$$2200\times10^{6}\,\frac{J}{s}\times\frac{86400\,s}{day}\times\frac{365\,day}{year}\simeq E_{OUTPUT}/year$$

call this the output ~~power~~ energy. The output ~~power~~ energy represents ~~af~~ a fraction of the gene~~r~~rated energy.

$$E_{OUT}=\mathcal{E}_1 E_{GEN}\quad\therefore\quad\frac{E_{OUT}}{\mathcal{E}_1}=E_{GEN}=mc^2$$

$$m_{NUCLEAR}\,(\text{per year})=\frac{E_{OUT}}{\mathcal{E}_1 c^2}\simeq N_1$$

$E_{OUT}=\mathcal{E}_2 E_{GEN}$ again and now $\mathcal{E}_2=\mathcal{E}_1+7.5\%$

$$E_{GEN}=31\times10^{6}\,\frac{J}{kg}\cdot m_{COAL}(kg)\qquad m_c=\frac{E_{OUT}}{\mathcal{E}_2(31\cdot10^6)}=N_2$$

$$\text{so - } m_{NUKE}=\frac{E_{OUT}}{\mathcal{E}_1 c^2}\qquad m_{COAL}=\frac{E_{OUT}}{\mathcal{E}_2\cdot31\cdot10^6}$$

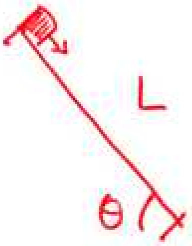
$$\frac{m_{COAL}}{m_{NUKE}}=\frac{\mathcal{E}_1 c^2}{\left(\mathcal{E}_1+\frac{7.5}{100}\right)(31\cdot10^6)}=\frac{(0.33)(9\cdot10^{16})}{(.405)(3.1\cdot10^7)}$$

$$=2.37\cdot10^9$$

$$\boxed{\text{a coal plant requires 2.4 billion times more fuel than an equivalent nuclear plant, each year.}}$$

WET. $U_0 + K_0 + W_{ncF} = U_f + K_f$ – set $U_f = \emptyset$

@ bottom of hill...



$U_0 = mgL\sin\theta$, $K_0 = \emptyset$ $\quad W_{NCF} = W_{F_D} + W_{F_f}$

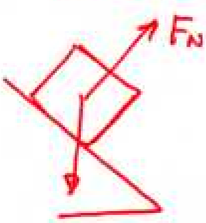
$W_{F_f} = -\mu mgL\cos\theta \quad W_{F_D} = -F_D L$

$$mgL\sin\theta - \mu mgL\cos\theta - F_D L = \tfrac{1}{2}mv_f^2$$

$$2L(mg\sin\theta - \mu mg\cos\theta - F_D) = mv_f^2 \qquad 1)$$

$$\frac{2L}{R}(mg\sin\theta - \mu mg\cos\theta - F_D) = \frac{mv^2}{R}$$ – not really useful in this case...

and



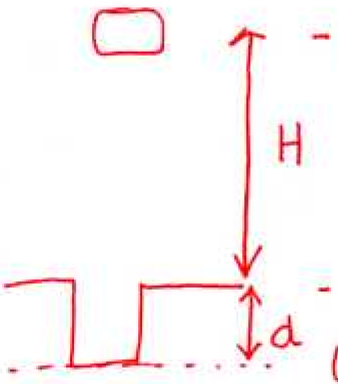
$F_N \sin\theta = \dfrac{mv^2}{R} = m(3.5g)$

$\therefore \dfrac{mv^2}{R} = 3.5mg \qquad R = \dfrac{mv_f^2}{3.5mg} \leftarrow 1)$

$$R = \frac{2L}{3.5mg}(mg\sin\theta - \mu mg\cos\theta - F_D)$$ – which given the provided values yeilds

$$R = \frac{2(70m)}{3.5(750kg)(9.8\,m/s^2)} \cdot \left((750kg)(9.8\,m/s^2)(\sin(38) - .1\cos(38)) - 125N\right)$$

$$\simeq \boxed{20.8m}$$



- $K = 0,\ U = mg(H+d)$

$W_g - W_{earth} = 0$ since $\Delta K = 0$

$U = 0,\ K = 0$

$W_{earth} = W_g \therefore F_{earth}\, d = m_{rock}\, g(H+d)$

$$F_E = \frac{mg(H+d)}{d} = \frac{20N(25.38)}{0.38} \simeq$$

$$\boxed{F_{EARTH} \simeq 1.34\ KN}$$

$$W_{net} = \Delta K = \tfrac{1}{2}mv_f^2 - \tfrac{1}{2}mv_0^2$$

$$= \tfrac{1}{2}(7.1\times10^{-3})(4\cdot10^2)^2$$

$$= \tfrac{1}{2}(7.1\cdot10^{-3})(16\cdot10^4) \simeq \boxed{568\,J}$$

since $W_{net} = F_{avg} \cdot \Delta x$ then

$$F_{avg} = \frac{W_{net}}{\Delta x} \simeq \boxed{4.37\,kN}$$

$\frac{m}{s} g h = \frac{J}{s} = \text{power}$ since $1 m^3 = 10^3 kg$ (water)

then $1.35 \cdot 10^6$ kg of water pass through turbines each second.

of total power available, $\frac{3}{4}$ is actually produced by the plant so $P_{OUTPUT} = \frac{3}{4}(1.35 \cdot 10^6 \frac{kg}{s})(9.81)(110m)$

$$\simeq \boxed{1.09 \text{ GW}}$$

since 25% of potential energy remains with the water then

$$\frac{1}{4}(m/\cancel{sec})(9.81)(110m) = \frac{1}{2} m v^2$$

$$\frac{2}{4}(\cancel{1.35 \cdot 10^6})(9.81)(110) = V^2$$

$$\boxed{V \approx 23 \text{ m/s}}$$

still plenty of oomph for rafting!

$P = F \cdot v \qquad F = ma \qquad a = \frac{dv}{dt} \quad v = \frac{dx}{dt}$

$\therefore$ with $x = 4t^3 - 3t^2 + t - 42$ then

hard way

$V = 12t^2 - 6t + 1$

$a = 24t - 6$

$P = \frac{dW}{dt}$ and $dW = P dt \quad \therefore W = \int_{t_0}^{t_f} P dt$

$P = m(24t-6)(12t^2-6t+1) \Rightarrow$ <prepare for tedious algebra>

$P = m(288t^3 - 144t^2 + 24t - 72t^2 + 36t - 6)$

$= m(288t^3 - 216t^2 + 60t - 6)$

$\int P dt = m\int(288t^3 - 216t^2 + 60t - 6)dt =$

$= m(\cancel{126}\,72\,t^4 - 72t^3 + 30t^2 - 6t)\Big|_2^5$ so...

$(35 \cdot 10^{-3} kg)\left[(\cancel{126}\,72)(5^4 - 2^4) - (72)(5^3 - 2^3) + 30(5^2 - 2^2) - 6(5-2)\right]$

$(35 \cdot 10^{-3} kg)\left[\cancel{76{,}734}\ 43848 - 8424 + 630 - 18\right]$

$\boxed{W_{bird} \simeq \cancel{2.4}\,1261\ kJ}$

easy way

$W = \Delta K = \frac{1}{2}m(v_f^2 - v_0^2) = 1261$