Test N1 Physics- Durée 1 h 15mn

part I:

Exercise 1 **Give the literal expression for each answer (اعطي العبارة حرفية)**

Consider three point charges as shown in Figure 1 and held fixed.

As given: $q_A = q_B = q_O = q$

1- Find expression of the forced applied to charge q_O in cartesian coordinates.

2- Deduce expression of the electric field vector $\vec{E}_o$ at point.

3- Find the expression for the electrical potential V_c au point C.

4- Determine the work done by the operator to assemble these three charges initially without interaction.

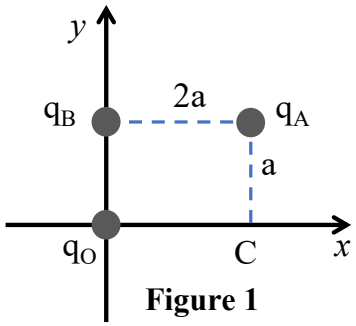

Figure 1

The fourth point charge $q_C = -2q$ is moved from infinity to point C calculate the work required in this process.

Exercise 2

Consider a longer cylinder of radius ***R*** and length **h** uniformly charged in surface with a density σ>0.

1- Find **the electric field** at any point in space.

2- Plot graph of **the electric field.**

Exercise 3

Two identical conductive corps carry charges $q_1 = 2.10^{-6}c$ and $q_2 = -8.10^{-6}$ C respectively. They are brought into contact and then separated.

- Calculate the new charges q_1' and q_2' of the two corps after contact. Specify the direction of electron transfer and their number.

part II:

Question1

Consider a point charge q positioned at the center of a sphere **S** with radius **R**. The sphere **S** is charged on its surface with a charge **Q** as illustrated in **Figure 2(a)**.

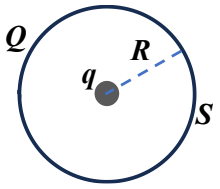

Figure 2(a)

Figure 2(B) displays the net flux through a Gaussian sphere centered on the particle, as a function of the sphere's radius, r.

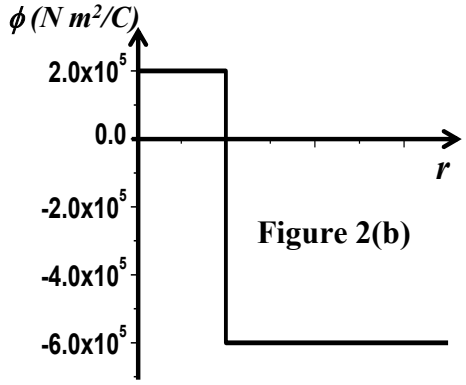

Figure 2(b)

Find:

- **a-** The value of the central charge q .
- **b-** The value of the charge **Q** of the sphere **S**.

$\varepsilon_0 = 8.854\times10^{-12}$ **(SI)**

Question2

In Figure 3, there are two closed surfaces centered on a positively charged point q . S_1 represents a **sphere** with radius R, while S_2 is a **cube** with side length **a**.

- **a-** Compare **the net flux** through surfaces S_1 and S_2.
- **b-** Compare **the magnitudes of the electric fields** on these surfaces and specify whether the magnitudes **are uniform or variable along each surface**.

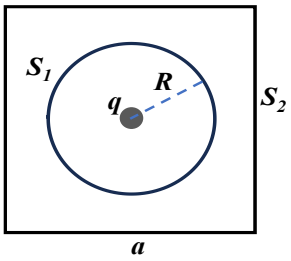

Figure 3

Question 3

- **a-** Define a dipole.
- **b-** Give a law governing the dipole moment and draw it.
- **c-** What happens if we place a dipole in an external electric field?
- **d-** The components of the electric field created by a dipole at point M in space, represented in polar coordinates, are given by:

$$\vec{E}(r,\theta) = \frac{1}{2\pi\varepsilon_0} p\left(\frac{cos\,\theta}{r^3}\right)\vec{u}_r + \frac{1}{4\pi\varepsilon_0} p\left(\frac{sin\,\theta}{r^3}\right)\vec{u}_\theta$$

Find the potential electric created by this dipole in point M.