

FIGURE 7-45 Problem 78.

78. A 0.25-kg skeet (clay target) is fired at an angle of  $30^\circ$  to the horizon with a speed of 25 m/s (Fig. 7-45). When it reaches the maximum height, it is hit from below by a 15-g pellet traveling vertically upward at a speed of 200 m/s. The pellet is embedded in the skeet. (a) How much higher did the skeet go up? (b) How much extra distance,  $\Delta x$ , does the skeet travel because of the collision?
79. A block of mass  $m = 2.20$  kg slides down a  $30.0^\circ$  incline which is 3.60 m high. At the bottom, it strikes a block of mass  $M = 7.00$  kg which is at rest on a horizontal surface, Fig. 7-46. (Assume a smooth transition at the bottom of the incline.) If the collision is elastic, and friction can be ignored, determine (a) the speeds of the two blocks after the collision, and (b) how far back up the incline the smaller mass will go.

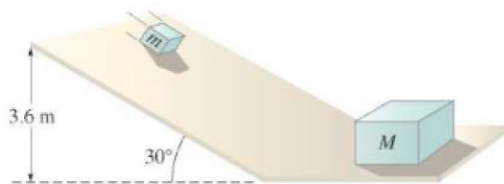


FIGURE 7-46 Problems 79 and 80.

80. In Problem 79 (Fig. 7-46), what is the upper limit on mass  $m$  if it is to rebound from  $M$ , slide up the incline, stop, slide down the incline, and collide with  $M$  again?

81. *The gravitational slingshot effect.* Figure 7-47 shows the planet Saturn moving in the negative  $x$  direction at its orbital speed (with respect to the Sun) of 9.6 km/s. The mass of Saturn is  $5.69 \times 10^{26}$  kg. A spacecraft with mass 825 kg approaches Saturn. When far from Saturn, it moves in the  $+x$  direction at 10.4 km/s. The gravitational attraction of Saturn (a conservative force) acting on the spacecraft causes it to swing around the planet (orbit shown as dashed line) and head off in the opposite direction. Estimate the final speed of the spacecraft after it is far enough away to be considered free of Saturn's gravitational pull.

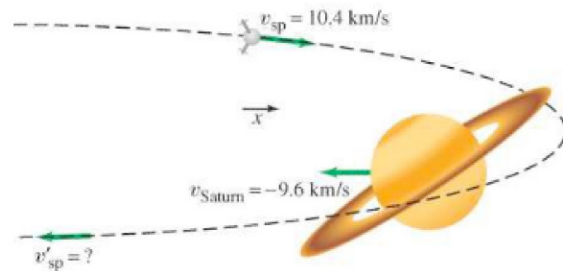


FIGURE 7-47 Problem 81.

## Answers to Exercises

- A:** Yes, if the sports car's speed is three times greater.  
**B:** Larger.  
**C:** (a) 6.0 m/s; (b) almost zero; (c) almost 24.0 m/s.  
**D:** The curve would be wider and less high.

- E:** Yes, by 300 times.  
**F:** Yes, KE was conserved.  
**G:**  $x_{CM} = -2.0$  m; yes.  
**H:** The boat moves in the opposite direction.