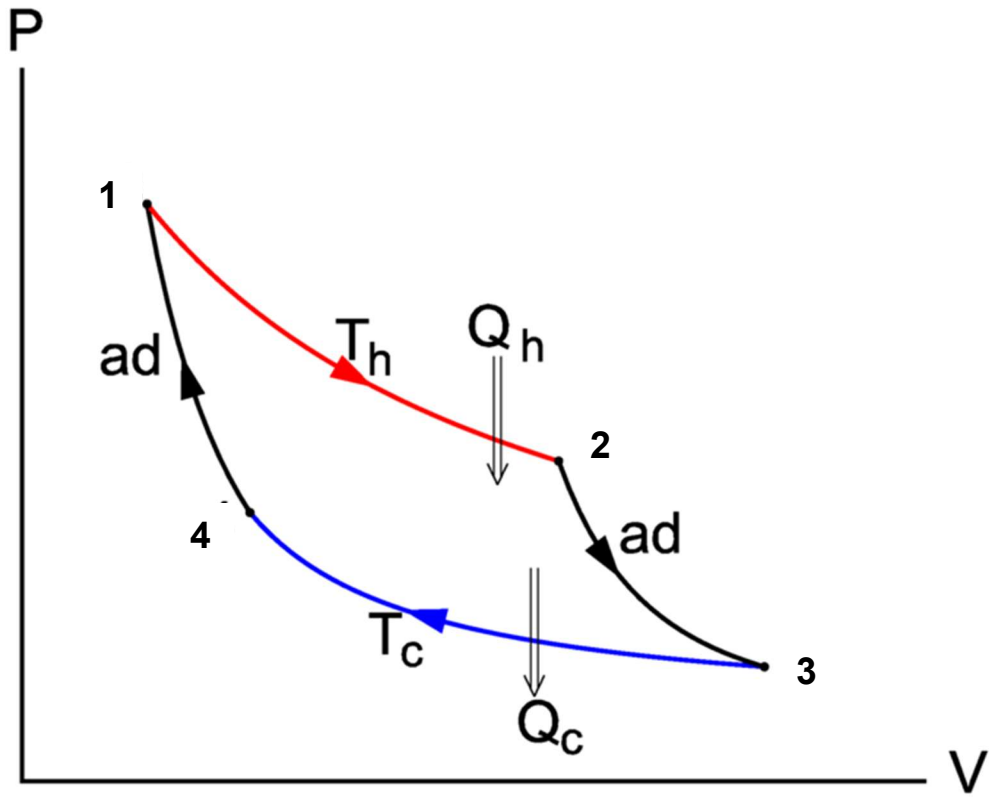
The Carnot Cycle



Step 1 – 2: Isothermal expansion
Heat is absorbed from the hot reservoir. Work is done by the gas. Since $\Delta U = 0$, $Q = W$

Step 2 – 3: Adiabatic expansion
Gas cools as the volume increases and pressure decreases. Temperature changes from T_H to T_C. Since the gas is cooling, the internal energy is decreasing. The system absorbs no heat in this step. Work is done by the gas. Since $Q = 0$, $\Delta U = -W$.

Step 3 – 4: Isothermal compression
System gives up heat to the cold reservoir. Work is done on the gas. Since $\Delta U = 0$, $Q = W$.

Step 4 – 1: Adiabatic compression
System returns to starting conditions. The system absorbs no heat in this step. The gas heats up because volume is decreasing and pressure is increasing. Since $Q = 0$, $\Delta U = -W$.

The net work done by the gas is equal to the area inside the curves.

	ΔU	Q	W
Step 1 – 2	0	Positive	Positive
Step 2 – 3	Negative	0	Positive
Step 3 – 4	0	Negative	Negative
Step 4 - 1	Positive	0	Negative