DATA.

5. Rate of Pump - $0.05m^3/min = 500dm^3/min$

Pressure change - 15bar.

Speed rotation - 1700rev/min

normal displacement - $10cm^3/rev$

torque input - 15N/m

Solution

Ideal flow rate = Normal displacement × Speed

$= 15 \times 1700 = 25,500cm^3/min = 25.500dm^3/min$

$= 25.5$

Volumetric efficiency.

$= \frac{\text{Actual flow}}{\text{Ideal flow}} = \frac{500}{25.5} = 19.60$

$Q = \frac{(500 \times 10^{-3})}{60m^3/s} = 83.3 \times 10^{-4} m^3/s$

fluid power.

$\Delta P = 100 \times 10^5 N/m^2$ - fluid power = $Q\Delta P = 83.3 \times 10^{-4} \times 100 \times 10^5$

fluid power = 83300W

Shaft Power

$= 2\pi NT/60 = \frac{2\pi \times 1700 \times 25.5}{60} = 4541.4 N/m$

Overall efficiency.

$= \frac{\text{fluid power}}{\text{Shaft power}} = \frac{83300}{4541.4} = 18.342$

Overall efficiency = 18.342 or 1834.2%.

2) DATA.

Inlet Diameter $(D_1) = 20cm = 0.2m$

throat Diameter $(D_2) = 100 = 0.10m$

Area of inlet $a_1 = \pi/4 \times (0.2)^2 = 0.03146 m^2$.

Area of throat $= \pi/4 \times (d_2)^2 = \pi/4 \times (0.1)^2$

$= 0.07854 cm^2$

$Cd = 0.98$, pressure $(p_1) = 17.685 \times 10^4 Nm^2$, $\rho = 10000 Kg/m^3$

$P_1/\rho g = \frac{17.653 \times 10^4}{9.81 \times 1000} = 18m$

$P_2/\rho g$ = 30cm of mercury = ~~-0.3m of~~ $-0.3 \times 13.6 = -4$.

differential head

$h = P_1/\rho g - P_2/\rho g = 18 - (-4)$

$= 22.08m$ (water.

$$Q = \frac{Cd \times a_1 a_2 \sqrt{2gh}}{\sqrt{(a_1)^2 - (a_2)^2}}$$

$$= \frac{0.98 \times 314.16 \times 0.007854}{\sqrt{(314.16^3)^2 - (0.001854)^2}} \times \sqrt{2 \times 9.81} \times 22.08m.$$

$$= \frac{50328837.21}{304} \times 165555 = 0.165m.$$

$= 165.56 lit/s$

3. DATA

Orifice Diameter – 15cm

Pipe Diameter – 30cm

Co-efficient of discharge of the mete is = 0.64.

flow of oil of Specific gravity – 0.9.

Solution.

$A_o = \pi/4 (15)^2 = 176.714 cm^2$ (A_o area of the Orifice)

$A_p = P_A (30)^2 - 706.838 cm^2$ (Area of the pipe)

$$H = \left[\frac{13.6}{0.9} - 1\right] \times 50cm \text{ of Oil}$$

$$= \left[15.1 - 1\right] \times 50cm = 14.1 \times 50$$

$= 705.56.$

$$Q_1 = \frac{C_d A_0 A_p}{\sqrt{(A_p^2) - (A_0)^2}} \sqrt{2gh}$$

$$Q = \frac{(0.64 \times 176.71 \times 706.86 \times}{\sqrt{(706.85)^2 - (176.74)^2}} \sqrt{2 \times 9.81 \times 7.05 \times 100}$$

$$= \frac{0.64 \times 176.71 \times 706.85 \times}{\sqrt{(706.858)^2 - (176.74)^2}} \sqrt{2 \times 9.81 \times 7.05 \times 100} \ cm^3/sec$$

$Q = 137414.25 cm^3/sec$

litres = 137.41425 lit/Sec

Rate of flow of Oil = 137.414 lit/Sec

4. <u>DATA</u>

Diff of mercury level, x = 170mm = 0.17m

Specific gravity of mercury = 13.6

Specifoc gravity (Sp) = 1.026.

Solutoon.

$$H = x\left[\frac{S_g}{S_0} - 1\right] = 0.17\left[\frac{13.6}{1.026} - 1\right]$$

$= 2.0834m$

$v = \sqrt{2gh}$

$= 2 \times 9.81 \times 2.08$

$= 6.39 m/s$

$$= \frac{6.39 \times 60 \times 60}{1000}$$

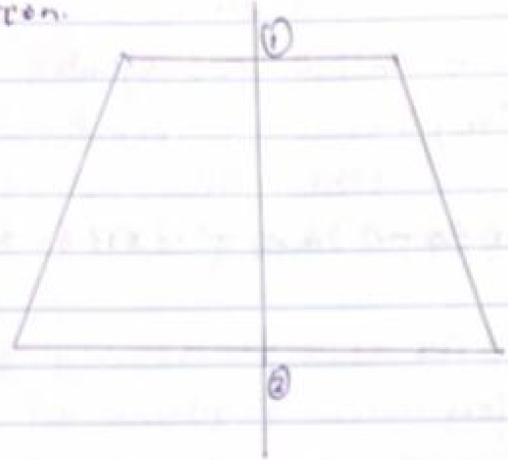
$$= \frac{23004}{1000} = 23.004$$

Speed of Submarine = 23.004 Km/hr

= 23.004 Km/hr

Solution.

(1)



Let Smaller end be represented by (1). Lower end by Represented by (2)

Solution.

$l = 2.0m$ $P.S P_g = 2.5m$

$V_1 = 5m/s$ $V_2 = 2m/s$

Loss of head $= h_L = \frac{0.35(V_1 - V_2)^2}{2g}$

$= \frac{0.35(5-2)^2}{2g} = \frac{0.35(3)^2}{2 \times 9.81} = \frac{0.35(9)}{2 \times 9.81} = 0.16m$

Pressure head $\frac{P_2}{\rho g} = ?(x)$, applying Bernoulli's equation at (1) & (2)

$P_1/\rho g + V_1^2/2g + Z_1 = P_2/\rho g + V_2^2/2g + Z_2 + h_L$

$Z_2 = 0, Z_1 = 2.0$

$2.5 + \frac{(5)^2}{2 \times 9.81} + 2.0 = \frac{P_2}{\rho g} + \frac{(2^2)}{2 \times 9.81} + 0.016$

$2.5 + 1.27 + 2.0 = \frac{P_2}{\rho g} + 0.203 + 0.16$

$\frac{P_2}{\rho g} = (2.5 + 1.27 + 2.0) - (0.203 + 0.16)$

$= 5.77 - 0.363 = 5.407 = 5.4m$ of fluid.