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LAB REPORT FOR EXPERIMENT 1

Date: ----------

Name:-----

Partner's Name:--

Registration No:------

Registration No:-----

Physics Section:-------

Instructor's Name:---

PHYSICS LAB EXPERIMENT 1: ELECTRIC FIELD MAPPING

1. PURPOSE

To determine the equipotential points and the line connecting between them on the graph and drawing the lines of force by using several electrode configration.

II. DATA AND DATA ANALYSIS

A. Mapping The Equipotential Lines

1- Enter your data in Table 1.1 below:

Table (1.1 a)

For one type of electrodes:

Location of P (position of equipotential point)				
P_1	P_2	P_3	P_4	P_5
(-8, 0)	(-6, 0)	(2, 0)	(6, 0)	(4, 0)
(-8, 3)	(-6, .5)	(2, 4)	(6, 0.5)	(4, 2.2)
(-8, -1.2)	(-6, -2)	(2, 2)	(6, -5.4)	(4, -0.3)
(-8, 1)	(-6, 1.8)	(2, -1.4)	(6, -2.5)	(4, -1.5)

For another type of electrodes:

Table (1.1 b)

Location of P (position of equipotential point)				
P_1	P_2	P_3	P_4	P_5
(7, 0)	(3, -1.5)	(-4, 0)	(-8, 4)	(5, 0)
(7, +1)	(3, 0)	(-4, 0.8)	(-8, 0)	(5, 1.8)
(7, 0.2)	(3, 3.8)	(-4, 2.9)	(-8, 1.4)	(5, 3.7)
(7, 1)	(3, 1.5)	(-4, 4)	(-8, -2.9)	(5, -3)

(9, 1.3)
(9, 0)
(9, 3.4)
(9, -2.5)

2- Use your data of Table (1.1a)and Table (1.1 b) to plot the equipotential points on two sheets of graph paper.

3- Connect the **eight points** corresponding to each location P_i with a line which is an **equipotential line**.

4- On the same graph , draw the lines of force. These are everywhere **perpendicular** to the equipotential lines, explain **why**.

Because the work done to move the electron a point to any point another point along the equipotential line is zero, so if lines of the force (field lines) wasn't perpendicular to the equipotential line, the work will not be zero because it will be wrong according to the concept of equivalent lines.

$W = q \Delta V = 0$ ($\Delta V = 0$)

$W = F \cdot ds$

$W = qE ds \cos\theta = 0$ $\quad \theta = 90°$

B. Measurement of The Electric Field

The data in Table (1.2) below are **V** in volts and **d** in centimeters.

