



ਪੰਜਾਬ ਟੈਕਨੀਕਲ ਯੂਨੀਵਰਸਿਟੀ ਜਲੰਧਰ  
PUNJAB TECHNICAL UNIVERSITY JALANDHAR

Max. Marks: 90

Time: 90 Mins.

Entrance Test for Enrollment in Ph.D. Programme

Important Instructions

- > Fill all the information in various columns, in capital letters, with blue/black ball point pen.
- > Use of calculators is not allowed.
- > All questions are compulsory. No negative marking for wrong answers.
- > Each question has only one right answer.
- > Questions attempted with two or more options/answers will not be evaluated.

Stream (Engg./Arch./Pharm./Mgmt./App.Sci./Life Sci.)

Applied Sciences

Discipline / Branch

Chemistry

Name

Father's Name

Roll No.

Date

Signature of Candidate

Signature of Invigilator

1. Which of the following is Hard Acid?
  - a.  $\text{Li}^+$
  - b.  $\text{Tl}^{3+}$
  - c.  $\text{Au}^+$
  - d.  $\text{Pd}^{2+}$
2. pH of a solution at  $25^\circ\text{C}$  is 2.If the pH is to be doubled then the hydronium ion concentration of the solution should be
  - a. decreased to 100 times
  - b. Increased to 100 times
  - c. Increased to 1000 times
  - d. Decreased to 10 times
3. Oxidation no of Chlorine in  $\text{Cl}_2\text{O}$ ,  $\text{Cl}_2$  and  $\text{ClO}_3^-$  is
  - a. -1, -1, +5
  - b. -1, 0, +5
  - c. +1, -1, +5
  - d. +1, 0, +5
4. The heat of combustion of substance is always
  - a. Negative
  - b. Positive
  - c. Zero
  - d. One

5. The vapour pressure of pure solvent is 0.80 atm. when the non volatile solute is added its vapour pressure drops to 0.6 atm the mole fraction of the solute in the solution is
- 0.75
  - 0.50
  - 0.25
  - 1.00
6. The  $\Delta G^\circ$  is zero for the reaction when
- $\Delta H=0$
  - $K(\text{equilibrium constant})=0$
  - $K=1$
  - $\Delta S=0$
7. Which of the binary system form the an ideal solution
- Benzene and Toluene
  - Acetic acid and water
  - Dichloromethane and water
  - acetone and ethanol
8. Hamiltonian Operator H has the expression
- $H = -\frac{h^2}{8\pi^2m}\nabla^2 + V$
  - $H = -\frac{h^2}{2m}\nabla^2 + V$
  - $H = -\frac{8\pi^2m}{h^2}\nabla^2 + V$
  - none of above
9. The degeneracy of each rotational state of a rigid rotator is given by
- $2m+1$
  - $2l+1$
  - $2n+1$
  - $1+m$
10. Which of the following statements is true for an *ideal-dilute* solution?
- The solute and solvent both obey Raoult's law
  - The solute obeys Raoult's law and the solvent obeys Henry's law.
  - The solute obeys Henry's law and the solvent obeys Raoult's law.
  - The solute and solvent both obey Henry's law.
11. The Laplacian operator  $\nabla^2$  is related to the

- a. kinetic energy
  - b. potential energy
  - c. wave number
  - d. none of above
12. Molar translational energy of a gas is
- a. RT
  - b.  $1/2RT$
  - c.  $3/2 RT$
  - d. none of above
13. Stirling's approximation can be expressed as
- a.  $n = \ln\left(\frac{n^n}{n!}\right)$
  - b.  $\ln n! = n - n \ln n$
  - c.  $\ln n! = n \ln n + n$
  - d. none of above
14. For Raman spectra, the molecule must have
- a. Isotropic polarisability
  - b. anisotropic polarisability
  - c. oscillating dipole moment
  - d. all of above
15. For pure rotational spectrum, the selection rule is
- a.  $\Delta J = \pm 1$
  - b.  $\Delta J = \pm 2$
  - c.  $\Delta J = 0$
  - d. all of above
16. The number of lines in the ESR spectrum of cyclopentadienyl radical is
- a. 3
  - b. 6

