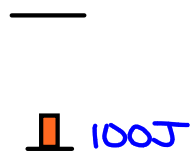2.8 Law of Conservation of Energy/Mechanical Energy

Recall: The Law of Conservation of Energy states that no energy is destroyed or lost it just changes from one form to another.
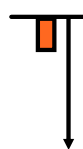
Mechanical Energy = Potential Energy + Kinetic Energy

100J

100J
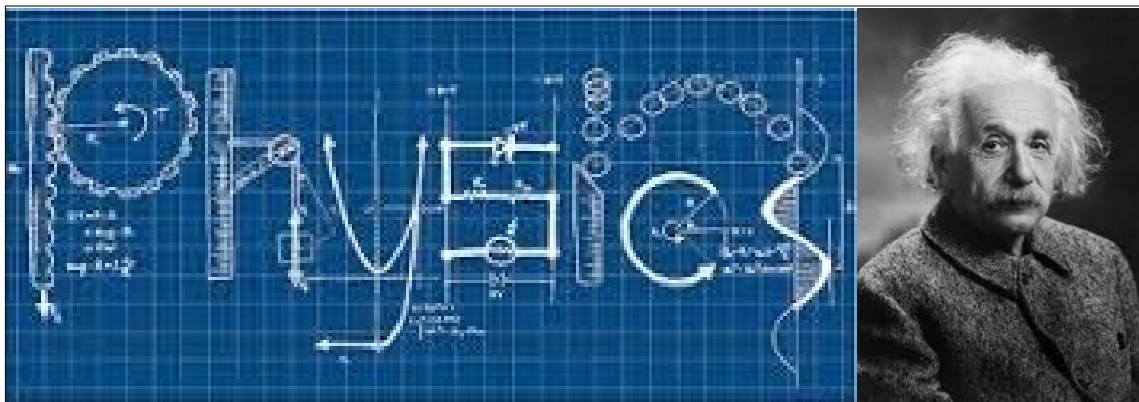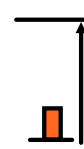
E_p = max	E_p = 0	E_p = decreases	E_p = increases
E_k = 0	E_k = max	E_k = increases	E_k = decreases

Mechanical Energy (E_T) is always the same
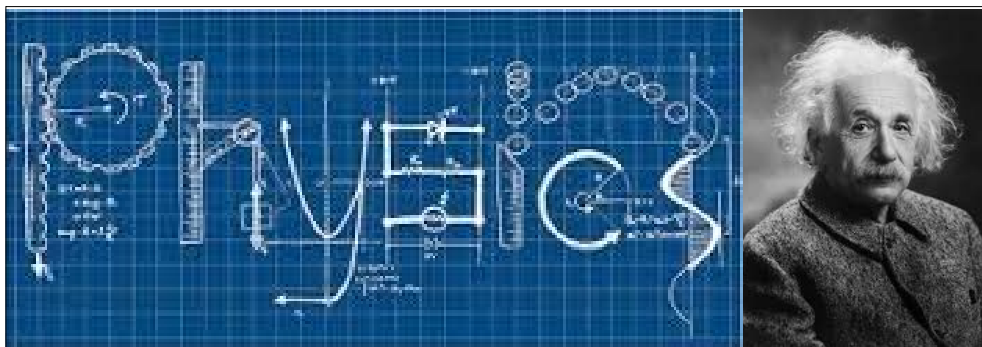
Ex.) A baseball (13 g) is thrown at a speed of 16 m/s at 2.0 m above the ground. What is the total energy at the instant the ball was released?

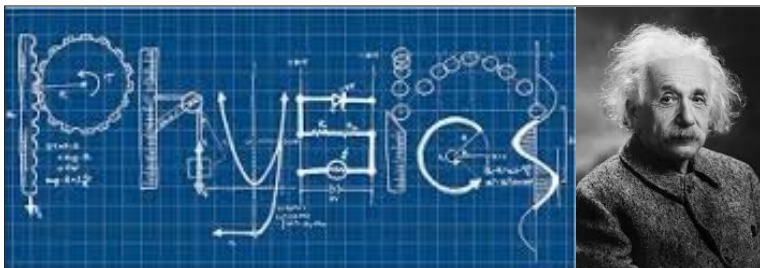mechanical
energy

$m = 0.013 \, kg$
$V = 16 \, m/s$
$h = 2.0 \, m$

$E_m = E_p + E_k$

$= mgh + \frac{1}{2}mv^2$

$= (0.013)(9.81)(2.0) + (\frac{1}{2})(0.013)(16)^2$

$= 0.25506 + 1.664$

$= \boxed{1.9 \, J}$

Ex.) A rock at the edge of a cliff is pushed and falls 17 m. If the rock has a mass of 2.5 kg, what speed does it hit the ground with?

$m = 2.5 \, kg$
$h = 17 \, m$
$g = 9.81 \, m/s^2$
$V = ?$

$E_{m\,top} = E_p$

$= mgh$

$= (2.5)(9.81)(17)$

$= 416.925 \, J$

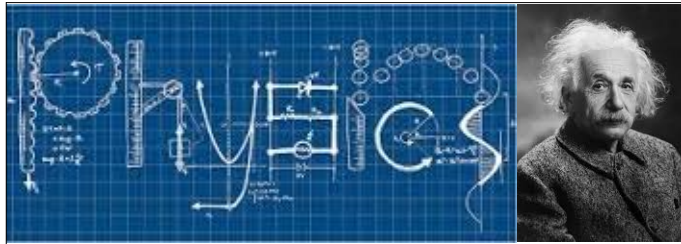$E_{m\,bottom} = E_k$

$416.925 \, J = \frac{1}{2}mv^2$

$416.925 = \frac{1}{2} \cdot 2.5 \cdot v^2$

$416.925 = 1.25v^2$

$\frac{416.925}{1.25} = \frac{1.25v^2}{1.25}$

$\sqrt{333.54} = \sqrt{v^2}$

$\boxed{V = 18 \, m/s}$

Ex.) An object has a mass of 450 kg and falls off a cliff at a speed of 28.5 m/s. How high is the cliff? and hits the ground

$E_P = max$
$E_k = 0J$

$E_k = max$
$E_P = 0J$

$E_{k_{bottom}} = E_{P_{top}}$

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

$\frac{\frac{1}{2}v^2}{g} = \frac{gh}{g}$

$h = \frac{0.5v^2}{g} = \frac{0.5(28.5)^2}{9.81}$

$\boxed{h = 41.4m}$

① Practice Questions.
② Worksheet - due tomorrow.
③ Quiz - tomorrow (E_P, E_k, E_m).