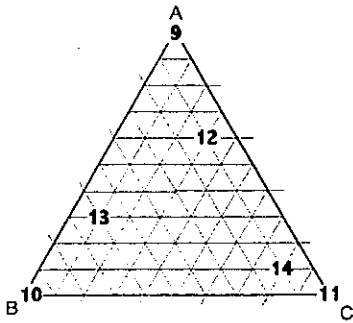


※ 考生請注意：本試題可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。
材料熱力學共 20 題選擇題，每題答對得 5 分，答錯倒扣 1 分；滿分 100 分，倒扣至 0 分為止。

- When a beaker of water at 300K is suddenly in touch with a heat reservoir at 400K, the change of entropy for the water is
(a) $C_p \ln(4/3)$ (b) $-C_p \ln(4/3)$ (c) $C_p(400-300)/400$ (d) $C_p(400-300)/300$ (e) none of the above
- 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?
(a) $\left(\frac{\partial V}{\partial P}\right)_T$ (b) $\left(\frac{\partial V}{\partial T}\right)_S$ (c) $\left(\frac{\partial P}{\partial T}\right)_V$ (d) $\left(\frac{\partial S}{\partial P}\right)_T$ (e) $\left(\frac{\partial T}{\partial V}\right)_P$
- The initial state of one mole of a monatomic ideal gas is $P = 10$ atm and $T = 300$ K. The change in the entropy of the gas for a constant-volume decrease in the pressure to 5 atm is
(a) -8.65 J/K (b) 5.76 J/K (c) 15.75 J/K (d) 43.25 J/K (e) 104.78 J/K
- What is not a thermodynamic parameter?
(a) Gibbs free energy (b) internal energy (c) activation energy (d) activity (e) chemical potential
- The most probable velocity of an ideal gas molecule at temperature T is equal to (m is the molecular weight):
(a) $\sqrt{2kT/m}$ (b) $\sqrt{3kT/2m}$ (c) $\sqrt{5kT/2m}$ (d) $\sqrt{3kT/m}$ (e) $\sqrt{8kT/\pi m}$
- A cylinder/piston contains 1 kg methane gas at 100 kPa, 20 °C. The gas is compressed reversibly to a pressure of 800 kPa. What is the work required if the process is isothermal (the molar mass of methane is 16.04 g/mol)?
(a) -516 kJ (b) -416 kJ (c) -316 kJ (d) -216 kJ (e) -116 kJ
- What is the mass of oxygen contained in a room $6 \times 10 \times 4$ m³ if the pressure is 100 kPa and the temperature 25 °C.
(a) 310 Kg (b) 300 Kg (c) 290 Kg (d) 280 Kg (e) 270 Kg
- For an regular (ideal) solution between components A and B, the entropy change is:
(a) zero (b) positive (c) $G^M = -RT(X_A \ln X_A + X_B \ln X_B)$ (d) G is zero (e) negative
- In a regular solution, the parabolic function is used to express
(a) entropy (b) volume (c) enthalpy (d) Gibbs free energy (e) density change

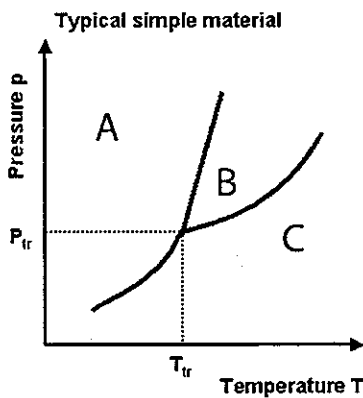
10. Oxygen gas stored at a pressure of 200 atm at 300 K in a cylindrical vessel of diameter 0.2 meters and height 2 meters. The van der Waals constant for oxygen are $a = 1.36 \text{ L}^2\text{atm/mole}$ and $b = 0.0318 \text{ L/mole}$. The mole of oxygen gas in a cylinder vessel is _____ moles.
 (a) 565 (b) 353 (c) 232 (d) 141 (e) 102
11. One mole of N_2 gas is contained at 273 K 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 _____ $\text{J mol}^{-1} \text{ K}^{-1}$.
 (a) 0.0217 (b) 0.217 (c) 2.17 (d) 21.7 (e) 217
12. A 50 g-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?
 (a) 9.8 (b) 4.9 (c) 0 (d) -4.9 (e) -9.8
13. A 50 g-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 ?
 (a) Positive; absorb from the environment, (b) positive; desorb to the environment, (c) zero,
 (d) negative; absorb from the environment, (e) negative; desorb to the environment.
14. At constant pressure, which of the following is true?
 (a) enthalpy is equivalent to work, (b) enthalpy is equivalent to heat,
 (c) enthalpy is equivalent to Gibbs free energy, (d) enthalpy is equivalent to internal energy,
 (e) enthalpy is equivalent to entropy.
15. The ΔH^M is heat of formation of a solution. Which of the following expression is correct?
 (a) $\Delta H^{M,\text{ideal}} > 0$ (b) $\Delta H^{M,\text{ideal}} < 0$ (c) $\Delta H^{M,\text{ideal}} = 0$ (d) $\Delta H^{M,\text{ideal}} = \Delta G^{M,\text{ideal}}$ (e) $\Delta H^{M,\text{ideal}} = \Delta S^{M,\text{ideal}}$
16. For a multicomponent solution, which of the following expression is correct? Q_i represents extensive property.
 (a) $\sum n_i d\bar{Q}_i = 0$ (b) $\sum n_i d\bar{Q}_i > 0$ (c) $\sum n_i d\bar{Q}_i < 0$ (d) $\sum n_i dQ = 0$ (e) $\sum d\bar{Q}_i = 0$
17. Regarding entropy change of the formation of an ideal solution, which of the following statement is correct? The entropy change
 (a) is due to the spatial rearrangement only (b) is a function of pressure only
 (c) is always equal to enthalpy change (d) is not related to the spatial situation
 (e) is zero at 0°C .

18. The following is a ternary diagram. Which of the following is correct? (number indicates location point)



- (a) 13 is 30%A-60%B-10%C
- (b) 11 has A+B phases
- (c) 12 is 40%A-90%B-70%C
- (d) temperature $9 > 10 > 11$
- (e) pressure $14 > 13 > 12$.

19. Please refer to the phase diagram of a typical simple material, which of the following is correct?



- (a) Area A and C are of the same phase
- (b) the coordinate (T_{tr}, P_{tr}) is the condition for co-existence of solid, liquid, and gas
- (c) B is gas phase
- (d) A is liquid phase
- (e) none of the above.

20. If Cu and Ni form an ideal face-centered cubic solid solution at 1000 °C, which range of value in the following is the activity of Cu, a_{Cu} , at $X_{Cu} = 0.25$? (Given: $\ln 2 = 0.69$.)

- (a) $-1 \leq a_{Cu} < -0.5$
- (b) $-0.5 \leq a_{Cu} < 0$
- (c) 0
- (d) $0 < a_{Cu} \leq 0.5$
- (e) $0.5 < a_{Cu} \leq 1$