- c. 1  
d. 4
17. If the rate of diffusion of A is 5 times that of B . What will be the density ratio of A and B?
- a. 1/25  
b. 25  
c. 1/5  
d. 5
18. The pressure of 2 moles of ideal gas having volume 44.8 L at 546 K is
- a. 2 atm  
b. 3 atm  
c. 4 atm  
d. 1 atm
19. The unit of the equilibrium constant for a reversible reaction  
 $\text{H}_2 + \text{I}_2 \leftrightarrow 2\text{HI}$  are
- a.  $\text{mol}^2\text{litre}$   
b.  $\text{Mol}^{-2}\text{litre}^{-1}$   
c.  $\text{Mol}^{-1}\text{litre}$   
d. None of above
20. Adsorption is
- a. endothermic process  
b. exothermic process  
c. can be endothermic or exothermic process  
d. none of above
21. Saturated solution of the  $\text{KNO}_3$  is used to make Salt bridge because
- a. velocity of  $\text{K}^+$  is greater than  $\text{NO}_3^-$  in water  
b. Velocity of  $\text{NO}_3^-$  is greater than  $\text{K}^+$  in water  
c. Both  $\text{NO}_3^-$  and  $\text{K}^+$  has same velocity in water  
d.  $\text{KNO}_3$  is ionic in nature

22. 0.60 mg of the precipitate is lost as a result of washing with 100 mL of solvent. If the precipitate weight is 60 mg, the relative error due to solubility is
- 0.001%
  - 0.01%
  - 1.0%
  - 10%
23. The phosphorescence spectrum of the excited species is due to
- singlet to triplet transition
  - triplet to singlet transition
  - vibrational mode
  - electron spin transition
24. Which of the following compound is microwave inactive?
- HCl
  - Cl<sub>2</sub>
  - NO
  - CO
25. Any substance which completely destroys or reduce the activity of a catalyst is called
- catalyst
  - inhibitor
  - promoter
  - catalyst poison
26. Which of the following error does not fall under the category of constant errors?
- Operational error
  - Reagent error
  - Erratic error
  - Proportional error
27. The polydispersity index is
- ratio of mass average molar mass to number average molar mass
  - ratio of number average molar mass to mass average molar mass

- c. sum of mass average molar mass to number average molar mass
  - d. equal to mass average molar mass
28. Which one of the following is not perfect differential?
- a.  $dQ$
  - b.  $dH$
  - c.  $dT$
  - d.  $dG$
29. The property which depends upon the number rather than nature of the dissolved particles in a solution are called
- a. General
  - b. Colligative
  - c. Isotonic
  - d. Isoelectronic
30. In the change of  $\text{NO}^+$  to  $\text{NO}$ , the electron are added to
- a.  $\sigma$ -orbital
  - b.  $\pi$ -orbital
  - c.  $\sigma^*$ -orbital
  - d.  $\pi^*$ -orbital
31. The partial hydrolysis of  $\text{XeF}_4$  at a low temperature gives
- a.  $\text{XeO}_3$
  - b.  $\text{XeOF}_2$
  - c.  $\text{XeOF}_4$
  - d.  $\text{XeF}_2$
32. Which of the following system has maximum no of unpaired electrons?
- a.  $d^6$  (Tetrahedral, high spin)
  - b.  $d^9$  (octahedral)
  - c.  $d^7$  (octahedral, low spin)
  - d.  $d^8$  (octahedral, high spin)
33. The CFSE of high spin octahedral complex having  $d^1$  configuration is
- a.  $-0.6\Delta_0$
  - b.  $-0.8\Delta_0$
  - c.  $-0.4\Delta_0$

