C.S.E.

CHEMISTRY – 2005

(PRELIMINARY)

Time Allowed : Two Hours *Maximum Marks : 300*

1. **Consider the following statements about alkynes :**

   1. Acetylene is a linear molecule, all four atoms lying along a single straight line
   2. Hydration of acetylene in the presence of acid and $HgSO_4$ yields acetaldehyde.
   3. Non-terminal alkynes form a precipitate when reacted with a solution of silver nitrate in alcohol
   4. Hydrogenation of alkynes over Lindlar catalyst yields almost exclusively the *cis*-alkene.

   Which of the statements given above are correct ?

   (a) 2, 3 and 4 (b) 1, 2 and 4

   (c) 3 and 4 (d) 1 and 3

2. $R\,Mg\,X \xrightarrow[(ii)\ R' - X]{(i)\ Cu\ X} R - R'$

   What is the reaction given above called ?

   (a) Wurtz synthesis (b) Corey-House synthesis

   (c) Sabatier synthesis (d) Williamson's synthesis

3. **Match List I *(Name of the reaction)* with List II *(Intermediate)* and select the correct answer using the codes given below :**

List I	List II
A. Sandmeyer	1. Carbanion
B. Friedel-Crafts	2. Carbene
C. Claisen condensation	3. Carbonium ion
D. Reimer-Tiemann	4. Free radical

	A	B	C	D
(a)	4	2	1	3
(c)	4	3	1	2

	A	B	C	D
(b)	1	3	4	2
(d)	1	2	4	3

4. **Among the following, which is the least stable carbanion ?**

(a) $C_6H_5\overset{\ominus}{C}H_2$ (b) $(CH_3)_3\overset{\ominus}{C}$

(c) $\overset{\ominus}{C}Cl_3$ (d) $\overset{\ominus}{C}H_3$

5. **Consider the following statements about methylene :**

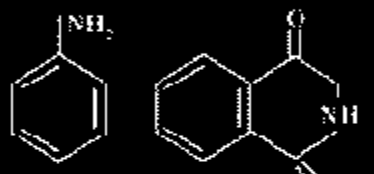
1. Methylene is formed by the photolysis of diazomethane.
2. Methylene can exist in two different forms, the singlet and triplet states.
3. Singlet methylene is a diradical and is stabler than the triplet state.
4. When methylene is generated in the presence of alkenes cyclopropanes are formed.

Which of the statements given above are correct ?

(a) 1, 2 and 4 (b) 1, 2 and 3

(c) 3 and 4 (d) 1, 3 and 4

6. **Consider the following compounds :**



I II

(III) NH_2CONH_2 (IV) CH_3CONH_2

Which one of the following represents correctly the decreasing order of basicity of the above compounds ?

(a) II > I > IV > III (b) III > IV > I > II

(c) II > IV > I > III (d) III > I > IV > II

7. **Alcohols are less volatile than ethers having the same molecular formula. What is the reason for this ?**

(a) Ethers have dipolar character

(b) Alcohols have resonance structures

(c) Inter-molecular hydrogen bonding is present in ethers

(d) Inter-molecular hydrogen bonding is present in alcohols

8. **Which one of the following molecules has the highest dipole moment ?**

(a) CH_3Cl (b) CH_2Cl_2

(c) $CHCl_3$ (d) CCl_4

9. **In which one of the following pairs, molecules/ions have similar shape ?**

(a) CO_2 and H_2O (b) BF_3 & t-butyl carbonium ion

(c) CCl_4 and $PtCl_4$ (d) NH_3 and BF_3

10. **For an octahedral complex, which of the following d-electron configurations will give maximum crystal-field stabilization energy ?**

(a) High-spin d^6 (b) Low-spin d^4

(c) Low-spin d^5 (d) High-spin d^7

11. **Which one among the following is a paramagnetic complex ?**

(a) $K_3[Ni(CN)_4]$ (b) $[Ni(H_2O)_4(CO)_2]$

(c) $[Co(NH_3)_6]Cl_3$ (d) $[Pt(NH_3)_4]Cl_2$

12. **Which one of the following does not obey EAN rule ?**

(a) $Fe(CO)_5$ (b) $Ni(CO)_6$

(c) $K_4Fe(CN)_6$ (d) $Mn_2(CO)_{10}$

13. **The coordination compound *cis*-platin, *cis*-$Pt(NH_3)_2Cl_2$ is a medicine for treatment of which one of the following ?**

(a) Malaria (b) Cancer

(c) Anemia (d) Diabetes

14. **Which one among the following exhibits optical isomerism ? (en = $H_2N-CH_2-CH_2-NH_2$)**

(a) *cis*-$[Co(NH_3)_4Cl_2]Cl$ (b) *trans*-$[Co(NH_3)_4Cl_2]Cl$

(c) *cis*-$[Co(en)_2Cl_2]Cl$ (d) *trans*-$[Co(en)_2Cl_2]Cl$

15. **The initial rate r_0 of a certain reaction depends on the initial concentrations of species A, B and C as shown in the table (concentration in mM and r_0 in mM s^{-1}) :**

$[A]_0$	1.00	1.00	2.00	1.00
$[B]_0$	1.00	2.00	2.00	1.00
$[C]_0$	100	100	100	400
$[D]_0$	1.0	2.0	4.0	025

What are the orders of the reaction with respect to A, B and C respectively ?

