

Answers P 1050 Final Exam Winter 2007

- 1 (a) (i) 0.020 kgm^2
 1 (a) (ii) $0.060 \text{ kgm}^2/\text{s}$
 1 (a) (iii) 0.005 kgm^2
 1 (a) (iv) 12.0 rad/s
 1 (a) (v) 0.270 J
 1 (b) $6\mathbf{k} \text{ kgm}^2/\text{s}$

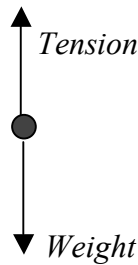
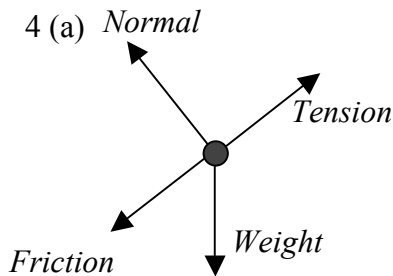
- 2 (a) 0.0653 J
 2 (b) -0.0275 J
 2 (c) 4.05 m/s
 2 (d) 0.639 s
 2 (e) 2.59 m
 2 (f) $4.05 \mathbf{i} \text{ m/s} - 6.27 \mathbf{j} \text{ m/s}$

3 (a) Write Newton's second law at top of loop: $-N - mg = -mv^2/R$. Since $N = 0$ (given) then m cancels and we have $g = v^2/R$. Rearrange to see $v = \sqrt{Rg}$.

3 (b) $E_i = mgh$ and $E_f = \frac{1}{2}mv^2 + mg(2R)$ (*height at the top of the loop is the diameter or twice the radius*). Equate the energies to find $mgh = \frac{1}{2}mv^2 + mg(2R)$. Cancel mass to find $gh = \frac{1}{2}v^2 + g(2R)$. Substitute in $v^2 = Rg$ (*from (a)*) to find $gh = \frac{1}{2}Rg + g(2R)$. Cancel g to find $h = \frac{1}{2}R + (2R) = 2.5R$.

3 (c) $\sqrt{5gR}$

3 (d) Write Newton's second law at bottom of loop to obtain $N - mg = mv^2/R$. Substitute in $v = \sqrt{5gR}$ to find $N - mg = m(5gR)/R = 5mg$. Solve for $N = 6mg$.



4 (b) $T = 589 \text{ N}$

4 (c) $a = 3.92 \text{ m/s}^2$ (up the hill for the 50 kg mass and down for the 100 kg mass)

4 (d) 1959 J

5 (a) 2.50 m/s , $\phi = 60^\circ$

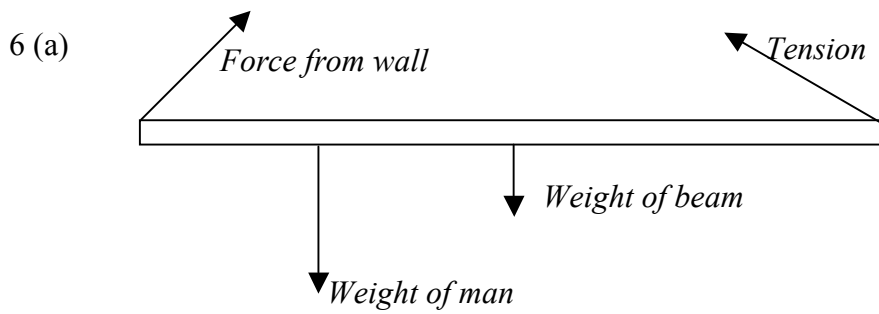
5 (b) $\mathbf{v}_1 = 3.75 \mathbf{i} + 2.17 \mathbf{j} \text{ m/s}$, $\mathbf{v}_2 = 1.25 \mathbf{i} - 2.17 \mathbf{j} \text{ m/s}$

5 (c) $0.125 \mathbf{i} - 0.217 \mathbf{j} \text{ kgm/s}$

5 (d)

$$\vec{v}_{cm-i} = \frac{m\vec{v}_{1-i} + m\vec{v}_{2-i}}{m+m} = \frac{m(5.00\mathbf{i}) + m(0)}{m+m} = 2.5\mathbf{i} \text{ m/s}$$

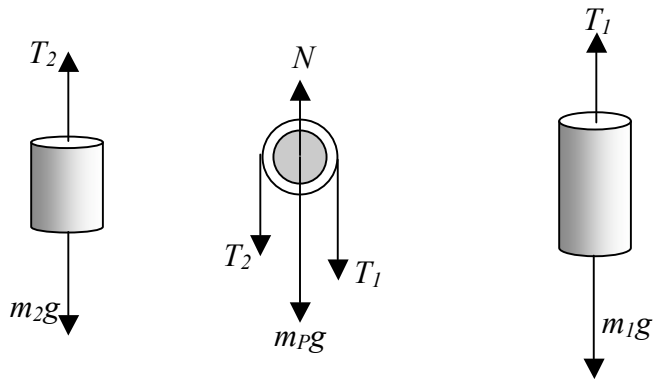
$$\vec{v}_{cm-f} = \frac{m\vec{v}_{1-f} + m\vec{v}_{2-f}}{m+m} = \frac{m(3.75\mathbf{i} + 2.17\mathbf{j}) + m(1.25\mathbf{i} - 2.17\mathbf{j})}{m+m} = \frac{m(3.75\mathbf{i}) + m(1.25\mathbf{i})}{m+m} = \frac{m(5.00\mathbf{i})}{m+m} = 2.5\mathbf{i} \text{ m/s}$$



6 (b) $T = 391 \text{ N}$

6 (c) $F_{\text{wall-y}} = 638 \text{ N}$, $F_{\text{wall-x}} = 235 \text{ N}$

7 (a)



7 (b) 0.450 kgm^2

7 (c) 1.51 m/s^2

7 (d) 3.47 m/s

8 (a) 0.500 Hz , $T = 2.00 \text{ s}$

8 (b) 5.00 cm

8 (c) $-\pi/6$

8 (d) 15.7 cm/s , 49.3 cm/s^2

8 (e) 4.83 cm , -4.07 cm/s , 47.7 cm/s^2

8 (f) 0.75 J

9 (a) 0.520 m

9 (b) 0.368 kgm^2

9 (c) -5.10 J

9 (d) 5.10 J , 5.27 rad/s

9 (e) 4.21 m/s

9 (f) 0 rad/s^2