

Electric Charge Problems

1. Find the total positive charge of all the protons in 1.0 mol of water. [9.632×10^5 C]
2. Find the total positive charge of all the protons in 5 gm of water. [2.676×10^5]
3. What would be the net charge of 1.0 gram gold piece after removal of 1.0% of its electrons? [386.336 C]
4. A balloon, initially neutral, is rubbed with fur until it acquires a net charge of -0.60 nC. (a) Assuming that only electrons are transferred, were electrons removed from the balloon or added to it? (b) How many electrons were transferred? [3.7×10^9]
5. A metallic sphere has a charge of $+4.0$ nC. A negatively charged rod has a charge of -6.0 nC. When the rod touches the sphere, 8.2×10^9 electrons are transferred. What are the charges of the sphere and the rod now? [Sphere = 2.688 nC and Rod = -4.688 nC]

Electric Force Problems

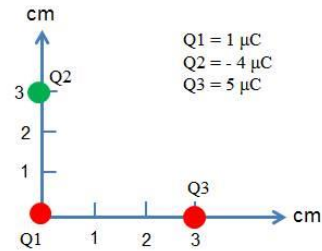
6. Two charges, 5 C and 15 C are separated by 10 cm. What is the force between them? [6.75×10^{13} N]
7. Two charges, 5 C and 15 C are separated by some distance. Force between them is 6.75×10^{13} N. What is the distance between them in cm? [10 cm]
8. Two charges, one is 5 C and another is unknown but force between them is 6.75×10^{13} N and they are separated by 10 cm. What is the other charge? [15 C]
9. If the electrical force of repulsion between two 1-C charges is 10 N, how far apart are they? [30000 m]
10. If the electrical force of repulsion between two same amount of charges is 10 N, and they are 30000 m apart. What is the magnitude of each charge? [1C]
11. Two +1 C charges are separated by 30000 m, what is the magnitude of the force? [10 N]
12. A total charge of 7.50×10^{-6} C is distributed on two different small metal spheres. When the spheres are 6.00 cm apart, they each feel a repulsive force of 20.0 N. How much charge is on each sphere? [1.067 micro coulomb and]
13. How many electrons must be removed from each of two 5.0-kg copper spheres to make the electronic force of repulsion between them equal in magnitude to the gravitational attraction between them? [2.675×10^9]

14. 14. What is the ratio of the electric force to the gravitational force between a proton and an electron separated by $5.3 \times 10^{-11} \text{ m}$ (the radius of a hydrogen atom)? [2.2911×10^{39}]

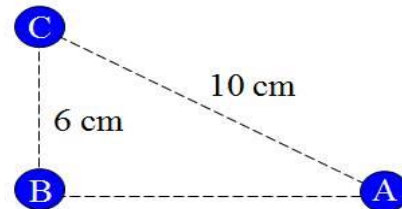
15. Three point charges are fixed in place in a right triangle. What is the electric force on the $5.0 \mu\text{C}$ charge due to the other two charges? [74N]

16. 16. Find the force on $1 \mu\text{C}$ charge? [64.0312 N]

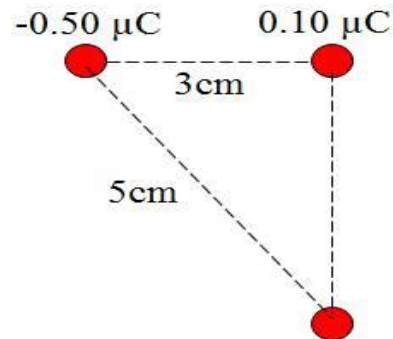
17. Find the force on $-4 \mu\text{C}$ charge?



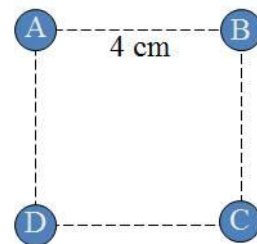
18. Three charges A($4 \mu\text{C}$), B($-6 \mu\text{C}$) and C($2 \mu\text{C}$) are placed at the vertices of a right angle triangle ABC. AC=10 cm, BC=6 cm. Find net force on charge B due to C and A charges.



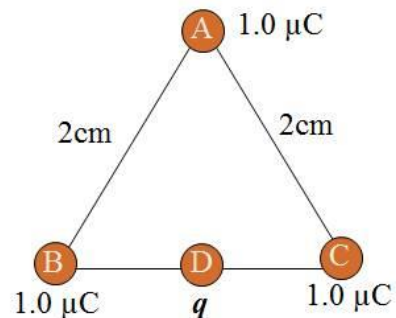
19. Three point charges are fixed at the corners of a right triangle. What is the electric force on the $+1.0\text{-}\mu\text{C}$ charge due to the other two charges?