(a) 1, 2 and –1 (b) 1, 2 and 1

(c) 2, 2 and –1 (d) 1, 1 and –1

16. **Match List I *(Character of Reaction)* with List II *(Order)* and select the correct answer using the codes given below :**

List I	List II
A. Reaction with identical rate and rate constant	1. Zero
B. Reaction rate doubles on increasing concentration four times	2. First
C. Half life period is inversely proportional to initial concentration	3. Second
D. Half life period is independent of concentration	4. Half

	A	B	C	D		A	B	C	D
(a)	1	4	3	2	(b)	3	2	1	4
(c)	1	2	3	4	(d)	3	4	1	2

17. **By what factor is $t_{1/2}$ of a second order reaction related to $t_{1/2}$ of the reaction ?**

(a) 1 (b) 2

(c) 3 (d) 4

18. **The mechanism for photo chemical decomposition of HI into H_2 and I_2 is**

1. $HI + h\upsilon \rightarrow \dot{H} + \dot{I}$ 2. $\dot{H} + HI \rightarrow H_2 + \dot{I}$

3. $\dot{I} + \dot{I} \rightarrow I_2$

What is the overall quantum yield of the reaction ?

(a) 0.5 (b) 1
(c) 2 (d) 4

19. **For which one of the following processes is inter system crossing (ISC) essential ?**
(a) Fluorescence (b) Phosphorescence
(c) Chemiluminescence (d) Radioactive decay

20. **Consider the following photochemical reactions :**

$H_2 + Cl_2 \xrightarrow[4000\,Å]{h\nu} 2HCl$ and

$H_2 + Br_2 \xrightarrow[5100\,Å]{h\nu} 2HBr$

These reactions are examples of which of the following ?
(a) Reactions of low and high quantum yields respectively
(b) Reactions of high and low quantum yields respectively
(c) Reactions with quantum yields equal to one
(d) Reactions with equal quantum yields but not equal to one

21. **Which one of the following statements is correct ?**
Peptization is a process of
(a) precipitation of colloidal particles
(b) purification of colloids
(c) dispersing precipitates into colloidal solution
(d) protection of colloidal solutions

22. **Which among the following are true for lyophilic sols ?**
1. Surface tension is lower than that of the medium.
2. Viscosity is higher than that of the medium.
3. Coagulation is reversible.

Select the correct answer using the code given below :
(a) 1 and 2 (b) 1 and 3
(c) 2 and 3 (d) 1, 2 and 3

Directions : The following **8 (Eight)** items consist of two statements.

ore labelled as the 'Assertion (A)' and the other as 'Reason (R)'. You are to examine these two statements carefully and select the answers to these items using the code given below :

(a) Both A and R are individually true and R is the correct explanation of A

(b) Both A and R are individually true but R is ***not*** the correct explanation of A

(c) A is true but R is false

(d) A is false but R is true

23. **Assertion (A)** : The atomic & ionic sizes of lanthanides decrease with increase of atomic number

Reason (R) : Successive addition of electrons into 4f orbital provides strong screening effect.

24. **Assertion (A)** : Inter-electronic repulsion between bond pair-bond pair, bond pair-lone pair and lone pair-lone pair in a molecule follows the order bond pair-bond pair < bond pair-lone pair < lone pair-lone pair.

Reason (R) : Bond pair electrons are confined in between two nuclei whereas lone pair electrons are attached with only one nucleus and occupy more space.

25. **Assertion (A)** : FeF_6^{3-} is colourless.

Reason (R) : This is because no spin-allowed transitions are possible in Fe^{3+} (high spin)

26. **Assertion (A)** : cis-1,3-dimethylcyclohexane is achiral in its chair conformation.

Reason (R) : It has plane of symmetry passing through carbon-1 and carbon-4

27. **Assertion (A)** : The hydrogens of the $-CH_2-$ group of 1, 3 cyclopentadiene are acidic and this hydrocarbon is nearly 10^{20} times more acidic

than ordinary alkanes.

Reason (R) : In cyclopentadienyl anion, all five carbons are equivalent as demonstrated by labelling experiments.

28. **Assertion (A)** : The viscosity of an ideal gas is independent of pressure at constant temperature.

Reason (R) : As the pressure is increased, the effect of the increase in number density of molecules is compensated by a proportionate decrease in the mean free path.

29. **Assertion (A)** : The addition of a small amount of a 'neutral' electrolyte (one that does not share a common ion) such as NaCl to a dilute solution of acetic acid, will cause an increase in the degree of dissociation of the acid.

Reason (R) : Due to the increased ionic strength, the mean ionic activity coefficient of H_3O^+ and CH_3COO^- will increase.

30. **Assertion (A)** : In a catalytic reaction, the energy of activation is reduced in comparison to the uncatalysed one.

Reason (R) : The catalyst affects the reaction equilibrium constant.

31. **In the proton NMR spectrum of $CH_3OCHClCH_2Cl$, which one of the following correctly describes the multiplicities of methyl, methylene and methine proton signals?**

	Methyl	*Methylene*	*Methine*
(a)	Triplet	Doublet	Singlet
(b)	Triplet	Singlet	Doublet
(c)	Singlet	Triplet	Singlet
(d)	Singlet	Doublet	Triplet

32. **At which pressure and temperature conditions is the behaviour**

of a real gas closest to that of an ideal gas ?

(a) 15 atmosphere and 200 k

(b) 1 atmosphere and 273 k

(c) 0.5 atmosphere and 500 k

(d) 15 atmosphere and 500 k

33. Consider a sample of He gas and one of Ne gas, both at 300 K and 1 atmosphere. Assuming ideal behaviour, which of the followings quantities are equal for the two samples ?

1. Root mean square speed of molecules.
2. Mean translational kinetic energy of molecules.
3. Number density of molecules.

Select the correct answer using the code given below :

(a) 1 and 2 (b) 2 and 3

(c) 1 and 3 (d) 1, 2 and 3

34. Which one of the following statements is correct ?

For a reversible adiabatic expansion of an ideal gas, the plot of log P vs log V is a straight line ($\gamma = \frac{C_p}{C_v}$)

(a) of slope γ (b) of slope $-\gamma$

(c) parallel to log P axis (d) of slope -1

35. The heat of formation of SiO_2 and MgO are – 48.4 kJ and –34.7 kJ respectively. What is the heat of reaction for $2Mg + SiO_2 \rightarrow 2MgO + Si$?

