

A

18204

120 MINUTES

- The ground state energy of a particle in a 1D box of length 1\AA is 0.6032×10^{-17} J. The energy gap between first and the second energy level is
A) 6.032×10^{-17} J B) 1.8095×10^{-17} J
C) 0.2528×10^{-17} J D) 0.6032×10^{-17} J
- The commutator $[\hat{L}_x, \hat{L}_y]$ is equal to
A) $i\hbar \hat{L}_z$ B) $i\hbar \hat{L}_z$ C) $-i\hbar \hat{L}_z$ D) $-i\hbar \hat{L}_z$
- The value of the spherical harmonics $Y_{1,0}(\theta, \phi)$ is
A) $\sqrt{\frac{3}{4\pi}} \sin \theta$ B) $\sqrt{\frac{3}{4\pi}} \cos \theta$
C) $\sqrt{\frac{3}{4\pi}} \sin \theta \cos \phi$ D) $\sqrt{\frac{3}{4\pi}} \sin \theta \sin \phi$
- The Huckel theory secular determinant equation for cyclobutadiene is
A)
$$\begin{vmatrix} x & 1 & 0 & 1 \\ 1 & x & 1 & 0 \\ 0 & 1 & x & 1 \\ 1 & 0 & 1 & x \end{vmatrix} = 0$$
 B)
$$\begin{vmatrix} x & 0 & 1 & 1 \\ 1 & x & 0 & 1 \\ 1 & 0 & x & 1 \\ 1 & 1 & 0 & x \end{vmatrix} = 0$$

C)
$$\begin{vmatrix} x & 1 & 0 & 0 \\ 1 & x & 1 & 0 \\ 0 & 1 & x & 1 \\ 0 & 0 & 1 & x \end{vmatrix} = 0$$
 D)
$$\begin{vmatrix} x & 0 & 0 & 1 \\ 1 & x & 1 & 0 \\ 0 & 1 & x & 1 \\ 1 & 0 & 0 & x \end{vmatrix} = 0$$
- The delocalisation energy of benzene according to Huckel M O method is
A) 0.48β B) 2.0β C) 4.0β D) 4.472β
- The number of fundamental vibrational modes of CO_2 appearing common both in its IR and Raman spectra are:
A) four B) three C) two D) zero

15. Match list I to list II and select the correct answer from the options given below.

List I

List II

- | | |
|---|---------------|
| a) $\left(\frac{\partial E}{\partial T}\right)_V$ | 1. V |
| b) $\left(\frac{\partial T}{\partial P}\right)_H$ | 2. C_v |
| c) $\left(\frac{\partial G}{\partial P}\right)_T$ | 3. μ_{JT} |
| d) $\left(\frac{\partial G}{\partial T}\right)_p$ | 4. $-S$ |

- | | |
|-----------------------|-----------------------|
| A) a-4, b-1, c-3, d-2 | B) a-2, b-3, c-1, d-4 |
| C) a-4, b-2, c-3, d-1 | D) a-3, b-2, c-1, d-4 |

16. The residual entropy of solid CO at absolute zero of temperature is

- | | |
|--|--|
| A) $2.50 \text{ JK}^{-1}\text{mol}^{-1}$ | B) $5.76 \text{ JK}^{-1}\text{mol}^{-1}$ |
| C) $5.76 \text{ K}^{-1}\text{mol}^{-1}$ | D) $3.76 \text{ JK}^{-1}\text{mol}^{-1}$ |

17. For an ideal binary mixture

- | |
|---|
| A) $\Delta V_{mix} = 0, \Delta H_{mix} = 0, \Delta S_{mix} = 0, \Delta G_{mix} = 0$ |
| B) $\Delta V_{mix} = 0, \Delta H_{mix} = 0, \Delta S_{mix} = +ve, \Delta G_{mix} = +ve$ |
| C) $\Delta V_{mix} = 0, \Delta H_{mix} = 0, \Delta S_{mix} = +ve, \Delta G_{mix} = -ve$ |
| D) $\Delta V_{mix} = -ve, \Delta H_{mix} = 0, \Delta S_{mix} = 0, \Delta G_{mix} = -ve$ |

18. For an adiabatic reversible expansion

- | | |
|---------------------------------------|---------------------------------------|
| A) $(T_1/T_2) = (V_2/V_1)^{\gamma-1}$ | B) $(T_1/T_2) = (V_2/V_1)^{1-\gamma}$ |
| C) $(T_2/T_1)^{\gamma-1} = (P_2/P_1)$ | D) $(T_1/T_2) = (P_2/P_1)^\gamma$ |

