EXERCISES 10.A

PART A

1. A uniform electrostatic field exists between two parallel plates having equal charges of opposite signs. An electron initially at the rest escapes from the surface negatively charged and strikes the x surface of the other plate, situated at 2cm in $1.5x10^{-8}$s.

a) Calculate the electric field,

b) Calculate the speed of the electron at the time of the impact with the second plate.

2. An electron is situated in a uniform electric field of intensity or field-strength 1,200,000Vm-1. Find the force on it, its acceleration, and the time it takes to travel 20mm from rest (electron mass, $m = 9.1\times10^{-31}$ kg).

3. A point charge −30μC is placed at the origin of coordinates. Find the electric field at the point $x= 5m$.

4. A 5.0μC point charge is placed at the point x = 20cm, y = 30cm, Find the magnitude of E due to it

a) At the origin.

b) At x =1m, y = 1m.

5. The ball of an electrostatic pendulum of mass 2.5g has a charge of 0.5μC.

a) What must be the intensity of a horizontal electrostatic field so that the wire makes an angle of 30° with the vertical?

b) What angle makes the wire with the vertical if the electrostatic field has an intensity of 104 NC^{-1}?

PART B

1. Two spheres A and B charged negatively of radii 3cm and 9cm have an electric potential 300 000 V. Determine the distance between them so that the spheres repel with a force F = 0.3N.

2. Three equal charges of+6ηC are located at the corners of an equilateral triangle whose sides are 12cm length. Find the potential at the centre of the base of the triangle.

3. Suppose metal parallel plates are spaced 0.50cm apart and are connected to a battery. Find the electric field between them and the surface charge density on the plates.

4. The charge on an electron is 1.6×10−19 C in magnitude. An oil drop has a weight of 3.2×1013N. With an electric field of 5×105 V/m between the plates of Millikan's oil drop apparatus this drop is observed to be essentially balanced. What is the charge of the drop in electronic charge units?

5. In the Millikan experiment, an oil drop carries four electronic charges and has a mass of 1.8×10−12 g. It is held almost at rest between two horizontal charged plates 1.8cm apart. What voltage must there be between the two charges plates?

6. Between two vertical parallel plates A and B exists a p.d V. The distance between the plates is 10cm. A small electrified ball of mass 0.3 g carrying a positive charge of 0.3μC is suspended to an insulating wire, of negligible mass that, the balance being realized forms an angle α=15° with the vertical. If g=9.8m/s2.

a) Calculate V. b) Trace some field lines between them, indicate their direction.

c)What work would be necessary to give to move the ball P and t bring it in the position P on the vertical of O; (length of the wire OP= l = 20cm).

PART C

1. Briefly describe how a lightening conductor can safeguard a tall building from being struck by lightening.

2. Find the force between two point charges +4μC and -3μC placed at a distance of 12dm apart in free space.

3. A charge of 4μC is placed in a vacuum. Determine the electric field intensity at a point P at a distance of 20cm from the charge.

4. The vertical deflecting plates in a Television set are 5.0cm and 1.0cm apart. If a potential difference of 100V is applied between the plates and the electron beam enters horizontally mid-way between the plates with a speed of 2.0 × 10-7ms-1. Find the kinetic energy gained from the electric field by an electron in the beam.

5. The studied device is in an empty enclosure. The study is done with regard a mark supposed galilean; being horizontal and vertical. Electrons penetrate in O, with a horizontal velocity, inside a parallel plates capacitor. Between the parallel plates P1 and P2 of this capacitor separated by a distance d is applied a constant voltage V = VP1-VP2 = 140V. We'll assume that the resulting electric field acts on electrons on a horizontal distance of 1m measured from O. Knowing that: Charge of an electron: e=1.6 x 10-19 C; Mass of an electron: m = 9.1 x 10^{31}kg ; Acceleration due to gravity: g = 9.8 $m.s^{-2}$; l = 15 cm; Velocity of arriving in O: vo = 30000kms^{-1}; distance between the plates P1 and P2: d =3cm.

a) Compare the values of the weight of the electron and the electrostatic force undergone inside the capacitor. Conclude.

b)i) Give the equations of coordinates x and y of the motion of the electron in the mark, when it passes between the plates P1 and P2. ii) Establish the equation of the trajectory of the electron.

c) With which vertical distance electrons are deviated at the exit of the capacitor?

(ii) What is the condition that electrons move out the electric field between the plates P1 and P2, the initial velocity keeping the above fixed value?

d) These electrons make a spot on a luminescent screen placed perpendicularly to and at a distance D = 20cm from the center C of the capacitor. What is the distance of that spot to the center I of the screen?

EXERCISES 10.B