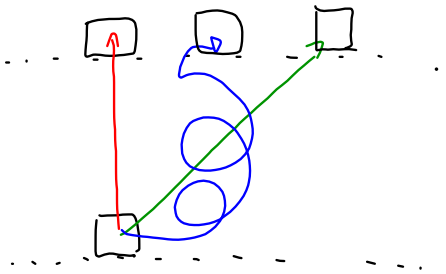
Chapter 7 - Conservation of Energy + Momentum

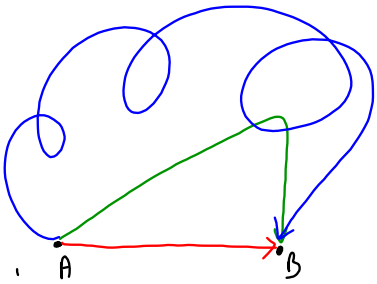
§7-1 Energy Transformations

Think about increasing the gravitational potential energy of a box.



In each case the work done is the same since the gravitional potential energy as increased by the same amount. The path does not matter since F_g is conservative force and you are doing work against F_g.

Consider pushing a crate along a rough floor.



More negative work is done over a longer distance so there is a decrease in total energy. Forces like friction or air resistance are referred to as non-conservative forces since the total energy at the end is not the same.

Law of Conservation of Mechanical Energy

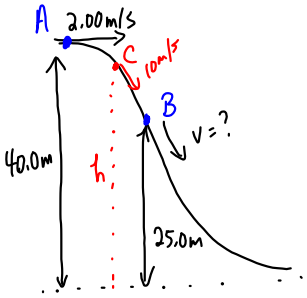
$$E_{TOTAL} = E'_{TOTAL}$$

(Before) (After)

$$E_g + E_k + E_e = E'_g + E'_k + E'_e$$

(neglecting air resistance or friction)

MP 12.5



a) $E_{TOT} = E'_{TOT}$

A (top) B (partway down)

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

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

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

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

$394.4\frac{m^2}{s^2} = 245.25\frac{m^2}{s^2} + \frac{1}{2}v_B^2$

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

$v_B = 17.3\,m/s$

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

A C

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

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

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

$394.4\frac{m^2}{s^2} = \left(9.81\frac{m}{s^2}\right)h_C + 50.0\frac{m^2}{s^2}$

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

$h_C = 35.1\,m$

TO DO

1. PP 12.7
2. Video Analysis
3. Ball Toss