Solutions: Exam 1: Fall, 2004, Section 3979

(1) $v_F = v_I + at \Rightarrow a = -v_I/t$

$x = v_I t + \frac{1}{2} a t^2 \rightarrow x = v_I t + \frac{1}{2}\left(-\frac{v_I}{t}\right) t^2 = \frac{1}{2} v_I t$

$\Rightarrow v_I = \frac{2x}{t} = \frac{2 \times 50}{5} \frac{m}{s} = \boxed{20 \frac{m}{s}}$

$x_P = v_{PI} t + \frac{1}{2} a_P t^2$

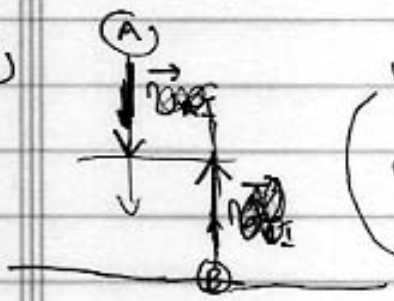
$x_A = x_P$

$v_{AI} t + \frac{1}{2} a_A t^2 = v_{PI} t + \frac{1}{2} a_P t^2$

$(v_{AI} - v_{PI}) t = \frac{1}{2}(a_P - a_A) t^2$

$t = \frac{2(v_{AI} - v_{PI})}{a_P - a_A} = \frac{2(40 - 0)}{5 - 3}\, s = \boxed{40\ s}$

(3)



$y_{AF} - y_{AI} = v_{AI} t - \frac{1}{2} g t^2$

$y_{BF} - y_{BI} = v_{BI} t - \frac{1}{2} g t^2$

$y_{AF} = y_{BF}$

$\Rightarrow y_{AI} + v_{AI} t - \frac{1}{2} g t^2 = y_{BI} + v_{BI} t - \frac{1}{2} g t^2$

$v_{AI} = \frac{y_{BI} - y_{AI}}{t} + v_{BI}$

$v_{AI} = \frac{0 - 30}{10} + \frac{20}{10}\ m/s = -15 + 10\ m/s = -5\ m/s$

$|v_{AI}| = \boxed{5\ m/s}$

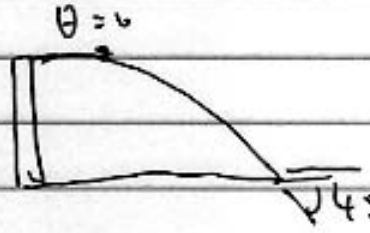
(4) $X = \frac{V_I^2 \sin 2\theta}{g}$ V_I same both

$\theta = 45°$ both (maximum distance)

$$\Rightarrow \frac{X_I}{X_E} = \frac{g_E}{g_I} = \frac{9.8}{4}$$

$$X_I = \frac{9.8}{4} \times 500\ m = \boxed{1225\ m}$$

(5)



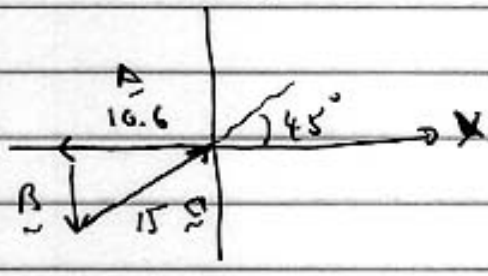
$$V_{xF} = V_I \cos\theta = V_I$$

$$V_{yF} = V_I \sin\theta - gt = -gt$$

$$1 = \tan 45 = \left| \frac{V_{yF}}{V_{xF}} \right| = \frac{gt}{V_I}$$

$$\Rightarrow V_I = gt = 9.8 \times 2\ \frac{m}{s} = \boxed{19.6\ m/s}$$

(6)



$$\underset{\sim}{A} + \underset{\sim}{B} + \underset{\sim}{C} = 0$$

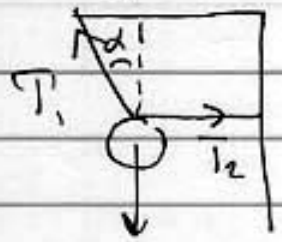
$$B_x = 0$$

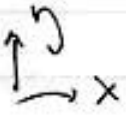
$$B_y = -A_y - C_y = -C_y$$

$$= -15 \sin 45 = -10.6\ m$$

$$\boxed{B = 10.6\ m}$$

(7)

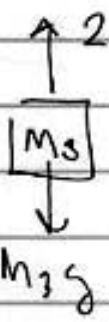




$$\Sigma F_y = T_1 \cos\alpha - mg = 0$$

$$T_1 = \frac{mg}{\cos\alpha} = \frac{2 \times 9.8\,N}{\cos 30^\circ} = \boxed{22.6\,N}$$

(8)



$$20N - m_3 g = m_3 a$$

$$a = \frac{20 - m_3 g}{m_3} = \frac{20 - 1 \times 9.8}{1}\ \frac{m}{s^2}$$

$$a = 20 - 9.8\ \frac{m}{s^2} = \boxed{10.2\ m/s^2}$$

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