Pre-Lab Report

Lab section:

Name & Surname:

Table #:

***Before the Lab** complete this page YOURSELF! Hand it in in the first 5 min. of the session PERSONALLY!*

You MUST justify your answers and show all steps. NO COPYCAT answers, or NO credits!

Please read the relevant presentation on PHYS LAB Website.

Q1. Instead of directly measuring the distance between two parallel plates, explain why we use R open: Ro and R closed: R_C values in the experiment. Should they stay the same while taking data? Why? **Explain in your OWN WORDS!**

Q2. What are the dimensions and unit of the slope when you plot F versus V^2? **Show** dimensional **analysis explicitly**. What is the difference between its dimensions and its unit? **Show your formulae / derivation below explicitly or no credits!**

(3rd Question is on the next page!)

Q3. What are Using the setups of this and the previous experiment (Force Between Current Carrying Wires), can you determine the speed of light? **Justify your answer and give the formulation if it is possible, or no credits!**

1

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Complete this report YOURSELF except DATA taking parts! Use a pencil for plots only and a pen for the rest! **Show your work clearly, NO COPYCAT analysis allowed, or NO credits!**

OBJECTIVE : To measure the force between two parallel plates as the voltage across them is varied, and to analyze the dependence of this force on the constants of the system, and to determine the permittivity constant.

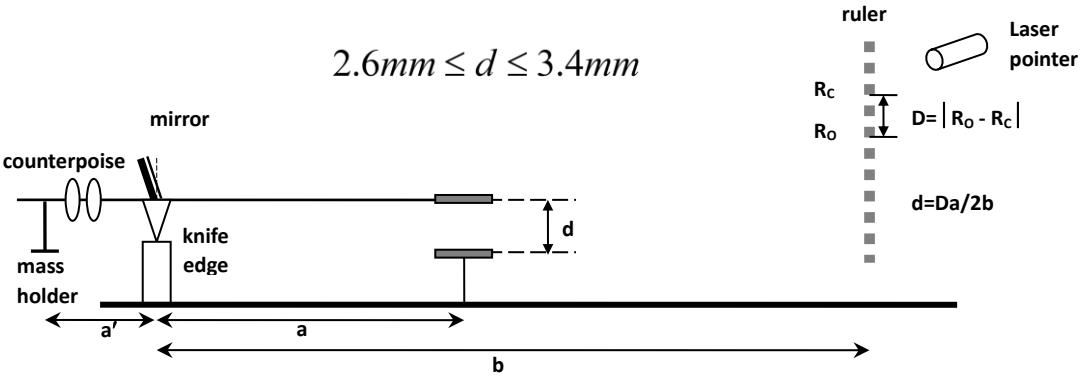
THEORY : The force between two charged plates can be shown as:

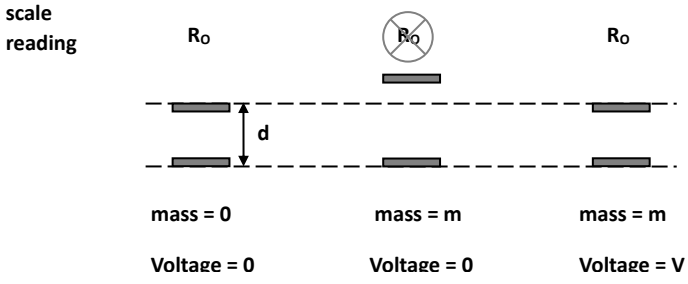
$$F = \frac{\varepsilon_o A}{2d^2} V^2$$

where ***A*** is the area of the plates, ***d*** is the separation between the plates and ***V*** is the voltage across them.

APPARATUS : Parallel-wires apparatus, laser pointer with a ruler, meter stick, high voltage power supply.

$$2.6mm \le d \le 3.4mm$$

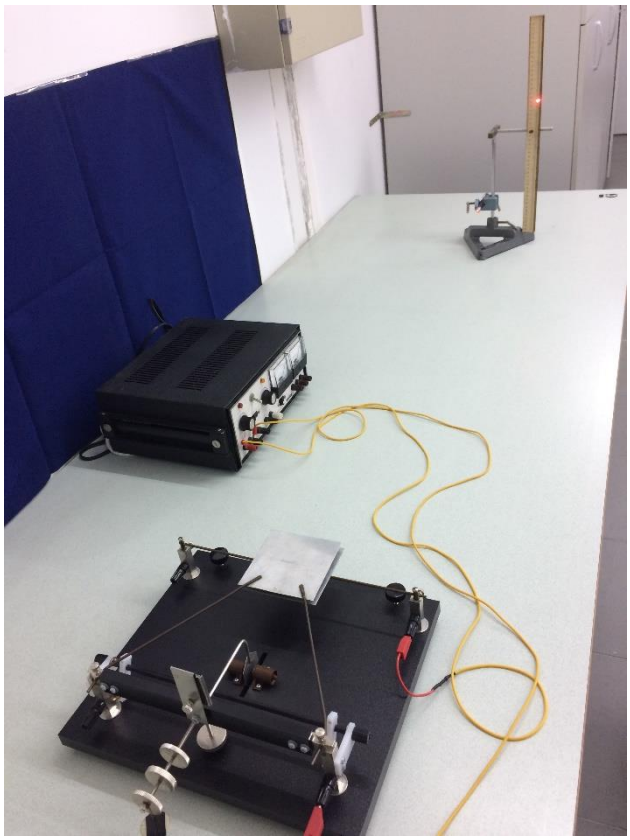




$$F_e = kV^2$$

$$k = \frac{\varepsilon_o A}{2d^2}$$

2



PROCEDURE :

1. Adjust the counterpoise so that the separation between the plates is about 3 mm.
2. Record the scale reading at equilibrium.
3. Then the upper plate is depressed until it is in contact with the lower plate, and a new scale reading is recorded.
4. The separation *d* is calculated using the expression $d = Da/2b$ where *D* is the difference in the readings on the ruler attached to the laser, *b* is the distance between the knife edge and the laser, and *a* is the distance between the knife edge and the plate center.
5. Add weights to the mass holder and increase the voltage until the original value of the plate separation *d* is recovered.
6. Record the corresponding values of *V* and *m*.
7. Compute the value of F_e for each value of *m*.
8. Plot F_e versus V^2 and find ε_0 from the slope.

