

momentum conservation - practice problems

1. On a low-friction track, a 2000 g cart moves right at 3 m/s while a 1000 g cart waits at rest. What is the total momentum of the two-cart system?

2. A 4 kg cart moves right at 2 m/s and a 2 kg cart moves left at 3 m/s. What is the total momentum? Use right as positive.

3. A 2 kg cart moving right at 3 m/s collides with a 1 kg cart at rest. After the collision, the 2 kg cart moves right at 1 m/s. What is the final velocity of the 1 kg cart?

4. A 3 kg cart moving right at 4 m/s collides with a 2 kg cart moving left at 1 m/s. After the collision, the 3 kg cart moves right at 2 m/s. What is the final velocity of the 2 kg cart?

5. A 2 kg cart moving right at 21.6 km/h sticks to a 4 kg cart at rest after their Velcro bumpers connect. What is their final velocity?

6. A 1.5 kg cart moving right at 8 m/s sticks to a 2.5 kg cart moving left at 2 m/s. What is their final velocity?

7. A 1 kg cart moving right at 5 m/s sticks to a 3 kg cart moving right at 1 m/s. What is their final velocity?

8. A 5 kg cart moving right sticks to a 3 kg cart at rest after a strip of tape connects them. After they stick together, they move right at 2 m/s. How fast was the 5 kg cart moving before the collision?

9. Two carts are initially at rest together. After a spring pushes them apart, a 2 kg cart moves right at 3 m/s. What is the velocity of the 3 kg cart?

10. A 2 kg cart moving at 5 m/s sticks to another cart at rest. After the collision, both carts move together. What is their final velocity?

11. A 2 kg cart and a 1 kg cart move together at 4 m/s. They separate. After separating, the 2 kg cart moves right at 3 m/s. What is the velocity of the 1 kg cart?

12. A 70 kg skater is standing still while holding a 5000 g backpack. The skater throws the backpack right at 6 m/s. What is the skater's velocity after the throw?

13. A 60 kg skater holding a 5 kg backpack moves right at 2 m/s. The skater throws the backpack forward at 6 m/s. What is the skater's velocity after the throw?

14. Three carts collide. A 2 kg cart moves right at 3 m/s, a 1 kg cart moves left at 4 m/s, and a 5 kg cart is at rest. After the collision, the 1 kg cart moves right at 1 m/s and the 5 kg cart moves right at 0.5 m/s. What is the final velocity of the 2 kg cart?

15. A 4 kg cart moving right at 5 m/s collides with a 2 kg cart. After the collision, the 4 kg cart moves right at 2 m/s and the 2 kg cart moves right at 7 m/s. What was the initial velocity of the 2 kg cart?

16. A cart explodes into two pieces. Before the explosion, its horizontal momentum is zero. A 1 kg piece moves right at 4 m/s. A 2 kg piece moves away horizontally. What is the horizontal velocity of the 2 kg piece?

17. A puck breaks into two pieces. Before the break, the vertical momentum is zero. A 0.50 kg piece moves upward at 3 m/s. A 0.75 kg piece moves vertically after the break. What is the vertical velocity of the 0.75 kg piece?

18. A 200 g toy car moving right at 12 m/s sticks to a 300 g toy truck moving left at 3 m/s. What is their final velocity?

19. In a simplified crash model, a 900 kg compact car moving right at 21.6 km/h sticks to a 1500 kg van moving right at 7.2 km/h. Ignore braking during the short collision. What is their speed immediately after the collision?