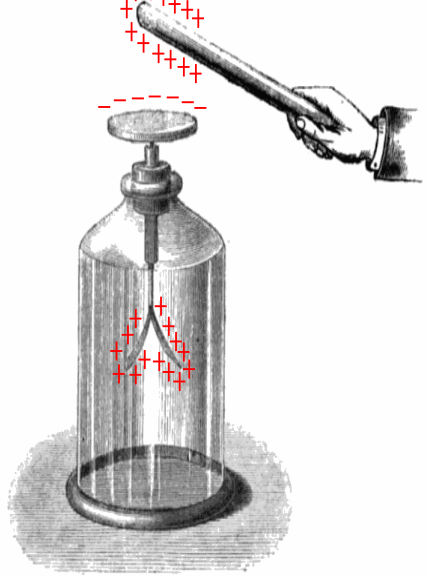
Chapter 19 Electrostatics

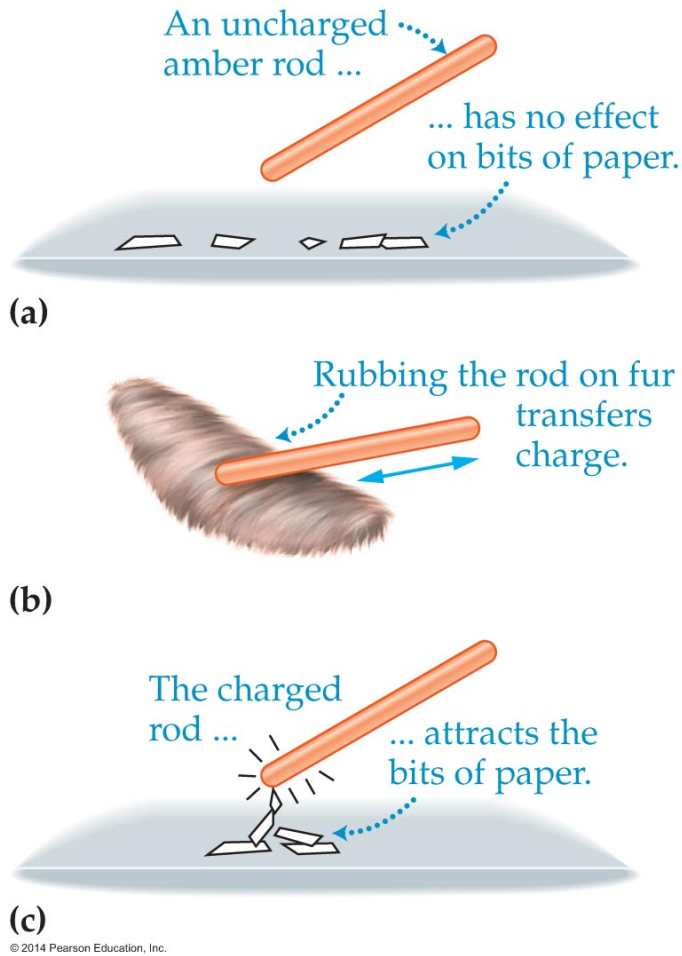


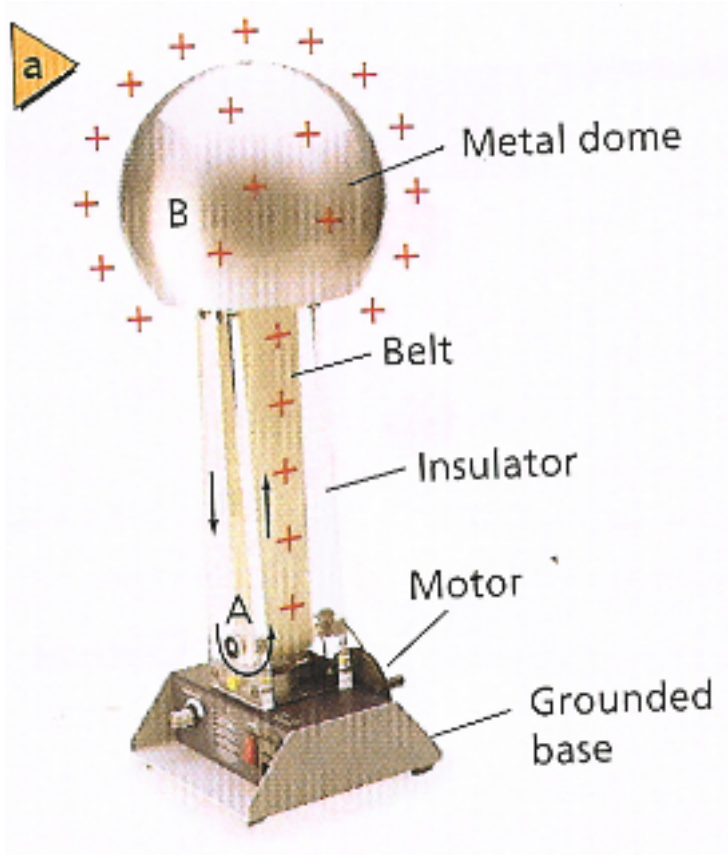
Read Pages 675-690.