(a) –13.62 kJ (b) –21.0 kJ

(c) 216 kJ (d) 1360 kJ

36. In a chemical reaction the values of ΔH and $T\Delta S$ are of the following types :

1. ΔH is negative and $T\Delta S$ is positive
2. ΔH is negative and $T\Delta S$ is negative, but $|\Delta H| > |T\Delta S|$
3. ΔH is positive and $T\Delta S$ is negative but $|\Delta H| < |T\Delta S|$

4. ΔH is positive and $T\Delta S$ is negative but $|\Delta H| > |T\Delta S|$

The reaction is feasible if

(a) 1 and 2 are valid (b) 2 and 3 are valid

(c) 1 and 4 are valid (d) 1 and 3 are valid

37. The temperature of 4 moles of an ideal gas is raised from 300 K to 350 K. What is the value of ($\Delta H - \Delta E$) for this process ? $\left[R = 8.3 \frac{J}{(mol K)}\right]$

(a) 0 (b) 415 J (c) 415 J (d) 1660 J

38. Which one of the following is correct for a spontaneous process ? (S = entropy)

(a) $\Delta S_{(system)} + \Delta S_{(surrounding)} > 0$

(b) $\Delta S_{(system)} > 0$

(c) $\Delta S_{(surrounding)} > 0$

(d) $\Delta S_{(system)} - \Delta S_{(system)} > 0$

39. For which of the following reactions, is the standard entropy of reaction ΔS° positive ?

1. $2H_2O(g) \rightarrow 2H_2(g) + O_2(g)$
2. $CO(g) + 2H_2(g) \rightarrow CH_3OH(g)$
3. $CH_3OH(g) + 3O_2(g) \rightarrow 2CO_2(g) + 3H_2O(g)$
4. $C_2H_5OH(l) + 3O_2(g) \rightarrow 2CO_2(g) + 3H_2O(l)$

Select the correct answer using the code given below

(a) 1, 2, 3 and 4 (b) 1, 3 and 4

(c) 1 and 3 (d) 2 and 4

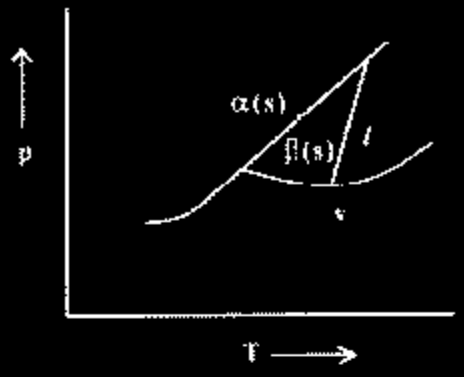
40. If ΔG_1° and ΔG_2° are the standard free energy changes for the reactions

$CO + 2H_2 \rightleftharpoons CH_3OH$ and $2CO + 4H_2 \rightleftharpoons C_2H_5OH + H_2O$, respectively, what is the standard free energy change for the reaction $2CH_3OH \rightleftharpoons C_2H_5OH + H_2O$?

(a) $2\Delta G_1^0 - \Delta G_2^0$ (b) $\Delta G_2^0 - 2\Delta G_1^0$

(c) $\Delta G_1^0 \quad \Delta G_2^0$ (d) $\Delta G_2^0 + 2\Delta G_1^0$

41.



The figure given above shows the schematic pressure p – temperature T phase diagram of a certain substance. How many triple points are there in the phase diagram ?

(a) 0 (b) 1

(c) 2 (d) 3

42. The phase diagram for a one-component system is shown below :

What are the numbers of degrees of freedom at the points B, X and Y, respectively ?

(a) 0, 1 and 2 (b) 0, 2 and 1

(c) 2, 1 and 1 (d) 1, 0 and 2

43. The concentration of OH^- ions at 298 K in a saturated solution of magnesium hydroxide, a sparingly soluble electrolyte, is 4.0×10^{-4} M. What is the solubility product of the salt at 298 K ?

(a) 8.0×10^{-12} (b) 4.0×10^{-8}

(c) 3.2×10^{-11} (d) 1.25×10^{-11}

44. What is the molality of ethanol in a solution of 23% C_2H_5OH and 77% water by weight ?

(a) 6.49 (b) 3.25

(c) 9.75 (d) 4.69

45. Vapour pressure of CCl_4 at 25°C is 143mm Hg. 0.5 g of a non-volatile solute (Mol. wt. 65) is dissolved in 100ml of CCl_4. What is the vapour pressure of the solutions ? (Density of CCl_4 = 1.538 g/cm^3). (At wt. : C =12, Cl = 35.45)

(a) 141.9 mm Hg (b) 94.39 mm Hg

(c) 99.34 mm Hg (d) 144.10 mm Hg

46. The reaction $2H_2 + 2NO \rightarrow N_2+2H_2O$ is assumed to proceed by the following mechanism :

$2NO \rightleftharpoons N_2O_2$ fast

$N_2O_2 + H_2 \rightarrow N_2O + H_2O$ slow

$N_2O + H_2 \rightarrow N_2 + H_2O$ fast

Which is the rate law for the reaction ?

(a) Rate = $k[NO][H_2]$ (b) Rate = $k[NO]^2[H_2]$

(c) Rate = $k[NO][H_2]^2$ (d) Rate = $k[NO]^2[H_2]^2$

47. The values of observed and calculated molecular weight of silver nitrate are 93 and 170 respectively. What is the degree of dissociation of silver nitrate ?