- d.  $0.0\Delta_0$
34. Iodine is an example of
- Ionic Crystal
  - Covalent crystal
  - Molecular Crystal
  - Metallic Crystal
35. Which of the following alkali metal has lowest mobility in aqueous solution?
- $\text{Li}^+$
  - $\text{Na}^+$
  - $\text{Rb}^+$
  - $\text{Cs}^+$
36. In spectrochemical series which ligand produce strong field
- $\text{Cl}^-$
  - $\text{H}_2\text{O}$
  - $\text{NO}_2^-$
  - $\text{CO}$
37. Optical Isomerism is shown by
- $[\text{Ni}(\text{CN})_4]^{2-}$
  - $[\text{Pt}(\text{NH}_3)_4]^{2+}$
  - $\text{Ni}(\text{CO})_4^{2-}$
  - $[\text{Co}(\text{en})_3]^{3+}$
38. The ground term for  $d^8$  system is
- ${}^3\text{F}_4$
  - ${}^4\text{F}_3$
  - ${}^5\text{D}$
  - ${}^6\text{S}$
39. In carboxypeptidase enzyme, the active metal is

- a. Fe
  - b. Cu
  - c. Zn
  - d. Mg
40. The valency of Cu ion in deoxy haemocyanin is
- a. +1
  - b. +2
  - c. 0
  - d. -1
41. The order of the Lewis acid strength of different boron halides is
- a.  $\text{BF}_3 > \text{BCl}_3 > \text{BBr}_3$
  - b.  $\text{BF}_3 < \text{BCl}_3 < \text{BBr}_3$
  - c.  $\text{BF}_3 = \text{BCl}_3 = \text{BBr}_3$
  - d. none of above
42. Which of the following carboranes are closo carboranes on the basis of wade's rule
- a.  $\text{B}_4\text{C}_2\text{H}_6$
  - b.  $\text{C}_2\text{B}_4\text{H}_8$
  - c.  $\text{CB}_6\text{H}_{12}$
  - d.  $\text{CB}_6\text{H}_{12}$
43. Which of the following is tetrabasic?
- a.  $\text{H}_4\text{P}_2\text{O}_7$
  - b.  $\text{H}_4\text{P}_2\text{O}_5$
  - c.  $\text{H}_3\text{PO}_3$
  - d.  $\text{H}_3\text{PO}_4$
44. In mosanto acetic acid synthesis the catalyst is
- a.  $[\text{Rh}(\text{CO})_2\text{I}_2]^-$
  - b.  $\text{Co}_2(\text{CO})_8$



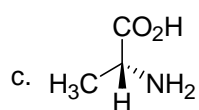
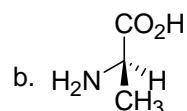
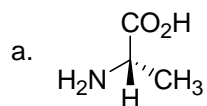
- c.  $\text{RhCl}(\text{PPh}_3)_3$
- d. none of above
45. In  $\text{ICl}_4^-$  the hybridization of Iodine is
- a.  $sp^3$
- b.  $sp^3d$
- c.  $dsp^2$
- d.  $sp^3d^2$
46. Which of the following species has highest dipole moment
- a.  $\text{NH}_3$
- b.  $\text{PH}_3$
- c.  $\text{SbH}_3$
- d. all have same dipole moment
47. The metal extracted by cyanide process is
- a. Ag
- b. Cu
- c. Mg
- d. Na
48.  $\text{PH}_4\text{I}$  and NaOH forms
- a.  $\text{PH}_3$
- b.  $\text{NH}_3$
- c.  $\text{P}_4\text{O}_6$
- d.  $\text{P}_4\text{O}_{10}$
49. The colour of lanthanide ions is due to
- a. d-d- transition
- b. f-f transition
- c. crystal defects
- d. d-f transitions

50. The tendency of actinides and Lanthanides to form complexes is mainly :-
- same
  - actinides have greater tendency to form complexes
  - lanthanides have greater tendency to form complexes
  - both are poor in complex formation
51. The effective atomic number of electrons in the valence shell of Vanadium with atomic no 23 in  $V(CO)_6$  is
- 16
  - 17
  - 18
  - 5
52. Which of the following metal carbonyls has highest IR stretching frequency  $\nu_{CO}$  ( $cm^{-1}$ )
- $Co(CO)(NO)(PPh_3)$
  - $Co(CO)(NO)(PCl_2Ph)$
  - $Co(CO)(NO)(PCl_3)$
  - $Co(CO)(NO)(PClPh_2)$
53. In NQR spectroscopy, the active nuclei should have spin
- $\leq 1/2$
  - $\geq 1$
  - $\leq 1$
  - none of above
54. The symmetry point group of  $H_2O$  is
- $C_{2v}$
  - $C_{3h}$
  - $D_{4h}$
  - $C_{4v}$
55. Caro's acid is

