

Name: _____

DISC: _____

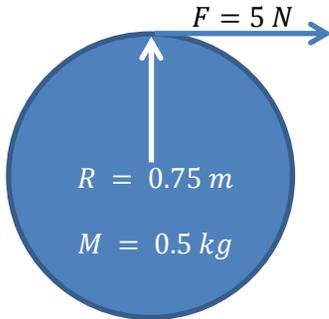
Score: ____ / 20

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 solid, horizontal disk is free to rotate about its center. A force of $F = 5\text{ N}$ acts tangentially at the edge of the disk.



MASS	RADIUS	I
0.5 kg	0.75 m	$I = \frac{1}{2}MR^2$

Table 1: Properties of the Disk

- a. What is the torque on the disk ($\tau = RF \sin\theta$)?

Torque (3 pts):

- b. The disk starts rotating from rest. Using $\tau = I \alpha$, what is the angular acceleration of the disk?

Angular Acceleration (2 pts):

- c. Recall: $\omega(t) = \omega_0 + \alpha t$. Calculate the angular speed of the disk at $t = 5\text{ s}$.

Angular speed (2 pts):

- d. What is the kinetic energy of the disk at $t = 5\text{ s}$ ($K = \frac{1}{2}I\omega^2$)?

Kinetic Energy (3 pts):

2. A solid cylinder rolls without slipping down an inclined plane. The cylinder starts from rest at the top of the incline. The following are true about the cylinder-inclined plane system:

ANGLE OF INCLINE	LENGTH OF INCLINE	CYLINDER MASS	CYLINDER RADIUS
20°	2 m	3 kg	0.2 m

- a. Draw a figure which describes the cylinder and inclined plane *before* the cylinder starts to roll. Remember to label all parts of the diagram.

Figure (2 pts):

- b. As the cylinder rolls down the incline which of the following occur (select all correct responses):

Selections (2 pts):

- i. Momentum is conserved.
 - ii. Potential energy is converted into kinetic energy.
 - iii. The cylinder will have both rotational and translational kinetic energy.
- c. What is the potential energy of the cylinder at the top of the incline ($U = mgh$)?

Potential Energy (2 pts):

- d. What is the total kinetic energy ($K = \frac{1}{2}Mv_{cm}^2 + \frac{1}{2}I\omega^2$) at the bottom of the incline (hint: total energy is conserved).

Total Kinetic Energy (2 pts):

- f. Using $\omega = v_{cm}/R$, find the rotational speed of the cylinder at the bottom of the ramp. For a solid cylinder $I = \frac{1}{2}MR^2$.

Rotational Speed (2 pts):