(a) 60% (b) 83%

(c) 47% (d) 62%

48. Me_3B, $B(OH)_3$ and BF_3 are three Lewis acids. Which one of the following is the correct sequence of these acids in order of

their increasing acid strength ?

(a) $Me_3B < BH_3 < BF_3$ (b) $Me_3B < BF_3 < BH_3$

(c) $BF_3 < Me_3B < BH_3$ (d) $BF_3 < BH_3 < Me_3B$

49. **Which one of the following is the factor of difference between ortho and para hydrogens ?**

(a) Alignment of electron spins

(b) Alignment of proton spins

(c) Number of neutrons

(d) Number of electrons

50. **What is obtained when calcium carbide is heated in nitrogen at 1000°C ?**

(a) Urea (b) Calcium cyanamide

(c) Calcium cyanide (d) Cyanamide

51. **In Which one of the following is metal-metal bond present ?**

(a) Cupric chloride (b) Stannous chloride

(c) Mercurous chloride (d) Mercuric chloride

52. **Which one of the following is liberated when the blue solutions of alkali metals in liquid ammonia decompose very slowly ?**

(a) Ammonia (b) Hydrogen azide

(c) Hydrogen (d) Nitrogen

53. **What is the compound obtained by heating a mixture of dry ammonium chloride and anhydrous borax to a red heat in a platinum crucible called ?**

(a) Boron nitride (b) Borazole

(c) Ammonium borohydride

(d) Ammonium chloroborate

54. **What is the volume of 0.1 M $Ba(OH)_2$ solution in water required to neutralize completely 20 ml of a 0.1 M aqueous solution of hypophosphorus acid (H_3PO_2) ?**

(a) [illegible] (b) 15 ml

(c) 20 ml (d) 30 ml

55. **Halide ions are reducing agents. Which one of the following is their correct sequence in the increasing order of their reducing power ?**
(a) $Cl^- > F^- > Br^- > I^-$ (b) $I^- > Br^- > Cl^- > F^-$
(c) $F^- > Cl^- > Br^- > I^-$ (d) $Br^- > Cl^- > F^- > I^-$

56. **The hexaaquo ion $[Ti(H_2O)_6]^{3+}$, shows a weak band with a maximum at 20,300 cm^{-1}. Which one among the following is the colour of the ion ?**
(a) Green (b) Blue
(c) Yellow (d) Purple

57. **Which one of the following is the spin-only magnetic moment of $K_3[Fe(CN)_6]$?**
(a) 1.73 BM (b) 2.83 BM
(c) 4.90 BM (d) 5.92 BM

58. **Besides oxide ore and coke, which one among the following constitutes the charge in the blast furnace in the extraction of iron ?**
(a) Silica (b) Dolomite
(c) Limestone (d) Quicklime

59. **What will be the energy released (approximately) in a nuclear reaction, in which the total mass loss is 0.01 amu ?**
(a) 0.931 MeV (b) 9.31 MeV
(c) 93.1 MeV (d) 931 MeV

60. **In a nuclear reactor, oxides of which of the following metals are used as a fuel material ?**
1. Uranium 2. Thorium
3. Actinium 4. Plutonium
Select the correct answer using the code given below :

(a) 1 and 3 (b) 2 and 3
(c) 1, 2 and 4 (d) 2, 3 and 4

61. What is the IUPAC name of $[Co(NH_3)_3(NO_2)(Cl)(CN)]$ compound ?

(a) Chloro cyano nitro triammine cobalt (III)
(b) Triammine chloro cyano nitro cobalt (III)
(c) Cyano chloro nitro triammine cobalt (III)
(d) Nitro chloro cyano triammine cobalt (III)

62. A 0.50 molal solution of ethylene glycol in water is used as coolant in a car. If the freezing point constant of water is 1.86 degree per molal, at which temperature will the mixture freeze ?

(a) 1.56°C (b) –0.93°C
(c) –1.86°C (d) 0.93°C

63. Which one of the following colligative properties can provide molar mass of proteins with greatest precision ?

(a) Elevation of boiling point
(b) Depression of freezing point
(c) Osmotic pressure
(d) Relative lowering of vapour pressure

64. The depressions of freezing points of 0.05 molal aqueous solution of the following compounds are measured :

1. NaCl 2. K_2SO_4
3. C_6H_{12} 4. $Al_2(SO_4)_3$

Which one of the above compounds will exhibit the largest depression of freezing point ?

(a) 3 (b) 2
(c) 4 (d) 1

65. In which of the following combinations, is buffer action expected ?

1. $NH_3 + NH_4Cl$
2. $HCl + NaCl$
3. $NH_3 + HCl$ in 2 : 1 mole ratio

Select the correct answer using the code given below :

(a) 1 and 2 (b) 1 and 3
(c) 2 and 3 (d) 1, 2 and 3

66. pK_a of acetic acid is 4.7. If 60 ml of 0.02 M acetic acid is mixed with 60 ml of 0.01 M NaOH, then what does pH value of the solution become equal to ?

(a) 3.7 (b) 4.7
(c) 5.7 (d) 2.7

67. What is the reason that the molar conductivity of HCl(aq) is greater than that of NaCl(aq) ?

(a) Molecular mass of HCl is less than that of NaCl
(b) Mobility of H^+ ions is more than that of Na^+ ions
(c) HCl gives strong acidic solution whereas NaCl gives a neutral solution
(d) HCl is ionized to a greater extent than NaCl is

68. A 0.2 molar aqueous solution of a weak acid is 3.2% dissociated at room temperature. What is the approximate value of the dissociation constant of the acid in water at room temperature ?

(a) 9.6×10^{-3} (b) 9.6×10^{-5}
(c) 2.0×10^{-4} (d) 1.25×10^{-6}

69. In a silver nitrate solution, the ratio of velocities of Ag^+ and NO_3^- ions is 0.85. What is the transport number of NO_3^- ion ?