19. The ionic strength of a solution which is 0.2 molal in CaCl_2 and 0.1 molal NaCl is

- | | | | |
|--------|--------|--------|--------|
| A) 0.6 | B) 1.2 | C) 1.4 | D) 0.7 |
|--------|--------|--------|--------|

20. Potassium chloride is commonly used for preparing salt bridge. This is because

- | |
|--|
| A) Both the cation and anion have same activity. |
| B) The cation and anion are isoelectronic. |
| C) It is a 1:1 electrolyte. |
| D) The transference numbers of cation and anion are nearly same. |

21. All spontaneous adsorption processes are

- | |
|---|
| A) highly exothermic and there is a decrease in entropy |
| B) highly endothermic and there is a decrease in entropy |
| C) highly exothermic and there is an increase in entropy |
| D) highly endothermic and there is an increase in entropy |

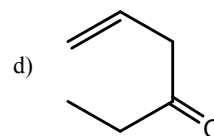
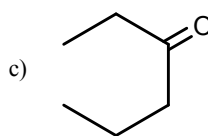
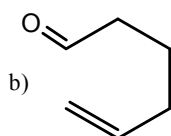
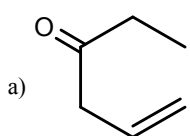
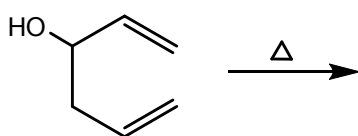
30. The emf of Daniel cell can be increased by increasing
 A) The surface area of Cu electrode
 B) The surface area of Zn electrode
 C) The concentration of Cu^{2+} solution
 D) The concentration of Zn^{2+} solution
31. Which is the incorrect statement?
 A) For solutions show +ve deviation from Raoult's law, $P_B > x_B P_B^0$
 B) For solutions show -ve deviation from Raoult's law, $P_B < x_B P_B^0$
 C) For solutions show +ve deviation from Raoult's law, $P_B < x_B P_B^0$
 D) For solutions obey Raoult's law, $P_B = x_B P_B^0$
32. The emf of the cell $\text{Ag(s)}/\text{Ag}^+(\text{aq}, 0.1\text{M})//\text{Ag}^+(\text{aq}, 0.01\text{M})/\text{Ag(s)}$ at 25°C is
 A) $+0.591\text{V}$ B) $+0.0591\text{V}$ C) -0.0591V D) -0.591V
33. The rate expression for the reaction $2\text{NO}(\text{g}) + 2\text{H}_2(\text{g}) \rightarrow \text{N}_2(\text{g}) + 2\text{H}_2\text{O}(\text{g})$ is given by $r = k[\text{NO}]^2[\text{H}_2]$. When $[\text{NO}]$ is doubled and $[\text{H}_2]$ is halved, the rate of the reaction is:
 A) doubled B) remain unchanged
 C) increased by four times D) increased by three times.
34. For a first order reaction a plot of $\ln k$ versus $1/T$ has slope -4157 . Energy of activation will be
 A) $-79.6 \text{ kJ mol}^{-1}$ B) $-34.5 \text{ kJ mol}^{-1}$
 C) $+34.5 \text{ kJ mol}^{-1}$ D) $+79.6 \text{ kJ mol}^{-1}$
35. Maxwell Boltzmann statistics is applicable for
 A) ideal gas B) protons C) photons D) electrons
36. Microcanonical ensembles are characterised by same
 A) N, V, E B) N, V, T C) N, T, μ D) N, V, μ
37. Maximum number of phases that can be coexist in a one component system is
 A) 1 B) 2 C) 3 D) 4
38. Total number of Bravais lattices, point groups and space groups in crystals are:
 A) 14, 32 and 230 B) 14, 32 and 232
 C) 14, 30 and 232 D) 7, 32 and 232
39. The molar mass of macromolecule determined by osmometry is
 A) \bar{M}_v B) \bar{M}_n C) \bar{M}_w D) \bar{M}_v and \bar{M}_n
40. The protons in acetone molecule appeared in an NMR spectrum recorded on a 60 MHz instrument at 120 Hz. At what frequency would it appear if it were recorded on 400 MHz instrument?
 A) 120 Hz B) 400 Hz C) 800 Hz D) 600 Hz

