Flipping Physics Lecture Notes:

Introduction to Conservation of Mechanical Energy

When the 3.6 kg object is dropped from a height of 2.00 meters:

$$KE_i = \frac{1}{2}mv_i^2 = \frac{1}{2}(3.6)(0)^2 = 0$$

Set the horizontal zero line at the ground where the object lands …

$$PE_{gi} = mgh_i = (3.6)(9.81)(2) = 70.632 \approx 70.6\,J$$

Determining the velocity of the object after having fallen 1/3 of a meter:

$$v_{iy} = 0;\ a_y = -g = -9.81\frac{m}{s^2};\ \Delta y = -0.\overline{3}m;\ v_f = ?$$

$$v_{fy}^2 = v_{iy}^2 + 2a_y\Delta y = 0^2 + 2a_y\Delta y \Rightarrow v_{fy} = \sqrt{2a_y\Delta y} = \sqrt{(2)(-9.81)(-0.\overline{3})} = \pm 2.55734 = -2.55734\frac{m}{s}$$

$$a = \frac{\Delta v}{\Delta t} \Rightarrow \Delta t = \frac{\Delta v}{a} = \frac{v_f - v_i}{a} = \frac{-2.55734 - 0}{-9.81} = 0.26069s$$

And now determining Kinetic Energy and Gravitational Potential Energy of the object after having fallen 1/3 of a meter:

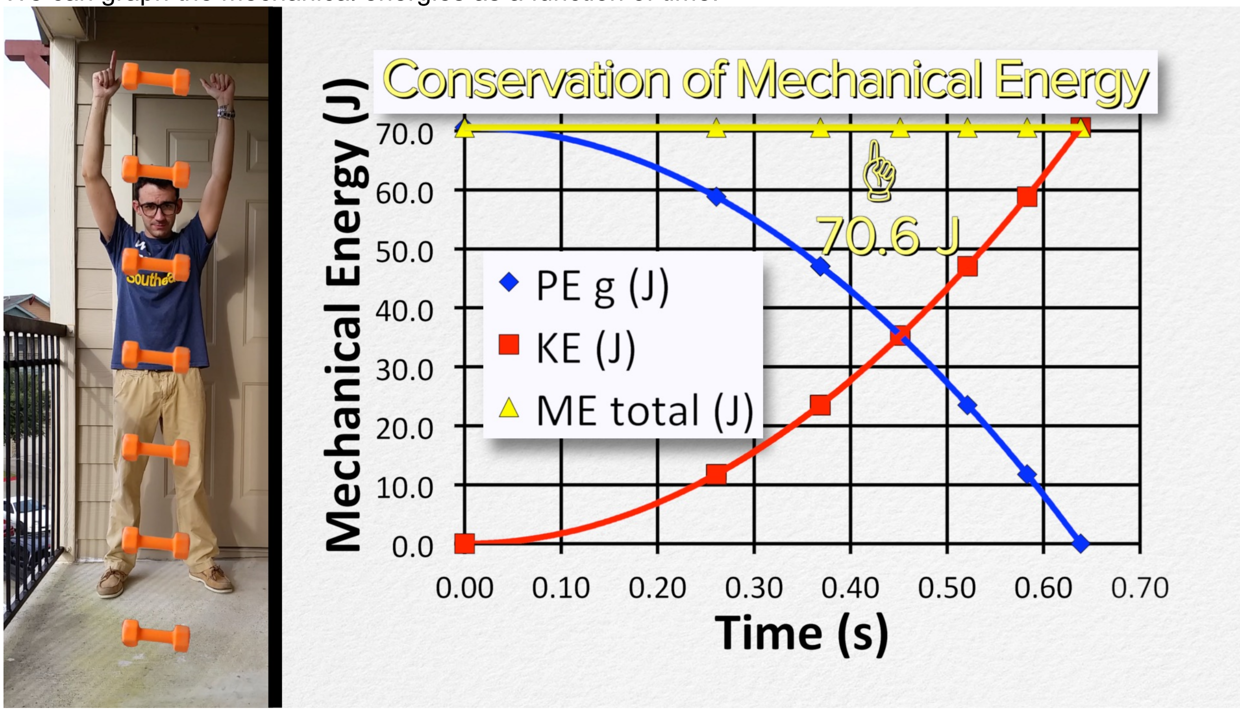
$$PE_h = mgh = (3.6)(9.81)(2 - 0.\overline{3}) = 58.860J$$

$$KE = \frac{1}{2}mv^2 = \frac{1}{2}(3.6)(-2.55734)^2 = 11.772J$$

And we can continue at each 1/3 of a meter interval to create this data table:

Height (m)	Time (s)	Velocity (m/s)	PE_g (J)	KE (J)	ME (J)
2.00	0	0	70.63	0	70.6
1.67	0.261	-2.56	58.86	11.77	70.6
1.33	0.369	-3.62	47.09	23.54	70.6
1.00	0.452	-4.43	35.32	35.32	70.6
0.67	0.521	-5.11	23.54	47.09	70.6
0.33	0.583	-5.72	11.77	58.86	70.6
0	0.639	-6.26	0	70.63	70.6

We can graph the mechanical energies as a function of time:



The total mechanical energy at every point adds up to 70.6 joules. This is because of Conservation of Mechanical Energy, the idea that energy is neither created nor destroyed; it simply changes forms. As the object falls it's gravitational potential energy because kinetic energy.

The equation for Conservation of Mechanical Energy is $\boxed{ME_i = ME_f}$

- True when $W_{friction} = 0$ & $W_{F_a} = 0$