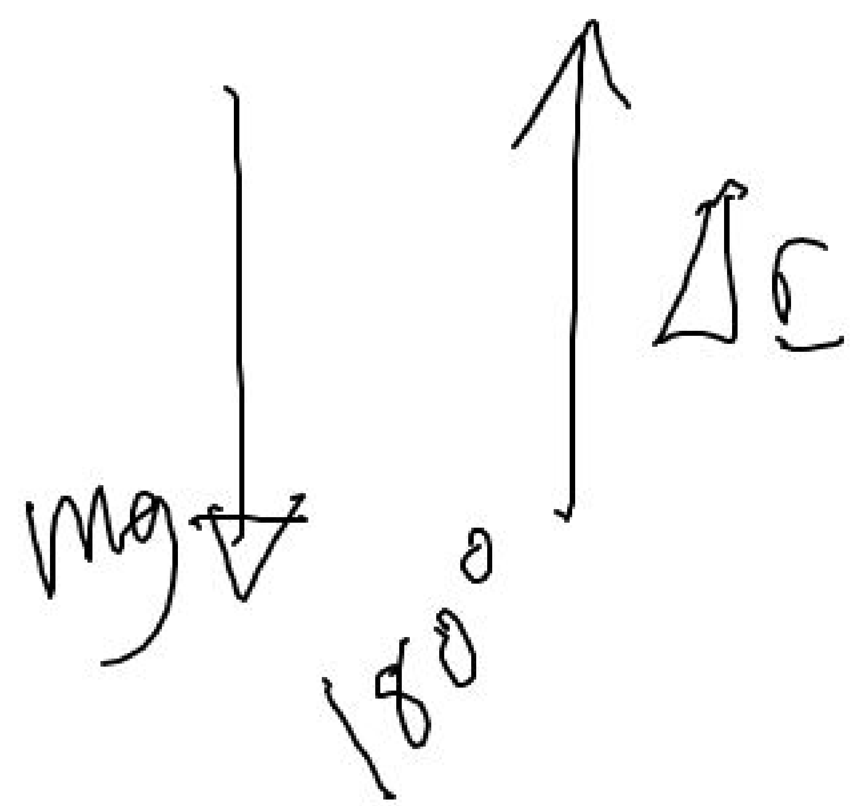
Conservation of Energy

$$W_{net} = F_{net}\,\Delta r = \Delta K = K_f - K_i$$
$$= F\,\Delta r \cos\phi$$



$$W_{net} = W_{gravity} + W_{person}$$

$$W_{net} = \cancel{W_{non}} + W_{con} = \Delta K$$

$$W_{con} = \underbrace{-\sum_i \Delta U_i}_{-\Delta U}$$

all consvs forces

$$\Rightarrow \boxed{0 = \Delta U + \Delta K} \Rightarrow \Delta E = 0$$

Conservation law

$$E = U + K$$

mechanical energy

$$\Delta E = 0$$

$$E_f = E_i$$

$$\frac{1}{2}\cancel{m}v_f^2 + \cancel{m}gy_f = \frac{1}{2}\cancel{m}v_i^2 + \cancel{m}gy_i \qquad y_f - y_i$$

$$(y_f - y_i) = \frac{\frac{1}{2}(v_i^2 - \cancel{v_f^2})}{g}$$

$$= \frac{v_i^2}{2g}$$

Potential Energy $U(x)$

Conservative forces (path-independent W)

Note: $U=0$ location arbitrary

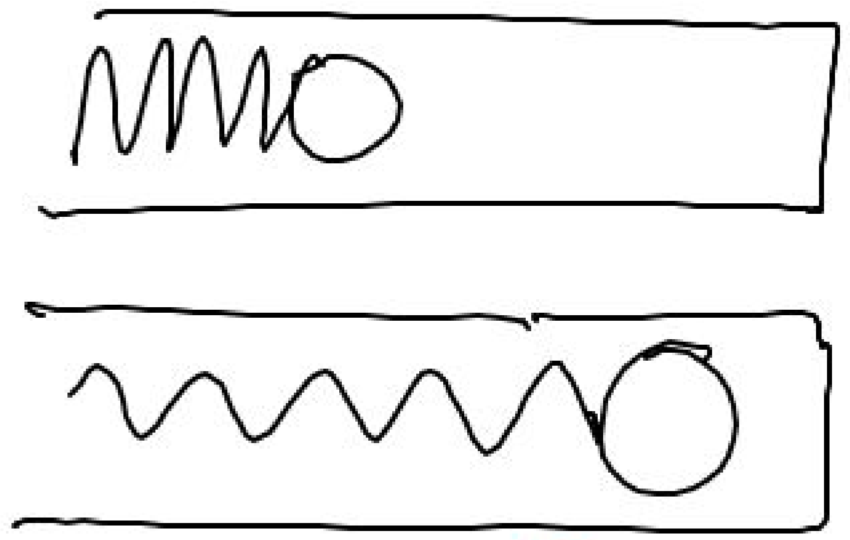
$\hookrightarrow W = -\Delta U$ definition

