

SPH4U

UNIVERSITY PHYSICS

ENERGY & MOMENTUM

☛ Perfectly Inelastic Collisions
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Perfectly Inelastic Collisions

*By now, you have probably concluded that when objects collide, become deformed, and stick together, the collision is inelastic. Physicists say that such a collision is **perfectly inelastic**.*

NOTE!
Since a perfectly inelastic collision results in the two objects sticking together, an analysis of this type of collision using conservation of momentum yields one very useful equation.

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Perfectly Inelastic Collisions

PERFECTLY INELASTIC COLLISIONS

$$v_f = \frac{m_A v_{Ai} + m_B v_{Bi}}{m_A + m_B}$$

where v_f is the velocity of **both** objects after the collision (m/s)
 v_i is the velocity of the object before the collision (m/s)
 m is the mass of the object (kg)

NOTE!

- The subscripts A and B refer to the two objects involved.
- Instead of i and f the ' symbol is sometimes used to represent final velocities.

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Perfectly Inelastic Collisions

PRACTICE

1. The two objects shown collide head-on and stick together in a perfectly inelastic collision. What is their combined velocity after the collision?

$v_{1+2} = -9.8 \text{ m/s}$

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Perfectly Inelastic Collisions

PRACTICE

2. A CSI expert needed to find the velocity of a bullet fired from a gun. He fired a 5.50 g bullet into a ballistic pendulum with a bob that had a mass of 1.75 kg. The pendulum swung to a height of 12.5 cm as shown. What was the velocity of the bullet just before it hit and became embedded in the pendulum bob? (Hint: start with conservation of energy and then use conservation of momentum.)

$v_b = 500 \text{ m/s}$

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PRACTICE

3. A block of wood with a mass of 0.50 kg slides across the floor toward a 3.50 kg block of wood. Just before the collision, the small block is travelling at 3.15 m/s. Because some nails are sticking out of the blocks, the blocks stick together when they collide. Scratch marks on the floor show they slid 2.63 cm before coming to a stop. What was the magnitude of the friction force?

$F_f = 12 \text{ N}$

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TEXTBOOK
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