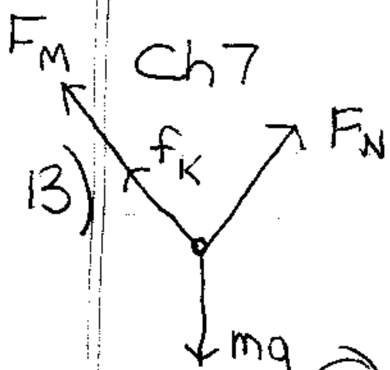
Ch7 ch7

13)



$a=0$ so ① $0 = mg\sin 27° - f_K - F_M$

$\Delta K = 0$

e) $W_{TOT} = 0$

$f_K = \mu F_N = \mu mg\cos 27°$

② $0 = F_N - mg\cos 27$

$W_g \overset{+}{=} (mg\sin 27°)(3.5m) \overset{+}{=} 5.9 \times 10^3$ J

$W_f = -(\mu mg\cos 27°)(3.5m) \overset{-}{=} 4.3 \times 10^3$ J

$W_M + W_g + W_f = W_{TOT} = 0$

$W_M = -1.6 \times 10^3$ J

21) $A \cdot (B+C) = A \cdot (-1.2\hat{i} - .9\hat{j} + 4.2\hat{k})$

$= (7.0\hat{i} - 8.5\hat{j}) \cdot (-1.2\hat{i} - .9\hat{j} + 4.2\hat{k})$

$= -8.4 + 7.65 = -.75$

b) $(A+C) \cdot B = (13.8\hat{i} - 15.7\hat{j}) \cdot (-8\hat{i} + 8.1\hat{j} + 4.2\hat{k})$

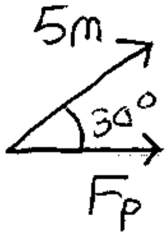
$\overset{-}{=} 110.4 - 127.2 = -237.57$

(ch 7)

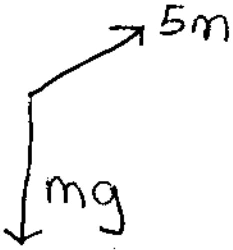
43) $\Delta K = W_{TOT}$

$$\Delta K = -\tfrac{1}{2} m V_0^2 = \tfrac{1}{2}(1300\,Kg)\left(\left(\frac{100\,Km}{hr}\right)\left(\frac{hr}{3600\,s}\right)\left(\frac{1000\,m}{1\,Km}\right)\right)^2$$

$$= 5.0 \times 10^5\ J$$

55) 

$$W_p = F_p\, d \cos 30°$$
$$= (150\,N)(5\,m)\cos 30°$$
$$= 650\ J$$

b) 

$$W_g = mgd \cos 120° = -490\,J$$

c) $0\,J = W_N$

d) $W_{TOT} = W_p + W_g + W_N$

$$= 160\,J = \Delta K = \tfrac{1}{2} m V_f^2$$

$$V_f = 4\,m/s$$

ch 8

#5) $U = mgh = 52\,J$ b) $15\,J = mgh_2$

c) W_{done} = part A = 52 J (Ground to Air)

Ch 8

13) $\frac{1}{2}mV_i^2 = \frac{1}{2}mV_f^2 + mgh$

$\frac{1}{2}V_i^2 = \frac{1}{2}(.70\,m/s)^2 + g(2.1\,m)$

$V_i = 6.46\,m/s$

19) Energy is conserved

$\frac{1}{2}Kx_0^2 + \frac{1}{2}mV_0^2 = \frac{1}{2}mV_{MAX}^2$

$\frac{1}{2}Kx_0^2 + \frac{1}{2}mV_0^2 = \frac{1}{2}KX_{MAX}^2$

so $V_{MAX} = \sqrt{\frac{Kx_0^2}{m} + V_0^2}$

$X_{MAX} = \sqrt{x_0^2 + \frac{V_0^2}{K}}$

29) $\xrightarrow{\quad}$ 350N

$W_{TOT} = \Delta K = \frac{1}{2}mv^2$

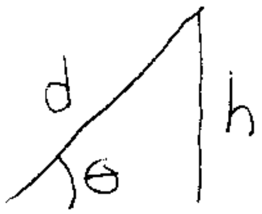
$W_{TOT} = (350N)(15m) + (350N)(15m) + (-\mu mg)(15m)$

$= 7200J = \frac{1}{2}mv^2 \quad V = 12.6\,m/s$

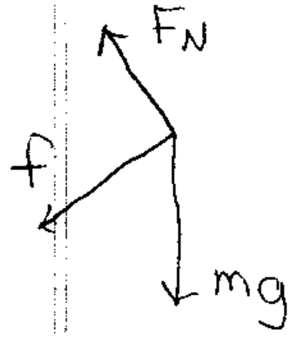
From force diagram

31) $\cancel{\mu(-mg\cos\theta)d - (\mu mg\sin\theta)d = -\frac{1}{2}mV_0^2}$

$\cancel{\mu = \frac{(g\cos\theta)d + \frac{1}{2}V_0^2}{dg\sin\theta}}$

31) 

