Answer on Question #71020, Physics / Molecular Physics | Thermodynamics

A mass of gas at an initial pressure of 28 bar and with an internal energy of 1500 kJ, is contained in a well-insulated cylinder of volume 0.06 m3. The gas is allowed to expand behind a piston until its internal energy is 1400 kJ; the law of expansion is PV^2=Constant. Calculate

1. Work done;
2. The final volume;
3. The final pressure;
4. Draw P-V diagram.

Solution:

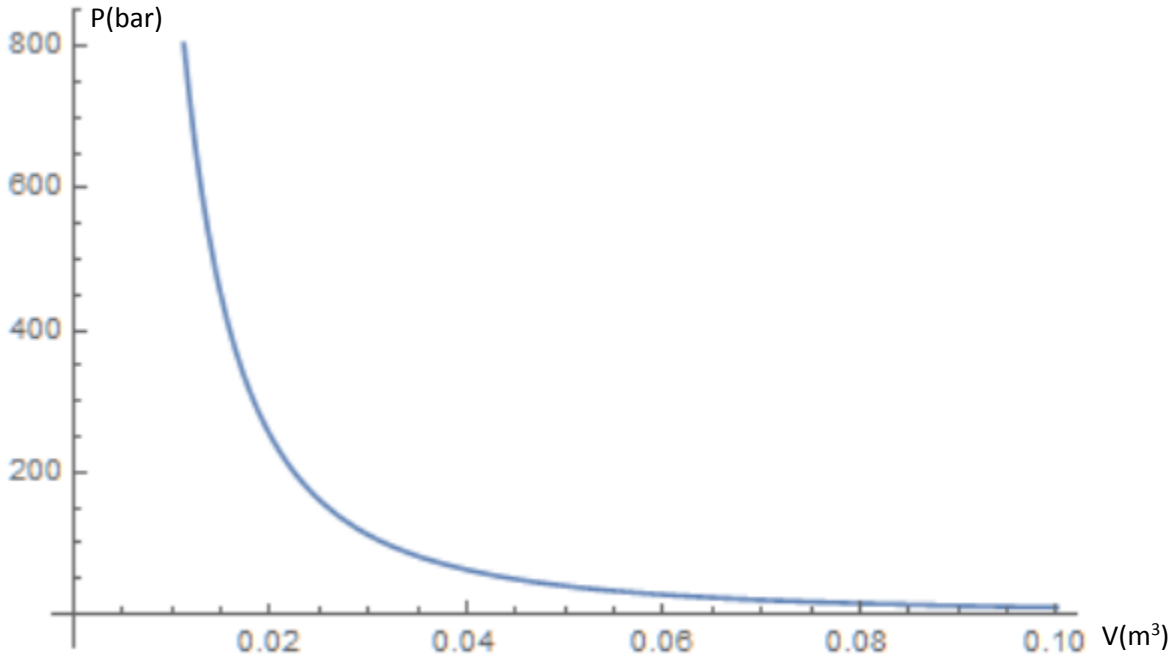
1) As there is no heat transfer in the system: $A = \Delta U = 140 - 1500 = -100kJ$

2)$A = \int pdV = [pV^2 = C] = -C \int \frac{1}{V^2} dV = C\left(\frac{1}{V_2} - \frac{1}{V_1}\right) = p_1 V_1^2 \left(\frac{1}{V_2} - \frac{1}{V_1}\right) = \mathbf{-100kJ}$

As we know, $V_1 = 0.06\ m^3, p_1 = 28\ bar, then\ \boldsymbol{V_2 = 0.148\ m^3}$

3) $p_2 = \frac{p_1 V_1^2}{V_2^2} = 28 * \frac{0.06^2}{0.148^2} = \mathbf{4.6\ bar}$

4)



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