The Law of Conservation of Energy

When anything is conserved it means the
TOTAL BEFORE = TOTAL AFTER

exchange

Any experiment is a change in energy between objects, or between forms in The same object. But total energy before is equal to the total energy after. The energy may change forms but is never created or destroyed the total energy remains constant.

We can express this with an equation:

$$E_{p_0} + E_{k_0} = E_{p_f} + E_{k_f} + E_H$$

[redacted]

A cat of 5.0 kg is 3.0 m up in a tree. What speed would it have at the ground if dropped? (assume no air resistance)

High Point ground

$$E_{p_0} + E_{k_0} = E_{p_f} + E_{k_f} + E_H$$

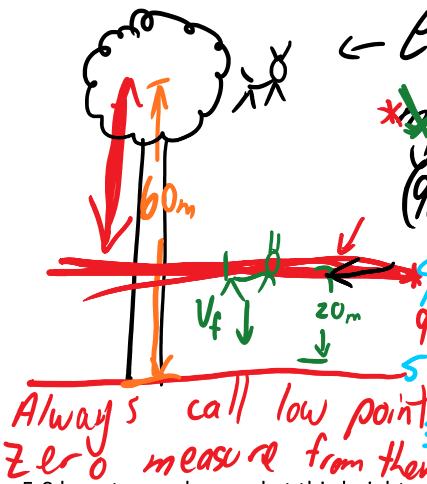
$$mgh_0 + \frac{1}{2}mv_0^2 = mgh_f + \frac{1}{2}v_f^2$$

$$(9.8)(3) = \frac{1}{2}v_f^2$$

$$\sqrt{58.8} = 7.7\ \frac{m}{s}$$

A cat is at rest 60.0 m up in a tree, it falls out, what speed does the cat have when still 20.0 m above the ground? (assume no air resistance.)

~~$Ep_o + Ek_o = Ep_f + Ek_f + E_H$~~



$$E_{p_0} + E_{k_0} = E_{p_f} + E_{k_f} + E_H$$

$$mgh_0 = mgh_f + \frac{1}{2}mv_f^2$$

$$(9.8)(60) = 9.8(20) + \frac{1}{2}v_f^2$$

$$9.8(60) - 9.8(20) = \frac{1}{2}v_f^2$$

$$588 - 196 = \frac{1}{2}v_f^2$$

$$392 = \frac{1}{2}v_f^2$$

$$\sqrt{784} = v_f = 28\ \frac{m}{s}$$

The same 5.0 kg cat was observed at this height of 20m to be travelling at only 20 m/s, what energy was dissipated as heat during the fall?

$$(9.8)(20) + \frac{1}{2}(5)(20)^2 + E_H$$

$$2940 = 980 + 1000 + E_H$$

$$960\text{J} = E_H$$

960J = Ek

A cat on the ground is thrown upward at 15 m/s, what velocity does it have when 4.0 m above the ground?

~~$Ep_o + Ek_o = Ep_f + Ek_f + E_h$~~

$E_{po} + E_{ko} = E_{pf} + E_{kf} + E_H$

$mgh_o + \frac{1}{2}mv_o^2 = mgh_f + \frac{1}{2}mv_f^2$

$\frac{1}{2}m(15)^2 = m(9.8)4 + \frac{1}{2}m v_f^2$

$112.5 = 39.2 + \frac{1}{2}v_f^2$

$112.5 - 39.2 = 73.3 = \frac{1}{2}v_f^2$

$\frac{73.3}{\frac{1}{2}} = v_f^2$

$146.6 = v_f^2$

$\sqrt{146.6} = v_f = 12.1 \frac{m}{s}$

A A sphinx of unknown mass is thrown from an alien space ship from height 45 m above Earth's surface UP at 20 m/s what speed has it when 12 m below the spaceship?

$E_{po} + E_{ko} = E_{pf} + E_{kf} + E_H$

$mgh_o + \frac{1}{2}mv_o^2 = mgh_f + \frac{1}{2}mv_f^2$

$9.8(12) + \frac{1}{2}(20)^2 = \frac{1}{2}v_f^2$

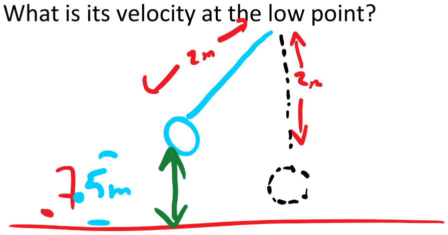
$117.6 + 200 = \frac{1}{2}v_f^2$

$317.6 = \frac{1}{2}v_f^2$

$\sqrt{635.2} = v_f = 25 \frac{m}{s}$

h=12, $v_o = 20 \frac{m}{s}$, h=0

A pendulum of length 2.0 m is released from height 0.75 m above the low point, What is its velocity at the low point?



High / Low

$E_{po} + E_{ko} = E_{pf} + E_{kf} + E_H$

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

$(9.8)(.75) = \frac{1}{2}v_f^2$

$\frac{7.35}{\frac{1}{2}} = v_f^2$

$\sqrt{14.7} = v_f = 3.8 \frac{m}{s}$

DO in booklet all energy conservation questions up to and including #8, skip 9