Lösungen

Thema: **Wirkungsgrad**

1. a) $\eta = \frac{P_{ab}}{P_{zu}}$; $P_{zu} = \frac{P_{ab}}{\eta} = \frac{30\,kW}{0{,}9} = \mathbf{33{,}3\,kW}$; b) $P_v = P_{zu} - P_{ab} = 33{,}3\,kW - 30\,kW = \mathbf{3{,}3\,kW}$

2. $P_{zu} = P_{ab} + P_v = 18{,}5\,kW + 1{,}5\,kW = 20\,kW$; $\eta = \frac{P_{ab}}{P_{zu}} = \frac{18{,}5\,kW}{20\,kW} = \mathbf{0{,}925 = 92{,}5\,\%}$

3. $\eta = \eta_G \cdot \eta_M = 0{,}86 \cdot 0{,}82 = \mathbf{0{,}705 = 70{,}5\,\%}$

4. $P_{ab} = \frac{F \cdot s}{t} = \frac{80000\,kg \cdot 9{,}81\,N/kg \cdot 50\,m}{3600\,s} = 10900\,W = 10{,}9\,kW$

Anmerkung: N / kg = m / s²

$P_{zu} = \frac{P_{ab}}{\eta} = \frac{10{,}9\,kW}{0{,}74} = 14{,}7\,kW = \mathbf{15\,kW}$

5. a) $\eta = \frac{P_{ab}}{P_{zu}} = \frac{P_{ab}}{U \cdot I} = \frac{13000\,W}{220\,V \cdot 68\,A} = 0{,}869 = \mathbf{87\,\%}$

b) $P_{zu} = U \cdot I = 220\,V \cdot 68\,A = 14960\,W = \mathbf{14{,}96\,kW}$

c) $P_v = P_{zu} - P_{ab} = 14960\,W - 13000\,W = \mathbf{1960\,W}$

6. $P_{ab} = P_{zu} \cdot \eta = 20\,kW \cdot 0{,}62 = 12{,}4\,kW$; $F = \frac{P_{ab} \cdot t}{s} = \frac{12400\,W \cdot 30\,s}{15\,m} = \mathbf{24800\,N}$

7. a) $P_{zuTu} = \frac{F \cdot s}{t} = \frac{110\,kg}{1\,s} \cdot 9{,}81\,\frac{N}{kg} \cdot 19\,m = 20500\,\frac{Nm}{s} = 20{,}5\,kW$

$P_{abTu} = P_{zuTu} \cdot \eta_1 = 20{,}5\,kW \cdot 0{,}73 = \mathbf{14{,}97\,kW}$

b) $P_{abGen} = P_{abTu} \cdot \eta_2 = 14{,}97\,kW \cdot 0{,}89 = \mathbf{13{,}32\,kW}$

c) $\eta_{ges} = \eta_1 \cdot \eta_2 = 0{,}73 \cdot 0{,}89 = \mathbf{0{,}65 = 65\,\%}$

8. a) $P_{abP} = \frac{F \cdot s}{t} = \frac{60000\,kg \cdot 9{,}81\,N/kg \cdot 26\,m}{3600\,s} = \mathbf{4251\,W = 4{,}25\,kW}$

b) $P_{zuP} = P_{abM} = \frac{P_{abT}}{\eta_P} = \frac{4{,}25\,kW}{0{,}71} = 5986\,W = \mathbf{6{,}0\,kW}$

c) $P_{zuM} = \frac{P_{abM}}{\eta_M} = \frac{6{,}0\,kW}{0{,}86} = 6{,}98\,kW = \mathbf{7{,}0\,kW}$

d) $\eta_{ges} = \eta_M \cdot \eta_P = 0{,}71 \cdot 0{,}86 = 0{,}611 = \mathbf{61\,\%}$

9. Aufzug: $P_{zu1} = \frac{F \cdot v}{\eta} = \frac{1500\,kg \cdot 9{,}81\,N/kg \cdot 0{,}7\,m/s}{0{,}5} = 20600\,W$

Pumpe: $P_{zu2} = \frac{F \cdot s}{t} = \frac{65000\,kg \cdot 9{,}81\,N/kg \cdot 18\,m}{3600\,s \cdot 0{,}65} = 4900\,W$

$P_{gesab} = 20600\,W + 4900\,W + 16000\,W = 41500\,W = 41{,}5\,kW$

$P_{Tuzu} = \frac{P_{Genab}}{\eta_{ges}} = \frac{P_{Genab}}{\eta_{Tu} \cdot \eta_{Gen}} = \frac{41{,}5\,kW}{0{,}82 \cdot 0{,}92} = 55\,kW$

$P_{Tuzu} = F \cdot v = F \cdot \frac{s}{t}$; $P_{Tuzu} = \frac{m \cdot g \cdot s}{t} \Rightarrow \frac{m}{t} = \frac{P_{Tuzu}}{g \cdot s}$

$\frac{m}{t} = \frac{55000\,W}{9{,}81\,m/s^2 \cdot 9\,m} = \frac{55000\,kg\,m^2/s^3}{9{,}81\,m/s^2 \cdot 9\,m} = 623\,\frac{kg}{s} \mathrel{\widehat{=}} \mathbf{623\,\frac{l}{s}}$