Electroscope: A device which is used to detect charges.

Revised 7.23.2020 Some diagrams from Pearson Physics by Walker. Used with permission

Rubbing objects together can cause charges to move/ separate.





Van De Graaff Generator – develops a large charge
by friction.

A glass rod rubbed on silk develops a positive charge.

A rubber rod rubbed on fur develops a negative charge.

Some substances tend to lose electrons and others tend to gain electrons.

The following materials will give up electrons when brought in contact with materials. They are in the order of most apt to give electrons to those that barely give up electrons.

Dry human skin (++++++)
Leather
Rabbit fur
Glass
Human hair
Nylon
Wool
Lead
Silk
Aluminum
Paper
Cotton (+)
Neutral

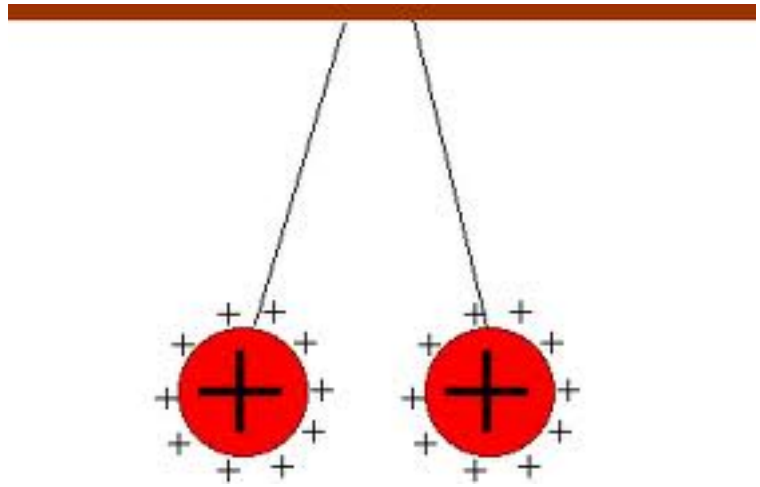
There are very few materials that do not tend to readily attract or give up electrons.

Steel (0)

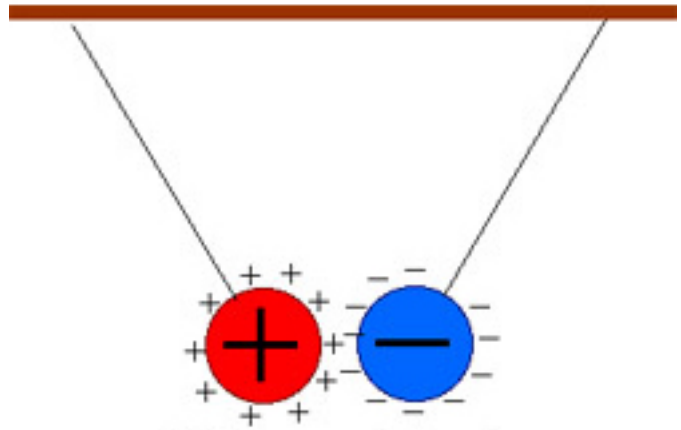
The following list of materials will attract electrons when brought in contact with other materials. They are in the order of least apt to attract electrons to those most apt to attract electrons.

Wood (-)
Amber
Hard rubber
Nickel, Copper
Brass, Silver
Gold, Platinum
Polyester
Styrene (Styrofoam)
Saran Wrap
Polyurethane
Polyethylene (like Scotch Tape)
Polypropylene
Vinyl (PVC)
Silicon
Teflon (- - - - - -)

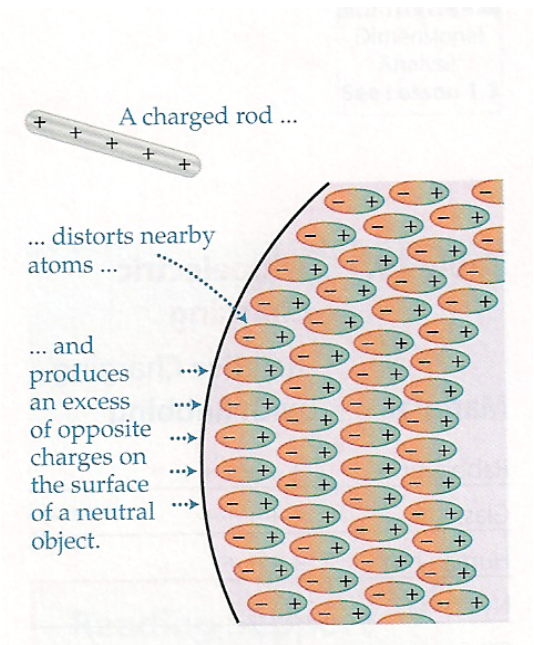
Like Charges repel.



