Problem 1:
Suppose a ping-pong ball and a bowling ball are rolling toward you. Both have the same momentum, and you exert the same force to stop each.

a. Is the time interval to stop the ping-pong ball shorter, longer or the same as the time interval to stop the bowling ball? Explain your reasoning.

b. Is the distance needed to stop the ping-pong ball shorter, longer, or the same as the distance needed to stop the bowling ball? Explain your reasoning.

Problem 2:
The compressive force per area necessary to break the tibia in the lower leg is about $1.6 \times 10^3$ bars. The smallest cross-sectional area of the tibia, about 3.2 cm$^2$, is slightly above the ankle. Suppose a person of mass $m$ jumps to the ground from a height $h$ and absorbs the shock of hitting the ground by bending her knees. During the time of collision $\Delta t$ the person lowers her center of mass by an amount $\Delta h$.

a. Find the average force of the ground on the person exerted during the shock absorption, in terms of $m$, $g$, $h$ and $\Delta h$. 
b. What is the average impulse of the ground on the person? Answer in terms of \( m \), \( g \), \( h \) and \( \Delta h \).

c. What is the maximum ratio \( h/\Delta h \) that a person of mass \( m = 60 \text{ kg} \) can sustain without breaking the tibia?

d. Assuming you bend your knees properly as you land, estimate the maximum height you can jump from without breaking your legs.

**Problem 3:**

Consider a frictionless track ABC as shown in the figure. A block of mass \( m_1 = 5.00 \text{ kg} \) is released from A at height \( h = 5.00 \text{ m} \). It makes a head-on elastic collision at B with a block of mass \( m_2 = 10.0 \text{ kg} \) that is initially at rest.

![Diagram of frictionless track ABC with blocks m1 and m2 at points A, B, and C.](image)

Calculate the maximum height to which \( m_1 \) rises after the collision.

**Problem 4:**

A ballistic pendulum consists of a pumpkin of mass 1.5 kg suspended on a 1 m string. A bullet of mass 10 g has an initial speed of 400 m/s and passes through the pumpkin. After the collision, the pendulum swings up to a maximum angle of 24\(^\circ\) between the string and the vertical. Find the final speed of the bullet after the collision and the energy lost in the collision.

**Problem 5:**

You have purchased a batch of defective baseballs. For some unknown reason, they tend to explode. You toss one of these balls straight up. While
in mid-air, it explodes into two fragments, one of which has mass $m_1 = 0.2$ kg; the other has mass $m_2 = 0.10$ kg. The two fragments land on the ground at the same time. The heavier fragment lands 3.0 m to your left. The lighter fragment lands to your right in some thick grass.

Where should you look for the fragment?