$\therefore$ volumetric efficiency $= \frac{0.05}{0.017} = 2.94\%$

ii) fluid power $= P \times Q$. where $P = 15 \times 10^5 N/m^2$

$Q = 0.05 m^3/min = \frac{0.05}{60}$

$= 8.33 \times 10^{-4} m/s$

fluid power $= 15 \times 10^5 \times 8.33 \times 10^{-4}$

$= 15 \times 10^5 \times 8.83.3 \times 10^{-5} = 1249.5 \times 10^{5-5}$

$\Rightarrow$ 1249.5 watts

iii) Shaft power $= 2\pi NT/60 = \frac{2\pi \times 1706 \times 15}{60}$

Shaft power $= 2670.35$ watts

iv) Overall efficiency $= \frac{\text{third power}}{\text{shaft power}}$

$\Rightarrow \frac{1249.5}{2670.35} = 0.468$

$\therefore$ Overall efficiency $= 0.468 \times 100 = 46.8\%$

(4) The difference of mercury is $= 170mm = 170 \times 10^{-3} = 0.17m$

The specific gravity of ~~mercury~~, $sg = 13.6$

the specific gravity of sea water, $so = 1.026$

The speed, $v = ?$.

$v = \sqrt{2gh}$, $h = ?$.

$h = x\left[\frac{sg}{so} - 1\right] = 0.17\left[\frac{13.6}{1.026} - 1\right]$

$= 2.0834m$

$\therefore v = \sqrt{2 \times 9.81 \times 2.0834} = 6.393 m/s$

In km/hr

$v = \frac{6.393 \times 60^2}{1000} = 23.01 km/hr$

(5) $Q = 0.05 m^3/min = 50 dm^3/min$

$P_0 = 15 bar = 15 \times 100000 = 15 \times 10^5 N/m^2$

Speed $= 1700 rev/min$

$T = 15 Nm$, $ND = 10 cm^3/rev$

Volumetric efficiency $= \frac{\text{Actual flow rate}}{\text{Ideal flow rate}}$

Ideal flow rate = Nominal flow rate x speed

$= 10 cm^3/rev \times 1700 rev/min$

$= 17000 cm^3/min$

Ideal flow rate $= \frac{17000}{100000} = 0.017 m^3/min$

Actual flow rate $= 0.05 m^3/min$

Using $Q = \frac{C_d \sqrt{2gh} \cdot A_1 A_2}{\sqrt{A_1^2 - A_2^2}}$

$$\Rightarrow \frac{0.98 \times \sqrt{2 \times 981 \times 2208 \times 3.14 \times 78.54^2}}{\sqrt{(8.14 \times 16)^2 - (78.54)^2}}$$

$$\Rightarrow \frac{0.98 \times 2081.37 \times 24674.1264}{304.18412}$$

$$= 165455.3 \text{ cm}^3/\text{s}$$

$$= \frac{165455.3}{1000} = 165.455 \text{ lit/sec}$$

(3) $A_{orifice} = \pi/4 \times (15)^2 = 176.714 \text{ cm}^2$ [A_o area of orifice]

$A_{pipe} = \pi/4 \times (30)^2 = 706.858 \text{ cm}^2$ (A_p area of pipe)

Differential head (h) $= \left[\frac{13.1}{0.9} - 1\right] \times 50$ cm of oil

$= 705.556$ cm of oil

$$Q = \frac{C_1 \times A_o \cdot A_p \times \sqrt{2gh}}{\sqrt{A_p^2 - A_o^2}}$$

$$= \frac{0.64 \times 176.714 \times 706.858 \times \sqrt{2 \times 9.81 \times 705.550}}{706.858^2 - 176.714^2}$$

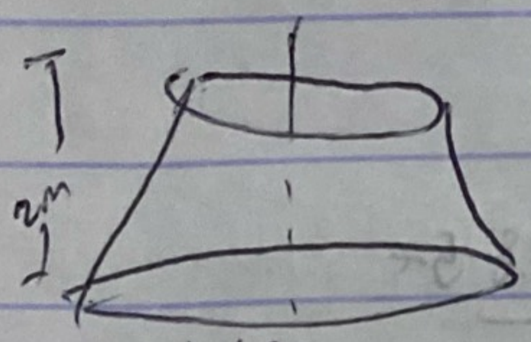
$$= 0.64 \times 182.5094 \times 11 \text{ 7.656}$$

$$= 13742.96 \text{ cm}^3/\text{sec}$$

$$\Rightarrow 13.74296 \text{ Lit/sec}$$

CIVIL ENG.

AHMED ABDALLAH IDRIS 18/ENG03/009

1) 

① $v_1 = 5 m/s$ $\quad p_1/w = 2.5 m$

② $v_2 = 2 m/s$

$$\frac{p_1}{w} + \frac{v_1^2}{2g} + z_1 = \frac{p_2}{w} + \frac{v_2^2}{2g} + z_2 + h_l$$

$$\frac{p_2}{w} = 2.5 + \frac{5^2 - 2^2}{2(9.81)} + 2 - \frac{0.35(3-2)^2}{2(9.81)}$$

$$\therefore \frac{p_2}{w} = 5.409 m \text{ of liquid}$$

2) let inlet diameter $= D_1 = 20cm$

let ~~throat~~ diameter $= D_2 = 10 cm$

let inlet area $= A_1 = \frac{\pi D_1^2}{4} = \frac{\pi (20)^2}{4} = 314.16 cm^2$

let throat area $= A_2 = \frac{\pi D_2^2}{4} = \frac{\pi (10)^2}{4} = 78.54 cm^2$

Density of water, $\rho = 1000 kg/m^3$

Pressure at inlet $= 17.658 N/m^2$

$$\therefore \frac{p_1}{\rho g} = \frac{17.658 \times 10^4}{1000 \times 9.81} = 18m$$

$\frac{p_2}{\rho g} = -30 cm$ of mercury $\quad S.G_{Hg} = 13.6$

$\frac{p_2}{\rho g} = -30 \times 10^{-2} m$ of mercury $\times 13.6 \Rightarrow -4.08m$

let differential head $= H = \frac{p_1}{\rho g} - \frac{p_2}{\rho g}$

$= 18 - (-4.08)$

$= 18 + 4.08 = 22.08m \times 100$

$\therefore H = 2208 cm$ //