**Answer on Question#40870 – Physics – Molecular Physics | Thermodynamics**

An ideal gas flows into one end of a porous cylinder at a temperature of 400 K degrees and out the other end at a temperature of 600 K degrees. The input pressure is 20 atmospheres and the output pressure is 10 atmospheres. If the input volume flow rate is 100 cm^3/sec what is the output flow rate?

**Solution:**

$\mathrm{T}_1 = 400\mathrm{K} - \text{initial temperature of a gas}$
$\mathrm{T}_2 = 600\mathrm{K} - \text{final temperature of a gas}$
$\mathrm{p}_1 = 20\ \text{atm} - \text{input pressure of a gas}$
$\mathrm{p}_2 = 10\ \text{atm} - \text{output pressure of a gas}$
$\mathrm{V}_1 = 100\mathrm{cm}^3 - \text{input volume of a gas per 1 second}$
$\mathrm{V}_2 - \text{input volume of a gas per 1 second}$

We can use the combined gas equation (for a portion of gas per one second)

$$\frac{\mathrm{p}_1\mathrm{V}_1}{\mathrm{T}_1} = \frac{\mathrm{p}_2\mathrm{V}_2}{\mathrm{T}_2} \qquad (1)$$

$$\mathrm{V}_2 = \frac{\mathrm{p}_1\mathrm{V}_1\mathrm{T}_2}{\mathrm{T}_1\mathrm{p}_2} = \frac{20\ \text{atm} \cdot 100\mathrm{cm}^3 \cdot 600\mathrm{K}}{400\mathrm{K} \cdot 10\ \text{atm}} = 300\ cm^3$$

Hence, input volume flow rate is $\frac{300cm^3}{s} = 300\frac{cm^3}{s}$.

**Answer:** input volume flow rate of the gas is $300\frac{cm^3}{s}$.