41. The electron gain enthalpy of halogens are in the order
 A) $F > Cl > Br > I$ B) $F > Br > Cl > I$
 C) $Cl > F > Br > I$ D) $Cl > Br > F > I$
42. Which is the smallest cation among the following?
 A) Fe^{2+} B) Fe^{3+} C) Na^+ D) Li^+
43. The faint pink colour of aqueous solution of Mn^{2+} ion is due to
 A) spin allowed d-d transition
 B) Laporte allowed d-d transition
 C) Ligand to metal charge transfer
 D) Laporte and spin forbidden d-d transition
44. Choose the correct statement given below
 A) Mn_3O_4 is inverse spinel B) Co_3O_4 is normal spinel
 C) Fe_3O_4 is normal spinel D) None of these
45. Among the hydrogen halides, which is the most powerful reducing agent?
 A) HCl B) HBr C) HF D) HI
46. The shapes of I_3^- , XeF_4 , ClF_3 and SF_4 are respectively
 A) Linear, square planar, T-shaped and see-saw
 B) V-shaped, square pyramid, T-shaped and see-saw
 C) Linear, pentagonal, T-shaped and see-saw
 D) Linear, square pyramid, T-shaped and tetrahedral
47. The unfavorable factor for the use of hydrogen as a fuel at room temperature and pressure is its
 A) Low enthalpy of combustion
 B) Low specific enthalpy
 C) Low enthalpy density
 D) High production cost
48. STYX number for B_2H_6 is
 A) 2002 B) 4112 C) 4002 D) 4102
49. The structure of polyhedron of the carborane cluster $C_2B_4H_6$ based on Wades rule is
 A) Arachno B) Nido C) Closo D) Hypo
50. Which of the following statements is not true for Zeise's salt?
 A) Pt is four coordinated.
 B) Ethylene molecule retains its original planarity in the complex.
 C) The hybridisation of Pt is dsp^2 .
 D) The hapticity of ethylene is two.

