# Exercise 4

Linear impulse and momentum

1. (Prob. 15-2) A *10-N* ball is thrown in the direction shown with an initial speed $v_A = 6$ *m/s*. Determine the time needed for it to reach its highest point B and the speed at which it is traveling at B. Use the principle of impulse and momentum for the solution.

2. (Prob. 15-6) A man hits the *50-g* golf ball such that it leaves the tee at an angle of $40°$ with the horizontal and strikes the ground at the same elevation a distance of 20m away. Determine the impulse of the club C on the ball. Neglect the impulse caused by the ball's weight while the club is striking the ball.

3. (Prob. 15-24) The *40-kg* slider block is moving to the right with a speed of *1.5 m/s* when it is acted upon b the forces F_1 and F_2. If these loadings vary in the manner shown on the graph, determine the speed of the block at $t = 6s$. Neglect friction and the mass of the pulleys and cords.
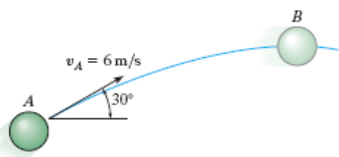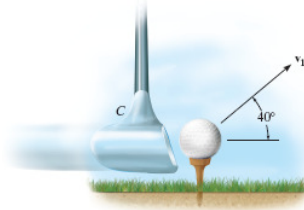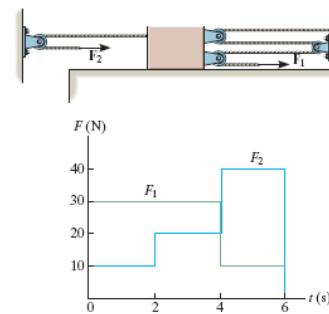
Prob. 15–2   Prob. 15–6   Prob. 15–24

Conservation of linear momentum

4. (Prob. 15-48) The 10-kg block is held at rest on the smooth inclined plane b the stop block at A. If the 10-g bullet is traveling at 300 m/s when it becomes embedded in the 10-kg block, determine the distance the block will slide up along the plane before momentarily stopping.

5. (Prob. 15-50) The free-rolling ramp has a weight of 600N. The crate, whose weight is 400N, slides from rest at A, 5m down the ramp to B. Determine the ramp's speed when the crate reaches B. Assume that the ramp is smooth, and neglect the mass of the wheels.
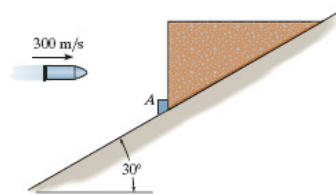
Prob. 15–48   Prob. 15–50

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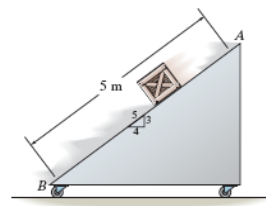
Impact

6. (Prob. 15-57) The three balls each weight *5N* and have a coefficient of restitution of *e=0.85*. If ball *A* is released from rest and strikes ball *B*, which eventually strikes ball *C*, determine the velocity of each ball after the second collision has occurred. The balls are assumed to slide without friction.

7. (Prob. 15-76) The *2.5-kg* block *B* is dropped from rest *1.5m* from the top of the *5kg* plate *P*, which is supported by the spring having a stiffness of *k=450N/m*. If *e=0.6* between the box and plate, determine the maximum compression imparted to the spring. Neglect the mass of the spring.

8. (Prob. 15-89) The two billiard balls *A* and *B* are originally in contact with one another when a third ball *C* strikes each of them at the same time as shown. If ball *C* remains at rest after the collision, determine the coefficient of restitution. All the balls have the same mass. Neglect the size of each ball.
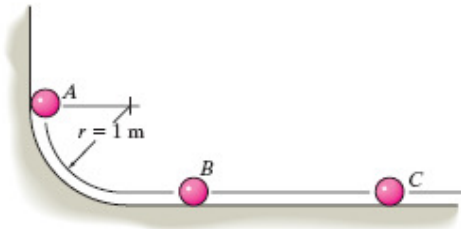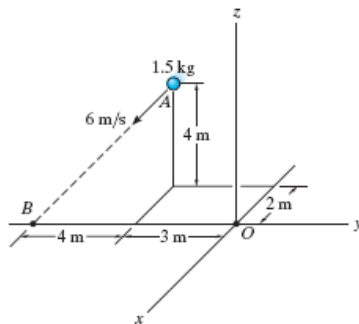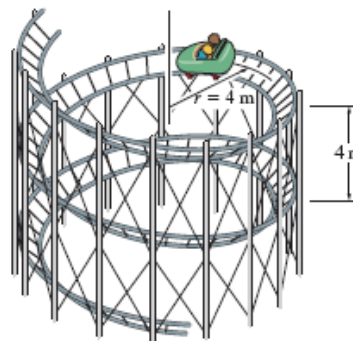
Prob. 15–57
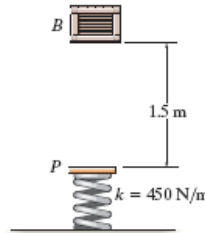
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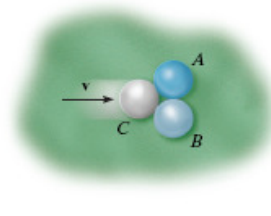
Prob. 15–89

Angular impulse and momentum

9. (Prob. 15-91) Determine the angular momentum $\mathbf{H}_O$ of the particle about point *O*.

10. (Prob. 15-107) The 400-kg roller-coaster car starts from rest on the track having the shape of a cylindrical helix. If the helix descends 4m for every one revolution, determine the time required for the car to attain a speed of 30m/s. Neglect friction and the size of the car.

Prob. 15–91

Prob. 15–107