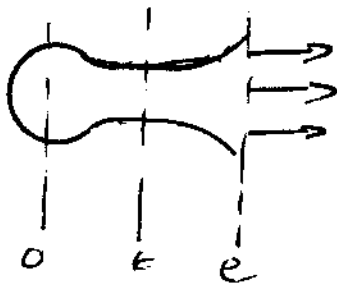


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$$\begin{aligned}\gamma &= 1.25 \\ \tilde{m} &= 34 \text{ kg/kmol} \\ T_0 &= 2800 \text{ K} \quad P_0 = 256 \\ R &= R_0 / \tilde{m} \\ R &= \frac{8314}{34} = 244.53 \text{ J/kgK}\end{aligned}$$

$$C_p = \frac{R\gamma}{\gamma-1} = \frac{244.53 \times 1.25}{0.25} = 1222.6 \text{ J/kgK}$$

Flow is choked so $\frac{T_0}{T_e} = 1 + \frac{(\gamma-1)}{2} = 1.125$

$$T_e = 2800 / 1.125 = 2489 \text{ K}$$

$$\frac{P_e}{P_0} = \left(\frac{2}{\gamma+1}\right)^{\frac{\gamma}{\gamma-1}} = 0.5549$$

$$P_e = 256 \times 0.5549 = 13.873 \text{ bar}$$

Sonic velocity $a_e = \sqrt{\gamma R T_e}$

$$a_e = v_e = \sqrt{1.25 \times 244.53 \times 2489} = 872.2 \text{ m/s}$$

DENSITY $\rho_e = \frac{m}{V} = \frac{P}{RT} = \frac{13.873 \times 10^5}{244.53 \times 2489}$

$$\rho_e = 2.279 \text{ kg/m}^3$$

EXIT $T_e = T_0 r^{\frac{\gamma-1}{\gamma}} = 2800 \left(\frac{1}{2.5}\right)^{0.25} = 1470.8 \text{ K}$

$$C_p T_0 = C_p T_e + \frac{v^2}{2}$$

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$$2 C_p (T_0 - T_e) = v_e^2 \quad (\text{velocity})$$

$$2 \times 1222.6 (2800 - 1470.8) = v_e^2$$

$$v_e = 1803 \text{ m/s}$$

DENSITY AT EXIT $\rho_e = \frac{M}{V} = \frac{P_e}{R T_e}$

$$\rho_e = \frac{1 \times 10^5}{244.53 \times 1470.8} = 0.278 \text{ kg/m}^3$$

MASS FLOW = $\rho A V$

$$\rho_e A_e v_e = \rho_e A_e v_e \quad \frac{A_e}{A_e} = \frac{\rho_e v_e}{\rho_e v_e}$$

$$\frac{A_e}{A_e} = \frac{2.279}{0.278} \times \frac{872.2}{1803} = \underline{\underline{3.965}} \quad \text{ANSWER}$$

THRUST

$$F = m \Delta V + A_e \Delta p$$

for $A_e = 1 \text{ m}^2$

$$A_e = 3.965 \text{ m}^2$$

$$m = 2.279 \text{ kg} \times A V$$

$$m = 2.279 \times 1 \times 872.2$$

$$m = 1988 \text{ kg/m}^2$$

$$F = 3.585 \text{ MN} + 0.397 \text{ MN}$$

$$F = \underline{\underline{3.982 \text{ MN}}} \quad \text{ANSWER}$$