

HW8 - due 6 pm Day 16 (Mon. Aug. 18) (6049271)

Question [1](#) [2](#) [3](#) [4](#) [5](#) [6](#) [7](#) [8](#) [9](#) [10](#) [11](#) [12](#) [13](#) [14](#) [15](#) [16](#) [17](#) [18](#)

1. Question Details

OSColPhys1 10.P.028.WA. [2611790]

The specifications for a ceiling fan you have just bought indicate that the total moment of inertia of its blades is $0.23 \text{ kg} \cdot \text{m}^2$ and they experience a net torque of $3.0 \text{ N} \cdot \text{m}$.

(a) What is the angular acceleration of the blades?

 rad/s^2 (b) When the blades rotate at 300 rpm what is the rotational kinetic energy? J

Supporting Materials

[Physical Constants](#)

2. Question Details

OSColPhys1 10.P.030.WA. [2611724]

A typical helicopter with four blades rotates at 260 rpm and has a kinetic energy of $6.85 \times 10^5 \text{ J}$. What is the total moment of inertia of the blades?

 $\text{kg} \cdot \text{m}^2$

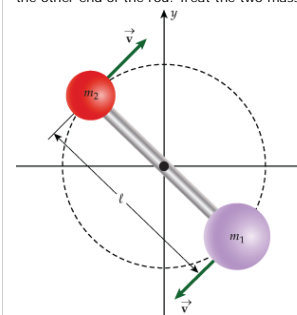
Supporting Materials

[Physical Constants](#)

3. Question Details

OSColPhys1 10.P.035.Tutorial.WA. [2611971]

A uniform rod of mass 2.40 kg and length 2.00 m is capable of rotating about an axis passing through its center and perpendicular to its length. A mass $m_1 = 4.90 \text{ kg}$ is attached to one end and a second mass $m_2 = 3.50 \text{ kg}$ is attached to the other end of the rod. Treat the two masses as point particles.



(a) What is the moment of inertia of the system?

 $\text{kg} \cdot \text{m}^2$ (b) If the rod rotates with an angular speed of 2.10 rad/s , how much kinetic energy does the system have? J

(c) Now consider the rod to be of negligible mass. What is the moment of inertia of the rod and masses combined?

 $\text{kg} \cdot \text{m}^2$ (d) If the rod is of negligible mass, what is the kinetic energy when the angular speed is 2.10 rad/s ? J

Supporting Materials

[Physical Constants](#)

4. Question Details

OSColPhys1 10.P.029.WA. [2611551]

A baseball has a mass of 0.15 kg and radius 3.7 cm . In a baseball game, a pitcher throws the ball with a substantial spin so that it moves with an angular speed of 30 rad/s and a linear speed of 47 m/s . Assuming the baseball to be a uniform solid sphere, determine the rotational and translational kinetic energies of the ball.

 $KE_{\text{rotational}} =$ J $KE_{\text{translational}} =$ J

Supporting Materials

[Physical Constants](#)

5. Question Details OSColPhys1 10.P.038.WA. [2611670]

A bus contains a 1500-kg, 0.600-m radius flywheel (a disk) and has a total mass of 10,000 kg.

(a) Calculate the angular velocity the flywheel must have to contain enough energy to take the bus from rest to a speed of 17.5 m/s, assuming 91.5% of the rotational kinetic energy can be transformed into translational energy.

 111 rad/s

(b) How high a hill can the bus climb with this stored energy and still have a speed of 5.00 m/s at the top of the hill?

 14.3 m

Supporting Materials

Physical Constants

6. Question Details OSColPhys1 10.P.036.WA. [2611728]

(a) What is the final velocity of a hoop that rolls without slipping down a 8.10 m high hill, starting from rest?

 8.91 m/s

(b) What would be the final velocity if a disk of the same mass and radius as the hoop rolled down the hill?

 10.3 m/s

Supporting Materials

Physical Constants

7. Question Details OSColPhys1 10.P.037.WA. [2611787]

A solid cylinder is released from the top of an inclined plane of height 0.27 m. From what height on the incline should a solid sphere of the same mass and radius be released to have the same speed as the cylinder at the bottom of the hill?

