Section 23.1 Properties of Electric Charges

2- (a) Calculate the number of electrons in a small, electrically neutral silver pin that has a mass of 10.0 g. Silver has 47 electrons per atom, and its molar mass is 107.87 g/mol.

Section 23.3 Coulomb's Law

9. A 7.50-nC point charge is located 1.80 m from a 4.20-nC point charge.

(a) Find the magnitude of the electric force that one particle exerts on the other.

(b) Is the force attractive or repulsive?

12. Three point charges lie along a straight line as shown in Figure P23.12, where $q1$ = 6.00 mC, $q2$ = 1.50 mC, and $q3$ = 22.00 mC. The separation distances are $d1$ = 3.00 cm and $d2$ = 2.00 cm. Calculate the magnitude and direction of the net electric force on (a) $q1$, (b) $q2$, and (c) $q3$.

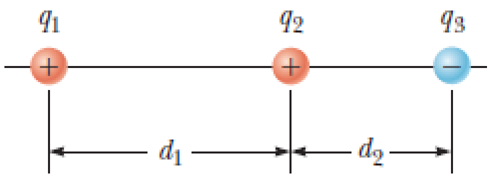

Figure P23.12

13. Two small beads having positive charges q1 = 3q and q2 = q are fixed at the opposite ends of a horizontal insulating rod of length d = 1.50 m. The bead with charge q1 is at the origin. As shown in Figure P23.13, a third small, charged bead is free to slide on the rod.

(a) At what position x is the third bead in equilibrium?

(b) Can the equilibrium be stable?

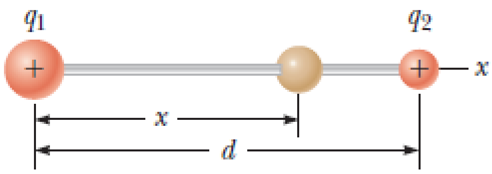

Figure P23.13 Problems 13 and 14.

15. Three charged particles are located at the corners of an equilateral triangle as shown in Figure P23.15. Calculate the total electric force on the 7.00-µC charge.

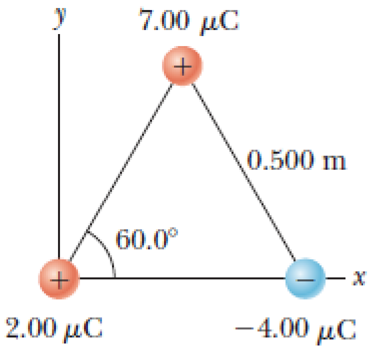

Figure P23.15 Problems 15 and 30.

Section 23.4 Analysis Model: Particle in a Field (Electric)

25. Four charged particles are at the corners of a square of side *a* as shown in Figure P23.25. Determine (a) the electric field at the location of charge *q* and (b) the total electric force exerted on *q*.

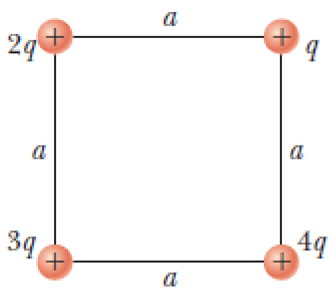

Figure P23.25

26. Three point charges lie along a circle of radius r at angles of 30^0, 150^0, and 270^0 as shown in Figure P23.26.
Find a symbolic expression for the resultant electric field at the center of the circle.

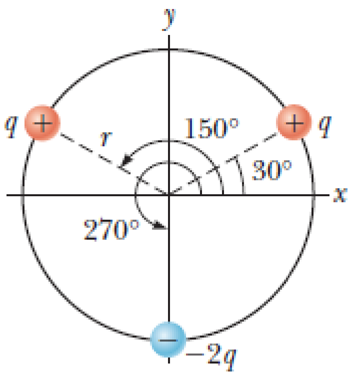

Figure P23.26

27. Twoequal positively charged particles are at opposite corners of a trapezoid as shown in Figure P23.27. Find symbolic expressions for the total electric field at (a) the point P and (b) the point P*.

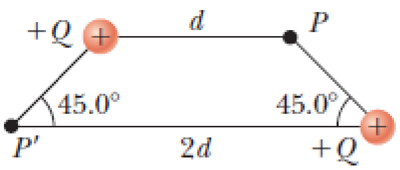

Figure P23.27

Section 23.6 Electric Field Lines

49. Figure P23.49 shows the electric field lines for two charged particles separated by a small distance.
(a) Determine the ratio q_1/q_2.
(b) What are the signs of q_1 and q_2?

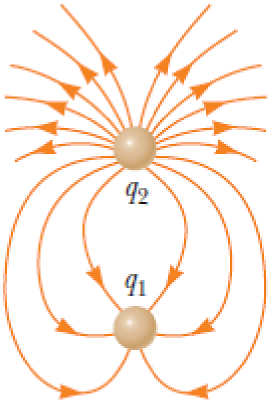

Figure P23.49

Section 25.1 Electric Potential and Potential Difference

1. Oppositely charged parallel plates are separated by 5.33 mm. A potential difference of 600 V exists
between the plates.
(a) What is the magnitude of the electric field between the plates?
(b) What is the magnitude of the force on an electron between the plates?
(c) How much work must be done on the electron to move it to the negative plate if it is initially positioned
2.90 mm from the positive plate?

