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. Give definitions of elastic and inelastic collisions. Compare them in terms of energy and momentum. **Justify your answer or no credits!**

Q2. At what height is half the kinetic energy converted into potential energy? Give your answer with respect to the maximum height H. **Show your calculations below explicitly or no credits!**

(3rd Question is on the next page!)

Q3. What are the possible sources of error in this experiment? Answer this question in terms of the classification in your book. **Justify your answer or no credits!**

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Lab Report

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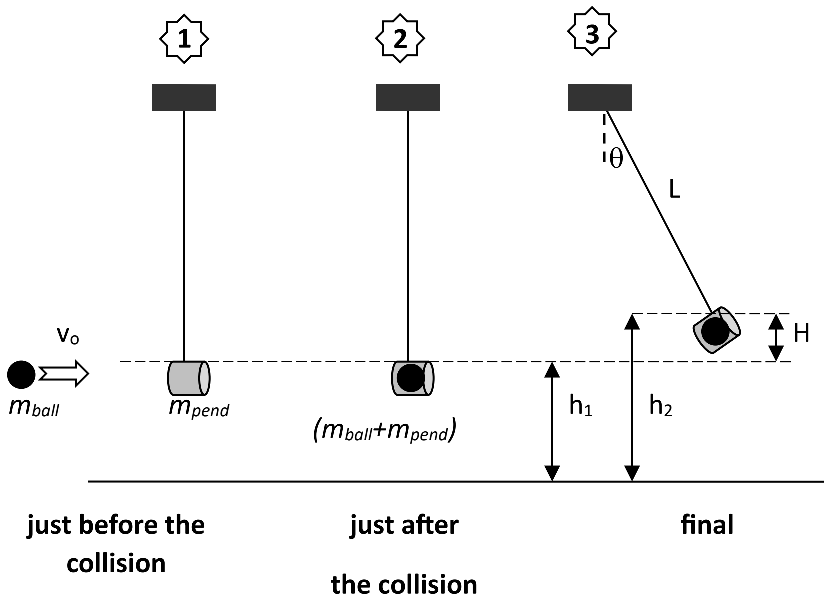
***Complete this report YOURSELF except DATA taking parts! Use a pencil for plots only and a pen for the rest!* Show your work clearly, NO COPYCAT analysis allowed, or NO credits!**

OBJECTIVE : To study the principle of conservation of momentum, and by applying this principle to measure the initial velocity of a ball.

THEORY :



In this experiment we will study the conservation of momentum using the ballistic pendulum. When the steel ball is shot towards the pendulum attachment of the apparatus, it will hit and stay inside the pendulum attachment. This is an example of a completely inelastic collision. We can express the conservation of momentum during the collision as:

$$m_{ball} v_o = (m_{ball} + m_{pend}) v_{final} .$$

Since the pendulum attachment is free to swing up, it will do so until all its kinetic energy turns into the potential energy:

$$\frac{1}{2}(m_{ball} + m_{pend}) v^2_{final} = (m_{ball} + m_{pend}) gH$$

The pendulum attachment pushes a pointer as it swings up until it reaches the maximum. Using this maximum angle information and the length of the pendulum attachment, we can determine H:

