Name:

Class:

PRE-EXPERIMENT 4: ROTATIONAL MOTION OF A RIGID BODY

OBJECTIVE

To determine the moment of of a fly-wheel.

INTRODUCTION

1. What is a rigid body?

   Rigid body is a body which change its size and shape when the force is exerted on it.

2. What is meant by moment of inertia?

   Moment of inertia is the tendency of a body to resist motion, expressed as the sum of the product of the mass of each particle in the body and the square of its perpendicular distance from the axis of rotation.

3. What is the symbol and SI unit for **moment of inertia**?

   Symbol of moment of inertia:

   SI unit of moment of inertia:

4. Moment of inertia depends on and from axis of rotation.

5. Complete **TABLE 4** with correct analogues between linear motion and rotational motion.

Linear Motion	Rotational Motion
Mass, m	Moment of inertia, I
Acceleration, a	
Net force, F	

LIVEWORKSHEETS

6. A motor capable of producing a constant torque of 100 N m is connected to a fly-wheel which rotates with an angular acceleration of 1000 rad s^{-2}. Calculate moment of inertia of the fly-wheel.

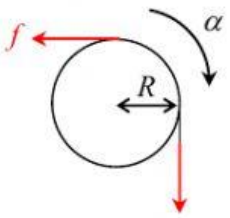
Using equation, $\tau = I\alpha$

Moment of inertia, $I = \frac{\tau}{\alpha} =$ ——— = _____ kg m^2

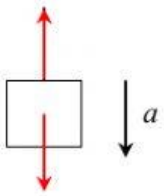
EXPERIMENT

7. Identify the forces exerted on the fly-wheel and falling slotted mass which causes acceleration.

(a) Fly-wheel



(b) Falling slotted mass



8. By referring to the diagram in 7.(a) and 7.(b), deduce equation by using Newton's 2nd law of motion.

(a) Fly-wheel:

$$\Sigma \vec{\tau} = \tau_{net}$$

$$-\tau = I\alpha$$

(b) Falling slotted mass:

$$\Sigma \vec{F} = F_{net}$$

$$mg - T =$$

$$T = mg - ma$$

LIVEWORKSHEETS

9. For this experiment, identify the

(a) manipulated variable: mass of the

(b) responding variable: time taken to reach

10. Complete the observation table with the suitable equation.

Acceleration	Angular acceleration	Tension in the string

$\alpha = \frac{a}{R} = \frac{2a}{d}$

$T = m(g - a)$

$a = \frac{2h}{t^2}$

DATA ANALYSIS

11. Complete the equation of the graph of α against T.

$$\alpha = \left(\frac{\quad}{I}\right)T - \left(\frac{\tau}{I}\right)$$

12. Base on the linear graph equation $y = mx + c$, fill in the suitable quantity by referring the equation in question 11.

(a) y-axis

(b) x-axis

(c) gradient, k

(d) y-interception

$\frac{R}{I}$

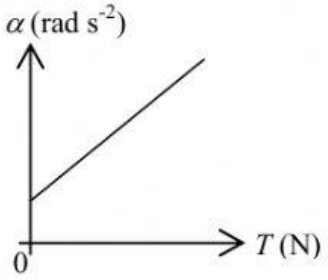
$-\frac{\tau}{I}$

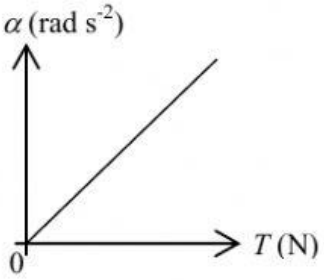
α

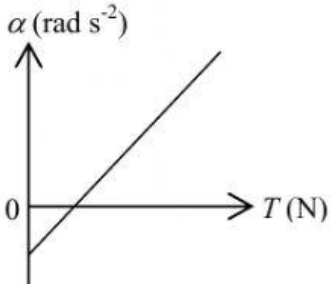
T

LIVEWORKSHEETS

13. Which of the following graphs represents this experiment?







14. How do we determine the value of moment of inertia of the fly-wheel from this graph?

Using the **gradient** of α against T graph,

$k = \frac{R}{I}$

$k = \frac{I}{R}$

Thus, moment of inertia of the fly-wheel,

$I = \frac{R}{k} = \frac{d}{2k}$

$I = kR = \frac{kd}{2}$

15. List the **POSSIBLE** precautions of this experiment.

(i) Make sure the slotted mass released from a height.

(ii) Avoid any external when releasing the slotted mass.

(iii) the string around the axle neatly.

(iv) Apply lubricants around the axis of rotation of the fly-wheel to frictional torque.

(v) Take repeated of time, t for each slotted mass.

LIVEWORKSHEETS