Chapter 7 - Conservation of Energy + Momentum

§7-1 Energy Transformations

Consider a rock with 100J of gravitational potential energy:

- $E_g = 100J$ $E_K = 0J$ $E_{TOTAL} = 100J$
- $E_g = 65J$ $E_K = 35J$ $E_{TOTAL} = 100J$
- $E_g = 40J$ $E_K = 60J$ $E_{TOTAL} = 100J$
- $E_g = 0J$ $E_K = 100J$ $E_{TOTAL} = 100J$

E_g decreases

E_K increase

lost E_g is gained E_K

The total energy remains constant in an isolated system (i.e. neglecting friction or air resistance)

Law of Conservation of Mechanical Energy

=> The total mechanical energy in an isolated system remains constant.

$$E_{total} = E'_{total}$$

(before) (after)

$$E_g + E_k + E_e = E_g' + E_k' + E_e'$$

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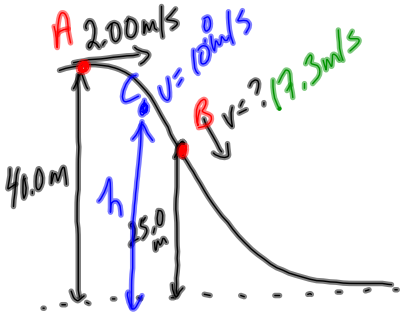

$E_{total} = E'_{total}$

(A) (B)

$E_{g_A} + E_{k_A} = E_{g_B} + E_{k_B}$

$mgh_A + \frac{1}{2}mv_A^2 = mgh_B + \frac{1}{2}mv_B^2$

$(9.81 m/s^2)(40.0m) + \frac{1}{2}(2.00 m/s)^2 = (9.81 m/s^2)(25.0m) + \frac{1}{2}v_B^2$

$392.4 \frac{m^2}{s^2} + 2.00 \frac{m^2}{s^2} = 245.25 \frac{m^2}{s^2} + \frac{1}{2}v_B^2$

$149.15 \frac{m^2}{s^2} = \frac{1}{2}v_B^2$

$v_B^2 = 2(149.15 \frac{m^2}{s^2})$

$v_B = 17.3 m/s$

- frictionless

a) v = ? when h = 25.0m

b) h = ? when v = 10.0m/s

b) $E_{total} = E'_{total}$

(A) (C)

$E_{g_A} + E_{k_A} = E_{g_C} + E_{k_C}$

$mgh_A + \frac{1}{2}mv_A^2 = mgh_C + \frac{1}{2}mv_C^2$

$gh_A + \frac{1}{2}v_A^2 = gh_C + \frac{1}{2}v_C^2$

$(9.81 m/s^2)(40.0m) + \frac{1}{2}(2.00 m/s)^2 = (9.81 m/s^2)(h_C) + \frac{1}{2}(10.0 m/s)^2$

$392.4 \frac{m^2}{s^2} + 2.00 \frac{m^2}{s^2} = (9.81 m/s^2)h_C + 50.0 \frac{m^2}{s^2}$

$344.4 \frac{m^2}{s^2} = (9.81 m/s^2)h_C$

$h_C = 35.1 m$

TO DO: PP|287