

UE Fluids Quiz 2 Solution Problem 1

S'08

a) Mass eq'n: $\oint \rho \vec{v} \cdot \hat{n} dA = 0$ (10)

$$\boxed{-\rho_1 V_1 A_1 + \rho_2 V_2 A_2 = 0}$$

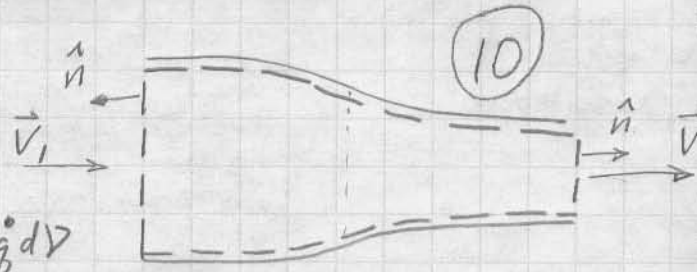
negligible

Enthalpy Eq'n: $\oint \rho \vec{v} \cdot \hat{n} (h + \frac{1}{2} V^2) dA = \iiint \rho g dV$

or $\oint \rho (\vec{v} \cdot \hat{n}) h dA = \dot{Q}$

$$\boxed{-\rho_1 V_1 h_1 A_1 + \rho_2 V_2 h_2 A_2 = \dot{Q}}$$

(15)



b) Since $\rho_1 V_1 A_1 = \rho_2 V_2 A_2$: $\rho_1 V_1 A (h_2 - h_1) = \dot{Q}$

$$\boxed{h_2 = h_1 + \frac{\dot{Q}}{\rho_1 V_1 A}}$$

(10)

c) Using equation of state:

$$\boxed{P_2 = \frac{\gamma P_2}{(\gamma - 1) h_2} = \frac{\gamma}{\gamma - 1} P_2 \frac{1}{h_1 + \dot{Q}/(\rho_1 V_1 A_1)}}$$

(5)