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. In your OWN WORDS, give a definition of μ_o in ONE SENTENCE!

Q2. Explain its meaning **in your OWN WORDS**! Why do we need μ_o?

(3rd Question is on the next page!)

Q3. Show the dimensional Analysis for μ_o. **Show your formulae / derivation below explicitly or no credits!**

Q4. What are the **relative** current directions in the wires in this experiment and how can you conclude this? How would you change the procedure or modify the setup if the relative directions were **otherway around**? *(Hint: Have a look at the paralel plate experiment! Do not offer to revert the current directions!)*

#6 Force Between Current Carrying Wires

1 Lab Report

Lab section:

Name & Surname:

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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 parallel, current carrying conductors and to analyze the dependence of this force on the constants of the system.

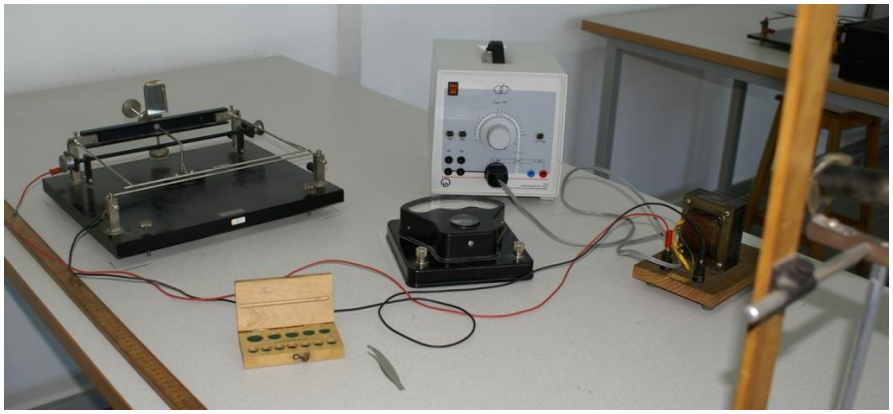
THEORY : Force between the current carrying wires is given as:

$$F = \frac{\mu_o}{2\pi}\frac{L}{d} I_1 I_2$$

and if the same current is passing through the wires as:

$$F = \frac{\mu_o}{2\pi}\frac{L}{d} I^2$$

where L is the length of the wires and d is the separation between the parallel wires. By measuring the force between current carrying parallel wires as a function of the current passing through them, we can determine the permeability of air. When the force values are plotted as a function of the squares of the corresponding current values, the straight line that fits the data best will have a slope that includes the permeability constant. From the slope of the straight line we can calculate the permeability constant as:



$$\mu_o = \frac{2\pi(slope)d}{L}$$

APPARATUS : Parallel-wires apparatus, laser pointer with a ruler, meter stick, 9-A AC-ammeter, AC power supply with a transformer.

PROCEDURE :

1. Adjust the counterpoise so that the separation between bars, d_o, is about 3 mm. Record the scale reading at equilibrium (R_o).
2. Then the upper bar is depressed until it is in contact with the lower bar, and a new scale reading is noted (R_c). The separation d_o is calculated.
3. To make measurements, add a certain mass to the weight pan, increase the current until the scale reading indicates the initial reading, R_o.
4. Read the ammeter. Plot F_m versus I^2 and determine μ_o.

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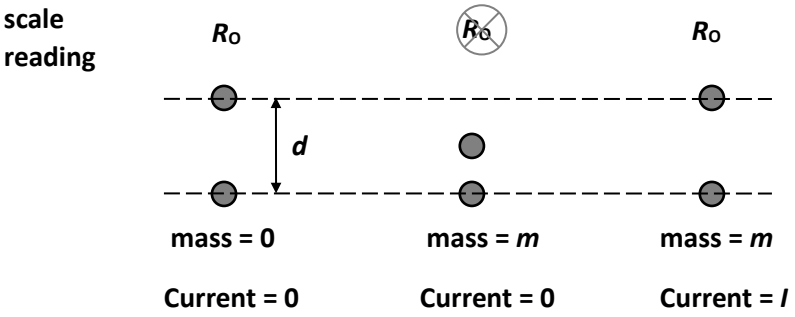
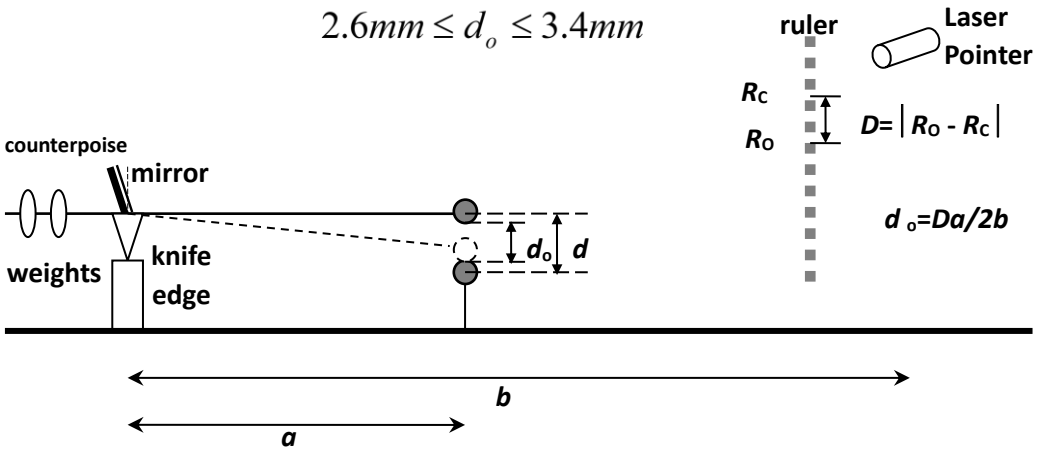


$$F_m = kI^2$$

$$k = \frac{\mu_o}{2\pi}\frac{L}{d}$$

$$2.6mm \le d_o \le 3.4mm$$



Theoretical Value of permeability of air:

$\mu_{oTV} = 4\pi \times 10^{-7}$ **N /A²** All figures significant!

