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1. $N = 0.9$; $\rho = 900 kg/m$; $D = 0.12m$; Length, $L = 12m$

(a) $Re = \frac{\rho D}{\mu}$

flow $Q = 785N$ in 25secs
$= 785 kg ms^{-2}$

$F = mg$
$\therefore m = F/g = \frac{7.85}{9.81} = 80kg$

$\dot{m} = m/t = \frac{80}{25}$
$= 3.20 kgs^{-1}$

$\dot{m} = \rho u A$
NOTE: $A = \frac{\pi D^2}{4} \Rightarrow \frac{\pi (0.12)^2}{4} = 0.0113 m^2$

$u = \dot{m}/\rho A = 3.20/(0.113 \times 900)$
$\therefore u = 0.314 ms^{-1}$

$\therefore Re = (900 \times 0.72 \times 0.314)/0.09$
$\therefore Re = 376.8$

Since the $Re = 376.8 < 2000$, then the flow is Laminar

$\Delta P = \frac{32 \mu u L}{D^2}$

$\Delta P = (32 \times 0.09 \times 0.314 \times 12)/(0.12)^2 = 753.6 N/m^2$

$P = \rho g h \quad \therefore h = P/\rho g$

$\therefore h = \frac{753.6}{9.8 \times 900} = 0.0853 m$

$\therefore h = 0.0853 m$

2. $D = 0.06m$; Length $L = 850m$; $C = 1000 kg/m^3$; $Q = 8.5$ Lit/sec $= (8.5 \times 10^{-3}) m^3/s$

$V = 0.5$ stokes $= 0.00005 m^2/s \Rightarrow 5 \times 10^{-5} m^2/s$

$\mu = V \times \rho \Rightarrow (5 \times 10^{-5}) \times 1000$

$\mu = 5 \times 10^{-2} N/m$

$Q = VA$

$\therefore A = \frac{Q}{V}$

Area $A = \frac{\pi D^2}{4} = \frac{\pi (0.06)^2}{4} = 2.827 \times 10^{-3} m^2$

$u = (8.5 \times 10^{-3}) / (2.827 \times 10^{-3})$

$\therefore u = 3.01 ms^{-1}$

(a) $\Delta P = 32 \frac{\mu u L}{D^2} \Rightarrow \frac{32 \times 0.05 \times 3.01 \times 850}{(0.06)^2} \Rightarrow 1,130 kN/m^2$

NOTE: $P = \rho g h$

$\therefore h = P/\rho g \Rightarrow \frac{(1.130 \times 10^3)}{1000 \times 9.81} = 110 m$

(b) $\tau_0 = \mu \frac{\delta u}{\delta x}$

$\tau_0 = -\left(\frac{\delta P}{\delta x}\right) \times \frac{r}{2}$

NOTE: Radius = Diameter/2 $= 0.03 m$

$\frac{\delta P}{\delta x} = -\left(\frac{1130 \times 10^3}{850}\right) \times \left(\frac{0.03}{2}\right) \Rightarrow 20 N m^2$ approximately

(c) $Re = \frac{\rho D u}{\mu} = \frac{1000 \times 0.06 \times 3.01}{0.05} = 3612$

The $Re = 3612$ which is greater than 2000 but less than 4000

$\therefore$ The flow is a "Transitional flow".