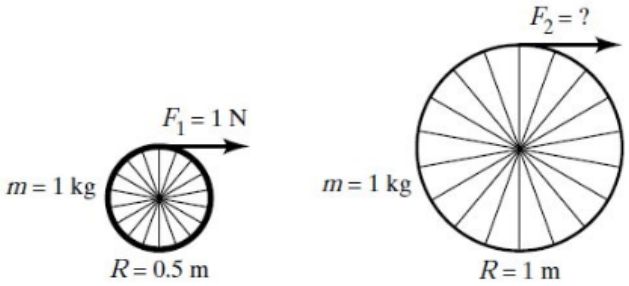
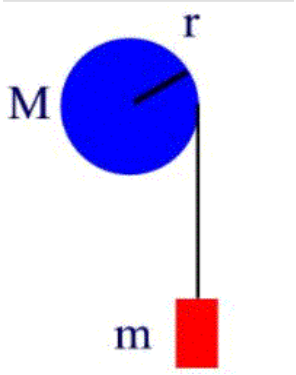
Name:_____

AP Physics 1: Rotational Motion
End of Chapter – Wrap Up

1. Two wheels with fixed hubs, each having a mass of 1.00 kg start from rest. Forces are applied F_1 = 1.00 N to the first wheel and F_2 to the second. Assume the hubs and spokes are massless, so that the moment of inertia about the center of mass is $I = MR^2$. How large must the force F_2 be so that both wheels have the same angular acceleration?



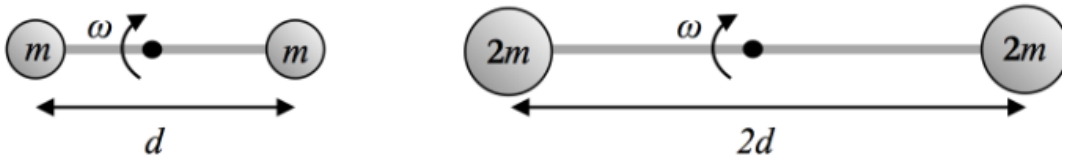
2. A uniform cylinder with a mass of 5.60 kg and a radius of 0.320 m is free to rotate about a horizontal axis. There is a mass of 92.0 grams tied to a string that is wrapped about the cylinder. The mass accelerates towards the ground.
   A. What is the moment of inertia of the cylinder?
   B. What is the cylinder's angular acceleration as the mass falls?
   C. What is the angular velocity of the cylinder when it has completed one revolution?



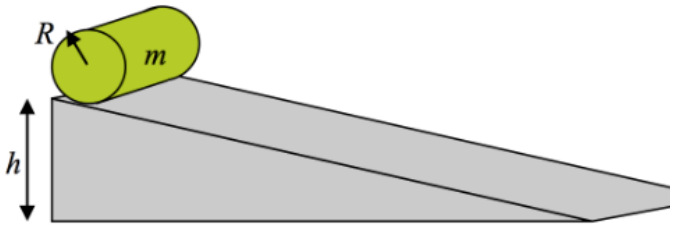
3. A solid disk with radius R, mass M, and moment of inertia $1/2MR^2$, rolls along a surface (without slipping) as a constant velocity v. What is the angular momentum of this disk about its axis as it rolls?
   A. MRv
   B. $\frac{MRv}{2}$
   C. 2MRv
   D. Mω
   E. $\frac{M\omega}{2}$

4. A dumbbell consists of two masses m connected by a rigid rod of negligible mass and length d. A physics student takes the dumbbells and rotates it about its center of mass with an angular velocity ω, giving it an angular momentum of L_1. The student then takes a second dumbbell, with masses 2m and length 2d and rotates them with the same angular velocity ω. What is the angular momentum of L_2 of this second dumbbell?

A. $2\ L_1$
B. $4\ L_1$
C. $6\ L_1$
D. $8\ L_1$
E. $16\ L_1$



5. A cylinder of mass m and radius R has a moment of inertia of $1/2mR^2$. The cylinder is released from rest at a height h on an incline plane, and rolls down the plane without slipping. What is the velocity v of the cylinder when it reaches the bottom of the incline?



A. $\sqrt{\frac{4}{3}gh}$

B. $\sqrt{\frac{1}{2}gh}$

C. $\sqrt{\frac{3}{4}gh}$

D. $\sqrt{\frac{3}{4}mgh}$

E. $\sqrt{gh}$

6. **[Bonus]** Suppose the Sun were to eventually collapse into a white dwarf, losing up to half its mass in the process and winding up with a radius 1.00% of its existing radius. Assuming the lost mass does not carry away any angular momentum, what would be the new period of the Sun's rotation?

Additional Values:

- Mass of the Sun: 1.989×10^{30} kg
- Radius of the Sun: 6.957×10^{8} m
- Current Period of the Sun = 30 days