 0.252 m

Supporting Materials

Physical Constants

8. Question Details OSColPhys1 10.P.040.WA. [2611509]

A ramp is inclined at an angle of 25° with the horizontal. You release a thin spherical shell of radius 0.40 m and it rolls without slipping, down the ramp for a distance L . If the mass of the shell is 1.5 kg, and its angular speed when it reaches the end of the ramp is 28.8 rad/s, what is the value of L ?

 26.7 m

Supporting Materials

Physical Constants

9. Question Details OSColPhys1 10.P.048.WA. [2611579]

When a diver gets into a tuck position by pulling in her arms and legs, she increases her angular speed. Before she goes into the tuck position, her angular velocity is 5.5 rad/s and she has a moment of inertia of $1.1 \text{ kg} \cdot \text{m}^2$. Once she gets into the tuck position, her angular speed is 19.1 rad/s. Determine her moment of inertia when she is in the tuck position. Assume the net torque on her is zero.

 0.317 $\text{kg} \cdot \text{m}^2$

Supporting Materials

Physical Constants

10. Question Details OSColPhys1 10.P.050.WA. [2611527]

A supernova results when a star that has used up all of its fuel undergoes an extremely violent explosion and its mass is blown outward. Consider the star, before the explosion to be a solid sphere of radius R rotating with an angular speed of 2.0 rev/day. Once the star explodes its mass rapidly expands into a spherical shell. Assuming that all of the star's mass is contained within this spherical shell and there are no external torques acting on it, what is the angular speed of this mass when the radius of the spherical shell is $5.0R$?

 0.048 rev/day

Supporting Materials

Physical Constants

11. Question Details OSColPhys1 10.P.047.WA. [2611767]

(a) Calculate the angular momentum of an ice skater spinning at 6.00 rev/s given his moment of inertia is $0.410 \text{ kg} \cdot \text{m}^2$.

 15.5 $\text{kg} \cdot \text{m}^2/\text{s}$

(b) He reduces his rate of spin (his angular velocity) by extending his arms and increasing his moment of inertia. Find the value of his moment of inertia if his angular velocity drops to 1.65 rev/s.

 1.49 $\text{kg} \cdot \text{m}^2$

(c) Suppose instead he keeps his arms in and allows friction with the ice to slow him to 3.00 rev/s. What average torque was exerted if this takes 19.0 seconds? (Indicate the direction with the sign of your answer. Assume that the skater's rotation is in the positive direction.)

 -0.407 $\text{N} \cdot \text{m}$

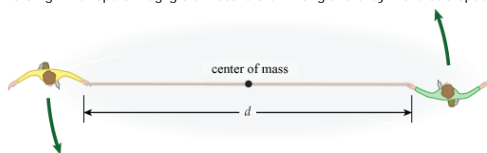
Supporting Materials

Physical Constants

12. Question Details

OSColPhys1 10.P.045.WA. [2611623]

Two friends hold on to a rope, one at each end, on a smooth, frictionless ice surface. They skate in a circle about an axis through the center of the rope and perpendicular to the ice. The mass of one friend is 76.0 kg and the other has a mass of 125.0 kg. The rope of negligible mass is 3.5 m long and they move at a speed of 5.50 m/s.



(a) What is the magnitude of the angular momentum of the system comprised of the two friends?

 $\text{kg} \cdot \text{m}^2/\text{s}$

(b) They now pull on the rope and move closer to each other so that the rope between them is now half as long. Determine the speed with which they move now.

 m/s

(c) The two friends have to do work in order to move closer to each other. How much work did they do?