Opposite charges attract



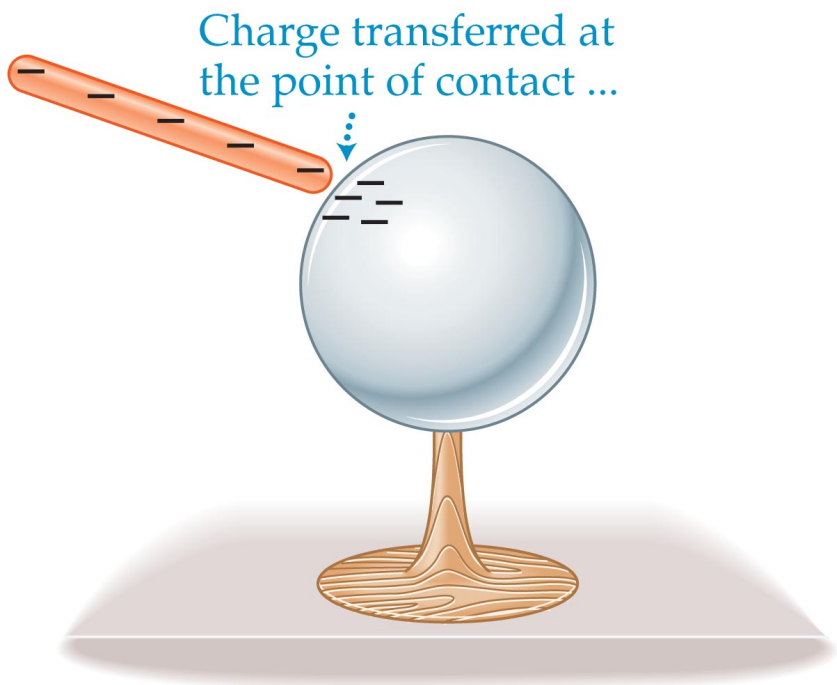
A neutral object MAY be attracted by a charged object due to polarization.



Lightning is simply an electrical [SEP] discharge.

Charging by Contact

The charged object receives a charge of sign similar to that on the charging object.