- a.  $\text{H}_2\text{SO}_5$
- b.  $\text{H}_2\text{S}_2\text{O}_8$
- c.  $\text{H}_2\text{S}_2\text{O}_7$
- d.  $\text{H}_2\text{SO}_4$
56. Which of the following ligands can show linkage isomerism in coordination complexes?
- a.  $\text{SCN}^-$ ,  $\text{NC}^-$ ,  $\text{NO}_2^-$
- b.  $\text{H}_2\text{O}$ ,  $\text{Cl}^-$ ,  $\text{NH}_3$
- c.  $\text{CN}^-$ ,  $\text{Br}^-$ ,  $\text{OH}^-$
- d.  $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{I}^-$
57. The IUPAC name of the compound  $[\text{Cr}(\text{PPh}_3)(\text{CO})_5]$  is
- a. Triphenylphosphinepentacarbonylchromium(0)
- b. pentacarbonyltriphenylphosphinechromium(0)
- c. Triphenylphosphinepentacarbonylchromium(I)
- d. Triphenylphosphinecarbonyl(0) pentacarbonyl
58. In the nuclear reaction:
- $${}^{130}_{52}\text{Te} + {}^2_1\text{H} \rightarrow {}^{131}_{53}\text{I} + ?$$
- a. Neutron
- b. Electron
- c. Positron
- d. proton
59. S-----S bond is present in
- a.  $\text{S}_2\text{O}_7^{2-}$
- b.  $\text{S}_3\text{O}_6$
- c.  $\text{S}_2\text{O}_8^{2-}$
- d.  $\text{S}_2\text{O}_4^{2-}$
60. Which of the following is weakest Lewis Base?
- a.  $\text{CH}_3^-$
- b.  $\text{OH}^-$
- c.  $\text{NH}_2^-$

d.  $F^-$

61. Which of the following structure of amino acid Alanine has "S" absolute configuration?



d. none of above

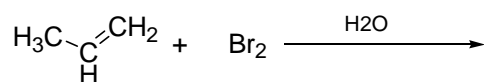
62. In case of trans-1,4-dimethyl cyclohexane, the two methyl group at 1<sup>st</sup> and 4<sup>th</sup> position of cyclohexane are at

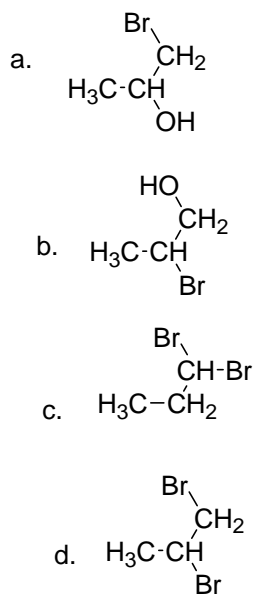
- a. axial position
- b. equatorial position
- c. one at axial and other at equatorial position
- d. none of above

63. The claisen rearrangement of allylphenyl ether is

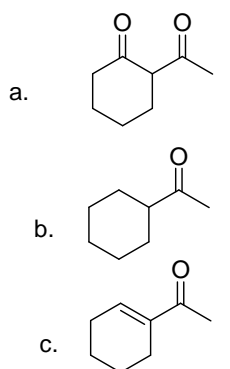
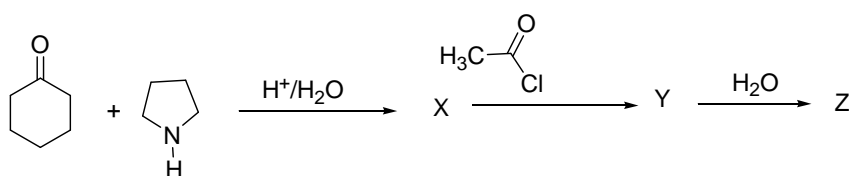
- a. [3,1] sigmatropic shift
- b. [1,3] sigmatropic shift
- c. [1,5] sigmatropic shift
- d. [3,3] sigmatropic shift

