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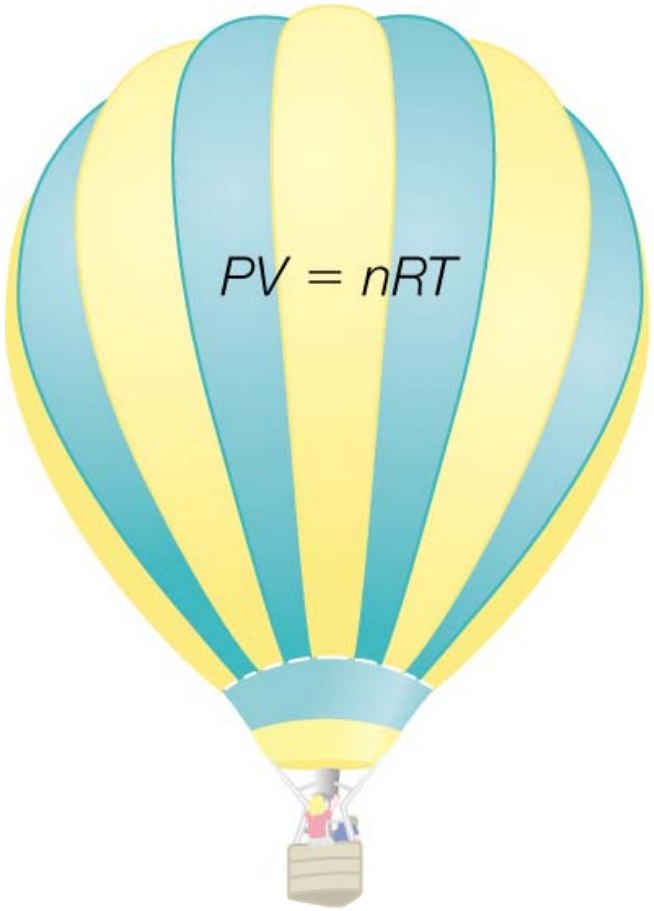
Reference Books

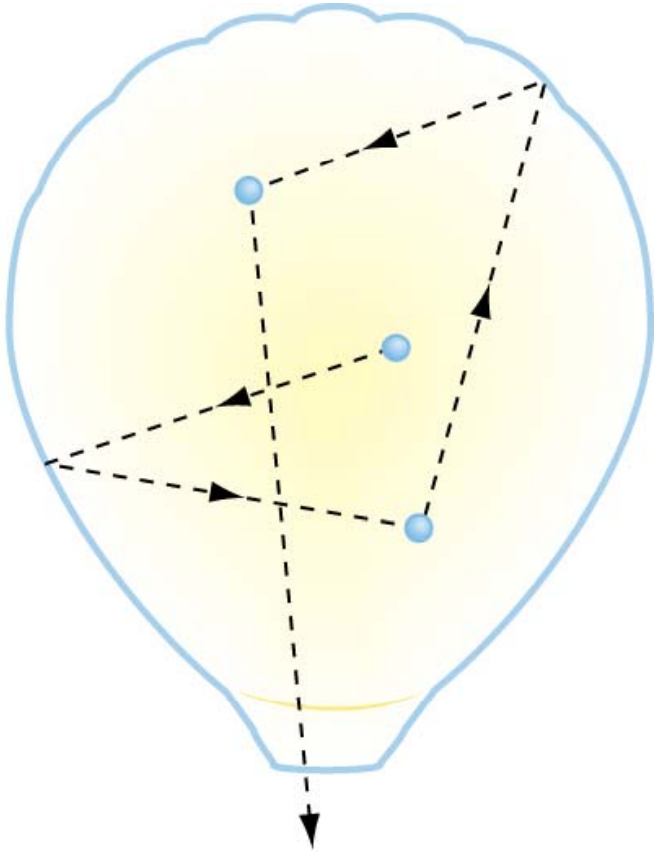
- Physical Chemistry for the Life Sciences
  (Engel, Drobny and Reid)
- Biophysical Chemistry
  (James P. Allen)

