CHAPTER 6

3. A 75-kg swimmer dives horizontally off a 500-kg raft. If the diver's speed immediately after leaving the raft is 4 m/s, what is the corresponding raft speed?

    a. 0.2 m/s
    b. 0.5 m/s
    c. 0.6 m/s
    d. 4.0 m/s

4. A 75-kg swimmer dives horizontally off a 500-kg raft. The diver's speed immediately after leaving the raft is 4.0 m/s. A micro-sensor system attached to the edge of the raft measures the time interval during which the diver applies an impulse to the raft just prior to leaving the raft surface. If the time interval is read as 0.20 s, what is the magnitude of the average horizontal force by diver on the raft?

    a. 900 N
    b. 450 N
    c. 525 N
    d. 1 500 N

5. During a snowball fight two balls with masses of 0.4 and 0.6 kg, respectively, are thrown in such a manner that they meet head-on and combine to form a single mass. The magnitude of initial velocity for each is 15 m/s. What is the speed of the 1.0-kg mass immediately after collision?

    a. zero
    b. 3 m/s
    c. 6 m/s
    d. 9 m/s

6. A 2 500-kg truck moving at 10.00 m/s strikes a car waiting at a traffic light, hooking bumpers. The two continue to move together at 7.00 m/s. What was the mass of the struck car?

    a. 1 730 kg
    b. 1 550 kg
    c. 1 200 kg
    d. 1 070 kg

7. A 0.12-kg ball is moving at 6 m/s when it is hit by a bat, causing it to reverse direction and have a speed of 14 m/s. What is the change of momentum of the ball?

    a. 0.39 kg·m/s
    b. 0.42 kg·m/s
    c. 1.3 kg·m/s
    d. 2.4 kg·m/s

8. A cannon of mass 1 500 kg fires a 10-kg shell with a velocity of 200 m/s at an angle of 45° above the horizontal. Find the recoil velocity of the cannon across the level ground.

    a. 1.33 m/s
    b. 0.94 m/s
    c. 2.41 m/s
    d. 1.94 m/s

9. A billiard ball collides in an elastic head-on collision with a second stationary identical ball. After the collision which of the following conditions applies to the first ball?

    a. maintains the same velocity as before
    b. has one half its initial velocity
    c. comes to rest
    d. moves in the opposite direction

10. A billiard ball collides in an elastic head-on collision with a second identical ball. What is the kinetic energy of the system after the collision compared to that before collision?

    a. the same as
    b. one fourth
    c. twice
    d. four times

11. In a two-body collision, if the momentum of the system is conserved, then which of the following best describes the kinetic energy after the collision?

    a. must be less
    b. must also be conserved
    c. may also be conserved
    d. is doubled in value

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    .

17. A machine gun is attached to a railroad flatcar that rolls with negligible friction. If the railroad car has a mass of 6.25×10^4 kg, how many bullets of mass 25 g would have to be fired at 250 m/s off the back to give the railroad car a forward velocity of 0.5 m/s?

    a. 400
    b. 2 000
    c. 3 000
    d. 5 000

18. Alex throws a 0.15-kg rubber ball down onto the floor. The ball's speed just before impact is 6.5 m/s, and just after is 3.5 m/s. What is the change in the magnitude of the ball's momentum?

    a. 0.09 kg·m/s
    b. 1.5 kg·m/s
    c. 4.3 kg·m/s
    d. 126 kg·m/s

19. Alex throws a 0.15-kg rubber ball down onto the floor. The ball's speed just before impact is 6.5 m/s, and just after is 3.5 m/s. If the ball is in contact with the floor for 0.025 s, what is the magnitude of the average force applied by the floor on the ball?

    a. 60 N
    b. 133 N
    c. 3.0 N
    d. 3.5 N

22. Lonnie pitches a baseball of mass 0.20 kg. The ball arrives at home plate with a speed of 40 m/s and is batted straight back to Lonnie with a return speed of 60 m/s. If the bat is in contact with the ball for 0.050 s, what is the impulse experienced by the ball?

    a. 360 N·s
    b. 20 N·s
    c. 400 N·s
    d. 9.0 N·s

23. Ann the Astronaut weighs 60 kg. She is space walking outside the space shuttle and pushes a 350-kg satellite away from the shuttle at 0.90 m/s. What speed does this give Ann as she moves toward the shuttle?

    a. 4.0 m/s
    b. 5.3 m/s
    c. 8.5 m/s
    d. 9.0 m/s

24. In a system with two moving objects, when a collision occurs between the objects,

    a. the total kinetic energy is always conserved.
    b. the total momentum is always conserved.
    c. the total kinetic energy and total momentum are always conserved.
    d. neither the kinetic energy nor the momentum is conserved.

