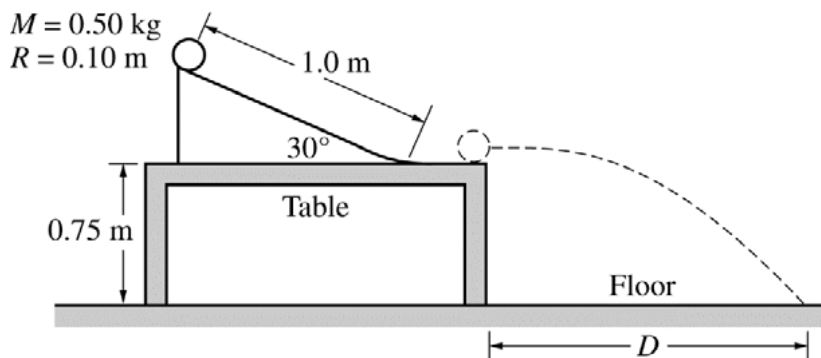




3. A uniform solid cylinder of mass $M = 0.50 \text{ kg}$ and radius $R = 0.10 \text{ m}$ is released from rest, rolls without slipping down a 1.0 m long inclined plane, and is launched horizontally from a horizontal table of height 0.75 m . The inclined plane makes an angle of 30° with the horizontal. The cylinder lands on the floor a distance D away from the edge of the table, as shown in the figure above. There is a smooth transition from the inclined plane to the horizontal table, and the motion occurs with no frictional energy losses. The rotational inertia of a cylinder around its center is $MR^2/2$.

- (a) Calculate the total kinetic energy of the cylinder as it reaches the horizontal table.
- (b) Calculate the angular velocity of the cylinder around its axis at the moment it reaches the floor.
- (c) Calculate the ratio of the rotational kinetic energy to the total kinetic energy for the cylinder at the moment it reaches the floor.
- (d) Calculate the horizontal distance D .

A sphere of the same mass and radius is now rolled down the same inclined plane. The rotational inertia of a sphere around its center is $\frac{2}{5}MR^2$.

- (e)
 - i. Is the total kinetic energy of the sphere at the moment it reaches the floor greater than, less than, or equal to the total kinetic energy of the cylinder at the moment it reaches the floor?
____ Greater than ____ Less than ____ Equal to
Justify your answer.
 - ii. Is the rotational kinetic energy of the sphere at the moment it reaches the floor greater than, less than, or equal to the rotational kinetic energy of the cylinder at the moment it reaches the floor?
____ Greater than ____ Less than ____ Equal to
Justify your answer.
 - iii. Is the horizontal distance the sphere travels from the table to where it hits the floor greater than, less than, or equal to the horizontal distance the cylinder travels from the table to where it hits the floor?
____ Greater than ____ Less than ____ Equal to
Justify your answer.

STOP

END OF EXAM