(4) $D = 2$ cm., $\bar{f} = 0.015$

$\vec{V}_1 = 900$ m/s

$T_1 = 225$ K

$P_1 = 2$ atm

a) $Ma_1 = \dfrac{V_1}{\sqrt{\gamma R T_1}} = 3.0$,

FROM TABLE B.3 (APPENDIX B): $\dfrac{\bar{f} L^*}{D} = 0.52$

THEN $L^* = \dfrac{0.52 \cdot 0.02}{0.015} = 0.7$ m

MASS FLOW RATE = $\dot{m} = \rho_1 V_1 A = \dfrac{P_1}{RT_1} V_1 \cdot \dfrac{\pi D^2}{4} =$ 0.88 kg/s

b) FOR $Ma_2 = 1.8$, TABLE B.3 $\dfrac{\bar{f} L^*}{D} = 0.24$

SO THAT $\dfrac{\bar{f} L}{D} = \left(\dfrac{\bar{f} L^*}{D}\right)_{Ma_1} - \left(\dfrac{\bar{f} L^*}{D}\right)_{Ma_2} = 0.28 \rightarrow L = \dfrac{0.28 \cdot 0.02}{0.015} = 0.37$ m

AND THE MASS FLOW RATE IS THE SAME AS IN *)