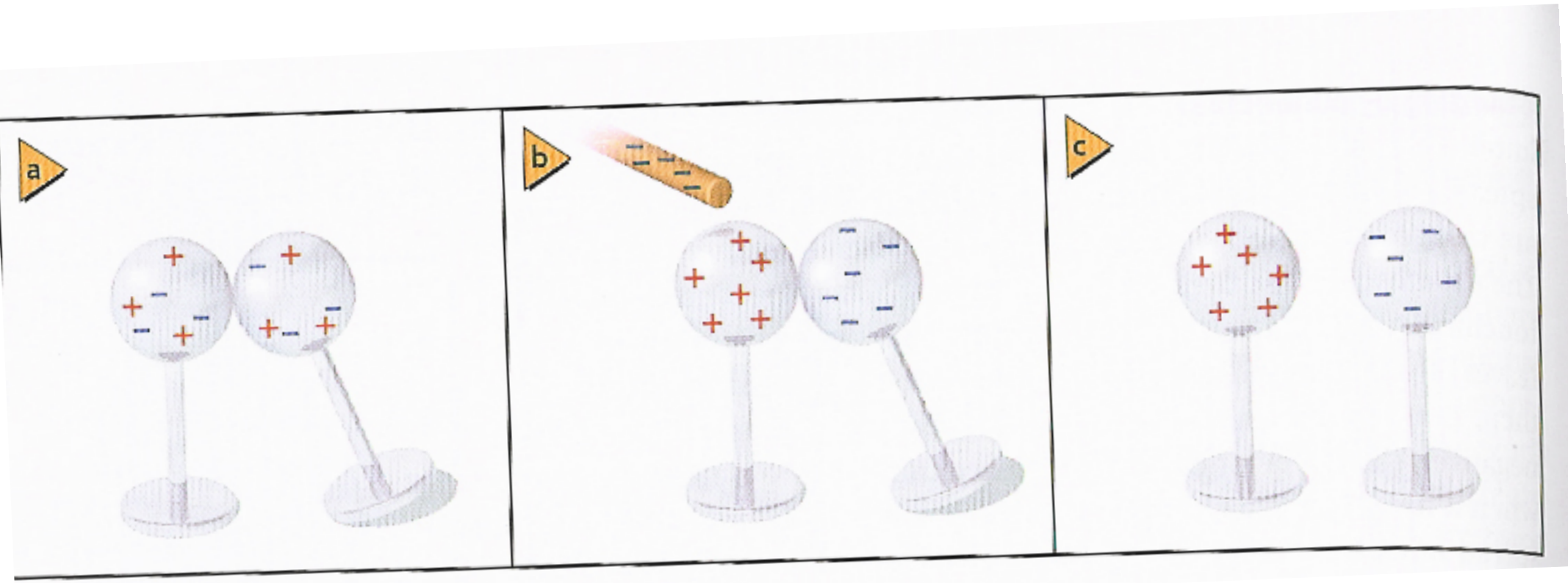


(a)

Charging by induction

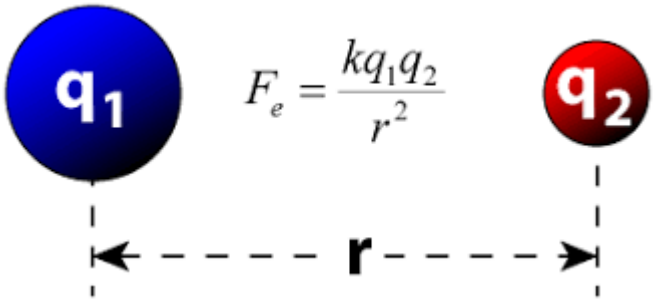
The charged object receives a charge of sign opposite that on the charging object.

Charge is conserved
--but it can be moved around



Coulomb's Law

Charles de Coulomb



$$F = (k\ q1\ q2\ )/r^2$$

F - force
k - Coulomb's law constant
q1 q2 - the charges
r - the distance between the charges

k = 9.0 x109 n m2/C2

Unit of charge: the coulomb = 6.24x10^18 e

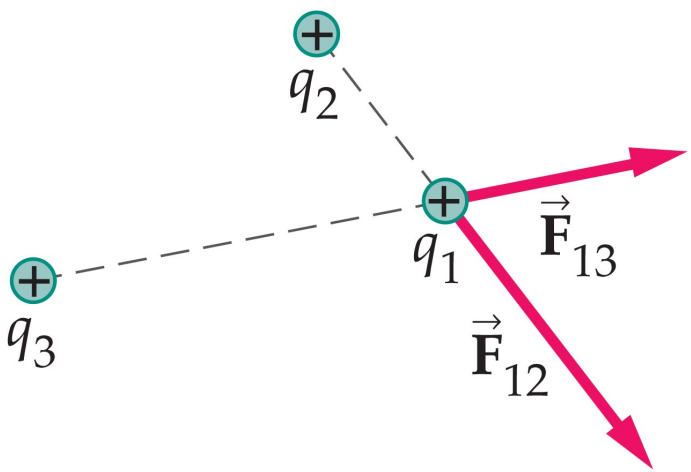
1 elementary charge = 1.6 x10^-19 coul

Problems:

1.What is the magnitude of the force between 2 electrons which are 1.50 cm apart?

2.What is the magnitude of the force between the proton and the electron in a hydrogen atom. Assume they are separated by 5.3x10^-11 m?

If there are multiple charges in an area, then the resultant (total) electrical force on any charge is equal to the vector sum of the individual forces. In other words: Coulomb forces add just like other forces...as vectors!



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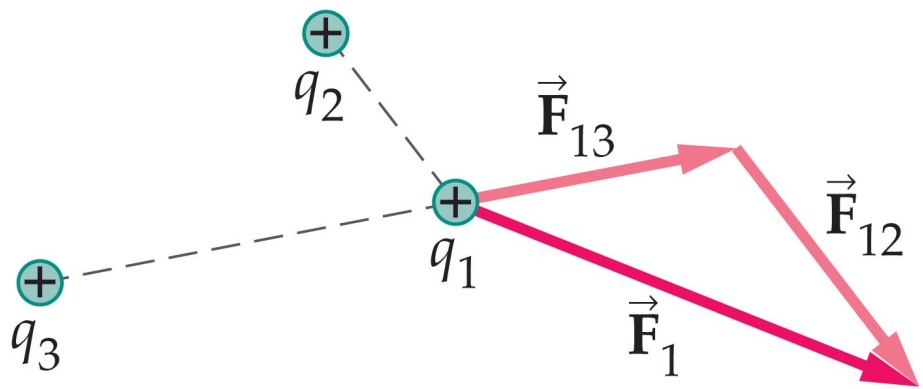

(b)