Physics Academy

www.physicsacademy.org

General Physics II

Electrostatic: Principles & Applications

Lecture (5): Discussion on Coulomb's Law and electric field

Dr. Hazem Falah Sakeek

Al-Azhar University of Gaza

Multiple Choice Questions

1. The magnitude of the electric force between two protons is 2.30×10^{-26} N. How far apart are they? (a) 0.100m (b) 0.022m (c) 3.10m (d) 0.0057m (e) 0.48m

2. Estimate the magnitude of the electric field due to the proton in a hydrogen atom at a distance of 5.29×10^{-11} m, the expected position of the electron in the atom. (a) 10^{-11} N/C (b) 10^{8} N/C (c) 10^{14} N/C (d) 10^{6} N/C (e) 10^{12} N/C

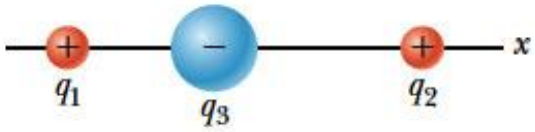
3. A very small ball has a mass of 5.00×10^{-3} kg and a charge of 4.00 μC. What magnitude electric field directed upward will balance the weight of the ball so that the ball is suspended motionless above the ground? (a) 8.21×10^{2} N/C (b) 1.22×10^{4} N/C (c) 2.00×10^{-2} N/C (d) 5.11×10^{6} N/C (e) 3.72×10^{3} N/C.

4. An electron with a speed of 3.00×10^{6} m/s moves into a uniform electric field of magnitude 1.00×10^{3} N/C. The field lines are parallel to the electron's velocity and pointing in the same direction as the velocity. How far does the electron travel before it is brought to rest? (a) 2.56 cm (b) 5.12 cm (c) 11.2 cm (d) 3.34 m (e) 4.24 m

5. A point charge of -4.00 nC is located at (0, 1.00) m. What is the *x* component of the electric field due to the point charge at (4.00, -2.00) m? (a) 1.15 N/C (b) -0.864 N/C (c) 1.44 N/C (d) -1.15 N/C (e) 0.864 N/C.

9. (i) A metallic coin is given a positive electric charge. Does its mass (a) increase measurably, (b) increase by an amount too small to measure directly, (c) remain unchanged, (d) decrease by an amount too small to measure directly, or (e) decrease measurably? **(ii)** Now the coin is given a negative electric charge. What happens to its mass? Choose from the same possibilities as in part (i).

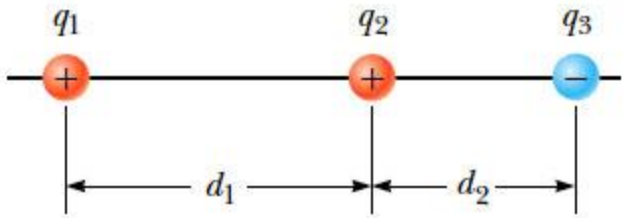
10. Assume the charge objects in the figure are fixed. Notice that there is no sight line from the location of q_2 to the location of q_1. If you were at q_1, you would be unable to see q_2 because it is behind q_3. How would you calculate the electric force exerted on the object with charge q_1? (a) Find only the force exerted by q_2 on charge q_1. (b) Find only the force exerted by q_3 on charge q_1. (c) Add the force that q_2 would exert by itself on charge q_1 to the force that q_3 would exert by itself on charge $q1$. (d) Add the force that q_3 would exert by itself to a certain fraction of the force that q_2 would exert by itself. (e) There is no definite way to find the force on charge q_1.



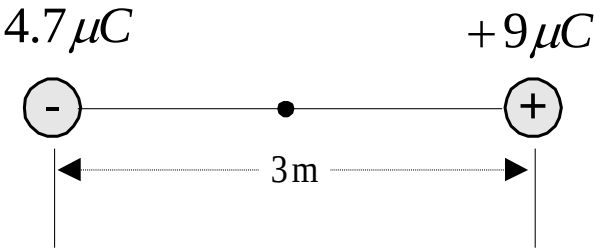
14. An object with negative charge is placed in a region of space where the electric field is directed vertically upward. What is the direction of the electric force exerted on this charge? (a) It is up. (b) It is down. (c) There is no force. (d) The force can be in any direction.

Problems To Solve By Yourself

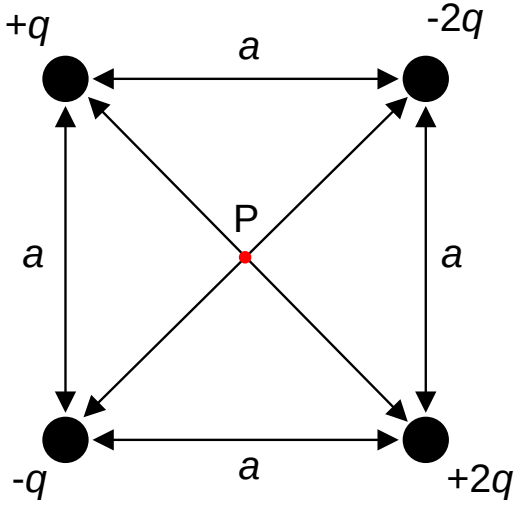
(1) Three point charges lie along a straight line as shown in the figure, where q_1 = 6.00 μC, q_2 = 1.50 μC, and q_3 = -2.00 μC. The separation distances are d_1 = 3.00 cm and d_2 = 2.00 cm. Calculate the magnitude and direction of the net electric force on (a) q_1, (b) q_2, and (c) q_3.



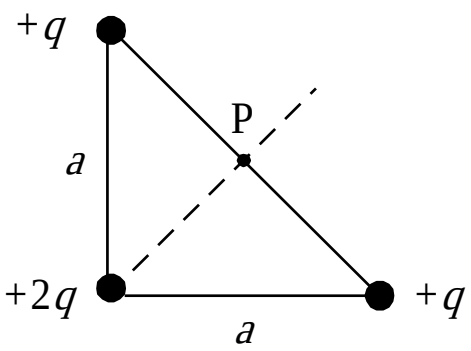
(2) Find the total electric field along the line of the two charges shown in the figure at the point midway between them.



(3) What is *E* in magnitude and direction at the center of the square shown in the figure? Assume that *q*=1μC and *a*=5cm.



(4) Calculate E (direction and magnitude) at point P in the figure.



(5) A uniform electric field exists in a region between two oppositely charged plates. An electron is released from rest at the surface of the negatively charged plate and strikes the surface of the opposite plate, 2.0cm away, in a time 1.5×10^{-8}s. (a) What is the speed of the electron as it strikes the second plate? (b) What is the magnitude of the electric field E?