MIXED REVIEW

34. Calculate the net charge on a substance consisting of a combination of 7.0×10^{13} protons and 4.0×10^{13} electrons.

35. An electron moving through an electric field experiences an acceleration of 6.3×10^{3} m/s^2.

a. Find the electric force acting on the electron.

b. What is the strength of the electric field?

36. One gram of copper has 9.48×10^{21} atoms, and each copper atom has 29 electrons.

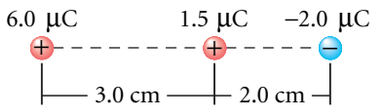
a. How many electrons are contained in 1.00 g of copper?

b. What is the total charge of these electrons?

37. Consider three charges arranged as shown below.

a. What is the electric field strength at a point 1.0 cm to the left of the middle charge?

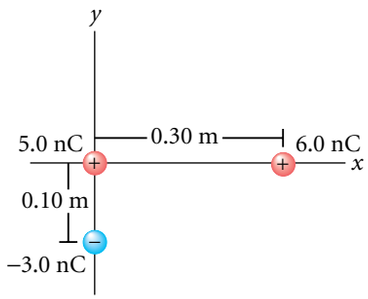
b. What is the magnitude of the force on a −2.0 μC charge placed at this point?



38. Consider three charges arranged in a triangle as shown below.

a. What is the net electric force acting on the charge at the origin?

b. What is the net electric field at the position of the charge at the origin?



39. Sketch the electric field pattern set up by a positively charged hollow conducting sphere. Include regions both inside and outside the sphere.

40. The moon ($m = 7.36 \times 10^{22}$ kg) is bound to Earth ($m = 5.98 \times 10^{24}$ kg) by gravity. If, instead, the force of attraction were the result of each having a charge of the same magnitude but opposite in sign, find the quantity of charge that would have to be placed on each to produce the required force.

41. Two small metallic spheres, each with a mass of 0.20 g, are suspended as pendulums by light strings from a common point. They are given the same electric charge, and the two come to equilibrium when each string is at an angle of 5.0° with the vertical. If the string is 30.0 cm long, what is the magnitude of the charge on each sphere?

42. What are the magnitude and the direction of the electric field that will balance the weight of an electron? What are the magnitude and direction of the electric field that will balance the weight of a proton?

43. An electron and a proton are each placed at rest in an external uniform electric field of magnitude 520 N/C. Calculate the speed of each particle after 48 ns.

44. A Van de Graaff generator is charged so that the magnitude of the electric field at its surface is 3.0×10^{4} N/C.

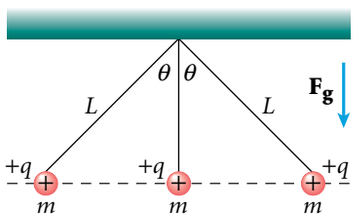
a. What is the magnitude of the electric force on a proton released at the surface of the generator?

b. Find the proton's acceleration at this instant.

45. Thunderstorms can have an electric field of up to 3.4×10^{5} N/C. What is the magnitude of the electric force on an electron in such a field?

46. An object with a net charge of 24 μC is placed in a uniform electric field of 610 N/C, directed vertically. What is the mass of this object if it floats in this electric field?

47. Three identical point charges, with mass $m = 0.10$ kg, hang from three strings, as shown below. If $L = 30.0$ cm and $\theta = 45°$, what is the value of q?



16 REVIEW

34. 4.8×10^{-6} C

35. **a.** 5.7×10^{-27} N, in a direction opposite **E**
b. 3.6×10^{-8} N/C

36. **a.** 2.75×10^{23} electrons
b. 4.40×10^{4} C

37. **a.** 2.0×10^{7} N/C, along the positive x-axis
b. 4.0×10^{1} N

38. **a.** 1.3×10^{-5} N, 77° below the negative x-axis
b. 2.6×10^{3} N/C, 77° below the negative x-axis

39. There are no lines inside the sphere. All lines outside the sphere are evenly spaced and are directed away from the sphere radially.

40. 5.72×10^{13} C

41. 7.2×10^{-9} C

42. 5.58×10^{-11} N/C, downward; 1.03×10^{-7} N/C, upward

43. $v_{electron} = 4.4 \times 10^{6}$ m/s; $v_{proton} = 2.4 \times 10^{3}$ m/s

44. **a.** 4.8×10^{-15} N
b. 2.9×10^{12} m/s^2

45. 5.4×10^{-14} N

46. 1.5×10^{-3} kg

47. 2.0×10^{-6} C