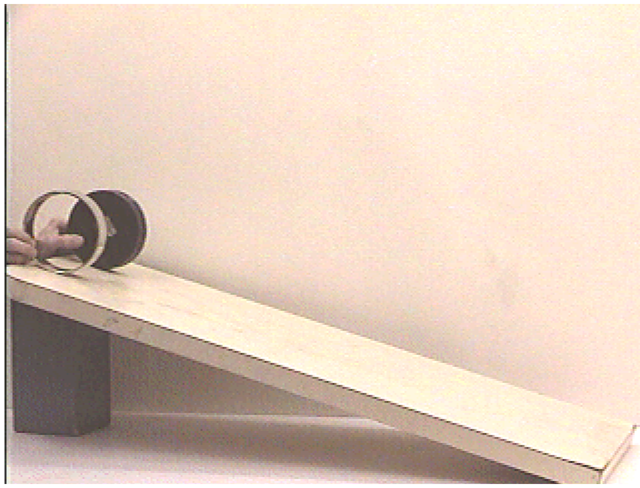
Answer #59

The answer is (b): the disc will win the race, as can be seen in an mpeg movie by clicking your mouse on the photograph below.



The moment of inertia of the disc about its axis is $mr^2/2$, but the moment of inertia of the ring about its axis is mr^2. Employing the parallel axis theorem, when the masses of the ring and the disc are the same, an additional moment of inertia of mr^2 must be added to each of the above moments to obtain the moment of inertia about the point of contact of the roller with the inclined plane, giving:

$3mr^2/2$ for the disc,

$2mr^2$ for the ring.

The torque due to gravity acting on either roller is mgr sin*a*, where *a* is the angle of the incline. The angular acceleration of the rollers is then:

(2/3)(g/r) sin*a* for the disc,

(1/2)(g/r) sin*a* for the ring.

The linear acceleration of each down the incline is the equal to the radius of the object multiplied by the angular acceleration:

(2/3) g sin*a* for the disc,

(1/2) g sin*a* for the ring.

Suppose that two uniform discs with different masses were raced down the incline. What would happen?

Suppose that a ring and a disc with different mass were raced down the incline. What would happen?

Suppose that two uniform discs with different radii were raced down the incline. What would happen?

By looking up the moment of inertia of various rolling objects in a table, place the following in order of how fast they would roll down an incline if released from rest at the same point at the top of the incline: (1) a light uniform disc, (2) a heavy ring, (3) a large, light ball, (4) a heavy uniform disc, (5) a light ring , (6) a small, heavy ball.

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For questions and comments regarding the *Question of the Week* contact Dr. Richard E. Berg by e-mail or using phone number or regular mail address given on the Lecture-Demonstration Home Page.