

Lecture 17.3 Entropy S

Note Title

THOMAS

Entropy S .. related to randomness and disorganization

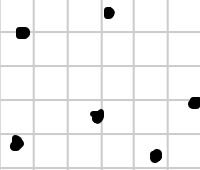
High entropy situations are highly randomized

Low S



drawer.
organized
Low S

time →



room
dis-organized
higher S

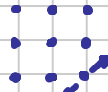
time →

House
more dis-organized
highest S

More accurate def. S : proportional to # ways a system can accommodate its energy.

Low S

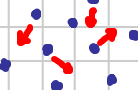
Solid
crystal-lattice
(ice)



Vibration

heat →

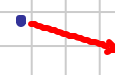
Liquid



- vibrate
- rotate
- translate: move

heat →

gas



- vibrate
- rotate
- TRANSLATION

Highest S

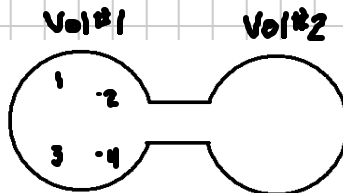
Entropy:

$$S = k \ln W$$

of microstates
microstate. eg. rearrangement of atoms & molecules.

Boltzmann Constant: $1.38 \times 10^{-23} \text{ J/K}$
units S

4 gas particles



macrostates

#1 V_1 V_2

#2 V_1 V_2

#3 V_1 V_2

#4 V_1 V_2

#5 V_1 V_2

Micro states

1,2,3,4

- 1,2,3 4
- 1,2,4 3
- 1,3,4 2
- 2,3,4 1

- 1,2 3,4
- 1,3 2,4
- 1,4 2,3
- 2,3 1,4
- 2,4 1,3
- 3,4 1,2

greatest S

$$S = k \ln W$$

$$W = 1$$

$$S = 0 \text{ J/K}$$

$$W = 4$$

$$S = k \ln 4$$

$$S = 1.91 \times 10^{-23} \text{ J/K}$$

$$W = 6$$

$$S = k \ln 6$$

$$S = 2.47 \times 10^{-23} \text{ J/K}$$

$$W = 4$$

$$S = 1.91 \times 10^{-23} \text{ J/K}$$

$$W = 1$$

$$S = 0 \text{ J/K}$$