Efficiency/Power Hmw

1.) $m = 12.5$ kg $v_1 = 0$ m/s $v_2 = 5.3$ m/s Efficiency = 85%

$E_K = \frac{1}{2}mv^2 = E_{in}$

$= \frac{1}{2}(12.5)(5.3)^2$

$= 176$ J

this will be the energy in [the energy used to increase kinetic energy

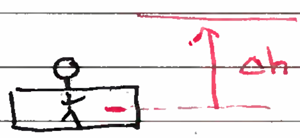
$\text{Efficiency} = \frac{E_{in}}{E_{out}} \times 100\%$

$E_{out} = \frac{E_{in}}{\text{Efficiency}} \times 100\%$

$E_{out} = \frac{176\text{ J}}{85\cancel{\%}} \times 100\cancel{\%} = 207$ J

∴ curious george used 207 J of energy (only 176 J was "useful")

2.)



this is the "usefull" part of the energy [what part of the electricity is used for work]

$E_{in} = 1.8 \times 10^3$ J $= \Delta E_g$

$E_{out} = 1.85 \times 10^3$ J

$m = 220$ kg + 60 kg

$= 280$ kg

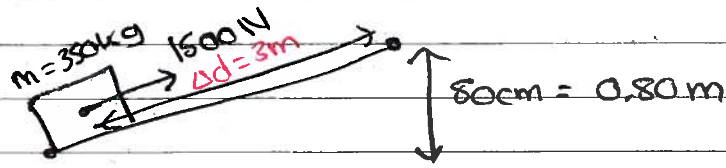
a.) $\text{Efficiency} = \frac{E_{in}}{E_{out}} \times 100\% = \frac{1.8 \times 10^3\text{ J}}{1.85 \times 10^3\text{ J}} \times 100\%$

$= \underline{\underline{97\%}}$

b.) $W = \Delta E_g = mg\Delta h$ $W =$

$\Delta h = \frac{W}{mg} = \frac{\Delta E_g}{mg} = \frac{1.8 \times 10^3}{(280)(9.8)} = \underline{\underline{0.66 \text{ m}}}$

3.)



a.) $W = F \cdot \Delta d$ [in same direction)

$= (1500)(3\text{ m})$

$= 4600\text{ J}$

[this is Eout]

b.) $E_g = mgh$

$h = 0.80\text{ m}$, $m = 350\text{ kg}$

$E_g = (350)(9.8)(0.8)$

$= 2744\text{ J}$

[this is "useful" energy"

c.) $\text{Efficiency} = \frac{E_{in}}{E_{out}} \times 100\% = \frac{2744}{4600} \times 100\% = 61\%$

d.) → the rest of the energy is lost as thermal energy [generated by friction]

4.) $F_{app} = 5450\text{ N}$

$\Delta d = 123\text{ m}$

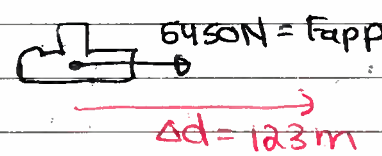
$\Delta t = 7.66\text{ s}$

in same direction

$W = F_{app} \Delta d$

$= (5450)(123)$

$= 670350\text{ J}$



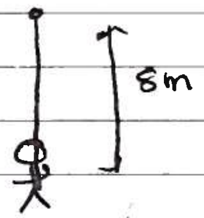
$P = \frac{W}{\Delta t} = \frac{670350}{7.66} = 87\,627$ J/s or watt

$= 87.6$ kilo watt (divide by 1000)

$= 118$ horsepower (divide by 746)

Efficiency/Power Hmw

5.)



$v = 0.8\,m/s$ $\quad m = 46\,kg$

$\Delta d = 8\,m$

a.) $\Delta t = ?$ $\quad v = \frac{\Delta d}{\Delta t}$ $\quad \Delta t = \frac{\Delta d}{v} = \frac{8m}{0.8\,m/s} = 10\,s$

b.) $E_g^{top} = mgh$ $\quad h = 8m$ $\qquad E_g^{bot} = mgh$ $\quad h = 0$

$= (46)(9.8)(8)$ $\qquad\qquad = 0\,J$

$= 3528\,J$

$\Delta E_g = 3528\,J$

c.) $P = \frac{\Delta E}{\Delta t} = \frac{3528\,J}{10s} = 352.8\,W$

d.) $P = \frac{\Delta E_g}{\Delta t} = mg\left(\frac{\Delta h}{\Delta t}\right)$ ← this is the velocity/speed change in height over time

$P = mg \cdot v$

6.)

$m = 65\,kg$ $h = 3.4\,m$

$\Delta t = 32\,s$

a.) $E_g = mgh$

$= (65)(9.8)(3.4)$

$= 2165.8\,J$

$= 2166\,J$

$E_g^{bot} = mgh = 0\,J$

$\Delta E_g = 2166\,J$

b.) $P = \dfrac{\Delta E_g}{\Delta t} = \dfrac{2166\,J}{32\,s} = 67.7\,W = 68\,W$