1 Actual fr = $\frac{10dm^3/min}{1000}$ = $0.01 m^3/min$

$Q = \frac{0.01}{60} = 1.67 \times 10^{-4} m^3/sec$

speed, N = 1,500 rev/min

$= 1,500/_{60} = 25$ rev/sec,,

P = 12 bar

if 1 bar = $1 \times 10^5 N/m^2$

12 bar = x

$x = 12 \times 10^5 N/m^2$,

Nominal displacement = $10 cm^3/rev$

$x = \frac{10}{1 \times 10^6} = 1 \times 10^{-5} m^3/rev$

ideal fr = nominal x speed

$= 25 \times 1 \times 10^{-5} = 2.5 \times 10^{-4} m^3/sec$,,

a) volumetric efficiency = $\frac{\text{Actual flow rate}}{\text{Ideal flow rate}} \times 100$

$= \frac{1.67 \times 10^{-4}}{2.5 \times 10^{-4}} \times 100\% = 66.8\%$

b) Fluid power = $Q \Delta p$

$= 1.67 \times 10^{-4} \times 12 \times 10^5$

$= 200.4 Nm/s$,,

- shaft power = $T.\omega$

T = torque input ω = angular speed

$T = 12.5\ Nm$

$\omega = 2\pi N$ for rps

$\omega = \frac{2\pi N}{60}$ for r/m

$\omega = 2 \times \frac{22}{7} \times 25 = 157.14$ rad/sec

shaft power $= 12.5 \times 157.14$
$= 1964.25$ watts

- overall efficiency = $\frac{\text{Fluid power}}{\text{Shaft power}} \times 100$

$= \frac{200.4}{1964.25} \times 100 = 10.2\%$

2) $\partial P = 100$ bar

$1\ bar = 10^3\ N/m^2$

$\partial P = 100 \times 10^5\ N/m^2$

Actual flow rate, $Q = 35\ dm^3/min$

$= \frac{35}{1000 \times 60}$ to m^3/sec

$= 5.83 \times 10^{-4}\ m^3/sec$

fluid power $= Q \partial p$

$= 5.83 \times 10^{-4} \times 100 \times 10^{5}$

$= 5830$ watts

shaft power $= \frac{\text{Fluid power} \times 100\%}{\text{Overall efficiency}} = \frac{5830 \times 100}{87}$

$= 6701.2$ watts

3 Nominal displacement

$x = \frac{50}{1 \times 10^{6}} = 5 \times 10^{-5} m^3/rev$

Actual flow rate $= 35 dm^3/min$

$= \frac{35}{1000 \times 60} = 5.83 \times 10^{-4} m^3/sec$

$\Delta P = 100 \times 10^{5} N/m^2$

fluid power $= 5.83 \times 10^{-4} \times 100 \times 10^{5} = 5830$ Watts

Overall efficiency $= \frac{\text{fluid power}}{\text{Shaft power}} \times 100\%$

Overall Efficiency $E = \frac{5830}{15{,}000} \times 100 = 38.87\%$

ideal flow rate = nominal displacement × speed

Speed, $N = 850rpm/60 = 14.2$ rps

ideal flow rate $= 5 \times 10^{-5} \times 14.2$
$= 7.085 \times 10^{-4} m^3/sec$

Vol efficiency $= \frac{\text{Act flow rate}}{\text{ideal flow}} \times 100$

$= \frac{5.83 \times 10^{-4}}{7.085 \times 10^{-4}} \times 100 = 82.3\%$

4 $Z = 2,400cm \times 10^{-2} = 240m$

Jet velocity = 66 m/sec

Vol flow rate = 13 l/s

$Q = 13/1000 = 13 \times 10^{-3} m^3/sec$

where $P = Z = 0$

$P = \frac{\rho Q \cdot V^2}{2} = \frac{1000 \times 13 \times 10^{-3} \times 66^3}{2} = 28314$ watts

ii) $p = 0, V = 0$

$P = \rho g Q z = 1000 \times 9.81 \times 13 \times 10^{-3} \times 240$
$= 30607.2$ watts
$P = 30.6072$ kilwatt,

ii) Power loss in transmission

Power of reservoir − Power of jet

$= 30607.2 - 28314$

$= 2293.2$ watts

iii) $h = \frac{\text{Power lost in transmission}}{\rho g Q}$

$h = \frac{2293.2}{1000 \times 9.81 \times 13 \times 10^{-3}} = 17.982m$

iv) Efficiency $= \frac{\text{Power of jet}}{\text{Power of reservoir}} \times 1000$