25. A railroad freight car, mass 15 000 kg, is allowed to coast along a level track at a speed of 2.0 m/s. It collides and couples with a 50 000-kg loaded second car, initially at rest and with brakes released. What percentage of the initial kinetic energy of the 15 000-kg car is preserved in the two-coupled cars after collision?

    a. 14%
    b. 23%
    c. 86%
    d. 100%

28. A model car is propelled by a cylinder of carbon dioxide gas. The cylinder emits gas at a rate of 4.5 g/s with an exit speed of 80.0 m/s. The car has a mass of 400 g, including the CO_2 cylinder. Starting from rest, what is the car's initial acceleration?

    a. 0.90 m/s^2
    b. 4.5 m/s^2
    c. 9.0 m/s^2
    d. 36 m/s^2

34. A 0.10-kg object moving initially with a velocity of +0.20 m/s makes an elastic head-on collision with a 0.15-kg object initially at rest. What percentage of the original kinetic energy is retained by the 0.10-kg object?

    a. 4%
    b. –4%
    c. 50%
    d. 96%

35. If the momentum of an object is tripled, its kinetic energy will change by what factor?

    a. zero
    b. one third
    c. three
    d. nine

37. Two billiard balls have velocities of 2.0 m/s and −1.0 m/s when they meet in an elastic head-on collision. What is the final velocity of the first ball after collision?

    a. −2.0 m/s
    b. −1.0 m/s
    c. −0.5 m/s
    d. +1.0 m/s

38. A ball with original momentum +4.0 kg·m/s hits a wall and bounces straight back without losing any kinetic energy. The change in momentum of the ball is:

    a. 0
    b. −4.0 kg·m/s
    c. 8.0 kg·m/s
    d. −8.0 kg·m/s

39.   Two objects, one less massive than the other, collide elastically and bounce back after the collision. If the two originally had velocities that were equal in size but opposite in direction, then after the collision which one will be moving faster?
    a. The less massive one.
    b. The more massive one.
    c. The speeds will be the same after the collision.
    d. There is no way to be sure without the actual masses.

40. A moderate force will break an egg. However, an egg dropped on the road usually breaks, while one dropped on the grass usually doesn't break. This is because for the egg dropped on the grass:

    a. the change in momentum is greater.
    b. the change in momentum is less.
    c. the time interval for stopping is greater.
    d. the time interval for stopping is less.

43. In a partially elastic collision between two objects with unequal mass:

    a. the velocity of one will increase by the amount that the velocity of the other decreases.
    b. the momentum of one will increase by the amount that the momentum of the other decreases.
    c. the energy of one increases by the amount that the energy of other decreases.
    d. the total momentum of the system will decrease.

44. A 7.0-kg bowling ball strikes a 2.0-kg pin. The pin flies forward with a velocity of 6.0 m/s; the ball continues forward at 4.0 m/s. What was the original velocity of the ball?

    a. 4.0 m/s
    b. 5.7 m/s
    c. 6.6 m/s
    d. 3.3 m/s

45. A billiard ball (Ball #1) moving at 5.00 m/s strikes a stationary ball (Ball #2) of the same mass. After the collision, Ball #1 moves at a speed of 4.35 m/s. Find the speed of Ball #2 after the collision.

    a. 1.25 m/s
    b. 1.44 m/s
    c. 2.16 m/s
    d. 2.47 m/s

48. Kaitlin uses a bat to hit a thrown baseball. She knocks the ball back in the direction from which it came in a partially inelastic collision. The bat, which is heavier than the baseball, continues to move in the same direction after the hit as Kaitlin "follows through." Is the ball moving faster before or after it was hit?

    a. The ball was moving faster before it was hit.
    b. The ball was moving faster after it was hit.
    c. The ball was moving at essentially the same speed before and after the hit.
    d. There is insufficient information to answer this problem.

49.   A lump of clay is thrown at a wall. A rubber ball of identical mass is thrown with the same speed toward the same wall. Which statement is true?

    a. The clay experiences a greater change in momentum than the ball.
    b. The ball experiences a greater change in momentum than the clay.
    c. The clay and the ball experience the same change in momentum.
    d. It is not possible to know which object has the greater change in momentum.

