Chapter 9 - 2, 5, 8, 9, 18
24, 39, 48, 58, 67

2) $\boxed{\vec{p}=0}$ because $\vec{v}=0$ at max height.

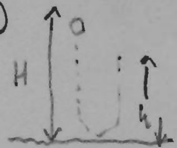
what is max height? $\frac{1}{2}mv^2 = mgh_{max} \Rightarrow h_{max} = \frac{v^2}{2g} = \boxed{11.5\,m}$

To get $v_{1/2}$: $\frac{1}{2}mv_1^2 = mg\frac{h_{max}}{2} + \frac{1}{2}mv_{1/2}^2 \Rightarrow v_{1/2}^2 = v_1^2 - gh \Rightarrow v_{1/2} = \boxed{10.6\,m/s}$

So $\vec{p} = m\vec{v} = .1 \times 10.6 = \boxed{1.06\ kg\,m/s\ \text{up}}$

5) $\frac{1}{2}mv^2 = KE \quad p = mv \Rightarrow v = p/m \Rightarrow \frac{1}{2}m\frac{p^2}{m^2} = \boxed{\frac{p^2}{2m}}$

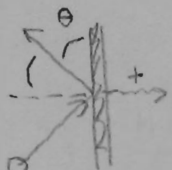
$K = \frac{p^2}{2m} \Rightarrow \boxed{p = \sqrt{2mK}}$

8) 

Impulse $= \Delta p = p_f - p_i \qquad v_i = -(2gH)^{1/2}$

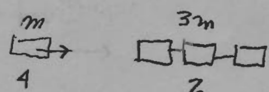
$\frac{1}{2}mv_f^2 = mgh \Rightarrow v_f = (2gh)^{1/2}$

$\Delta p = m([2gh]^{1/2} + [2gH]^{1/2}) = .15([2g\,5/4]^{1/2} + (2g \cdot .96)^{1/2}) = \boxed{1.39\ N\cdot s}$

9) 

$\frac{\Delta p}{\Delta t} = \frac{p_f - p_i}{.2} = \frac{-mv\sin\theta - mv\sin\theta}{.2} = 10mv\sin\theta = \boxed{-260\ N}$

3 10 60°

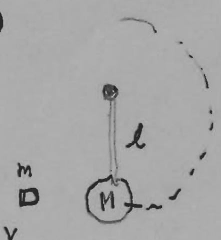
18) 

$4m + 6m = 4mV \Rightarrow V = \frac{10}{4} = \boxed{2.5\,m/s}$

$K_i = \frac{1}{2}m16 + \frac{1}{2}3m4 = 14M$

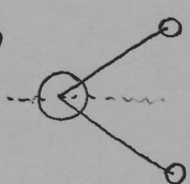
$K_f = \frac{1}{2}4m(6.25) = 12.5M \qquad \Delta K = 14M - 12.5 = 1.5M = \boxed{3.75\times10^4\,J}$

2.5×10^4

24) 

$mv = MV + mv/2 \Rightarrow \boxed{V = \frac{mv}{2M}}$

$\frac{1}{2}MV^2 = 2\ell Mg \Rightarrow V = (4\ell g)^{1/2} = \frac{mv}{2M} \Rightarrow \boxed{v = \frac{(4\ell g)^{1/2}2M}{m}}$

39) 

$y_{cm} = 0$

$x_{cm} = \frac{1(.1\cos53) + 1(.1\cos53)}{18} = \frac{.2\cos53}{18} = \boxed{.0067\ nm}$

48) 

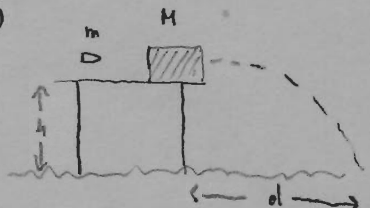
$v_{cm} = \frac{.2\ 150 - .3(-.4)}{.5} = \boxed{59.8\ m/s} \leftarrow v_{cm}$

same afterwards
(no external forces)

P 262 (9.20) + (9.21)

$v_{1f} = \left(\frac{m_1 - m_2}{m_1 + m_2}\right) v_{1i} + \frac{2m_2}{m_1 + m_2} v_{2i} = \frac{-.1}{.5} 150 + \frac{.6}{.5}(-.4) = \boxed{-30.5\ m/s}$

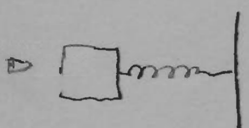
$v_{2f} = \frac{2m_1}{m_1 + m_2} v_{1i} + \frac{m_2 - m_1}{m_1 + m_2} v_{2i} = \frac{.4}{.5} 150 + \frac{.1}{.5}(-.4) = \boxed{119.9\ m/s}$

58) 

$mv = (M+m)V \Rightarrow \boxed{V = \frac{mv}{m+M}}$

$\frac{1}{2} g t^2 = h \Rightarrow t = \left(\frac{2h}{g}\right)^{1/2} \Rightarrow d = Vt = \left(\frac{mv}{m+M}\right)\left(\frac{2h}{g}\right)^{1/2}$

Solve for v = $\boxed{d\left(\frac{g}{2h}\right)^{1/2} \frac{(m+M)}{m}}$

67) 

$mv_i = MV + mv_f$

$\frac{1}{2} MV^2 = \frac{1}{2} k \Delta x^2$ } block-spring system $V = \left(\frac{k\Delta x^2}{M}\right)^{1/2} = \left(\frac{900\ .05^2}{1}\right)^{1/2} = \boxed{1.50\ m/s}$

$\frac{(.005)400 - 1(1.5)}{.005} = v_f = \boxed{100\ m/s}$

$ME_i = \frac{1}{2} m v^2 = \frac{1}{2}(.005)400^2 = 400\ J$

$ME_f = \frac{1}{2} k x^2 + \frac{1}{2} m v_f^2 = \frac{1}{2}(900)(.05)^2 + \frac{1}{2}(.005)100^2 = 1,125 + 25 = 26.125$

So $400 - 26.125 \cong \boxed{374\ J}$