

76. Using mechanical energy conservation, we find the speed  $v$  of a pendulum at the bottom of its swing is related to the height  $h$  it was released from (or that it swings up to) by  $v^2 = 2gh$ . Thus, the conservation of momentum at the instant they collide can be expressed as

$$m_1 \sqrt{2gd} = (m_1 + m_2) \sqrt{2gh_f} .$$

Therefore, the “final” height of the system (which it swings to shortly after the collision) is

$$h_f = \left( \frac{m_1}{m_1 + m_2} \right)^2 d .$$