

Momentum Worksheet

1. A force acting on a 2 kg mass increases its speed from 3 m/s to 6 m/s. What is the original momentum of the object? What is the final momentum of the object? What is the change in momentum of the object?
 2. A 2 kg cart is moving at 4 m/s on a horizontal table. When a 2 kg brick is dropped into the cart causing the cart to slow down, the cart with the brick inside slows down to 2 m/s, what is the change in momentum of the **cart**?
 3. A 5 g bullet is fired with a velocity of 100 m/s toward a 10 kg stationary solid block resting on a frictionless surface. a) What is the change in momentum of the bullet if it is embedded in the block? b) What is the change in momentum of the bullet if it ricochets in the opposite direction with a speed of 99 m/s almost the same speed as it had originally?
 4. An impulse of 20 N s acting on an object whose mass is 5 kg. What will be the object's change in velocity?
 5. How many seconds does it take for a net force of 20 N to change the velocity of a 5 kg mass by 2 m/s ?
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6. A 1 kg mass moving north at 2 m/s collides head - on with a 3 kg mass moving south at 1 m/s. What is the total momentum of the system before the collision? What will be the total momentum of the system after the collision?
 7. A 95 kg fullback, running at 8.2 m/s, collides in midair with a 128 kg defensive back moving in the opposite direction. Both players end up with zero speed. a) What was the fullback's momentum before the collision? b) What was the change in the fullback's momentum? c) where did the momentum go that was lost by the fullback? d) What was the defensive back's original velocity?
 8. A glass ball, ball A, has mass 5 g, moves at a velocity 20 cm/s. It collides with a second glass ball, ball B, of mass 10 g, moving along the same line with a velocity of 10 cm/s. After the collision, ball A is still moving but with a velocity of 8 cm/s. a) What was ball A's original momentum? b) What is ball A's change in momentum? c) What is ball B's change in momentum? d) What is the momentum of ball B after the collision? e) What is ball B's speed after the collision?
 9. Before a collision, a 25 kg object is moving at +12 m/s. Find the impulse that acted on this object if after the collision it moves at: a) +8 m/s b) -8 m/s.
 10. A 2 000 kg railroad car is coasting on a track at a constant velocity of 20 m/s. As the car coasts under a loading ramp, a 500 kg bale of hay is dropped into it. What will be the velocity of the bale of hay inside the car?
 11. A 2575 kg van runs into the back of a 825 kg compact car at rest. They move off together at 8.5 m/s. Assuming no friction with the ground, find the initial speed of the van.
 12. A 15 g bullet is shot into a 5085 g wooden block standing on a frictionless surface. The block, with the bullet in it, acquires a velocity of 1.0 m/s. Calculate the velocity of the bullet before striking the block.
 13. A hockey puck, mass 0.115 kg, moving at 35 m/s, strikes a stationary octopus that was thrown on the ice by a fan. The octopus has a mass of 0.265 kg. The puck and octopus slide off together. Find their velocity.
 14. A 50 kg woman, riding on a 10 kg cart, is moving east at 5 m/s. The woman jumps off the cart and hits the ground at 7 m/s eastward, relative to the ground. Calculate the velocity of the cart after she jumps off.
 15. Two students on roller skates stand face-to-face, and then push each other away. One student has a mass of 90 kg, the other 60 kg. Find the ratio of their velocities just after their hands lose contact. Which student has the greater speed?
 16. A car with mass 1245 kg, moving at 29 m/s, strikes a 2175 kg car at rest. If the two cars stick together, with what speed do they move?

17. A 95 kg fullback, running at 5 m/s, attempts to dive across the goal line for a touchdown. Just as he reaches the goal line for a touchdown. Just as he reaches the goal line, he is met head-on in midair by two 75 kg linebackers, one moving at 2 m/s and the other at 4 m/s. If they all become entangled as one mass, with what velocity do they travel? Does the fullback score?
18. A gun with a mass of 2 000 kg fires a 20 kg shell horizontally with a velocity of 300 m/s. What is the recoil velocity of the gun?
19. Object A has a mass of 6 kg and a velocity of 10 m/s. Object B, which has a mass of 2 kg, is standing motionless. Object A strikes object B and continues in the same direction at a speed of 6 m/s. What is the velocity of object B after impact?
20. A bullet whose mass is 0.001 kg leaves a rifle with a muzzle velocity of 1 000 m/s. It strikes a block of wood (mass 10 kg), initially at rest, and remains embedded in it. After the bullet hits the block, what will be the velocity of the bullet-block system?
21. A 0.2 kg plastic ball moves with a velocity of 0.3 m/s. It collides with a second plastic ball of mass 0.1 kg which is stationary. After the collision, the velocity of the 0.1 kg ball is 0.26 m/s. What is the new velocity of the first ball?
22. Ball A, rolling west at 3 m/s, has a mass of 1 kg. Ball B has a mass of 2 kg and is stationary. After colliding with ball B, ball A moves west at 2 m/s. Calculate the velocity of ball B after the collision.

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23. A 2 000 kg railroad car is coasting on a track at a constant velocity of 20 m/s. As the car coasts under a loading ramp, a 500 kg bale of hay is dropped into it. What will be the velocity of the bale of hay inside the car? What is the change in kinetic energy of the system? Is this collision elastic or inelastic?
 24. A 1 kg ball is rolling to the right at 4 m/s when it collides with a 3 kg ball rolling to the left at 4 m/s. After the collision, the 3 kg ball stops. What is the velocity of the 1 kg ball? What is the change in kinetic energy of the system? Is this collision elastic or inelastic?
 25. A 2600 kg van runs into the back of a 800 kg compact car at rest. They move off together at 8.5 m/s. What was the initial speed of the van? What is the change in kinetic energy of the system? Is this collision elastic or inelastic?
 26. A 2 kg ball is rolling at 9 m/s when it collides with a 4 kg ball going at the slower velocity of 3 m/s. After the collision, the 4 kg ball is moving at 7 m/s. What is the velocity of the 2 kg ball? What is the change in kinetic energy of the system? Is the collision elastic or inelastic?

1. 6 kgm/s, 12 kg m/s, and 6 kg m/s	2. - 4 kg m/s	3. 0.5 kg m/s 0.995 kg m/s	4. 20 kgm/s and 4 m/s	5. 0.5 sec	6. - 1 kg m/s, - 1 kg m/s	7. 779 kgm/s, -779 kgm/s, gained by defensive back -6.1 m/s	8. 0.001 kgm/s, -0.0006 kgm/s, 0.0006 kgm/s, 0.0016 kgm/s 0.16 m/s
9. -100 kg m/s -500 kg m/s	10. 16 m/s	11. 11.2 m/s	12. 340 m/s	13. 10.59 m/s	14. -5 m/s	15. 2:-3 60 kg	16. 10.56 m/s
17. 0.102 m/s yes	18. -3 m/s	19. 12 m/s	20. 0.1 m/s	21. 0.17 m/s	22. 0.5 m/s to the west	23. 16 m/s, -80000 J, inelastic	24. -8m/s, 0J, elastic
25. 11.1 m/s, -37792 J, inelastic	26. 1 m/s, 0 J, elastic						