Physics II

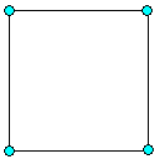
Electric Field and Force

$F = k\frac{q_1 q_2}{d^2}$ Coulomb's law, where $k = 9\times10^9\ Nm^2/C^2$

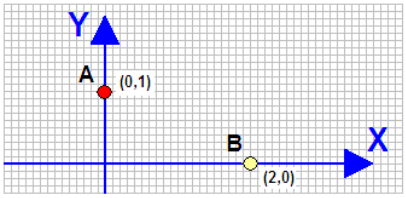
$E = \frac{F_{test}}{q_{test}}$ Definition of electric field. This is a vector.

$E = k\frac{Q}{d^2}$ Electric field for a point charge. This is a vector.

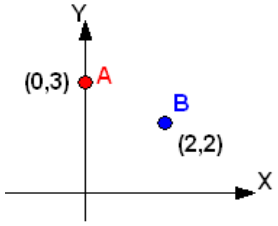
Problem 1.- A charge of q = 6μC is placed at each corner of a square 0.35m on a side. Determine the magnitude of the force on each charge.



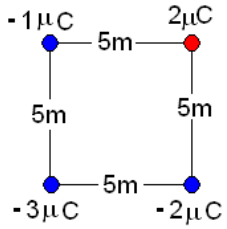
Problem 2.- Determine the electric field magnitude at the origin due to the charges located at A and B. Consider the coordinates given in meters and charge $q_A = -2\mu C$ and $q_B = -1\mu C$.



Problem 3.- Determine the electric ***field*** at the origin of coordinates due to the charges located at A and B. Consider the coordinates given in meters and charges $Q_A = 4\mu C$ and $Q_B = -5\mu C$.
In your answer write the vector as components and find its magnitude.

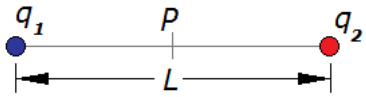


Problem 4.- Calculate the net force on the positive charge on the right upper corner of the square shown in the figure. Give your answer in magnitude of the vector.

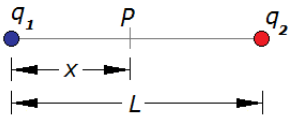


Problem 5.- Calculate the electric field at point "P" in the figure:

Problem 6.- Determine the magnitude and direction of the electric field at a point *P* midway between charges q_1=-16μC and q_2=+11.2μC that are a distance *L*=10cm apart.



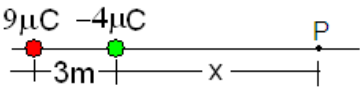
Problem 7.- Determine the position of a point *P* between a charge q_1=-4μC and another q_2=+1μC that are at a distance *L*=1m apart where the electric field has the minimum value.



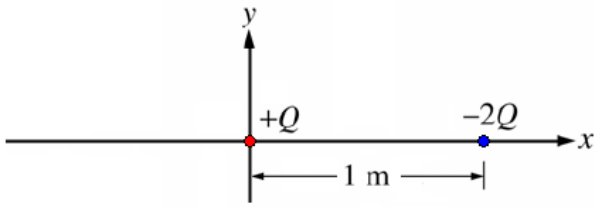
Problem 8.- Calculate the electric force between an alpha particle and an aluminum nucleus separated by 0.529×10^{-10} m
Charge of an alpha particle 3.2×10^{-19} C
Charge of an aluminum nucleus 20.8×10^{-19} C

Problem 9.- Find the acceleration experienced by an electron in an electric field of 250 V/m
Charge of the electron $q_e = -1.6\times10^{-19}$ C and mass $m_e = 9.1\times10^{-31}$kg

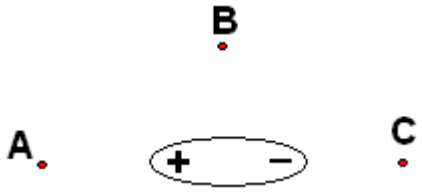
Problem 10.- Given the two charges shown in the figure, at what position "x" is the electric field zero?



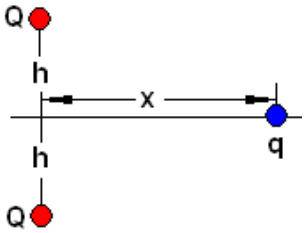
Problem 10a.- A charge of +Q coulombs is placed at the origin and a charge of -2Q coulombs is placed at x=+1 meter as shown in the figure. At what point on the x-axis will a test charge of +q coulombs experience zero net force?