Lecture

Thermodynamics

Macroscopy vs Microscopy





熱力學的四個法則

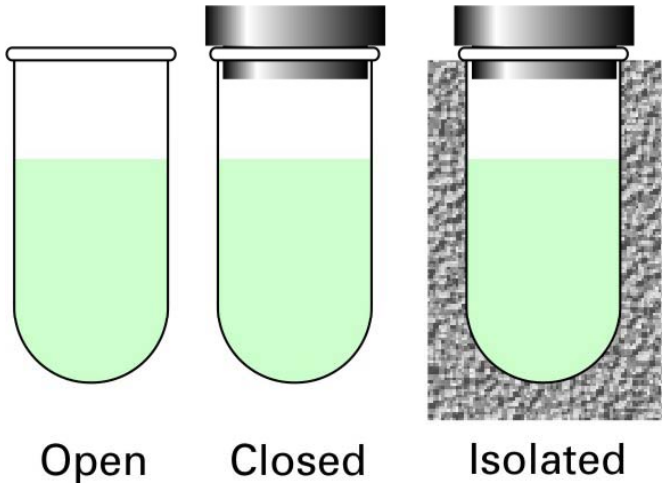
The Zeroth Law of Thermodynamics

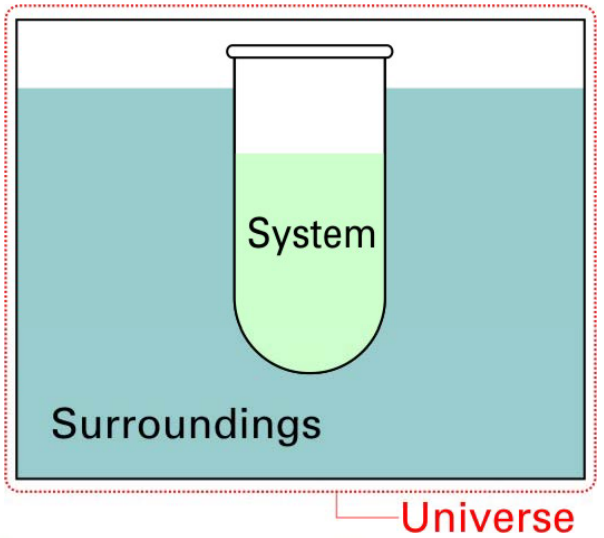
- Two systems that are separately in thermal equilibrium with a third system are also in thermal equilibrium with one another.

$$A = B$$
$$B = C \longrightarrow B = C$$

The First Law of Thermodynamics

- The internal energy, U, of an isolated system is constant.





The Second Law of Thermodynamics

- It is impossible for a system to undergo a cyclic process whose sole effects are the flow of heat into the system from a cold reservoir and the flow of an equivalent amount of heat out of the system into a hot reservoir.

$$\Delta S > 0$$

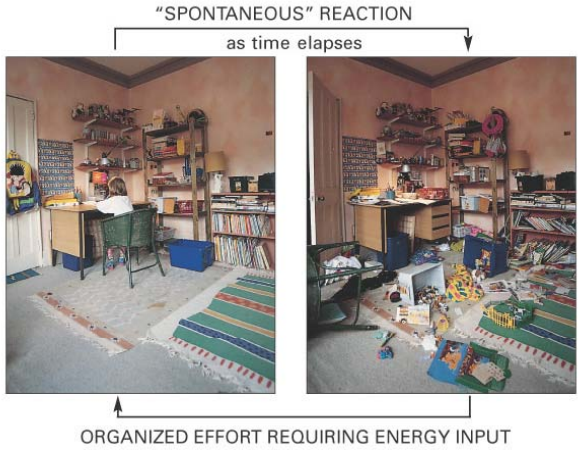


Figure 3-5 Essential Cell Biology, 2/e. (© 2004 Garland Science)

