Momentum Review

1.A rock is dropped from a high tower and falls freely under the influence of gravity. Which one of the following statements is true concerning the rock as it falls?
A) It will gain an equal amount of momentum during each second.
B) It will gain an equal amount of kinetic energy during each second.
C) It will gain an equal amount of speed for each meter through which it falls.
D) It will gain an equal amount of momentum for each meter through which it falls.
E) The amount of momentum it gains will be proportional to the amount of potential energy that it loses.

2. Jennifer is walking at 1.63 m/s. If Jennifer weighs 583 N, what is the magnitude of her momentum?
A)97.0 kg • m/s B)137 kg • m/s C)68.6 kg • m/s D) 672 kg • m/s E)951 kg • m/s

3. A 1.0-kg ball has a velocity of 12 m/s downward just before it strikes the ground and bounces up with a velocity of 12 m/s upward. What is the change in momentum of the ball?
A) zero kg • m/s
B) 12 kg • m/s, downward
C) 12 kg • m/s, upward
D) 24 kg • m/s, downward
E) 24 kg • m/s, upward

4. In which one of the following situations is linear momentum *not conserved*?
A) A bomb suspended by a string explodes into one hundred fragments.
B) A bowling ball collides with ten pins.
C) A golf ball is struck by a club.
D) An astronaut floating in space throws a hammer away and subsequently moves in the opposite direction.
E) A tree limb is struck by lightning and falls to the ground.

5. An object of mass 3*m*, initially at rest, explodes breaking into two fragments of mass *m* and 2*m*, respectively. Which one of the following statements concerning the fragments *after the explosion* is true?
A) They may fly off at right angles.
B) They may fly off in the same direction.
C) The smaller fragment will have twice the speed of the larger fragment.
D) The larger fragment will have twice the speed of the smaller fragment.
E) The smaller fragment will have four times the speed of the larger fragment.

6. A 100-kg cannon at rest contains a 10-kg cannon ball. When fired, the cannon ball leaves the cannon with a speed of 90 m/s. What is the recoil speed of the cannon?
A) 4.5 m/s B) 9 m/s C) 45 m/s D) 90 m/s E) zero

7. An 80-kg astronaut carrying a 20-kg tool kit is initially drifting toward a stationary space shuttle at a speed of 2 m/s. If she throws the tool kit toward the shuttle with a speed of 6 m/s as seen from the shuttle, her final speed is
A) 1 m/s toward the shuttle.
B) 1 m/s away from the shuttle.
C) 2 m/s toward the shuttle.
D) 4 m/s toward the shuttle.
E) 6 m/s away from the shuttle.

8. A 58.5-kg astronaut is floating toward the front of her stationary ship at 0.15 m/s, relative to the ship. She wishes to stop moving, relative to the ship. She decides to throw away the 2.50-kg book she's carrying. What should the speed and direction of the book be to achieve her goal?
A) 0.15 m/s, toward the front of the ship
B) 3.5 m/s, toward the back of the ship
C) 3.7 m/s, toward the front of the ship
D) 0.30 m/s, toward the back of the ship
E) 1.8 m/s, toward the front of the ship

9. Different types of collisions between interacting bodies are *categorized* on the basis of
   A) kinetic energy conservation.
   B) mechanical energy conservation.
   C) linear momentum conservation.
   D) the magnitude of the forces involved.
   E) the temporal duration of the collision.

10. Which one of the following is characteristic of an *inelastic collision*?
   A) Total mass is not conserved.
   B) Total energy is not conserved.
   C) Linear momentum is not conserved.
   D) Kinetic energy is not conserved.
   E) The change in momentum is less than the total impulse.

11. Complete the following statement: Momentum will be conserved in a two-body collision *only if*
   A) both bodies come to rest.
   B) the collision is perfectly elastic.
   C) the kinetic energy of the system is conserved.
   D) the net external force acting on the two-body system is zero.
   E) the internal forces of the two body system cancel in action-reaction pairs.

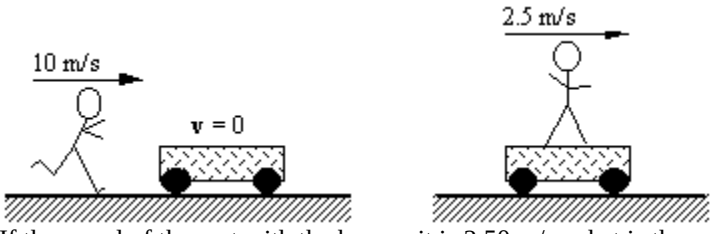
12. While in horizontal flight at a speed of 20 m/s, a baseball of mass 0.11 kg is struck by a bat. After leaving the bat, the baseball has a speed of 29 m/s in a direction opposite to its original direction. The magnitude of the impulse given the ball is
   A) 0.99 kg · m/s
   B) 5.4 kg · m/s
   C) 2.2 kg · m/s
   D) 3.2 kg · m/s
   E) 0.55 kg · m/s

13. A pitcher throws a baseball with a velocity of 27 m/s. After being struck by a bat the ball travels in the opposite direction with a velocity of 40 m/s. If the ball has a mass of 0.11 kg and is in contact with the bat for 3.0 ms, the average force exerted by the bat on the ball is
   A) 0.99 kN B) 4.8 kN C) 1.5 kN D) 7.4 kN E) 2.5 kN

14 Two balls of equal mass are thrown against a massive wall with equal velocities. The first rebounds with a speed equal to its striking speed, and the second sticks to the wall. The impulse that the first ball transmits to the wall, relative to the second, is
   A) twice as great.
   B) half as great.
   C) the same.
   D) four times as great.
   E) one-fourth as great.

