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.

This experiment is combination of some of your previous experiments; Projectile motion, Rotational Inertia. Other than those Parallel Axis Theorem is going to be used.

Q1. Give a summary of what is going to be done in this experiment. Use the relevant formulae in your explanation. **Justify your answers, show calculations if needed or no credits!**

#8 Conservation of Angular Momentum

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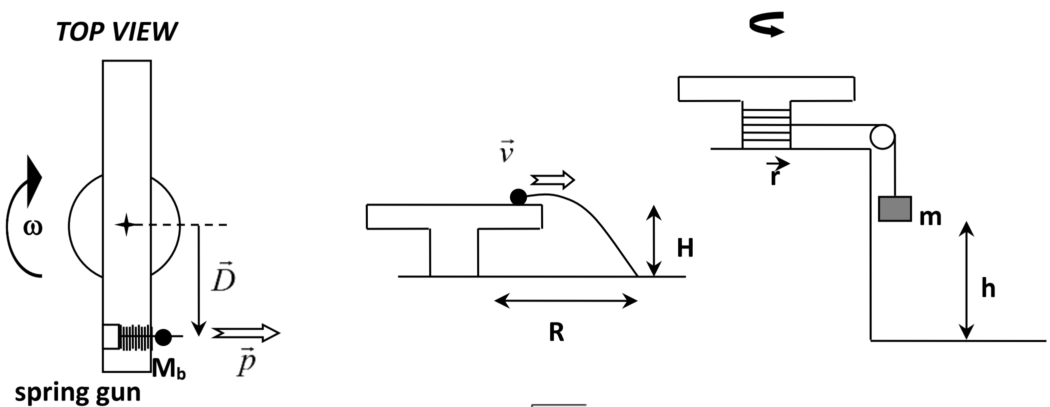
***Complete this report YOURSELF except DATA taking parts! Use a pencil for plots only and a pen for the rest!* Show your work clearly, NO COPYCAT analysis allowed, or NO credits!**

OBJECTIVE : To study the conservation of angular momentum of a system about a fixed axis.



$$\vec{L}_{ball} = \vec{D} \times \vec{p}$$
$$\vec{L}_{TurnTable} = I \cdot \vec{\omega}$$

$$v = R\sqrt{\frac{g}{2H}}$$
$$\vec{p} = \boldsymbol{M_b \vec{v}}$$

$$I = mr^2\left[\frac{gt^2}{2h} - 1\right]$$

THEORY :

In a system shown on the left of the figure above we can study the conservation of angular momentum. When the spring gun is released and shoots the ball, the ball has also an angular momentum defined by its linear momentum since the spring gun is fixed on the turntable. The turntable is free to rotate around its axis. Since this is like an inverse collision, the momentum and the angular momentum are conserved:

$$L_{ball} = L_{turn-table}$$

or

$$M_b vD = I\omega$$

Determining the moment of inertia of the spring gun assembly will be done similar to the previous experiment, **Rotational Inertia**. The important points are summarized on the right side of the figure above.

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APPARATUS : Rotational inertia apparatus with rotational sensor, data logger, mass and hanger set.

PROCEDURE :

1. Fire the ball at 2 different positions (@10.0 cm and @20.0 cm) on the aluminum rotating platform by releasing the compressed spring. The initial velocity of the ball can be determined by measuring the range and the initial height of the ball.
2. Read the angular velocity of the turntable from the data logger.
3. For the rotational inertia of the turntable when the spring gun is placed at the center, wind the cord onto the drum and hang a mass m at the end of the cord. After determining the height of the mass above the floor, release the mass and determine the time for descent. Calculate the rotational inertia of the assembly when the spring gun is at the center ($I_{SPRINGGUN}^{CM}$).
4. Calculate *I* at 2 different positions (*D)* on the aluminum rotating platform by using parallel axes theorem ($I_D = I_{SPRINGGUN}^{CM} + M_{gun} D^2$)
5. Calculate M_b for different *D* values.

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DATA:

Description / Symbol		Value & Unit
Mass of the ball	M_b =	. . . .
Mass of the spring gun	M_{gun} =	. . . .
Initial height of the ball	H =	. . . .
Mass on the mass holder + mass of the holder	m =	. . . .
Height of the mass holder from the floor	h =	. . . .
Time for descent	t =	. . . .
Diameter of the drum	d =	. . . .
Radius of the drum	r =	. . . .

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CALCULATIONS & RESULTS:

D ( )	*R* ( )	*Velocity of the ball* *v* ( )

$I_{SPRINGGUN}^{CM}$ = ...

D ( )	ω ( )	I_D ( )	M_b ( )

Average mass of the ball M_b = ...

% Error for M_b **=** . . . .

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

PHYL101 Intro **Presentation #8** **PHYL101 Lab Book**