國立成功大學

110學年度碩士班招生考試試題

編　號：91

系　所：材料科學及工程學系

科　目：材料熱力學

日　期：0202

節　次：第 2 節

備　註：可使用計算機

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※ 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。

1. About regular solution, which of the following is True?
   (a) a hypothetical solution
   (b) an ideal solution
   (c) if the value of α_B is dependent of the composition, then $\ln\gamma_A = \alpha_B X_B^2$
   (d) it has to obey $RT\ln\gamma_B = X_A^2$
   (e) none of the above.

2. Which is not a thermodynamic parameter?
   (a) internal energy
   (b) Gibbs free energy
   (c) activation energy
   (d) Helmholtz free energy
   (e) enthalpy.

3. In an adiabatic process, to compress a gas to a small volume will result in
   (a) decrease in internal energy
   (b) the gas has positive work done on the surrounding
   (c) increase in temperature
   (d) heat loss
   (e) weight loss.

4. When the face-centered cubic (fcc) phase is in equilibrium with the body-centered cubic (bcc) phase in a binary system at constant temperature and pressure, what of the followings is true?
   (a) $a_A^{fcc}=a_B^{bcc}$,
   (b) $a_A^{fcc}=a_A^{bcc}$,
   (c) entropy of the system reaches the maximum,
   (d) Gibbs free energy of the fcc phase reaches its minimum,
   (e) none of the above is applicable.

5. When a piece of steel A with temperature of 30℃ and a piece of aluminum B with temperature of 50℃ were put in contact side by side, which of the following is true
   (a) the Al atom will diffuse into steel A
   (b) configuration entropy will not increase
   (c) total entropy will not be affected

(d) thermal entropy will not increase.
(e) the equilibrium temperature will definitely be 40℃.

6. About standard state, which of the following is True?
(a) it is a reference state
(b) it can be any state
(c) its value is usually set to zero
(d) all of the above
(e) none of the above.

7. During the phase change of one-component system, G may be plotted as a function of pressure, or function of temperature, if there is one curve with a straight line with positive slope, which one in the following is **not true**:
(a) this curve may represent a solid phase
(b) this curve may represent a liquid phase
(c) this curve should be G vs T curve
(d) this curve should be G vs P curve
(e) slope has physical meaning of volume.

8. If Cu and Ni form a Raoultian solution, which range of value in the following is the activity of Cu, a_{Cu}, at X_{Cu} = 0.36?
(a) $1 \geq a_{Cu} > 0.5$,
(b) $0.5 \geq a_{Cu} > 0$,
(c) 0,
(d) $0 > a_{Cu} \geq -0.5$,
(e) $-0.5 > a_{Cu} \geq -1$.

9. When performing a thermochemical measurement on a binary system, only the data of one component are needed because the other can be derived based which of the followings?
(a) Maxwell relations,
(b) Henry's law,
(c) Gibbs-Duhem equation,
(d) Gibbs-Helmholtz equation,
(e) Boltzmann equation.

10. Which function is a path function?
(a) Gibbs free energy;

(b) entropy;
(c) heat;
(d) enthalpy;
(e) internal energy.

11. In the A-B system of regular solution, the assumption of random mixing is based on the following assumption, which is True?
(a) atoms have no interactions
(b) A-B bond energy is not far away from the average of A-A and B-B bond energies as in the pure components
(c) Raoultian behavior for A, and Henrian behavior for B
(d) all of the above
(e) none of the above.

12. What of the followings is true?
(a) A binodal curve is equivalent to an immiscible gap.
(b) An ideal gas may form a supercritical fluid when the temperature and pressure are both above the critical point.
(c) The fugacity of a phase can be directly measured with experiments.
(d) An reversible adiabatic process is an isentropic process and vice versa,
(e) None of the above is applicable.

13. Which property is an intensive property?
(a) enthalpy;
(b) pressure;
(c) Gibbs free energy;
(d) entropy;
(e) volume.

14. 'High-entropy' alloys usually involve quinary (5-component) materials systems. What of the following statements on a quinary system is true?
(a) Maximum number of co-existing phases is five,
(b) a triple point of solid, liquid and vapor phases is invariant,
(c) The alloy with equal molar composition possesses the lowest Gibbs free energy,
(d) supercritical state may exist,
(e) eutectic points with a liquid phase and two solid phases are invariant.

15. If the pressure of a system remains unchanged during a heating process, the product of heat capacity and temperature difference is equal to
    (a) the change of internal energy
    (b) entropy change
    (c) enthalpy change
    (d) volume change
    (e) weight change.

16. Which function can be described as an "energy in transit"?
    (a) work
    (b) Gibbs free energy
    (c) enthalpy
    (d) internal energy
    (e) Helmholtz free energy.

17. To formulate a more realistic gas equation, the ideal gas equation has to be modified based on some facts. Which of the following is NOT one of them?
    (a) real gas molecules interact with one another
    (b) real gas molecules has finite volume
    (c) real gas has internal energy
    (d) real gas has defects
    (e) all of the above.

18. For a binary system, which of the following reactions is incorrect?
    (a) Peritectoid: $Liquid\ 1 + Solid\ 2 \rightarrow Solid\ 3$
    (b) Eutectoid: $Solid\ 1 \rightarrow Solid\ 2 + Solid\ 3$
    (c) Eutectic: $Liquid\ \rightarrow Solid\ 1 + Solid\ 2$
    (d) Peritectic: $Liquid + Solid\ 1\ \rightarrow Solid\ 2$
    (e) none of the above.

19. In a regular solution, the reason that the Gibbs free energy of mixing curve between the spinodal compositions has no physical significance is because
    (a) spinodal is inconsistent
    (b) the activity has to be positive
    (c) the criterion for stability requires that $\frac{\partial a_i}{\partial X_i} > 0$
    (d) all of the above

(e) none of the above.

20. For solid, liquid and vapor states of H_2O, Gibbs free energies of various states, G, plotted as function of temperature T, at constant pressure, you will find that the vapor phase shows
(a) curve with steepest negative slope
(b) near horizontal line
(c) curve with steepest positive slope
(d) with slightly positive slope
(e) none of above is correct.