

# Monday

- Work
  - Area under P vs V graph.
- Thermodynamic processes
  - Isochoric, isobaric, isothermal, adiabatic
- Thermodynamic cycles
  - Combination of thermo cycles with same initial and final state after one complete cycle.
  - Positive and negative values?
    - Use definitions of thermal energy, work, and 1<sup>st</sup> law of thermodynamics to determine.
  
- One note crashed... will post typical lecture notes asap.

# Warm up

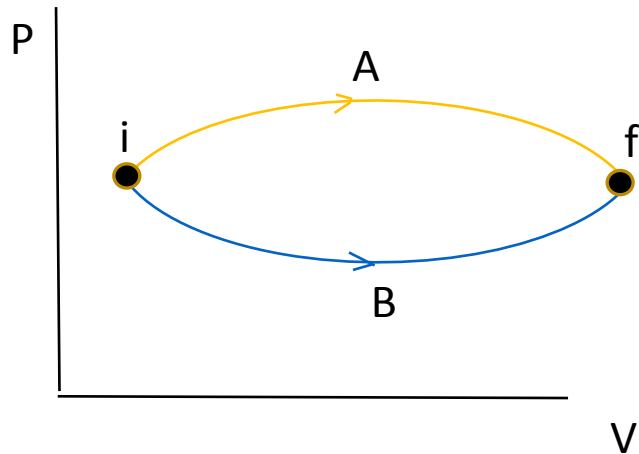
Is touch an accurate measure of temperature?

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# Example Problem

For the two processes shown, which of the following is true:

1.  $Q_A < Q_B$
2.  $Q_A > Q_B$
3.  $Q_A = Q_B$
4. not enough information to determine



# Example Problem

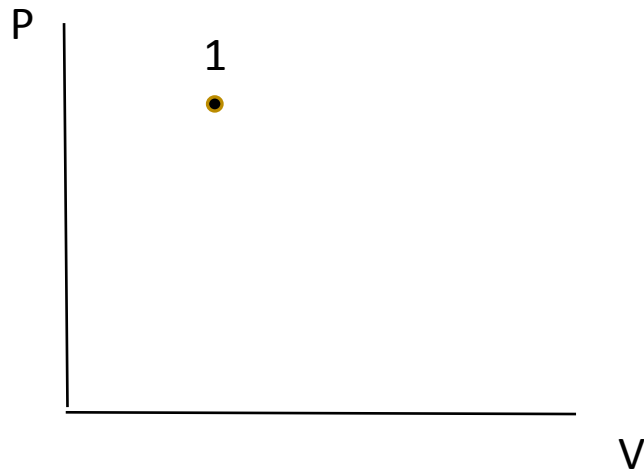
A gas cylinder and piston are covered with a heavy insulation. The piston is pushed into the cylinder compressing the gas. In this process, the gas temperature

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1. increases
2. decreases
3. stays the same
4. not enough information to determine

## Example Problem

One mole of monatomic gas is initially in an equilibrium state labeled “1” on the P-V diagram below. The gas goes through an isothermal expansion to a new equilibrium state “2”, then undergoes an isobaric compression to an equilibrium state “3”, then finally goes through a isochoric process back to the initial state “1”. Starting from the initial state 1, sketch this thermodynamic cycle.

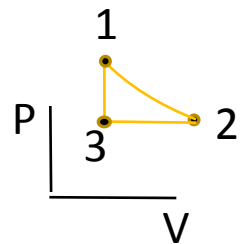


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Determine the sign of the work, heat, and change in thermal energy for each process of the cycle (i.e. each “segment”) and for the total cycle.

	1 → 2	2 → 3	3 → 1	Complete cycle
$\Delta E^{\text{TH}}$				
Q				
W				

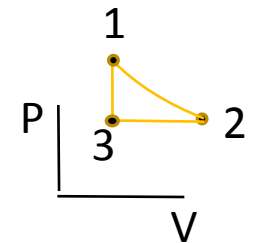


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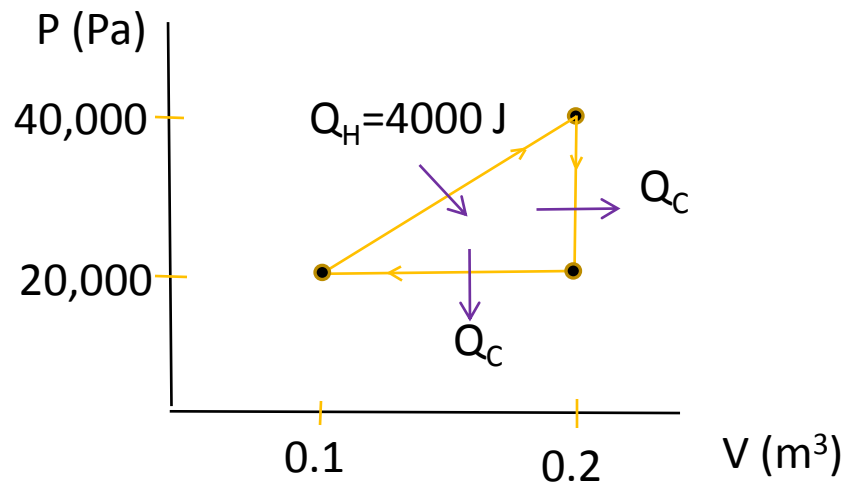
	1 → 2	2 → 3	3 → 1	Complete cycle
$\Delta E^{\text{TH}}$	0 / isotherm	- / $T_f < T_i$	+ / $T_f > T_i$	0 / cycle
Q	+ / 1 <sup>st</sup> law	- / 1 <sup>st</sup> law	+ / 1 <sup>st</sup> law	+ / 1 <sup>st</sup> law
W	- / expansion	+ / compression	0 / Isochore	- / area



Is this a heat engine or heat pump?

# Example Problem

What is the thermal efficiency of this heat engine?





**End of Monday**