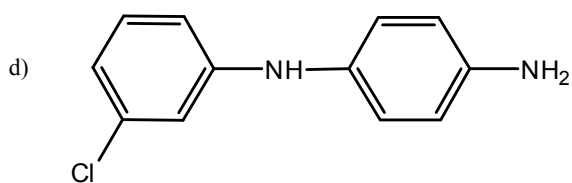
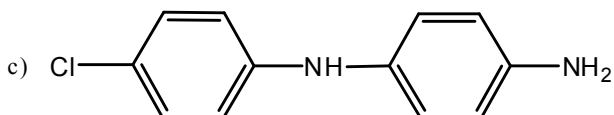
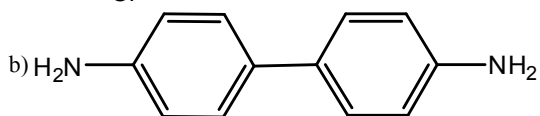
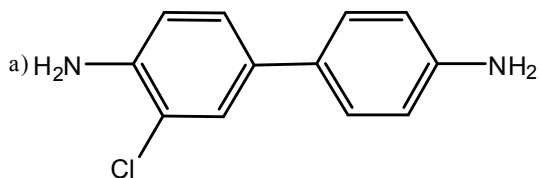
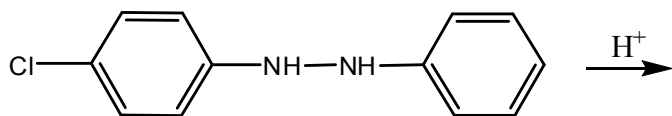
51. Metal ions capable of forming double bonds with oxygen are
 A) Cr(III), Os(VIII), Mn(III) B) Cr(III), Os(VI), Mn(II)
 C) Cr(III), Os(VIII), Mn(II) D) Cr(VI), Os(VIII), Mn(VII)
52. The d-orbitals on the Re atoms suitable for making delta bond in $[\text{Re}_2\text{Cl}_8]^{2-}$ is
 A) d_{xy} B) d_{yz} C) d_{xz} D) $d_{(x^2-y^2)}$
53. Number of Cu-O bonds present in $\text{Cu}(\text{CH}_3\text{COO})_2 \cdot 2\text{H}_2\text{O}$ is
 A) 6 B) 8 C) 10 D) 4
54. The hapticities shown by C_5H_5 rings in the molecule $\text{Ti}(\text{C}_5\text{H}_5)_4$ is/are:
 A) 1 only B) 1 & 5 C) 2 & 5 D) 5 only
55. The catalyst used for the conversion of ethylene to acetaldehyde is
 A) Wilkinson catalyst B) $\text{PdCl}_2/\text{CuCl}_2$
 C) $\text{Al}(\text{Et})_3/\text{TiCl}_4$ D) $\text{Co}_2(\text{CO})_8$
56. The terms derived from d^2 configuration are:
 A) $^3\text{D}, ^3\text{P}, ^1\text{D}, ^1\text{P}, ^1\text{S}$ B) $^3\text{F}, ^3\text{P}, ^1\text{G}, ^1\text{D}, ^1\text{S}$
 C) $^3\text{P}, ^3\text{F}, ^1\text{G}, ^1\text{D}, ^3\text{S}$ D) $^3\text{F}, ^3\text{P}, ^3\text{G}, ^1\text{D}, ^1\text{S}$
57. The metals present in nitrogenise:
 A) Cu and Zn B) Cu and Ni C) Ni and Co D) Fe and Mo
58. Which one is Vaska's complex?
 A) $[\text{Co}(\text{PPh}_3)_2\text{COCl}]$ B) $\text{trans}-[\text{Ir}(\text{PPh}_3)_2(\text{CO})\text{Cl}]$
 C) $\text{cis}-[\text{Ir}(\text{PPh}_3)_2(\text{CO})\text{Cl}]$ D) $[\text{Ir}(\text{C}_2\text{H}_4)_2\text{COCl}]$
59. Which ligand would create the largest d-orbital splitting to a given 3d metal ion in an octahedral field?
 A) N-nitrito B) Ethylenediamine
 C) Acetylacetonato D) Carbonyl
60. The correct order of d-orbital splitting in a square planar field is
 A) $(dxz = dyz) < dz^2 < dxy < dx^2-y^2$
 B) $dz^2 < (dxz = dyz) < dx^2-y^2 < dxy$
 C) $dz^2 < dx^2-y^2 < (dxz = dyz) < dxy$
 D) $dz^2 < dx^2-y^2 < dxy < (dxz = dyz)$
61. The reaction, $[\text{RhCl}(\text{PPh}_3)_3] + \text{H}_2 \longrightarrow [\text{RhCl}(\text{PPh}_3)_3(\text{H})_2]$ is
 A) oxidative addition B) reductive elimination
 C) insertion D) beta elimination
62. The process of precipitating of two slightly soluble compounds containing same cation or anion from the solution is known as:
 A) fractional precipitation B) post precipitation
 C) co-precipitation D) homogeneous precipitation

63. Elemental boron can be purified by
 A) Zone refining B) Van Arkel process
 C) Electrolytic process D) Thermite process
64. The strength of H_2SO_4 , HClO_4 and HCl in glacial acetic acid are in the order
 A) $\text{H}_2\text{SO}_4 > \text{HClO}_4 > \text{HCl}$ B) $\text{HCl} > \text{HClO}_4 > \text{H}_2\text{SO}_4$
 C) $\text{H}_2\text{SO}_4 > \text{HCl} > \text{HClO}_4$ D) $\text{HClO}_4 > \text{H}_2\text{SO}_4 > \text{HCl}$
65. Zintl ions among the following are:
 1) PF_6^- 2) Sn_9^{4-} 3) AsBi^{5+} 4) Sb_7^{3-}
 A) 1, 2, 3 B) 1, 2, 4 C) 2, 3, 4 D) 2 & 4
66. Which of the following compound is ESR active?
 A) KMnO_4 B) $\text{K}_2\text{Cr}_2\text{O}_7$
 C) $\text{Cu}_2(\text{CN})_2$ D) $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$
67. The role of carbonic anhydrase enzyme is to
 A) regulate pH and CO_2 formation
 B) oxidise ascorbic acid
 C) help in digesting proteins
 D) transport oxygen in higher animals.
68. The complex ion $[\text{Co}(\text{en})_2\text{Cl}_2]^+$ exhibit
 A) optical isomerism only
 B) optical isomerism and geometrical isomerism
 C) geometrical isomerism only
 D) neither optical nor geometrical isomerism.
69. Match the following from List I (fuels) with List II (composition)
- | <u>List I</u> | | <u>List II</u> | |
|---------------|--------------|----------------|--|
| a) | water gas | 1) | $\text{CO} + \text{N}_2$ |
| b) | Producer gas | 2) | $\text{CO} + \text{H}_2$ |
| c) | Coal gas | 3) | CH_4 |
| d) | Marsh gas | 4) | $\text{CO} + \text{H}_2 + \text{CH}_4 + \text{CO}_2$ |
- A) a-1, b-2, c-3, d-4 B) a-2, b-1, c- 3, d-4
 C) a-1, b-2, c-4, d-3 D) a-2, b-1, c-4, d-3
70. The metal ion and the macrocyclic ring present in met-haemoglobin is
 A) Fe (II) and corrin B) Co(II) and corrin
 C) Fe(II) and porphyrin D) Fe(III) and porphyrin
71. Number of hyper fine ESR signals for $[\text{Mn}(\text{H}_2\text{O})_2]^{2+}$ ($I_{\text{Mn}}=5/2$).
 A) 5 B) 36 C) 15 d) 30

