

九十二學年度_ 化學系、生命科學系、原子科學系____系轉學生招生考試
科目_普通化學_科號_0042, 0152, 0162_共_4_頁第_1_頁 *請在試卷【答案卷】內作答

選擇題（單選題），請在電腦卡作答（每題二分）

- Which orbital gives an electron a greater probability of being found closer to the nucleus ? (A) 3s (B) 3p (C) 3d (D) 3f .
- Consider a 2p electron in N atom, what is the value of Z_{eff} (effective nuclear charge) that a 2p electron experiences ? (A) 6.66 (B) 5.80 (C) 3.83 (D) 1.00 .
- The metallic radii in the third row of the d block are very similar to those in the second row, and not significantly larger as might be expected given their considerably larger numbers of electrons. We name this as (A) penetration (B) inert-pair effect (C) lanthanide contraction (D) catenation .
- Compare the bond enthalpy of the following combinations. Which bond enthalpy trends is right ? (A) C-C > Si-C > Ge-C (B) C-C < Si-C < Ge-C (C) C-Cl < Si-Cl < Ge-Cl (D) C-Cl > Si-Cl > Ge-Cl .
- Which of the following molecules is a paramagnetic species ? (A) F_2 (B) O_2 (C) N_2 (D) C_2 .
- Which of the following groups of ions is classified as hard acid ? (A) F^- , Cu^+ (B) Br^- , H^+ (C) H^+ , Na^+ (D) SCN^- , H_2O .
- Which of the following ligands shows the ambidentate character ? (A) NH_3 (B) 2, 2'-bipyridine (C) NO_2^- (D) ethylenediamine .
- Naphthalene is known to react with sodium to form sodium naphthalide in THF, and serve as a convenient reducing agent. The formation of the radical anion is ascribed to (A) solubility in organic solvent (B) benzene ring (C) thermal stability (D) the low-energy π LUMO of arene.
- Judging from the tendency to hydrolyze, which of the following compounds possesses the greatest carbanion character ? (A) Al_2R_6 (B) GaR_3 (C) InR_3 (D) BR_3 .
- On the basis of Hund's rule, which term of the following terms is the ground state ? (A) ^3F (B) ^3P (C) ^1G (D) ^1D .
- Charge-transfer transitions are generally intense compared with ligand-field transitions. So, the color of the pigment "cadmium yellow, CdS " is due to the transition (A) $\text{Cd}^{2+}(5s) \leftarrow \text{S}^{2-}(\pi)$ (B) $\text{Cd}^{2+}(4d) \leftarrow \text{S}^{2-}(\pi)$ (C) $\text{Cd}^{2+}(5s) \rightarrow \text{S}^{2-}(\pi)$ (D) $\text{Cd}^{2+}(4d) \rightarrow \text{S}^{2-}(\pi)$.
- Which of the following proteins is not a O_2 transport and storage proteins ? (A) myoglobin (B) hemoglobin (C) hemocyanin (D) ferritin.

