Chapter 2: 1-D Motion

1. A bolt in an elevator ceiling h meter above the elevator floor works loose and falls when the elevator is moving downward from rest at a constant acceleration of a. (a) How long does it take for the bolt to the elevator floor. According to the observer standing on the lobby of the building (b) What is the velocity of the bolt relative to the floor at impact?

2. A bus accelerates at 1.5 m/s^2 from rest for 12 s. It then travels at constant velocity for 25 s, after which it slows to a stop with an acceleration of -1.5 m/s^2. (a) How far does the bus travel? (b) What is its average velocity?

3. Ball A is dropped from the top of a building at the same instant that ball B is thrown vertically upward from the ground. When the balls collide, they are moving in opposite directions, and the speed of A is twice the speed of B. At what fraction of the height of the building does the collision occur?

4. Two stones are thrown vertically upward from the ground, one with three times the initial speed of the other. (a) if the faster stone takes 10 s to return to the ground, how long will it take the slower stone to return? (b) If the slower stone reaches a maximum height of H, how high (in terms of H)will the faster stone go?

5. A flowerpot falls off windowsill and falls past the window below. You may ignore air resistance. It takes the pot 0.42 s to pass from the top to the bottom of this window, which is 1.90 m high. How far is the top of the window below the windowsill from which the flowerpot fell?

6. A hot air balloonist, rising vertically with a constant velocity of magnitude 5.0 m/s, releases a sandbag at an instant when the balloon is 40.0 m above the ground. (a) Compute the position and velocity of the sandbag at 1.0 s after its release? (b) How many second after its release will the bag strike the ground? (c) With what magnitude of velocity does it strike the ground? (d) What is the greatest height above the ground that the sandbag reaches?

7. A rock is dropped from the top of a tall building. The rock's displacement in the last second before it hits the ground is 45% of the entire distance it falls. How tall is the building?

8. Two cars are driving at the same constant speed on a straight road, with car 1 in front of car 2. Car 1 suddenly starts to brake with constant acceleration and stops in 10 m. At the instant car 1 comes to a stop, car 2 begins to brake with the same acceleration. It comes to a halt just as it reaches the back of car 1. What was the separation between the cars before they starting braking?