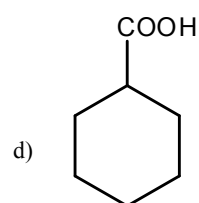
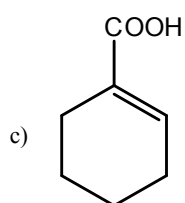
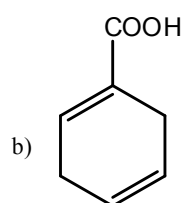
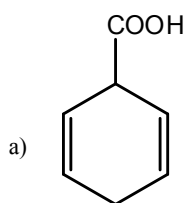
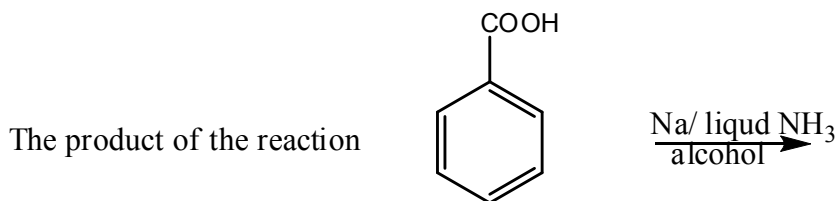
81. Number of oxygen atoms shared in the structures of chain and cyclic silicates are
 A) 1 and 2 respectively B) 2 and 1 respectively
 C) 2 and 2 respectively D) 2 and 3 respectively
82. An unknown alkyl halide reacts with alcoholic potash followed by ozonolysis yields propanal and methanal as products. The alkyl halide is
 A) 1-bromobutane B) 2-bromobutane
 C) 1, 2-dibromobutane D) 1,4-dibromobutane
83. 18- annulene is aromatic. The number of protons in the shielded region is
 A) 18 B) 12 C) 6 D) 10
84. Which is not true for reversed phase HPLC?
 A) The stationary phase is non-polar
 B) Starting eluent is polar and the eluent polarity is gradually decreased.
 C) The most polar component will come out first.
 D) Only polar eluent is used always
85. The best method for the separation of o- and p-nitrophenols mixture is
 A) Steam distillation
 B) Simple distillation
 C) Distillation under reduced pressure
 D) Fractional distillation
86. The correct order of polarity of solvents is
 A) $C_6H_{14} < C_6H_6 < CH_2Cl_2 < CH_3Cl < EtOAc < EtOH < AcOH$
 B) $C_6H_{14} < C_6H_6 < CH_3Cl < CH_2Cl_2 < EtOAc < EtOH < AcOH$
 C) $C_6H_{14} < C_6H_6 < CH_2Cl_2 < CH_3Cl < EtOH < EtOAc < AcOH$
 D) $C_6H_{14} < C_6H_6 < CH_3Cl < CH_2Cl_2 < EtOH < EtOAc < AcOH$
87. What would be the product of the reaction?



88. In the following rearrangement reaction, the final product is



89.