13. One of the most remarkable redox reactions is the conversion of water and carbon dioxide into carbohydrates and oxygen using solar radiation as an energy source. There are two photochemical reaction centers, photosystem I and photosystem II, the photosystem I is based on chlorophyll a_1 , chlorophyll a_1 is a (A) a manganese (B) a copper (C) an iron (D) a magnesium dihydroporphyrin complex.
14. Teflon is a polymer. The formula is (A) $(\text{CHCl}-\text{CHCl})_n$ (B) $(\text{CF}_2-\text{CF}_2)_n$ (C) $(\text{CH}_2-\text{CH}_2)_n$ (D) $(\text{CHCl}-\text{CHCN})_n$.
15. Predict the product of the following reaction: $\text{C}_6\text{H}_{12}\text{O}_6$ (glucose) + yeast (catalyst) \rightarrow ? (A) $6\text{CH}_3\text{OH} + \text{H}_2\text{O}$ (B) $2\text{CH}_3\text{CH}_2\text{OH} + 2\text{CO}_2$ (C) $2\text{CH}_3\text{CH}_2\text{OH} + 2\text{H}_2\text{O}$ (D) $\text{CH}_3\text{COCH}_3 + 3\text{CO}$.
16. The geometry of CoCl_4^{2-} is (A) tetrahedral (B) square planar (C) octahedral (D) trigonal planar.
17. The Haber process for manufacturing ammonia represents an efficient process. What is the catalyst for this process ? (A) aluminum oxide (B) manganese oxide (C) iron oxide (D) nickel oxide.
18. The ions (A) K^+ , Na^+ (B) Ca^{2+} , Na^+ (C) Ca^{2+} , Mg^{2+} (D) Li^+ , Be^{2+} often found in natural water supplies are called "hard water".
19. Which of the following compounds in solid possesses a "three-center bond" ? (A) $(\text{BeCl})_n$ (B) $(\text{BeH}_2)_n$ (C) $(\text{MgCl}_2)_n$ (D) $(\text{CaCl}_2)_n$.
20. Predict the reaction product of the reaction $2\text{Na(s)} + \text{O}_2\text{(g)} \rightarrow$ (A) 2NaO (B) NaO_2 (C) Na_2O (D) Na_2O_2 .
21. Vitamins can be divided into two classes "fat-soluble and water-soluble". Which one of the following vitamins is water-soluble (A) vitamin A (B) vitamin B (C) vitamin D (D) vitamin E.
22. There are three types of holes in closest packed structures. For spheres of a given diameters, the size of holes is (A) trigonal < tetrahedral < octahedral (B) trigonal > tetrahedral > octahedral (C) trigonal = tetrahedral < octahedral (D) trigonal < tetrahedral = octahedral.
23. The n-type semiconductor is a silicon crystal doped with (A) boron (B) aluminum (C) phosphorus (D) arsenic.
24. The relatively weak forces that exist among noble gas atoms and nonpolar molecules are called (A) dipole-dipole interaction (B) hydrogen-bonding (C) London dispersion force (D) polarizability.
25. The overall reaction $\text{NO}_{2\text{(g)}} + \text{CO}_{\text{(g)}} \rightarrow \text{NO}_{\text{(g)}} + \text{CO}_{2\text{(g)}}$. The reaction mechanism

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follows: $\text{NO}_{2(g)} + \text{NO}_{2(g)} \rightarrow \text{NO}_{3(g)} + \text{NO(g)} \dots\dots \text{slow}$

$\text{NO}_{3(g)} + \text{CO(g)} \rightarrow \text{NO}_{2(g)} + \text{CO}_{2(g)} \dots\dots \text{fast}$

The rate law is (Rate = ?) (A) $k[\text{NO}_2]^2$ (B) $k[\text{NO}_2]$ (C) $k[\text{NO}_3]$ (D) $k[\text{NO}_3][\text{CO}]$.

26. What is the bond order of the NO^+ ? (A) 4 (B) 3 (C) 2 (D) 1.
27. The molecular structure of I_3^- is (A) linear (B) bent (C) trigonal bipyramidal (D) square planar.
28. Choose the largest ion in the following group. (A) Ba^{2+} (B) Cs^+ (C) I^- (D) Te^{2-} .
29. Which of the molecules possesses polar bonds but no resulting dipole moment? (A) SO_3 (B) SO (C) SO_2 (D) CHCl_3 .
30. The first ionization energy for phosphorus is 1060 KJ/mole. Then the first ionization energy of sulfur was estimated as (A) 1200 (B) 1080 (C) 1005 (D) 500 KJ/mole.
31. Determine the angular momentum quantum number (l) of 3d orbital (A) $l = 0$ (B) $l = 1$ (C) $l = 2$ (D) $l = 3$.
32. The corrosion of iron is an electrochemical reaction. Which of the following statements is correct? (A) Anode reaction: $\text{Fe}^{2+} \rightarrow \text{Fe}^{3+} + \text{e}^-$ (B) cathode reaction: $\text{Fe}^{2+} + 2\text{e}^- \rightarrow \text{Fe}$ (C) anode reaction: $\text{Fe} \rightarrow \text{Fe}^{3+} + 3\text{e}^-$ (D) $\text{O}_2 + 2\text{H}_2\text{O} + 4\text{e}^- \rightarrow 4\text{OH}^-$.
33. Which of the following is the best reducing agent? (A) F_2 (B) Fe (C) Na (D) Ni .
34. Calculate ΔG° for the reaction $\text{C}_{(s)}^{\text{diamond}} \rightarrow \text{C}_{(s)}^{\text{graphite}}$ if $\text{C}_{(s)}^{\text{diamond}} + \text{O}_{2(g)} \rightarrow \text{CO}_{2(g)}$ $\Delta G^\circ = -397 \text{ KJ}$ and $\text{C}_{(s)}^{\text{graphite}} + \text{O}_{2(g)} \rightarrow \text{CO}_{2(g)}$ $\Delta G^\circ = -394 \text{ KJ}$. (A) 3 KJ (B) -3 KJ (C) 791 KJ (D) -791 KJ.
35. By knowing the number of protons in a neutral element, you should be able to determine (A) the number of neutrons in the neutral element (B) the number of electrons in the neutral element (C) the name of the element (D) two of these are true.
36. The value of the equilibrium constant, K , is dependent on which of the following? (A) the initial concentration of the reactants (B) the initial concentration of the products (C) the temperature of the system (D) reaction time.
37. Which of the following species is the strongest base? (A) Cl^- (B) F^- (C) NO_2^- (D) CN^- .
38. Which of the following has the strongest bond? (A) O_2 (B) O_2^+ (C) O_2^- (D) O_2^{2-} .
39. Predict the number of unpaired electrons in the complex ion $[\text{Cr}(\text{CN})_6]^{4-}$. (A) 0 (B) 3 (C) 2 (D) 4.

