Answer on Question # 58712 – Physics – Molecular Physics | Thermodynamics

An ideal gas is in equilibrium at initial state with temperature T_0 = 137 ^oC, pressure P_0 = 0.75 Pa and volume V_0 = 0.75 m^3. If there is a change in state in which the gas undergoes an isothermal process to a final state of equilibrium during which the volume is doubled. Calculate the temperature and pressure of the gas at this final state.

Solution:

In an isothermal process, the temperature of the gas is constant. The temperature of the gas at the final state T_f is equal to the initial temperature:

$$T_f = T_0 = 137 \left[{}^o\mathrm{C} \right].$$

The relation between thermodynamic parameters in an isothermal process is described by Boyle-Mariotte law:

$$pV = \text{const};$$

$$p_0 V_0 = p_f V_f.$$

The pressure of the gas in the final state:

$$p_f = \frac{p_0 V_0}{V_f} = \frac{p_0 V_0}{2V_0} = \frac{p_0}{2} = \frac{0.75}{2} = 0.375 \left[\mathrm{Pa} \right].$$

Answer: $T_f = 137 \left[{}^o\mathrm{C} \right]; \; p_f = 0.375 \left[\mathrm{Pa} \right].$