

mass rocks at the same speed. Sandy throws her rock horizontally while Chris throws his upward at an angle of  $45^\circ$  to the horizontal. Are the rocks moving at the same speed when they hit the ground, or is one moving faster than the other? If one is moving faster, which one? Explain.

20. A solid cylinder and a hollow cylinder have the same mass, same radius, and turn on frictionless, horizontal axles. (The hollow cylinder has lightweight

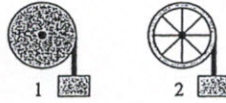


FIGURE Q10.20

A rope is wrapped around each cylinder and tied to a block. The blocks have the same mass and are held the same height above the ground as shown in Figure Q10.20. Both blocks are released simultaneously. The ropes do not slip. Which block hits the ground first? Or is it a tie? Explain.

21. You are much more likely to be injured if you fall and your head strikes the ground than if your head strikes a gymnastics pad. Use energy and work concepts to explain why this is so.
22. Jason slides a large crate down a ramp from a truck to the ground. To control the crate and keep it sliding at constant speed, Jason backs down the ramp in front of the crate while pushing upward on it. During its trip to the bottom, is the thermal energy created in the ramp and the crate greater than, less than, or equal to the crate's loss of gravitational potential energy? Explain.

### Multiple-Choice Questions

23. || A roller coaster starts from rest at its highest point and then descends on its (frictionless) track. Its speed is 30 m/s when it reaches ground level. What was its speed when its height was half that of its starting point?  
A. 11 m/s    B. 15 m/s    C. 21 m/s    D. 25 m/s
24. | You and a friend each carry a 15 kg suitcase up two flights of stairs, walking at a constant speed. Take each suitcase to be the system. Suppose you carry your suitcase up the stairs in 30 s while your friend takes 60 s. Which of the following is true?  
A. You did more work, but both of you expended the same power.  
B. You did more work and expended more power.  
C. Both of you did equal work, but you expended more power.  
D. Both of you did equal work, but you expended less power.

What is her speed at the bottom of the slope?

### Section 10.7 Energy in Collisions

41. || A 50 g marble moving at 2.0 m/s strikes a 20 g marble at rest. What is the speed of each marble immediately after the collision? Assume the collision is perfectly elastic and the marbles collide head-on.
42. | Ball 1, with a mass of 100 g and traveling at 10 m/s, collides head-on with ball 2, which has a mass of 300 g and is initially at rest. What are the final velocities of each ball if the collision is (a) perfectly elastic? (b) perfectly inelastic?
43. | An air-track glider undergoes a perfectly inelastic collision with an identical glider that is initially at rest. What fraction of the first glider's initial kinetic energy is transformed into thermal energy in this collision?
44. | Two balls undergo a perfectly elastic head-on collision, with one ball initially at rest. If the incoming ball has a speed of 200 m/s, what are the final speed and direction of each ball if  
a. The incoming ball is *much* more massive than the stationary ball?  
b. The stationary ball is *much* more massive than the incoming ball?

Ch. 10 (select questions + problems)

