

EXP.7: Force and Acceleration

Lab Report

Complete this report YOURSELF except DATA taking parts! This report will not be submitted (except the very last page), but you should carefully complete it as preparation for the applied exam.

Suggested Pre-Lab Question

Q1. Should the masses of the washers, which are placed on the hanger to overcome the friction, be added to the total mass? Why?

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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?

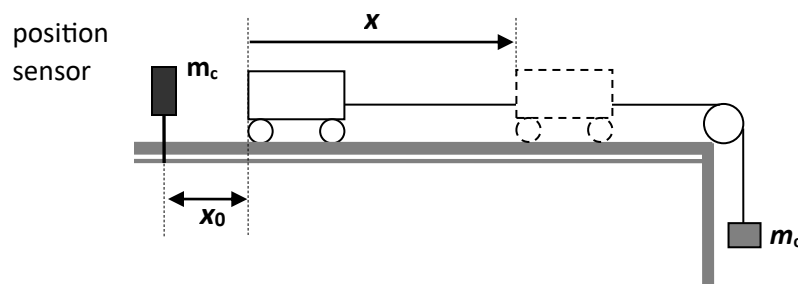
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Experiment

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.

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.



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Acceleration of the car can be calculated from the Newton's Law:

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

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

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

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.

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

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.

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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.
- Download the mobile application SPARKVUE! **Use the square codes in the Lab.**
- Using the mobile application SPARKVUE, connect to the data logger. **(Consult to the manual on lab tables)**
- 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.
- Read the position information and record the values in Table 2.1.

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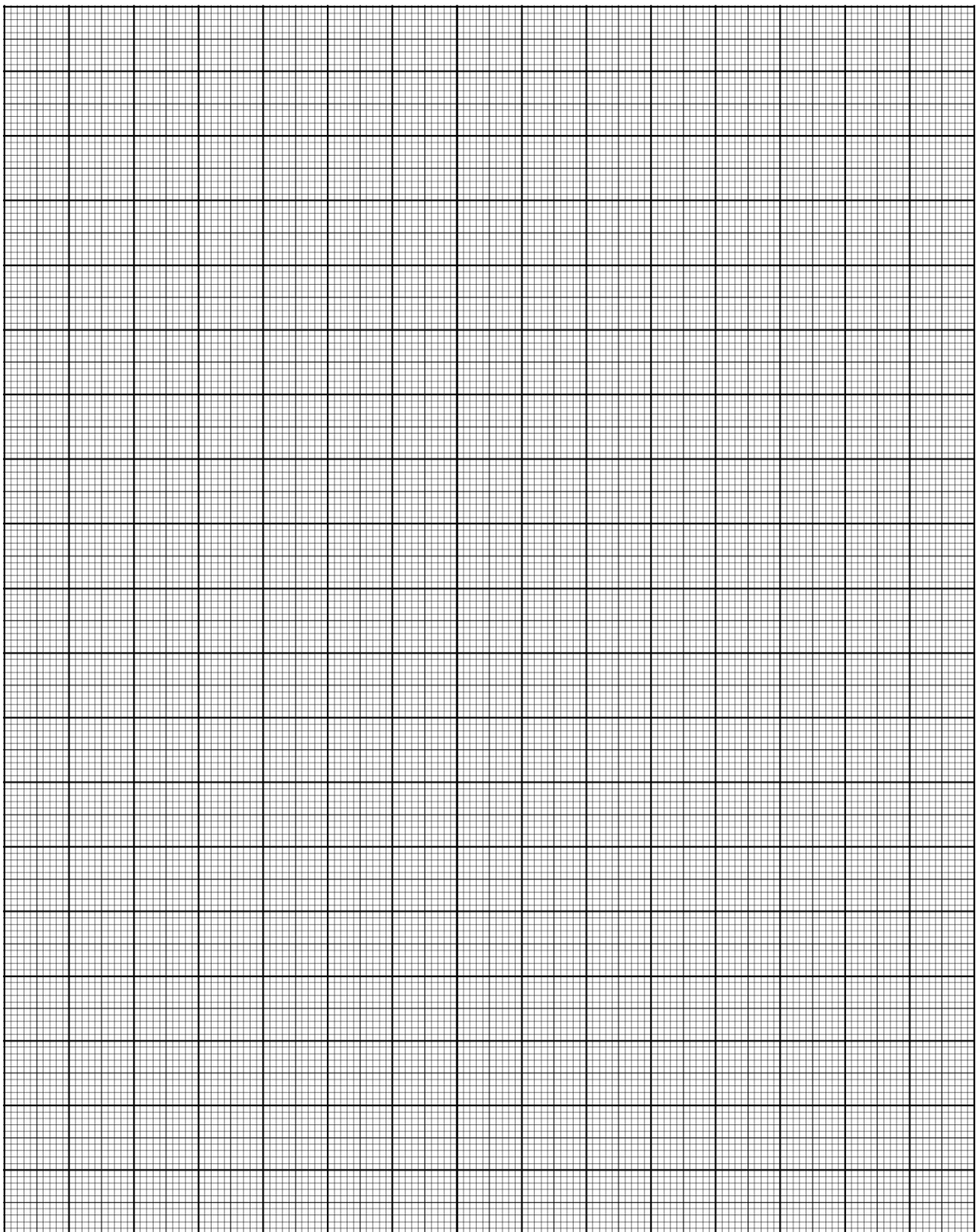
- Measure the length of each interval and calculate the average velocity for each interval. Note them in Table 2.1
- On the graph paper given on the next pages, plot the average velocity versus time and determine the acceleration.

DATA-TAKING

Description / Symbol	Value & Unit
Hanging mass m_0 =
4 Initial distance of the Car x_0 =
Number of Cylinders in the Car =
Data Taking Rate =

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CALCULATIONS & RESULTS

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

SP₁ : (;)

SP₂ : (;)

B) By using SP₁ and SP₂, calculate the slope and other quantities below:

Description / Symbol	Calculations (show each step)	Result
SLOPE	=
	
7 Acceleration a	=
Total Mass M_{total}	=
	
Mass of the Car m_c	=
	

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Post-Lab Report

Aim of the experiment:

Suggestions for possible solutions to the problems experienced during the experiment:

Conclusion:

8 I have completed this experiment myself as specified in the lab sheet and as explained by the lab instructor.

Name & Surname:

Student ID:

Lab Section:

Table #:

Date:

Signature of the
student

As the instructor of this Lab Section I confirm that the student has participated in and completed this experiment on time.

Stamp of the PHYS
Labs and signature of
the instructor

This page serves as proof of the fact that the student participated in and completed the experiment, only if it is submitted in time and accepted by the Lab instructor. The student and the instructor shall sign it along with the stamp of the Physics Laboratories.