Momentum and Impulse Equations Worksheet

Level: A-Level / AP Physics 1 | Difficulty: Intermediate | Topic: Mechanics

Practice momentum and impulse problems including conservation of momentum in elastic and inelastic collisions. 10 problems with full worked solutions.

Equations you will need

p = mv	Momentum
J = FDt = Dp	Impulse = force x time = change in momentum
m_1u_1 + m_2u_2 = m_1v_1 -	Conservation of momentum

Symbol key

Symbol	Quantity	Unit
p	momentum	kg*m/s
m	mass	kg
v	velocity	m/s
J	impulse	N*s
F	force	N
Dt	time interval	s

Practice problems

1. A 2 kg ball moves at 5 m/s. Find its momentum.

2. A 0.15 kg baseball changes velocity from -30 m/s to +40 m/s. Find the impulse.

3. A 1500 kg car decelerates from 20 m/s to 0 in 4 s. Find the average braking force.

4. A 5 kg trolley at 4 m/s collides with a stationary 3 kg trolley and they stick. Find the final speed.

5. A 2 kg ball at 6 m/s hits a 4 kg ball at rest elastically. Find both final speeds.

6. A bullet of 0.02 kg fired at 400 m/s into a 4 kg block at rest. Find the final common velocity.

7. A 70 kg skater pushes off a 50 kg skater, who moves at 2 m/s. Find the first skater's recoil speed.

8. Find the impulse from a 50 N force applied for 0.4 s.

9. A 0.05 kg ball hits a wall at 20 m/s and bounces back at 18 m/s. Find the impulse on the ball.

10. A 1000 kg rocket fires ejecting 50 kg of gas at 200 m/s. Find rocket recoil speed.

Answer key

Full worked solutions for each problem.

1. p = mv = 2 x 5 = 10 kg*m/s
2. J = Dp = 0.15(40 - (-30)) = 10.5 N*s
3. F = Dp/Dt = (1500 x -20)/4 = -7500 N
4. (5)(4) = 8v -> v = 2.5 m/s
5. v_1 = ((2-4)/6)(6) = -2 m/s; v_2 = ((2x2)/6)(6) = 4 m/s
6. (0.02)(400) = 4.02v -> v = 1.99 m/s
7. 0 = 70v + 50(2) -> v = -1.43 m/s
8. J = FDt = 50 x 0.4 = 20 N*s
9. J = 0.05(-18 - 20) = -1.9 N*s
10. 0 = 950v + 50(200) -> v = -10.5 m/s