

Question Paper for the Screening Test

Post: Junior Technician

Department: Chemistry

Name: _____

Application Number: _____

Total Marks: 50

Duration: 1.5 Hours

Date: January 3, 2025

Information to the Candidate:

- Please answer all questions, each carrying 1 mark with no negative marking
- Nonprogrammable calculator is allowed to use

QUESTIONS

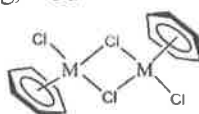
- The root-mean-square speed of a gas molecule at T Kelvin temperature follows the following power law:
(A) T^{-1} (B) T (C) $T^{\frac{1}{2}}$ (D) $T^{-\frac{1}{2}}$
- If the dimension of a quantum-mechanical wavefunction of a physical system is L^{-1} , then this is a system of
(A) zero-dimension (B) one-dimension (C) two-dimension (D) three-dimension
- The degeneracy of the first excited state for a free particle confined in a cube with infinite potential outside is
(A) 1 (B) 2 (C) 3 (D) 4
- The number of rotational degrees of freedom for HCl is
(A) 1 (B) 2 (C) 3 (D) 4
- The stability of a chemical bond is primarily governed by
(A) Orbital overlap integral (B) Coulomb integral
(C) Exchange integral (D) Independent of orbital overlap, Coulomb and exchange integrals
- Low-lying electronic spectrum of benzene consists of
(A) No detectable spectral lines (B) Only $n\pi^*$ transition
(C) Only $\pi\pi^*$ transition (D) Both $n\pi^*$ and $\pi\pi^*$ transitions
- Identify the correct order of increasing interaction strength among non-covalent “van der Waals (vdW)”, “dipole-dipole (dd)” and “Coulomb (C)”.
(A) $vdW < C < dd$ (B) $vdW < dd < C$ (C) $dd < vdW < C$ (D) $C < dd < vdW$
- The degrees of freedom at the triple point for pure water is
(A) 0 (B) 1 (C) 2 (D) 3
- The hybridization of central B in B_2H_6 is
(A) sp^3 (B) sp^2 (C) sp (D) dsp^3
- Consider a reaction between A and B, which is carried out for different initial concentrations, and the corresponding half-life times are measured. The data is listed in the below table.

Experiment No.	[A] ₀ (μM)	[B] ₀ (μM)	$t_{\frac{1}{2}}$ (s)
1	10	10	30
2	10	20	30
3	20	20	15

Identify the correct statement from the following.

- The reaction is 0th order with respect to A and 1st order with respect to B
 - The reaction is 1st order with respect to A and 0th order with respect to B
 - The reaction is 1st order with respect to A and 2nd order with respect to B
 - The reaction is 2nd order with respect to A and 1st order with respect to B
- The C-C bond-order in benzene is
(A) 1.0 (B) 1.5 (C) 1.7 (D) 2.0
 - The degeneracy of the rotational energy level with quantum number J=3 for HBr is
(A) 1 (B) 3 (C) 7 (D) 9
 - The reduced Planck constant ($\hbar$) has the dimension of
(A) Energy (B) Linear Momentum
(C) Angular Momentum (D) Dipole moment

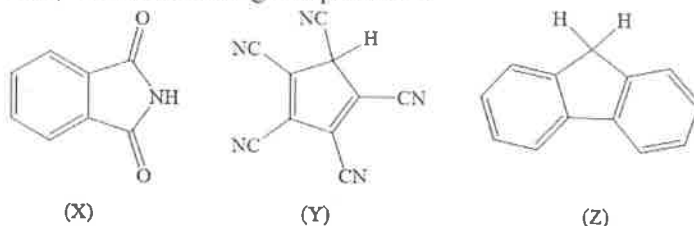
14. The dimension of "a" present in the equation of state $\left(P + \frac{n^2a}{V^2}\right)(V - nb) = nRT$ is
 (A) ML^5T^{-2} (B) MLT^{-2} (C) ML^2T^{-2} (D) L^2
15. Given that the molar ionic conductivities of Ca^{2+} and Cl^- in aqueous medium are $119.0 \text{ S cm}^2 \text{ mol}^{-1}$ and $76.3 \text{ S cm}^2 \text{ mol}^{-1}$ respectively, then the molar conductivity ($\text{S cm}^2 \text{ mol}^{-1}$) for aqueous $CaCl_2$ at infinite dilution is
 (A) 195.3 (B) 271.6 (C) 33.6 (D) 42.7
16. The decimal number corresponding to the binary number 1001 is
 (A) 3 (B) 5 (C) 7 (D) 9
17. The binary number corresponding to the decimal number 5 is
 (A) 100 (B) 101 (C) 110 (D) 010
18. A computing server has two physical processors, each with 32 cores. In order to fulfil the 8GB random access memory (RAM) requirement per core, the total amount of RAM required for the server is
 (A) 64 (B) 128 (C) 256 (D) 512
19. The Linux command used to securely copy files from one computer system to a remote server is
 (A) cp (B) scp (C) mv (D) rm
20. What is the full form of SMPS?
 (A) Switch Module Power System (B) Switch Mode Power Supply
 (C) Standard Minimum Power Source (D) Switch Module Power Supply
21. ^{39}Y , ^{40}Zr , ^{41}Nb , ^{42}Mo , ^{43}Tc , ^{44}Ru , ^{45}Rh , ^{46}Pd , ^{47}Ag , ^{48}Cd



