Power + Efficiency

Power → $P = \frac{W}{\Delta t}$ (units are Watts (W))

$1 W = \frac{1 J}{s}$

$$\text{Efficiency} = \frac{E_O}{E_I} \times 100\%$$

MP|266

$W = 1.85 \times 10^5 J$

$\Delta t = 12.0 s$

$P = ?$

$$P = \frac{W}{\Delta t}$$

$$P = \frac{1.85 \times 10^5 J}{12.0 s}$$

$$\boxed{P = 1.54 \times 10^4 W}$$

p263:

1 hp = 746 W

$$P = 1.54 \times 10^4 W \left(\frac{1 hp}{746 W} \right)$$

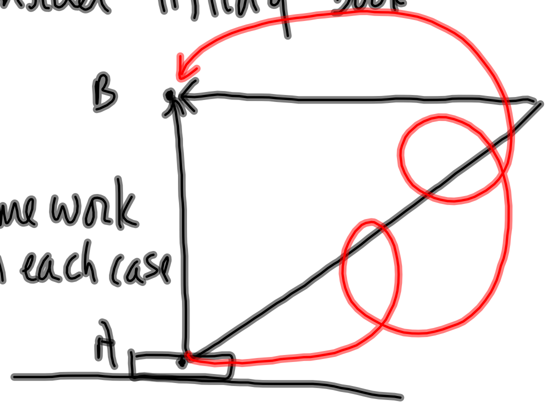
$$\boxed{P = 20.7 hp}$$

Chapter 7 - Conservation of Energy + Momentum

§7-1 Energy Transformations

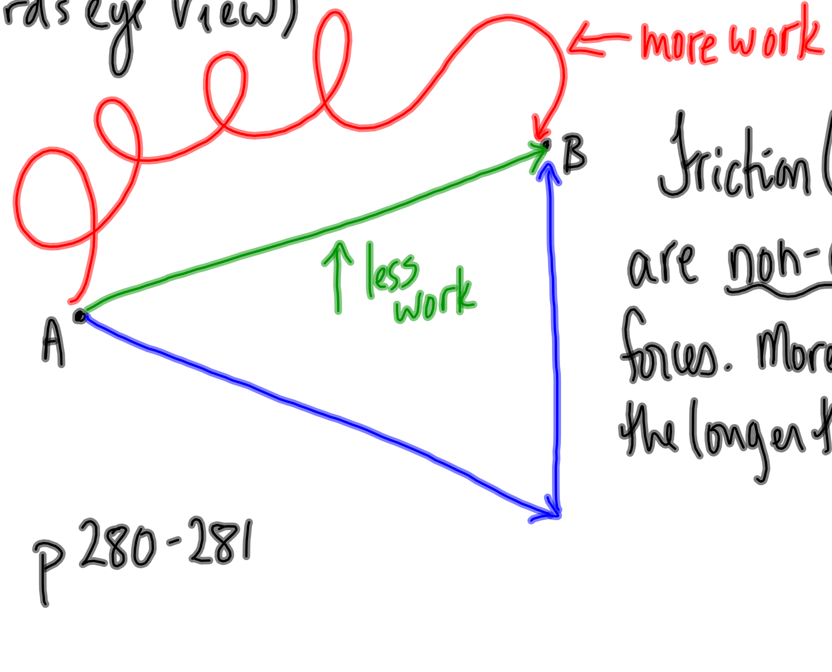
Consider lifting book

Same work in each case



Gravity is a conservative force. The path that the object takes does not matter

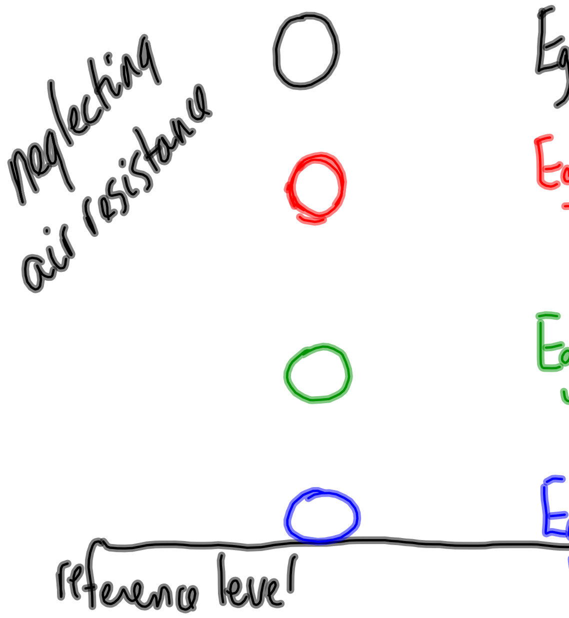
Now consider pushing an object along the floor (bird's eye view)



Friction (or air resistance) are non-conservative forces. More work is done the longer the path.

Read p 280-281

Consider dropping a ball:



$E_g = 100J \quad E_k = 0 \quad E_{TOTAL} = 100J$

$E_g = 70J \quad E_k = 30J \quad E_{TOTAL} = 100J$

$E_g = 35J \quad E_k = 65J \quad E_{TOTAL} = 100J$

$E_g = 0J \quad E_k = 100J \quad E_{TOTAL} = 100J$

Law of Conservation of Mechanical Energy

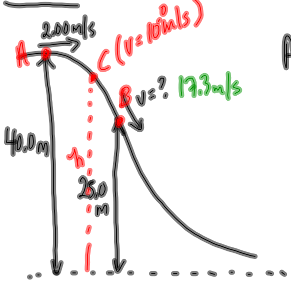
The total energy remains the same neglecting non-conservative forces like air resistance and friction.

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

(before) (after)

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

MP|285



a) v = ?, h = 25.0m
b) h = ?, v = 10.0m/s

According to the Law of Conservation of Energy

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

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

$$E_{k(A)} + E_{g(A)} = E_{k(B)} + E_{g(B)}$$

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

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

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

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

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

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

$$\boxed{v_B \doteq 17.3\,m/s}$$

b)

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

$$E_{k(A)} + E_{g(A)} = E_{k(C)} + E_{g(C)}$$

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

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

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

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

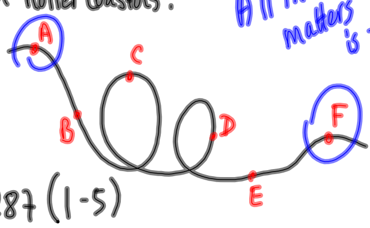
$$394.4\,\frac{m^2}{s^2} = 50.0\,\frac{m^2}{s^2} + (9.81\,m/s^2)h_C$$

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

$$\boxed{h_C \doteq 35.1\,m}$$

DON'T GET STRESSED IF YOU DO NOT HAVE A MASS! Just let it be "m"!

Consider Roller Coasters!



All that matters is the start (A) and the end (F) or end (D)

PP|287 (1-5)