64. The product of the following reaction is





65. The end product (Z) of following reaction is



d. none of above

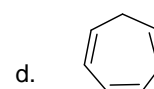
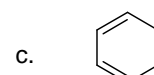
66. Allene exhibit optical isomerism due to the presence of

- Asymmetric carbon atom
- cumulated double bond
- conjugated double bond
- isolated double bond

67. Which of the following would react faster with N-bromosuccinimide?

- a. Benzene
- b. Toluene
- c. Methane
- d. Pyridine

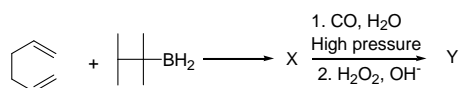
68. Which of the following is aromatic?




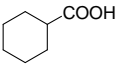
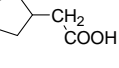

69. The nucleophilicity of different halide ions in polar aprotic solvent is

- a.  $F^- > Cl^- > Br^- > I^-$
- b.  $F^- < Cl^- < Br^- < I^-$
- c.  $F^- = Cl^- = Br^- > I^-$
- d.  $Cl^- > Br^- > I^- > F^-$

70. The product of the following reaction is



the Y is

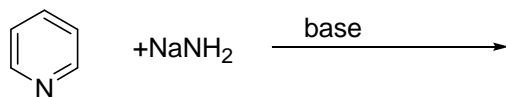
- a. 
- b. 
- c. 
- d. 

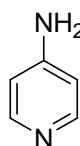
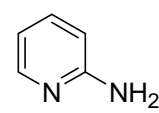
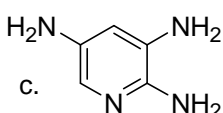
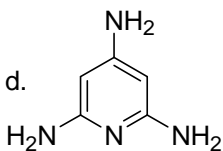
71. Paterno-Buchi reaction involves the cycloaddition reactions between

- a. Two different Alkene
- b. Two carbonyl compound

- c. Carbonyl group and Alkene
- d. carbonyl group and alkane

72. In chichibabin reaction given below the product of the reaction is

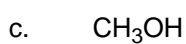
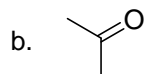
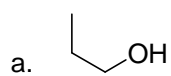
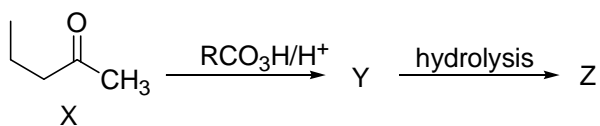


- a. 
- b. 
- c. 
- d. 

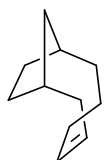
73.  $\alpha,\beta$ -unsaturated carbonyl compounds undergo a ring closure reaction with conjugate diene. The reaction is called as

- a. Hofmann Reaction
- b. Perkin reaction
- c. Diels-Alder Reaction
- d. cope rearrangement

74. The Baeyer viliger rearrangement of "X" gives the final product "Z"

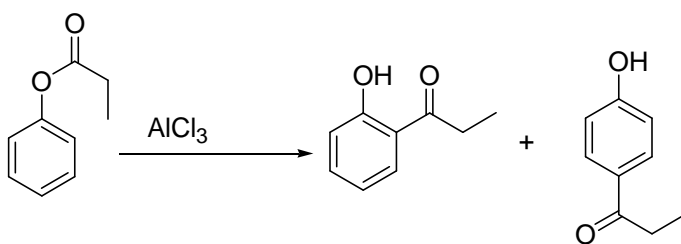


75. The IUPAC name of the following compound is



- Bicyclo[6.2.1]undec-3-ene
- Bicyclo[8.2.1]undec-3-ene
- Bicycle[2.2.1]dec-3-ene
- Tricyclo[5.2.2] hept-1-ene

76. The conversion shown below is an example of



- Friedel-crafts acylation
- Claisen rearrangement
- Fries rearrangement
- Reimer-Tiemann reaction

