2010 F=ma Exam: Problem 14

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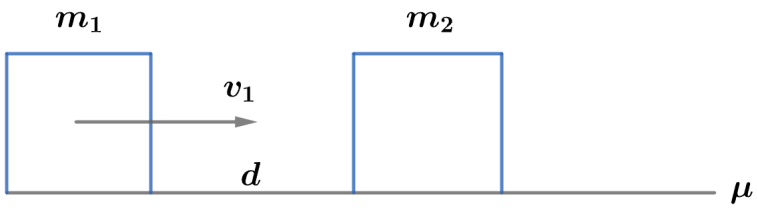
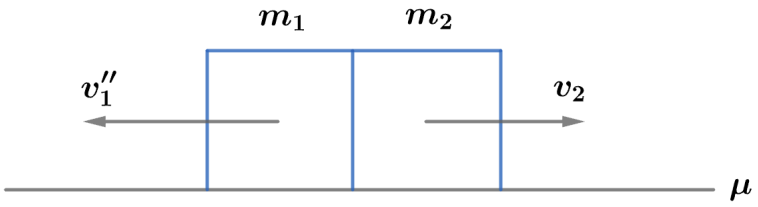


By conservation of energy, the velocity of m_1 when it reaches m_2 is

$$\frac{1}{2}m_1 v_1'^2 = \frac{1}{2}m_1 v_1^2 - \mu m_1 g d$$

$$v_1' = \sqrt{v_1^2 - 2\mu g d}$$



Using the elastic collision equation, the velocity of m_2 right after the collision is

$$v_2 = \frac{2m_1}{m_1 + m_2} v_1'$$

We conserve energy again to find how far m_2 slides:

$$\frac{1}{2}m_2 v_2^2 = \mu m_2 g d_2$$

$$d_2 = \frac{v_2^2}{2\mu g} = \frac{1}{2\mu g}\left(\frac{2m_1}{m_1 + m_2}\right)^2 (v_1^2 - 2\mu g d) = \frac{4m_1^2}{(m_1 + m_2)^2}\left(\frac{v_1^2}{2\mu g} - d\right) = 1.79\,\text{m}$$

so the answer is $\boxed{\text{B}}$.