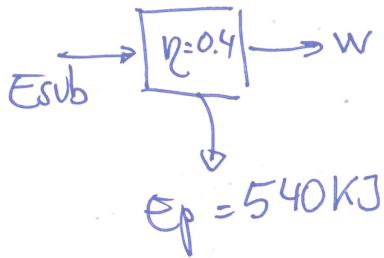


8



$$\eta = \frac{W}{E_{sub}}$$

$$E_{sub} = E_{p} + W$$

$$E_{sub} = 540 \text{ kJ} + 0.4 \cdot E_{sub}$$

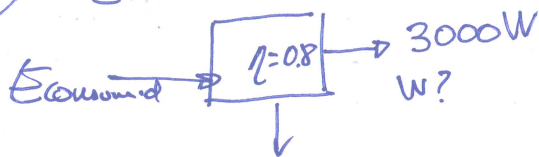
$$E_{sub} - 0.4 \cdot E_{sub} = 540$$

$$0.6 E_{sub} = 540$$

$$E_{sub} = \frac{540 \text{ kJ}}{0.6} = \boxed{900 \text{ kJ}}$$

$$W = 900 \text{ kJ} - 540 \text{ kJ} = \boxed{360 \text{ kJ}}$$

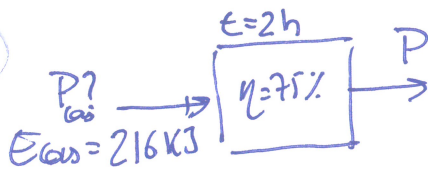
9



$$W = P \cdot t = 3000 \text{ W} \cdot 60 \text{ s} = 180.000 \text{ J}$$

$$\eta = \frac{W}{E_{cons}} \rightarrow E_{cons} = \frac{W}{\eta} = \frac{180.000 \text{ J}}{0.8} = \underline{\underline{225.000 \text{ J}}}$$

10

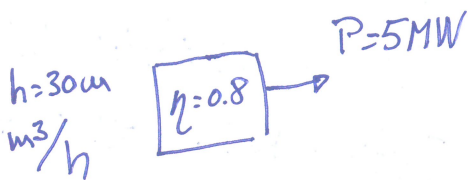


$$P_{cons} = \frac{E_{cons}}{t} = \frac{216.000 \text{ J}}{7200 \text{ s}} = \underline{\underline{30 \text{ W}}}$$

$$P = P_{cons} \cdot \eta = 30 \text{ W} \cdot 0.75 = \underline{\underline{22.5 \text{ W}}}$$

$$2 \text{ h} \cdot \frac{3600 \text{ s}}{1 \text{ h}} = 7200 \text{ s}$$

11



$$P_{sub} = \frac{P}{\eta} = \frac{5 \text{ MW}}{0.8} = 6.25 \text{ MW} = 6.25 \cdot 10^6 \text{ W}$$

$$E_p = \frac{mgh}{t} \rightarrow P_{sub} = q_m \cdot g \cdot h$$

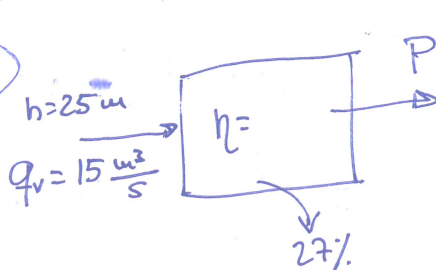
$$21236.83 \frac{\text{kg}}{\text{s}} \cdot \frac{1 \text{ m}^3}{1000 \text{ kg}} \cdot \frac{3600 \text{ s}}{1 \text{ h}} = 76452.6 \frac{\text{m}^3}{\text{h}}$$

$$q_m = \frac{P_{sub}}{g \cdot h} = \frac{6.25 \cdot 10^6 \text{ W}}{9.81 \frac{\text{m}}{\text{s}^2} \cdot 30 \text{ m}} = 21236.83 \frac{\text{kg}}{\text{s}}$$

12

$$E = mc^2 = 1 \cdot 10^{-3} \text{ kg} (3 \cdot 10^8 \text{ m/s})^2 = 90 \cdot 10^{12} \text{ J}$$

