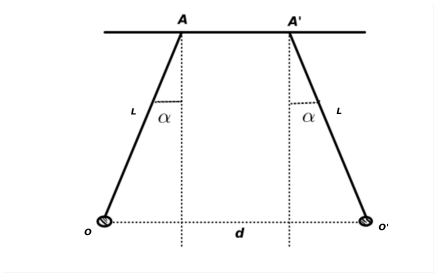
Electro-Magneto Static

Tutorials

Tutorial 1 : Electrostatics 1

Exercise 1.

Consider two electric pendulums, formed of two balls of masses m, suspended by wires of silk of lengths L, at points A and A'. The two balls carry an identical charge q , which it will be considered as punctual. The two pendulums deviate by the same angle α, as shown in the following figure:

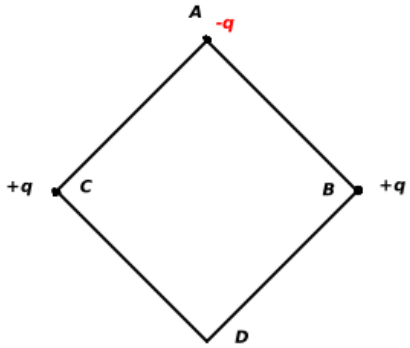


1. Why do these masses deviate by the same angle α? Explain.
2. Determine the value of the charge q.
3. If the charge q is negative, represent the electric field vector created by this system at a point M located in the middle of the line segment AA' and calculate its intensity.

We give : L =10 cm ; m =1 g ; OO' =d = 7 cm ; $b = AA'$ = 5 cm.

Exercise 2.

Point charge is placed at each corner, A, B and C of a square with side length a, as indicated in the figure below (absence of charge at D).



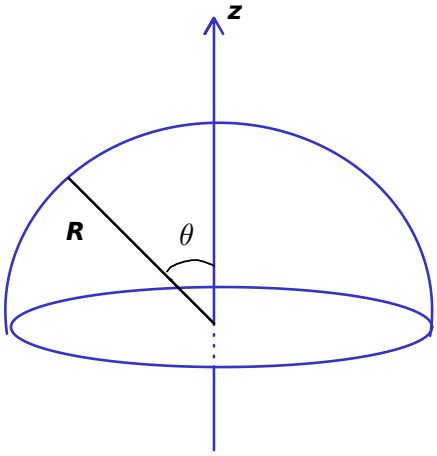
1. Graph and calculate the electric field produced by the three charges at the corner D.
2. Calculate the potential product in D.
3. We now add a charge $Q = +2q$ at the point D, find the electric force exerted by the other charges on this charge.
4. Calculate the potential energy of the charge $Q = +2q$.

Exercise 3.

Charge Q is uniformly distributed around a hemisphere with center O and radius R.

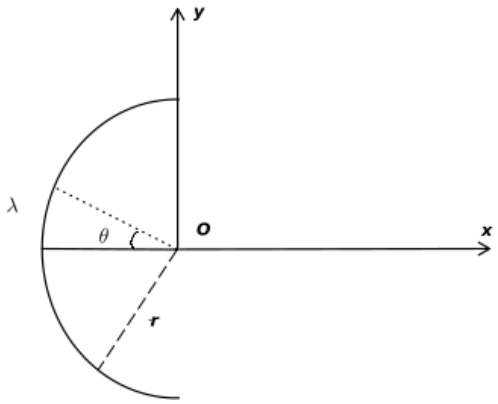
a. Find the magnitude and direction of the resulting electrostatic field at the center O, when the surface charge density is negative ($\sigma < 0$).

b. Find the magnitude and direction of the resulting electrostatic field at the center O of a uniformly charged hemisphere with a positive volume charge density $\rho > 0$.



Exercise 4.

A circular ring, of radius r, is placed in the xOy plane. A portion of the ring is uniformly charged, from $\theta = \pi/2$ to $\theta = -\pi/2$, with a linear charge density.



1. Give the expression for the electrostatic field at the center O if the portion of the ring is uniformly charged with a linear charge density $\lambda > 0$ from $\theta = \pi/2$ to $\theta = -\pi/2$. Draw a diagram.
2. Give the expression for the electrostatic field at the center O if the portion of the ring is uniformly charged with a positive linear charge density λ^+ from $\theta = \pi/2$ to $\theta = 0$ and a negative linear charge density λ^- from $\theta = 0$ to $\theta = -\pi/2$, such that $|\lambda^+| = |\lambda^-|$. Draw a diagram.

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