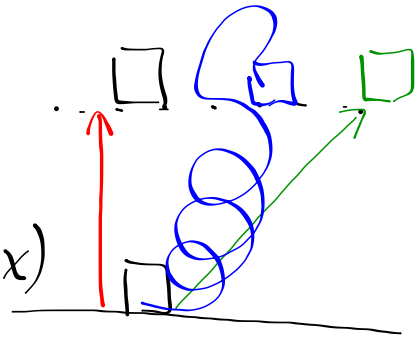
Chapter 7 - Conservation of Energy + Momentum

§7.1 Energy Transformations

Conservative force - the path does not matter

Side View (lifting a box)

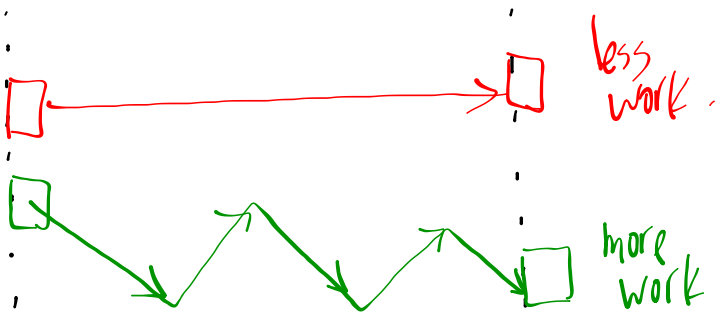


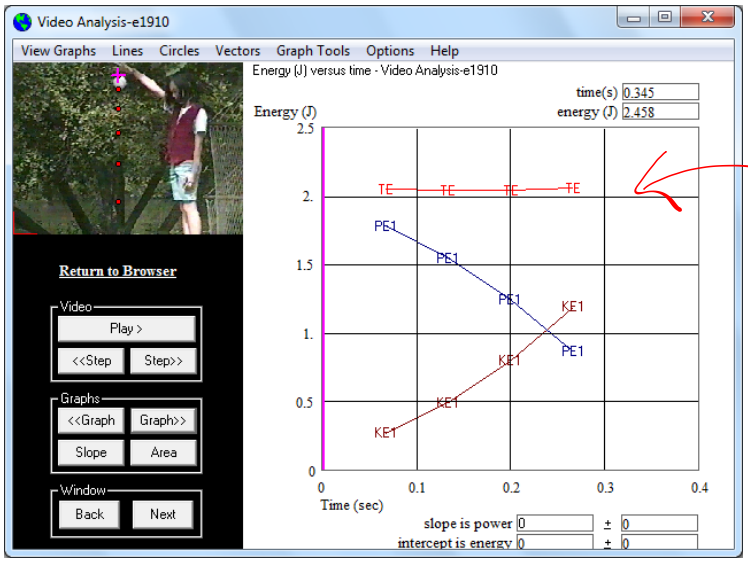
Each path results in the same amount of work being done against gravity.

The force of gravity is an example of a conservative force. The path does not matter in terms of the amount of work being done

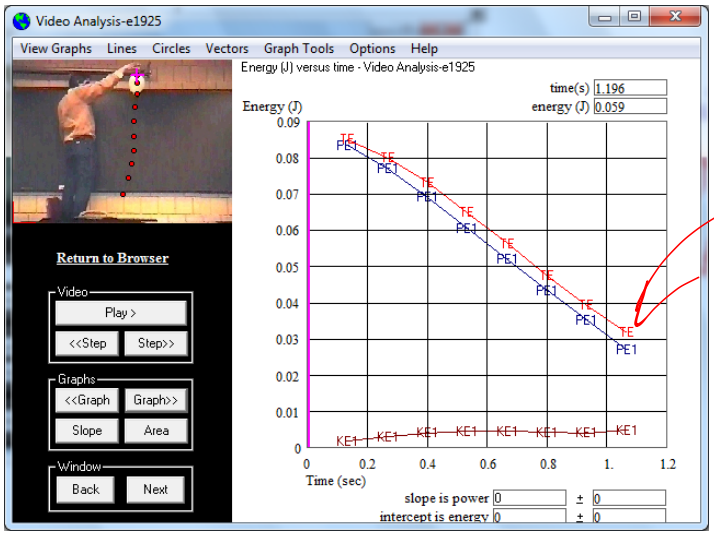
Non-conservative force - the path taken affects the amount of work done by the force
An example is friction or air resistance.

Bird's eye View (pushing a box along a rough floor)





(mechanical) total energy (KE + PE) is constant



Total mechanical Energy decreases due to air resistance (non-conservative force)

Law of Conservation of Mechanical Energy

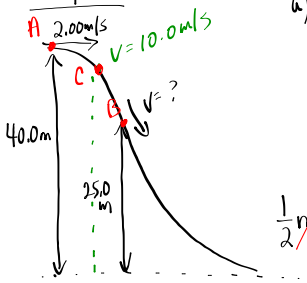
The total mechanical energy remains constant in the absence of any nonconservative forces like friction or air resistance.

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

(before) (after)

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

mp 285



a) What is the speed at B?

$$E_{total}^{(A)} = E_{total}'^{(B)}$$

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

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

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

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

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

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

$$298.3\,\frac{m^2}{s^2} = v_B^2$$

$$v_B = 17.3\,m/s$$

b) How high when $v = 10.0\,m/s$?

$$E_{total}^{(A)} = E_{total}'^{(C)}$$

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

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

??

$$2.00\,\frac{m^2}{s^2} + 392.4\,\frac{m^2}{s^2} = \frac{1}{2}(10.0\,m/s)^2 + (9.81\,m/s^2)(h_C)$$

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

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

$$h_C = 35.1\,m$$

TO DO

① PP 278