13



$$\eta = 1 - 0.27 = 0.73$$

$$P_{sub} = q_m \cdot g \cdot h$$

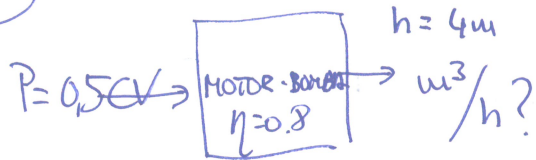
$$P_{sub} = 15 \frac{\text{m}^3}{\text{s}} \cdot \frac{1000 \text{ kg}}{1 \text{ m}^3} \cdot 9.81 \frac{\text{m}}{\text{s}^2} \cdot 25 \text{ m}$$

$$P_{sub} = 3678750 \text{ W}$$

$$P_{\text{utile}} = P_{sub} \cdot \eta = 3678750 \text{ W} \cdot 0.73 = 2685487.5 \text{ W}$$

$$P_{\text{sub}} = 2685.5 \text{ kW} = 3648.76 \text{ CV}$$

(14)



$$P_{\text{sub}} = 0.5 \text{ CV} \frac{736 \text{ W}}{1 \text{ CV}} = 368 \text{ W}$$

$$P_{\text{util}} = q_m \cdot g \cdot h$$

$$q_m = \frac{P_{\text{util}}}{g \cdot h} = \frac{368 \cdot 0.8}{9.81 \cdot 4} = 7.503 \frac{\text{kg}}{\text{s}}$$

$$7.503 \frac{\text{kg}}{\text{s}} \cdot \frac{1 \text{ m}^3}{1000 \text{ kg}} \cdot \frac{3600 \text{ s}}{1 \text{ h}} = 27.01 \frac{\text{m}^3}{\text{h}}$$

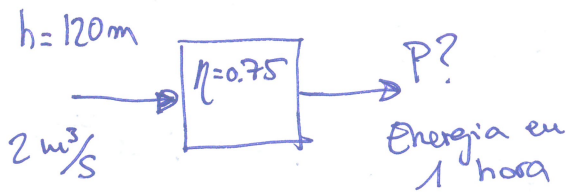
(15)

$$P = 82 \text{ CV}$$

KWh en 15 min?

$$\left(82 \text{ CV} \frac{736 \text{ W}}{1 \text{ CV}} \cdot \frac{1 \text{ KW}}{1000 \text{ W}} \right) \cdot 15 \text{ min} \cdot \frac{1 \text{ h}}{60 \text{ min}} = 15.088 \text{ KWh}$$

(16)



$$2 \frac{\text{m}^3}{\text{s}} \cdot \frac{1000 \text{ kg}}{1 \text{ m}^3} = 2000 \text{ kg/s}$$

$$P_{\text{sub}} = q_m \cdot g \cdot h$$

$$P_{\text{sub}} = 2000 \text{ kg/s} \cdot 9.81 \frac{\text{m}}{\text{s}^2} \cdot 120 \text{ m}$$

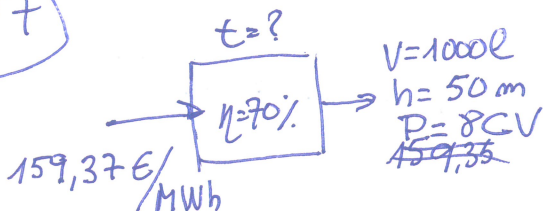
$$P_{\text{sub}} = 2354400 \text{ W}$$

$$P_{\text{util}} = P_{\text{sub}} \cdot \eta = 2354400 \text{ W} \cdot 0.75$$

$$P_{\text{util}} = 1.765.800 \text{ W}$$

$$1.765.800 \frac{\text{J}}{\text{s}} \cdot \frac{3600}{1 \text{ h}} = 6.36 \cdot 10^9 \frac{\text{J}}{\text{h}}$$

(17)



$$700714.29 \text{ J} \cdot \frac{1 \text{ MWh}}{3.6 \cdot 10^9 \text{ J}} \cdot \frac{159.37 \text{ €}}{1 \text{ MWh}}$$

$$\text{COST} = 0.031 \text{ €}$$

$$8 \text{ CV} \frac{736 \text{ W}}{1 \text{ CV}} = 5888 \text{ W}$$

$$E_p = m \cdot g \cdot h = 1000 \text{ kg} \cdot 9.81 \frac{\text{m}}{\text{s}^2} \cdot 50 \text{ m}$$

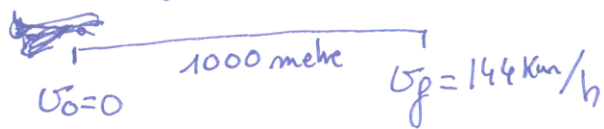
$$W = E_p = 490500 \text{ J}$$

$$P = \frac{W}{t} \quad t = \frac{W}{P} = \frac{490500 \text{ J}}{5888 \text{ W}} = 83.305 \text{ s}$$

$$E_{\text{cons}} = \frac{W}{\eta} = \frac{490500 \text{ J}}{0.7} = 700714.29 \text{ J}$$

18

$$m = 15000 \text{ kg}$$



P.?

$$v = 144 \frac{\text{km}}{\text{h}} \cdot \frac{1 \text{ h}}{3600 \text{ s}} \cdot \frac{1000 \text{ m}}{1 \text{ km}} = 40 \text{ m/s}$$

$$(3) P = \frac{W}{t} = \frac{12 \cdot 10^6 \text{ J}}{50 \text{ s}} = \boxed{2,880.000 \text{ W}}$$

