

4. An ideal gas is allowed to expand from 1 L to 10 L against a constant external pressure of 1 bar. The work done in kJ is:

a) +10.0

b) -0.9

c) -2.0

d) -9.0

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Solution:

This is an irreversible process as gas is expanding against a constant external pressure.

Work done in irreversible process

$$\begin{aligned} W &= - P_{\text{ext}} \Delta V = - 1 \text{ bar} \times 9 \text{ L} = - 10^5 \text{ Pa} \times 9 \times 10^{-3} \text{ m}^3 = - 9 \times 10^2 \text{ N-m} \\ &= - 900 \text{ J} = - 0.9 \text{ kJ} \end{aligned}$$