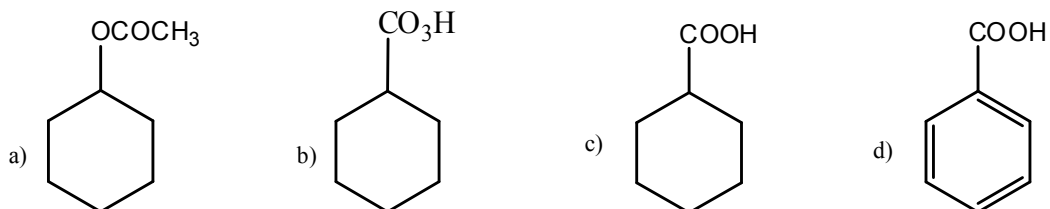
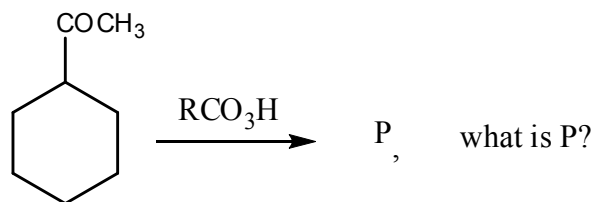


90. The reaction involved in the transformation of cyclohexanoneoxime to caprolactum is

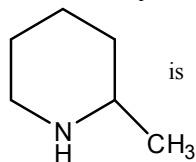
- A) Beckmann rearrangement
- B) Demjanov rearrangement
- C) Wagner-Meerwein rearrangement
- D) Favorski rearrangement

91.

In the reaction



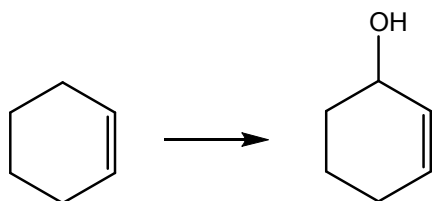
92. The unsaturated hydrocarbon formed at the end of Hoffmann exhaustive methylation of



93. The product formed in the reduction of naphthalene in the presence of Ni is

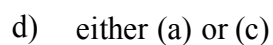
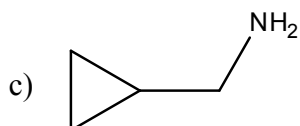
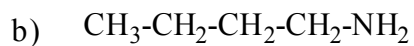
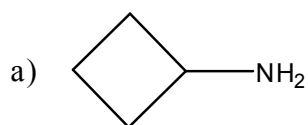
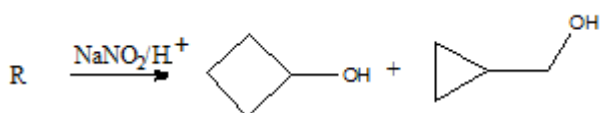
- A) cis-decalin B) trans-decalin
 C) 1,4-dihydro naphthalene D) 1,2,3,4-tetrahydronaphthalene

94. Suggest a suitable reagent for the transformation

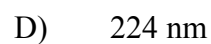
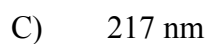
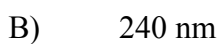
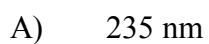
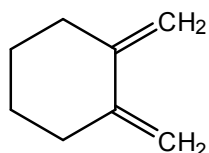


- A) MnO_2 B) OsO_4
 C) $\text{H}_2\text{O}_2/\text{OH}^-$ D) SeO_2/AcOH

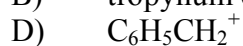
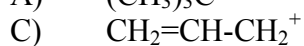
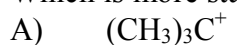
95. The reactant R in the following reaction is



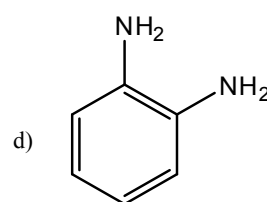
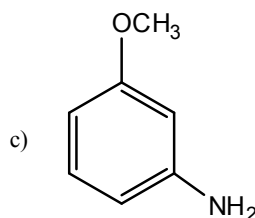
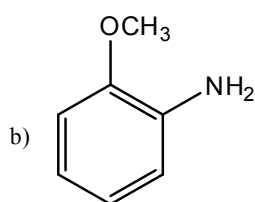
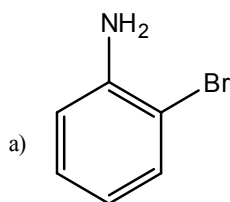
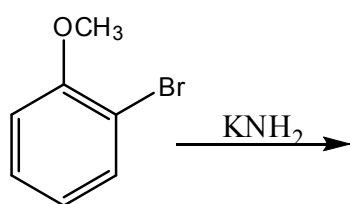
96. The λ_{max} calculated for the following molecule by applying Woodward-Fieser rule is