Table 1.2

V(volt)	d(cm)
0.4	2
0.8	4
1.2	6
1.5	8
1.9	10
2.2	12

0.4
0.8
1.2
1.5
1.9
2.2

1. Plot **V** (as dependent variable) versus **d** .
   Find the slope of your graph.

slope = $\frac{\Delta V}{\Delta d}$ = Electric field

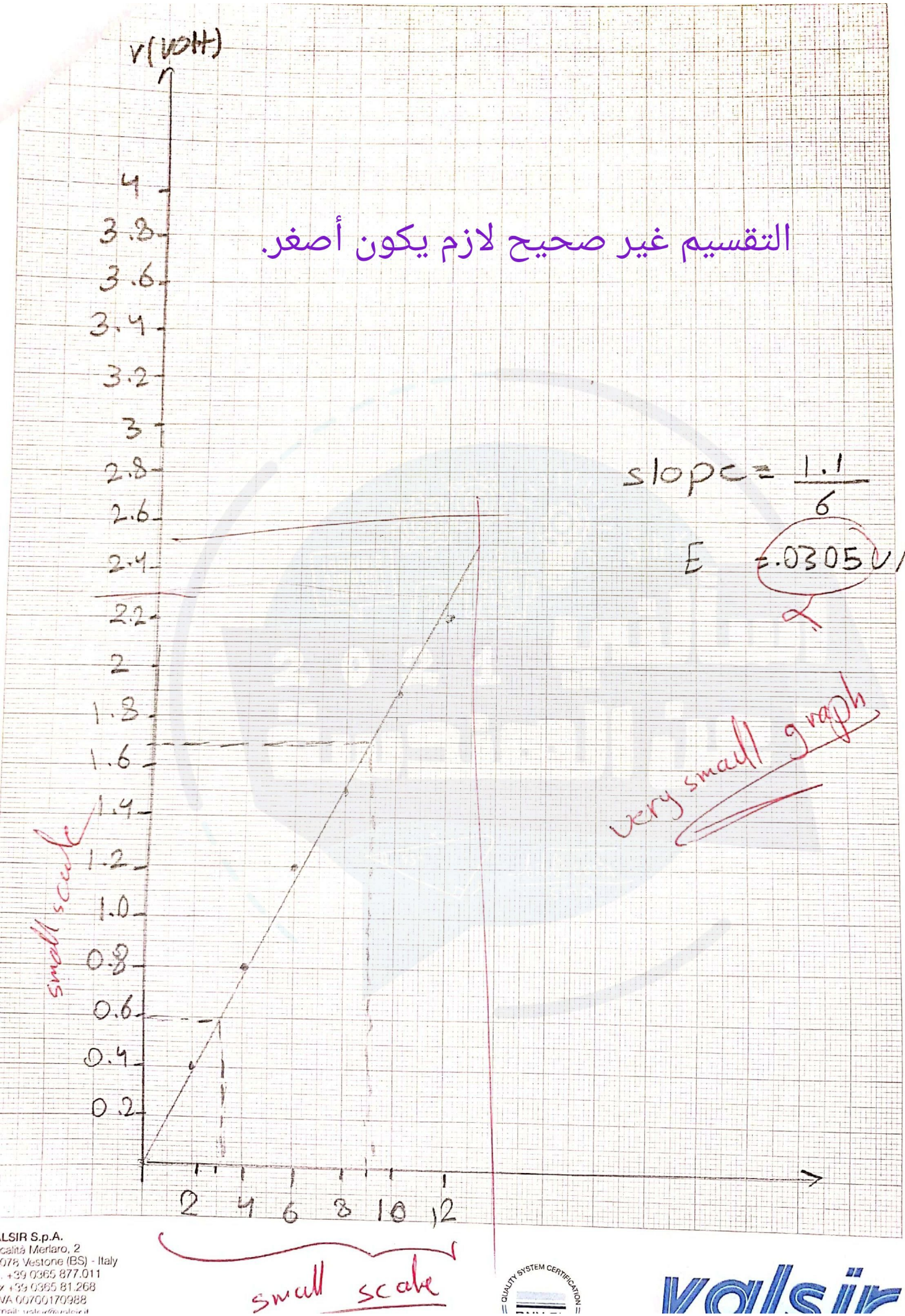
= .0305 V/cm

2. How is the slope related to the electric field ?

the slope represent the magnitude of the electric field

3. What conclusion can you draw about the electric field in the region between the electrodes near the center?

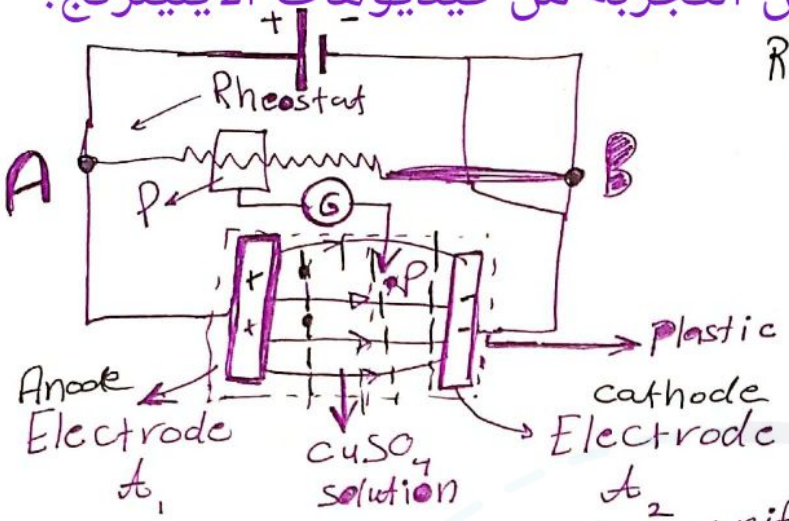
The electric field between the electrodes is constant because when the distance between electrodes increases, the voltage increase than ratio of V/d remains constant and uniform.



التقسيم غير صحيح لازم يكون أصغر.

*Electric field mapping

تلخيص التجربة من فيديوهات الايلينرنج:



Rheostat: يحصل منها على قيم مختلفة هي المقاومة

(حساسة)

- بدنا نتحقق انو عنا uniform electric field وخطوط تساوي الجهد بعيدة عن الحواف *
- نجد النقطة اللي جهد G = 0 ~ 8 مرات
- خطوط تساوي الجهد عمودية على المجال الكهربائي *

