Question # 82119

A sample of nitrogen at 40°C has a volume of 5.0 L. At what temperature will it occupy 8.0 L?

Answer:

The temperature of the nitrogen sample, which occupies 8.0 L, will be 227.8 °C.

It is able to find the solution of this task, only if the pressure (P) is constant (Charles's law [1]). Otherwise, according to the ideal gas law [2], there is an infinite number of solutions:

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} = const$$

So, the temperature of nitrogen will be:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} = const$$

$$T_2 = \frac{V_2 * T_1}{V_1} = \frac{8\,l * 313\,K}{5\,l} = 500.8\,K = 227.8\,°C$$

References:

[1]   https://en.wikipedia.org/wiki/Charles%27s_law

[2]   https://en.wikipedia.org/wiki/Ideal_gas_law

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