$h = d\sin\theta \quad d = 12\,m$



$W_g = -mgh = -mgd\sin\theta$

$W_f = (-\mu_K mg\cos\theta)d$

$F_N = mg\cos\theta \quad \Delta K = W_{Tot}$

$$-\tfrac{1}{2}mv_0^2 = -mgd\sin\theta - \mu_K mgd\cos\theta$$

$$\frac{\frac{1}{2}v_0^2 - gd\sin\theta}{gd\cos\theta} = \mu_K = \frac{\frac{1}{2}v_0^2}{gd\cos\theta} - \tan\theta = .23$$

39) $\frac{1}{2}mv_0^2 = \frac{GmM}{r}$ so $v_0 = \sqrt{\frac{2GM}{r}}$

In orbit $\frac{mv^2}{r} = \frac{GMm}{r^2}$ so $v = \sqrt{\frac{GM}{r}}$

57) $\frac{1}{2}mv^2 = \frac{1}{2}(80\,kg)(5\,m/s)^2 = 1000\,J$

b $P = \text{Watts} = \frac{\Delta W}{\Delta t} = 1000\,W$

65) Ave mass ~ 65 kg $P = \frac{\Delta W}{\Delta t} = \frac{Mgh}{1\,hr}$

$$P = \frac{(65\,kg)(47000)g(200\,m)}{3600\,s} \sim 2\times 10^6\,W = 2\,MW$$

Ch9

#5) $\Delta p = \int_{1s}^{2s} (26\hat{i} - 12t^2\hat{j})\,dt$

$= (26t\,\hat{i} - 4t^3\hat{j})\Big|_{1s}^{2s}$

$= (52Ns\,\hat{i} - 32Ns\,\hat{j}) - (26Ns\,\hat{i} - 4Ns\,\hat{j})$

$= 26Ns\,\hat{i} - 28Ns\,\hat{j}$

#13) $0 = M_B V_{B_f} + M_C V_{B_f} + M_P (10m/s)$
(initial)

$0 = (81kg)V_{Bf} + (5.4kg)(10m/s)$

$V_{Bf} = -.67\ m/s$

23) $J = \Delta p = F_{AVE}\,\Delta t$

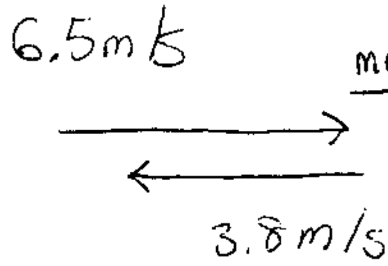
$(.06kg)(65m/s) = (F_{AVE})(.03s)$

$F_{AVE} = 130N$

28) Area under curve = Impulse 1 Block = .5NS
~12 Blocks so ~6Ns = Δp = mV $V = 100m/s$

Ch 9

35) momentum + energy conservation



momentum

$$① \; (.22\,kg)(6.5\,m/s) = (.22\,kg)(-3.8\,m/s) + m_2 V_2$$

Energy

$$② \; \tfrac{1}{2}(.22\,kg)(6.5\,m/s)^2 = \tfrac{1}{2}(.22\,kg)(-3.8\,m/s)^2 + \tfrac{1}{2} m_2 V_2^2$$

$$① \; V_2 = \frac{2.266\,kg\,m/s}{m_2}$$

$$② \; 3.06\,J = \tfrac{1}{2} m_2 \frac{5.13\,kg^2 m^2/s^2}{m_2^2}$$

$$6.12\,J = \frac{5.13\,kg^2 m^2/s^2}{m_2} \qquad m_2 = .84\,kg$$

$$① \; V_2 = \frac{2.266\,kg\,m/s}{.84\,kg} = \pm 2.7\,m/s$$

45.

$$x: \; mV - mV\cos\theta = \frac{2mV}{3}\cos\theta'$$

square + Add (cancel mV) $\rightarrow$

$$y: \; -mV\sin\theta = \frac{2mV}{3}\sin\theta'$$

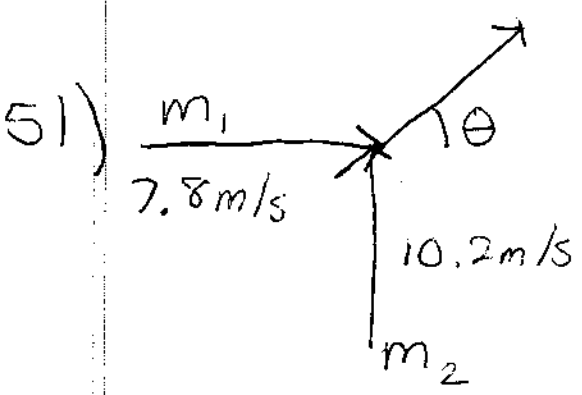
$$\left(1 - \cos\theta = \tfrac{2}{3}\cos\theta'\right)^2$$