97. Which is more stable?



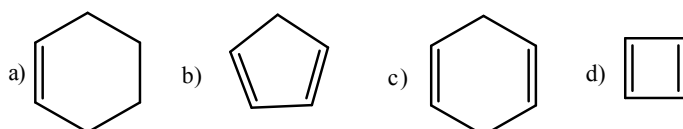
98. The major product of the reaction is



99. Match the IR frequencies from group II with the carbonyl compounds from group I .

<u>Group I</u>		<u>Group II</u>	
a)	2-cyclohexenone	1)	1780cm ⁻¹
b)	Cyclohexanone	2)	1750cm ⁻¹
c)	Cyclobutanone	3)	1680cm ⁻¹
d)	Cyclopentanone	4)	1710cm ⁻¹
A) a-3, b-4, c-1, d-2		B) a-3, b-2, c-1, d-4	
C) a-4, b-1, c-3, d-2		D) a-2, b-1, c-3, d-4	

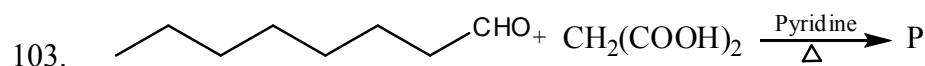
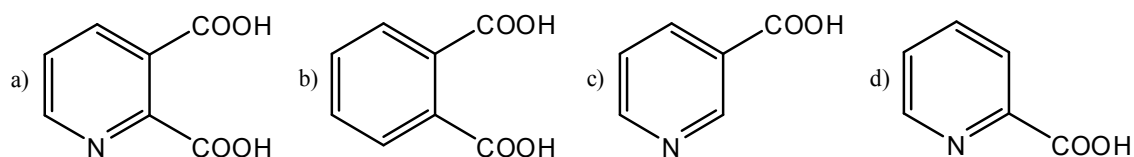
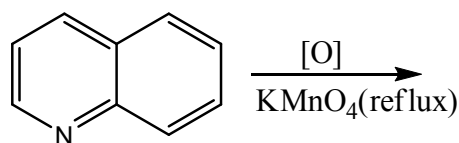
100. Which is more acidic?



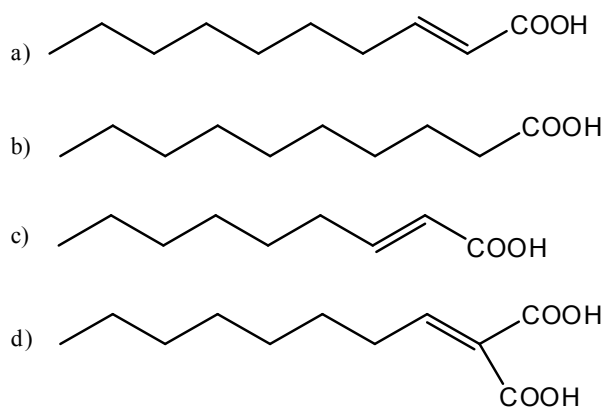
101. Which one of the following shows highest dipole moment?

- A) 1,3-dichlorobenzene B) 1,3,5-trichlorobenzene
 C) 1,4-dichlorobenzene D) 1,2-dichlorobenzene

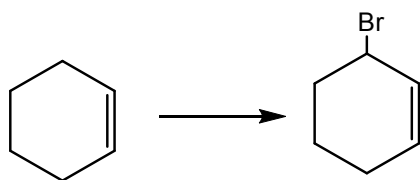
102. What would be the product of the following reaction?



What is P?

