Solution

Midterm Exam 03 (PHYS 203A) Spring 2018

Prob. 1

$$W_{total} = \Delta K = \frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2$$

$$= \frac{1}{2}(25)(10)^2 - \frac{1}{2}(25)(5)^2 = 940 \text{ Joules}$$

Prob. 2

(a) $W_T = 0$

(b) $\Delta U = mgh_f - mgh_i = -mgh = -(5.0)(9.8)(0.40) = -20. \text{ J}$

(c) $\Delta K + \Delta U = 0 \Rightarrow \Delta K = -\Delta U = 20. \text{ J}$

Prob. 3

$$K = \frac{1}{2} m v^2 \Rightarrow K = \frac{p^2}{2m}$$

$$p = mv$$

$$m = \frac{p^2}{2K} = \frac{(11)^2}{2(60.5)} = 1.0 \text{ kg}$$

$$v = \frac{p}{m} = \frac{11}{1.0} = 11 \text{ m/s}$$

Prob. 4

$$\frac{1}{2} m v_A^2 + mgh_A = \frac{1}{2} m v_c^2 + mgh_c$$

$$\frac{1}{2}(5.0)^2 + (9.8)(50.0) = \frac{1}{2} v_c^2 + (9.8)(40.0)$$

$$v_c^2 = (5.0)^2 + 2(9.8)(10.0)$$

$$v_c = 15 \frac{m}{s}$$

Prob. 5

$m_2 = 3m_1$

$$m_1 v_{1i} + m_2 v_{2i} = (m_1 + m_2) v_f$$

($v_{2i} = 0$)

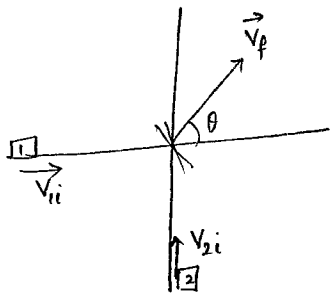
$$v_f = \frac{m_1 v_{1i}}{m_1 + m_2} = \frac{1}{4} v_{1i} = \frac{4.00}{4} = 1.00 \frac{m}{s}$$

Prob. 6

$$m_1 v_{1i} \hat{i} + m_2 v_{2i} \hat{j} = (m_1 + m_2) \vec{v}_f$$

$$(2000)(20)\hat{i} + (6000)(10)\hat{j} = 8000 \vec{v}_f$$

$$\vec{v}_f = 5.00 \hat{i} + 7.50 \hat{j}$$



magnitude: $|\vec{v}_f| = \sqrt{5.00^2 + 7.50^2} = 9.0 \frac{m}{s}$

direction: $\theta = \tan^{-1}\left(\frac{7.50}{5.00}\right) = 56°$ North of East.

Prob. 7

$\omega_i = +20.0 \frac{rad}{s}$ $\quad \Delta t =$ $\quad \alpha =$

$\omega_f = 0$

$\Delta\theta = +12.0$ revolutions $= (12.0)(2\pi)$ rad $= 75.4$ rad

$$\alpha = \frac{\omega_f^2 - \omega_i^2}{2\Delta\theta} = \frac{0 - (20.0)^2}{2(75.4)} = -2.65 \frac{rad}{s^2}$$

$$a = \alpha R$$

$$= -(2.65)(0.300)$$

$$= -0.795 \frac{m}{s^2}$$