(a) 0.46 (b) 0.54
(c) 0.84 (d) 0.16

70. The equivalent conductivities at infinite dilution (λ^0) for sodium acetate in water at 298 K are 128.0, 425.0 and 91.0

cm^2/Ω eq, respectively. A solution of acetic acid shows an equivalent conductivity of 38.8 cm^2/Ω eq. What is the percent dissociation of acetic acid ?

(a) 5.0 (b) 10.0

(c) 20.0 (d) 30.0

71. Ag_2SO_4 solution was electrolysed in a cell having platinum electrodes till 1.6 g of oxygen was liberated at the anode. What was the amount of silver deposited at the cathode ? (At wt. of Ag = 108).

(a) 21.60 g (b) 0.8 g

(c) 108.88 g (d) 1.6 g

72. The standard reduction potentials for Fe^{2+}/Fe and Sn^{2+}/Sn electrodes are –0.44 V and –0.14V respectively. What is the standard emf for the cell reaction

$$Fe^{2+} + Sn \rightarrow Fe + Sn^{2+} \ ?$$

(a) +0.30 V (b) –0.58 V

(c) +0.58 V (d) –0.30 V

73. Consider the following second order reaction with respect to the concentration of [A] :

$2A \rightarrow$ products

To obtain a straight line with slope equal to the rate constant k, what should one plot as a function of time ?

(a) $[A]^2$ (b) $1/[A]^2$

(c) $\ln[A]^2$ (d) $1/[A]$

74. A proposed mechanism for the reaction

$Hg_2^{2+} + Tl^{3+} \rightarrow 2Hg^{2+} + Tl^{+}$

in aqueous solution is

$Hg_2^{2+} \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} Hg^{2+} + Hg$ (fast, at equilibrium)

$Tl^{3+} + Hg \xrightarrow{k_2} Tl^{+} + Hg^{2+}$ (slow)

The rate of reaction is given by

(a) $k_2[Tl^{3+}][Hg_2^{2+}]$

(b) $\frac{k_1 k_2}{k_{-1}} \frac{[Tl^{3+}][Hg_2^{2+}]}{[Hg^{2+}]}$

(c) $\frac{k_1 k_{-1}}{k_2} \frac{[Tl^{3+}][Hg^{2+}]}{[Hg_2^{2+}]}$

(d) $k_1 k_2 k_{-1}[Tl^{3+}][Hg_2^{2+}][Hg^{2+}]$

75. Which one of the following cannot be obtained from the solution of Schrödinger wave equation ?

(a) Wave function of an electron
(b) Energy of an electron in a 1-D box
(c) Energy of an electron in orbitals
(d) Velocity of electrons in circular orbits

76. Which of the following are not acceptable sets of quantum numbers for an electron in an atom ?

1. $n = 3, l = 0, m_l = 1, m_s = -\frac{1}{2}$
2. $n = 3, l = 1, m_l = 1, m_s = \frac{1}{2}$
3. $n = 3, l = 2, m_l = 0, m_s = \frac{1}{2}$
4. $n = 3, l = 1, m_l = 2, m_s = \frac{1}{2}$

Select the correct answer from the code given below :

(a) 1 and 2 (b) 1 and 3
(c) 1 and 4 (d) 2 and 3

77. What is the orbital angular momentum of an electron in 2s orbital ?

(a) $\frac{h}{2\pi}$ (b) 0

(c) $\frac{h}{2\sqrt{\pi}}$ (d) $\frac{h}{\sqrt{2\pi}}$

78. **Which one of the following gives an electron a greater probability of being found close to the nucleus ?**

(a) 3s (b) 3p

(c) 3d (d) 4s

79. **Which one of the following compounds contains a cation having non-inert gas outermost configuration ?**

(a) NaCl (b) KCl

(c) $CaCl_2$ (d) $CuCl_2$

80. **Match List I *(Element)* with List II *(Valency Shell Electronic Configuration)* and select the correct answer using the code given below the lists :**

List I	List II
A. Ag	1. $4d^6 5s^2$
B. Rh	2. $4d^7 5s^1$
C. Pd	3. $4d^8 5s^1$
D. Ru	4. $4d^{10} 5s^0$

	A	B	C	D		A	B	C	D
(a)	1	3	2	4	(b)	4	2	3	1
(c)	1	2	3	4	(d)	4	3	2	1

81. **Which of the following are non-polar ?**

1. SiF_4 2. XeF_4 3. SF_4

4. BF_3 5. NF_3

Select the correct answer using the code given below :

(a) 1, 2, 3 and 4 (b) 2, 3 and 5

(c) 3, 4 and 5 (d) 1, 2 and 4

82. **Among the following metals, which form peroxide on heating in excess oxygen ?**

1. Lithium 2. Sodium
3. Barium 4. Aluminium

Select the correct answer using the code given below :

(a) 1 and 2 (b) 2 and 3
(c) 3 and 4 (d) 1 and 3

83. Which of the following systems are isoelectronic ?

1. CN^-, Co^+, No 2. CN^-, CO, NO^+
3. F_2, OF, S_2^- 4. OH^-, HF, NH_3

Select the correct answer using thew code given below :

(a) 1, 2 and 3 (b) 1, 3 and 4
(c) 1, 2 and 4 (d) 2, 3 and 4

84. Match List I *(Element)* with List II *(Electronegativity on Pauling scale)* and select the correct answer using the codes given below the lists :

List I	List II
A. Carbon	1. 0.8
B. Nitrogen	2. 1.6
C. Aluminium	3. 2.5
D. Cesium	4. 3.0
	5. 4.0

	A	B	C	D		A	B	C	D
(a)	2	4	5	1	(b)	3	1	2	4
(c)	2	1	5	4	(d)	3	4	2	1

85. Where is an electron added to during the change of NO^+ to NO ?

(a) σ orbital (b) π orbital
(c) σ^* orbital (d) π^* orbital

86. Consider the following statements :

Sodium bicarbonate has

1. ionic bond. 2. covalent bond.