 J

Supporting Materials

Physical Constants

13. Question Details

OSColPhys1 10.P.046.Tutorial.WA. [2611937]

A 1.80 -m radius playground merry-go-round has a mass of 120 kg and is rotating with an angular velocity of 0.410 rev/s. What is its angular velocity after a 40.0 -kg child gets onto it by grabbing its outer edge? The child is initially at rest.

 rev/s

Supporting Materials

Physical Constants

14. Question Details

OSColPhys1 10.P.049.WA. [2611803]

A carousel has a radius of 1.70 m and a moment of inertia of 114 $\text{kg} \cdot \text{m}^2$. A girl of mass 48.5 kg is standing at the edge of the carousel, which is rotating with an angular speed of 3.10 rad/s. Now the girl walks toward the center of the carousel and stops at a certain distance from the center d . The angular speed of the carousel is now 5.2 rad/s. How far from the center did the girl stop?

 m

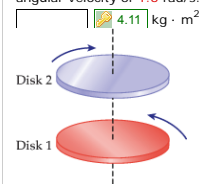
Supporting Materials

Physical Constants

15. Question Details

OSColPhys1 10.P.059.WA. [3092729]

In the diagram disk 1 has a moment of inertia of 3.8 $\text{kg} \cdot \text{m}^2$ and is rotating in the counterclockwise direction with an angular velocity of 6.3 rad/s about a frictionless rod passing through its center. A second disk rotating clockwise with an angular velocity of 8.9 rad/s falls from above onto disk 1. The two then rotate as one in the clockwise direction with an angular velocity of 1.6 rad/s. Determine the moment of inertia of disk 2.



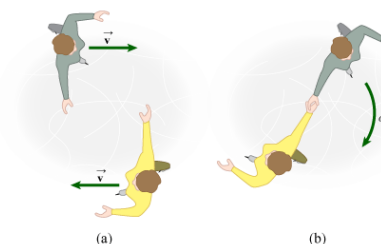
Supporting Materials

Physical Constants

16. Question Details

OSColPhys1 10.P.056.WA. [2611542]

Twin skaters approach one another as shown in the figure below and lock hands.



(a) Calculate their final angular velocity, given each had an initial speed of 1.90 m/s relative to the ice. Each has a mass of 70 kg, and their centers of mass are 0.710 m from their locked hands. You may approximate their moments of inertia to be that of point masses at this radius.

 rad/s

(b) Compare the initial and final kinetic energy.

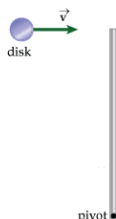
$$\frac{KE_i}{KE_f} = \text{input} \quad \text{input}$$

Supporting Materials

Physical Constants

17. Question Details OSColPhys1 10.P.057.WA. [2611775]

The figure shows an overhead view of a 2.30-kg plastic rod of length 1.20 m on a table. One end of the rod is attached to the table, and the rod is free to pivot about this point without friction. A disk of mass 47.0 g slides toward the opposite end of the rod with an initial velocity of 22.5 m/s. The disk strikes the rod and sticks to it. After the collision, the rod rotates about the pivot point.



(a) What is the angular velocity of the two after the collision?
 rad/s

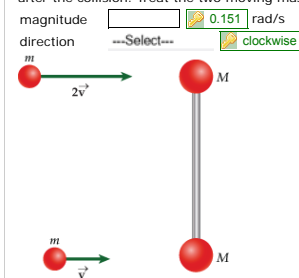
(b) What is the kinetic energy before and after the collision?
 $KE_i =$ J
 $KE_f =$ J

Supporting Materials

[Physical Constants](#)

18. Question Details OSColPhys1 10.P.060.WA. [2611444]

A cylindrical rod of length 2.0 m, radius 0.5 m, and mass 1.5 kg has two spheres attached on its ends. The centers of the spheres are 1.0 m from the center of the rod. The mass of each sphere is 0.66 kg. The rod is capable of rotating about an axis passing through its center and perpendicular to the plane of the page, but the set up is stationary to begin with. A small mass of value 0.23 kg moving with a velocity $v = 1.5$ m/s strikes the bottom mass of the dumbbell and sticks to it. At the same instant, a second mass of equal value but moving with twice the velocity strikes the top mass of the dumbbell and sticks to it. The entire system starts to rotate. Determine the magnitude and direction of the angular velocity of the system after the collision. Treat the two moving masses and the masses at the end of the rod like point particles.



Supporting Materials

[Physical Constants](#)

Assignment Details

Name (AID): HW8 - due 6 pm Day 16 (Mon. Aug. 18) (6049271)
 Submissions Allowed: 5
 Category: Homework
 Code:
 Locked: No
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 Last Saved: Aug 15, 2014 08:06 AM PDT
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