Electrostatics Problem Set

1. What will happen to the magnitude of the force between two charges Q1 and Q2 separated by a distance R if

a)  one of the charges is doubled

b)  both charges are doubled

c)  separation distance is doubled

d)  separation distance is tripled

e)  both charges are doubled and separation distance is doubled

f)  both charges are doubled and separation distance is halved

1. What force would be exerted on a 1.00 µC positive charge by a 1.00 µC negative charge one meter away from it?

1. What is the force of repulsion between two bodies carrying 6.0 µC of charge and separated by 1.0 x 10-6 m?

1. What is the force of attraction between a proton and an electron in a hydrogen atom, if they are 5.00 x 10-11 m apart?

1. How many coulombs of charge would there be in one kilogram of electrons? How much force would this charge exert on another kilogram of electrons 1.0 km away?
2. Two small spheres are located 0.50 m apart. Both have the same charge on them. If the repulsive force is 5.0 N, what charge is on the spheres, in microcoulombs?

1. Three charge objects are located at the corners of an equilateral triangle with sides 1.0 m long. Two of the objects carry a charge of 5.0 µC each. The third object carries a charge of –5.0 µC. What is the resultant force acting on the –5.0 µC object? Assume all three objects are very small.

1. What is the repulsive force between two alpha particles which are 1.0 x 10-6 m apart? (An alpha particle carries an excess of two elementary positive charges, since an alpha particle is the Helium nucleus)
2. How far apart are two protons if they repel each other with a force of 1.0 x 10-3 N?
3. If a charge of 1.0 x 10-3 C experiences a force of 1.0 N in an electric field what is the electric field strength?

1. A proton is placed in an electric field of strength 5.0 x 103 N/C. At what rate will it accelerate?
2. What is the electric field strength midway between a 75 µC charge and –25 µC charge, if the charges are 2.0 m apart? Give the direction as well as the magnitude of the electric field.
3. The electric field strength between two plates which are 3.0 cm apart is 3.0 x 103 N/C. What is the voltage between the plates?
4. Two point charges of +8.0 µC are separated by a distance of 1.0 m. If the force between the charges is F, what will the force be if 4.0 µC are removed from the one point charge and transferred to the other point charge?

Solutions for 12-25

12. 2F, 4F, ¼ F, 1/9 F, F, 16F 13. 9 x 10-3 N 14. 3.2 x 1011 N 15. 9.2 x 10-8 N

16. a)  1.8 x 1011 C          b) 2.8 x 1026 N 17. 12 µC 18. 0.39 N 19. 9.2 x 10-16 N 20. 4.8 x 10-13 m 21. 1 x 103 N/C 22. 4.8 x 1011 m/s2 23. 9.0 x 105 N/C towards – 25 µC 24. 90 V 25. 0.75 F