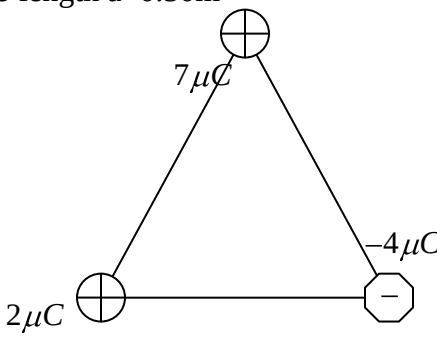
Properties of electric charges

1. (2) a)Calculate the number of electrons in a small silver pin of mass 10.0g. Silver has 47 electrons per atom, and its molar mass is 107.87 g/mol. b)Electrons are added to the pin until the net negative charge is 1.00mC. How many electrons are added for every billion electrons already present?

a) 2.62E24, b) 2.38

2. (3) Richard Feynman once said that if two persons stood at arm's length from each other and each person had 1% more electrons than protons, the force of repulsion between them would be enough to lift the entire earth. Does this make sense?
3. (5) Two protons in a molecule are separated by 3.80E-10m. Find the electric force exerted by one proton on the other b) How does the magnitude of this force compare to the magnitude of gravitational attraction between the two protons. a)1.59E-9N b)1.29E-45N
4. (7)Three point charges are located at the corners of an equilateral triangle with side-length a=0.50m



Calculate the resultant electrostatic force on the top charge. ($\vec{F} = 0.755N\vec{i}\text{-}0.436N\vec{j}$)

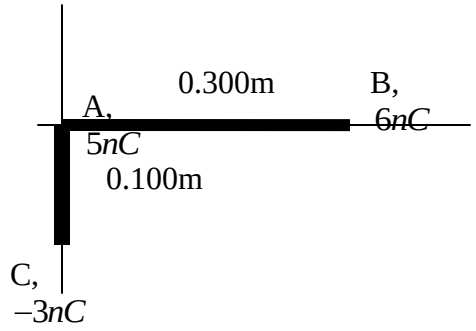
5. (9)Two identical small spheres are placed with their centers 0.300m apart. One is given a charge of 12nC, the other of -18.0 nC. a)Find the electric force exerted by one sphere on the other. b) The spheres are connected with a conducting wire. Find the electric force between them after they have reached electrostatic equilibrium. a) 2.16e-5N b)8.99E-7 N

6. (11) In the Bohr theory of the hydrogen atom, an electron moves in a circular orbit around the proton, where the radius of the electron is 0.529E-10m. a) Find the electric force between them. b) If this force causes the centripetal acceleration, what is the speed of the electron? a) 8.22E-8N; b) 2.19E6m/s

The Electric Field:

7. (12) A charge of -2.50E-6μC is separated from a charge 6.00E-6μC by a distance of 1.00m. Determine the point where the resultant electric field is 0. (At 2.82 m distance from the positive charge and 1.82 m distance from the negative charge on a line connecting the two charges.)

8. Three point charges are arranged as shown. a) Find the resultant field at point A. b) Find the vector force on the charge at A.



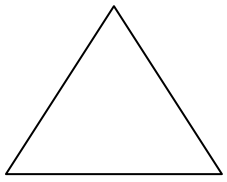
a) $\vec{E} = \langle -5.99, -27.0 \rangle 100 V/m$ b) $\vec{F} = -\langle 3.00, 13.5 \rangle \mu N$

Electric field of a continuous charge distribution

9. (21) A rod 14.0 cm long is uniformly charged and has a total charge of -22.0E-6C. Determine the magnitude and direction of the electric field along the axis of the rod at a point 36.0 cm from its center. (1.59E6 V/m, directed towards the rod)

10. (23) A uniformly charged ring of radius 10.0 cm has a total charge of 75.0E-6C. Find the electric field on the axis of the ring at a) 1.00cm, b) 5.00cm, c) 30.0cm, and d) 100cm from the center of the ring.
(6.64, 24.1, 6.4, 0.664 MV/m.)

11. (27) A uniformly charged insulating rod of length 14.0cm is bent into the shape of a semicircle. The rod has a total charge of -7.50E-6C. Find the magnitude and direction of the field at the center of the circle.
($\vec{E} = -2.16E7 \frac{N}{C} \vec{\imath}$)



12. (35) Three equal positive charges q are at the corners of an equilateral triangle of side a. Find the location of a point where the electric field is 0. What are the magnitude and direction of the resultant electric field at the top point of the triangle? $\vec{E} = 1.73 k_e \frac{q}{a^2} \vec{\jmath}$

13. (41) A proton moves at 4.50E5m/s in the horizontal direction. It enters a uniform vertical electric field with a magnitude of 9.60E3 N/C. Ignoring any gravitational

effects, find a) the time interval required for the proton to travel 5.00 cm horizontally, b) its vertical displacement during the previous time interval, c) the horizontal and vertical components of its velocity after that time. (111 ns, 5.68mm, $v_x = 4.50E5 m/s; v_y = 1.02E5 m/s$)