Part I

1. Two teams are having a tug-of-war match. Which of the following can be considered an isolated system?

   (a) one team
   (b) both teams
   (c) both teams and the rope
   (d) none of the above systems

   Answer: (d) Since they are pushing on the earth the earth is part of the system

2. A railcar (mass of 1000 kg) moves horizontally at speed 10 m/s. Friction between the railcar and the track can be neglected. A 40-kg bale of hay falls vertically onto the railcar; the car continues to move horizontally.

   How do the horizontal momentum and the kinetic energy of the railcar-hay system change, if at all, when the bale of hay falls into the car? (Assume that the vertical speed of the hay just before it lands in the cart is small enough to neglect its contribution to the system kinetic energy.) Choose all that are true.

   (a) horizontal momentum remains constant
   (b) horizontal momentum increases
   (c) horizontal momentum decreases
   (d) kinetic energy remains constant
   (e) kinetic energy increases
   (f) kinetic energy decreases

   Answers:(a) the cart loses the momentum and the hay gains it. (f) it is an inelastic collision so KE is lost.

3. Two objects with mass m_1 and m_2 approach each other from opposite directions and collide head-on elastically. Object 1 leaves with a final speed greater than its initial speed. How do m_1 and m_2 compare?

   (a) $m_1 > m_2$ (b) $m_1 = m_2$ (c) $m_1 < m_2$ (d) not enough information

   Answer: (d) it depends on the relative speeds of the objects. If the initial speeds were the same then the answer would be (c)

4. A basketball dropped (from rest) from a height of 1 meter strikes the earth and returns to a height of 1 meter. The collision between the basketball and the earth is:

   (a) elastic   (b) inelastic   (c) totally inelastic   (d) not enough information.

   Answer: (a) energy is conserved since the ball returns to the same height.