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 <u>the relevant presentation</u> **on PHYS LAB Website.**

In this experiment the idea of average velocity is important. Be careful while fitting the time data! The average velocity data should be fitted at the middle of time values.

Q1. Should the masses of the washers, which are placed on the hanger to overcome the friction, be added to the total mass? Why? **Justify your answer or no credits!**

(2nd Question is on the next page!)

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Q2. If the velocity versus time graph does not pass through the origin, what is the meaning of this nonzero y-intercept value physically? **Justify your answer or no credits!**

Lab Report

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**Lab section:**

Name & Surname: **Table #:**

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 effect of force acting on a mass.

THEORY : In this experiment, the motion of the car on a special track is studied. Masses are placed on the mass holder that is attached to the car. When the masses are released, they fall to the floor while applying a force on the cars due to the gravitation.
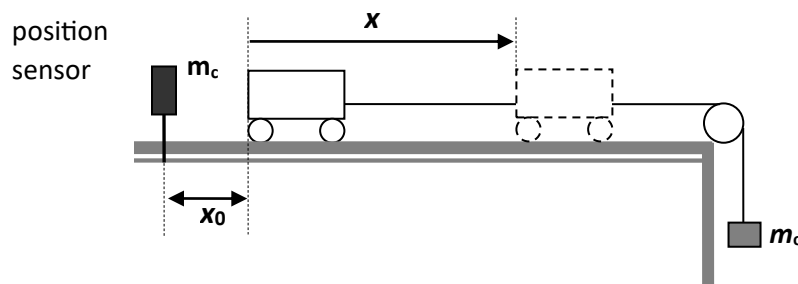
Acceleration of the car can be calculated from the Newton's Law:

$$M_{total}a = m_o g$$

$$a = \frac{m_o}{M_{total}} g$$

$$M_{total} = m_c + m_0$$

To measure the acceleration we have to record the motion of the mass+car system as a function of time. As you know, the velocity is the derivative of the position and the acceleration is the derivative of the velocity with respect to the time. So, if we know the position as a function of time, we can determine the velocity and the acceleration. However, it is difficult to record the position on a continuous base experimentally. We can only determine the position at specific times. Even though the velocity and the acceleration may not be constant, we can still determine the average velocity for a specific interval.

$$v_{average} = \Delta x / \Delta t$$

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From the plot of the average velocity versus the time we can determine the acceleration by taking the derivative of the function defined by this graph.

APPARATUS : Car and track, masses with hanger, position sensor, data logger, balance.

PROCEDURE :

• You will be determining the positions with the help of a position sensor. The sensor works by sending ultrasound pulses forward and listening for the echoes. From the known speed of sound in the air and the time between the transmission and reception of the ultrasound signals, the data logger determines the distance to the sensor.

• Set the position sensor approximately 20 cm away from the car before releasing it.

• Adjust the data logger to an appropriate rate (suggested value is 10 per second) and compensate for the friction force.

• Place the given mass on the holder. Start the data logger and release the car. Stop the data logger when the mass holder hits the ground.

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DATA-TAKING

- Using the up and down buttons on the data logger, read the position information in its memory and record the values in Table 2.1. (Consult to the appendix on page 7!)
- Measure the length of each interval and calculate the average velocity for each interval. Note them in Table 2.1
- On the graph paper given on the next pages, plot the average velocity versus time and determine the acceleration.

Description / Symbol	Value & Unit
Mass on the holder + mass of the holder $m_o=$	. . . .
Initial distance of the Car x_0 =	. . . .
Number of Cylinders in the Car =	. . . .
Data Taking Rate =	. . . .

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t ( )	x ( )	Δx ( )	$V_{\text{ave}} = \Delta x / \Delta t$ ( )