DATA:

Description	Symbol	Value & Unit

Length of the lever arm a = ...

Distance from the scale with the mirror to the ruler b = ...

3

Description	Symbol	Value & Unit

Diameter of the wire $2r$ = ...

Length of the wire L = ...

Reading when

the wires are open R_O = ...

Reading when

the wires are closed R_C = ...

Difference in readings D = ...

Separation

between the wires d_o = ...

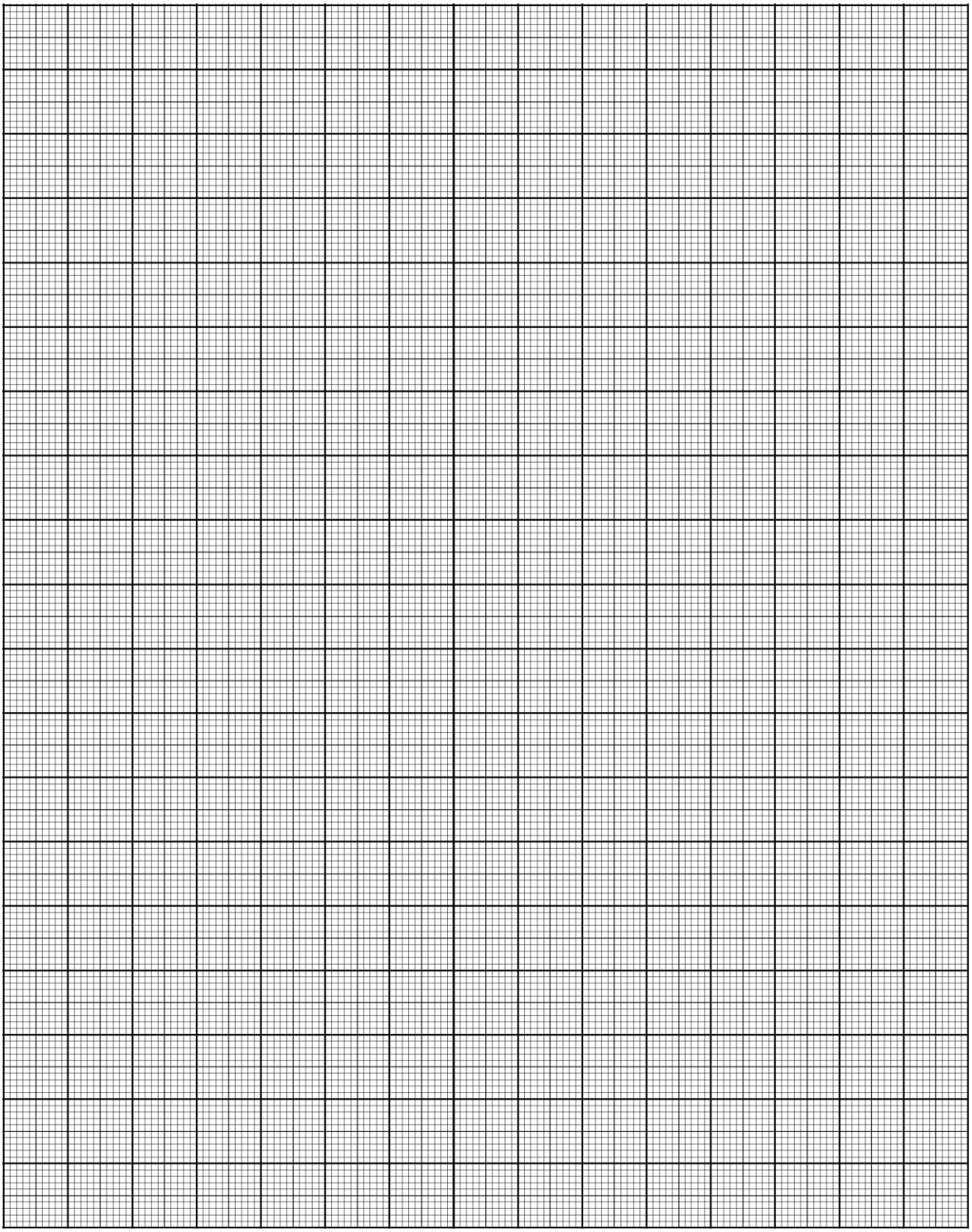
Separation between

the wire centers d = ...

Mass m ( )	Current I ( )	$F_m = m.g = k\, I^2$ ( )	Square of the Current I^2 ( )

4

Plot F_m versus I^2:



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

SP_1 : (;)

SP_2 : (;)

RESULTS:

Description		Calculation (show each step)	Result
SLOPE	=	. . . . .	. . . . .
		. . . . .	
$(\mu_o)_{EV}$	=	. . . . .	. . . . .
		. . . . .	
% Error for μ_o	=	. . . . .	. . . . .
		. . . . .	

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

PHYL201 Intro **Presentation #6** **PHYL201 Lab Book**