



Name Surname- Signature:

EXPERIMENT NO	5
EXPERIMENT TITLE	: ROTATIONAL MOTION
OBJECTIVE OF THE EXPERIMENT (10 points):	

1) Determine the position of the traces by taking the direction of motion as the positive **y** direction. Then, record the position of each trace and the time it takes for mass **m** to reach that position in the table below..
(5 points)

[illegible]

2) Using the data from the table, plot the position versus the square of time ($y-t^2$) graph. Calculate the **linear acceleration** of the motion using the slope of this graph. **(15 points)**

3) Determine the angle φ that the air table makes with the horizontal. Calculate the theoretical linear acceleration from the relation below (**take $g = 980 \text{ cm/s}^2$**) and compare it with the experimental acceleration found in item 2 by calculating the % error. **(15 points)**

$$a_{\text{theo}} = mg \sin\varphi / (m + M/2)$$

4) Using the experimental acceleration a , calculate the angular acceleration of the disk and the tension in the string from the equations below. **(10 points)**

$$\alpha = a / R \quad T = m(g \sin\varphi - a)$$

5) Calculate the experimental moment of inertia of the disk using the α and T values found in item 4. Compare it with the theoretical value by calculating the % error. **(15 points)**

$$I_{\text{exp}} = RT / \alpha \quad I_{\text{theo}} = MR^2 / 2$$

6) Calculate the final linear velocity of mass m and the final angular velocity of the disk. **(10 points)**

$$v_{\text{final}} = a \cdot t_{\text{final}} \quad \omega_{\text{final}} = v_{\text{final}} / R$$

- 7) Taking $d = y_{\text{final}}$, calculate the potential energy lost by mass m and the total kinetic energy gained by the system (take $I = I_{\text{theo}}$). State whether mechanical energy is conserved; if there is a difference, discuss its causes. **(15 points)**

$$\Delta U = mgd \sin\phi \quad K = \frac{1}{2}mv_{\text{final}}^2 + \frac{1}{2}I\omega_{\text{final}}^2$$

- 8) Interpret the results obtained in the experiment. **(5 points)**