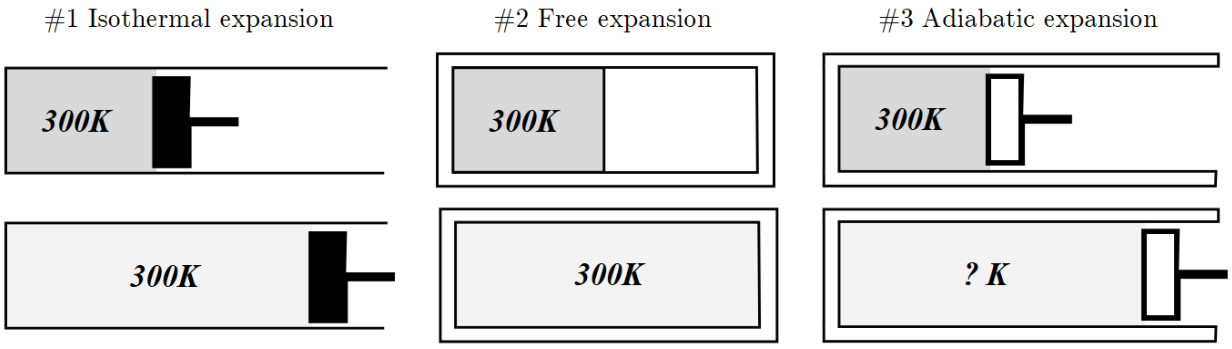
Ungraded Quiz

Consider the two processes described below.

Process #1 Five moles of an ideal gas are initially confined in a one-liter cylinder with a movable piston, at a temperature of 300 K. Slowly the gas expands against the movable piston, while the cylinder is in contact with a thermal reservoir at 300 K. The temperature of the gas remains constant at 300 K while the volume increases to two liters.

Process #2 A thin plastic sheet divides an insulated two-liter container in half. Five moles of the same ideal gas are confined to one half of the container, at a temperature of 300 K. The other half of the container is a vacuum. The plastic divider is suddenly removed and the gas expands to fill the container. Because it is a free expansion of an ideal gas (no work is done on or by the gas), the final temperature of the gas is also 300 K.

Process #3 The same cylinder as in process #1 is thermally insulated and then allowed to slowly expand, starting at 300 K, to twice its original size (two liters).



1. Are $\Delta S_{\text{isothermal}}$, ΔS_{free} and $\Delta S_{\text{adiabatic}}$, the change in entropy of the gas for each process, positive, negative, or zero? Please explain your reasoning.

2. Is $\Delta S_{\text{isothermal}}$ greater than, less than, or equal to ΔS_{free}? How do each of these compare with $\Delta S_{\text{adiabatic}}$? Please explain.

3. Are $\Delta S_{\text{surr-isothermal}}$, $\Delta S_{\text{surr-free}}$ and $\Delta S_{\text{surr-adiab}}$, the change in entropy of the surroundings for each process, positive, negative, or zero? Please explain.

by David Roundy