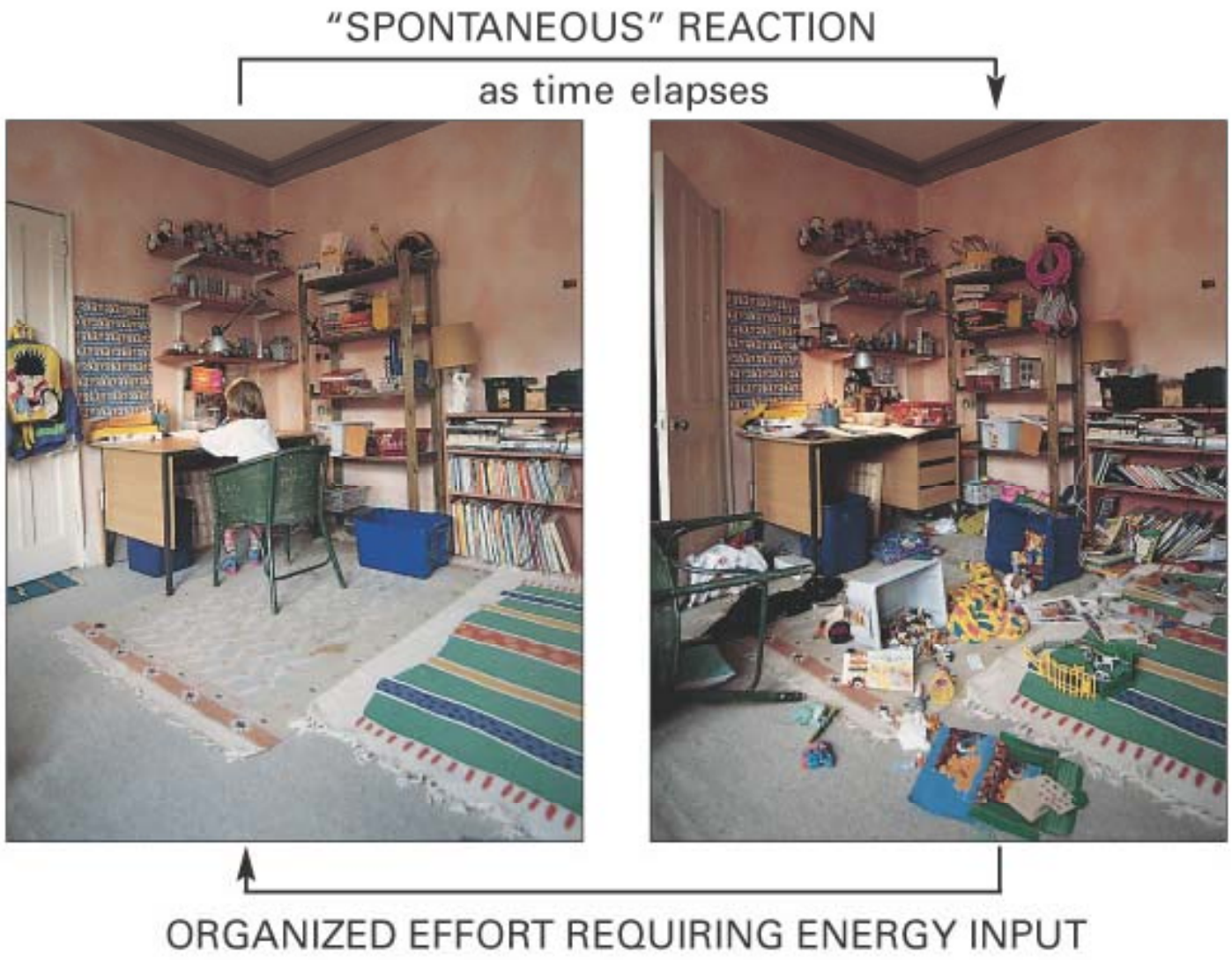


Figure 3-5 **Essential Cell Biology, 2/e. (© 2004 Garland Science)**

The Third Law of Thermodynamics

- The entropy of a pure, perfectly crystalline substance (element or compound) is zero at 0K.

$$S = 0, \text{ when crystalline at } 0K$$

End of Lecture

Slide Downloading

http://ytlab.kmu.edu.tw