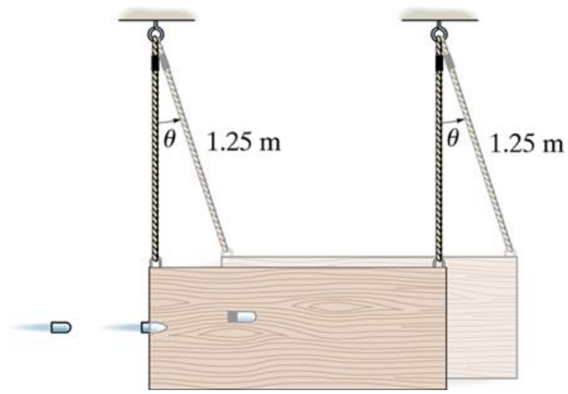
Quiz 07: Chapter 15 Due: Friday 16 Feb 24

Examine the solved problem below. There are four errors in the solution below. Your task is to locate and identify those errors, then correct them and calculate the proper result. If the same error occurs more than once, only count it as a single error, even if you have to correct it in more than one instance.

Each correctly identified error is worth 4 points, and the re-calculated result is worth 4 points as well. You must save your work in pdf format and submit via the Quiz 07 Assignment in the Chapter 15 folder in the Quizzes folder of the Online Classroom in Blackboard. Please do not use any other file format than pdf.

The ballistic pendulum consists of a wooden block ($m_A = 4\text{kg}$) attached to cables ($l = 1.25\text{m}$), originally at rest, $\theta = 0°$. When a bullet ($m_B = 2\text{g}$) strikes and becomes embedded in it, it is observed that the block swings upward to a maximum angle of $\theta = 6°$, where it comes to rest. Calculate the speed of the bullet v_o at the instant just before impact.



A) Calculate the height of the block in its final position:

$$h = l\cos\theta = (1.25\text{m})\cos(6°) = 1.24\text{m}$$

B) Calculate the potential energy when the block reaches maximim height:

$$U_2 = m_A g h = (4\text{kg})\left(9.8\tfrac{\text{m}}{\text{s}^2}\right)(1.24\text{m}) = 48.7\text{N}$$

C) Energy is conserved from the instant after the collision until the block comes to rest:

$$T_1 = \tfrac{1}{2}m_A v_1^2$$
$$U_1 = 0$$
$$T_1 = U_2$$
$$\tfrac{1}{2}m_A v_1^2 = m_A g h$$
$$v_1 = \sqrt{\frac{2gh}{m_A}} = \sqrt{\frac{2\left(9.8\frac{\text{m}}{\text{s}^2}\right)(1.24\text{m})}{(4\text{kg})}}$$
$$v_1 = 4.94\tfrac{\text{m}}{\text{s}}$$

D) Momentum is conserved during the collision:

$$p_o = p_1$$
$$m_B v_o = m_A v_1$$
$$v_o = \frac{m_A v_1}{m_B} = \frac{(4\text{kg})\left(4.94\frac{\text{m}}{\text{s}}\right)}{(0.02\text{kg})} = 987\tfrac{\text{m}}{\text{s}}$$