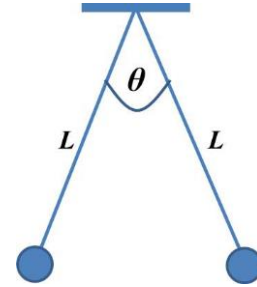
20. 3 charges, $1.0 \mu\text{C}$ each, are placed in 3 corners of a square A, B, C. Calculate the charge located at point D so that the net force on charge at B will be zero. [-2.83 micro Coulomb]



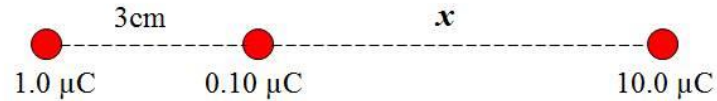
21. 3 charges, $1.0 \mu\text{C}$ each, are located on three vertices A, B, C of an equilateral triangle with sides 2 cm each. Another charge q is located at the mid point of the side BC. Calculate q so that net force on the charge at A due to the charges at B, C and D is zero.



22. Two pith balls with the same mass $m = 9.0 \times 10^{-8}$ kg and the same positive charge Q are suspended from the same point by insulating threads of length $L = 0.98$ m. What is the charge Q ? Assume the angle between the thread θ is 30 degree [2.6 nC]



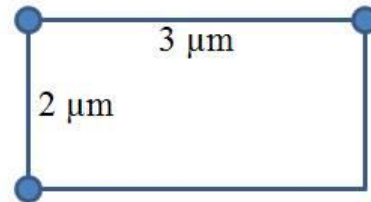
23. Three point charges are placed on the x-axis. A charge of $3.00 \mu\text{C}$ is at the origin. A charge of $-5.00 \mu\text{C}$ is at 20.0 cm, and a charge of $8.00 \mu\text{C}$ is at 35.0 cm. What is the force on the charge at the origin? [1.615 N in +x direction]
24. Three point charges $1.0 \mu\text{C}$, $0.10 \mu\text{C}$ and $10.0 \mu\text{C}$ are placed on a straight line and net force on $0.10 \mu\text{C}$ is **zero**. Find x in cm. [9.4868 cm]



Electric Field Problems

25. Two point charges, $q_1 = +20.0 \text{ nC}$ and $q_2 = +10.0 \text{ nC}$, are located on the x-axis at $x = 0$ and $x = 1.00 \text{ m}$, respectively. Where on the x-axis is the electric field will be zero? [0.585 m from +20 nC]
26. 23. Two point charges, $q_1 = -20.0 \text{ nC}$ and $q_2 = +10.0 \text{ nC}$, are located on the x-axis at $x = 0$ and $x = 1.00 \text{ m}$, respectively. Where on the x-axis is the electric field will be zero? [2.4143 m from +10 nC]
27. 24. Two point charges, $q_1 = +20.0 \text{ nC}$ and $q_2 = -10.0 \text{ nC}$, are located on the x-axis at $x = 0$ and $x = 1.00 \text{ m}$, respectively. Where on the x-axis is the electric field will be zero? [2.43 m from -10 nC charge]
28. Two equal charges, $+10.0 \text{ nC}$ each, are located on the x-axis at $x = 0$ and $x = 1.00 \text{ m}$, respectively. What is the magnitude of electric field at the point $x = 0.50 \text{ m}$? [0 N/C]

29. Positive point charges, $1 \text{ } \mu\text{C}$ each, are placed at three corners of a rectangle, as shown in the figure. (a) What is the electric field at the fourth corner? [3.06×10^{15}] (b) A small object with a charge of $+2.0 \text{ } \mu\text{C}$ is placed at the fourth corner. What force acts on the object? [$6.12 \times 10^9 \text{ N}$]



30. Two equal charges ($Q = +1.00 \text{ nC}$) are situated at the diagonal corners A and C of a square of side 1.0 m . What is the magnitude of the electric field at point D? [12.73 N/C]



31. 2 charges 5 nC and 10 nC are placed at A and B. Find a point C on AB such that electric field is zero at C. $AB = 2 \text{ m}$ [zero electric field is 0.829 m far from 5 nC charge OR zero electric field is $2 - 0.829 \text{ m}$ far from 10 nC charge]
32. 10 nC charge is located at point A ($0, 6 \text{ cm}$). Calculate the x component of the electric field at the point P ($6 \text{ cm}, 0$) [8829.01 N/C]
33. -10 nC charge is located at $(0, 0)$ point. Calculate the y component of electric field at point P ($4 \text{ cm}, 5 \text{ cm}$). [-17157.72 N/C]