

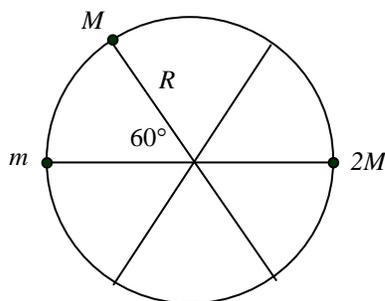
MULTIPLE CHOICE REVIEW: CHAPTERS 6–8

1974 – 16. An automobile of mass m is proceeding around a highway curve of 30 m radius. The surface of the roadway is horizontal, and the coefficient of friction between the tires and the roadway is .50. The maximum speed with which the car can round the curve without slipping is closest to . . .

- a. 3 m/s
- b. 5 m/s
- c. 10 m/s
- d. 12 m/s
- e. 14 m/s

2004 – 67. A satellite of mass m and speed v moves in a stable, circular orbit around a planet of mass M . What is the radius of the satellite's orbit?

- a. $\frac{G \cdot M}{m \cdot v}$
- b. $\frac{G \cdot v}{m \cdot M}$
- c. $\frac{G \cdot M}{v^2}$
- d. $\frac{G \cdot m \cdot M}{v}$
- e. $\frac{G \cdot m \cdot M}{v^2}$



1998 – 58. A wheel of radius R and negligible mass is mounted on a horizontal frictionless axle so that the wheel is in a vertical plane. Three small objects having masses m , M , and $2M$, respectively, are mounted on the rim of the wheel, as shown above. If the system is in static equilibrium, what is the value of m in terms of M ?

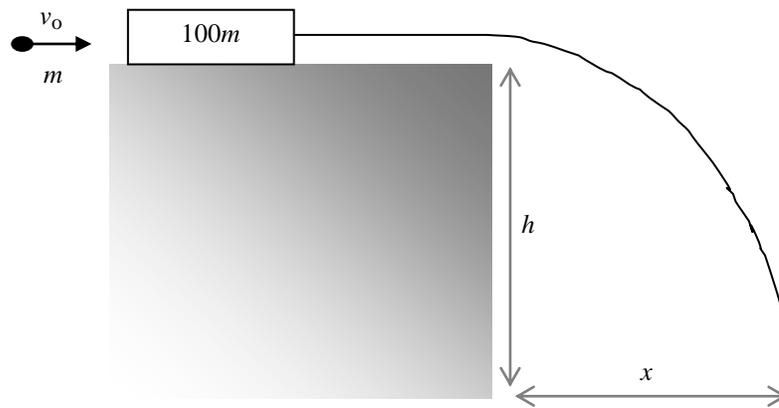
- a. $\frac{M}{2}$
- b. M
- c. $\frac{3 \cdot M}{2}$
- d. $2 \cdot M$
- e. $\frac{5 \cdot M}{2}$

FREE RESPONSE REVIEW: CHAPTERS 6 – 8



1985 – 1. A 2.0 kilogram block initially hangs at rest at the end of two 1.0 meter strings of negligible mass as shown on the left diagram above. A 0.003 kilogram bullet, moving horizontally with a speed of 1000 meters/second, strikes the block and becomes embedded in it. After the collision, the bullet/block combination swings upwards, but does not rotate.

- Calculate the speed of the bullet/block combination just after the collision.
- Calculate the ratio of the initial kinetic energy of the bullet to the kinetic energy of the bullet/block combination immediately after the collision.
- Calculate the maximum vertical height above the initial rest position reached by the bullet/block combination.



1990 – 1. A bullet of mass m is moving horizontally with speed v_o when it hits a block of mass $100m$ that is at rest on a horizontal frictionless table, as shown above. The surface of the table is a height h above the floor. After impact, the bullet and the block slide off the table and hit the floor a distance x from the edge of the table.

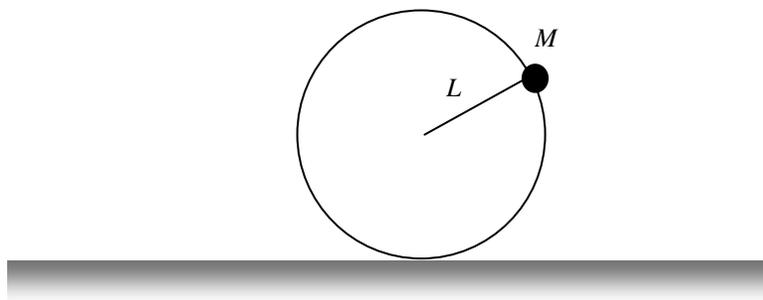
Derive expressions for the following quantities in terms of m , h , v_o , and appropriate constants.

- the speed of the bullet-block combination as it leaves the table.
- the change in kinetic energy of the bullet-block system during impact.
- the distance x .

Suppose that the bullet passes through the block instead of remaining in it.

- State whether the time required for the block to reach the floor from the edge of the table would now be greater, less, or the same. Justify your answer.
- State whether the distance x for the block would now be greater, less, or the same. Justify your answer.

FREE RESPONSE REVIEW: CHAPTERS 6 – 8 (CONT)

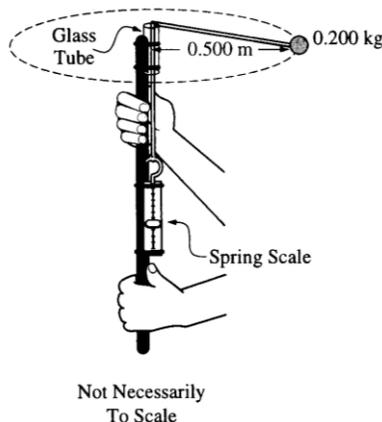


1984 – 1. A ball of mass M attached to a string of length L moves in a circle in a vertical plane as shown above. At the top of the circular path, the tension in the string is twice the weight of the ball. At the bottom, the ball just clears the ground. Air resistance is negligible. Express all answers in terms of M , L , and g .

- Determine the magnitude and direction of the net force on the ball when it is at the top.
- Determine the speed v of the ball at the top.

The string is then cut when the ball is at the top.

- Determine the time it takes the ball to reach the ground.
- Determine the horizontal distance the ball travels before hitting the ground.



1997 – 2. To study circular motion, two students use the hand-held device shown above, which consists of a rod on which a spring scale is attached. A polished glass tube attached at the top serves as a guide for a light cord attached to the spring scale. A ball of mass 0.200 kg is attached to the other end of the cord. One student swings the tube around at constant speed in a horizontal circle with a radius of 0.500 m. Assume friction and air resistance are negligible.

- How much work is done by the cord in one revolution? Explain how you arrived at your answer.
- The speed of the ball is determined to be 3.7 m/s. Assuming that the cord is horizontal as it swings, calculate the expected tension in the cord.
- The students find that, despite their best efforts, they cannot swing the ball so that the cord remains exactly horizontal.
 - Draw a vector diagram to represent the forces acting on the ball and identify the force that each vector represents.
 - Explain why it is not possible for the ball to swing so that the cord remains exactly horizontal.
 - Calculate the angle that the cord makes with the horizontal.