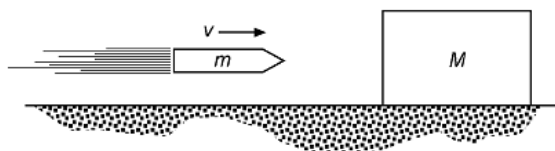


Sticky (Inelastic) Collisions

Directions: Read online textbook pages 222 – 225. Solve the following problems using the GUESS method and proper significant figures. Be sure to show ALL work.

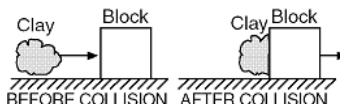
- In a baseball game, a batter hits a ball for a home run. Compared to the magnitude of the impulse imparted to the ball, the magnitude of the impulse imparted to the bat is
 (A) greater (B) less (C) the same
- In the diagram below, a block of mass M initially at rest on a frictionless horizontal surface is struck by a bullet of mass m moving with horizontal velocity v .



What is the velocity of the bullet-block system after the bullet embeds itself in the block?

- (A) $\left(\frac{M+v}{M}\right)m$ (B) $\left(\frac{m}{M+m}\right)v$ (C) $\left(\frac{M+m}{m}\right)v$ (D) $\left(\frac{m+v}{M}\right)m$

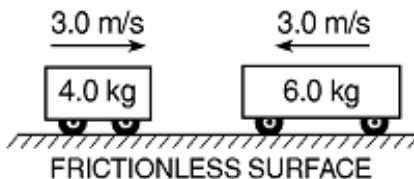
- As shown in the diagram below, a lump of clay travels horizontally to the right toward a block at rest on a frictionless surface. Upon collision, the clay and the block stick together and move to the right.



Compared to the total momentum of the clay and the block before the collision, the momentum of the clay-block system is

- (A) greater (B) less (C) the same

- The diagram below shows a 4.0 kilogram cart moving to the right and a 6.0 kilogram cart moving to the left on a horizontal frictionless surface.



When the two carts collide they lock together. The magnitude of the total momentum of the two cart system after the collision is

- (A) 6.0 kg·m/s (B) 15 kg·m/s (C) 30. kg·m/s (D) 0.0 kg·m/s

5. A freight car weighing 2.5×10^4 kg runs into another freight car of the same weight. The first was moving at 31.8 m/s north and the second was moving at 21.4 m/s south. If the cars are coupled together after the collision, what is their final velocity?

Before	After
$P_{\text{before}} =$ $m_1v_1 + m_2v_2 =$ $(2.5E4 \text{ kg})(+31.8 \text{ m/s}) + (2.5E4 \text{ kg})(-21.4 \text{ m/s}) =$ $+ 2.6E5 \text{ kg} \cdot \text{m/s} =$ $5.2 \text{ m/s north} =$	P_{after} $(m_1 + m_2) v_f =$ $(2.5E4 \text{ kg} + 2.5E4 \text{ kg})(v_f) =$ $(5.0E4 \text{ kg}) v_f$ v_f

6. A block of mass 27 kg, sliding with a speed of 14 m/s on a smooth level surface, makes a head-on collision with a block of unknown mass, initially at rest. The two stick together. After the collision the velocity of the mega-block is 5.5 m/s in the same direction as the first block's velocity. Determine the mass of the 2nd block.

Before	After
$P_{\text{before}} =$ $m_1v_1 + m_2v_2 =$ $(27 \text{ kg})(+14 \text{ m/s}) + (m)(0) =$ $+ 378 \text{ kg} \cdot \text{m/s} =$ $42 \text{ kg} =$	P_{after} $(m_1 + m_2) v_f =$ $(27 \text{ kg} + m)(5.5 \text{ m/s}) =$ $+ 148.5 \text{ kg} \cdot \text{m/s} + (5.5 \text{ m/s})(m)$ m

7. A 4.0 kg block traveling to the right at 5.6 m/s collides with a 2.5 kg block which is traveling to the left at 1.4 m/s. If the two blocks are stuck together after the collision, what is their velocity?

Before	After
$P_{\text{before}} =$ $m_1v_1 + m_2v_2 =$ $(4.0 \text{ kg})(+5.6 \text{ m/s}) + (2.5 \text{ kg})(-1.4 \text{ m/s}) =$ $19 \text{ kg} \cdot \text{m/s} =$ $+2.9 \text{ m/s right} =$	P_{after} $(m_1 + m_2) v_f =$ $(4.0 + 2.5 \text{ kg})(v_f) =$ $(6.5 \text{ kg}) v_f$ v_f

8. A 0.310 kg hockey puck moving at 71.2 m/s is caught by a 113 kg goalie moving towards it at 0.16 m/s. With what velocity does the goalie slide on the ice after catching the puck?

Before	After
$P_{\text{before}} =$ $m_1v_1 + m_2v_2 =$ $(0.310 \text{ kg})(+71.2 \text{ m/s}) + (113 \text{ kg})(-0.16 \text{ m/s}) =$ $+ 3.992 \text{ kg} \cdot \text{m/s} =$ $+ 0.035 \text{ m/s towards goal} =$	P_{after} $(m_1 + m_2) v_f =$ $(.310 \text{ kg} + 113 \text{ kg})(v_f) =$ $(113.310 \text{ kg}) v_f$ v_f