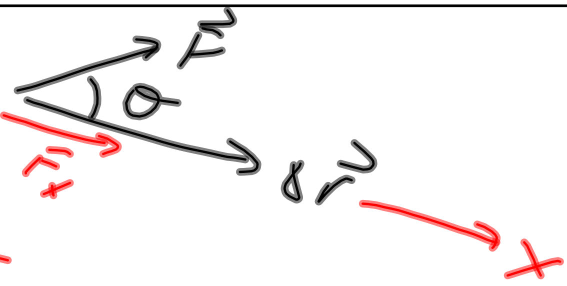
C6 $W \doteq F \Delta r \cos\theta$



$= F_x \Delta x$

$$= \begin{cases} + & \text{acute} \\ 0 & \perp \\ - & \text{obtuse} \end{cases}$$

$P = \frac{W}{\delta t}$ $\quad \epsilon \doteq \frac{W_{out}}{W_{in}}$ or $\frac{W_{out}}{Q_{in}}$

$y \uparrow$ $\boxed{W_{grav} = -mg\,\Delta y}$ conservative force

$W_{fric} = -f \Delta x \Big\}$ non-conservative "lossy"

$$\boxed{\begin{aligned} g &= 9.8\ m/s^2 \\ &= 9.8\ N/kg \\ &\ 9.79930\ldots \end{aligned}}$$

Energy Conservation -

$$E_{before} = E_{after}$$

$$W_{net} \doteq F_{net\,x}\,\Delta x = \left(F_g + F_f + F_{air} + F_N + \dots + F_{spring} + F_{?}\right)\Delta x$$

N2L //

$$m a_x \Delta x$$

$$\overset{ancient}{=} m\left(\frac{v^2 - v_0^2}{2}\right)$$

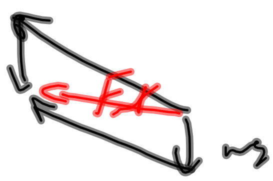
Recall (ancient): $v^2 = v_0^2 + 2a\,\Delta x$

$$\frac{v^2 - v_0^2}{2} = \frac{\cancel{2}a\,\Delta x}{\cancel{2}}$$

$$\overset{math}{=} \tfrac{1}{2}mv^2 - \tfrac{1}{2}mv_0^2 \doteq K - K_0$$

$$\boxed{W_{net} \overset{N2L}{=} \Delta K}$$ ~ Work Energy Thm ~ holistic

$F_{net} = ma$ ~ moment by moment



K of $\frac{\text{rollercoaster}}{\text{car}} = \frac{1}{2}(500\,\text{kg})(36\ \frac{m}{s})^2 = 343\,\text{kJ}$

$80 \frac{\cancel{mi}}{\cancel{hr}} \left(\frac{1609\,m}{1\,\cancel{mi}}\right)\left(\frac{1\,\cancel{hr}}{3600\,s}\right) = 36\ m/s$

$\frac{kg}{} \cdot \frac{m}{s^2} \cdot m = Nm = J$

K of sball $= \frac{1}{2}(.6\,\text{kg})(15\ \frac{m}{s})^2 = 68\,J$

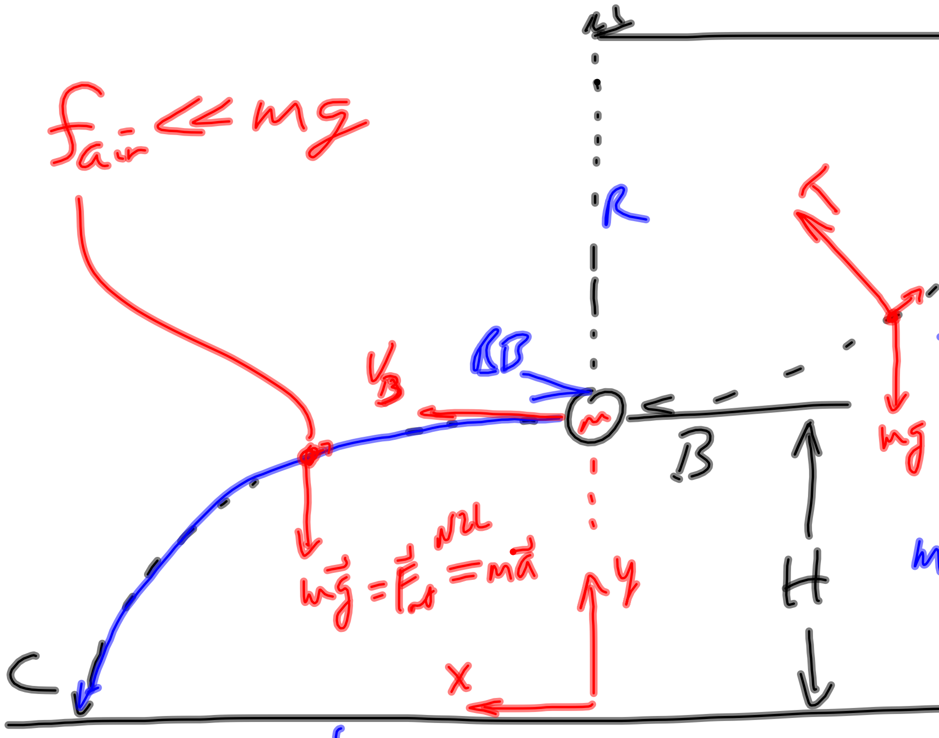
K H.B. $= \frac{1}{2}(86\,\text{kg})(11\ \frac{m}{s})^2 = 5200\,J$