Table2.1

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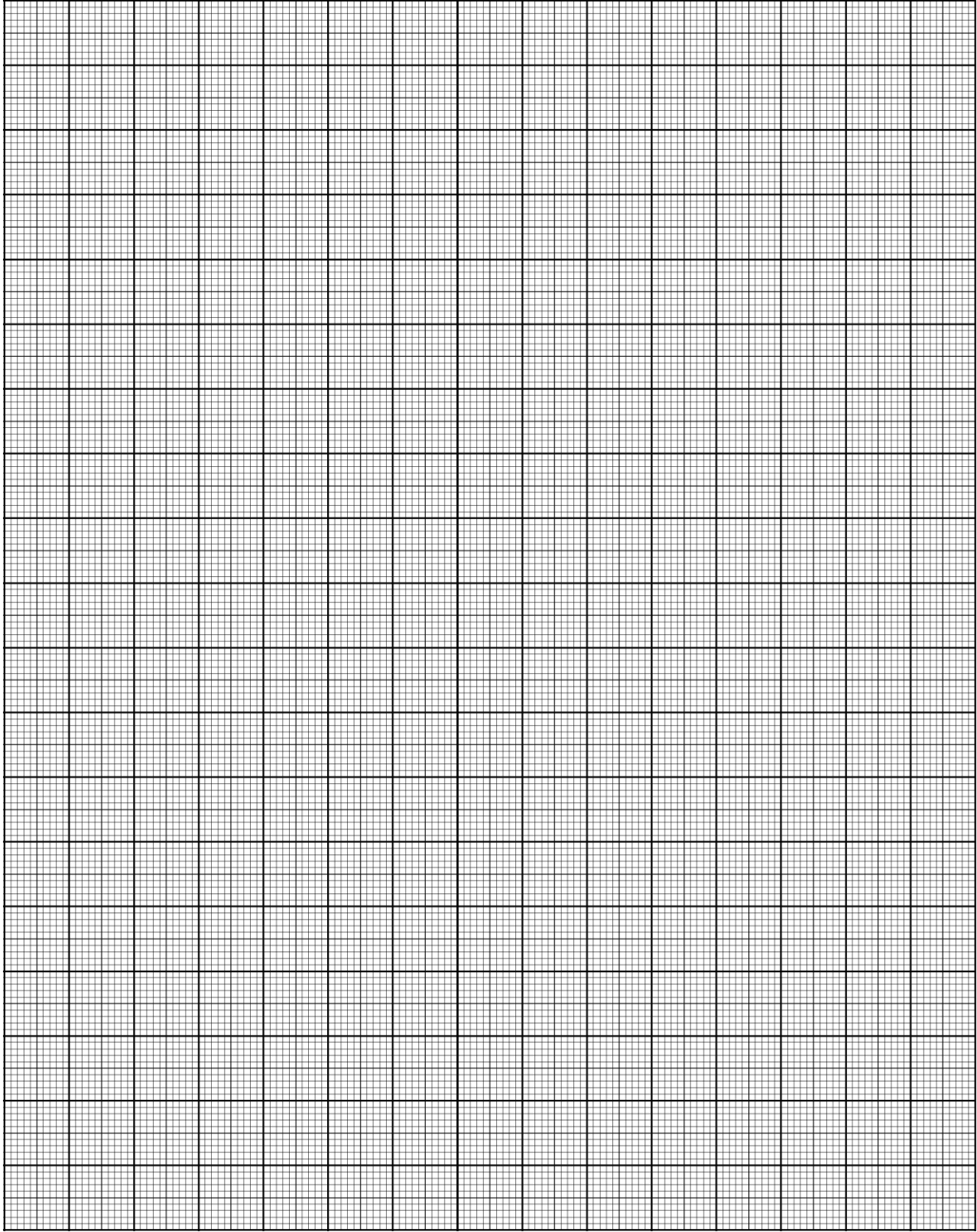
CALCULATIONS & RESULTS

A)   **From the line above, choose two SLOPE POINTS other than data points:**

SP_1 :   (;   )

SP_2 :   (;   )

B)   **By using SP_1 and SP_2, calculate the slope and other quantities below:**

Description / Symbol	Calculations (show each step)	Result

SLOPE   = ...

. . . .

Acceleration a = ...

Total Mass M_{total} = ...

. . . .

Mass of the Car m_c = ...

. . . .

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APPENDIX: DATA LOGGER!

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DATA LOGGER BUTTONS:

Mode Button: Switched between displays.

Arrow Button: Starts-stops data taking.

Plus-Minus Button: Switches between the elements of sub-menus.

Check Button: Alters the input values in sub-menus.

HOW TO USE THE DATA LOGGER:

1. Make sure data taking rate is 10 s^-1.
2. Make sure the device is in Position (m) mode.
3. Make sure the memory is clear. (You need to pick Data Memory sub-menu, then hit the Check Button, choose All Data Sets using the Plus and Minus Buttons and delete all data sets using the Check Button.)
4. Pick Position (m) sub-menu, if you hit Arrow Button it will start taking data, if you hit one more time it will stop.
5. Pick Review Set # 1 Position, hit the Check Button, then you will be able to view the data values.

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

PHYL101 Intro   **Presentation #2**   **PHYL101 Lab Book**

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