# 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.*
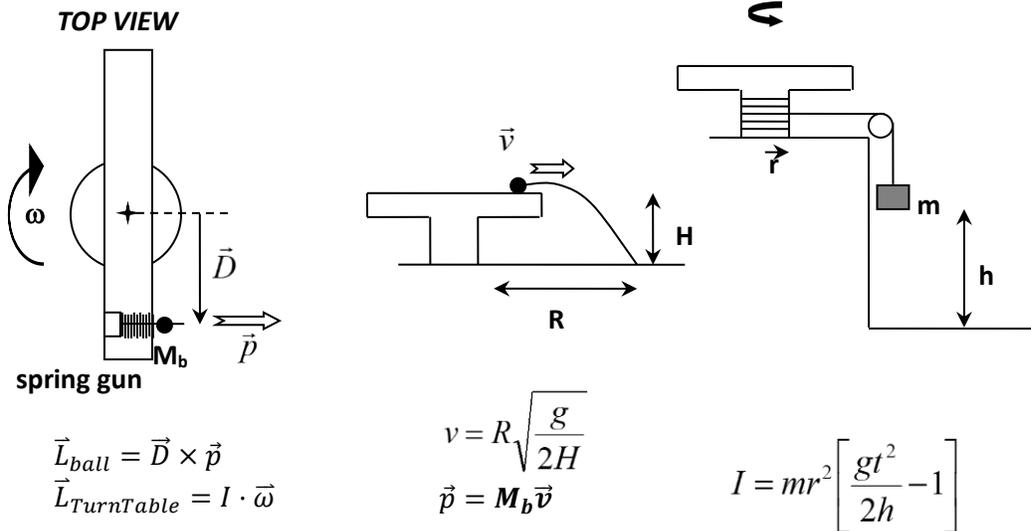
## Suggested Pre-Lab Question

**Q1.** Give a summary of what is going to be done in this experiment. Use the relevant formulae in your explanation.

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## Experiment

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

**TOP VIEW**

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

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

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

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***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

$$M_b v D = I\omega$$

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.

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



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**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.

## DATA:

| Description / Symbol | Value & Unit |
|---|---|

Mass of the ball      $M_b$ = .........................................................

Mass of the

spring gun      $M_{gun}$ = .........................................................

Initial height of

the ball      $H$ = .........................................................

Hanging mass $m$      = .........................................................

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 $v$ ( ) |
|---|---|---|
| | | |
| | | |

$$I^{CM}_{SPRINGGUN} = \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$

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| D ( ) | $\omega$ ( ) | $I_D$ ( ) | $M_b$ ( ) |
|---|---|---|---|
| | | | |
| | | | |

Average mass of the ball  $M_b$ =  $\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$

**% Error for $M_b$**        =  $\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$

**In the next experiment, which is <u>an applied exam</u>, you will have a different setup and a different experiment. Be careful about units, dimensions and significant figures.**

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# Post-Lab Report

**Aim** of the experiment:

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

**Conclusion:**

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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

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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.*