

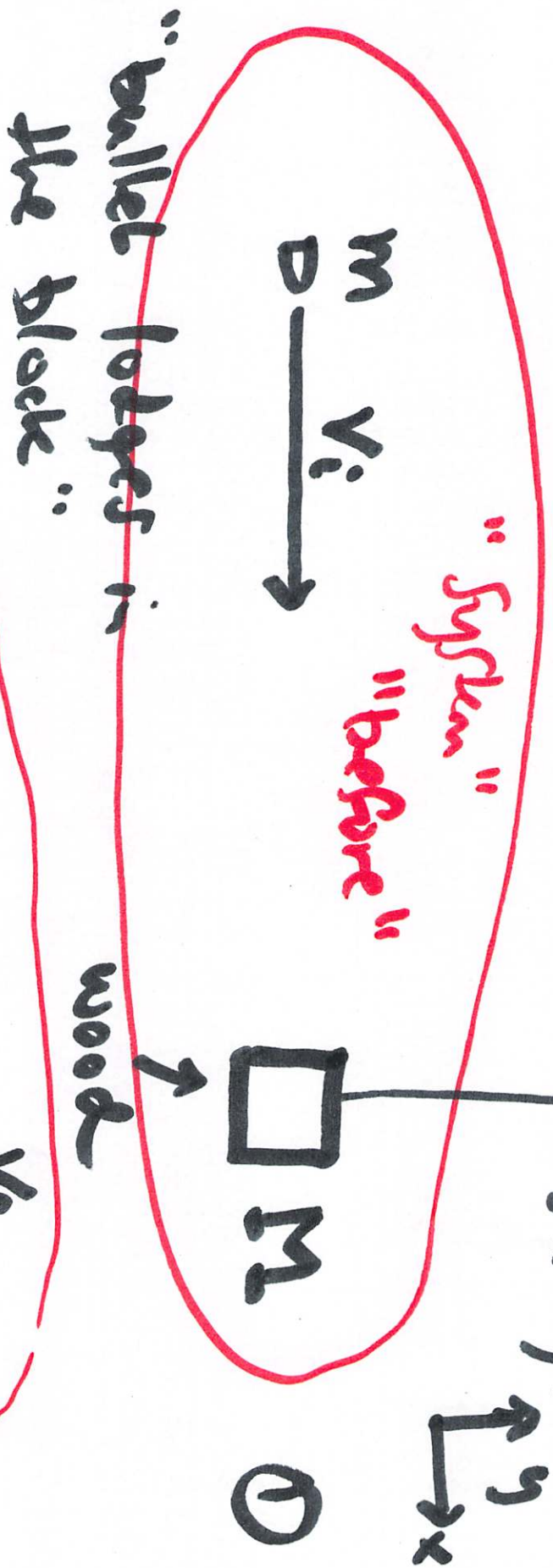
Energy, work

"Energy conservation": Any change in energy can be accounted for in terms of work.

Momentum.

"Momentum conservation": Any change in the total momentum of a system can be accounted for by an external \vec{F}

Vacuum Chamber



"bullet lodges in the block"



Collision is not elastic so heat must have been generated.

Energy conservation:

$$\frac{1}{2} m \vec{v}_i^2 = \frac{1}{2} (M+m) |\vec{v}_f|^2 + Q \quad \text{heat!}$$

momentum conservation:

$$\vec{p} = m \vec{v}_i = (M+m) \vec{v}_f + \text{external stuff.}$$

(bullet external stuff all in \hat{y} -direction)

So: $p_x = m |\vec{v}_i| = (M+m) |\vec{v}_f|$

b/c \vec{v}_i, \vec{v}_f both point in the x -direction

$$|\vec{V}_p| = \frac{m}{M+m} |\vec{V}_i|$$

i.e.: $|\vec{V}_p| \ll |\vec{V}_i|$ if $M \gg m$

$$KE_1 = \frac{1}{2} m |\vec{V}_i|^2 \quad \text{not equal}$$

$$KE_2 = \frac{1}{2} (M+m) |\vec{V}_p|^2 = \frac{1}{2} (M+m) \left(\frac{m^2}{(M+m)^2} |\vec{V}_i|^2 \right)$$

$$= \frac{1}{2} m \left(\frac{m}{M+m} \right) |\vec{V}_i|^2$$