

The adiabatic expansion of a gas is a type of thermodynamic process in which a gas expands rapidly without any heat exchange with its surroundings. The expansion method was used with an 18-liter carboy connected to an open-tube dibutyl phthalate manometer and a nitrogen gas cylinder. After the carboy was purged with nitrogen gas to ensure all the atmospheric gasses were expelled, the gas was adiabatically expanded by dropping the pressure of the carboy momentarily to atmospheric pressure by releasing the stopper. After the change in pressure, the carboy with the remaining gas was allowed to return to its initial temperature. The time-dependent pressure changes of nitrogen can be seen in this change in states in the figure. The first linear portion of the plot is the initial pressure of the filled carboy and the sharp dip is the carboy changing to atmospheric pressure hence expanding out the carboy. When the stopper was removed, it was placed back as quickly as humanly possible to ensure no heat was exchanged between the carboy and the surrounding. After some gas was expanded out of the carboy, a remainder of the gas was left which when left on its own, attempted to return to its initial temperature which causes it to increase in pressure until stabilized. This is represented by the second linear portion of the graph after the dip.

The Time-Dependent Change in Pressure During the Adiabatic Expansion of Nitrogen Gas

