From HW (pp 266)

#3.

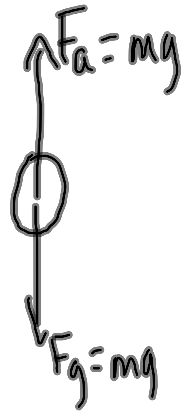
$m = 75.0 kg$

$\Delta d = 5.75 m$

$P = 200 W$

$\Delta t = ?$

(compare to 20s)



$W = F_{\parallel} \Delta d$

$W = mg\Delta d$

$W = (75.0 kg)(9.81 m/s^2)(5.75 m)$

$W = 4230.56 J$

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

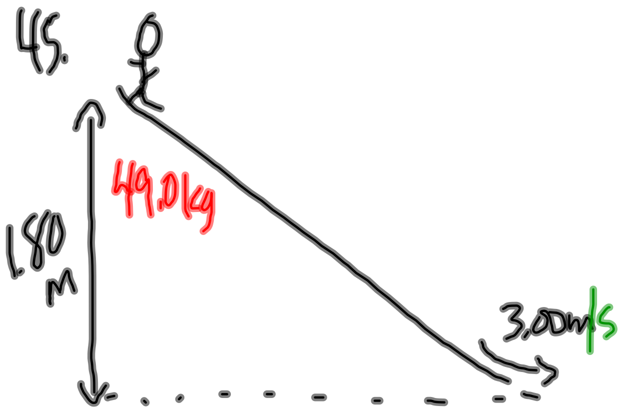
$$\Delta t = \frac{W}{P}$$

$$\Delta t = \frac{4230.56 J}{200 J/s}$$

$$\boxed{\Delta t \doteq 21.1 s}$$

Since it would take you 21.1s to complete the trip and you only have 20s, you cannot make the trip in the time allowed.

45.



E_g (INPUT)

E_k (OUTPUT)

$E_g = mgh$

$E_g = (49.0\,kg)(9.81\,m/s^2)(1.80\,m)$

$E_g = 865.242\,J$ (INPUT)

$E_k = \frac{1}{2}mv^2$

$E_k = \frac{1}{2}(49.0\,kg)(3.00\,m/s)^2$

$E_k = 220.5\,J$ (OUTPUT)

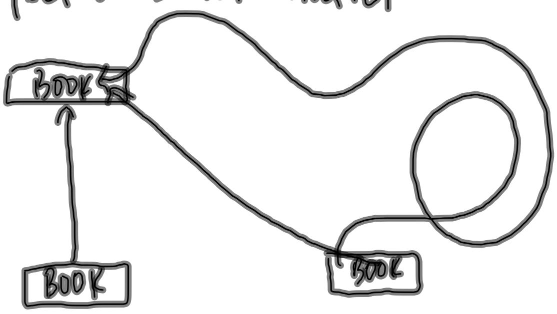
$\text{Efficiency} = \frac{E_O}{E_I} \times 100\%$

$\text{Efficiency} = \frac{220.5\,J}{865.242\,J} \times 100\%$

$\text{Efficiency} = 25.5\%$

§7.1 Energy Transformations

Conservative force ~ gravity is a conservative force; the path of the object does not matter



non-conservative force ~ the work done by a non-conservative force (like air resistance or friction) depends on the path the object.

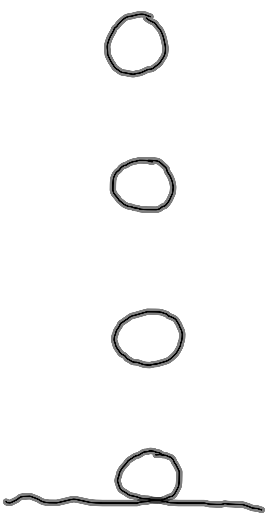
Law of Conservation of Mechanical Energy

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

(before) (after)

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

(neglecting friction + other non-conservative force)



$E_g = 100J$, $E_k = 0$, $E_{total} = 100J$

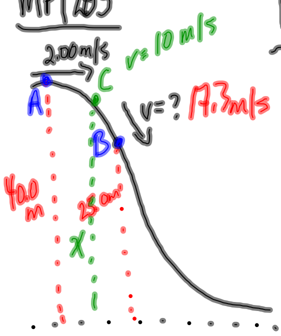
$E_g = 70J$, $E_k = 30J$, $E_{total} = 100J$

$E_g = 30J$, $E_k = 70J$, $E_{total} = 100J$

$E_g = 0J$, $E_k = 100J$, $E_{total} = 100J$

MP|285

Law of Conservation of Mechanical Energy



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

$$E_{A\,total} = E_{B\,total}$$

$$E_{gA} + E_{kA} = E_{gB} + E_{kB}$$

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

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

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

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

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

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

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

$$E_{total\,A} = E_{total\,C}$$

$$E_{gA} + E_{kA} = E_{gC} + E_{kC}$$

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

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

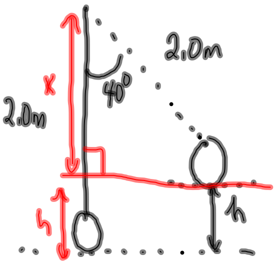
from part(a) ⟶ $$394.4\,\frac{m^2}{s^2} = (9.81\,m/s^2)h_C + \frac{(10.0\,m/s)^2}{2}$$

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

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

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

Consider a pendulum:



TO DO:

PP|287