40. Which of the following belongs to tertiary amine ? (A) RNH_2 (B) R_3N (C) R_2NH (D) NH_3 (here R is alkyl group).
41. Which of the following is not a polyprotic acid ? (A) H_3PO_4 (B) H_2SO_4 (C) HClO_4 (D) H_2PO_4^- .
42. Which of the following ion has the largest hydration energy (KJ/mole) (A) Li^+ (B) Na^+ (C) K^+ (D) Ca^{2+} .
43. Which of the following orbital designations are incorrect (A) 1s (B) 5d (C) 4f (D) 1p.
44. Which of the following bonds has the largest polarity ? (A) F-H (B) S-H (C) Cl-H (D) H-H.
45. The H-O-H bond angle of H_2O is known as 104.5° . The H-N-H bond angle of NH_3 can be estimated as (A) 103° (B) 100° (C) 107° (D) 109.5° .
46. The simplest aromatic alcohol is called (A) methonal (B) ethanol (C) phenol (D) 1-propanol.
47. The three-dimensional structure of a protein is crucial to its function. The process of breaking down this structure is called (A) degradation (B) denaturation (C) dealkylation (D) desulfurization.
48. Which statement is correct (en = ethylenediamine) ? (A) the trans isomer of $[\text{Co}(\text{en})_2\text{Cl}_2]^+$ is optically active (B) the cis isomer of $[\text{Co}(\text{en})_2\text{Cl}_2]^+$ and its mirror image are not superimposable (C) the cis isomer of $[\text{Co}(\text{en})_2\text{Cl}_2]^+$ and its mirror image are not optical isomers (D) the trans isomer of $[\text{Co}(\text{en})_2\text{Cl}_2]^+$ and its mirror image are not identical.
49. Choose the substance with the higher positional entropy (per mole) at a given temperature (A) $\text{CO}_{2(s)}$ (B) $\text{CO}_{2(l)}$ (C) $\text{CO}_{2(g)}$ (D) $\text{N}_{2(s)}$.
50. Consider $\text{CuS}_{(s)}$: $K_{sp} = 8.5 \times 10^{-45}$; $\text{Ag}_2\text{S}_{(s)}$: $K_{sp} = 1.6 \times 10^{-49}$; $\text{HgS}_{(s)}$: $K_{sp} = 1.6 \times 10^{-54}$; $\text{Bi}_2\text{S}_{3(s)}$: $K_{sp} = 1.1 \times 10^{-73}$. Which salt is the most soluble in water (A) $\text{CuS}_{(s)}$ (B) $\text{Ag}_2\text{S}_{(s)}$ (C) $\text{HgS}_{(s)}$ (D) $\text{Bi}_2\text{S}_{3(s)}$.