القدس عاصمة الثقافة الاسلامية al QUDS

Physics Lab 2

Student Name:

Student No.: **Sec:**

Day: **Date:**

Experiment No.:

Experiment Name:

Student Partners:

Lecturer:

Experiment No. 1

Exp1. Electric Field Lines and Equipotential Surfaces

Objective:

The purpose of this experiment is to explore the electric force per unit charge (or the electric field) as a function of the distance from various charged electrode configurations, after mapping the equipotential lines.

Equipment:

Apparatus for mapping equipotential surfaces (glass water sink or pan), DC-power supply, Multimeter, Graph paper (provided).

Theory:

The electric force per unit charge is called the electric field intensity or simply the electric field (E). The electric field is a vector quantity given by:

$$\vec{E} = k\frac{q}{r^2}\hat{r}$$

SI units of **E**: **Newton/Coulomb = N/C.**

From the equation above you should also realize that the magnitude of the electric field decreases as **the inverse square of the distance from the point source** (in this experiment, the electrodes), and should be noticed that:

(1) Like all other vector quantities, it has both magnitude and direction.

(2) Electric field lines flow from positively to negatively charged regions (positive to ground in this experiment).

(3) The number of these lines is proportional to the charge.

(4) The density of electric field lines (how close together they are) will decrease as you get further away from the source.

(5) The electric field vector E at a point is tangent to the line at that point.

The electrical potential V which is constant along equipotential surfaces (ΔV=0), **are perpendicular to electrical field lines**.

$$\Delta V = V_2 - V_1 \qquad \Rightarrow W = q\,\Delta V = 0$$

But $\quad W = F\Delta x\cos\theta = qE\Delta x\cos\theta = 0$

$\cos\theta = 0 \qquad \Rightarrow \theta = 90^0$

Thus, by mapping experimentally where the potential is constant, you can get a map of the electrical field. That is the main point of this experiment. Draw lines between electrodes of constant potential first and then map the electric field lines perpendicular at any point of the equipotential surface.

Sketch two configurations of the electrodes on the graph paper.

Connect the apparatus to the power supply. Turn the power supply on and set it to 6 volts as shown in fig, (1) connect the ground from the voltmeter to the ground from the power supply.

Now, using the positive probe you will mark out some equipotential surfaces around the electrodes. Being careful to not touch the water with anything other than the probe, locate 6-8 points each for the following voltages; 1,2,3,4,5 V . Make sure the points are spread out, so that you can get a good sampling of the space around each electrode.

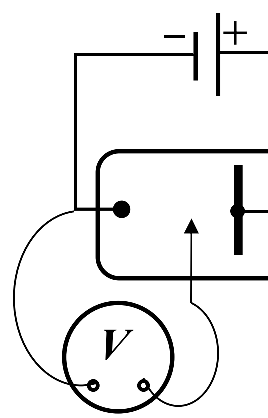

Fig.1

Connect the points of equal voltage (potential) with a smooth line and label them. These are equipotential surfaces.

Now draw the corresponding electric field lines, with arrows to show the direction of the field. Repeat the same steps for three different electrodes.

Exp1. Electric Field Lines and Equipotential Surfaces

Name: ……………………………… Day and Date: …..………………

Student's No.: …………………………… Sec.: ………………………

Partners Names: ……………………………………………………

Data and Calculation:

Data sheet for **point - point** charge.

V_1 =		V_2 =		V_3 =		V_4 =		V_5 =	
x(cm)	y(cm)	x (cm)	y (cm)	x (cm)	y (cm)	x (cm)	y (cm)	x (cm)	y (cm)

Data sheet for **point** and **line** charge

$V_1 =$		$V_2 =$		$V_3 =$		$V_4 =$		$V_5 =$	
x(cm)	y(cm)	x (cm)	y (cm)	x (cm)	y (cm)	x (cm)	y (cm)	x (cm)	y (cm)

Data sheet for two line charge.

$V_1 =$		$V_2 =$		$V_3 =$		$V_4 =$		$V_5 =$	
x(cm)	y(cm)	x (cm)	y (cm)	x (cm)	y (cm)	x (cm)	y (cm)	x (cm)	y (cm)

<u>Questions:</u>

Q1. What is the angle between the equipotential surfaces and electrical field lines?

<u>Answer</u>

Q2. In which case of the three performed setups we get uniform electric fields?

<u>Answer</u>:

Q3. Where are regions of strongest and weakest electric fields located?

<u>Answer</u>:

Q4. Can electric field lines ever cross? Explain.

<u>Answer:</u>

Q5. Show that at any point on an equipotential surface, the electric filed lines is perpendicular to the surface?

<u>Answer:</u>