

## 國立臺北科技大學 113 學年度碩士班招生考試

系所組別：3401 資源工程研究所

## 第一節 基礎熱力學 試題 (選考)

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**注意事項：**

1. 本試題共 20 題，每題 5 分，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。

1. In the phase diagram of one component system, pressure is plotted as a function of temperature. During the transition from liquid state to vapor state, which of the following is true?
  - (A)  $dP/dT$  is positive;
  - (B) it is endothermic reaction;
  - (C) the volume change from solid to vapor is increasing;
  - (D) all of above are correct.
2. When we plot Gibbs free energy,  $G$  vs. pressure,  $P$  at constant temperature, generally,  $G$  of the solid phase looks like
  - (A) a curve with increasing slope;
  - (B) a straight line with positive slope;
  - (C) a curve with decreasing slope;
  - (D) a straight line with negative slope.
3. The relationship between the variations of temperature and pressure which is required for the maintenance of equilibrium between two different phases may be expressed by the
  - (A) van der Waals equation;
  - (B) Ellingham line;
  - (C) Gibbs Duhem equation;
  - (D) Clapeyron equation.
4. Which substance has the lowest absolute entropy?
  - (A) liquid gold;
  - (B) solid gold;
  - (C) liquid silicon;

- (D) solid silicon.
5. At 373K,
  - (A)  $C_p > C_v$ ;
  - (B)  $C_p = C_v$ ;
  - (C)  $C_p < C_v$ ;
  - (D) all above answers are possible.
6. Exactly 10 liter of a 0.1 M solution of a substance A is added to 30 liter of a 0.05 M solution of a substance B. Assume ideal behavior and calculate the entropy of mixing.
  - (A) 15.1 J/K
  - (B) -15.1 J/K
  - (C) 5.6 J/K
  - (D) -5.6 J/K
7. A chemical reaction occurs at 373K in a gas mixture that behaves ideally, and the total amount of gas increases by 0.1 mole. If  $\Delta U = 1000$  J, what will be the  $\Delta H$ ?
  - (A) 1000J;
  - (B) 1031 J;
  - (C) 1083 J;
  - (D) 1310 J.
8. Two moles of an ideal gas underwent a reversible isothermal expansion until its volume is tripled. If the gas performed 2000 J of work, what is its temperature?
  - (A) 23.1 K;
  - (B) 84.2 K;
  - (C) 109.5 K;
  - (D) 219.0 K.
9. For a real gas  $P(V-b) = RT$ ,  $C_p - C_v = ?$ 
  - (A)  $R$
  - (B)  $bR$
  - (C)  $R/b^2$
  - (D)  $R/b$
10.  $\left(\frac{\partial T}{\partial V}\right)_S = \underline{\hspace{2cm}}$ 
  - (A)  $-\left(\frac{\partial S}{\partial P}\right)_V$

注意：背面尚有試題

- (B)  $-\left(\frac{\partial P}{\partial S}\right)_V$
- (C)  $\left(\frac{\partial P}{\partial S}\right)_V$
- (D)  $-\left(\frac{\partial P}{\partial S}\right)_T$
11. Which of the following is not a state function?  
 (A) PV work;  
 (B) entropy;  
 (C) internal energy;  
 (D) temperature.
12. For an ideal monoatomic gas,  $PV^\gamma = 210.3$ , where  $\gamma = C_p/C_v$ . After a reversible adiabatic process, the pressure of system reduces from 20 atm to 4 atm. The work is \_\_\_\_\_?  
 (A) 58.5;  
 (B) 49.5;  
 (C) 37.1;  
 (D) 28.6.
13.  $C_p - C_v =$  \_\_\_\_\_?  
 (A)  $\left(\frac{\partial S}{\partial T}\right)_P \left[T \left(\frac{\partial S}{\partial V}\right)_T\right]$   
 (B)  $\left(\frac{\partial V}{\partial T}\right)_P \left[T \left(\frac{\partial S}{\partial V}\right)_T\right]$   
 (C)  $\left(\frac{\partial V}{\partial T}\right)_P \left[T \left(\frac{\partial P}{\partial V}\right)_T\right]$   
 (D)  $\left(\frac{\partial H}{\partial T}\right)_P \left[T \left(\frac{\partial S}{\partial V}\right)_T\right]$
14. Au-Ag alloy is an ideally mixing of Au and Ag atoms. The gram atomic weights of Au and Ag are 198 and 107.6, respectively. When 10 g of Au are mixed with 20 g of Ag to form a homogenous alloy, the increase in entropy is \_\_\_\_\_ J/K.  
 (A) -8.34;  
 (B) 1.02;  
 (C) 9.20;  
 (D) 13.6.
15. What is not a thermodynamic parameter?  
 (A) Gibbs free energy;  
 (B) internal energy;  
 (C) activation energy;  
 (D) activity.
16. What is the mass of oxygen contained in a room of  $6 \times 10 \times 4 \text{ m}^3$  if the pressure is 100 kPa and the temperature is  $25^\circ\text{C}$ .  
 (A) 280 kg;  
 (B) 290 kg;  
 (C) 300 kg;  
 (D) 310 kg.
17. The molar volume of a liquid metal is greater than that of the solid metal. An increase in pressure causes the equilibrium melting temperature to  
 (A) decrease;  
 (B) increase  
 (C) remain the same  
 (D) it depends
18. The solubility of nitrogen at 1 atm pressure in liquid iron increases as the temperature is increased. Dissolution of nitrogen in iron  
 (A) is endothermic;  
 (B) is exothermic;  
 (C) gives an ideal solution;  
 (D) it depends.
19. Which of the following is negative for ideal gases?  
 (A)  $\left(\frac{\partial S}{\partial T}\right)_P$   
 (B)  $\left(\frac{\partial H}{\partial T}\right)_P$   
 (C)  $\left(\frac{\partial G}{\partial P}\right)_T$   
 (D)  $\left(\frac{\partial S}{\partial P}\right)_T$
20. What a three-component system is in equilibrium (pressure is fixed at 1 atm) with zero degree of freedom, there must coexist  
 (A) one phase

- (B) two phases
- (C) three phases
- (D) four phases