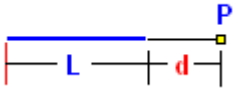
Problem 11.- Draw arrows to indicate the direction of the electric field at points **A**, **B** and **C** due to the dipole shown in the figure.



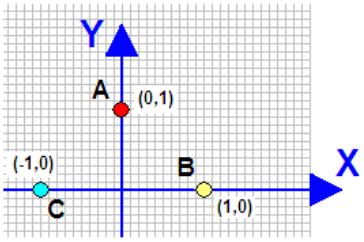
Problem 12.- In the following arrangement find an expression for the net force on the charge "q" due to the other two charges "Q" and find the value of "x" that makes the force maximum.



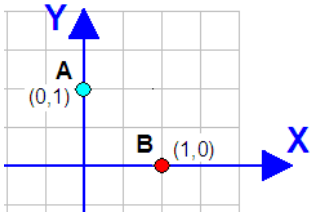
Problem 13.- We want to find the electric field at point "P" due to a wire with constant linear density of charge λ=5μC/m and length L=1m located a distance d=0.5m from point P as shown in the figure.



Problem 14.- Determine the electric field (magnitude and direction) at the origin due to the charges located at A, B and C. Consider the coordinates given in meters and charge of q_A=-2μC, q_B=-1μC and q_C=1μC.

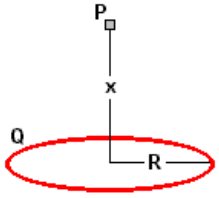


Problem 15.- Determine the magnitude of the electric field at the origin due to the two charges "A" and "B". Consider the positions given in meters and charge of A=30μC and B=-30μC.

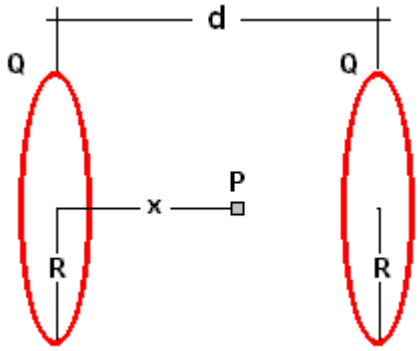


Problem 16.- An 18μC charge is placed 1.2 m from an identical 18μC charge. Calculate the electric field and the electric potential at the point midway between them

Problem 17.- The ring shown in the figure has a uniform charge Q and radius R. Determine the electric ***field*** at point P, which is located on the axis of the ring a distance "x" from its center. In the same charge distribution, find the electric ***potential*** at point P.



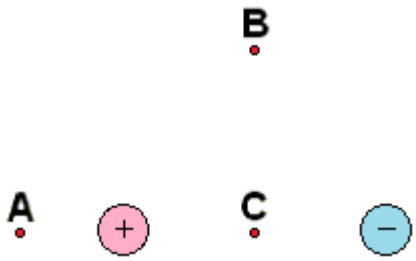
Problem 17a.- Each of the rings shown in the figure has uniform charge Q and radius R. Determine the electric ***field*** at point P, which is located on the axis of the rings a distance "x" from the center of the left ring.



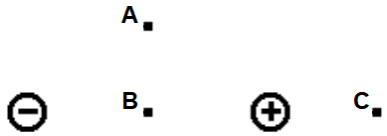
Problem 18.- Find the net force on a charge Q=8.5μC located at the origin of coordinates (0,0) due to a charge q_1=1.5μC located at (1.0m, 1.0m) and another charge q_2=-2.0μC located at (-2.0m, 2.0m).

Problem 19.-Find the magnitude of the net force on a charge Q=1.5μC located at position (0, 1.0 m) due to a charge q_a = 2.5μC located at the origin (0,0) and another charge q_b = -5μC located at (1.0m,1.0m).

Problem 20.- Indicate the direction of the electric field at points A, B and C due to the two charges shown in the figure as "+" and "-". Consider the charges identical in magnitude, but one positive and the other negative, as shown.



Problem 20a.- Indicate the direction of the electric field at points A, B and C due to the two charges shown in the figure. Consider the charges identical in magnitude, but positive and negative as indicated.



Problem 21.- A sphere of 1.0 m radius is uniformly charged over its entire volume with total charge Q = 1.5×10^{-6}C. Find the electric field inside the sphere at a distance of 0.5m from its center.

Problem 22.- If a positively charged particle enters a region of uniform electric field which is perpendicular to the particle's initial velocity, will the kinetic energy of the particle increase, decrease or stay the same? Why?

Problem 23.- Determine the electric ***field*** at the origin of coordinates due to the charges located at A, B and C. Consider the coordinates given in meters and charges Q_A=4μC, Q_B=4μC and Q_B=5μC.
In your answer, write the vector as components.