#1 Static Equilibrium of a Rigid Body

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. Write down the 2 conditions that must be met for a rigid body to be in equilibrium and comment on them. Is there a third condition? **Justify your answer or no credits!**

(2nd Question is on the next page!)

Q2. Show dimensional analysis for Torque! **Show your formulae / derivation below explicitly or no credits!**

1

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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 equilibrium conditions of a body when there are forces applied on it.

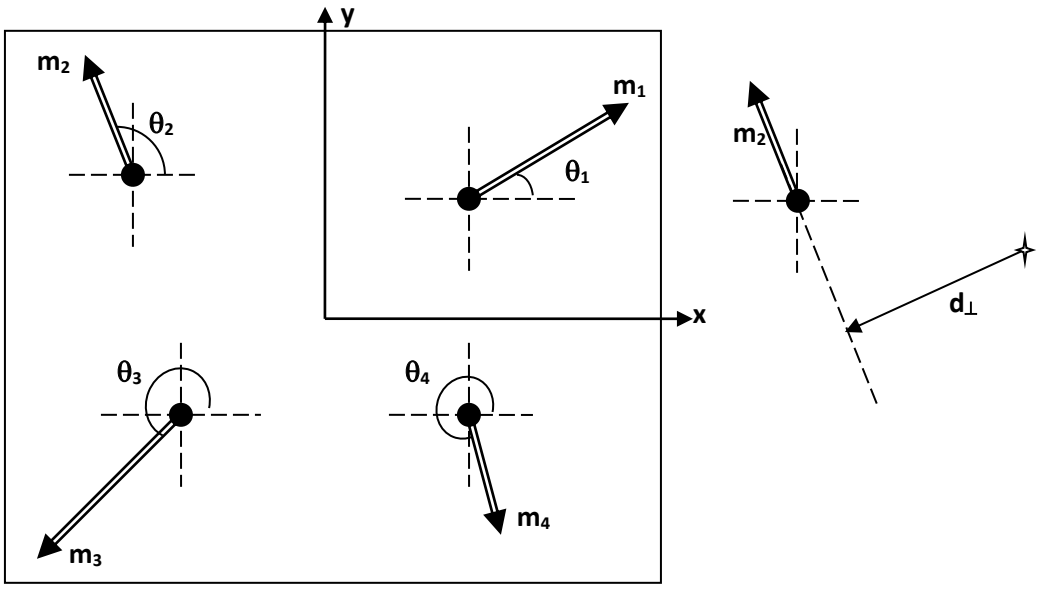
THEORY : A rigid body is in equilibrium when the total force and the torque acting on it are equal to zero:

$$\sum \vec{F} = 0, \quad \sum \vec{\tau} = 0$$

or if we write these in component form:

$$\sum F_x = 0, \qquad \sum F_y = 0, \qquad \sum F_z = 0$$

$$\sum \tau_x = 0, \qquad \sum \tau_y = 0, \qquad \sum \tau_z = 0.$$



PROCEDURE :

1. Place a piece of paper on the movable disc and replace the center pin.
2. Insert four pegs, by punching through the paper, into four different holes in the disc, and place the strings over the pulleys.
3. Attach known masses to the free ends of three of the cords.

4. Adjust the angular position and the mass suspended from the fourth cord until the disc is in equilibrium when the pin is removed.
5. With a pencil, mark the positions of the strings and write the magnitude of each force.
6. Indicate the direction of the forces and determine whether the forces are balanced.
7. Choose any point on the data paper and compute the algebraic sum of torques about the chosen point.

DATA-TAKING

Description / Notation	**Value & Unit**

MASS - 1:

Mass on the holder m_1 = ...

Perpendicular Distance to the axis of rotation $d_{1\perp}$ = ...

Angle between the *x*-axis and the Force θ_1 = ...

Direction : *Clockwise* ☐ *Counterclockwise* ☐

MASS - 2:

3

Mass on the holder m_2 = ...

Perpendicular Distance

to the axis of rotation $d_{2\perp}$ = ...

Angle between the

x-axis and the Force θ_2 = ...

Direction : *Clockwise* ☐ *Counterclockwise* ☐

MASS - 3:

Mass on the holder m_3 = ...

Perpendicular Distance

to the axis of rotation $d_{3\perp}$ = ...

Angle between the

x-axis and the Force θ_3 = ...

Direction : *Clockwise* ☐ *Counterclockwise* ☐

MASS - 4:

Mass on the holder m_4 = ...

Perpendicular Distance

to the axis of rotation $d_{4\perp}$ = ...

Angle between the

x-axis and the Force θ_4 = ...

Direction : *Clockwise* ☐ *Counterclockwise* ☐

CALCULATIONS

ΣF_x : .....

ΣF_y : .....

$\Sigma \tau_z$: .....

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

PHYL102 Intro

Presentation #1

PHYL102 Lab Book