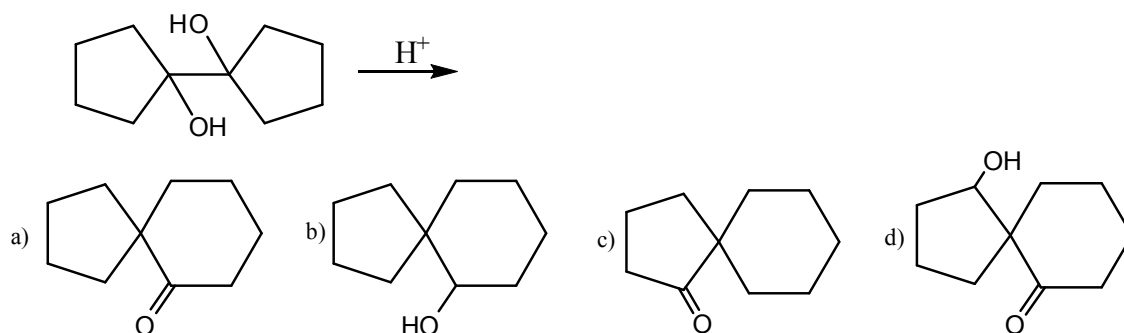


104. Which are the amino acids containing sulphur?
 A) Proline and cysteine B) Tryptophan and methionine
 C) Serine and cysteine D) Cysteine and methionine
105. The compound that can be synthesised by Kolbe Schmidt reaction is
 A) 2-hydroxybenzene carboxylic acid
 B) 2-acetyl benzenecarboxylic acid
 C) Phenyl ethanoic acid
 D) 2-aminobenzene carboxylic acid
106. The product of crossed Cannizzaro reaction between C_6H_5CHO and $HCHO$
 A) Formic acid and benzyl alcohol
 B) Benzoic acid and methanol
 C) Methyl benzoate
 D) benzyl formate
107. Which of the following molecule consume two molecules of ethyl magnesium bromide?
 A) $HC \equiv C - CH_3$ B) $HC \equiv C - CH_2 - OH$
 C) $HO - H_2C - H_2C - OH$ D) Both B and C
108. Solvent suitable for carrying out microwave assisted organic synthesis is
 A) Benzene B) p-xylene
 C) cyclohexane D) ethylene glycol
109. Find the reagent suitable for the conversion

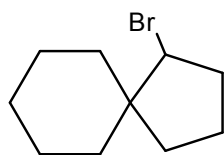


- A) Br_2 in CCl_4 B) Br_2 / red phosphorous
 C) HBr/H_2O_2 D) NBS/AIBN

110. Predict the product of the following reaction.



111. Give the IUPAC name of the following compound.

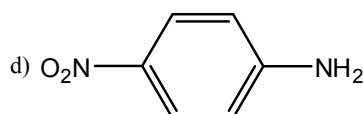
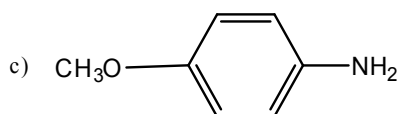
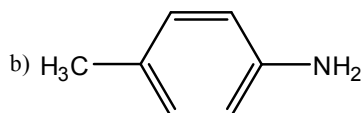
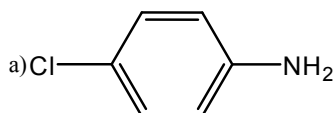


- A) 1-bromospiro[5,4] decane B) 1-bromospiro[4,5]decane
C) 2-bromospiro[4,5]decane D) 2-bromospiro[5,4]decane

112. The more stable confirmation of cis-1, 2-dimethyl cyclohexane

- A) Both group equatorial
B) Both axial
C) One axial and one equatorial
D) Twist boat conformation

113. Which is the weakest base among the following?



114. The reagent used for the separation of primary, secondary and tertiary amines from a mixture is

- A) Benzenesulphonylchloride
B) o-toluene sulphonylchloride
C) Thionyl chloride
D) Tosyl chloride

115. D-Glucose and D-mannose are related as

- A) Anomers B) Epimers
C) Enantiomers D) Homomers

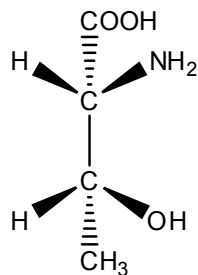
116. Cis-trans isomerism is shown by

- A) Cyclohexene B) 1,2-dibromocyclohexane
C) 1-butene D) 2,3-dimethyl butane

117. The intermediate formed in Reimer-Tiemann reaction is

- A) Carbonium ion B) Carbanion
C) Carbene D) Dichlorocarbene

118. Absolute configuration of carbon atoms 2 and 3 are



- A) 2S, 3S B) 2S, 3R C) 2R, 3S D) 2R, 3R

119. The chief product in the Ziegler-Natta catalysed polymerisation of propylene is

- A) isotactic polypropylene
B) syndiotactic polypropylene
C) atactic polypropylene
D) mixture of syndiotactic and atactic polypropylenes.

120. Dacron is a copolymer formed by the condensation of

- A) phenol & formaldehyde
B) adipic acid & hexamethylenetetramine
C) ethylene glycol and terephthalic acid
D) urea & formaldehyde
-