

國立臺北科技大學 114 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. To see the volume change of a particular material during the phase transition between solid and liquid, one shall consider which of the following thermodynamic function? (5 分)
(a) $\left(\frac{\partial V}{\partial P}\right)_T$ (b) $\left(\frac{\partial V}{\partial T}\right)_S$ (c) $\left(\frac{\partial T}{\partial V}\right)_P$ (d) $\left(\frac{\partial S}{\partial P}\right)_T$
2. One mole of N_2 gas is contained at 273K and a pressure of 1 atm. The addition of 3000 joules of heat to the gas at constant pressure causes 832 joules of work to be done during the expansion. C_V of N_2 gas is _____ $J \text{ mol}^{-1} \text{ K}^{-1}$. (5 分)
(a) 0.217 (b) 2.17 (c) 21.7 (d) 217
3. A 50g weight egg covered with bubble wrap, initially at rest, is dropped from 10 m high onto the ground and does not break. With the wrapped egg treated as the system, what is the change of internal energy, ΔU , in Joule? (5 分)
(a) 9.8 (b) 4.9 (c) -4.9 (d) -9.8
4. A 50g weight egg covered with bubble wrap, initially at rest, is dropped from 10 m high onto the ground and does not break. With the wrapped egg treated as the system, what is the sign of heat, Q ? (5 分)
(a) positive; absorb from the environment (b) positive; desorb to the environment
(c) zero (d) negative; absorb from the environment
5. Which of the following is true about the application of molar C_V and C_P ? (5 分)
(a) $dH = C_P dT + (1 - \alpha T)VdP$ (b) For one mole of ideal gases, $C_P - C_V = \frac{1}{R}$
(c) $C_P = C_V - \frac{TV\alpha^2}{\beta}$ (d) $C_P - C_V = \left(\frac{\partial V}{\partial T}\right)_P \left[P - \left(\frac{\partial U}{\partial V}\right)_T\right]$

6. Which of the following is not a state function? (5 分)
(a) PV work (b) entropy (c) temperature (d) internal energy
7. 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 (5 分)
(a) decrease (b) remain the same (c) increase (d) it depends
8. At constant pressure, which of the following is true? (5 分)
(a) enthalpy is equivalent to work (b) enthalpy is equivalent to internal energy
(c) enthalpy is equivalent to heat (d) enthalpy is equivalent to Gibbs free energy
9. $C_P - C_V =$ _____ (5 分)
(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) $\left(\frac{\partial H}{\partial T}\right)_P \left[T \left(\frac{\partial S}{\partial V}\right)_T\right]$
10. Which gas constant is not true? (5 分)
(a) $5.19 \times 10^{19} \text{ eV K}^{-1} \text{ mol}^{-1}$ (b) $1.987 \text{ cal K}^{-1} \text{ mol}^{-1}$
(c) $0.082 \text{ L atm K}^{-1} \text{ mol}^{-1}$ (d) $3.14 \text{ J K}^{-1} \text{ mol}^{-1}$
11. $\left(\frac{\partial T}{\partial V}\right)_P =$ _____ (5 分)
(a) $-\left(\frac{\partial S}{\partial P}\right)_V$ (b) $-\left(\frac{\partial P}{\partial S}\right)_V$ (c) $\left(\frac{\partial P}{\partial S}\right)_V$ (d) $-\left(\frac{\partial P}{\partial S}\right)_T$
12. The ΔH^M is heat of formation of a solution. Which of the following expression is correct? (5 分)
(a) $\Delta H^{M, \text{ideal}} > 0$ (b) $\Delta H^{M, \text{ideal}} < 0$ (c) $\Delta H^{M, \text{ideal}} = \Delta G^{M, \text{ideal}} < 0$
(d) $\Delta H^{M, \text{ideal}} = 0$
13. The value of degree of freedom of water at triple point is (5 分)
(a) 0 (b) 1 (c) 2 (d) 3
14. Internal energy is constant when (5 分)
(a) entropy and volume are constant (b) entropy or volume is constant
(c) volume and temperature are constant (d) volume or temperature is constant
15. $(a+bT+cT^2)$ is often a description of (5 分)
(a) entropy (b) heat capacity (c) heat conductivity (d) activity
16. Which substance has the lowest absolute entropy? (5 分)
(a) liquid gold (b) solid gold (c) liquid silicon (d) solid silicon
17. It is most reasonable for a gas engine to have an efficiency of (5 分)
(a) 0.3 (b) 1 (c) 10 (d) 100
18. Which remains unchanged during free expansion of an ideal gas? (5 分)
(a) pressure (b) Gibbs free energy (c) entropy (d) internal energy

注意：背面尚有試題

19. Which one of the following statements is related with the zeroth law of thermodynamics? (5 分)

- (a) At $T=0$, $V=P=0$ (b) For A, B, C three systems, if $T_A=T_C$ and $T_B=T_C$ then $T_A=T_B$ (c) As $T \rightarrow 0$; free energy $\rightarrow 0$ (d) None of above

20. Regarding the work, heat and internal energy, which of the following statements correct? (5 分)

- (a) The work done on an adiabatic system can be converted to internal energy completely. (b) The mechanical work done on a system will become the kinetic energy dissipated heat. (c) The work done on an adiabatic system is not a state function. (d) Heat can be converted to the performed work completely.