Power Practice Problems Key

Note Title 2016-02-28

① $P = \frac{W}{t} = \frac{F \cdot d}{t} = F \cdot v$ $\therefore v = \frac{P}{F} = \frac{950\,W}{575\,kg\,(9.8\,N/kg)}$

$v = 0.169\,m/s$

② $14.0\,hp \times \frac{750\,W}{1\,hp} = 10{,}500\,W$

$\frac{75\,km/h}{3.6} = 20.83\,m/s$

$P = F \cdot v$

$F = \frac{P}{v} = \frac{10{,}500}{20.83} = 504\,N$

③ $P = \frac{F \times d}{t}$ $\therefore t = \frac{F \times d}{P} = \frac{425(9.8)(40.0)}{1550} = 107\,s$

④ $P = \frac{W}{t}$ $W = \Delta E_K = \frac{1}{2}mv^2 - \frac{1}{2}mv_0^2 = \frac{1}{2}(1278)(16.7^2 - 25^2)$

$90\,km/h = 25\,m/s$

$60\,km/h = 16.7\,m/s$

$W = -220{,}645\,J$

$\therefore P_{FRICTION} = \frac{220{,}645}{7.00} = 31{,}251\,W$

∴ Approximate engine power between 90 km/h and 60 km/h needed to overcome friction is $31{,}300\,W$ $(42\,hp)$

⑤ $P = \frac{W}{t} = \frac{\Delta E_K}{t} = \frac{\frac{1}{2}mv^2 - \frac{1}{2}mv_0^2}{t} = \frac{\frac{1}{2}(7.25)(11.11)^2 - 0}{2.25}$

$40\,km/h = 11.11\,m/s$

$P = 199\,W$

⑥ $2.00\,h = 7200\,s$ $\quad W = P \cdot t = 3750\,(7200)$

$5\,hP = 3750\,W$ $\quad W = 2.7 \times 10^7\,J$

⑦ $P = \frac{W}{t} = \frac{\Delta E_p}{t} = \frac{mg\Delta h}{t} = \frac{5.25(9.8)(2.65)}{60\,s} = 2.27\,W$

⑧ $60.0\,\frac{L}{s} \Rightarrow 60.0\,\frac{kg}{s}$

$\Delta h = 85.0\,m$

$P = \frac{W}{t} = \frac{\Delta E_p}{t} = \frac{mg\Delta h}{t} = \left(\frac{m}{t}\right)(g\Delta h)$

$P = \left(60.0\,\frac{kg}{s}\right)\left(9.8\,\frac{N}{kg} \cdot 85.0\,m\right)$

$P = 5.00 \times 10^4\,W$

⑨ $P = 4.5 \times 10^4\,W$

$m = 1500\,kg$

$v = 25.0\,m/s$

$P = \frac{W}{t} = \frac{F \times d}{t} = F \times v$

a) $F = \frac{P}{v} = \frac{4.5 \times 10^4\,W}{25.0\,m/s} = 180\,N$

b) $\mu = \frac{F_f}{F_N} = \frac{180\,N}{1500(9.8)} = 0.0122$

⑩ $\frac{\Delta m}{\Delta t} = 45\,\frac{kg}{min} = 0.75\,\frac{kg}{s}$

$\Delta h = 6.00\,m$

$P = \frac{W}{t} = \frac{\Delta E_p}{t} = \frac{mg\Delta h}{\Delta t}$

$P = 0.75\,\frac{kg}{s}\left(9.8\,\frac{N}{kg} \times 6.00\,m\right)$

$P = 44.1\,W$

(11) $P = \frac{\Delta E_P}{t} = \frac{mg\Delta h}{t} = \frac{90\,kg\left(9.8\,\frac{N}{kg}\right)(500\,m)}{\left(45.0\,min \times 60\,\frac{s}{min}\right)}$

$P = 163\,W$

(12) $v = \frac{20{,}000\,m}{(3\times 3600) + (55\times 60)} = 1.418\,m/s$

$P = F \cdot v$

$= 65\,N \times 1.418\,m/s$

$= 92.2\,W$

(13) $P = \frac{W}{t} = \frac{\Delta E_K}{t} = \frac{\frac{1}{2}mv^2 - \frac{1}{2}mv_0^2}{t}$

$v = v_0 + at$

$t = \frac{(32-8)}{3} = 27.33\,s$

a) $W = \frac{1}{2}(1200)(32.0^2 - 8^2)$

$= 5.76\times 10^5\,J$

(b) $\therefore P = \frac{\frac{1}{2}(1200)(32.0^2 - 8.0^2)}{27.33} = 19{,}637\,W$

$P = 1.96\times 10^4\,W$