WS-17 for 6th class

Task

① Given $Mg = 400N$

$h = 5m$; $t = 6$ sec

$$P = \frac{mgh}{t} = \frac{400 \times 5}{6}$$

$$\simeq 333.3W$$

② $E = P \times t$

Given $P = 20W$

$t = 1y = 365$ days

$= 365 \times 24$ hrs

$E = 20 \times 365 \times 24$

$= 175.2 \times 10^3$ Wh

$= 175.2$ kWh

③ $\eta = 80\% = \frac{80}{100}$

$$\frac{P_{out}}{P_{in}} = \frac{80}{100} = \frac{4}{5}$$

$$\Rightarrow P_{in} = \frac{5}{4} P_{out}$$

$$\Rightarrow P_{in} = \frac{5}{4} \times 800 \times 10$$

$= 10000$

$P_{in} = 40$ kW

vol $= 800$ lit

$= 800 \times 10^{-3} m^3$

$d_w = 10^3$ kg/m^3

$m_w = d_w \times$ vol

$= 10^3 \times 800 \times 10^{-3}$

$m_w = 800$ kg

$$P_{out} = \frac{mgh}{t}$$

$$P_{out} = \frac{800 \times 9.8 \times 40}{9.8}$$

$P_{out} = 800 \times 40 W$

$$P_{out} = \frac{mgh}{t}$$

$$= \frac{2 \times 10^4 \times 10 \times 90}{3600}$$

$P_{out} = 5000W$

④ $m = 2000$ kg

$\sin\theta = \frac{1}{50}$

$v = 18$ kmph $= 18 \times \frac{5}{18}$

$v = 5$ m/sec.

Power $= F v$

$= mg \sin\theta \, v$

$$\Rightarrow 2000 \times 10 \times \frac{1}{50} \times 5$$

$= 2000 W$

⑤ $m = 2 \times 10^4$ kg

$t = 1$ hr ; $h = 90$m

$$\eta = \frac{P_{out}}{P_{in}}$$

$$\Rightarrow \frac{80}{100} = \frac{5000}{P_{in}}$$

$$\Rightarrow \frac{4}{5} = \frac{5000}{P_{in}}$$

$$\Rightarrow P_{in} = \frac{5}{4} \times 5000$$

$P_{in} = 6.25 \times 10^3 W$

⑥ $n = 450$; $m = 20$gm

$= 20 \times 10^{-3}$ kg

$t = 1$ min

$= 60$ sec.

$P = 7.2$ kW

$= 7.2 \times 10^3 W$

$$P = \frac{W}{t} = \frac{n \frac{1}{2} m v^2}{t}$$

$$\Rightarrow \frac{7.2 \times 10^3}{1} = \frac{450 \times \frac{1}{2} \times 20 \times 10^{-3} v^2}{60}$$

