# Fall 2008 CH301 Practice Quiz 6

1. Statistical thermodynamics theory
When calculating positional entropy using the Boltzmann formula ($S = k \cdot \ln W$), which of the following statements is/are true?

I. W is a theoretical value and its actual value must be experimentally determined.
II. The actual value of W is always an integer.
III. The equation exactly as written above could describe one atom's or molecule's entropy.

1. I only
2. II only
3. III only
4. I and II only
5. I and III only
6. II and III only
7. I, II and III
8. None

2. Statistical thermodynamics internal energy calculation (E=0.5kT)
Which of the following atoms or molecules is incorrectly paired with its total rotational energy?

1. He, 0
2. $CH_4$, 1.5kT
3. $I_3^-$, 1.5kT
4. $N_2$, 1kT
5. $O_3$, 1.5kT

3. Statistical thermodynamics positional entropy calculation (S = klnW)
Which of the following systems is incorrectly paired with its positional entropy at absolute zero?

1. 5 molecules of $BFH_2$, $7.58 \times 10^{-23}$ J·K-1
2. 100 molecules of $O_2$, 0 $J \cdot K^{-1}$
3. 2 molecules of $CFH_3$, $3.87 \times 10^{-23}$ $J \cdot K^{-1}$
4. 20 molecules of HF, $1.91 \times 10^{-22}$ $J \cdot K^{-1}$
5. 10 molecules of $NH_3$, $1.52 \times 10^{-22}$ $J \cdot K^{-1}$

4. Internal energy theory
Which of the following statements concerning internal energy is/are true?

I. Change in internal energy is never zero.
II. Change in internal energy is equal to heat when volume is held constant
III. Change in internal energy is equal to heat when pressure is held constant

1. I only
2. II only
3. III only
4. I and II only
5. I and II only
6. II and III only
7. I, II and III
8. None

5. Internal energy calculation ($\Delta U = q + w$)
If an expanding balloon absorbs 100 kJ of heat and exerts 300 J of work, what is its change in internal energy?

1. -99700 J
2. -200 J

3. 400 J
4. 100300 J
5. 99700 J

6. Ranking system entropies

Rank the following systems in terms of increasing entropy:

I. 1 mole of solid carbon dioxide at 300 K
II. 1 mole of solid carbon dioxide at 100 K
III. 1 mole of gaseous carbon dioxide at 30 K
IV. 1 mole of gaseous carbon dioxide and 1 mole of gaseous oxygen at 500 K
V. 1 mole of gaseous carbon dioxide at 500 K

1. III < II < I < V< IV
2. III < I < III < IV < V
3. V < IV < III < II < I
4. II < III < IV < V < I
5. I < III < II < V < IV

7. Calculation of ΔS from heat transfer

If a given system absorbs 1000 J of heat, what will $\Delta S_{surroundings}$ be if this takes place at 127 °C?

1. 3.5 $J \cdot K^{-1}$
2. 3.0 $J \cdot K^{-1}$
3. 2.5 $J \cdot K^{-1}$
4. 4.5 $J \cdot K^{-1}$
5. 5.2 $J \cdot K^{-1}$

8. Calculation involving the second law equation

Consider the evaporation of water at standard pressure at 101 °C. Even without knowing the exact values in $\Delta S_{vap}$ and $\Delta H_{vap}$, what can you say about the value of $\Delta S_{system}$ for this process.

1. $\Delta S_{system}$ would be a small positive number.
2. $\Delta S_{system}$ would be a small negative number.
3. $\Delta S_{system}$ would be a large negative number.
4. $\Delta S_{system}$ would be a large positive number.