Multiple choice. Indicate the best answer.

1. A 1 kg object moving at 1 m/s has an elastic collision with a 2 kg object at rest. Which of the following statements is true after the collision?
   1. The total kinetic energy of both objects is equal to 0.5 J
   2. The total kinetic energy of both objects is greater than 0.5 J
   3. The total kinetic energy of both objects is less than 0.5 J
   4. More information is needed to determine the kinetic energy after the collision
2. A 0.1 kg ball of putty initially moving at 10 m/s strikes and sticks to a 5 kg bowling ball initially at rest. After the collision, the momentum of the bowling ball is
   1. less than 1 kg m/s
   2. equal to 1 kg m/s
   3. greater than 1 kg m/s
   4. more information is needed to determine the momentum after the collision
3. A 0.1 kg golf ball initially moving at 10 m/s strikes and bounces back off a 5 kg bowling ball initially at rest. The momentum of the bowling ball after the collision is
   1. less than 1 kg m/s
   2. equal to 1 kg m/s
   3. greater than 1 kg m/s
   4. more information is needed to determine the momentum after the collision
4. A fly encounters the windshield of a speeding car. Which experiences the greater change in momentum?
   1. The car
   2. The fly
   3. They are the same
   4. It depends on the speed of the car
5. Car A moving to the right has a perfectly inelastic collision with car B moving to the left. Immediately after the collision, the combined wreckage is seen to move to the left. From this we can determine:
   1. Car B was moving quicker than car A
   2. Car A was lighter than car B
   3. Car B had more momentum than car A
   4. Car A felt a greater force from the collision than car B

**Long Answer. Answer the following questions, showing all work.**

1. A 2000 kg train car moving at 3 m/s links with a 3000 kg train car initially at rest. What is the speed of the cars after the collision?
2. Bob, whose mass is 68 kg is rolling on his 2 kg skateboard at 6.0 m/s catches a ball initially traveling at 9.0 m/s in the opposite direction. After Bob catches the ball, he rolls in his original direction at only 4.5 m/s. What is the mass of the ball?
3. A 4.8 kg bowling ball moving at 10 m/s strikes a 1.6 kg bowling pin, initially at rest, head-on. The pin flies forwards at 15 m/s after the collision.
   1. What is the final velocity of the bowling ball?
   2. Is this an elastic or inelastic collision? (Show your work to justify your answer.)