(2) $D_1 = 20cm = 0.2m$

$A_1 = \frac{\pi}{4} \times 0.2^2 = 0.0314 m^2$

Throat diameter $= D_2 = 0.1m$

" $A_2 = \frac{\pi}{4} \times 0.1^2 = 0.00785 m^2$

$P_1 = 0.176 = 176 kN/m^2$

$\frac{P_1}{w} = \frac{176}{9.81} = 17.94m$

$\frac{P_2}{w} = -0.30m = -0.3 \times 13.6 = -4.08m$

$h = \frac{P_1}{w} - \frac{P_2}{w} = 17.94 - -4.8 = 22.74m$

$Q = Cd \times \frac{A_1 A_2}{\sqrt{A_1^2 - A_2^2}} \times \sqrt{2gh}$

$= 0.97 \times \frac{0.0314 \times 0.00785}{\sqrt{(0.0314)^2 - (0.00785)^2}} \times \sqrt{2 \times 9.81 \times 22.74m}$

$= \frac{0.000241}{0.0304} \times 21.12$

$= 0.1674 m^3/s$

(3)

(4)

h=

(4) Reading of manometer is 170mm = 0.17m of mercury

Sp gravity of mercury $S_{hl} = 13.6$

Sp gravity of sea water $S_1 = 1.026$

$$h = y\left(\frac{S_{hl}}{S_1} - 1\right) = 0.17\left(\frac{13.6}{1.026} - 1\right)$$

$$h = 2.08$$

$$V = \sqrt{2gh} = \sqrt{2 \times 9.81 \times 2.08}$$

$$= 6.39 \text{ m/s}$$

5) $\frac{1000\,dm^3}{0.05} = 1m^2$

volumetric flow rate $= \frac{0.05}{60} = Q = 8.3\times10^{-4}\,m^3/s$

Speed $= 1700$ rev/min

$\frac{1700}{60} = 28.3$ rev/min

Pressure $\partial p = 15$ bar $= 15\times10^5\,N/m^2$

Nominal displacement $= 10\,cm^3/rev$

$100\,cm = 1m$

$100^3\,cm^3 = 1m^3$

$x = \frac{10}{1000000} = 1\times10^{-5}\,m^3/rev$

Ideal flow rate = nominal × speed

$= 1\times10^{-5} \times 28.3$

$= 2.83\times10^{-4}\,m^3/s$

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

$= \frac{8.3\times10^{-4}}{2.83\times10^{-4}} \times 100$

$= 293.2\%$

ii fluid power $P_f = Q \cdot \partial P = 8.3\times10^{-4} \times 15\times10^5$

$= 1245$ watts

iii Shaft power $= T \cdot \omega$

T = torque

ω = angular speed

$T = 15$

$\omega = \frac{2\pi N}{60} = 2\times\frac{22}{7} \times 28.3 = 177.8$

177.88 rad/s

— Piffroa

Shaft power = 15 x 177.88 = 2668.2 watt

iv) Overal efficiency = $\frac{\text{fluid power}}{\text{Shaft power}} \times 100$

$= \frac{1245}{2608.2} \times 100 = 46.65\%$