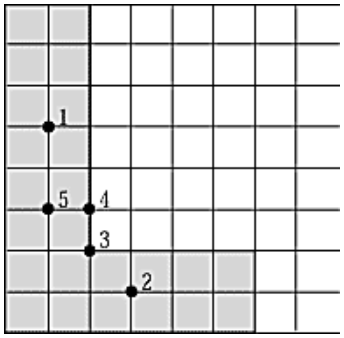
15. A 0.050-kg lump of clay moving horizontally at 12 m/s strikes *and sticks to* a stationary 0.10-kg cart that can move on a frictionless air track. Determine the speed of the cart and clay after the collision.
   A) 2 m/s B) 4 m/s C) 6 m/s D) 8 m/s E) 12 m/s

16. A 50.0-kg boy runs at a speed of 10.0 m/s and jumps onto a cart as shown in the figure. The cart is initially at rest.



If the speed of the cart with the boy on it is 2.50 m/s, what is the mass of the cart?
   A) 150 kg B) 175 kg C) 210 kg D) 260 kg E) 300 kg

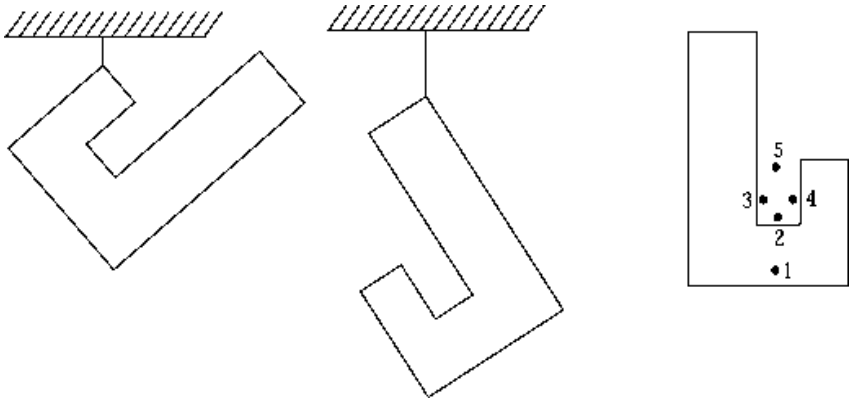
17.



An L-shaped piece, represented by the shaded area on the figure, is cut from a metal plate of uniform thickness. The point that corresponds to the center of mass of the L-shaped piece is

A) 1 B) 2 C) 3 D) 4 E) 5

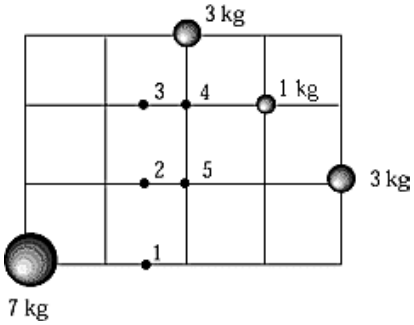
18.



The figure shows a piece of sheet metal suspended in two positions by a string. From the way the metal hangs, you can see that the center of gravity is nearest point

A) 1 B) 2 C) 3 D) 4 E) 5

19.



The center of mass of the system of particles shown in the diagram is at point

A) 1 B) 2 C) 3 D) 4 E) 5

20.Which one of the following is true concerning momentum?

A) Momentum is a force.
B) Momentum is a scalar quantity.
C) The SI unit of momentum is kg • m^2/s.
D) The momentum of an object is always positive.
E) Momentum and impulse are measured in the same units.

21. A 7.30-kg bowling ball strikes a 1.60-kg pin at rest head-on. Before the collision, the velocity of the ball is +6.00 m/s. After the collision, the velocity of the ball is +5.40 m/s. What is the velocity of the pin after the collision?
A) +0.6 m/s B) +5.4 m/s C) +1.2 m/s D) +2.7 m/s E) +52 m/s

22. A football player kicks a 0.41-kg football initially at rest; and the ball flies through the air. If the kicker's foot was in contact with the ball for 0.051 s and the ball's initial speed after the collision is 21 m/s, what was the magnitude of the average force on the football?
A) 9.7 N B) 46 N C) 81 N D) 170 N E) 210 N

23. A bat strikes a 0.050-kg baseball so that its velocity changes by +30 m/s in 0.10 s. With what average force was the ball struck?
A) +15 N B) −15 N C) +300 N D) −300 N E) +150 N

24. Momentum is conserved in which of the following?
A) elastic collisions
B) inelastic collisions
C) explosions
D) collisions between automobiles
E) All of these are correct.

25. An object of mass M_1 is moving with a speed v on a straight, level, frictionless track when it collides with another mass M_2 that is at rest on the track. After the collision, M_1 and M_2 stick together and move with a speed of
A) v B) M_1v C) $(M_1 + M_2)v/M_1$ D) $M_1v/(M_1 + M_2)$ E) M_1v/M_2