淡江大學九十三學年度碩士班招生考試試題

系別：化學學系　　科目：物 理 化 學

准帶項目請打「○」否則打「x」
簡單型計算機　X

選擇題，答錯不倒扣，每題 4 分

1. Which of the following is an intensive property? (a) heat capacity, (b) work, (c) molar volume, (d) weight.
2. Which of the following is NOT a state function? (a) heat, (b) Gibbs free energy, (c) entropy, (d) enthalpy.
3. The entropy change from state 1 to state 2 is $\Delta S = \int^{e} dq/T$, where the integral must be evaluated following a (a) reaction path, (b) reversible path, (c) constant pressure, (d) constant volume.
4. Which of the following equations is NOT true in a closed system with reversible process? (a) $dG = -SdT + VdP$, (b) $A = U - TS$, (c) $dH = -TdS + VdP$, (d) $G = H - TS$.
5. Which of the following statements is NOT true? (a) The unattanibility of absolute zero is best regarded as a consequence of the law of thermodynamics. (b) The third law entropy of a perfect diamond crystal is zero at 0 K. (c) The third law entropy of a perfect graphite crystal is zero at 0 K. (d) The kinetic energy of a perfect crystal is zero at 0 K.
6. The van der Waals equation of real gas is $(P + a/\bar{V}^2)(\bar{V} - b) = RT$. Which of the following statements is true? (a) The term $a/\bar{V}^2$ is meant to correct for the effect of the intermolecular repulsive forces on the gas pressure. (b) The term b is meant to correct for the volume available for the molecules to move. (c) b is the volume of the molecules. (d) The value of a is the same for different gases.
7. Which of the following statements is NOT true for an ideal solution? (a) The chemical potential of each species is given by $\mu_i = \mu_i^*(T, P) + RT \ln x_i$ for all components. (b) $\Delta H_{mix} = 0$, at constant T, P. (c) $\Delta V_{mix} = 0$, at constant T, P. (d) $\Delta S_{mix} = 0$, at constant T, P.
8. The molecular weight of a solute can NOT be determined by which of the following measurements? (a) melting point depression, (b) boiling point elevation, (c) heat capacity, (d) osmotic pressure.
9. The entropy of a thermodynamic system is (a) k log W, (b) R log W, (c) k ln W, (d) R ln W. Where W, k and R are the total number of system quantum states that have a significant probability of being occupied, Boltzmann constant and gas constant, respectively.
10. A two component phase diagram at constant P is shown in figure 1 at constant pressure. Which of the following statements is true? (a) A_2B melts congruently at T_2. (b) The lowest melting point of B and A_2B mixture is T_1. (c) Point D is a peritectic point. (d) Region 1 contains solid solution of B and A_2B.
11. From a three component phase diagram shown in figure 2 at constant T and P, the mole ratio of point D with respect to A, B and C is (a) 3:2:1, (b) 1:2:3, (c) 3:1:2, (d) 2:1:3.
12. Which of the following compounds is NOT appropriate for making a salt bridge? (a) KNO_3, (b) KCl, (c) KBr, (d) $MgSO_4$.
13. Which of the following statements is NOT true? (a) A catalyst can alter the equilibrium constant of a reaction. (b) Most of the reactions that occur in living organisms are catalyzed by molecules called enzymes. (c) A catalyst is a substance that increases both the rate of a forward reaction and the reversed reaction. (d) A heterogeneous catalysis, the reaction occurs at the interface between two phases.
14. A compound contains three kinds of atoms, A, B and X. It crystallizes into a cubic unit-cell with A atom at the body centered position, B atoms at each corner and X atoms at the center of each edges. The simplest formula of this compound is (a) ABX_3, (b) AB_8X_{12}, (c) AB_2X_3, (d) ABX.
15. Which of the following statements is true? (a) Endothermic reactions have higher activation energies than exothermic reactions. (b) The specific rate constant for a reaction is independent of the concentrations of the reacting species. (c) In all reaction mechanisms, there is a single rate-determining step. (d) The rate of a catalyzed reaction is independent of the concentration of the catalyst.
16. Which of the following statements is true? (a) The conductivity of a NaCl aqueous solution can be

◀注意背面尚有試題▶

淡江大學九十三學年度碩士班招生考試試題

系別：化學學系　　科目：物 理 化 學

准帶項目請打「○」否則打「×」
簡單型計算機　×

measured by using a DC current with Pt electrodes. (b) A portable cell is a reversible cell. (c) The emf ε of a reversible cell can be determined by the Nernst equation. (d) The equilibrium constant, *K*, of a cell reaction can be determined by the ΔH at constant T and P.