$$\Rightarrow 1.8 \times 10^3 = 20 \times 10^{-3} v^2$$

From calculation we get

$v = 300$ m/sec

(7) $m_2 = 2m_1$

$v_2 = \frac{1}{2} v_1$

$Power = \frac{w}{t} = \frac{\frac{1}{2}mv^2}{t}$

$P \propto mv^2$

$\Rightarrow \frac{P_1}{P_2} = \frac{m_1}{m_2}\left(\frac{v_1}{v_2}\right)^2$

$= \frac{m_1}{2m_1}\left[\frac{v_1}{\frac{v_1}{2}}\right]^2$

$= \frac{1}{2} 2^2$

$\Rightarrow \frac{P_1}{P_2} = 2$

(8) $\eta = 60\%$

$\frac{P_{out}}{P_{in}} = \frac{60}{100} = \frac{3}{5}$

$\Rightarrow P_{in} = \frac{5}{3} \times P_{out}$

$\Rightarrow P_{in} = \frac{5}{3} \times \frac{10 \times 10^3}{3}$

$\Rightarrow \frac{50}{9} \times 10^3$

$= 5.5 \times 10^3$

$P_{in} \Rightarrow 5.5\ kw$

$P_{out} = \frac{w}{t}$

$= \frac{mgh}{t}$

$= \frac{d \times vol \times gh}{t}$

$= 10^3 \times 20 \times 10 \times 10$

40×60

$= \frac{10 \times 10^3}{3}$

(9) Given $P = \frac{1}{2} P_{avg}$

$= \frac{1}{2} F v$

$P = \frac{1}{2} dAv^2 v$

$P = \frac{1}{2} dAv^3$

From $F = mg$

$= d \times vol \times \frac{v}{t}$

$= d \times A \times l \times \frac{v}{t}$

$\Rightarrow dAv \times v$

$= dAv^2$

L Task

(1) Given $m_L = 80kg$; $h = 20m$

$t = 25sec$ $M_m = ?$ $P = 1568\ w$

$P = \frac{w}{t} = \frac{Mgh}{t}$

$\Rightarrow 1568 = \frac{(m_m + m_L) g h}{t}$

$\Rightarrow 1568 = \frac{(m_m + M_L) \times 10 \times 20}{25}$

$\Rightarrow 1568 = 8(M_m + M_L)$

196

$\Rightarrow 196 = M_m + 80$

$\Rightarrow M_m = 116\ kg$

(2) Given $T = 9000N$

$v = 4 m/sec.$

$P = F \cdot V$

$= T \cdot V$

$= 9000 \times 4$

$= 36000\ w$

$= 36 \times 10^3\ w.$

(3)

(4) Given $n = 3$; $v = 15 m/s$

$t = 1sec$; $m = 0.4kg$

$Power = \frac{w}{t} = n\frac{\frac{1}{2}mv^2}{t}$

$= 3 \times \frac{1}{2} \times 0.4 \times (15)^2$

1

$= 3 \times 0.2 \times 225$

$= 3 \times 45 = 135\ w$

(5)

(6) Given $\frac{m}{t} = 8\ gm/cc$

$= 8 \times 10^{-3}\ kg/s$

$Power = \frac{w}{t} = \frac{\frac{1}{2}mv^2}{t}$

$= \frac{1}{2} 8 \times 10^{-3} \times (140)^2$

$\Rightarrow 4 \times 10^{-3} \times 140 \times 140$

$Power = 78.4\ w$

(7) $vol = 400\ lit = 400 \times 10^{-3} m^3$

$m = d_w \times vol$

$= 10^3 \times 400 \times 10^{-3}$

$m = 400\ kg$

$P = \frac{w}{t} = \frac{mgh}{t}$

$P = \frac{400 \times 9.8 \times 40}{98}$

$P = 16\ w$

(8) $T = 2000\ N$

$v = 6 m/sec.$

$P = F \cdot V$

$= T \cdot V$

$= 2000 \times 6$

$= 12 \times 10^3\ w$

$= 12\ kw$

(9) Given Power = 40 kw

$= 40 \times 10^3$ w

$m = 10$ tonne $= 10 \times 10^3$ kg

$t = 4$ sec

$\text{Power} = \frac{w}{t} = \frac{k \cdot E}{t}$

$\Rightarrow 40 \times 10^3 = \frac{\frac{1}{2} m v^2}{t}$

$\Rightarrow 4 \times 10^4 = \frac{1}{2} \times \frac{10^4 \times v^2}{4}$

$\Rightarrow v^2 = 32 \Rightarrow v = \sqrt{32}$

$\Rightarrow v = 5.656$ m/sec

(10) Given $\eta = 80\%$

$\eta_{Pump} = 70\%$

$\eta_{Total} = \eta_{Electric} \eta_{Pump}$

$= 80\% \ 70\%$

$= 5600\ \%$

$= 56\ \%$.

(5) Given vol $= 2400$ lit $= 2400 \times 10^{-3}$ m^3

$m_w = d_w \times \text{vol} = 10^3 \times 2400 \times 10^{-3}$

$m_w = 2400$ kg.

$m_w = 2$ $t = 12$ min

$= 12 \times 60$ sec.

$P = \frac{w}{t} = \frac{mgh}{t}$

$P = \frac{2400 \times 10 \times 24}{12 \times 60}$ (40, 2)

$P = 800$ w

$= 0.8$ kw