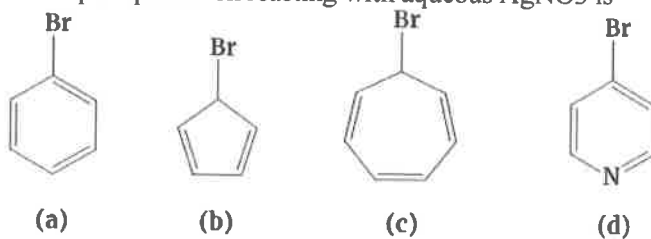
If the above complex follows the $18e^-$ rule, find out M?

- (A) Pd (B) Ru (C) Rh (D) Ag
22. The number of metal-metal bond(s) in $Os_3(CO)_{12}$ is
 (A) 0 (B) 1 (C) 2 (D) 3
23. The pH of $0.0033\text{M H}_3\text{PO}_4$ is
 (A) 1 (B) 2 (C) 3 (D) 4
24. Which of the following complexes exhibits geometrical isomerism?
 (A) $[Pt(NH_3)_2Cl_2]$ (B) $[Co(NH_3)_6]^{3+}$ (C) $[Ni(CO)_4]$ (D) $[Cu(NH_3)_4]^{2+}$
25. The magnitude of the crystal field splitting energy (Δ) depends on:
 (A) The type of ligand and its field strength (B) The size of the metal ion only
 (C) The oxidation state of the metal ion only (D) The geometry of the ligand alone
26. Jahn-Teller distortion in an octahedral complex arises due to:
 (A) Symmetric distribution of electrons in degenerate orbitals
 (B) Unequal occupancy of degenerate orbitals
 (C) The presence of strong field ligands
 (D) The absence of d-electrons
27. Which of the following organometallic compounds is commonly used as a catalyst in hydroformylation?
 (A) Wilkinson's catalyst (B) Zeise's salt (C) $[RhH(CO)(PPh_3)_3]$ (D) Grignard reagent
28. Which of the following reactions is commonly associated with organometallic chemistry?
 (A) Wurtz reaction (B) Oxidative addition
 (C) Hoffmann rearrangement (D) Cannizzaro reaction
29. The toxic effect of cyanide (CN^-) is due to its binding with which metal-containing enzyme?
 (A) Glutathione peroxidase (B) Carbonic anhydrase
 (C) Cytochrome c oxidase (D) Nitrogenase
30. Which of the following isotopes is commonly used in medical imaging?
 (A) Carbon-14 (B) Iodine-131
 (C) Uranium-235 (D) Radon-222
31. The number of primitive basis in the hexagonal closed-pack lattice is
 (A) 1 (B) 2 (C) 3 (D) 4
32. What is the correct order of packing fraction for BCC, FCC, and HCP structures?
 (A) FCC > HCP > BCC (B) HCP > FCC > BCC
 (C) BCC > FCC > HCP (D) FCC = HCP > BCC

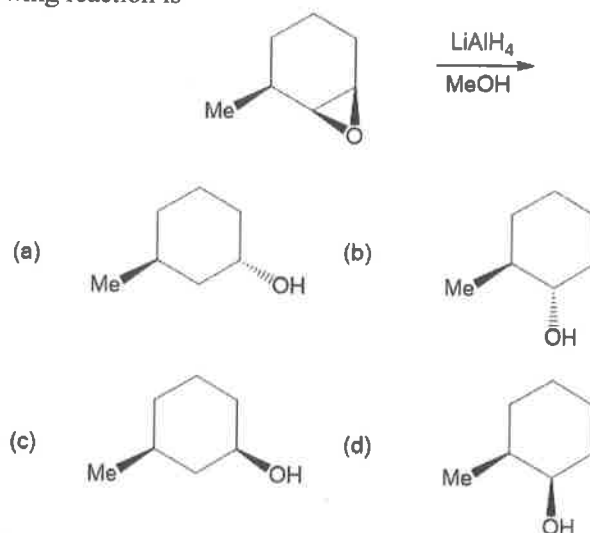
33. Which of the following is an example of an inverse spinel?
 (A) MgAl_2O_4 (B) ZnFe_2O_4 (C) CuFe_2O_4 (D) Fe_3O_4
34. The transition metal ion present in the Ziegler-Natta catalyst is
 (A) Fe (B) Ti (C) Cu (D) Ir
35. The spin-only magnetic moment (in units of Bohr Magneton) of Prussian Blue is
 (A) 0 (B) 2.83 (C) 1.73 (D) 5.92
36. The increasing order of acidity for the following compounds is