Theoretical Value of permitivity of air:

$(\varepsilon_0)_{TV}$ = 8.85×10^{-12} N/V^2 All figures significant!

DATA:

Description	Symbol		Value & Unit
Length of the lever arm	*a*	=	.....
Lever arm for the weight	*a′*	=	.....
Distance from the mirror scale to the ruler	*b*	=	.....

3

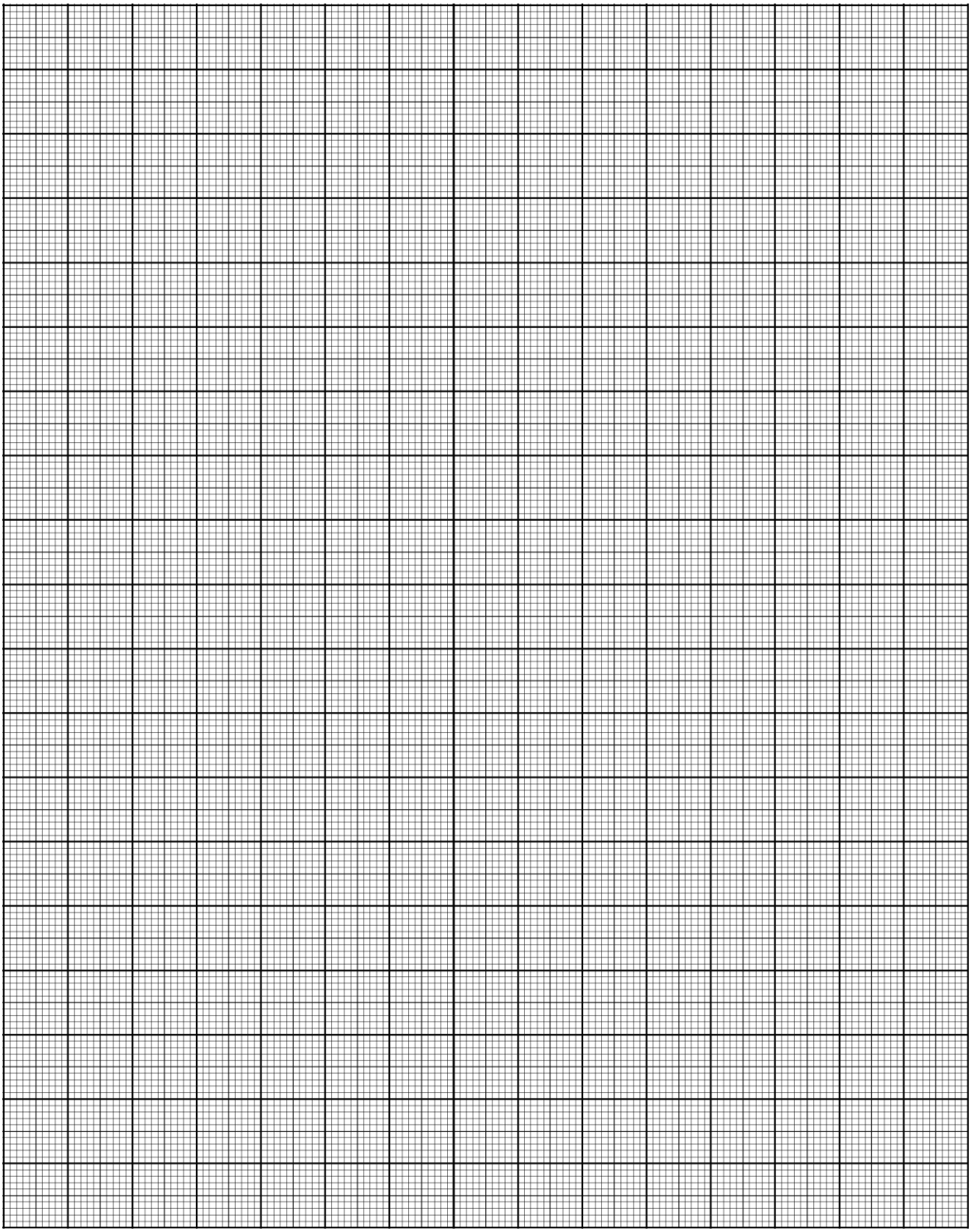
Description	Symbol		Value & Unit
Length of the plate	L	=	.....
Area of the plate	A	=	.....
Reading when the plates are open	R_O	=	.....
Reading when the plates are closed	R_C	=	.....
Difference in readings	D	=	.....
Separation between the plates	d	=	....

Limits for d: 2.6 mm. $\leq d \leq$ 3.4 mm.

Mass m ( )	$F_e = mga'/a = kV^2$ ( )	Potential V ( )	Square of Potential V^2 ( )

4

Plot F_e versus V^2:



5 **From the graph, choose two SLOPE POINTS other than data points,**

SP_1 : (;)

SP_2 : (;)

RESULTS:

Description	Calculation (show each step)	Result

SLOPE = ...

. . . . . .

$(\varepsilon_o)_{EV}$ = ...

. . . . . .

% Error for ε_o:

Consult to the resources for this experiment from PHYS LAB Website:

PHYL201 Intro

Presentation #7

PHYL201 Lab Book