$W_{nt} = \Delta K = 0 - 5200\,J = -5.2\,kJ$

$= F(1m)(-1) \Rightarrow F = 5200\,N = 1200^{\#}$

$W_{\text{thing BBL}} = F(1.5m) = \Delta K = 68\,J - 0$

$F = \frac{68\,J}{1.5\,m} = 45\,N \sim 10^{\#}$



A

$V_A = 0$

$K = 0$

$K_B = \frac{1}{2} m V_B^2$

$= \Delta K$

W_{net} = W.E.T.

$= W_g + W_T + W_f$

$= -mg\Delta y$

$mgR = \frac{1}{2} m V_B^2$

$V_B = \sqrt{2gR}$

$= 4.09\ m/s$

i = B → f = C

x	y
$a_x = 0$	$a_y = -g$ ~ const.
$V_x = V_{x0} + \cancel{a_x t}$	$V_y = V_{y0} - gt$
$\Delta x = V_{x0} t + \cancel{\frac{1}{2} a_x t^2}$	$\Delta y = \cancel{V_{y0}} t - \frac{1}{2} g t^2$
$\Delta x = V_B \sqrt{\frac{2H}{g}}$	$\underbrace{= -H \qquad 0}$

$=$

$\frac{2H}{g} = \frac{\cancel{g} t^2}{\cancel{g}} \Rightarrow t = \sqrt{\frac{2H}{g}}$

$\Delta x = V_B \sqrt{\frac{2H}{g}}$

$= \sqrt{2gR}\sqrt{\frac{2H}{g}}$

$= \sqrt{4RH}$

$= \sqrt{4(.855\ m)(1.067)}$

$= 1.910\ m$

Conservation laws

γ

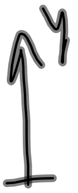
$$6\,O_2 + C_6H_{12}O_6 \rightleftarrows 6CO_2 + 6H_2O$$

# of C = # of C

# of O = # of O

mass of reactants = mass of prod.

$$E = K + U_g + U_s$$



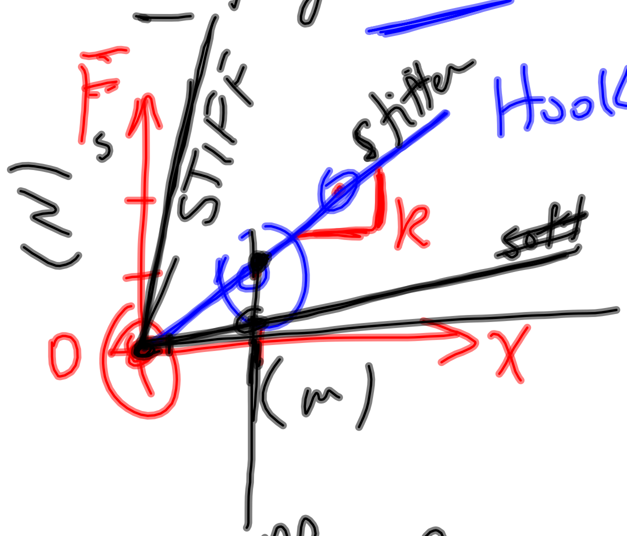
$$= \frac{1}{2}mv^2 + mgy + \frac{1}{2}kx^2$$

$\vec{F}_{net} = m\vec{a}$ ~ moment by moment

$W_{net} = \Delta K \qquad K \doteq \frac{1}{2}mv^2 \qquad \underline{W} \doteq \underline{F}\Delta x$

$W_{net} = W_g + W_s + W_T + W_f + W_N + \dots$

$= -mg\Delta y - \frac{1}{2}kx^2 + W_{nc}$ non-conservative



Hooke's law spring

" ~~Y = mX + b~~ "

$F_s = kX$

$F_{ph\,lab\,spring} = 9.21\,x$

$(N) = \left(\frac{N}{\cancel{m}}\right)\cancel{(m)}$

k ~ stiffness coefficient

$W_{spring} = F_x \Delta X \cos\theta = \left(\frac{0 + kx}{2}\right) X \cos 180°$