Ex/ $\uparrow +y$ Gravity $W_{gravity} = -mg\Delta y \Rightarrow \boxed{U_g = mgy}$

Elastic $W_{elastic} = \int_{x_1}^{x_2} -kx\,dx \Rightarrow \boxed{U_e = \frac{1}{2}kx^2}$

$x=0$ equilibrium

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



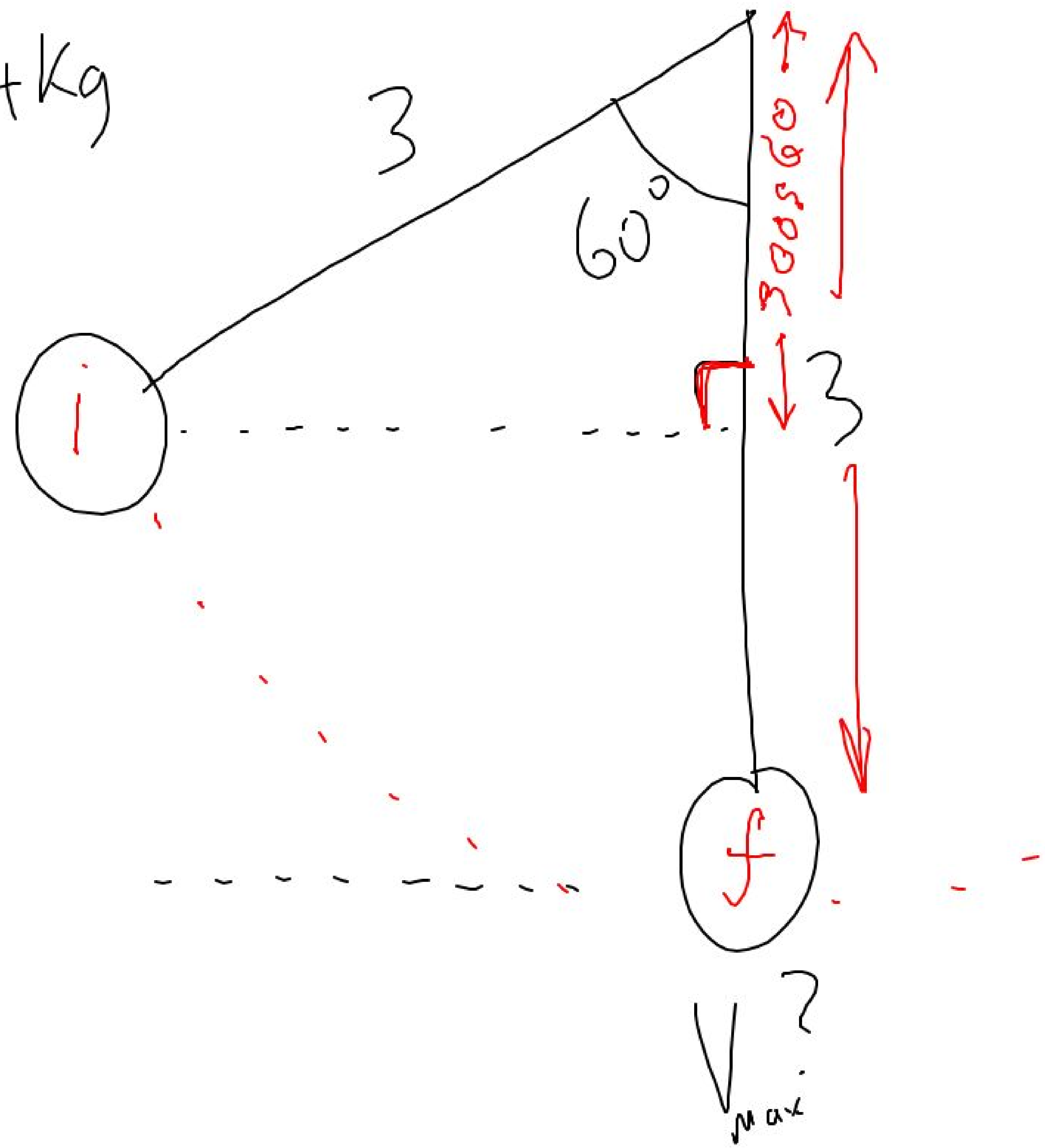
i

f

$$\frac{1}{2}\cancelto{0}{mv_i^2} + \frac{1}{2}kx_i^2 + \cancel{mgy_i} = \frac{1}{2}mv_f^2 + \frac{1}{2}\cancelto{0}{kx_f^2} + \cancel{mgy_f}$$

