Student's Name: ________________________________ Student's Name: ________________________________

Lab day & time: ____________________ Date: ___________________

Rotational Motion (M7) - Data Sheets

(Show all calculations and write all results on the data sheets in ink)

Activity 1: Moment of Inertia *(2 p.)*

Be sure to fill-in the correct units in the space provided: (   )

Mass of Aluminum disk M_1 = ______________ (   )

Radius of Aluminum disk R = ______________ (   )

The theoretical value of the moment of inertia of the Aluminum disk:

I_{disk} = ______________ (   )

Mass of the black ring M_2 = ______________ (   )

Inner radius of the black ring R_{inner} ______________ (   )

Outer radius of the black ring R_{outer} = ______________ (   )

The theoretical value of the moment of inertia of the black ring:

I_{ring} = ______________ (   )

Moment of inertia of the Aluminum disk and the black ring combined:

$I_{Activity\ 1} = I_{disk} + I_{ring}$ = ____________ (   )

Activity 2: Moment of Inertia from Angular Acceleration *(2 p.)*

Be sure to fill-in the correct units in the space provided: (   )

Radius of the <u>middle disk</u> of the 3-step pulley r = ____________ (   )

Average angular acceleration $|\alpha_{AVE}|$ data for the Aluminum disk and the black ring combined.

Mass of the brass discs and the plastic mass hanger combined (kg)	m = 0.045 kg	m = 0.065 kg	m = 0.085 kg
Absolute value of the angular acceleration $|\alpha_{AVE}|$ (rad/s^2)			

Complete the table below. Use the <u>angular acceleration</u> for each of the mass values in calculating the linear acceleration (a).

	m = 0.045 kg	m = 0.065 kg	m = 0.085 kg
Linear acceleration $a = |\alpha_{AVE}|\, r$ (m/s^2)			
Force $T = m\,(g-a)$ (N)			
Torque $\tau = T{*}r = m\,(g-a)r$ (N*m)			
Moment of inertia $I = \tau/|\alpha_{AVE}|$ (kg*m^2)			

The average moment of inertia for all three masses attached to the pulley:

$I_{Activity\ 2}$ = ________________ (kg*m^2)

In *Activity 1*, you calculated the moment of inertia of the disk and the ring combined. Find the percent difference between the value of the moment of inertia (for the disk and the ring combined) measured in Activity 2 versus the combined moment of inertia from Activity 1.

$$\text{Percent difference} = \left|\frac{I_{\text{Activity 2}} - I_{\text{Activity 1}}}{I_{\text{Activity 1}}}\right| \times 100\% = \_\_\_\_\_\_\_\_\_\_ \ (\%)$$

Activity 3: Changing Moment of Inertia *(1 p.)*

Does the angular velocity change when the person on the platform quickly pull-in his arms?

(*increases, decreases, or no change*) _____________

Does the mass of the person on the platform change when he pull-in his arms?

(*increases, decreases, or no change*) _____________

Does the moment of inertia of the person on the platform change when he pull-in his arms?

(*increases, decreases, or no change*) _____________

Is the angular momentum conserved in this experiment?

(*Yes or No*) ______

If yes, then why? If no, then why not? ____

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Activity 4: Conservation of Angular Momentum *(1.5 p.)*

What is the motion of the person on the platform at the beginning, when the axis of the wheel is horizontal?

(Options: *spinning clockwise, spinning counterclockwise, no motion*) ________________

What is the initial value of the angular momentum vertical component of the person on the platform when the axis of the bicycle wheel is horizontal?
(Options: *positive, negative, zero*) ________________

What is the motion of the person on the platform when the axis of the wheel is turned vertical?
(Options: *spinning clockwise, spinning counterclockwise, no motion*) __________________

What is the direction of rotation of the platform, when the person on the platform inverted (turned upside down) the bicycle wheel?
(Options: *spinning clockwise, spinning counterclockwise, no motion*) __________________

What is the direction of rotation of the platform relative to the direction of rotation of the wheel?
(Options: *spinning in the same direction, spinning in the opposite direction, no motion*)

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What is the total value of the angular momentum vertical component of the platform when the axis of the spinning bicycle wheel is vertical (including the momentum of the wheel)?
(Options: *positive, negative, zero*) ________________________

You noticed that the person on the platform is spinning much slower (and in the opposite direction) than the bicycle wheel. The person on the platform is spinning slower because it has ____.

(Options: *smaller moment of inertia; more friction; larger moment of inertia*)

Complete the lab report and return it to the lab TA.