Name: _____ DISC: _____ Score: _____ / 20

Instructions:

- Do your own work.
- Answer the questions below in the space provided.
- Make sure you show all your work and any equations that you use.
- Please place a box around your answers.
- Remember to give the correct units with all numerical answers.

Q1	Q2	Q3	Q4
10	10	5	5

1. A block of mass *M* is tied to a string fixed at the center of a frictionless circular disk as shown below. The block rotates with constant angular speed ω and radius *R* around the center.

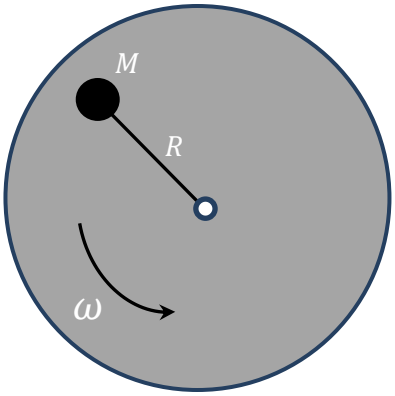


Figure 1: Top View of a Rotating Block

Table 1: Properties of the System

R	***M***	**I**	***ω***
$1.4\ m$	$2.5\ kg$	MR^2	$9\ rad/s$

External Torques (2 pts):

a. Are there external torques acting on this system around the axis of rotation?
   i. No, since the disk is frictionless.
   ii. Yes, since the string has tension pulling on the block.

Explanation of Conservation (3 pts):

b. Like linear momentum, angular momentum is a conserved quantity. In your own words, explain the conditions under which angular momentum is conserved.

Angular Momentum (2 pts):

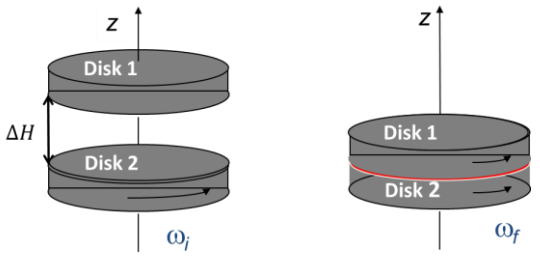
c. Remember, angular momentum is $L = I\omega$. What is the angular momentum of the block?

New speed (3 pts):

d. You pull on the string, reducing the radius of rotation to $1/4$ of the original radius. Calculate the new angular speed ω_{new}.

2. Consider a system consisting of two circular disks as shown below. Their masses, radii, and initial angular speeds are given as follows:

DISK	MASS	RADIUS	INITIAL ω
1	$60\ kg$	$0.6\ m$	$0\ rad/s$
2	$50\ kg$	$0.6\ m$	$40\ rad/s$



Initial (Start) Final (Finish)

Explanation (3 pts):

a. Initially, Disk 1 is stationary and Disk 2 is rotating with angular speed ω_i as shown in the figure above (left panel). Disk 1 suddenly falls onto Disk 2; then, they stick together and rotate with angular speed ω_f as depicted in the right panel. Explain in your own words what you expect to be conserved and why.

Angular Momentum (2 pts):

b. Calculate the angular momentum for the *Initial* system.

Angular Momentum (2 pts):

c. What is the *final* angular momentum of the system?

Final speed (3 pts):

d. Find the *final* angular speed (ω_f) of the system.