$= \frac{28314}{30607.2} \times 100 = 92.5 \simeq 93\%$

5) $\Upsilon = 890$ $h = 300m$, $V = 7m/s$ $Q = 220l/s$

$= 0.22\ m^3/s$

− Power of jet $P = \frac{1}{2} \times \rho Q V^3 = \frac{1}{2} \times 890 \times 0.22 \times 7^3$

$P = 4797.1$ watts

~~244.7~~

− Power from reservoir

$P = wQh = 890 \times 9.81 \times 0.22 \times 300$

$= 576239.4W$

Power from reservoir $= \gamma Q H = 890 \times 0.22 \times 300 = 58740$ kg m/sec

issuing jet $= \frac{1}{2} \rho V^2 Q = \frac{1}{2} \times \frac{890}{9.81} \times 7^2 \times 0.22$

$= 489$ kg m/s

Power lost in transmission $= \gamma Q h = 58740 - 489$

$= 58251$ kg m/s.

$h = \frac{58251}{890 \times 0.22} = 297.5m$ //

Efficiency $\eta = \frac{\text{Power of jet}}{\text{supply}} = \frac{489}{58740} = 0.0083 \times 100$

$= 0.83\%$ //

6 $E = mgh$

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

$t = \sqrt{\frac{20 \times 2}{g}} = 4.07s$

$P = \frac{\pi \times 0.05^2 \times 20 \times 1000 \times 9.81 \times 20}{4.07} = 7558.4W$ //

7 $\rho g = 19.62$, $d_1 = 0.3m$ $d_2 = 0.2m$

for manometer

$$P_1 + \rho g g_2 = P_2 + \rho_g g(z_1 - R) + \rho_w g R_b$$

$$P_1 - P_2 = 19.62(z_2 - z_1) + 587.423$$

for venturimeter

$$\frac{P_1}{\rho_g g} + \frac{u_1^2}{2g} + z_1 = \frac{P_2}{\rho_g g} + \frac{u_2^2}{2g} + z_2$$

$$P_1 - P_2 = 19.62(z_2 - z_1) + 0.803u_2^2$$

$$0.803u_2^2 = 587.423$$

$$u_2 = \sqrt{\frac{587.423}{0.803}} = 27.05 m/s$$

$Cd = 0.96$

$$Q_2 = 27.05 \times 3.14 \times \left(\frac{0.2}{2}\right)^2 = 0.85 m^3/s$$

$$Q_1 = Cd\, Q_2 = 0.96 \times 0.85 = 0.816 m^3/s$$

//

8 Question not complete!

for 1

9 $D_1 = 300mm = 0.3m$, Area $a_1 = \pi/4 (0.3)^2 = 0.0707 m^2$

$P = 400 kN/m^2$, $h_{z_1} = 10m$

for 2

$D_2 = 150mm = 0.15m$, $a_2 = \pi/4 \times (0.15)^2 = 0.01767 m^2$

$z_2 = h = 6m$

$Q = 40 lit/s = 0.04 m^3/sec$

$Q = A_1 V_1 = A_2 V_2$

$\therefore V_1 = Q/A_1 = \frac{0.04}{0.0707} = 0.566 m/s$

$V_2 = Q/A_2 = \frac{0.04}{0.01767} = 2.264 m/sec$

$$\frac{P_1}{W} + \frac{V_1^2}{2g} + z_1 = \frac{P_2}{W} + \frac{V_2^2}{2g} + z_2$$

$$P_2/W = P_1/W + (V_1^2 - V_2^2/2g) + z_1 - z_2$$

$$= (400 - 9.81) + 1/(2*9.81)*(0.566^2 - 2.264^2) + (10-6)$$

$$= 40.77 - 0.245 + 4$$

$$\frac{P_2}{W} = 44.525 m = 9.81 kN/m^2$$

$$P_2 = 44.525 \times 9.81 = 436.8 kN/m^2$$

10 reading $= 170mm$

SG of mercury $= 13.6$

SG of water 1.026

$$h = y\left[\frac{\text{Sg of mercury}}{\text{Sg of water}} - 1\right]$$

$$h = 0.17\left(\frac{13.6}{1.026} - 1\right) = 2.083$$

$$V = \sqrt{2gh} = \sqrt{2 \times 9.81 \times 2.083}$$

$$V = 6.393 m/s$$