- (A) $Z < X < Y$ (B) $X < Z < Y$ (C) $Z < Y < X$ (D) $Y < Z < X$
37. The increasing order of nucleophilicity for the following anions is
 CH_3CO_2^- , CH_3O^- , $\text{C}_6\text{H}_5\text{O}^-$, NO_3^-
 (A) $\text{CH}_3\text{CO}_2^- < \text{CH}_3\text{O}^- < \text{C}_6\text{H}_5\text{O}^- < \text{NO}_3^-$ (B) $\text{NO}_3^- < \text{CH}_3\text{CO}_2^- < \text{C}_6\text{H}_5\text{O}^- < \text{CH}_3\text{O}^-$
 (C) $\text{NO}_3^- < \text{C}_6\text{H}_5\text{O}^- < \text{CH}_3\text{CO}_2^- < \text{CH}_3\text{O}^-$ (D) $\text{CH}_3\text{CO}_2^- < \text{C}_6\text{H}_5\text{O}^- < \text{CH}_3\text{O}^- < \text{NO}_3^-$
38. The hybridizations of the central and terminal carbons of allene are
 (A) sp^2 and sp^2 (B) sp^2 and sp^3 (C) sp and sp^2 (D) sp and sp^3
39. Identify the compound that forms precipitates on reacting with aqueous AgNO_3 is

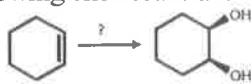


- (A) a (B) b (C) d (D) c
40. The final product for the following reaction is



- (A) d (B) c (C) a (D) b
41. Which of the following additions to alkenes occur(s) specifically in "anti" fashion?
 (A) hydroboration-oxidation (B) addition of Br_2
 (C) addition of H_2 (D) addition of H_2O in dilute acid
42. The peroxide functionality for the addition of HBr to an alkene is
 (A) nucleophile (B) electrophile (C) radical chain initiator (D) solvent

43. Choose the appropriate reagent(s) for the following chemical transformation.



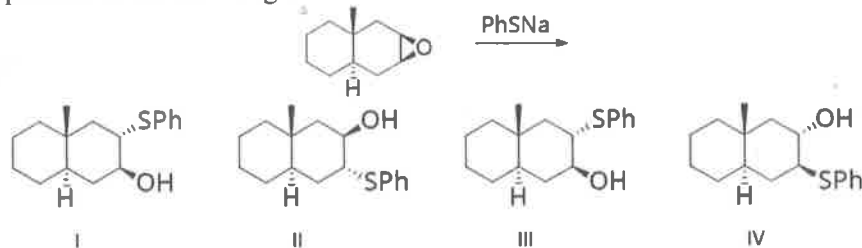
- (A) $\text{OsO}_4/\text{H}_2\text{O}_2$ (B) H_3O^+ (C) $\text{Hg}(\text{OAc})_2/\text{H}_2\text{O}_2$ (D) $\text{CH}_3\text{CO}_3\text{H}/\text{H}_3\text{O}^+$

44. Which symmetry does the following molecule have?



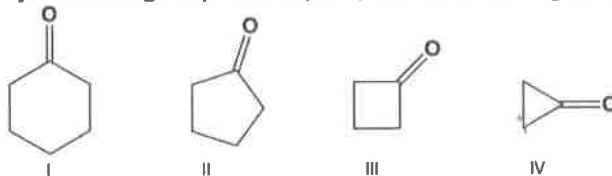
- (A) Centre of symmetry (B) C_4 axis of symmetry
(C) Plane of symmetry (D) C_6 axis of symmetry

45. Identify the major product of the following reaction



- (A) I (B) II (C) III (D) IV

46. The correct order of the carbonyl stretching frequencies (cm^{-1}) for the following compounds is

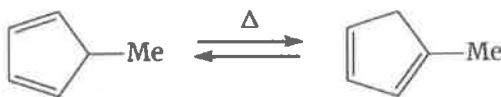


- (A) $\text{I} > \text{II} > \text{III} > \text{IV}$ (B) $\text{I} < \text{II} < \text{III} < \text{IV}$ (C) $\text{I} < \text{II} \approx \text{III} < \text{IV}$ (D) $\text{I} > \text{II} \approx \text{III} > \text{IV}$

47. The ^1H NMR spectrum of HD exhibits

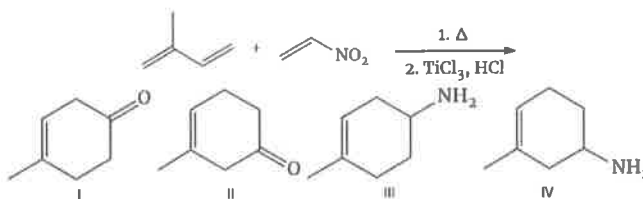
- (A) a singlet (B) a doublet
(C) a triplet with intensity ratio 1:2:1 (D) a triplet with intensity ratio 1:1:1

48. The following reaction is an example of



- (A) 1, 3-sigmatropic shift (B) 1, 3- methyl shift (C) 1, 5-sigmatropic shift (D) 1, 5-methyl shift

49. The major product formed in the following reaction is



- (A) I (B) II (C) III (D) IV

50. Which amino acid is basic in nature from the following?

- (A) Asparagine (B) Leucine (C) Tyrosine (D) Arginine

- End -