

Name: \_\_\_\_\_

DISC: \_\_\_\_\_

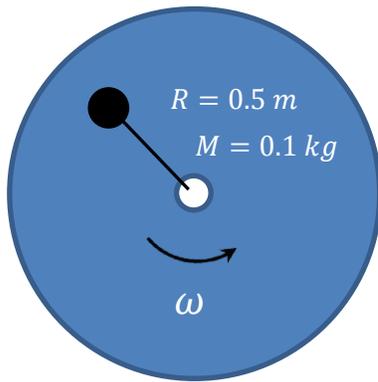
Score: \_\_\_\_ / 20

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. Consider a block tied to a string which rotates with constant speed on a frictionless surface as shown in the diagram.



R (disk-to-block)	M (block)	I	$\omega$
0.5 m	0.1 kg	$MR^2$	10 rad/s

Table 1: Properties of the System

Figure 1: Top View of Rotating Block

- a. There are external torques acting on this system?

External Torques (2 pts):

- i. No, the table is frictionless.
- ii. Yes, the string has tension pulling on the block.

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

Explanation of Conservation (3 pts):

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

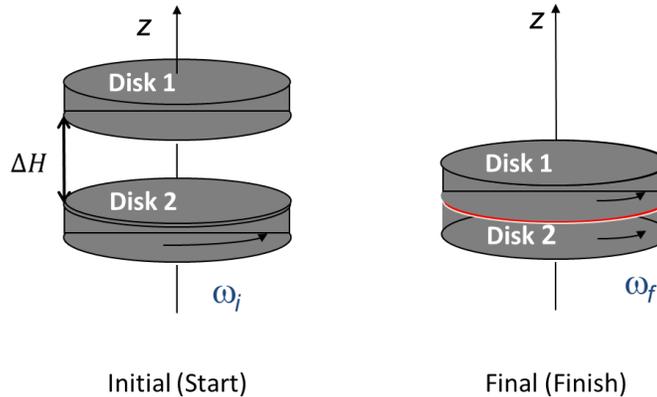
Angular Momentum (2 pts):

- d. You pull on the string, reducing the radius of the rotation by  $R/3$ . Calculate the new rotational velocity  $\omega_{new}$ .

New speed (3 pts):

2. Consider the system of two disks as shown in the diagram. The important parameters are given in the table:

DISK	MASS	RADIUS	MOMENT OF	INITIAL $\omega$
1	20 kg	0.5 m	$\frac{1}{2}MR^2$	0 rad/s
2	10 kg	0.5 m	$\frac{1}{2}MR^2$	30 rad/s



- a. Disk 1 is initially stationary and Disk 2 is initially rotating as shown in the *Initial* diagram. Disk 1 suddenly falls resulting in the situation in the *Final* diagram. Explain in your own words what you expect to happen.

Explanation (3 pts):

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

Angular Momentum (2 pts):

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

Angular Momentum (2 pts):

- d. Find the final rotational speed ( $\omega_f$ ) of the system of disks in the *Final* diagram.

Final speed (3 pts):