

48. A 7.50 kg laundry bag is dropped from rest at an initial height of 3.00 m.
- What is the speed of Earth toward the bag just before the bag hits the ground? Use the value 5.98×10^{24} kg as the mass of Earth.
 - Use your answer to part (a) to justify disregarding the motion of Earth when dealing with the motion of objects on Earth.
49. A 55 kg pole-vaulter falls from rest from a height of 5.0 m onto a foam-rubber pad. The pole-vaulter comes to rest 0.30 s after landing on the pad.
- Calculate the athlete's velocity just before reaching the pad.
 - Calculate the constant force exerted on the pole-vaulter due to the collision.
50. An unstable nucleus with a mass of 17.0×10^{-27} kg initially at rest disintegrates into three particles. One of the particles, of mass 5.0×10^{-27} kg, moves along the positive y -axis with a speed of 6.0×10^6 m/s. Another particle, of mass 8.4×10^{-27} kg, moves along the positive x -axis with a speed of 4.0×10^6 m/s. Determine the third particle's speed and direction of motion. (Assume that mass is conserved.)

Alternative Assessment

- Design an experiment to test the conservation of momentum. You may use dynamics carts, toy cars, coins, or any other suitable objects. Explore different types of collisions, including perfectly inelastic collisions and elastic collisions. If your teacher approves your plan, perform the experiment. Write a report describing your results.
- Design an experiment that uses a dynamics cart with other easily found equipment to test whether it is safer to crash into a steel railing or into a container filled with sand. How can you measure the forces applied to the cart as it crashes into the barrier? If your teacher approves your plan, perform the experiment.
- Obtain a videotape of one of your school's sports teams in action. Create a play-by-play description of a short segment of the videotape, explaining how momentum and kinetic energy change during impacts that take place in the segment.
- Use your knowledge of impulse and momentum to construct a container that will protect an egg dropped from a two-story building. The container should prevent the egg from breaking when it hits the ground. Do not use a device that reduces air resistance, such as a parachute. Also avoid using any packing materials. Test your container. If the egg breaks, modify your design and then try again.
- An inventor has asked an Olympic biathlon team to test his new rifles during the target-shooting segment of the event. The new 0.75 kg guns shoot 25.0 g bullets at 615 m/s. The team's coach has hired you to advise him about how these guns could affect the biathletes' accuracy. Prepare figures to justify your answer. Be ready to defend your position.