: Power, Efficiency and % Elasticity

① $P = \frac{\Delta E}{t} = \frac{K - K_0}{t} = \frac{\frac{1}{2}mv^2}{t} = 1.1 \times 10^5 \text{ W}$

b. $E_{in} = \frac{E_{out}}{e} = 1.5 \times 10^6 \text{ J}$

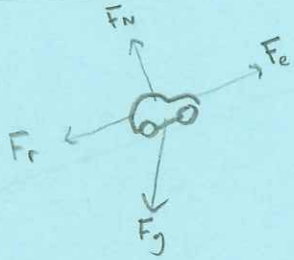
② $e = \left|\frac{E_{out}}{E_{in}}\right| = \frac{mgh}{2.2 \times 10^5 \text{ J}} = 0.82 = 82\%$

③ $e = \left|\frac{E_{out}}{E_{in}}\right| = \left|\frac{-mgh}{2.2 \times 10^5 \text{ J}}\right| = 0.82 = 82\%$

④ $P = \frac{W}{t} = \frac{Fd}{t} = Fv^* = 1.10 \times 10^3 \text{ N}(34.0 \text{ m/s}) = 37\,000 \text{ W}$

* $v = \frac{d}{t}$ for CONSTANT SPEED ONLY *

⑤



$\Sigma \vec{F} = 0$

$F_e = F_r + mg\sin 10°$

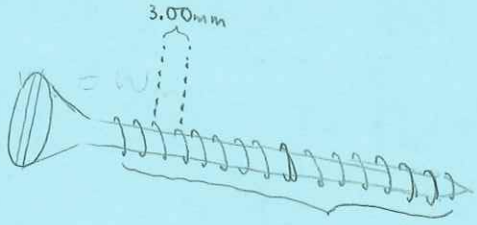
$P = \frac{W}{t} = \frac{Fd}{t} = Fv = (F_r + mg\sin 10°)v$

$P = 110\,000 \text{ W}$

⑥ a. $W = Fd = 5.0 \times 10^5 \text{ N}(42\,000 \text{ m}) = 2.1 \times 10^{10} \text{ J}$

b. 5200 hp

(7) a. $P = \frac{W}{t} \Rightarrow W = Pt = 500W(0.86s) = \underline{430\,J}$

b. 

- Each full turn drives the screw 3.00mm further into the wood.

so $N \times 3.00mm = 60.0mm$

$N = 20$

- The screw must be turned 20 times
- Each turn has the drill rotate through $2\pi r = 2\pi(1.00\times10^{-3}m) = 0.006283185m$

Total distance for the input force is $N(2\pi r) = 0.125663706m$

$= 12.5663706cm$

$W = Fd$; $F = \frac{W}{d} = 3421.831276N \approx \underline{3400N}$

c. $e = \frac{W_o}{W_{in}} \Rightarrow W_{in} = \frac{W_o}{e} = \frac{430J}{0.80} = \underline{540J}$

---

(8) a. $W = Fd = mgd = 1.00\times10^3kg(9.80\,m/s^2)(5.00m) = \underline{49000\,J}$

b. $\underline{49000\,J}$

c. $\underline{0\,J}$

d. $\Rightarrow P = \left|\frac{\Delta E}{t}\right| = \frac{|-49000J + (-1000kg(9.80\,m/s^2)(0.10m))|}{0.050\,s} = 999600W$

(the mass falls 10.0cm further upon striking the post!)

$P = \underline{1.00\times10^6\,W}$

---

(9) $W_{nc} = \Delta K + \Delta U = K - K_0 = -\frac{1}{2}(1780kg)(26.8\bar{3}\,m/s)^2 = -640824.7\bar{2}\,J$

a. $\underline{641\,000\,J\text{ of heat.}}$

b. $\vec{d} = \frac{1}{2}(\vec{v} + \vec{v}_0)t \Rightarrow t = \frac{28m}{\frac{1}{2}(26.8\bar{3} + 0)} = 2.086956522s$

$P = \frac{|W|}{t} = \frac{|-640824.7\bar{2}|}{2.086956522s} = 307061.8461W = \underline{310\,000W}$

c. $\Rightarrow$ Each front is 35%, each rear 15% $\Rightarrow$

Right Front = $\underline{110\,000W}$ Right Rear = $\underline{46\,000W}$

Left Front = $\underline{110\,000W}$ Left Rear = $\underline{46\,000W}$

(10) a. 100.0W is the INPUT! $\mathcal{E} = Pt = 100W \times 3600s = 3.6 \times 10^5 J$

b. $e = \frac{\mathcal{E}_{out}}{\mathcal{E}_{in}} \Rightarrow \mathcal{E}_{out} = 0.40(3.60 \times 10^5 J) = 1.44 \times 10^5 J$

c. $\mathcal{E}_{waste} = \mathcal{E}_{in} - \mathcal{E}_{out} = 2.16 \times 10^5 J$

(11) $\vec{d} = \vec{v}_0 t + \frac{1}{2}\vec{a}t^2$ ($\vec{v}_0 = 0$)

$\vec{a} = \frac{2\vec{d}}{t^2} = 2.17920947\ m/s^2$

$\Sigma \vec{F} = m\vec{a} = 204.8456902 N$

$P = \frac{W}{t} = \frac{Fd}{t} = 2138.263989 W$

$P = 2100 W$