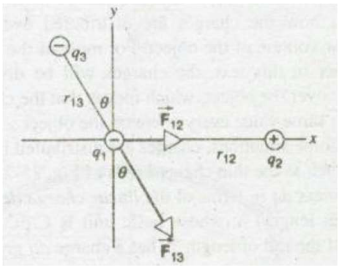
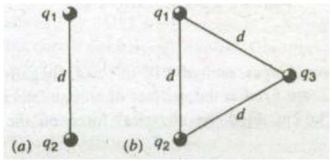
Numerical Problems

Topic Covered: Coulomb's Force

1. Suppose that positive and negative charges, each of magnitude $1.37\times10^5\ C$ could be concentrated into two separate bundles, held $100\ m$ apart. What attractive force would act on each bundle?
2. The average distance r between the electron and the proton in the hydrogen atom is $5.3\times10^{-11}\ m$. (a) What is the magnitude of the average electrostatic force that acts between these two particles? (b) What is the magnitude of the average gravitational force that acts between these particles?
3. The nucleus of an iron atom has a radius of about 4×10^{-15} m and contains 26 protons. What repulsive electrostatic force acts between two protons in such a nucleus if a distance of one radius separates them?
4. The figure shows three charged particles, held in place by forces not shown. What electrostatic force, due to the other two charges, acts on q_1? Take $q_1 = -1.2\ \mu C$, $q_2 = +3.7\ \mu C$, $q_3 = -2.3\ \mu C$, $r_{12} = 15\ cm$, $r_{13} = 10\ cm$, and $\theta = 32^o$.



5. What must be the distance between point charge $q_1 = 26.3\ \mu C$ and point charge $q_2 = -47.1\ \mu C$ for the attractive electrical force between them to have a magnitude of $5.66\ N$?
6. Following figure shows two charges, q_1 and q_2, held a fixed distance d apart. (a) Find the strength of the electric force that acts on q_1. Assume that $q_1 = q_2 = 21.3\ \mu C$ and $d = 1.52\ m$. (b) A third charge $q_3 = 21.3\ \mu C$ is brought in and placed as shown in figure. Find the strength of the electric force on q_1 now.



7. Each of two small spheres is charged positively, the total charge being $52.6\ \mu C$. Each sphere is repelled from the other with a force of $1.19\ N$ when the spheres are $1.94\ m$ apart. Calculate the charge on each sphere.
8. Two equally charged particles are held 3.2×10^{-3} m apart and then released from rest. The initial acceleration of the first particle is observed to be 7.0 m/s^2 and that of the second to be 9.0 m/s^2. If the mass of the first particle is 6.3 x 10^{-7} kg, what are (a) the mass of the second particle and (b) the magnitude of the charge of each particle? {Ans: (a) 4.9 x 10^{-7} kg (b) 7.1 x 10^{-11} C}
9. In the return stroke of a typical lightning bolt, a current of 2.5 x 10 4 A exists for 20 μs. How much charge is transferred in this event? {Ans: 0.50 C}