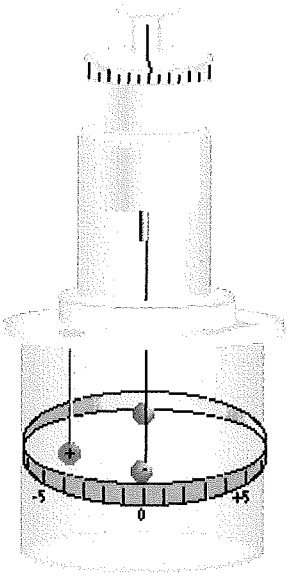
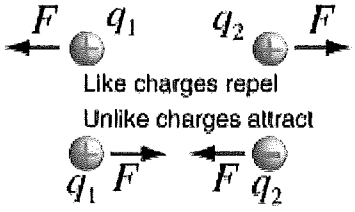
Physics 12
Section 16-5
Coulomb's Law

1. Charles Coulomb (1736-1806) studied forces due to electric charge. He used a torsion apparatus to study electric forces.



2. Coulomb used the above device to determine his equation, which is:



$$F = \frac{kq_1q_2}{r^2} = \frac{q_1q_2}{4\pi\varepsilon_0 r^2}$$ *Coulomb's Law*

$$k = \frac{1}{4\pi\varepsilon_0} \approx 9x10^9 N \cdot m^2/C^2 = \text{Coulomb's constant}$$

q_1 and q_2 are point charges and r is the distance between the two charges

ε_0 = permittivity of space, a characteristic of the space between the charges.

Example 16-1 page 483 Determine the magnitude of the electric force on the electron of a hydrogen atom exerted by the single proton that is its nucleus. The electron orbits the nucleus at a distance of 0.53×10^{-10}m.

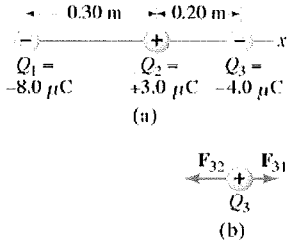
$$F = \frac{k\, q_1 q_2}{r^2}$$

$$F = \frac{(9.0 \times 10^9 Nm^2/C^2) \times (1.6 \times 10^{-19} C) \times (1.6 \times 10^{-19} C)}{(0.53 \times 10^{-10} m)^2}$$

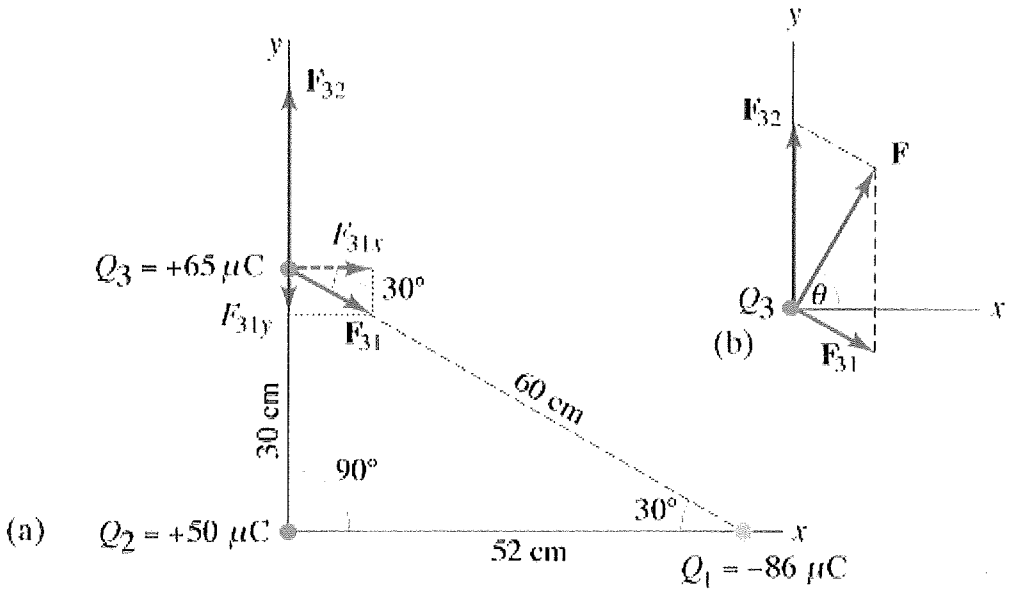
$$F = 8.2 \times 10^{-8} N$$

This is an attractive force since the charges are opposite.

Example 16-3 page 484: Three charged particles are in a line, as shown in fig 16-18a. Calculate the net electrostatic force on particle 3 due to the other two charges.



Example 16-4 page 485: Electric force using vector components. Calculate the net electrostatic force on charge Q_3 due to the charges Q_1 and Q_2.



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