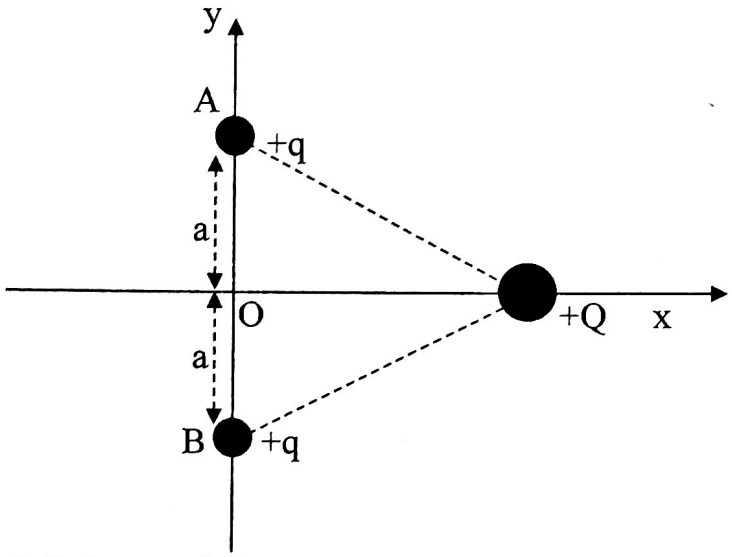
Info-Spe-API
2017/2018

Exercise sheet n°1
Electrostatics

Exercise 1

Let's consider two pointlike charges both with charge q = 2μ C. These are located at points A and B along y-axis separated from point O by distance a = 3 cm.
A charge +Q = 4μ C is at point M on x-axis such that OM = x.

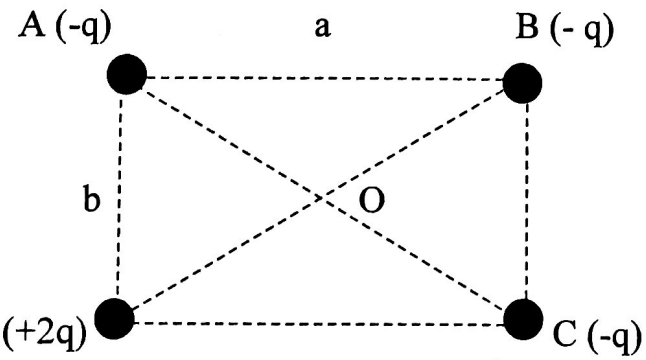


1- Sketch the net force $\vec{F}_e$ of all electrostatic forces acting on Q.

2- Determine as function of x the intensity of $\vec{F}_e$.

Exercise 2

Four pointlike charges (with q > 0) are located at points A, B, C and D. These points are corners of a rectangle of length a, width b and center O such that angle (ABO) = 30°.



1- Express the norms of the electric vector fields $\vec{E}_A(B)$, $\vec{E}_D(B)$ and $\vec{E}_C(B)$ which are generated at B respectively by charges q_A, q_D et q_C. Write their expression in terms of k, q and a. Draw them by respecting the scale.

2- Write the norm of the total electrostatic field $\vec{E}(B)$ which is created at B as function of k, q and a. Sketch $\vec{E}(B)$.

3- Write the norm of the total electrostatic field $\vec{E}(O)$ which is created at O as function of k, q and a. Sketch $\vec{E}(O)$.

4- Compute the electrostatic potential V(O) created at O in terms of k, q and a.

Exercise 3: Millikan's experience

Between two horizontal metallic plaques, which are separated by d = 1.5 cm, of a capacitor one generates a potential difference $\Delta V = 3$ kV. It can be noticed that some negatively charged oil droplets are in equilibrium between the plaques.

Given data: $\Delta V = E.d$, such that E is the capacitor electric field.

1- What are the plaque polarities?

2- What is the charge of one oil droplet? Compare this value with the electron charge.

Given data:

- volumic mass of oil: $\rho = 900$ kg/m^3
- droplet diameter: D = 4 µm
- intensity of Earth's gravitational field: g = 10 m/s^2