Week 1: Lecture 1

Review

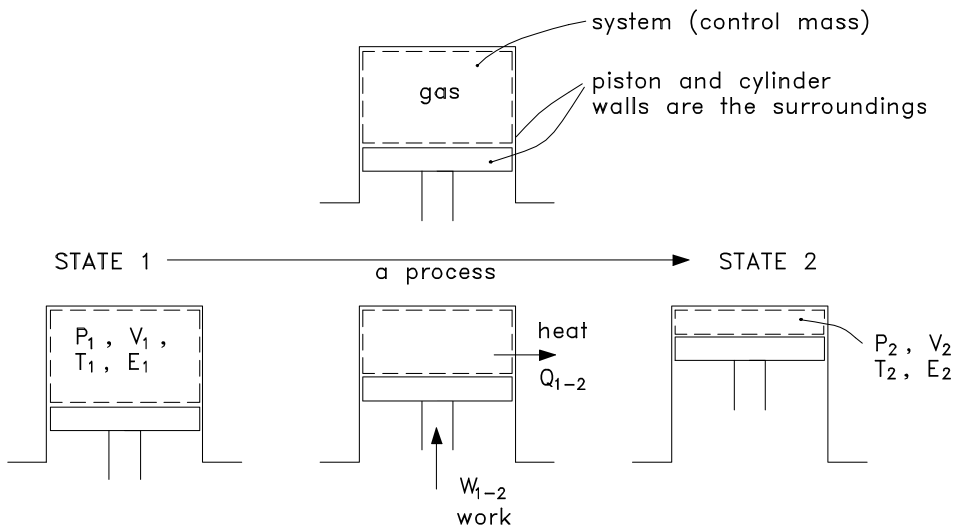
- any specified collection of matter under study is called a **system**
- all systems posses properties like mass, energy, entropy, volume, pressure, temperature, etc
- thermodynamics deals with these properties of matter as a system interacts with its surroundings through work and heat transfer
- work and heat transfer are not properties, they are the forms energy takes to cross the system boundary

First Law of Thermodynamics

Conservation of Energy: the energy content of an isolated system is constant

$$\textit{energy entering} \;-\; \textit{energy leaving} \;=\; \textit{change of energy within the system}$$

Control Mass Analysis



first law energy balance

$$\left\{\begin{array}{c}\text{Initial}\\ \text{Energy}\\ E_1\end{array}\right\} \begin{array}{c}+\\ \\ \text{-}\end{array} \left\{\begin{array}{c}\text{Energy gain } W_{1-2}\\ \\ \text{Energy loss } Q_{1-2}\end{array}\right\} = \left\{\begin{array}{c}\text{Final}\\ \text{Energy}\\ E_2\end{array}\right\}$$

$$\boxed{E_1 + W_{1-2} - Q_{1-2} = E_2}$$

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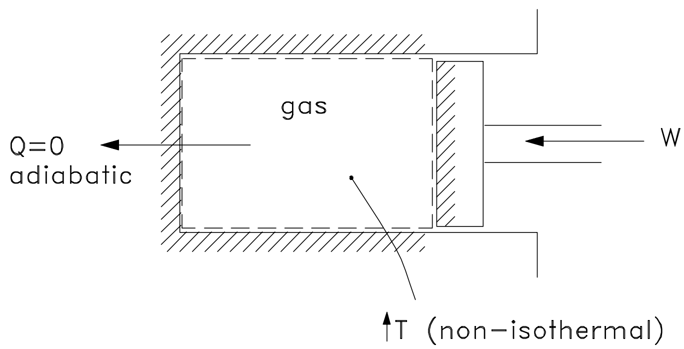
Some Interesting Points

- the internal energy of a system will depend to a large extent but not exclusively on temperature

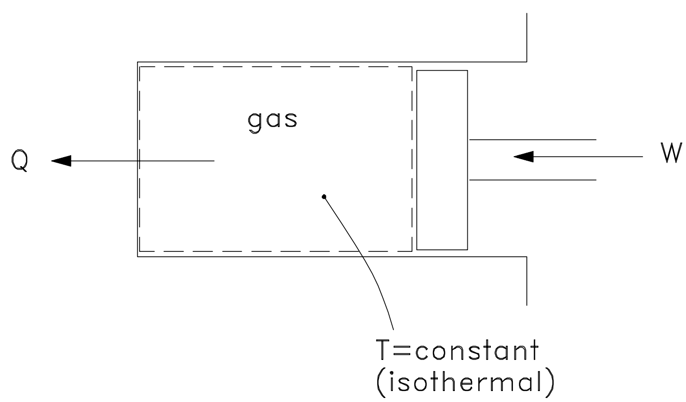
$$u = u(T) \quad (only)$$

- a change in the system temperature does not necessarily imply that heat transfer is taking place



- no change in the system temperature does not necessarily imply "no energy transfer as heat" (isothermal compression of a gas)

  Isothermal Compression of a Gas



- Adiabatic does not always mean isothermal