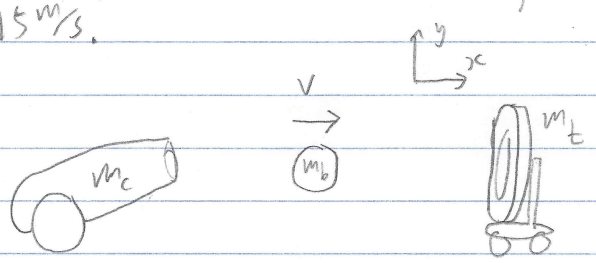
1000kg

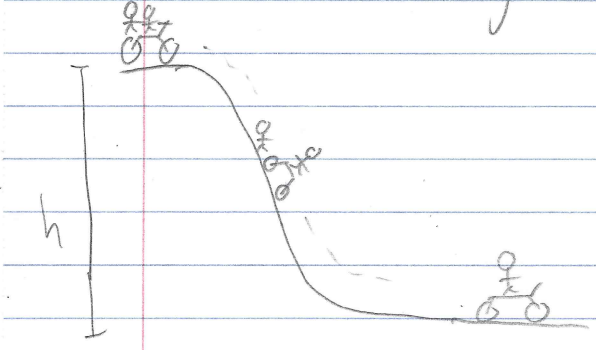
② A cannon on wheels shoots a 50kg cannon at a 10kg target, also on wheels. If the collision is completely elastic, determine the final velocity of the cannon and the target. The cannonball travels at 15 m/s.



$-m_c v_c = m_b v_b \qquad v_c = -\frac{m_b v_b}{m_c} = -0.75\ m/s$

$m_b v_b = (m_b + m_t) v_t \qquad v_t = \frac{m_b v_b}{(m_b + m_t)} = 12.5\ m/s$

③ A two-seater bicycle is rolling down a 30m hill. halfway down the hill, one of the passengers falls off the bike. Determine the velocity at the bottom of the hill if the bike has a mass 15kg and each passenger has a mass 70kg.



State 1: mgh

State 2: $\frac{mgh}{2} + \frac{1}{2}mv_2^2$

State 3: $\frac{1}{2}mv_3^2$

v_2

$mgh = \frac{mgh}{2} + \frac{1}{2}mv_2^2 \qquad v_2 = \sqrt{\frac{mgh}{2} \times \frac{2}{m}} = \sqrt{gh} = 12.13\ m/s$

$m_i v_i = m_f v_f$

$m_i = 70 \times 2 + 15 = 155$

$m_f = 85$

$v_i = v_2 = 12.13\ m/s$

$v_f = 22.119\ m/s$

$\frac{mgh}{2} + \frac{1}{2}m v_f^2 = \frac{1}{2}m v_g^2$

$v_3 = 25.727\ m/s$ ✓