$$H = L(1-\cos\theta)\,.$$

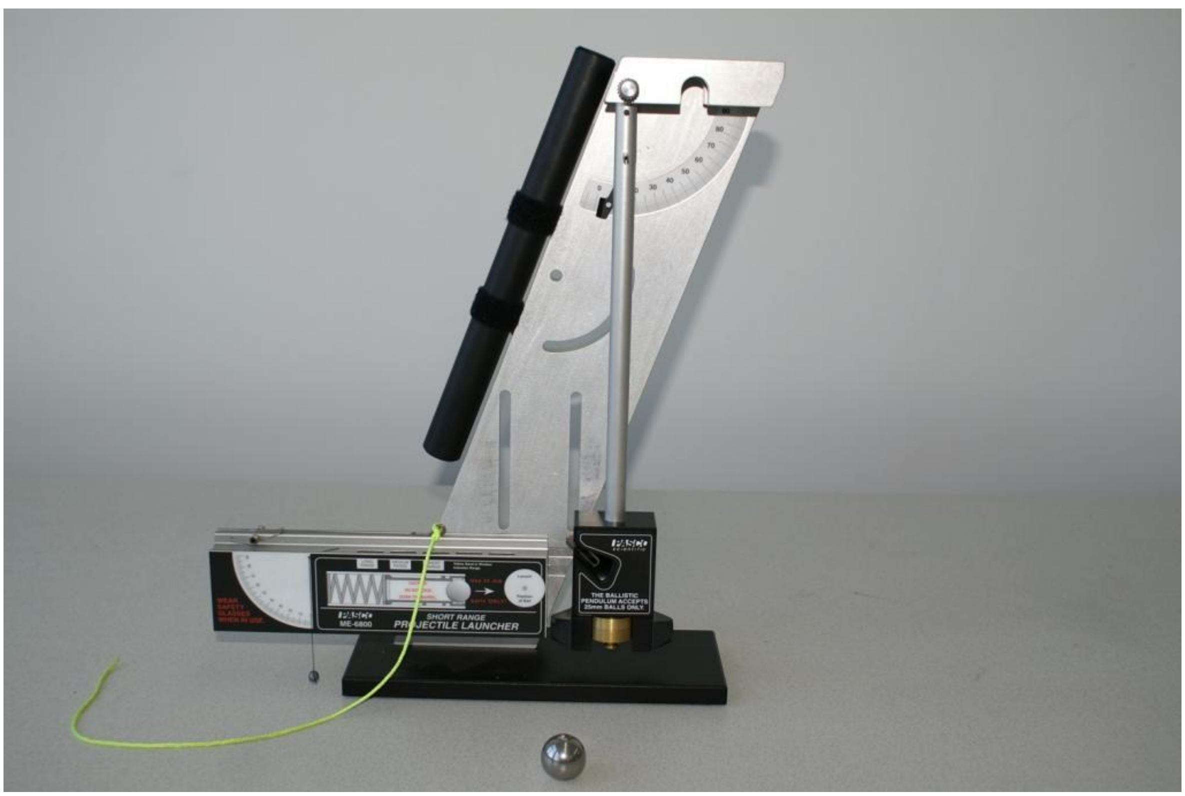
Then using this value and working backwards from the equations above, we can determine the initial velocity of the ball:

$$v_0 = \frac{m_{ball} + m_{pend}}{m_{ball}}\sqrt{2gH}$$

APPARATUS : Ballistic pendulum with the pendulum attachment, meter stick, balance, steel ball

PROCEDURE :

1. By equating the momentum before the collision to that after the collision, and equating the kinetic energy of the system just after the collision to the increase in potential energy at the height h_2, the initial velocity of the ball can be calculated.
2. Fire the ball into the pendulum two times for each compression level of the spring gun and determine the mean increase in height *H*. Do not forget to reset the angle pointer just before shooting the ball to the pendulum attachment. Calculate the initial velocity of the ball v_o for corresponding compression level.



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DATA:

Description/Symbol			**Value & Unit**

Acceleration due to gravity g_{TV} = 9.81 m/s^2

Mass of the ball	m_{ball}	=	....
Mass of the pendulum	m_{pend}	=	....
Length of the pendulum	L	=	....

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Short Range

Level of Compression	(i)	θ	$H = L(1-Cos\theta)$ ( )
Short Range Compression	1		
	2		
Average of H^{SR}		$\frac{1}{2}\sum_{i=1}^{2} H_i^{SR} =$	

Medium Range

Level of Compression	(i)	θ	$H = L(1-Cos\theta)$ ( )
Medium Range Compression	1		
	2		
Average of H^{MR}		$\frac{1}{2}\sum_{i=1}^{2} H_i^{MR} =$	

Long Range

Level of Compression	(i)	θ	$H = L(1-Cos\theta)$ ( )
Long Range Compression	1		
	2		
Average of H^{LR}		$\frac{1}{2}\sum_{i=1}^{2} H_i^{LR} =$	

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CALCULATIONS & RESULTS

Description/Symbol		Calculations (show each step)	Result	Dimension
Velocity of the ball for SR				
$V_{SR\text{-ave}}$	=	....	....	....
		....		
Velocity of the ball for MR				
$V_{MR\text{-ave}}$	=	....	....	....
		....		
Velocity of the ball for LR				
$V_{LR\text{-ave}}$	=	....	....	....
		....		

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

PHYL101 Intro

Presentation #4

PHYL101 Lab Book