Let’s look at reversibility. When someone says a compression is reversible, they mean that all of the work done to compress the system can be gotten back out by expanding the container back to its original volume. This means that the system experiences no net energy change after going through the compression/expansion cycle. Conversely, an irreversible compression is one where you can’t get all of the energy used in compression back out and the system is hotter after going through the cycle.

Mathematically, in a reversible compression Pinteral always equals Pexternal, so work equals int(Pextdv) = int(Pintdv) = int(RT/Vdv). We’re going to try to make physical sense of those equations.