3. coordinate bond. 4. hydrogen bond.

Which of the following statements given above are correct ?

(a) 1 and 2 (b) 1, 2 and 4

(c) 2 and 3 (d) 1 and 4

87. Match List I *(Compound)* with List II *(Molecular shape)* and select the correct answer using the codes given below the lists :

List I	List II
A. XeF_4	1. Tetrahedral
B. SeF_4	2. Square planar
C. XeO_3	3. Pyramidal
D. XeO_4	4. Triangular planar
	5. Distorted tetrahedral

	A	B	C	D
(a)	3	1	4	5
(c)	3	5	4	1

	A	B	C	D
(b)	2	5		
(d)	2	1		

88. Which one of the following is the molecule with the lowest bond order ?

(a) CO (b) CO_2

(c) NO_3^- (d) CN^-

89. Match List I *(Molecule)* with List II *(Bond Angle)* and select the correct answer using the codes given below the lists :

List I	List II
A. BF_3	1. 88°
B. NF_3	2. 96°
C. PF_3	3. 103°
D. ClF_3	4. 110°
	5. 120°

	A	B	C	D
(a)	5	3	2	1

	A	B	C	D
(b)	1	2	4	5

(c) 5 2 4 1 (d) 1 3 2 5

90. Which are the species in which sulphur undergoes sp^3 hybridisation ?

1. SF_4 2. SCl_2
3. SO_4^{2-} 4. H_2S

Select the correct answer using the code given below :

(a) 1 and 3 (b) 1, 2 and 4
(c) 2, 3 and 4 (d) 3 and 4

91. Consider the following reaction :

$P_4 + 3OH^- + 3H_2O \rightarrow x + y$

What are the oxidation states of phosphors in x and y respectively in the above reaction ?

(a) -3, +3 (b) -3, +1
(c) +3, -1 (d) -3, +5

92. Which of the following ligands will bind to a trivalent lanthanide ion (Ln^{3+}) most strongly ?

(a) R_2S (b) R_3P
(c) NO_3^- (d) F^-

93. Consider the following statements about elimination reactions :

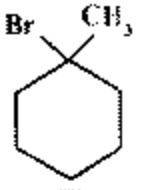
1. The first step in the mechanisms of E1 and S_N1 reactions is identical.
2. The rate of E1 reactions depends on the nature and concentration of the base.
3. In E1 elimination, Hofmann's rule governs the orientation of the double bond.
4. E2 elimination of adjacent groups on a six membered ring proceeds best when the leaving groups are anti, viz. trans-diaxial.

Which of the above statements are correct ?

(a) 1, 2 and 3 (b) 2 and 4
(c) 1 and 4 (d) 1, 2, 3 and 4

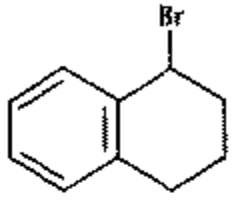
94. Consider the S_N1 solvolysis of the following halides in aqueous formic acid :

$(CH_3)_2CHCHBrCH_3$
I



III

$C_6H_5CHBrC_6H_5$
II

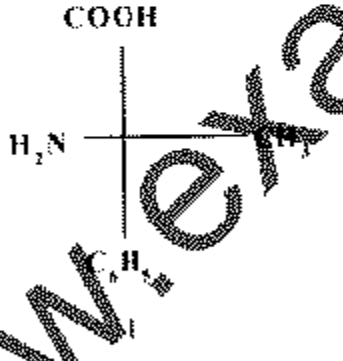


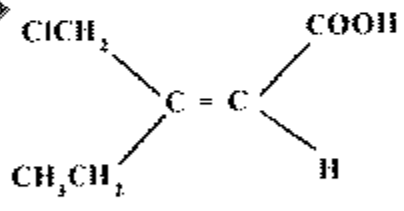
IV

Which one of the following is the correct sequence of the halides given above in the decreasing order of their reactivity ?

(a) I > IV > III > II (b) II > III > IV > I
(c) I > III > IV > II (d) II > IV > III > I

95. Which one is the correct configurational assignment (in terms of the Cahn, Ingold and Prelog principles) for each of the compounds listed below ?





II

	I	II
(a)	R	S
(b)	S	E
(c)	L	S
(d)	S	Z

96. Consider the S_N2 displacement of the following compounds with $\overset{\ominus}{Cl}$ ion in dimethylformamide :

CH_3CH_2Br (I) $\quad$ $(CH_3)_2CHCH_2Br$ (III)

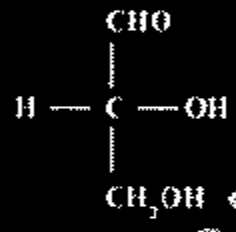
$CH_3CH_2CH_2Br$ (II) $\quad$ $(CH_3)_3CCH_2Br$ (IV)

Which one of the following correctly represents the decreasing order of reactivity of these compounds in the above reaction ?

(a) IV > III > II > I (b) I > IV > III > II

(c) IV > I > II > III (d) I > II > III > IV

97.



Which is the correct order of priority of groups attached to the chiral carbon in the compound given above while assigning R or S configuration ?

