

Thermodynamics - 1

Example Problem Carnot Cycle and Clausius Inequality Applications (Ch-6 n Ch-7)

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Example Problem 1: Carnot Cycle

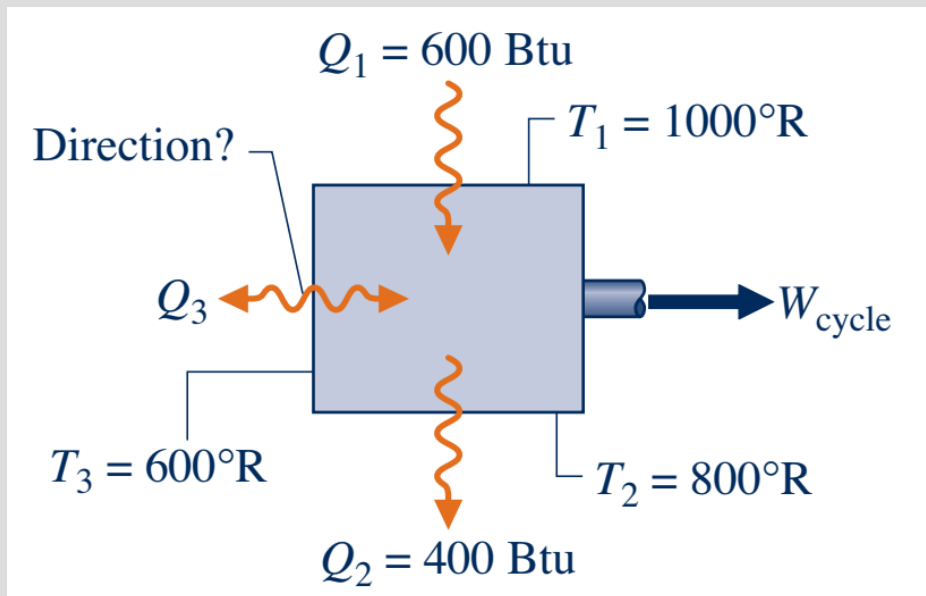
A quantity of water within a piston–cylinder assembly executes a Carnot power cycle. During isothermal expansion, the water is heated from saturated liquid at **50 bar** until it is a saturated vapor. The vapor then expands adiabatically to a pressure of **5 bar** while doing **364.31 kJ/kg** of work.

- a. Sketch the cycle on p-v diagram
- b. Evaluate Heat and Work for each process, in kJ
- c. Evaluate the thermal efficiency.

Example Problem 2: Clausius Inequality

Shown in Figure is a system that executes a power cycle while receiving 600 Btu by heat transfer at a temperature of 1000°R and discharging 400 Btu by heat transfer at a temperature of 800°R. A third heat transfer occurs at a temperature of 600°R. These are the only heat transfers experienced by the system.

- a. Applying an energy balance together with Eq. 5.13, determine the direction and allowed range of values, in Btu, for the heat transfer at 600°R.
- b. For the power cycle, evaluate the maximum theoretical thermal efficiency.



$$\oint \left(\frac{\delta Q}{T} \right)_b = -\sigma_{\text{cycle}}$$