Gas-Liq-Solids Three-laws-Thermo

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October 30, 2021

Outline

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General Notice

- unit: Kelvin(K) & $J \cdot K^{-1} \cdot mol^{-1}$

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Why do we study kinetic molecular theory?

- Graham's law of effusion?

Understanding from A New Point of View

Here we will discuss the **ideal gas equation** from a new point of view, *i.e.*, **kinetic molecular theory**(KMT).

Understanding from A New Point of View

First we should get aware of the **prerequisite** of KMT.

[1] Sun, Ting, *CHEM2100J-FA21-Ch5-6*, pp. 35.

Understanding from A New Point of View

First we should get aware of the **prerequisite** of KMT. Recall what has been taught in lectures.

1. A gas is in continuous random motion
2. Gas molecules are infinitesimally small
3. They move in straight lines until collision
4. Gas molecules do not influence one another except during collisions
5. The collisions are elastic

Prerequisites of KMT shown in slides[1]

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Understanding from A New Point of View

Example

For a model satisfying KMT, suppose there exists N gas molecules in a cubic box with length L. Each molecule has the mass of m, and the speed of u.

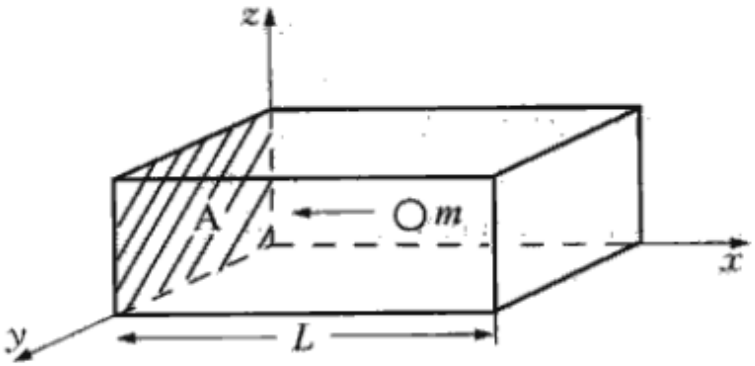


Figure 1.7 An elastic collision of molecule with a well.

Understanding from A New Point of View

(1) Calculate the average kinetic energy of each molecule $\bar{E}_k$.
(2) If the relationship between average molecule and the temperature is

$$\bar{E}_k = \frac{3}{2}kT$$

where k denotes the Boltzmann constant and satisfies $k = \frac{R}{N_A}$.

Understanding from A New Point of View

Solution

We may assume there are $\frac{N}{3}$ molecules moving along the x-axis direction since there are N molecules and only three directions in total.

Apparently, the momentum of these moleclues is mu. For a whole collision process (we can also refer this process as *bouncing*), the distance the molecule travels is $2L$ and the change of momentum is $2mu$.

Understanding from A New Point of View

(Continued)
Hence

Liquid

Outline

An example of blocks

example

This is an example of block.

An example of blocks

example

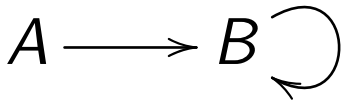
This is an example of block.

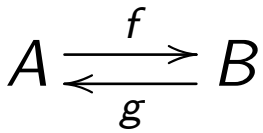
This is another block.

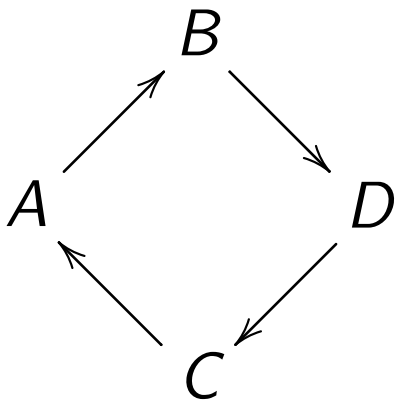
Examples of figures and tables

Figure: An example of figure

Examples of Graphs







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- Smoot Salute! `http://web.mit.edu/spotlight/smoot-salute`.