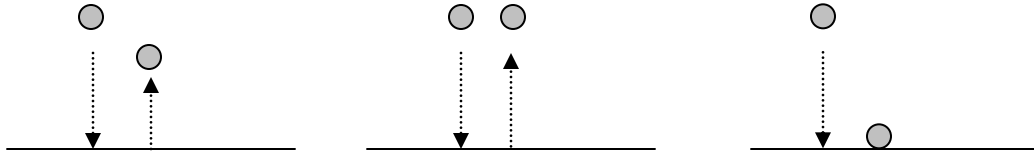


Physics 122/121  
Problems: Collisions – Elastic and Inelastic

1. Study the diagrams below. An object is dropped in each case. The path taken by the object after the collision has been moved slightly to the right so that it can be easily seen. Decide whether the collision is elastic, inelastic or completely inelastic.



2. A freight car of mass  $1.0 \times 10^5$  kg travels at 3.0 m/s and collides with a stationary freight car of mass  $2.0 \times 10^5$  kg on a horizontal track. The two cars lock and roll together after impact in the initial direction of the first freight car.
- Find the velocity of the two cars after the collision.
  - What type of collision occurred? Explain.
3. A 3.8 kg block of wood initially at rest is struck by a bullet moving at 494 m/s. The bullet exits the block of wood with a speed of 293 m/s.
- If the block of wood moves in the same direction as the bullet with a speed of  $1.9 \times 10^{-2}$  m/s, what is the mass of the bullet?
  - How much kinetic energy was lost?
4. Two soft putty balls, X and Y, approach each other and stick together on impact. Initially ball X has a mass of 1.0 kg and a speed of 0.17 m/s and ball Y has a mass of 3.0 kg and a speed of 0.15 m/s.
- What is their common velocity after impact?
  - Fizzicks says the balls of putty were involved in an elastic collision. Is he correct? Explain.
5. A hard steel ball of unknown mass suspended at the end of a long string is struck head-on by another steel ball of mass 1.0 kg suspended in a similar manner. The moving ball had an initial velocity of 5.0 m/s to the right and it rebounded with a velocity of 4.0 m/s to the left. The stationary ball moved off to the right with a speed of 1.0 m/s.
- What was the mass of the stationary ball?
  - What type of collision occurred? Explain.
6. A ball of mass  $m_1 = 0.250$  kg and velocity  $v_1 = 5.00$  m/s, east collides head-on with a ball of mass  $m_2 = 0.800$  kg that is initially at rest. If the collision is elastic, what are the velocities of the balls after the collision?
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2. a) The velocity of the two cars is 1.0 m/s in the initial direction of the first freight car.  
b) The collision was inelastic. Kinetic energy ( $3.0 \times 10^5$  J) was lost.
3. a) The mass of the bullet is 0.36 g.  
b) There were 28 J of energy lost.
4. a) Their common velocity is 0.070 m/s in the initial direction of ball Y.  
b) He is not correct. The putty balls stick together after impact so the collision is totally inelastic. You should find that 0.038 J of kinetic energy were lost.
5. a) The mass of the stationary ball was 9.0 kg.  
b) The collision is elastic. Kinetic energy is conserved ( $K_i = K_f = 13$  J).
6. The final velocities of  $m_1$  and  $m_2$  are 2.62 m/s west and 2.38 m/s east respectively.