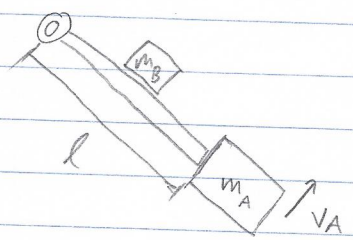
20-P-MOM-DY-29

A $m = 1$ kg block is attatched to the end of a $\ell = 1.5$ rigid rod with negligible mass. The other end of the rod is connected to a pivot which allows the rod to rotate in the horizontal plane. If the mass is traveling at the velocity $v = 2\ m/s$ before the rod has a completely inelastic collision with a 0.5 kg mass at the middle of the rod, determine the velocity of the block after the collision.



Solution: $H_1 + \sum \int_{t_1}^{t_2} M\,dt = H_2$

$r_O m_B v_B + r_A m_A v_A + 0 = r_A m_A v_{A2} + r_B m_B v_{B2}$

($r_O m_B v_B \downarrow 0$)

$v_{A2} = \omega_2 r_A$

$v_{B2} = \omega_2 r_B$

$r_A m_A v_A = r_A m_A \omega_2 r_A + r_B m_B \omega_2 r_B = \omega_2 (r_A^2 m_A + r_B^2 m_B)$

$\therefore \omega_2 = \dfrac{r_A m_A v_A}{(r_A^2 m_A + r_B^2 m_B)} = 1.18 J$

$v_{A2} = \omega_2 r_A = 1.77\ m/s$