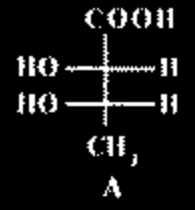
(a) OH > CHO > CH_2OH > H

(b) H > CH_2OH > CHO > OH

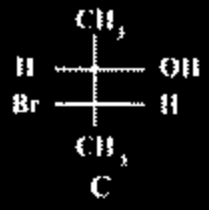
(c) CHO > OH > CH_2OH > H

(d) CH_2OH > CHO > OH > H

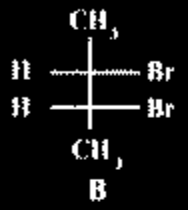
98. **Consider the following statements about the Fisher projections A-D :**



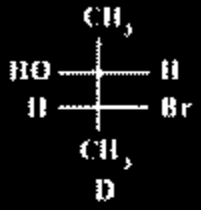
A



C



B



D

1. A and B are erythro forms while C and D are threo forms.
2. A and C are erythro forms while B and D are threo forms.
3. B is a meso-form while C and D are dl forms.
4. A and B are meso-form while C and D are diastereomers.

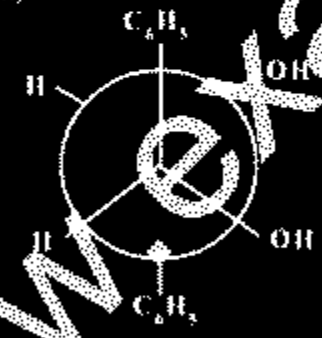
Which of the above statements are correct ?

(a) 1, 2 and 4 (b) 2, 3 and 4

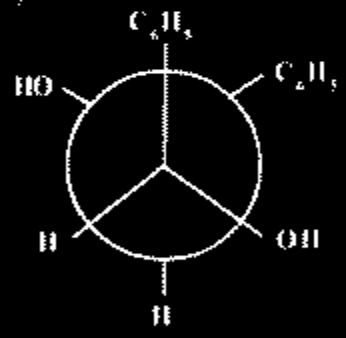
(c) 1 and 3 (d) 3 and 4

99. **Which one of the following Newman Projection formulae correctly represents a meso structure ?**

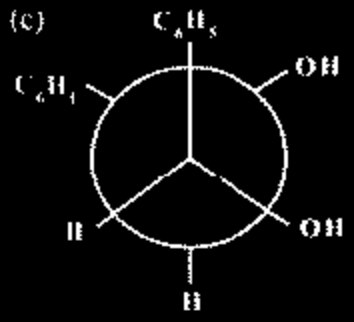
(a)



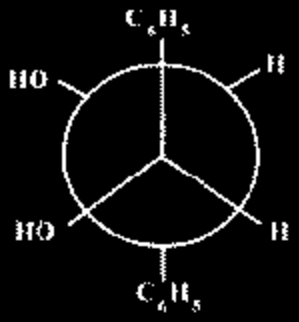
(b)



(c)



(d)



100.

$$CH_3CHO + HCN \longrightarrow CH_3 - \underset{\displaystyle OH}{\underset{|}{C}}H - CN$$

$$\xrightarrow{H_3O^+} CH_3 - \underset{\displaystyle COOH}{\overset{\displaystyle OH}{\overset{|}{\underset{|}{C}}}} - H$$

Which acid would be obtained in the reaction given above ?

(a) D-Isomer only

(b) L-Isomer only.

(c) 50% D-Isomer + 50% L-Isomer

(d) 20% D-Isomer + 80% L-Isomer

101. What is the number of asymmetric carbon atoms present in α-D-glucopyranose molecule ?

(a) Two (b) Three

(c) Four (d) Five

102. An organic compound 'A', on oxidation, consumes one mole of periodic acid and yields one mole each of acetaldehyde and acetic acid. What would be the structure of 'A' ?

(a) $CH_3COCHOHCH_3$ (b) $CH_3COCOCH_3$

(c) $CH_3CHOHCHOHCH_3$ (d) $(CH_3)_2CHOHCHO$

103. **Which one of the following compounds could yield three different monochlorinated products ?**

(a) n-hexane (b) 3-mehtylpentane

(c) n-butane (d) Propane

104. **$R-CH=CH-CHO \rightarrow R-CH=CH-COOH$**

Which one of the following reagents can be used to bring about the transformation given above ?

(a) Chromic acid (b) Alkaline permanganate

(c) Hydrazine (d) Tollens reagent

105. **In the reaction**

how is the product formed ?

(a) Michael addition followed by Aldol condensation

(b) Aldol condensation followed by Michael addition

(c) Mannich reaction

(d) Knoevenagel reaction followed by Aldol condensation

106. **Match List I with List II and select the correct answer using the codes given below the lists :**

List I	List II
A. Coordination polymerisation	1. Polypeptide
B. Free radical polymerisation	2. Nylon-66
C. Addition polymerisation	3. Ziegler-Natta catalyst
D. Natural rubber	4. Azobisisobutyronitrile
	5. *cis*-1, 4-polyisoprene

	A	B	C	D		A	B	C	D
(a)	3	5	2	4	(b)	2	4	1	5
(c)	3	4	2	5	(d)	2	5	1	4

107. Which one of the following reagents will accomplish trans-hydroxylation of an olefinic bond ?

(a) m-chloroperbenzoic acid/$H_3O^{\oplus}$

(b) O_3 / Zn

(c) B_2H_6 / H_2O_2, $OH^{\ominus}$

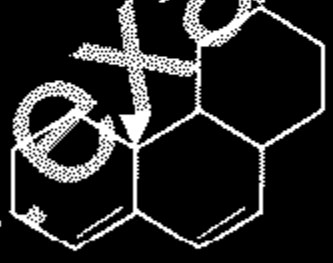
(d) OsO_4 / Na_2CO_3

108. Match List I *(Vibration)* with List II *(Approximate $\bar{\upsilon}$ cm^{-1})* and select the correct answer using the codes given below the lists :

	List I		List II
A.	O-H stretch	1.	700 - 900
B.	C = O stretch	2.	1700 - 1750
C.	C-H stretch (saturated)	3.	3300 - 3600
D.	=C-H bend (olefinic)	4.	3000 - [illegible]

	A	B	C	D		A	B	C	D
(a)	4	1	3	2	(b)	3	2	4	1
(c)	4	2	3	1	(d)	3	1	4	2

109. What is the λ_{max} value for the following compound according to Woodward rule ?



(a) 250 nm (b) 260 nm
(c) 280 nm (d) 320 nm

110. Consider the following spectral data for an Organic Compound A :

λ_{max} 279 nm (ϵ =16)

υ_{max} 1725 cm^{-1}

PMR δ 1.02(t, 3H) 2.06(s, 3H), 2.39(q, 2H)

What is the most likely structure of A ?

