

## Quiz 16.1 – Entropy

Name: \_\_\_\_\_

**Question 1**

For each process, indicate whether the entropy change for the system is positive or negative:

- H<sub>2</sub>O(g) → H<sub>2</sub>O(l)
- CO<sub>2</sub>(s) → CO<sub>2</sub>(g)
- N<sub>2</sub>(g) + 3 H<sub>2</sub>(g) → 2 NH<sub>3</sub>(g)
- Na<sub>2</sub>CO<sub>3</sub>(aq) + H<sub>2</sub>SO<sub>4</sub>(aq) → Na<sub>2</sub>SO<sub>4</sub>(aq) + 2 H<sub>2</sub>O(l) + CO<sub>2</sub>(g)
- NaC<sub>2</sub>H<sub>3</sub>O<sub>2</sub>(aq) → NaC<sub>2</sub>H<sub>3</sub>O<sub>2</sub>(s)
- The valve on a pressurized gas tank is opened, and gas comes streaming out
- A sample is taken out of the freezer and left on the counter for twenty minutes

**Question 2**

Use the Boltzmann definition of entropy to find the entropy of each system:

- Tossing a single six-sided die
- Tossing two six-sided dice (consider the dice to be distinguishable)
- A 0.0100 g diamond is cooled to near absolute zero. The only excited state accessible at this temperature is a nuclear spin state, which each carbon atom having an equal probability of being in the excited or ground state (consider the carbon atoms to be distinguishable)
- 4 He atoms are placed in a chamber with two halves. Each atom has equal probability to be in either half of the chamber (consider the He atoms to be indistinguishable)
- 4 different gas particles are placed in a chamber with two halves. Each atom has equal probability to be in either half of the chamber (consider the particles to be distinguishable)

## 오늘 (*Today*)

By 구상 (Ku Sang)

오늘도 신비의 샘인 하루를 맞는다.

이 하루는 저 강물의 한 방울이  
어느 산골짜 옹달샘에 이어져 있고  
아득한 푸른 바다에 이어져 있듯  
과거와 미래와 현재가 하나다.

이렇듯 나의 오늘은 영원 속에 이어져  
바로 시방 나는 그 영원을 살고 있다.

그래서 나는 죽고 나서부터가 아니라  
오늘서부터 영원을 살아야 하고  
영원에 합당한 삶을 살아야 한다.

마음이 가난한 삶을 살아야 한다.  
마음을 비운 삶을 살아야 한다.

Today again I meet a day, a well of mystery.

Like a drop of that river extends to  
a spring of a valley and then to  
the faraway blue sea, for this day  
the past, the future, and the present are one.

So does my today extend to eternity,  
and right now I am living the eternity.

So, starting from today, I should live  
eternity, not after I die,  
and should live a life that deserves eternity.

I should live the life of a poor heart.  
I should live the life of an empty heart.