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

$$(1) W = E_c = \frac{1}{2} m v^2 = \frac{1}{2} 15000 \text{ kg} \cdot (40 \text{ m/s})^2$$

$$W = 12000000 \text{ J} = 12 \cdot 10^6 \text{ J}$$

$$(2) v = v_0 + at \rightarrow a = \frac{v}{t}$$

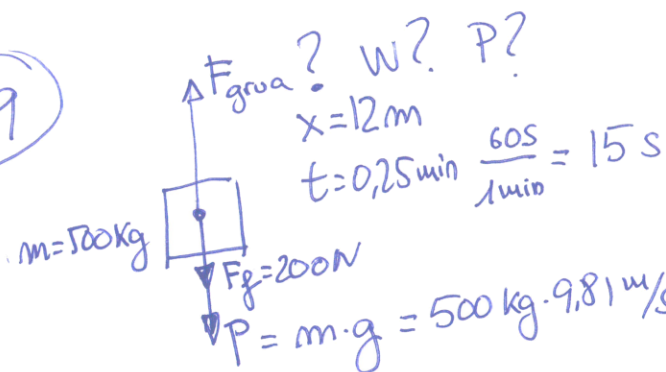
$$x = v_0 t + \frac{1}{2} a t^2$$

$$x = \frac{1}{2} \left(\frac{v}{t} \right) \cdot t^2 = \frac{1}{2} v t$$

$$x = \frac{1}{2} v t \rightarrow t = \frac{2x}{v}$$

$$t = \frac{2 \cdot 1000 \text{ m}}{40 \text{ m/s}} = \boxed{50 \text{ s}}$$

19



? W? P?

$$x = 12 \text{ m}$$

$$t = 0,25 \text{ min} \cdot \frac{60 \text{ s}}{1 \text{ min}} = 15 \text{ s}$$

$$F_g = 200 \text{ N}$$

$$P = m \cdot g = 500 \text{ kg} \cdot 9,81 \text{ m/s}^2 = 4905 \text{ N}$$

$$F_{grua} = F_g + P = 200 \text{ N} + 4905 \text{ N}$$

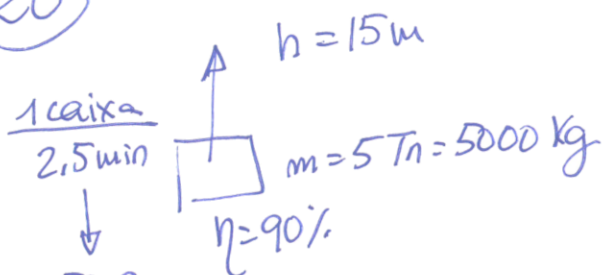
$$F_{grua} = 5105 \text{ N}$$

$$W = F \cdot d = 5105 \text{ N} \cdot 12 \text{ m} =$$

$$W = 61260 \text{ J}$$

$$P = \frac{W}{t} = \frac{61260 \text{ J}}{15 \text{ s}} = \underline{\underline{4084 \text{ W}}}$$

20



$$\frac{1 \text{ caixa}}{2,5 \text{ min}}$$

$$150 \text{ s}$$

W? Potile? Pconsumida?

$$W_{caixa} = E_p = m \cdot g \cdot h = 5000 \text{ kg} \cdot 9,81 \text{ m/s}^2 \cdot 15$$

$$W = 735750 \text{ J}$$

$$P_{\text{tile}} = \frac{W}{t} = \frac{735750 \text{ J}}{150 \text{ s}} = \underline{\underline{4905 \text{ W}}}$$

$$P_{\text{cons}} = \frac{P_{\text{tile}}}{\eta} = \frac{4905 \text{ W}}{0,9} = \underline{\underline{5450 \text{ W}}}$$

21

$$m = 65 \text{ kg}$$

$$5000 \text{ pessoas/h}$$

$$h = 2,5 \text{ m}$$

$$\eta = 0,9$$

P?

$$E_p = W = m g h = 65 \text{ kg} \cdot 9,81 \text{ m/s}^2 \cdot 2,5 \text{ m} = \underline{\underline{1594,125 \text{ J}}}$$

$$\frac{1594,125 \text{ J}}{\text{pessoa}} \cdot \frac{5000 \text{ pessoas}}{1 \text{ h}} \cdot \frac{1 \text{ h}}{3600 \text{ s}} = 2214,06 \text{ W}$$

$$P_{\text{consumida}} = \frac{P_{\text{tile}}}{\eta} = \frac{2214,06 \text{ W}}{0,9}$$

$$\boxed{P_{\text{consumida}} = 2460,07 \text{ W}}$$