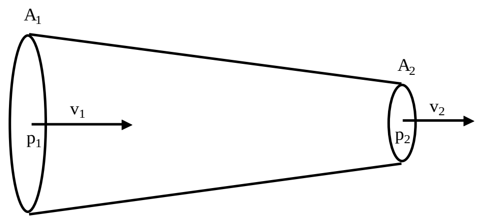
The rate of flow of liquid of density $1.29\times10^3 kg/m^3$ through conic section of pipe having radii of ends as 0.1 m and 0.04 m having pressure drop across the length as $20N/m^2$ is given by $\frac{\pi}{n}m^3/s$, where the natural number n is closest to:

(A) 3500 (B) 7000 (C) 1750 (D) 350

*Solution*




We have, $p_1+\frac{1}{2}\rho v_1^{\,2}=p_2+\frac{1}{2}\rho v_2^{\,2}$

$$\therefore v_2^{\,2}-v_1^{\,2}=\frac{2}{\rho}(p_1-p_2)=\frac{2}{\rho}\times20=\frac{40}{\rho}$$

Also, $v_1A_1=v_2A_2$

$$\therefore v_2=v_1\frac{A_1}{A_2}=v_1\frac{r_1^{\,2}}{r_2^{\,2}}=v_1\frac{0.1^2}{0.04^2}=6.25v_1$$

Now, $(6.25v_1)^2-v_1^{\,2}=\frac{40}{\rho}$

$$\therefore 7.25v_1\times5.25v_1=\frac{40}{\rho}$$

$$\therefore v_1=\sqrt{\frac{40}{7.25\times5.25\times1.29\times10^3}}\approx\sqrt{\frac{40}{49\times10^3}}=\frac{1}{35}\text{ m/s}$$

Rate of flow = $v_1A_1=v_2A_2=\frac{1}{35}\times\pi\times0.1^2=\frac{\pi}{3500}m^3/s$

Hence, (A)