Pg 178 - 180; #28, 29, 32, 33

28.) - need to find speed of block just after collision

$$K_i = U_{g_f} = \frac{1}{2}(m)\vec{v}_i^{\,2} = mgh \Rightarrow \vec{v}_i = \sqrt{\frac{\cancel{m}gh}{\frac{1}{2}\cancel{m}}}$$

$$\rightarrow \vec{v}_i = \sqrt{2(10 m/s^2)(.120m} = 1.55 m/s$$

* now use conservation of $\vec{p}$ to solve rest

$$(m_{bullet} \cdot \vec{v}_{i\,bullet}) + (m_{block} \cdot \vec{v}_{i\,block}) = (m_{bullet} \cdot \vec{v}_{f\,bullet}) + (m_{block} \cdot \vec{v}_{f\,block})$$

$$\vec{v}_{i\,bullet} = \frac{(m_{bullet} \cdot \vec{v}_{f\,bullet}) + (m_{block} \cdot v_{f\,block})}{m_{bullet}}$$

$$\vec{v}_{i\,bullet} = \frac{(.007kg \cdot 200 m/s) + (1.5kg \cdot 1.55 m/s)}{(.007kg)}$$

$$\vec{v}_{i\,bullet} = 532.14 m/s$$

how would you solve? process!

Pg 179: 30, ~~32, 44~~, 48, ~~55~~, 56, ~~57~~, 58, 59

30.) *need to determine $\vec{V}_i$ of block & bullet following collision

- need to use a kinematic to solve for Δt, for block & bullet to travel from ground to table

For vertical direction:

Δx	1.0m
$\vec{V}_i$	0m/s
$\vec{V}_F$	
$\vec{a}$	$-10 m/s^2$
Δt	

$$\Delta x = \vec{V}_i \Delta t + \frac{1}{2}\vec{a}\Delta t^2 \rightarrow \Delta t = \sqrt{\frac{\Delta x}{\frac{1}{2}a}}$$

$$\rightarrow \Delta t = \sqrt{\frac{1.0m}{\frac{1}{2}(-10 m/s)}}$$

$$\Delta t = .45s$$

* now use this to find $\vec{V}_i$ in "x" direction of bullet & block

For horizontal direction:

Δx	2.00m
$\vec{V}_i$	
$\vec{V}_F$	
$\vec{a}$	$0 m/s^2$
Δt	.45

$$\Delta x = \vec{V}_i \Delta t + \frac{1}{2}\vec{a}\Delta t^2$$

$$\rightarrow \vec{V}_i = \frac{\Delta x}{\Delta t} = \frac{2.00m}{.45s} = 4.45 m/s \rightarrow \text{of bullet \& block}$$

* now cons. of $\vec{p}$ to solve for $\vec{V}_i$ of bullet

$$(m_{bullet} \cdot \vec{V}_i) + (m_{block} \cdot \vec{V}_i) = ((m_{bull} + m_{block}) \vec{V}_F)$$

$$\rightarrow \vec{V}_{i\,bullet} = \frac{(m_{bullet} + m_{block}) \cdot \vec{V}_F}{m_{bullet}}$$

$$\rightarrow \vec{V}_i = \frac{(.008kg + .250kg) \cdot +4.45 m/s}{(.008kg)} = +143 m/s$$

33) start w/ cons of energy to solve for speed of block & bullet just after impact

$\rightarrow K_{\text{block \& bullet}} = U_g \rightarrow$

$\rightarrow \frac{1}{2}(m_{\text{block \& bullet}})(\vec{v}_i^{\,2}) = \frac{1}{2}kx^2$

$\rightarrow \vec{v}_i = \sqrt{\frac{kx^2}{m_{\text{total}}}} = \sqrt{\frac{(150\,N/m)\cdot .80\,m^2}{.112\,kg}} =$

$\vec{v}_i$ bullet & block $= 29.3\,m/s$

$\rightarrow$ is $\vec{v}_f$ in cons of $\vec{p}$

*now use conservation of $\vec{p}$

$(m_{\text{bullet}} \cdot \vec{v}_i) + (m_{\text{block}} \cancel{\vec{v}_0}) = (m_{\text{tot}} \cdot \vec{v}_f)$

$\rightarrow \vec{v}_i = \frac{m_{\text{tot}} \cdot \vec{v}_f}{m_{\text{bullet}}}$

$\rightarrow \vec{v}_i = \frac{.112\,kg \cdot 29.3\,m/s}{.012\,kg} = 273\,m/s$