Section 25.3 Electric Potential and Potential Energy Due to Point Charges

Note: Unless stated otherwise, assume the reference level of potential is V 5 0 at $r = \infty$

13. Two point charges are on the y axis. A 4.50-mC charge is located at y 5 1.25 cm, and a 22.24-µC charge is located at y 5 21.80 cm. Find the total electric potential at (a) the origin and (b) the point whose coordinates are (1.50 cm, 0).

14. The two charges in Figure P25.14 are separated by d =2.00 cm. Find the electric potential at (a) point A and
(b) point B, which is halfway between the charges.

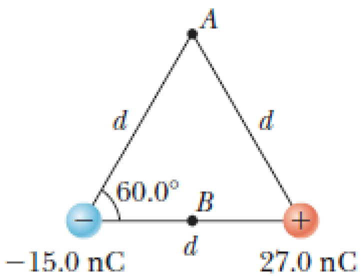

Figure P25.14

18. The two charges in Figure P25.18 are separated by a distance d 5 2.00 cm, and Q = 15.00 nC. Find (a) the electric potential at A, (b) the electric potential at B, and (c) the electric potential difference between B and A.

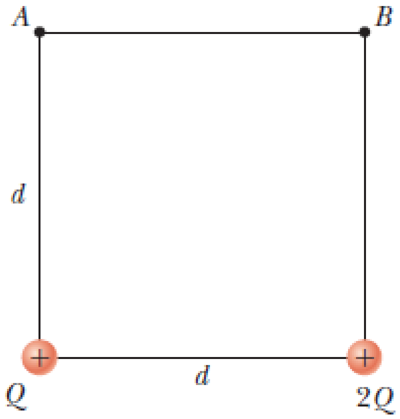

Figure P25.18

Section 25.4 Obtaining the Value of the Electric Field from the Electric Potential

36. Figure P25.36 represents a graph of the electric potential in a region of space versus position *x*, where the electric field is parallel to the *x* axis. Draw a graph of the *x* component of the electric field versus *x* in this region.

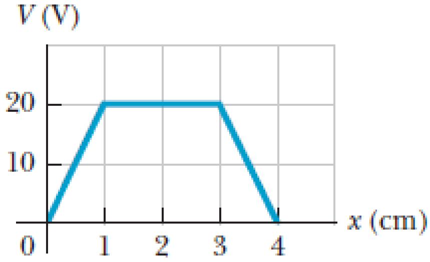

Figure P25.36

Section 26.1 Definition of Capacitance

1. (a) When a battery is connected to the plates of a 3.00- μF capacitor, it stores a charge of 27.0 μC. What is the voltage of the battery? (b) If the same capacitor is connected to another battery and 36.0 μC of charge is stored on the capacitor, what is the voltage of the battery?

Section 26.2 Calculating Capacitance

5. A 50.0-m length of coaxial cable has an inner conductor that has a diameter of 2.58 mm and carries a charge of 8.10 μC. The surrounding conductor has an inner diameter of 7.27 mm and a charge of 28.10 μC. Assume the region between the conductors is air.
(a) What is the capacitance of this cable? (b) What is the potential difference between the two conductors?

Section 26.3 Combinations of Capacitors

13. Two capacitors, $C_1 = 5.00\ \mu F$ and $C_2 = 12.0\ \mu F$, are connected in parallel, and the resulting combination
is connected to a 9.00-V battery. Find (a) the equivalent capacitance of the combination, (b) the potential difference across each capacitor, and (c) the charge stored on each capacitor.

14. What If? The two capacitors of Problem 13 ($C_1 = 5.00\ \mu F$ and $C_2 = 12.0\ \mu F$) are now connected in series and to a 9.00-V battery. Find (a) the equivalent capacitance of the combination, (b) the potential difference across each capacitor, and (c) the charge on each capacitor.

19. For the system of four capacitors shown in Figure P26.19, find (a) the equivalent capacitance of the system, (b) the charge on each capacitor, and (c) the potential difference across each capacitor.

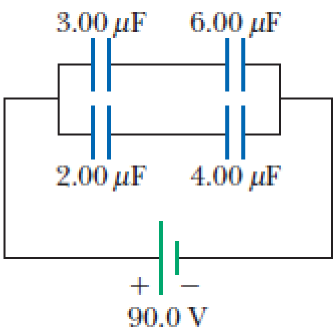

Figure P26.19

25. Find the equivalent capacitance between points *a* and *b* in the combination of capacitors shown in Figure P26.25.

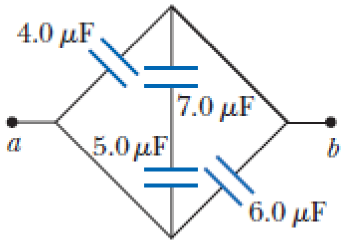

Figure P26.25

Section 26.4 Energy Stored in a Charged Capacitor