77. The most stable diene among the following is

- 1,2-butadiene
- 1,4-pentadiene
- 1,4-cyclohexadiene



d. 1,3-butadiene

78.  $\text{Eu(dpm)}_3$  and  $\text{Pr(fod)}_3$  are example of

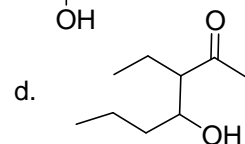
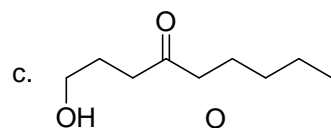
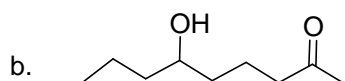
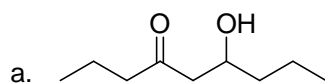
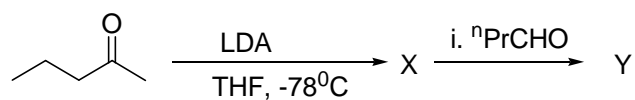
a. Complexing reagents

b. Precipitation reagent

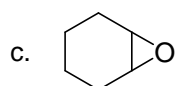
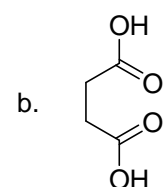
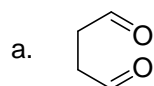
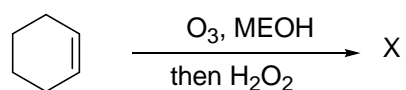
c. Buffer reagent

d. Shift reagent

79. Predict the product 'Y' in the following reaction?



80. The X in the following reaction is

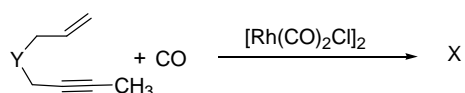


d. None of above

81.  $\text{OsO}_4$  is used for the dihydroxylation of the alkenes. The stereochemistry of two hydroxyl group are

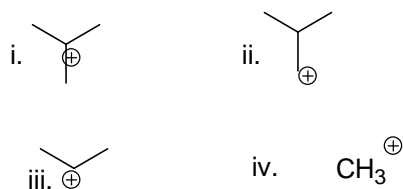
- a. vicinal and syn
- b. geminal and syn
- c. vicinal and anti
- d. none of above

82. Predict the "X" in following reaction ?



- a.
- b.
- c.
- d.

83. The order of stability of different alkyl carbocation is



- a.  $\text{I} > \text{iii} > \text{ii} > \text{iv}$
- b.  $\text{I} < \text{iii} < \text{ii} < \text{iv}$
- c.  $\text{iii} < \text{I} < \text{ii} < \text{iv}$
- d.  $\text{iv} < \text{iii} < \text{I} < \text{ii}$

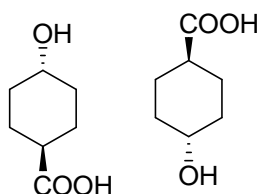
84. Which of the following is not an electrophile?

- a.  $\text{NH}_3$
- b.  $\text{Br}^+$
- c.  $\text{H}^+$
- d.  $\text{BF}_3$

85. In the  $^1\text{H-NMR}$  spectrum of toluene, the resonance due to  $\text{CH}_3$  is expected at

- a.  $\delta$  1.5
- b.  $\delta$  0.5
- c.  $\delta$  2.5
- d.  $\delta$  3.5

86. The compounds given below are



- a. Enantiomers
  - b. Identical
  - c. Regioisomer
  - d. Diastereomers
87. In Wittig reaction
- a. Alkenes are formed
  - b. Aldehyde are formed
  - c. Alkanes are formed
  - d. None of above
88. The electron spin resonance of  $\text{Cu}^{2+}$  has four lines. The nuclear spin of Cu is
- a.  $\frac{1}{2}$
  - b.  $\frac{3}{2}$
  - c. 1
  - d. 4
89. The major products formed in the nitration(  $\text{HNO}_3/\text{H}_2\text{SO}_4$ ) of aniline and acetanilide are
- a. *o*-nitroaniline and *o*-nitroacetanilide
  - b. *p*-nitroaniline and *p*-nitroacetanilide
  - c. *m*-nitroaniline and *m*-nitroacetanilide
  - d. *m*-nitroaniline and *p*-nitroacetanilide`
90. Which of the following is polar aprotic solvent

- a. carbon tetrachloride
- b. Toluene
- c. hexane
- d. N,N-dimethylformamide