TD 5

Ex 01 :

$\frac{R_1}{R_2} = ?$

1) $Q_{V_1} = Q_{V_2}$

$S_1 V_1 = S_2 V_2$

$S_1 V_1 = 4 S_2 V_2$

$\pi R_1^2 = 4\pi R_2^2$

$\frac{R_1^2}{R_2^2} = 4 \Rightarrow \frac{R_1}{R_2} = 2$

2) $R_1 - R_2 = ?$

$\tan \alpha = \frac{R_1 - R_2}{L}$

$R_1 - R_2 = L \tan \alpha$

Calculating L :

$L = \frac{R_1 - R_2}{\tan \alpha}$ $\quad R_2 = \frac{R_1}{2} = 25$ mm

$L = \frac{50 - 25}{\tan 15} = 93.3$ mm

Ex 2 :

$Q_{V_1} = Q_{V_2} + Q_{V_3}$

$Q_{V_3} = Q_{V_1} - Q_{V_2} = Q_{V_1} - S_2 V_2$

$Q_{V_3} = 1.5 - \frac{\pi (30 \times 10^{-2})^2}{4} = 7.5$

$Q_{V_3} = 0,97 \ m^3/s$

$Q_{m_3} = \rho . Q_V = 1000 \times 0,97 = 970 \ kg/s$

$Q_{V_2} = S_2 V_2 \Rightarrow V_2 = \frac{Q_{V_2}}{S_2} = \frac{0.97}{\frac{\pi \times (40 \times 10^{-2})^2}{4}}$

$V_2 = 7.72 \ m/s$

Ex 3 :

$Q_{V_3} + Q_{V_2} = Q_{V_1}$

$S_3 V_3 = S_1 V_1 + S_2 V_2 \Rightarrow V_3 = \frac{S_1 V_1 + S_2 V_2}{S_3}$

$V_3 = \frac{0,05 \times 4 + 0,01 \times 8}{0,06} = 4,67 \ m/s$

$V_x = V \sin 60 = 4,67 \sin 60 = 4,04 \ m/s$

$V_y = V \cos 60 = 4,67 \cos 60 = 2,335$

Ex 4 :

$Q_{V_1} = Q_{V_2} + Q_{V_3} + Q_{V_4}$

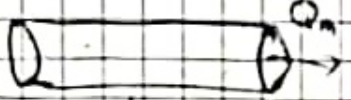
$Q_{V_2} = Q_{V_1} - (Q_{V_3} + Q_{V_4})$

$V_2 = \frac{A_1 V_1 - (A_3 V_3 + Q_{V_4})}{A_2}$

$V_2 = \frac{0,2 \times 5 - (0,15 \times 12 + 0,1)}{0,2}$

$V_2 = -4,5 \ m/s$

Ex 5 :



$Q_m = \rho . Q_V = \rho S V$

$PV = nRT \Rightarrow PV = \frac{m}{M} RT \Rightarrow PM = \rho RT$

$$\rho = \frac{PM}{RT}$$

$$Q_m = \frac{PM}{RT} \cdot S \cdot v$$

N.A :

$$Q_m = \frac{200 \times 10^3 \times 29 \times 10^{-3}}{8,31 (20+273)} \frac{\pi (3 \times 10^{-2})^2}{4} \times 20$$

$$Q_m = 33,636 \times 10^{-3} \text{ kg/s}$$

Ex 6 :

$$V_{moy} = \frac{1}{h} \int_0^{y=9} V_{max} \left(\frac{y}{h}\right)^{1/2} dy = \frac{3}{\sqrt{h}} \left[\frac{y^{3/2}}{3/2}\right] 3 \times \frac{1}{\frac{2}{3}} \times \frac{9}{2} = 4,5 \text{ m/s}$$

$$Q_v = A \cdot V_{moy} = (2 \times 1) \times 4,5 = 9 \text{ m}^3/\text{s}$$

Ex 7 : $h = f(t)$

$$Q = \frac{dV}{dt} \quad / \quad Q_v = S \cdot V \qquad V = \frac{\pi r^2 h(t)}{3}$$

$$\tan \alpha = \frac{r}{h} \qquad \Rightarrow V = \frac{\pi \tan^2 \alpha \, h^3(t)}{3}$$

$$\frac{d}{dt}\left(\frac{\pi \tan^2 \alpha \, h^3(t)}{3}\right)$$

$$\frac{\pi}{3} \tan^2 \alpha \frac{d h^3(t)}{dt} = \frac{\pi}{3} tg^2 \alpha \, 3 h(t)^2 \frac{dh(t)}{dt}$$

$$S \cdot V = \frac{d^2}{4} kt = \frac{\pi}{3} tg^2 \alpha \, 3 h(t)^2 \frac{dh(t)}{dt}$$

$$\frac{d^2}{4} kt = tg^2 \alpha \, h(t)^2 \frac{dh(t)}{dt}$$

$$\int_0^t \frac{d^2}{4} kt \, dt = \int_0^h tg^2 \alpha \, h(t)^2 \, dh(t)$$

$$\frac{d^2}{4} k \left[\frac{t^2}{2}\right]_0^t = tg^2 \alpha \left[\frac{h^3(t)}{3}\right]_0^h$$

$$\frac{d^2}{8} k t^2 = tg^2 \alpha \frac{h^3}{3}$$

$$\boxed{h = \sqrt[3]{\frac{3 d^2 k t^2}{8 tg^2 \alpha}}}$$