50. A tennis ball is held above and in contact with a basketball, and then both are simultaneously dropped. The tennis ball bounces off the basketball at a fairly high speed. This is because:

    a. The basketball falls farther than the tennis ball.
    b. The tennis ball is slightly shielded from the Earth's gravitational pull.
    c. The massive basketball transfers momentum to the lighter tennis ball.
    d. The tennis ball has a smaller radius.

52. Two skaters, both of mass 75 kg, are on skates on a frictionless ice pond. One skater throws a

0.3-kg ball at 5 m/s to his friend, who catches it and throws it back at 5 m/s. When the first skater has caught the returned ball, what is the velocity of each of the two skaters?

    a. 0.02 m/s, moving apart
    b. 0.04 m/s, moving apart
    c. 0.02 m/s, moving towards each other
    d. 0.04 m/s, moving towards each other

55. Popeye, of mass 70 kg, has just downed a can of spinach. He accelerates quickly and stops Bluto, of mass 700 kg (Bluto is very dense), who is charging in at 10 m/s. What was Popeye's speed?

    a. 10 m/s
    b. 31 m/s
    c. 50 m/s
    d. 100 m/s

56. Mitch throws a 100-g lump of clay at a 500-g target, which is at rest on a horizontal surface. After impact, the target, including the attached clay, slides 2.1 m before stopping. If the coefficient of friction is $\mu = 0.50$, find the speed of the clay before impact.

    a. 4.5 m/s
    b. 12 m/s
    c. 27 m/s
    d. 36 m/s

58. A car wash nozzle directs a steady stream of water at 1.5 kg/s, with a speed of 30 m/s, against a car window. What force does the water exert on the glass? Ignore backsplash.

    a. 11 N
    b. 45 N
    c. 110 N
    d. 440 N

59. Two identical 7-kg bowling balls roll toward each other. The one on the left is moving at +4 m/s while the one on the right is moving at −4 m/s. What is the velocity of each ball after they collide elastically?

    a. Neither is moving.
    b. −4 m/s, +4 m/s
    c. +4 m/s, −4 m/s
    d. −14 m/s, 14 m/s

62. A 5-kg object is moving to the right at 4 m/s and collides with another object moving to the left at 5 m/s. The objects collide and stick together. After the collision, the combined object

    a. is moving to the right.
    b. is moving to the left.
    c. is at rest.
    d. has less kinetic energy than the system had before the collision.

63. A 5-kg object is moving to the right at 4 m/s and collides with a 4-kg object moving to the left at 5 m/s. The objects collide and stick together. After the collision, the combined object

    a. has the same kinetic energy that the system had before the collision.
    b. has more kinetic energy than the system had before the collision.
    c. has no kinetic energy.
    d. has less momentum than the system had before the collision.

64. Object 1 has twice the mass of Object 2. Both objects have the same kinetic energy. Which of the following statements is true?

    a. Both objects can have the same magnitude of momentum.
    b. Object 1 has a momentum of greater magnitude than Object 2.
    c. The magnitude of the momentum of Object 2 is four times that of Object 1.
    d. All the statements are false.

65.   Object 1 has twice the mass of Object 2. Each of the objects has the same magnitude of momentum. Which of the following statements is true?

    a. Both objects can have the same kinetic energy.
    b. One object has 0.707 times the kinetic energy of the other.
    c. One object has twice the kinetic energy of the other.
    d. One object has 4 times the kinetic energy of the other.

CHAPTER 6 - ANSWERS

#	Ans	Difficulty	#	Ans	Difficulty
1.	C	1	34.	A	2
2.	A	1	35.	D	1
3.	C	1	36.	B	1
4.	D	2	37.	B	1
5.	B	2	38.	D	1
6.	D	2	39.	A	2
7.	D	2	40.	C	1
8.	B	2	41.	C	2
9.	C	1	42.	A	2
10.	A	1	43.	B	2
11.	C	1	44.	B	2
12.	B	1	45.	D	3
13.	D	1	46.	D	3
14.	C	1	47.	D	2
15.	A	1	48.	D	2
16.	A	1	49.	B	2
17.	D	2	50.	C	2
18.	B	2	51.	A	2
19.	A	2	52.	B	2
20.	A	2	53.	C	2
21.	D	2	54.	B	3
22.	B	2	55.	D	2
23.	B	2	56.	C	3
24.	B	2	57.	A	3
25.	B	3	58.	B	2
26.	D	3	59.	B	2
27.	C	3	60.	D	3
28.	A	2	61.	C	1
29.	C	2	62.	D	2
30.	B	2	63.	C	2
31.	B	2	64.	B	3
32.	D	3	65.	C	3
33.	A	2	66.	D	2