(a) $CH_3 - \overset{O}{\overset{\|}{C}} - CH_2CH_3$

(b) $CH_3O - \overset{O}{\overset{\|}{C}} - CH_2CH_3$

(c) $CH_3O - CH_2 - \overset{O}{\overset{\|}{C}} - CH_3$

(d) $CH_3CH_2\overset{O}{\overset{\|}{C}} - CH_2 - OCH_3$

111. Which one of the following peptides is formed when Ala-Ser-Thr-Lys-Gly-Arg-Ser-Gly is treated with trypsin ?

(a) Ala-Ser-Thr-Lys (b) Ala-Ser-Thr
(c) Arg-Ser-Gly-Ala (d) Ala-Ser-Thr-Lys-Gly

112. Which one of the following amino acids liberates ammonia on mild hydrolysis and then yields a different amino acid ?

(a) Tyrosine (b) Asparagine
(c) Alanine (d) Hydroxyproline

113. Consider the following statements about carbohydrates :

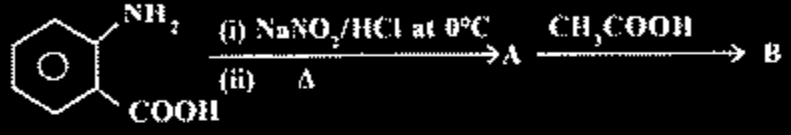
1. Bromine water can be used to differentiate an aldose from a ketose.
2. All monosaccharides, whether aldose or ketose, are reducing sugars.

3. Osazone formation destroys the configuration about C-2 of an aldose, but does not affect the configuration of the rest of the molecule.
4. A pair of diastereomeric aldoses which differ only in configuration about C-2 is termed as pair of anomers.

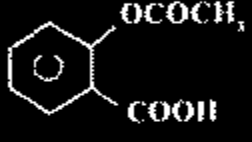
Which of the above statements are correct ?

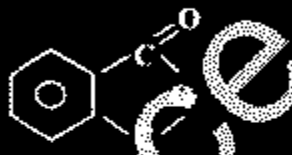
(a) 1, 3 and 4 (b) 2 and 4
(c) 1 and 4 (d) 1, 2 and 3

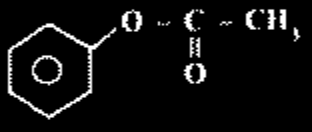
114. Consider the following reaction :

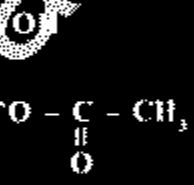


What is the product B in the reaction given above ?

(a)


(b)


(c)


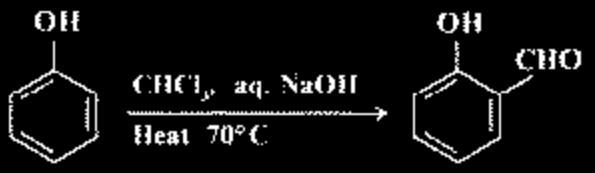
(d)


115.

What is the mechanism of the reaction given above, called ?

(a) S_N1 (b) S_N2
(c) Addition-elimination (d) Elimination-addition

116. Consider the following reaction :



What is the reaction known as and which species does it involve, respectively ?

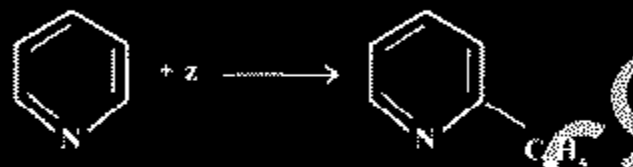
(a) Sandmeyer, free radical

(b) Reimer Tiemann, carbene

(c) Hunsdiecker, free radical

(d) Friedel-Crafts, carbonium ion

117.



Which reagent is Z in the reaction given above ?

(a) C_6H_5Cl, $AlCl_3$ (anhydrous)

(b) C_6H_5Br / hυ

(c) C_6H_5Li

(d) $C_6H_5CONH_2$ / liq. NH_3

118. Which one of the following compounds would *not* yield n-butane when reacted with n-butyllithium ?

(a) Ethanol (b) Acetone

(c) Acetic acid (d) 1-butyne

119. Which reagent is used for converting propylene to polypropylene ?

(a) $TiCl_4 + (CH_3)_2Mg$

(b) $TiCl_4 + CH_3(CH_2)_3Li$

(c) $TiCl_4 + (C_2H_5)_4Pb$

(d) $TiCl_4 + K/THF$

120. **Consider the following statements about Grignard synthesis :**

1. The carbon-magnesium bond of the Grignard regent is covalent, but highly polar, carbon being positive relative to electronegative magnesium.
2. The Grignard reaction is an example of the typical reactions of aldehydes and ketones, viz., nucleophilic addition.
3. The reaction of carboxylic esters with Grignard reagents is an excellent method of preparing tertiary alcohols.
4. Grignard synthesis is important as it permits formation of new carbon-oxygen bond.

Which of the above statements are correct ?

(a) 1, 2 and 3 (b) 1, 2 and 4

(c) 1 and 4 (d) 2 and 3