ال G موصلة بنقطة معينة من الريوستات

بدي ابحث عن نقطة بالمحلول جهد عندها 0 = جهد النقطة اللي ع ال Rheostat وعندي سطح تساوي جهد

* وقتها حيكون جهدها =

حلما حركنا ال ع الـ Rheostat يتغير الجهد بنفس الاتجاه لحدما يصير الجهد = الجهد عند ال -

P_1	P_2	P_3	P_4	P_5
(x_1, y_1)	(x_1, y_1)			
(x_2, y_2)				
(x_8, y_8)	(x_8, y_8)			

- بتحريك ال Rheostat بحصل على نقاط جهد مختلفة *
* بيكون عندي graph sheet فبقدر تقرأ إحداثيات النقطة بتحرك ال pointer داخل ال solution مشان تغير النقطة

و مرات

- يتوقع ان خطوط تساوي الجهد عمودية ع المجال (الأسود)

$$V = -E \cdot d$$

$$V = -Ed\cos\theta \rightarrow \cos 90$$

$$V = 0$$

* لحد أسطح تساوي الجهد تختلف عن بعضها ← قيمة الجهد ينخفض لما نمشي مع الـ Electric field

Sliding contact → القطعة اللي بتحرّكها

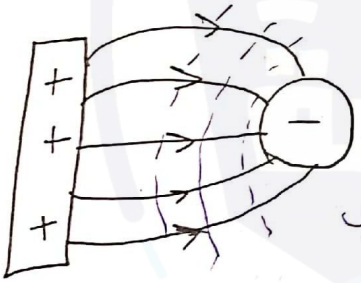
لما نحرّك الريوستات لليمين خط الجهد ع اليمين

$R = \frac{V}{Q}$

5 مواقع للـ sliding
8 points كل موقع

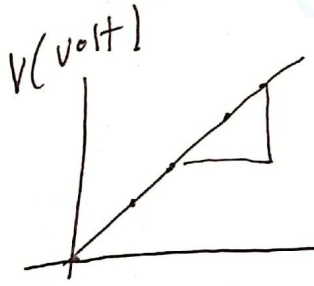
electric field ← الآن نجد

cylindrical Electrode

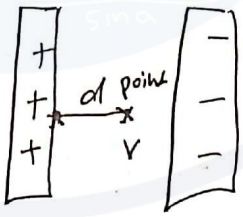


not uniform electric field

- الخطوط الزرقاء (خطوط تساوي الجهد)



