Review Problems for Celebration #2

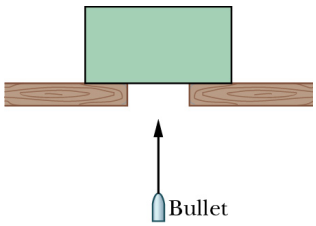
Q1) If the net force on a system is zero, is the net torque also zero? *Explain.*

If the net torque on a system is zero, is the net force also zero? *Explain.*

Q2) Suppose a solid sphere was rolling smoothly across a level surface such that it's total kinetic energy (translational plus rotational) was equal to 10.0 J. How much energy would a spherical shell have if it had the same mass and radius as the solid sphere and was rolling at the same speed?

Problem 1

A 9.5 g bullet moving directly upward at 1.15×10^3 m/s strikes and passes through the center of mass of a 5.0 kg block initially at rest (see the figure below). The bullet emerges from the block moving upward at 450.0 m/s.

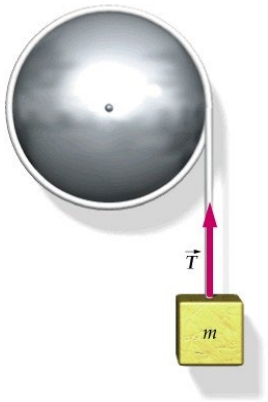


a) How high does the block rise?

b) If the bullet was in contact with the block for 1.00×10^{-4} s, what was the average force exerted by the bullet on the block?

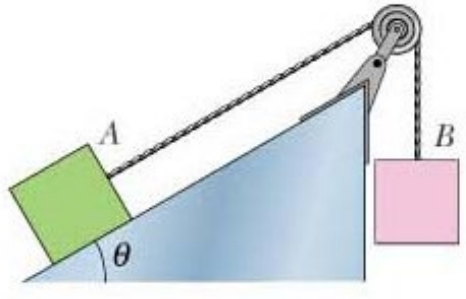
Problem 2

A uniform sphere of mass 5.0 kg and radius 0.75 m is free to rotate about a horizontal axis through its center. A string is wrapped around the sphere and is attached to an object of mass 300 g. Find the *acceleration* of the object.



Problem 3

In the figure below, block A has a mass of 4.50 kg, block B has a mass of 3.75 kg, and the angle of the frictionless inclined plane is $\theta = 35.0°$. The two blocks are connected by massless string that passes over a pulley (disk) of mass 1.50 kg and radius of 25 cm. If the system is released from rest, how long does it take the pulley to reach an angular velocity of 22.5 rad/s?

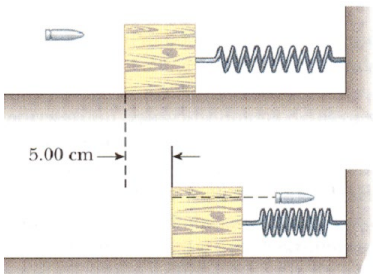


Problem 4

Problem 4 A rotating, horizontal turntable completes one turn every 1.50 s. A coin is located at a distance 35.0 cm from the center of the turntable. If the coin is on the verge of slipping, what is the coefficient of static friction between the coin and turntable?

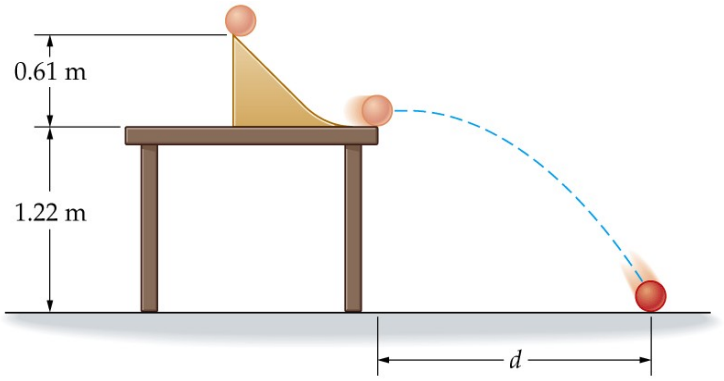
Problem 5

A 5.00-g bullet moving with an initial speed of 400 m/s is fired into and passes through a 1.00-kg block very quickly. The block, initially at rest on a frictionless, horizontal surface, is connected to a spring of force constant 900 N/m. If the block moves 5.00 cm to the right after impact, find the **speed** at which the bullet **emerges** from the block.



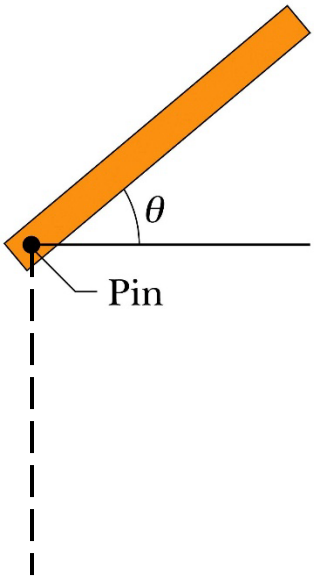
Problem 6

A solid sphere released from rest rolls without slipping down a ramp, dropping a vertical height of 0.61 m. The ball leaves the bottom of the ramp, which is 1.22 m above the floor, moving horizontally (see the figure below). How far from the edge of the table does the ball land?



Problem 7

The thin uniform rod in the figure has length 2.40 m and can pivot about a horizontal, frictionless pin through one end as shown in the figure below. It is released from rest at angle $\theta = 40^{o}$ above the horizontal. **(a)** What is the angular speed of the rod as it passes through the vertical dashed line? **(b)** What is the linear speed of the center of mass as it passes through the vertical dashed line?



Problem 8

The figure to the right shows an overhead view of a uniform disk that can rotate about its center like a merry-go-round. The disk has a radius of 25 cm and a mass of 1.50 kg and is initially at rest. Starting at t = 0 s, two forces are applied as indicated in the figure. The magnitude of F_1 is 5.50 N and the magnitude of F_2 is 6.00 N. The forces maintain their orientations as the disk rotates. What is the magnitude of total acceleration of a point on the rim of the disk at t = 0.50 s?