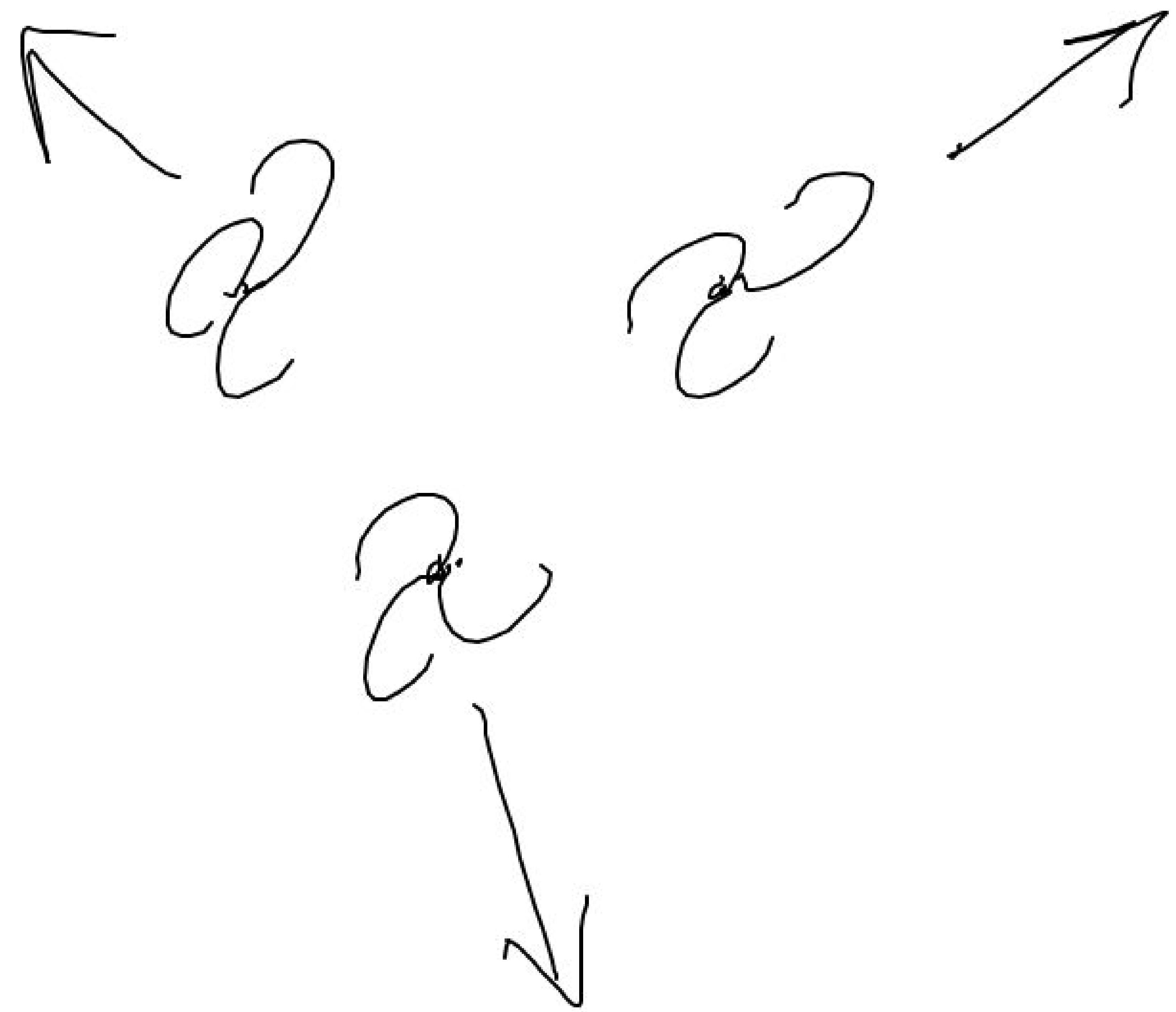
$$\frac{1}{2}kx_i^2 = \frac{1}{2}mv_f^2$$

$m = 0.4kg$



$$E_i = E_f$$

$$\cos 60 = \frac{1}{2}$$



$$E = K + U_g$$

$$+ \ ?$$

Dark Energy