Chapter 21
Electric Charge

Q1. Suppose that isolated charges Q and q attract each other with a force F. If the separation between these charges were made half as great, each charge would then experience a force Ans:4 F.
Q2. Three charges are located as shown in Figure 1. If a = 3.0 m, Q_1 = 2.0 micro-C, and Q_2 = Q_3 = 8.0 micro-C, what is the magnitude of the electric force on charge Q_1? Ans:0.011 N

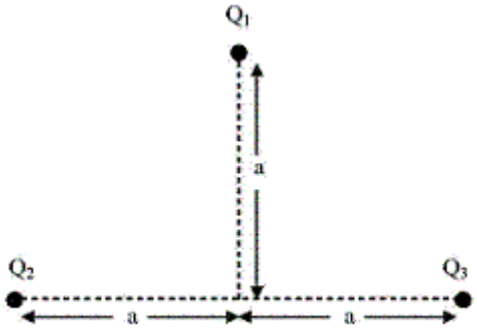
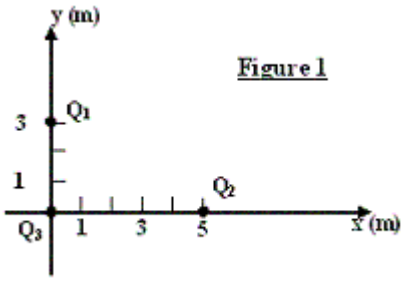


Figure 1

Q3. Three points charges are located on the x-y plane as follows: Q_1 = -10 micro-C at (4 m, 0), Q_2 = 20 micro-C at (0, 10 m), and Q_3 at (4 m, 10 m). If the net force on Q_1 points in the negative x-direction, find the charge Q_3.Ans:-16 micro-C
Q4. A charge +2q is placed at the origin and a charge -q is placed at x= 0.200 m on the x-axis. Where, on the x-axis, can a third charge +q be placed so that the force on it is zero? Ans:0.683 m
Q5. Consider three point charges, Q_1=Q_2= 2 micro-C and Q_3= 4 micro-C, located as shown in Figure 1. Find the magnitude of the resultant force on Q_3. Ans:8.5×10^{-3} N



Q6. A negative charge is placed at the center of a square. Each corner of the square has a fixed charge of 1.00×10^{-6} C. If the resulting force acting on each charge is zero, the magnitude of the negative charge is:Ans:0.96×10^{-6} C.
Q7. Two neutral metal spheres are separated by 0.3 km. How much electric charge must be transferred from one sphere to the other so that their electrical attraction is 10^3 N?Ans:0.1 C.
Q8. A charge of + 3.2×10^{-6} C is placed at the origin. A second charge (q_2) is placed at x = 3.0 m. If a charge of 1.0×10^{-6} C experiences no force if placed at x = 4.0 m, then q_2 is:Ans:- 0.2×10^{-6} C.
Q9.Two small charged objects repel each other with a force F when separated by a distance d. If the charge on each object is reduced to one-fourth of its original value and the distance between them is reduced to d/2 the force becomes:Ans:F/4.

Q10. Two fixed particles, of charges q_1 = + 1.0×10^{-6} C and q_2= - 9.0×10^{-6} C, are 10 cm apart. How far from each should a third charge be located so that no net electrostatic force acts on it?Ans:5 cm from q_1 and 15 cm from q_2.

Q11. A mass with a charge "Q" is suspended in equilibrium from a beam balance. A point charge q = + 10 micro-C is then fixed at a distance d = 5.0 cm below "Q" and an extra mass m = 4.0 g has to be placed on the pan to obtain equilibrium, see figure (3). Find the value of the charge "Q".Ans:- 1.1×10^{-9} C.

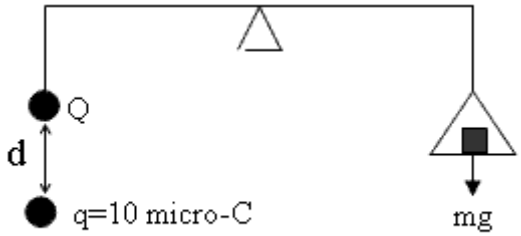


Figure 3

Q12. Two point charges q_1 and q_2 lie along the x-axis. q_1 = + 16.0 micro-Coulombs is at x = 2.00 m and q_2 = + 9.00 micro-Coulombs is at the origin. Where a negative charge q3 must be placed on the x-axis such that the net electrostatic force on it is zero? Ans:x = + 0.857 m

Q13. Consider two identical conductor spheres, A and B. Initially, sphere A has a charge of -80 Q and Sphere B has a charge of +20 Q. If the spheres touched and then are separated by a distance of 0.3 m, what is the resultant force between them? [Take Q = 5.7×10^{-8} C]Ans:0.3 N, repulsive.

Q14. In figure 3, Q = 60 micro-C, q = 20 micro-C, a = 3.0 m, and b = 4.0 m. Calculate the total electric force on q. [i and j are the unit vectors in the positive direction of x-axis and y-axis, respectively]. Ans:0.69 i (N).

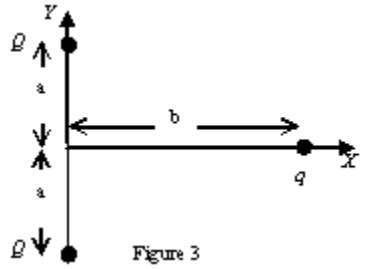


Figure 3

Q15. In figure (1), if Q = 30 micro-C, q = 5.0 micro-C and d = 0.3 m, find the net force on q. [i and j are the unit vectors in the positive direction of x-axis and y-axis, respectively]. Ans:zero.

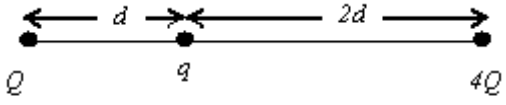


Figure 1

Q16. What is the electric force between two protons which are separated by 1.6×10^{-15} m. Ans:90 N, repulsive.

Q17. Two positive charges (+8.0 C and +2.0 C) are separated by 300 m. A third charge is placed a distance r from the +8.0 C charge so that the resultant electric force on the third charge due to the other two charges is zero. The distance r is Ans:200 m.