1. What must be the distance between point charge $q_1 = 52\ \mu C$ and point charge $q_2 = -48\ \mu C$ for the electrostatic force between them to have a magnitude of 7.70 N?

2. A particle of charge $+3.20\times10^{-6}$ C is 12.0 cm distance from a second particle of charge -1.6×10^{-6} C. Calculate the magnitude of the electrostatic force between the particles.

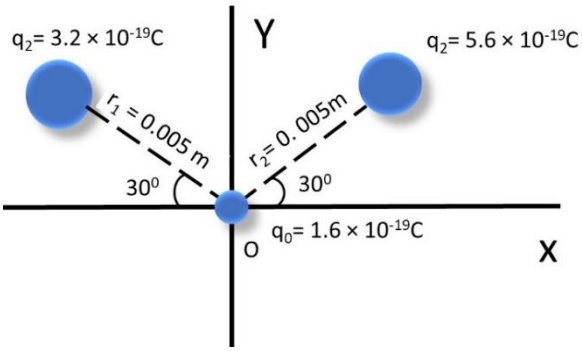
3. Two equally charged particles are held 5.20×10^{-3} m apart and then released from the rest. The initial acceleration of the first particle is observed to be 7.0 m/s^2 and that of the second to be 9.0 m/s^2. If the mass of the first particle is 5.9×10^{-7} kg (a) what are the mass of the second particle? (b) the magnitude of the charge of each particle?

4. Let us consider the two protons are separated at a distance 5 nm from each other. Compare the electrostatic force and gravitational force between them. The gravitational constant is $G = 6.6743 \times 10^{-11}\ m^3\ kg\text{-}1\ s^{-2}$ and the mass of each proton is $1.67262192 \times10^{-27}$ kg.

5. From the figure,

(a) Calculate the magnitude of net force on test charge q_0.

(b) Calculate the direction of net force on test charge q_0. Left side is charge $q_2 = 3.2X10^{-19}C$.



6. What is the magnitude of the electroststi force betewwn a singly charged sodium ion (Na^+, of charge +e) and an adjacent singly charged chlorine ion (Cl^-, of charge -e) in a salt crystal if their separation is 3.81×10^{-7} m.

7. Point charge of + 8.0 μC and - 5.0 μC are placed on an x axis, at x = 8.0 m and x= 14 m. What charge must be placed at x = 26.0 m so that any test charge at x = 0 experience no electrostatic force?

8. How far apart must two protons be if the magnitude of the electrostatic force acting on either one due to the other is equal to the magnitude of gravitational force on a proton at Earth's surface.

9. Two charged particles are attached to an x axis: Particle 1 of charge -2.00×10^{-8} C is at position x = 5.00 cm and particle 2 of charge -2.00×10^{-8} C is at the position x = 22.0 cm. Midway between the particles, what is the net electric field in unit-vector notation?

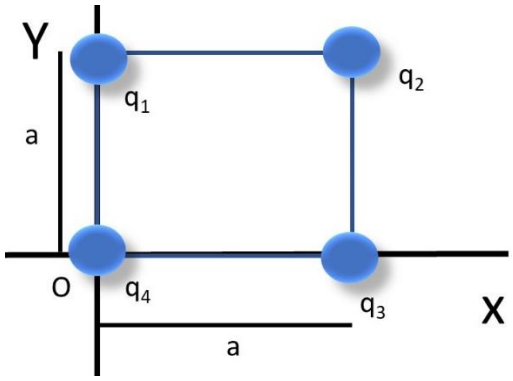
10. A charged particle produces an electric field with a magnitude of 5.0 N/C at a point that is 60 cm away from the particle. What is the magnitude of the particle's charge?

11. An electric dipole consists of charge + 2e and -2e separated by 0.75nm. It is in an electric field of strength 5.4×10^{-8} N/C. Calculate the magnitude of the torque on the dipole when the dipole moment is (a) parallel to (b) perpendicular to the electric field.

12. A surface has the area vector $\vec{A} = (2\hat{\imath} + 3\hat{\jmath})$ m^2. What us the flux of a uniform electric field through the area if the field is (a) $\vec{E} = 4\hat{\imath}\ N/C$ $(b)\vec{E} = 6\hat{k}$ N/C.

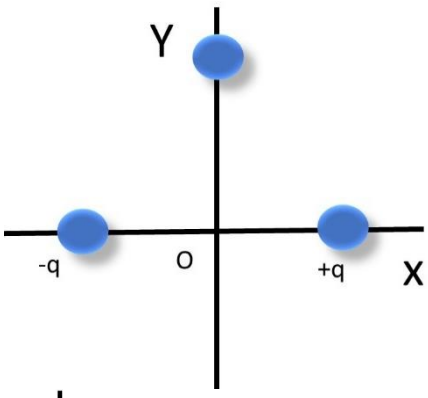
13. How much work is required to turn an electric dipole 180^0 in a uniform electric field of magnitude E = 56.0 N/C if the dipole moment has a magnitude of $p = 3.2\times10^{-24}$ C and the initial angle 65^0.

14. In the figure, the four particles form a square of edge length a=5.00 cm and have charges q_1 = +10.00 nC, q_2 = -20.0 nC, q_3 = +20.0 nC and q_4 = -10.0 nC. In unit vector notation, what net electric field do the particle produces at the square's center?



15. The electric potential difference between the ground and a cloud in a particular thunderstorm is 1.2×10^9 V. In the unit of electron-volts, what is the magnitude of the charge in the electric potential energy of an electron that moves between the ground and the cloud?

16. In figure, two charged particles on an x axis: $-q = -4.8 \times 10^{-19}$ C is at x = -3.00 m and $q = 4.80 \times 10^{-19}$ C is at x = 3.00 m. What are the (a) magnitude and (b) direction of the net electric field produced at point P in the Y axis at y = 4.00 m.



17. Two particles of charge q_1 and q_2 are separated by distance d in the figure. The net electric field due to the particles is zero at x = d/4. With V = 0 at infinity, locate any point on the x axis (other than infinity) at which the electric potential due to the two particles is zero.