Calorie – 4.186 J

Cal = 1000 cal

– raise 1 g H_2O – 14.5–15.5°C

BTU – energy to raise 1 pound of H_2O by $1\,^{\circ}F$

$\sim 1{,}055\ J$

therm - 100,000 BTU

105.5 MJ

~ energy in 100 cu ft. Natural gas

kWh - 3.6 MJ

1000 W for 1 h

erg - 10^{-7} J

one dyne over 1cm

$\underline{\text{dyne}} \rightarrow \frac{g \cdot cm}{s^2}$

Foe - 10^{51} Fifty one ergs

~ energy released by Supernova

~ 10^{44} J

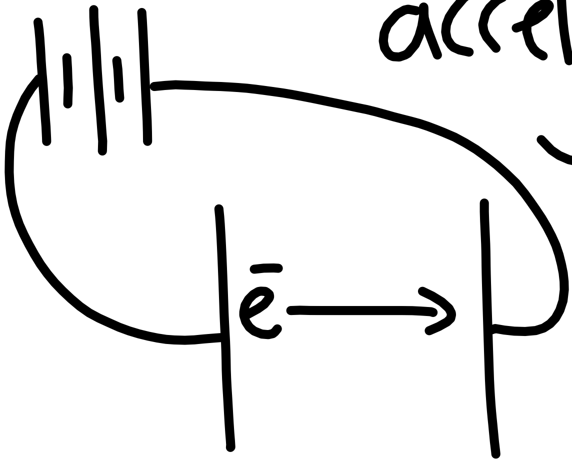
BOE - energy in 42 US gallons of oil

6.1×10^9 J

Quad – 10^{15} BTU

1.055×10^{18} J

eV - energy when e^- accelerates from rest through 1V



1.602×10^{-19} J

Kiloton - energy in 1000 t of TNT

4.184×10^{12} J

Kinetic Energy

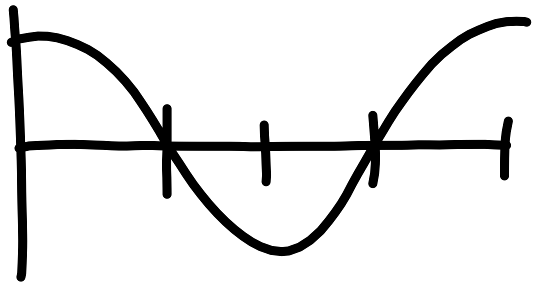
Review:

$W = \Delta E$

$W = \vec{F}\vec{s}$

$W = \vec{F}\cdot\vec{s}$

$W = |F||s|\cos\theta$



$\vec{F}$ $\rightarrow$, $\vec{s}$ $\rightarrow$: $\theta = 0^\circ$

$\vec{F}$ $\rightarrow$, $\vec{s}$ $\leftarrow$: $\theta = 180^\circ$

$$V_f^2 = V_i^2 + 2ad$$

$$\frac{V_f^2 - V_i^2}{2d} = a$$

$$F = ma$$

$$F = m\left(\frac{V_f^2 - V_i^2}{2d}\right)$$

$$Fd = m\,\frac{V_f^2 - V_i^2}{2}$$

$$Fd = \frac{mV_f^2}{2} - \frac{mV_i^2}{2}$$

$$Fd = \underbrace{\frac{1}{2}mv_f^2}_{K_f} - \underbrace{\frac{1}{2}mv_i^2}_{K_i}$$

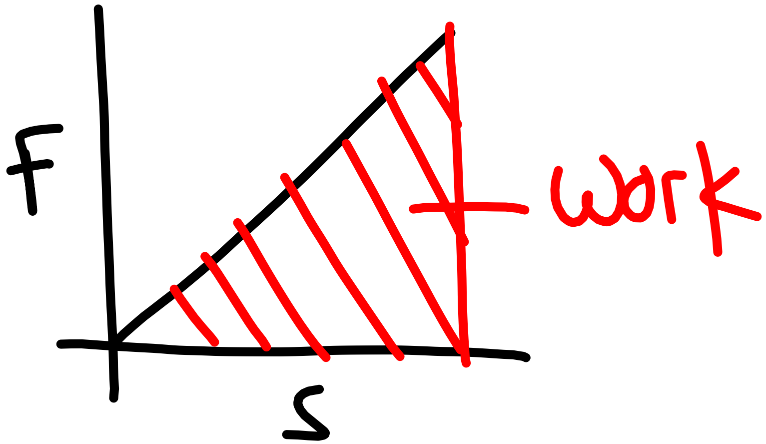
$$\vec{F}\cdot\vec{s} = K_f - K_i = \Delta E$$

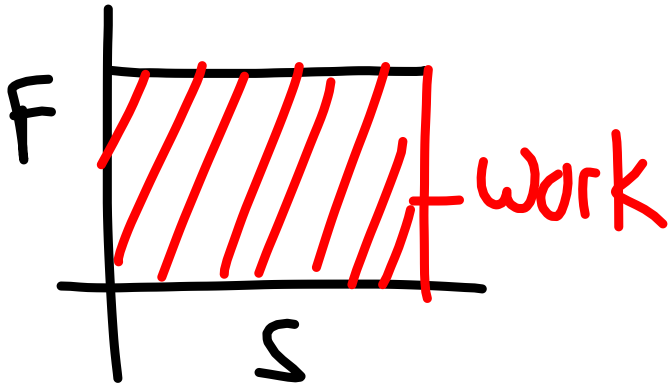
<u>or</u> ....

$$\Delta K = \vec{F} \cdot \vec{s}$$

$$\Delta K = \vec{F}(s) \cdot d\vec{s}$$

$$\Delta K = W = \int F(s)\, ds$$





$$\Delta K = \int F(s)\, ds$$

$$= \int ma \cdot ds$$

$$= m\int \frac{dv}{dt}\, ds$$

$$= m\int \frac{ds}{dt}\, dv$$

$$= m\int_{v_i}^{v_f} v\, dv$$

$$= m \frac{v^2}{2}$$

$$= m \frac{v_f^2 - v_i^2}{2}$$

$$\Delta K = \frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2$$

ex: Work on a 2.00 Kg Brick falling 3.00 From Rest?

$$W = \Delta E = \Delta K = K_f - \cancel{K_i}^{\,0}$$

$$V_f^2 = \cancel{V_i^2}^{\,0} + 2ad$$

$$V_f = \sqrt{2ad} = \sqrt{2(9.81)(3)} = 7.67\,\frac{m}{s}$$

$$K_f = \frac{1}{2} m v_F^2$$

$$K_f = \frac{1}{2}(2)(7.67)^2$$

$$K_f = 58.9\ J$$