Answer on Question #58674-Engineering-Mechanical Engineering

1Kg of a fluid is compressed reversibly according to a law pv=0.25 where p is in bar v is in m^3/Kg. The final volume is 1/4 of the initial volume. Calculate the work done on the fluid and sketch the P-V diagram

Solution

The work done on the fluid is

$$W = -\int_{V_1}^{V_2} pdV = \int_{V_2}^{V_1} pdV;$$

$$pv = 0.25 \to p = \frac{0.25}{V}.$$

$$1\ bar = 10^5 Pa$$

$$W = \int_{V_2}^{V_1} \frac{0.25 \cdot 10^5}{V} dV = 0.25 \cdot 10^5 \ln\left(\frac{V_1}{V_2}\right) = 0.25 \cdot 10^5 \ln\left(\frac{1}{1/4}\right) = 34660\,J.$$