slope = Electric field volt/cm



V	d
x	x
x	x

d : بعد النقطة عن positive electrode

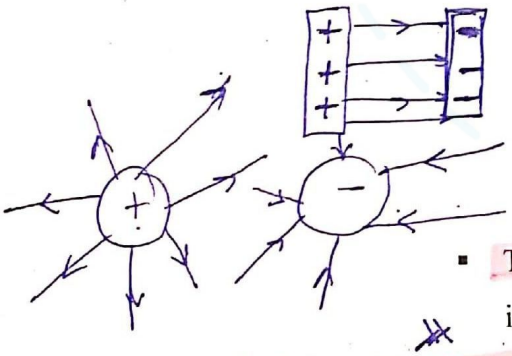
* بعدها بنغيّر موقع الـ pointer نضعه على الخط المستقيم العامودية الـ 2electrode بالوسط تماماً موجود *

- كلما زادت الـ d تقل الـ V عكسية

بحساب الـ R يعطينا قراءة موجبة نأخذ |

EXPERIMENT 1
ELECTRIC FIELD MAPPING

- In the **Electric Field Mapping** experiment, the circuit configuration will allow for better understanding of the concept of the **Electric Field** by examining the **Potential** at every point within a certain region (field). Moreover, it will confirm **Uniformity** of the electric field, in the region between two parallel electrodes of opposite charges, near the center.
- An **Electric Field** $\vec{E}$ exists in the space around any **charged** object.
- This $\vec{E}$ at any point in space is given as :
  - $\vec{E} = \frac{\vec{F_{el}}}{q_0}$ (The Electric Force acting on a small positive test charge placed at that point divided by the test charge); its unit is in Newton/Coulomb (N/C).
- A convenient way to visualize $\vec{E}$ is to draw **(Patterns) Lines** related to the **electric field:**
  - These lines are **Tangent** to the **Electric Field** at each point.
  - **Direction** of each line is that of the **Force** on a positive test charge placed in the field.
  - Note that the field lines should be directed:
    - **Parallel Outward (Inward)** for a **Positively (Negatively)** charged **rectangular** electrode; and
    - **Radially Outward (Inward)** for the **Positively (Negatively)** charged **cylindrical** electrode.



  - These **Lines** are always **Perpindicular** to **Equipotential Lines** drawn in the same region.
- Points of the **Same Potential** in the electric field are called **Equipotential Points.**
- If these point are connected, they form an **Equipotential Line.**

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- These equipotential points will be determined in this experiment for two different electrode configurations:
  - Two parallel rectangular brass electrodes of opposite charge, (Figure 1); and
  - One cylindrical and one rectangular electrode configuration of opposite charge, (i.e. Replacing one of the electrodes in circuit shown in Figure 1with a cylindrical electrode).

- In today's experiment, we want to:
  - **Build up simple electric circuit** using different **circuit elements** including:
    - **Electric wires** (considered as perfect conductors eventhough they tend to heat up during the experiment, hence, their power dessipation is ignored).
    - **DC Power Supply**.
    - **Two** sets of Brass **Electrodes (1st set** of two rectangular electrodes and **2nd** set of one cylindrical and one rectangular electrodes**).**
    - **Galvanometer** to be connected in parallel (in order to work as an Ammeter).
    - **Voltmeter** to be connected in parallel (in order to register the voltage).
    - **Rheostat** (Variable resistor).
    - **Liquid Conductor** (Electrolyte – $CuSO_4$ in tray).
    - **Contact Pointer.**
  - **Search** for equipotential points (P_1, P_2, etc…) between the electrodes. These points will be at the same potential as point P and located when galvanometer reads Zero based on the rheostat handle position.
  - **Hence,** the (x,y) coordinates of each point will be tabulated, plotted on a sheet of graph paper, connected to form equipotential lines, and finnally utilized to draw the lines of force.
  - From circuit in **Figure 2**, collect data points (V vs. d), **Plot** them as V(Volts) as dependent variable versus d(cm); then find the **Slope** of the graph, and state what **Conclusion** you can make.