$= -\frac{1}{2}kx^2$

$$\boxed{W_{net} = \Delta K} \sim N2L$$

$$= \underline{W_g} + \underline{W_s} + W_{nc}$$

$$W_{nc} = \Delta K - W_g - W_s$$

$$= \underline{\Delta K} + \underline{\Delta U_g} + \underline{\Delta U_s}$$

$K = \frac{1}{2}mv^2$

$U_g = mgy$

$U_s = \frac{1}{2}kx^2$

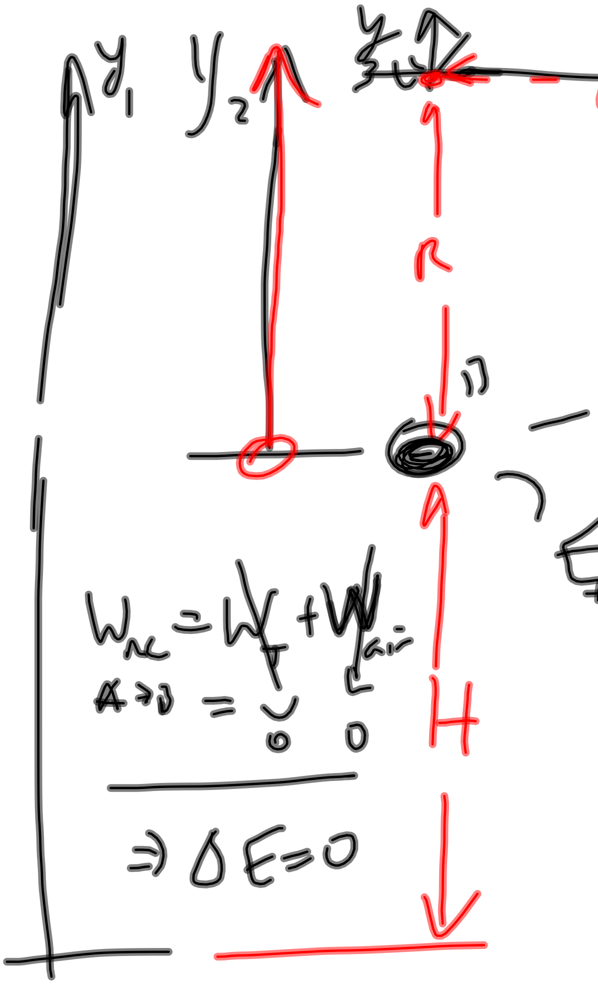
y

$$W_{nc} = (\underbrace{K + U_g + U_s}_{})_f - (\underbrace{K + U_g + U_s}_{})_i$$

$$W_{nc} = E_f - E_i = \Delta E$$

$$\boxed{W_{nc} = \Delta E}$$

~ energy conservation (if $W_{nc} = 0$)

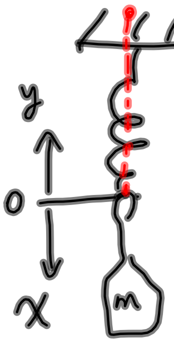


$$E_1 = K + U_g + U_s$$
$$= \frac{1}{2}mv^2 + mgy + \frac{1}{2}kx^2$$
$$= 0 + mgR \quad 0$$

$$E_f = K + U_g + U_s$$
$$= \frac{1}{2}mv^2 + mg(0) + 0$$

$$W_{nc} = W_f + W_{air}$$
$$A \to B = 0 \quad 0$$

$$\Rightarrow \Delta E = 0$$

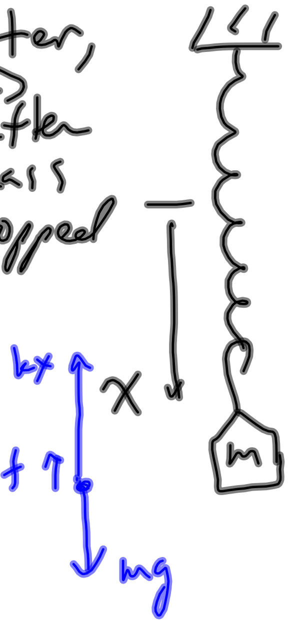


← your spring

$F = kx$

$v = 0$

later, after mass dropped →



Note: b/c y pts up & x pts dn & $x = 0 = y$ @ origin, $y = -x$

⋮ - string holding mass in place, burn it to release

$$E = K + U_g + U_s$$
$$= \tfrac{1}{2}mv^2 + mgy + \tfrac{1}{2}kx^2$$
$$= \tfrac{1}{2}mv^2 - mgx + \tfrac{1}{2}kx^2$$

@ release $v=0, y=0, x=0$

so $E = 0$

$W_{NC} = 0$ b/c friction, f, is the only other force and it's tiny.

$$\therefore\ 0 = \tfrac{1}{2}mv^2 - mgx + \tfrac{1}{2}kx^2$$

describes all subsequent motion

Now you can ask where ($x=?$) is it stopped ($v=0$)? $0 = 0 - mgx + \tfrac{1}{2}kx^2$

$$\Rightarrow\ 0 = \tfrac{1}{2}kx^2 - mgx$$
$$0 = x\left(\tfrac{1}{2}kx - mg\right)$$

↳ . . . . .

Recall basic algebra, when $0 = A \cdot B$, either $A = 0$ or $B = 0$