T.C.

GEBZE TECHNICAL UNIVERSITY

PHYSICS DEPARTMENT

PHYSICS LABORATORY II

EXPERIMENT REPORT

THE NAME OF THE EXPERIMENT

The Coulomb Constant

PREPARED BY

NAME AND SURNAME :

STUDENT NUMBER :

DEPARTMENT :

GROUP NO :

TEACHING ASSISTANT :

DATE OF THE EXPERIMENT : ….. / ….. / …….

DATE : ….. / ….. / …….

Equipments :

-Metal spheres

-Power supply

-Insulation bar with metal

-Insulating bar with capacitor

-Capacitor measuring tool

Experiment Set:

Figure 1: *The experimental set-up of the Coulomb constant k*

Experimental Procedure:

1. We will connect the end of the black insulation bar to the 'GROUND' section on the Power Supply (when it is turned on, the red light turns on).
2. The other end of the black insulation bar, which is metal surface, will be brought into contact with the metal sphere surface. This way, we will neutralize the charge on the metal sphere surface.
3. Then, neutralize the insulating bar with capacitor by pressing the very small gray button on the black small box connected to it.
4. Touch the insulating bar with capacitor to the surface of the metal sphere and measure the load on the metal sphere to ensure that there is no load on the metal sphere. If the sphere is still loaded, repeat step second.
5. Later, we will connect the end of the red insulating bar to the first voltage value in the table 1 in the 'Voltage' section on the Power Supply.
6. The other end of the red insulation bar, which is the metal surface, will be contacted with the metal sphere surface. In this way the metal sphere surface will be loaded.
7. For the metal sphere with a capacitor insulating, first repeat step 3 and then measure Capacitor measuring tool the load on the surface of the metal sphere with a capacitor insulating bar and write this value under "Charge" column in the table 1. Repeat this process 4 times for same value of voltage.
8. These operations will be repeated for each voltage value in the table 1.

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Table 1

Number of Measurements	Radius of sphere r = 0.04 m					
	Potential	Charge				
	V (…..….)	q (…..….)				
		1	2	3	4	Avg
1	750					
2	1500					
3	3000					
4	6000					

After measuring the charge on the sphere surface, calculate the $\frac{q}{r}$ for each experiment.

Exp 1:

Exp 2:

Exp 3:

Exp 4:

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Use the $\frac{q}{r}$ values calculated above to plot the graph. Electrostatic potential equation $V = \frac{k\,q}{r}$ can rewrite $k = \frac{V}{(q/r)}$. Remember, the radius of the metal sphere is r = 0.04 m. Draw a line passing closest to all of the data points. (*y axis : V ; x axis* = $\frac{q}{r}$)

