Badji- Mokhtar University -ANNABA

Faculty of Technology
Computer science department &ElectronicsDepartment
1st year Computer sciences& automatics (2023-2024)
Online courses

Courswork Exercise of Physics 2

Coulomb's law, Electrostatic field and potential

Exercise 1:

Calculate the electrostatic force exerted between an electron and a proton separated by a distance a in the hydrogen atom.

1. Compare this force with the force of universal mass attraction.

Given: $e = 1.6\times10^{-19}\ C$; $m_e = 9.1\times10^{-31}\ kg$; $m_p = 1.672\times10^{-27}\ kg$; $g = 9.81\ m.s^{-2}$; $G = 6.67\times10^{-11}\ N.m^2.kg^{-2}$; $a = 0.53\times10^{-10}\ m$; $K = 9\times10^{9}\ N.m^2.C^{-2}$.

Exercise 2 :(homework)

Two identical conductive spheres carry charges $\mathbf{q_1}$ and $\mathbf{q_2}$ respectively. They are put in **contact** and then **separated**. Determine the charges $\mathbf{q_1'}$ and $\mathbf{q_2'}$ they take, the direction of the electron transfer, and the number of charges transferred in the following cases:

1- $q_1 = 5.10^{-8}$ C , $q_2 = 0$C
2- $q_1 = 4.10^{-8}$C , $q_2 = 9.10^{-8}$C
3- $q_1 = 2.10^{-8}$C , $q_2 = -7.10^{-8}$

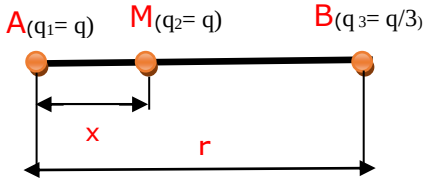
Exercise 3:

We consider a system of point charges, shown in the figure opposite. Positive charges q_1 and q_2 are fixed at points A and B respectively, by r = 3 cm.

Let us consider a charge $q_3 > 0$, constrained to move along the segment AB.

1) Calculate the force F exerted by q_1 and q_2 on q_3 as a function of x.
2) Calculate the abscissa x_0 for which the Charge q_3 is in equilibrium.

Given: $q_1 = q_3 = q$; and $q_2 = q/2$



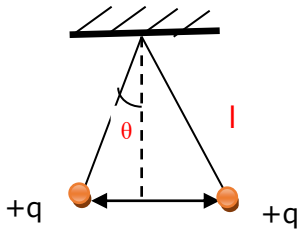
Exercise 4: (homework)

Two identical conducting balls **A** and **B** (of negligible dimensions) separated by **d = 50 cm**, carry the charges **q** and $\frac{q}{4}$ respectively. On the line which joins A and B, a third ball C (supposed to be point) is allowed to move without friction. Ball C being initially neutral. We then encountered it in **contact** with ball **A** then we left it to its own devices, without initial speed.

-Determine the equilibrium position of ball **C**. Is this position stable?

Exercise 5:

Two identical balls of mass m and positive charge q are suspended at the same point by a wire of length l and form two simple pendulums. After repulsion, each ball separates by an angle θ.



- Find the distance r between them.

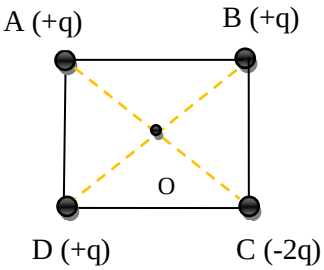
Given: tg θ ≈ sinθ, m = 10 g, l = 120 cm, q = $2.4.10^{-8}$ C, K = 9.10^{9} Nm^2C^{-2} and g = 10 m/s^2.

Exercise 6:

Four point charges q, q, -2q and q are placed respectively at the vertices of a square ABCD with side a.

1) Calculate the modulus of the field at point O, intersection of the diagonals.

2) Calculate the electric potential created by the four charges at point O. Given: q = 1 μC and a = 1cm



Exercise 7: (homework)

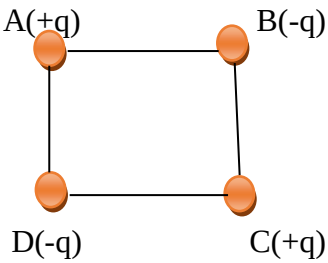
Four point charges $\mathbf{q_A}$, $\mathbf{q_B}$, $\mathbf{q_C}$ and $\mathbf{q_D}$ are placed respectively at the vertices of a square ABCD with side a, as shown (Figure), such as: $\mathbf{q_A = q_B = q_C = q_D = q>0;}$

We Give**:** $\mathbf{q=10^{-9}}$ C, a=10 cm, k = 9.10^{9} USI.

1/ Determine and draw to scale: **1cm → 450 N/C**, the electric field vector $\vec{E}_D$ creates by the three electric charges $\mathbf{q_A}$, $\mathbf{q_B}$ and $\mathbf{q_C}$ at point **D**

2/ Deduce and draw to scale: **1cm → 5.10^{-7} N,** the force vector $\vec{\mathbf{F}}_\mathbf{D}$ exerted on $\mathbf{q_D}$.

3/ Determine the $\mathbf{V_D}$ potential created by the three electrical charges $\mathbf{q_A}$, $\mathbf{q_B}$ and $\mathbf{q_C}$ at point **D**.



Exercise 8:

Given an equilateral triangle ABC with side a and two charges -2q and +q at B and C.

1/ Calculate the field E and potential V created by the charges at A.

2/ Place a third charge -3q at point A. Deduce the force exerted on this charge.

3/ Calculate the potential energy of (-3q) at point A.

Numerical application: q = $0.5.10^{-3}$C and a = 5 mm