$$\left(-\sin\theta = \tfrac{2}{3}\sin\theta'\right)^2$$

$$1 - 2\cos\theta + (\cos^2\theta + \sin^2\theta) = \tfrac{4}{9}(\sin^2\theta' + \cos^2\theta')$$

$$2 - 2\cos\theta = 4/9 \qquad \theta = 39^\circ$$

ch9

51) 

$$m_1\vec{V}_{1_i} + m_2\vec{V}_{2_i} = m_1\vec{V}_{1_f} + m_2\vec{V}_{2_f}$$

$$x: (3.3\,\text{Kg})(7.8\,\text{m/s}) = (7.9\,\text{Kg})\,V_{fx}$$

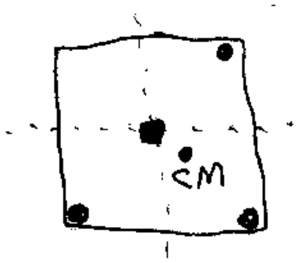
$$y: (4.6\,\text{Kg})(10.2\,\text{m/s}) = (7.9\,\text{kg})\,V_{fy}$$

$$V_{fx} = 3.26\,\text{m/s}$$

$$V_{fy} = 5.94\,\text{m/s}$$

$$V = \sqrt{V_{fx}^2 + V_{fy}^2} = 6.8\,\text{m/s} \qquad \theta = \tan^{-1}\frac{5.94}{3.26}$$

$$= 61^\circ$$

63) 

$$x_{cm} = \frac{1}{9800\,\text{kg}}\Big((6200\,\text{kg})0 + (1200\,\text{kg})(9\,\text{m}) + (1200\,\text{kg})(9\,\text{m}) + (1200\,\text{kg})(-9\,\text{m})\Big)$$

origin at center of ferry

$= 1.1$ m (right of center)

likewise $y_{cm} = -1.1$ m (south of center)

73) $\uparrow +$ momentum conserved $\quad 0 = MV_{BE} + V_{PE}\,m$

initial Balloon-Earth Person-Earth

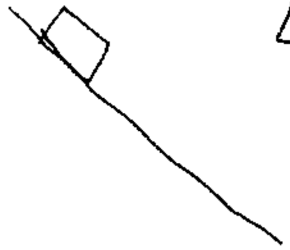
$$V_{PE} = V_{PB} + V_{BE}$$

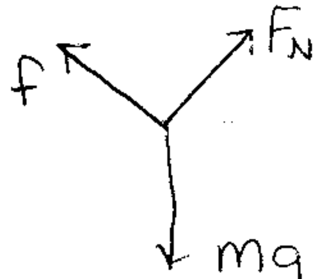
Person walks downward

$$0 = MV_{BE} + m(-V + V_{BE})$$

$$V_{BE} = \frac{mV}{M+m}$$

j7.4, j8.5, j8.12

j7.4  $\Delta K = 0 = W_{TOT}$



$W_f + W_{mg} = W_{TOT} = 0$

$W_f = -W_{mg}$

$W_{mg} = mgh$ $\quad h \approx .5m$ $\quad$ so $W_g = (12kg)(9.81m/s^2)(.5m)$

$W_f = -59J$ $\qquad W_g = 59J$

$\Delta U = -59J$

(j8.5) $(2500kg)(11m/s) = (m + 2500kg)(7.05m/s)$

$m = 1400kg$

j8.12 1) x: $m(14.14m/s)\cos 45^\circ + m(14.14m/s)\cos 45^\circ$

$= m(14.14m/s)\cos 45^\circ + m(14.14m/s)\cos 45^\circ$ ✓

same for y

$0 =$ y: $-m(14.14m/s)\sin 45^\circ + m(14.14m/s)\sin 45^\circ$

$= +m(14.14m/s)\sin 45^\circ + -m(14.14m/s)\sin 45^\circ$

2) momentum = 0 in both x and y

3) Along 45° line $m(14.14m/s) = m(14.14m/s)$

4) harder $\qquad$ 5) harder $\Rightarrow$

j8.12) cont.

different $\rightarrow$ 2kg

4) x: $m(14.14 m/s)\cos 45^\circ + m_2(14.14)\cos 45^\circ$

$= m(19.44 m/s)\cos 60^\circ + m_2(10.54 m/s)\cos 20^\circ$

y: $m(-14.14 m/s)\sin 45^\circ + m_2(14.14)\sin 45^\circ$

$= m(19.44 m/s)\sin 60^\circ + m_2(-10.54)\sin 20^\circ$

Close

5) x: $m_1(14.14 m/s)\cos 45^\circ + m_2(14.14)\cos 45^\circ$

$= m_1(11.85 m/s)\cos 32^\circ + m_2(28.2)\cos 69^\circ$

10kg

y: $m_1(14.14 m/s)\sin 45^\circ + m_2(14.14)\sin 45^\circ$

$= -m_1(11.85)\sin 32^\circ - m_2(28.20)\sin 69^\circ$