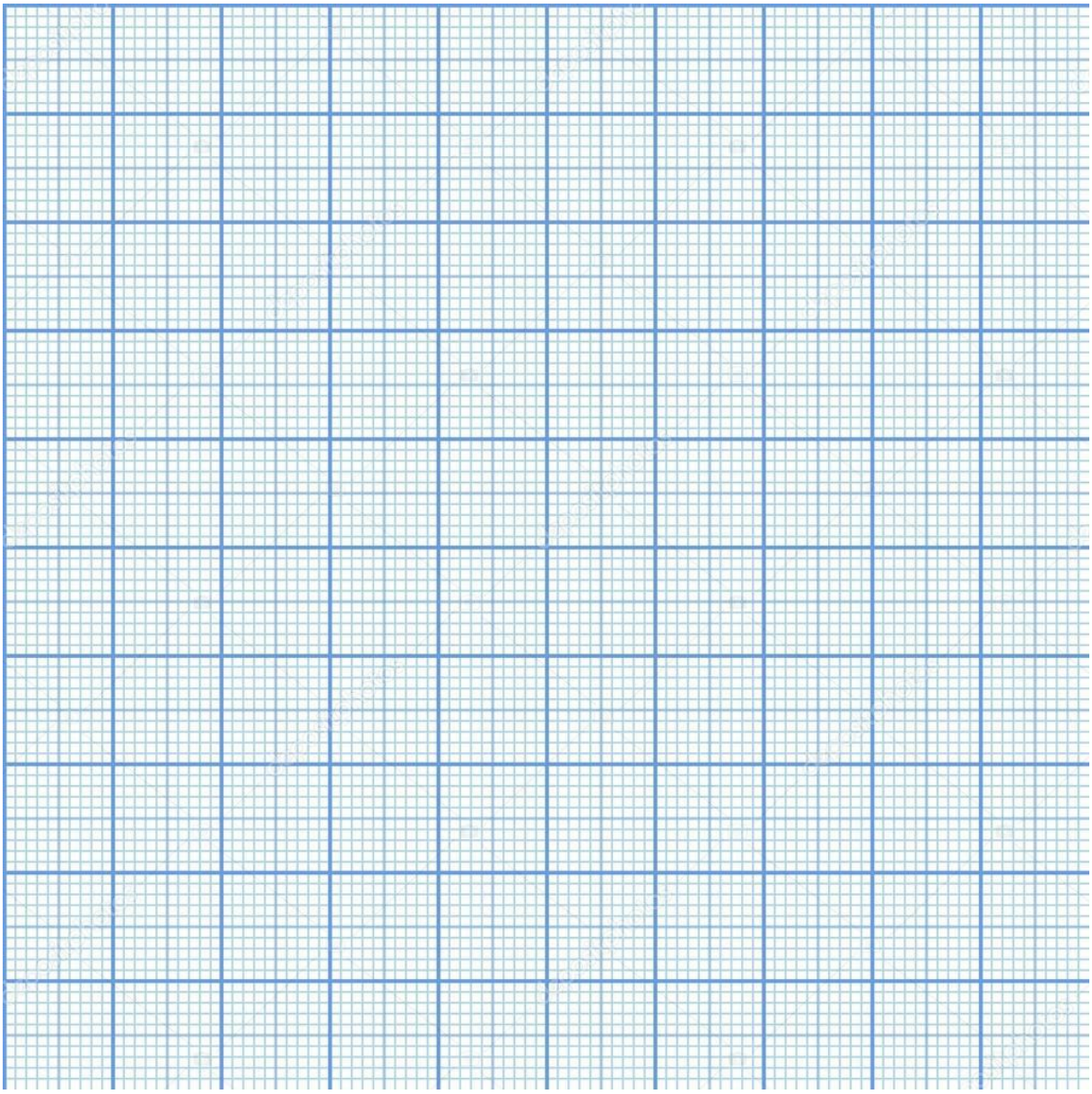

Figure 1: *V* - $\frac{q}{r}$ *graph*

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Calculate the slopes of the lines that fit the data points on your *V* vs. $\frac{q}{r}$ graphs, which are plotted in the previous step. In the following formulae, the x_i 's represent the $\frac{q}{r}$, while the y_i's represent the Voltage V. n is the number of data used in calculations..Calculate the slope m of the graph corresponding to the Coulomb constant k_{Exp} value using the data in the graph. Write down the <u>intermediate steps.</u>

$$\sum_{i=1}^{n} x_i y_i =$$

$$\sum_{i=1}^{n} x_i^2 =$$

$$m = \frac{\sum_{i=1}^{n} x_i y_i}{\sum_{i=1}^{n} x_i^2}$$

Compare experimental Coulomb constant $\boldsymbol{k_{exp}}$ and theoretical Coulomb constant $\boldsymbol{k_{teo}}$ values of Coulomb constant k with each other and calculate the relative percentage error.

$\boldsymbol{(k_{teo} = 8.987\ 10^9\ Nm^2/C^2)}$

$$\%\ relative\ error = \frac{|k_{exp} - k_{teo}|}{k_{teo}}\ 100 = \ldots\ldots\ldots\ldots\ldots\ldots$$

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Conclusion, Comment and Discussion:

(**Tips**: Give detail explanation about what you've learned in the experiment and also explain the possible errors and their reasons.)

-Give detail explanation about what you've learned in the experiment

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-Explain the possible errors and their reasons in the experiment

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Questions:

1. Find the unit of the Coulomb constant ***k*** in Coulomb's law equation when we have units for all other physical quantities.

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2. An alpha α particle is the nucleus of a helium atom. It has a mass m = 6.64×10^{-27} kg and a charge q = +2e = 3.2×10^{-19} C. Compare the force of the electric repulsion between two a-particle with the force of gravitational attraction between them.

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3.Give three examples of electrostatic force in daily life and briefly explain them.

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