

國立臺北科技大學 110 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. Indicate the wrong statement for the definition of isolated system in the following,
 - (a) no energy interchanged in the system
 - (b) no energy exchange with the surrounding
 - (c) no expansion or contraction of the system
 - (d) no work done by the system ($W = 0$)
 - (e) no heat entering from outside ($Q = 0$)
2. Indicate the wrong statement for the definition of closed system in the following,
 - (a) energy can be interchanged in the system
 - (b) the volume of the system is constant
 - (c) no mass enters or leaves the system
 - (d) work can be done by the system ($W \neq 0$)
 - (e) heat can enter the system ($Q \neq 0$)
3. Which function is a path function,
 - (a) Gibbs free energy
 - (b) Entropy
 - (c) Work
 - (d) Enthalpy
 - (e) Temperature

4. Consider that one mole of ideal gas expands from $V_1=10$ liters to $V_2=20$ liters, through three different reversible paths, (1) isobarically, (2) isothermally, and (3) adiabatically, then the work done would be,
 - (a) $W_1 > W_2 > W_3$
 - (b) $W_1 > W_3 > W_2$
 - (c) $W_2 > W_3 > W_1$
 - (d) $W_2 > W_1 > W_3$
 - (e) $W_3 > W_1 > W_2$
5. C_P is equal to C_V at
 - (a) 0K
 - (b) 0°C
 - (c) 298K
 - (d) 398K
 - (e) near melting point
6. About the monoatomic ideal gas, which of the following description is correct,
 - (a) $(\partial U / \partial V)_T < 0$
 - (b) $(\partial T / \partial P)_H = 0$
 - (c) $\alpha = (1/V)(\partial V / \partial T)_P = 1/273$
 - (d) $S = C_V/R$
 - (e) $C_P = 3R/2$
7. About the thermodynamic equation, which of the following is correct,
 - (a) $T = (\partial U / \partial S)_V$
 - (b) $T = (\partial H / \partial S)_V$
 - (c) $T = (\partial A / \partial S)_V$
 - (d) $T = (\partial G / \partial S)_V$
 - (e) none of above is correct

注意：背面尚有試題

8. About ideal gas,
- (a) An ideal gas is an assemblage of volumeless noninteracting particles which obeys the ideal gas law, $PV = RT$.
 - (b) The internal energy of an ideal gas arises solely from the translational motions of the gas particles and hence is a function only of temperature,
 - (c) The enthalpy of an ideal gas is a function only of temperature,
 - (d) The internal energy U is constant with respect to the gas volume, i.e. $(dU/dV)_T = 0$, hence the pressure P can be expressed as $P = (dS/dV)_T$,
 - (e) The above are all correct.
9. The numbers of ways in which the particles can be distributed in space is related to the concept of the thermodynamic property
- (a) thermal entropy
 - (b) degree of mixed-up-ness
 - (c) enthalpy
 - (d) configuration entropy
10. When pressure is constant, enthalpy is equivalent to
- (a) heat
 - (b) internal energy
 - (c) entropy
 - (d) work
11. At constant pressure, when temperature increases, Gibbs free energy
- (a) always increases
 - (b) always decreases
 - (c) does not change
 - (d) increases following by decreasing
12. When a piece of steel A with temperature of 30°C and a piece of aluminum B with temperature of 50°C were put in contact side by side, which of the following is true
- (a) the Al atom will diffuse into the steel A
 - (b) configuration entropy will not change
 - (c) total entropy will not be affected
 - (d) thermal entropy will not increase
13. When a three-component system is in equilibrium (pressure is fixed at 1atm) with zero degree of freedom, there must coexist
- (a) one phase
 - (b) two phases
 - (c) three phases
 - (d) four phases
 - (e) none of the above.
14. Which relationship is correct?
- (a) $(\partial T/\partial V)_S = -(\partial P/\partial S)_V$
 - (b) $(\partial T/\partial P)_S = -(\partial V/\partial S)_P$
 - (c) $(\partial S/\partial V)_T = -(\partial P/\partial T)_V$
 - (d) $(\partial S/\partial P)_T = (\partial V/\partial T)_P$
 - (e) none of the above.
15. The chemical potential of species i (μ_i) is equal to
- (a) $(\partial G/\partial n_i)_{T, V, n_j}$
 - (b) $(\partial U/\partial n_i)_{T, V, n_j}$
 - (c) $(\partial H/\partial n_i)_{T, V, n_j}$
 - (d) $(\partial A/\partial n_i)_{T, V, n_j}$
 - (e) none of the above

16. The heat capacity (C_P) for an element Z is $C_P = 24 + 5 \times 10^{-3}T$ (J/mole K), to what temperature would you have to heat Z at constant pressure to raise its molar enthalpy by 1J? (Start with Z in the state: $P = 1 \text{ atm}$, $T = 298 \text{ K}$)

- (a) 286.4K
- (b) 298.04K
- (c) 541.32K
- (d) 785.44K
- (e) >1000K

17. $2\text{Ni}_{(s)} + \text{O}_2 = 2\text{NiO}$, $\Delta G^0 = -471200 + 172T$ J

$2\text{NiO} = 2\text{Ni}_{(l)} + \text{O}_2$, $\Delta G^0 = 506180 - 192.2T$ J

The molar entropy of melting nickel is _____ J/K.

- (a) 0
- (b) 10.1
- (c) 23.5
- (d) 37.1
- (e) 47.5

18. 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

19. The relationship between the variations of pressure and temperature which is require 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

20. For a steam engine, steam enters at 500°C and is exhausted at 120°C . What is the maximum efficiency of this engine?

- (a) 0.63
- (b) 0.55
- (c) 0.49
- (d) 0.75
- (e) 0.33