At a playground, a child pushes perpendicularly on the outside edge of a merry-go-round with a force of 30 N. If the diameter of the merry-go-round is 3.5 m, what torque is applied?

Torque = F l sin θ, where θ is 90 degrees

Torque = 30 N * (3.5 / 2), because l is the distance from where the F is applied to the point of rotation of the object.

52.5 N m

Two children are balanced on a seesaw when one is 1.6 m and the other is 2.5 m from the pivot point. If the first has a mass of 23 kg, what is the mass of the second child?

Balance the torques on both side! (Torque = F l sin θ),

F = m*g

(1.6 m * 23 kg * 9.8 m/s^2) = (2.5 m * X kg * 9.8 m/s^2)

X = 14.72 kg

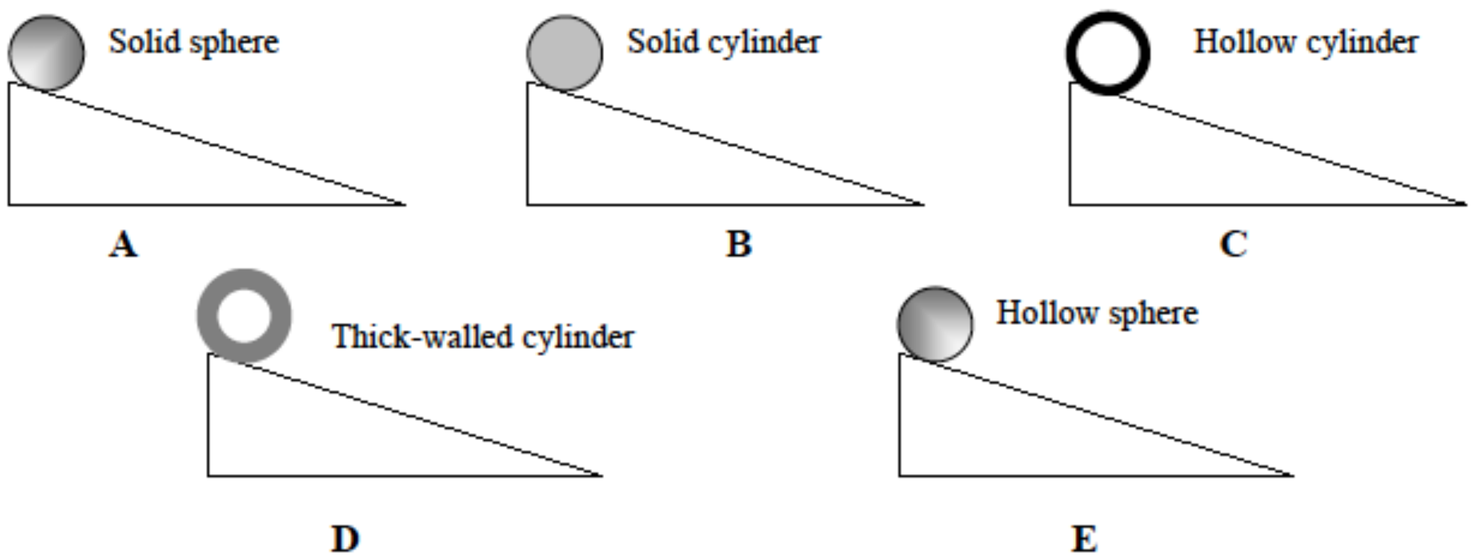
A centrifuge rotor has a moment of inertia of 3.5 x 10^{-2} kg m^2. How much energy is required to bring it to rest from 12,500 rpm (revolutions per minute)?

This is also conservation of energy. The rotor has a KE = ½ I w2, when it is in motion. Therefore, this is the amount of energy needed to bring it to rest. w must be in radians/seconds:

KE = ½ (3.5 x 10^{-2} kg m^2) * (125000 * 1/60 * 2pi rad/1 rev)^2 = 30,000 J

Shown below are five objects of equal mass and radius. All five objects are released from rest and roll the same distance down the same hill without slipping.

Rank the situations shown below from greatest to least in terms of their total mechanical energy when they reach the bottom of the hill.



Answer: they all have the same E at the bottom of the hill! Conservation of energy says they all start with the same energy (E total initial = PE = mgh, and they all have the same mass and same height above ground to start.