

國立臺北科技大學 111 學年度碩士班招生考試

系所組別：3720 分子科學與工程系有機高分子碩士班乙組

第一節 化工熱力學 試題

第一頁 共三頁

注意事項：

1. 本試題共三大題，共 100 分。
2. 不必抄題，作答時請將試題題號及答案依照順序寫在答案卷上。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

一、單選題：(每題 3 分，共 30 分)

1. _____ For the same amount of energy supplied to the system, the rise of temperature is larger at constant volume condition or constant pressure condition?
 - a. constant volume condition
 - b. constant pressure condition
 - c. both conditions have the same rise of temperature
 - d. none of the above answer is correct
2. _____ Which of the following statements is correct for the spontaneous direction of change?
 - a. the total energy of the isolated system should tend towards a minimum
 - b. the dispersal of energy into a more uniform form
 - c. system's entropy change should be positive
 - d. none of the above statement is correct
 - e. all the above statements are correct
3. _____ When an endothermic process takes place in an adiabatic container, the system temperature should:
 - a. increase
 - b. decrease
 - c. remain the same
 - d. none of the above answer is correct
4. _____ Which of the following statements for "repulsive interaction dominant gas system" is correct?
 - a. positive Joule-Thomson coefficient

- b. compression factor < 1
- c. positive internal pressure
- d. all the above answers are correct
- e. none of the above answer is correct

5. _____ In an isothermal process, the internal energy of gas
 - a. decrease
 - b. no change
 - c. increase
 - d. unpredictable change
 - e. depends on the pressure
6. _____ Which of the below statements is correct for the expansion coefficient?
 - a. is the fractional change in volume that accompanies a rise in temperature at constant pressure
 - b. for ideal gas, the expansion coefficient is proportional to volume
 - c. The higher the volume of the gas, the higher its expansion coefficient
 - d. all the above answers are correct
 - e. none of the above answer is correct
7. _____ Which one is the reference state of carbon at 298 K and 1 bar condition?
 - a. s, graphite
 - b. s, graphene
 - c. s, diamond
 - d. s, charcoal
 - e. none of the above answer is correct
8. _____ Gibbs energy always increases when the pressure of the system is increased at constant temperature and composition. Which phase of the molar Gibbs energy is more sensitive to pressure?
 - a. gas
 - b. liquid
 - c. solid
 - d. the change of molar Gibbs energy to pressure does not depend on material phase
 - e. none of the above answer is correct
9. _____ Which of the below statement is incorrect for the isothermal compressibility?
 - a. can be obtained from the slope of the plot of volume against pressure at constant temperature

注意：背面尚有試題

- b. for ideal gas, the isothermal compressibility is inversely proportional to pressure
- c. The higher the pressure of the gas, the lower its compressibility
- d. is a measure of the fractional change in volume when the pressure is increased by a small amount at constant temperature
- e. none of the above answer is incorrect

10. _____ Which of the following Maxwell relations is correct?

- a. $\left(\frac{\partial T}{\partial V}\right)_S = \left(\frac{\partial p}{\partial S}\right)_V$
- b. $\left(\frac{\partial T}{\partial p}\right)_S = \left(\frac{\partial V}{\partial S}\right)_p$
- c. $-\left(\frac{\partial p}{\partial T}\right)_V = \left(\frac{\partial S}{\partial V}\right)_T$
- d. $\left(\frac{\partial V}{\partial T}\right)_p = \left(\frac{\partial S}{\partial p}\right)_T$

- e. none of the above answer is correct

二、複選題：(每題 4 分，共 40 分)

1. _____ Which of the followings are NOT a state function?

- a. enthalpy
- b. internal energy
- c. heat
- d. work
- e. none of the above answer is correct

2. _____ For exothermic phase transition, which of the following statements are correct?

H: enthalpy; S: entropy

- a. $\Delta_{\text{trs}}H < 0$
- b. $\Delta_{\text{trs}}S < 0$
- c. system becomes more ordered
- d. vaporization is an exothermic phase transition
- e. none of the above answer is correct.

3. _____ Which of the following statements are correct for “heat capacity at constant volume, C_V ”?

- a. C_V increases as temperature increases
- b. C_V decreases as temperature increases
- c. C_V is an intensive property

- d. C_V is an extensive property
- e. none of the above answer is correct

4. _____ Which of the following statements for “attractive interaction dominant gas system” are correct?

- a. positive Joule-Thomson coefficient
- b. compression factor < 1
- c. positive internal pressure
- d. all the above answers are correct
- e. none of the above answer is correct

5. _____ Which of the following statements are “internal pressure, π_T ” are correct?

- a. π_T is a measure of the strength of the cohesive forces in the sample
- b. π_T has the same dimension as pressure
- c. π_T is a measure of the variation of the U of a substance as its V is changed at constant T
- d. $\pi_T = 0$ for ideal gas
- e. none of the above answer is correct

6. _____ Which of the following statements for “Joule-Thomson coefficient” are correct?

- a. Joule-Thomson coefficient depends on the identity of gas molecules
- b. Joule-Thomson coefficient depends on the identity of gas pressure
- c. Joule-Thomson coefficient depends on the interaction between gas molecules
- d. all the above answers are correct
- e. none of the above answer is correct

7. _____ Which of the following processes are not spontaneous?

- a. a gas expands to fill the available volume
- b. confine a gas to a smaller volume
- c. a ball leaps upward
- d. force some a chemical reaction to go in reverse
- e. none of the above process is spontaneous

8. _____ Which of the following statements are for the third law of thermodynamics are correct?

- a. The entropy of a perfect crystal is zero when the temperature of the crystal is equal to absolute zero (0 K) and the crystal is perfect crystal
- b. If the crystal is not perfect but with some inherent disorder, even at 0 K, $S(0) > 0$
- c. The entropy at 0 K is called residual entropy

- d. all the above statements are correct
- e. none of the above answer is correct

9. _____ Which of the following statements are correct?

- a. A positive ion entropy means that the ion has a higher molar entropy than H^+ in water
- b. A positive ion entropy means that the ion has a lower molar entropy than H^+ in water
- c. A negative ion entropy means that the ion has a lower molar entropy than H^+ in water
- d. A negative ion entropy means that the ion has a higher molar entropy than H^+ in water
- e. none of the above answer is correct

10. _____ Which of the following statements are correct for the efficiency of Carnot cycle (ϵ)?

- a. ϵ depends on the temperatures of heat sources (T_c, T_h)
- b. the larger the difference of T_c and T_h , the larger the ϵ is
- c. the ϵ of isothermal Carnot cycle ($T_c=T_h$) is zero
- d. none of the above statement is correct
- e. all the above statements are correct

三、簡答題：(每題分數如題前說明，共 30 分)

1. (本題總分 15%) Can the maximum work done by the system be greater than the decrease of internal energy? Please discuss your answer.

2. (本題總分 15%) Please calculate the entropy change when helium (He) at 298 K and 1.00 bar in a container of 0.5 liter (L) is allowed to expand to 1.000 L and is simultaneously heated to 373 K.