17. Which of the following statements is NOT true? (a) In both classical and quantum mechanics, knowledge of the present state of an isolated system allows the future state to be predicted with certainty. (b) For a stationary state, Ψ is a function of coordinations only. (c) The function $|\Psi|^2$ is the probability density for finding particles at a specific time *t*. (d) The state function in quantum mechanics must be single valued, continuous, and quadratically integrable.

18. Which of the following statements is NOT true? (a) One particle with a spin quantum number, s = 1/2 is called a fermion. (b) There is no classical analog of spin. (c) The spinning electron acts like a magnet. (d) The length of the spin angular momentum is determined by the operator of $\hat{S}_z$.

19. Which of the following statements is NOT true? (a) The simplest molecule is H_2^+. (b) ψ is zero at the nucleus for all H-atom stationary state. (c) The most probable value of the electron-nucleus distance in a ground state of H-atom is at r = 0.529 Å. (d) The ground state energy of a diatomic molecule is a function of interatomic distance.

20. Which of the following statements is true? (a) The degrees of vibrational freedom of a linear polyatomic molecule with *N* atoms are $3N - 5$. (b) For CO_2, the symmetric stretch is IR active. (c) The molecular electronic energy level has isotope effect. (d) The overtone band is a transition from $v = 0$ to $v = 1$, where *v* is the vibrational quantum number.

21. Which of the following operators can be used for finding the quantum numbers *n*, *l*, m_l and m_s for each electron in an atom, respectively? (a) $\hat{H}$, $\hat{L}$, $\hat{L}_z$, $\hat{S}_z$, (b) $\hat{H}$, $\hat{L}^2$, $\hat{L}_z$, $\hat{S}$ (c) $\hat{H}$, $\hat{L}^2$, $\hat{L}_z$, $\hat{S}_z$, (d) $\hat{H}$, $\hat{L}$, $\hat{L}_z$, $\hat{S}$.

22. Which of the following statements is true about the variation theorem? (a) The trial function must be normalized. (b) The trial function must be well-behaved. (c) Any function may be used as a trial function. (d) It is possible to obtain an approximate energy which is smaller than the E_{gs}, where gs is the ground state.

23. The first person, (a) Bohr, (b) Einstein, (c) Heisenberg, (d) Planck, proposed the existing of "energy quantization" in the history.

24. The Hamiltonian operator of an atom with *N* electrons is (a) $\sum_{i=1}^{N} -\frac{\hbar^2}{2m_i}\nabla_i^2 - \sum_{i=1}^{N}\frac{Ze^2}{r_i} + \sum_{i<}^{N}\sum_{j}^{N}\frac{e^2}{r_{ij}}$, (b) $\sum_{i=1}^{N} -\frac{\hbar^2}{2m_i}\nabla_i^2 - \sum_{i=1}^{N}\frac{Ze^2}{r_i} + \sum_{i}^{N}\sum_{j}^{N}\frac{e^2}{r_{ij}}$, (c) $\sum_{i=1}^{N} -\frac{\hbar^2}{2m_i}\nabla_i^2 - \sum_{i=1}^{N}\frac{e^2}{r_i} + \sum_{i<}^{N}\sum_{j}^{N}\frac{e^2}{r_{ij}}$, (d) $\sum_{i=1}^{N} -\frac{\hbar^2}{2m_i}\nabla_i^2 - \sum_{i=1}^{N}\frac{e^2}{r_i} + \sum_{i}^{N}\sum_{j}^{N}\frac{e^2}{r_{ij}}$,

25. Which of the following term symbols is the ground state of Mn^{2+} ($_{25}$Mn)? (a) ^{1}H, (b) ^{2}F, (c) ^{4}P, (d) ^{6}S.

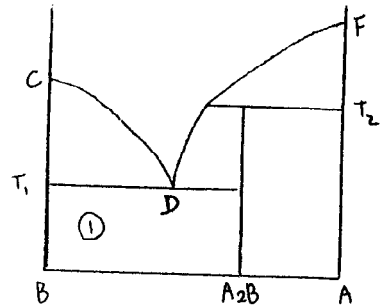

Figure 1

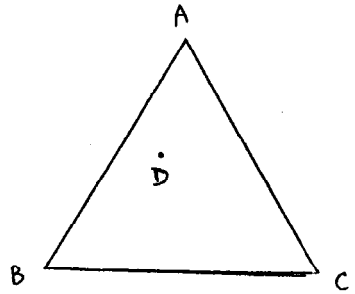

Figure 2