University of M 'sila

Faculty of: Technology **Common Base**

Third Series Of Exercises - Phys 02

Exercise 01: Fig.01

Three-point charges are placed at the vertices of an equilateral triangle of side $'a'$. $Q_1 = q$ *at point* **A (0,0,0)**, $Q_2 = q$ *at point* **B (0, a,0)** *and* $Q_3 = 2q$ *at point* **C** $(0,\frac{1}{2}a,\frac{\sqrt{3}}{2}a)$

1/ *Find the field created at the centroid* $'\mathbf{G}'$ *of this triangle*

If we place a negative charged particle with masse $'\mathbf{m}'$ $-Q_0$ *at that centroid,*

2/ *Draw the field line of this system*

3/ *What is the ratio* $'\frac{Q_0}{m}'$ *of the particle to be in equilibrium.*

4/ *What is the energy required to form this system configuration?*

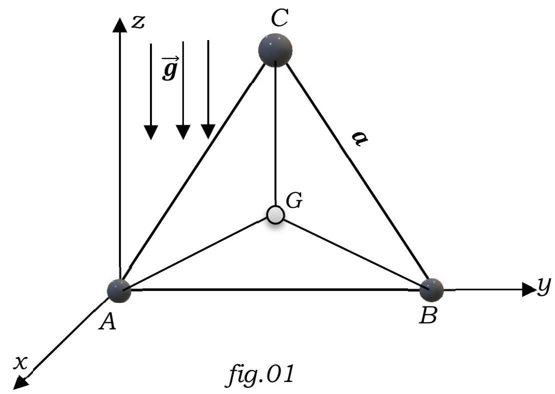

fig.01

Exercise 02: Fig.02

A uniform distributed charge over a surface of cylinder, of radius **R** *and Hight* **H**, *with a charge density* $\sigma(R = H)$.

1/ *Find the electric field* $\vec{E}(P)$ *at a point* **P** *on its axis and located at a distance 2H from its upper end.*

2/ *Find the electric potential* $\mathbf{V}(\mathbf{P})$ *at that point*

3/ Additional question

Find the electric field and potential at point P in plan of symmetry perpendicular to the axis of cylinder at distance **x** *from the axis*

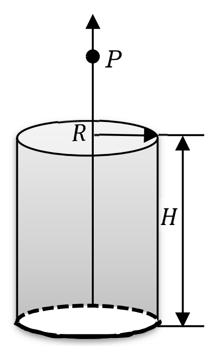

fig.02

Exercise 03: Fig.03

A very long cylinder of radius **R** *has a charge distributed in volume with a charge density positive* ρ. *Using GAUSS law*

1/ *Find the electric field* $\vec{E}$ *at every point in space.*

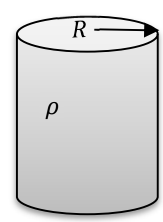

fig.03 - a

2/ *Deduce the electric potential* $\boldsymbol{V}$ *created at every point in space (Taking* $\boldsymbol{V}(\mathbf{0}) = \mathbf{0}$*).*

By creating in this cylinder, a cylindrical cavity that has the same axis at distance $\boldsymbol{d}$

3/ *Find the field inside this cavity. What do you notice about this field?*

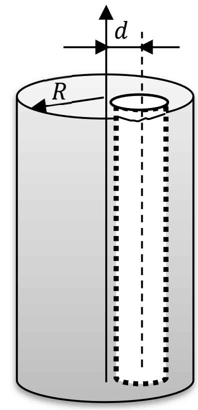

fig.03 - b

Exercise: 04

A spherical conductor of radius R1and charge Q, is surrounded by a conducting shell with inner radius R2 and outer radius R3.

1/ *Find the charge on each surface?*

2/ *Find the electric field at all points in space?*

3/ *Determine the potential at all points in space.*

If the outer surface is connected to ground,

4/ *Determine the potential difference between the two conductors? What is the capacitance of the formed capacitor? (**Additional**)*

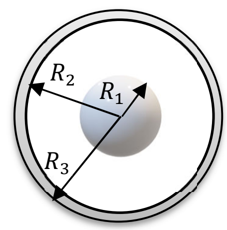

fig.04

Exercise: 05 (Homework)

Two identical charges $\boldsymbol{Q_1} = \boldsymbol{q}$ *located at point* $\boldsymbol{A}$ $(\mathbf{0}, \boldsymbol{d}, \mathbf{0})$ *and* $\boldsymbol{Q_2} = \boldsymbol{q}$ *located at* $\boldsymbol{B}$ $(\mathbf{0}, \boldsymbol{d}, \mathbf{0})$.

1/ *Find the electric field created, at point* $\boldsymbol{P}$ $(\mathbf{0}, \mathbf{0}, \boldsymbol{z})$*, by these two charges*

2/ *Verify the limit case for* $\boldsymbol{z} >> \boldsymbol{d}$*. What do you observe?*

3/ *What will be the expression of the field if the charges are opposites* $\boldsymbol{Q_1} = \boldsymbol{q}$ *and* $\boldsymbol{Q_2} = -\boldsymbol{q}$*?*

4/ *Verify the limit case for* $\boldsymbol{z} >> \boldsymbol{d}$*. What do you observe?*

What does this configuration represent?

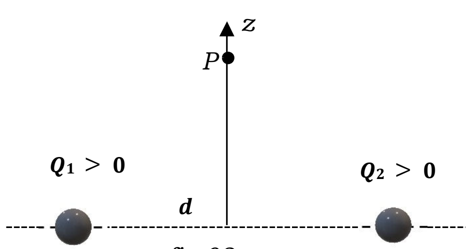

fig.02 - a

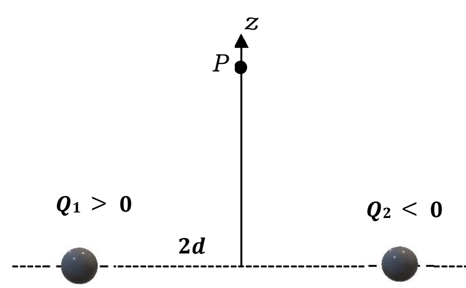

fig.05 - b