Haifaa altoumah& Rabab Alfaraj

COMPOUND (PHYSICAL) PENDULUM

OBJECTIVE:

Use the compound pendulum to find:

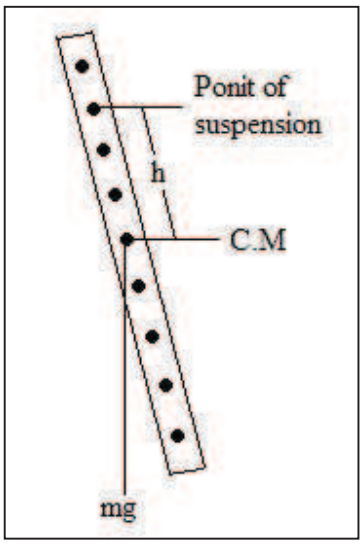
1) The acceleration due to gravity *g*.

2) The moment of inertia of the rod.

THEORY:

Any object mounted on a horizontal axis so as to oscillate under the force of gravity is a compound pendulum. The one used in this experiment is a uniform rod suspended at different locations along its length. The period T of a compound pendulum is given by

$$T = 2\pi\sqrt{\frac{I}{Mgh}} \qquad (1)$$



Where:

I is the rotational inertia of the pendulum about the axis of suspension

M is the pendulum mass

And h is the distance between the suspension point and the center of mass.

Using the parallel axis theorem

$I=I_G+Mh^2$ (2)

I_G is the rotational inertia of the body about its center of mass and it is given by

$I_G=MK^2$ (3)

Substituting equation 3 in equation 2

$I= M (h^2 + K^2)$ (4)

Where K is the radius of gyration .substituting equation 4 in equation 1

$$T = 2\pi\sqrt{\frac{h^2 + K^2}{gh}} \qquad (5)$$

The period of the simple pendulum is given by

$$T = 2\pi\sqrt{\frac{L}{g}} \qquad (6)$$

The period of a compound pendulum equals the period of a simple pendulum of a length

$$L = \frac{h^2 + K^2}{h} \qquad (7)$$

This equation can be solved to find L and K:

$$L = h_1 + h_2 \qquad (8)$$

$$K = \sqrt{h_1 h_2} \qquad (9)$$

PROCEDURE:

1- First hang the pendulum horizontally and move it until it reaches equilibrium so you can find the center of mass and mark it.

2- Secondly hang it vertically inserting the tip of the knife in the first hole from the center of mass. Then set it oscillating through a small angle.

3- Measure the time needed for 20 oscillations and the corresponding h.

4- Repeat steps 2 and 3 for the other holes.

5- Record your measurements in a table.

By Haifaa altoumah& Rabab Alfaraj

MEASURMENTS AND RESULTS:

M=

One Side from C.M			The other side of C.M		
h(m)	20T (s)	T(s)	h(m)	20T (s)	T(s)

From the graph:

T	h_1 (average)	h_2 (average)	$L=h_1+h_2$	$K=\sqrt{h_1 h_2}$	$g=\frac{4\pi^2 L}{T^2}$	$I_G=MK^2$
(s)	(m)	(m)	(m)	(m)	(m/s^2)	Kg m^2

Finally calculate:

g (average)

I_G (average)

GRAPHS: